

Study and Simulation of Remote Sensing System:  
COMPACT Airborne Spectral Sensor (COMPASS)

Paper for fulfillment of Remote Sensing Systems Course 1051-765  
and M.S. Project Requirements

Cynthia Scigaj

## ***Table of Contents***

Acknowledgements.....	5
Abstract.....	5
Megacollect and Megascene 1 .....	5
COMPACT Airborne Spectral Sensor (COMPASS) .....	8
Background.....	8
Design and Specifications.....	9
(FOUO) COMPASS Megacollect Data.....	13
DIRSIG Simulation.....	16
Scene.....	17
Creation of Calibration Tarps .....	17
Scene File.....	23
Atmosphere.....	27
Response File.....	31
Platform.....	32
Platform Motion.....	40
Data Collection .....	48
Simulation.....	49
Results.....	50
Recommendations for Follow On Research .....	54
Works Cited .....	55
Appendices.....	56
DIRSIG Support Files.....	56
Emissivity Files.....	56
Geometric Database File – “megacollect_cal_panels.gdb” .....	137
Object Database Files .....	138
Scene File – “megacollect_cal_panels.scene” .....	138
Weather File – “mls.wth” .....	141
Tape5 Files.....	144
Atmosphere File – “mls_11km_vis.atm” .....	145
Response File – “COMPASS_7_8_nm.rsp” .....	146
Platform File – “compass_megacollect_mls_11km_vis.platform” .....	151
Platform Motion File – “compass_megacollect.ppd” .....	171
Tasks File - “compass_megacollect.tasks” .....	208
Simulation File - “compass_megacollect_mls_11km_vis.sim” .....	209
Radiosonde Data - “buf20040607_12.txt” .....	210

## ***Table of Figures***

Figure 1 – Satellite Image of Northern Rochester, NY Depicting Megascene 1 (Image Courtesy of Nina Raqueño) .....	6
Figure 2 – Ground Photo of Calibration Tarps at Camp Eastman 07 June 2004.....	7
Figure 3 – Aerial Image of Panels at Camp Eastman 07 June 2004 (WASP - Terra Pix at 3,000 ft).....	7
Figure 4 – Image of Aircraft Used by COMPASS Taken by the Author in June 2004.....	8

Figure 5 – Image of Underside of Aircraft Used by COMPASS Taken by the Author in June 2004 .....	9
Figure 6 – “COMPASS optical layout” (Source: Zadnik et al., figure 1) .....	9
Figure 7 – “COMPASS Scan Pattern” (Source: Simi et al., “On-Board Processing for the COMPASS”, figure 1) .....	10
Figure 8 – Image of COMPASS Taken by the Author in June 2004 .....	11
Figure 9 – “Band center vs. channel number” (Source: Zadnik et al., figure 6).....	13
Figure 10 – (FOUO) Uncalibrated (a - on left) and Calibrated (b - on right) COMPASS Images of the Camp Eastman Area Collected 07 June 2004 .....	14
Figure 11 – (FOUO) An Entire COMPASS HSI Flight Line .....	14
Figure 12 – (FOUO) Flightpath Metadata from Camp Eastman Flight Line .....	15
Figure 13 – Required Additions to the ".cshrc" File .....	16
Figure 14 – DIRSIG User Interface From "dircsig_edit-4.2.3" .....	16
Figure 15 – High-Resolution DIRSIG Rendering of Megascene 1, Tile 4.....	17
Figure 16 – Comparison of Black Tarp Reflectance Spectra .....	18
Figure 17 – Excerpt From "black_cal_tarp_megacollect.ems" Emissivity File .....	19
Figure 18 – Material Entries for the Gray and Black Calibration Tarps .....	20
Figure 19 – "megacollect_cal_panels.gdb" File .....	21
Figure 20 – Files "megacollect_cal_panels.gdb" and "megacollect_materials.mat" Opened in Bulldozer .....	22
Figure 21 – "Megacollect_Cal_Panels.odb" File.....	23
Figure 22 – "tile_4.odb" .....	23
Figure 23 – Scene GUI - Geometry Tab .....	24
Figure 24 – Text Entry of "Megacollect_Cal_Panels.odb " to the Geometry List of the Scene File.....	24
Figure 25 – Scene GUI - Material Tab .....	25
Figure 26 – Scene GUI - Property Maps Tab: Terrain Class Map .....	26
Figure 27 – Scene GUI - Property Maps Tab: Texture Maps.....	27
Figure 28 – Atmospheric Conditions GUI - Weather Tab.....	28
Figure 29 – "tape5_edit" Window .....	29
Figure 30 – "tape5_edit" View of Card 2 .....	29
Figure 31 – Atmospheric Conditions GUI - Radiation Transport Tab .....	30
Figure 32 – Atmospheric Conditions GUI - Turbulence Tab .....	31
Figure 33 – Band Center vs. Wavelength Comparison of Published Values .....	32
Figure 34 – Platform GUI - System/Platform Editor.....	32
Figure 35 – (FOUO) Platform GUI - Mount Editor: Clock.....	33
Figure 36 – Platform GUI - Mount Editor: Across-Track .....	34
Figure 37 – Platform GUI - Instrument Editor .....	34
Figure 38 – Platform GUI - Focal Plane Editor.....	35
Figure 39 – Platform GUI - Detector Array Editor.....	36
Figure 40 – Platform GUI – Basic Capture Detector Array Response Editor: Spectral Response .....	37
Figure 41 – Platform GUI – Basic Capture Detector Array Response Editor: Spatial Response .....	38
Figure 42 – Basic Capture Detector Array Response Editor: Output.....	39
Figure 43 – Platform GUI - Focal Plane Editor: Truth Image Dialog Box .....	40

Figure 44 – (FOUO) Parameters Entered into the Dynamic Position Wizard.....	41
Figure 45 – (FOUO) Results of Dynamic Position Wizard: Rows 1-21 .....	42
Figure 46 – (FOUO) Results of Dynamic Position Wizard: Rows 22-42 .....	43
Figure 47 – (FOUO) Results of Dynamic Position Wizard: Rows 43-63 .....	44
Figure 48 – (FOUO) Results of Dynamic Position Wizard: Rows 64-84 .....	45
Figure 49 – (FOUO) Results of Dynamic Position Wizard: Rows 85-105 .....	46
Figure 50 – (FOUO) Results of Dynamic Position Wizard: Rows 106-126 .....	47
Figure 51 – (FOUO) Results of Dynamic Position Wizard: Rows 127-143 .....	48
Figure 52 – (FOUO) "compass_megacollect.tasks" File .....	49
Figure 53 – ENVI Header for “compass_megacollect_mls_11km_vis.img” .....	50
Figure 54 – (FOUO) “compass_megacollect_mls_11km_vis.img” Displayed in ENVI: a) Channel 8, b) RGB Display with Channels 34,21,8 Respectively and c) RGB Display with Channels 34,21,8 Respectively with a Gaussian Stretch Applied. ....	51
Figure 55 – (FOUO) ROI Designation in DIRSIG Data .....	51
Figure 56 – (FOUO) ROI Designation in COMPASS Data a) Calibrated Data b) Uncalibrated Data .....	52
Figure 57 – (FOUO) Comparison of Gray Calibration Panel Spectra.....	53
Figure 58 – (FOUO) Comparison of Black Calibration Panel Spectra .....	53

### ***Table of Tables***

Table 1 – COMPASS System Characteristics .....	12
--	----

## **Acknowledgements**

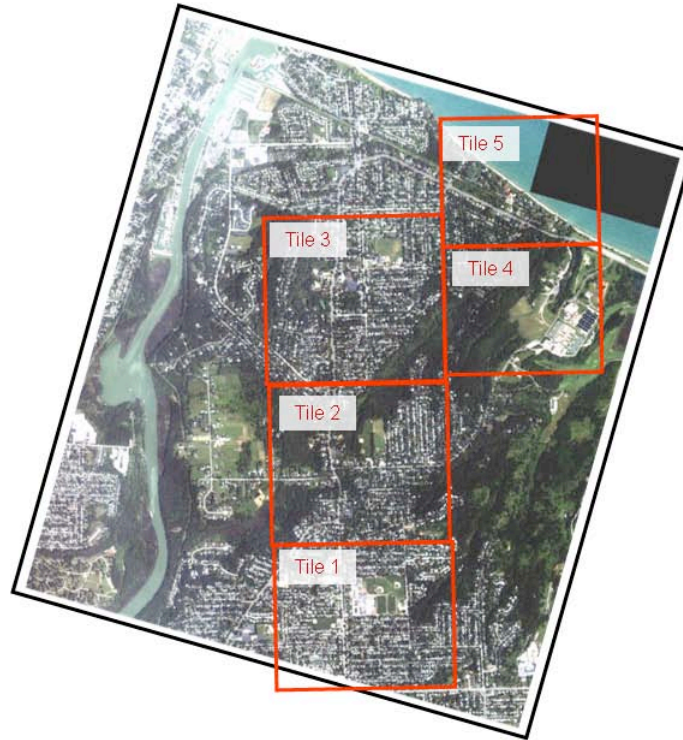
This paper represents a collective effort and was possible through the DIRSIG simulation knowledge and input of Dave Pogorzala and Scott Brown, the COMPASS data documentation and MODTRAN expertise of Dr. Rolando Raqueño, ground truth organization and documentation of Nina Raqueño, network support from Brett Matzke and Jim Bodie, and project guidance from Dr. Carl Salvaggio.

## **Abstract**

DIRSIG (Digital Imaging and Remote Sensing Image Generation tool) has undergone several upgrades to increase its functionality. Concurrent with these additions was the opportunity to receive data from an airborne hyperspectral imaging system in which knowledge of conditions and items on the ground were known. This project will attempt to model this sensor and compare synthetic data with real world data and in the process flex the capabilities of DIRSIG and the entire process to create a synthetic scene from measured data.

## **Megacollect and Megascene 1**

In June 2004, the Digital Imaging and Remote Sensing group of the Rochester Institute of Technology was given the unique opportunity to conduct a large scale ground truth collect concurrent with multiple overhead imaging systems. The location chosen for this effort was an area of northern Rochester which had been extensively researched, measured, and modeled under previous efforts for DIRSIG simulations and referred to as “Megascene 1”. Due to its large size, Megascene 1 is broken up into 5 “tiles” (see Figure 1). As the collect was over the Megascene 1 area and was so large in scale, it was referred to as the “Megacollect”.



**Figure 1 – Satellite Image of Northern Rochester, NY Depicting Megascene 1 (Image Courtesy of Nina Raqueño)**

Several experiments covering a range of applications were designed and executed on June 6-7, 2004. The epicenter of this effort was an area of Rochester named “Camp Eastman”. Camp Eastman is located in the center of tile 4 in Megascene 1. As part of the experiments conducted, two large canvas tarps (hereto called “calibration tarps”) were laid out adjoining each other. An approximately south facing view of these tarps from the ground is Figure 2. These tarps were measured with thermocouples, radiometers, an Exergen contact infrared thermometer, an ASD FieldSpec Pro spectroradiometer, and a D&P Instrument microFTIR. One of the airborne sensors to image the area was an RIT in-house system called “WASP”. WASP stands for Wildfire Airborne Sensor Program. One of the four sensors on this platform is “Terra Pix”. Terra Pix is a high-resolution Bayer-filtered RGB sensor covering the 0.4-0.9micron spectral range. One of the many images Terra Pix captured of the calibration tarps can be seen in Figure 3. This particular image is roughly facing north-up.



**Figure 2 – Ground Photo of Calibration Tarps at Camp Eastman 07 June 2004**



**Figure 3 – Aerial Image of Panels at Camp Eastman 07 June 2004 (WASP - Terra Pix at 3,000 ft)**

(FOUO) Aside from WASP, another airborne sensor that collected data during the Megacollect on 07 June 2004 was the COMPACT Airborne Spectral Sensor (COMPASS).

## COMPACT Airborne Spectral Sensor (COMPASS)

### ***Background***

The COMPACT Airborne Spectral Sensor (COMPASS) system was developed at the Army Night Vision and Electronic Sensors Directorate (NVESD) as a technology demonstration (Zadnik et al. 182), (Simi et al., “COMPASS”, 129). It was designed for terrain characterization and consists of a hyperspectral imager (HSI) and a high-resolution imager (HRI) (Zadnik et al. 182), (Simi et al., “COMPASS”, 130). The HSI consists of a 256x256 pixel single focal plane array covering the 0.4-2.35 micron spectral region which is utilized in whiskbroom mode while the 8192 element HRI is operated in pushbroom mode (Simi et al., “COMPASS”, 129-130). Figure 4 is a photo taken of the aircraft used by COMPASS in June 2004 while on the ground at the Rochester International Airport. According to crew that operated the instrument at the time (Roberta Yuhas and Anthony Hill) this is a DC3 built in 1942. They also indicated that a 4 ft by 6 ft portion of the underside of this plane was removed to allow for imaging (see Figure 5).



**Figure 4 – Image of Aircraft Used by COMPASS Taken by the Author in June 2004**



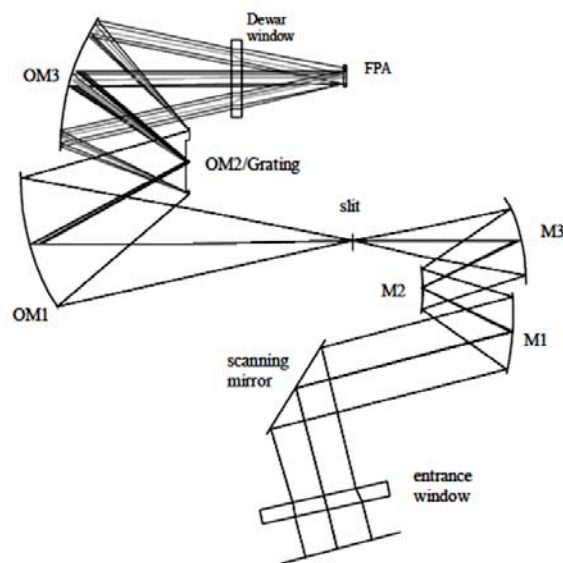


**Figure 5 – Image of Underside of Aircraft Used by COMPASS Taken by the Author in June 2004**

## ***Design and Specifications***

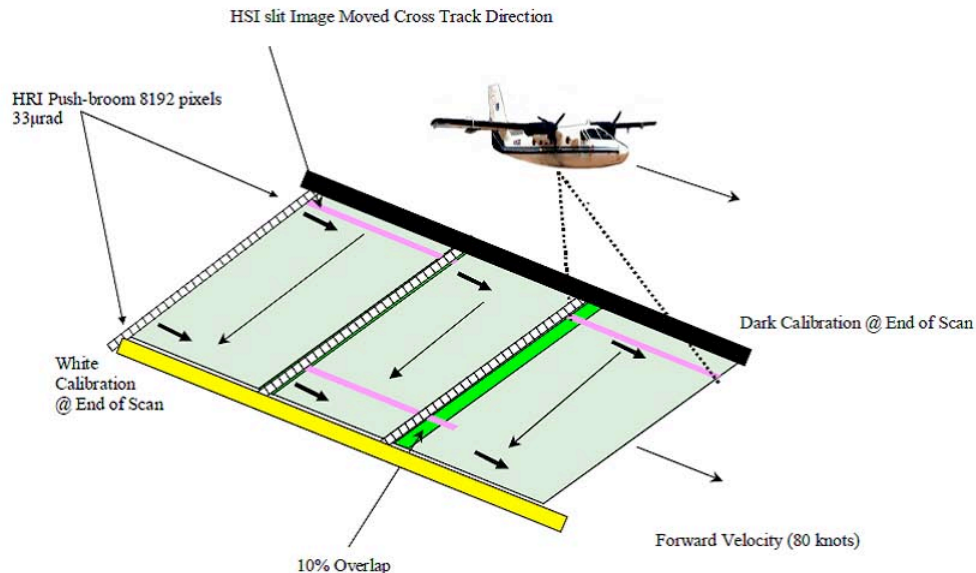
According to Zadnik et al., “This system utilizes a Split Offner spectrometer design in order to minimize distortion to less than 1/10 of a pixel” (Zadnik et al. 182). Figure 6 shows the optical layout of the system. On page 183 of “Calibration Procedures and Measurements for the COMPASS Hyperspectral Imager”, Zadnik et al. describe the optical layout:

“Light enters the instrument through a fused silica window onto the cross-track scan mirror. The telescope is focused onto an entrance slit to the split Offner spectrometer. The spectrometer section is designed to re-image the entrance slit onto the FPA with very little smile and keystone distortion. An order sorting filter (OSF) resides 0.01 inches in the front of the FPA surface and is designed to block higher diffraction orders, allowing only the first order image to reach the FPA. A cold filter provides the cutoff wavelength of 2.35 microns.”



**Figure 6 – “COMPASS optical layout” (Source: Zadnik et al., figure 1)**

Figure 7 illustrates the imaging of both the HSI and the HRI on the airborne platform. The HRI is pushbroom scanned in the forward motion of the aircraft (Simi et al., “COMPASS”, 130). The HSI is whiskbroom scanned perpendicular to the motion of the aircraft which provides a broader field of regard than if it were pushbroom scanned (Simi et al., “COMPASS”, 130), (C. Simi, personal communication, “RE: a few more”, October 14, 2004). The HSI focal plane is imaged by a “40 $\mu$ m by >256x40 $\mu$ m” entrance slit (C. Simi, personal communication, “RE: a few more”, October 14, 2004). According to Simi, “A UniBlitz shutter closes in front of the slit after [every] scan” which provides the dark current for calibration (personal communication, “RE: more questions”, October 14, 2004). Additionally, the white calibration can be done on the backswing before the next scan of the whiskbroom although a very effective inscene calibration transfer method was implemented which allowed for the calibration coefficient to be tailored to the scene light level (C. Simi, personal communication, “RE: more questions”, October 14, 2004). According to Simi et al., “Attitude information is provided from the Boeing C-MIGIT INS, which is mounted on the spectrometer housing...The mirror will be roll compensated using information from the C-MIGITS.”, (“COMPASS”, 130).

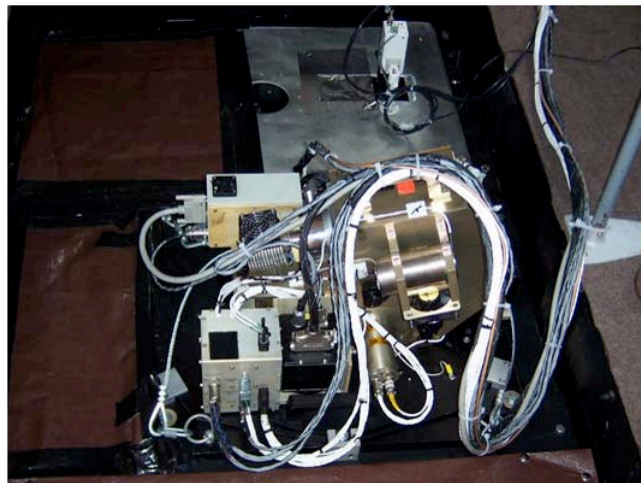


**Figure 7 – “COMPASS Scan Pattern” (Source: Simi et al., “On-Board Processing for the COMPASS”, figure 1)**

COMPASS is capable of operating at frame rates between 100 and 350Hz (Simi et al., “COMPASS”, 130). This is the rate at which the 1x256 spatial pixels are imaged in the cross-track direction by the scan mirror, before swinging back to reset for the next capture. Data from the ground is captured by the mirror in one scan direction only. Calibration occurs in between each scan (Simi et al. 138). Pixels are not capturing data of the ground in the period between when the mirror finishes the last line of data of one capture and the first line of the next capture. The first line of this next capture is one projection of 256 spatial pixels on the ground ahead of the last capture, though as indicated by Figure 7 there is a 10% overlap between scans. In order to determine the scan period, the number of lines in a single sweep of the array across the ground is

divided by the frame rate. If given a cross-track scan of 256 lines at a frame rate of 200Hz, the scan period would be 1.28 seconds long. The nominal cross-track scan FOV is 15 degrees at an altitude of 10,000ft (C. Simi, personal communication, “RE: more questions”, October 14, 2004). At this altitude, in order to correctly sample the ground without overlap or data gaps in the cross-track direction, then the scan mirror rate would have to be 11.7 degrees per second.

Figure 8 is a photo taken of COMPASS as mounted in a DC3 aircraft in June 2004. A compilation of sensor and design characteristics for the HSI, as well as nominal operational specifications can be found in Table 1.



**Figure 8 – Image of COMPASS Taken by the Author in June 2004**

**Table 1 – COMPASS System Characteristics**

<b>Description</b>	<b>Specification</b>	<b>Citation</b>
Array size	256x256	(Simi et al., "COMPASS", 131)
Focal Plane Array	A Single HgCdTe Array	(Winter et al. 1036)
Spectral Range	400nm to 2350nm	(Zadnik et al. 182)
Average Spectral Bandwidth	8.0nm +/- 0.5nm over the instrument range	(Zadnik et al. 182)
Number of Spectral Bands	256	(Zadnik et al. 182)
Spectral Response Shape	Gaussian	(Zadnik et al. 183)
Spectrometer FOV	5.5°	(Simi et al., "COMPASS", 130)
Spectrometer IFOV	350 microradians	(C. Simi, personal communication, "RE: more questions", October 14, 2004)
Spectrometer Cross Track Scan FOV	18-30°	(Simi et al., "COMPASS", 130)
Nominal Spectrometer Cross Track Scan FOV	15° at 10,000 ft 30° at 20,000 ft	(C. Simi, personal communication, "RE: more questions", October 14, 2004)
Number of Cross-track Pixels Per Swath	256	(Simi et al., "COMPASS", 130)
Effective Focal Length Requirement	100.1mm	(Simi et al., "COMPASS", 131)
GSD	0.85m at 8000 ft 1.65m at 14,500 ft	(Simi et al., "COMPASS", 130)
Ground Coverage Rate	133 sq km/hr at 8,000 ft 240 sq km/hr at 14,000 ft	(Simi et al., "COMPASS", 131)
Pixel Size	40 microns	(Simi et al., "COMPASS", 131)
Detector Readout	digitized to 14-bits	(Winter et al. 1036)
Data Rate	200 frames per second; 26Mbytes/s	(Schaff et al. 1)
Frame Rate	100-350 Hz	(Simi et al., "COMPASS", 130)
MTF Requirement	≥ 0.9 @ nyquist for 633nm	(Simi et al., "COMPASS", 131)
INS-D-GPS	Boeing C-MIGITS roll,	(Simi et al., "COMPASS",

	pitch, yaw, alt, UTC, lat., long., provided per frame of data	131)
--	---	------

Though a version of the document, “Calibration Procedures and Measurements for the COMPASS Hyperspectral Imager” the author received listed both the spectral bandwidth and spacing of the HSI channels at 7.8 nm, this was changed to 8.0 +/- 0.5 nm when the paper was published (Zadnik et al, 182). Figure 9 shows the relationship of the 256 spectral bands to their centers (wavelength in nanometers).

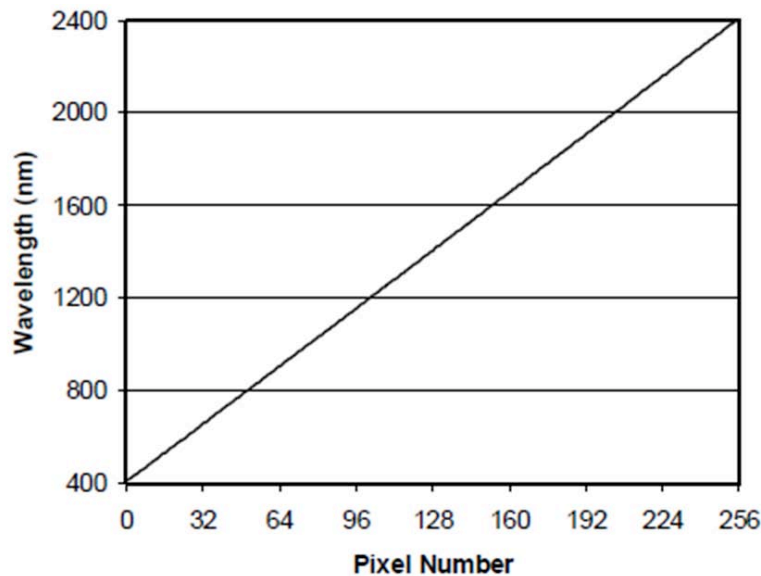
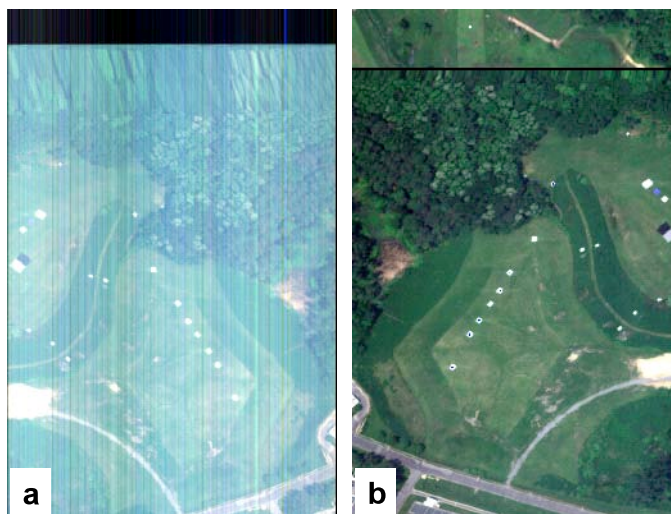


Figure 9 – “Band center vs. channel number” (Source: Zadnik et al., figure 6)

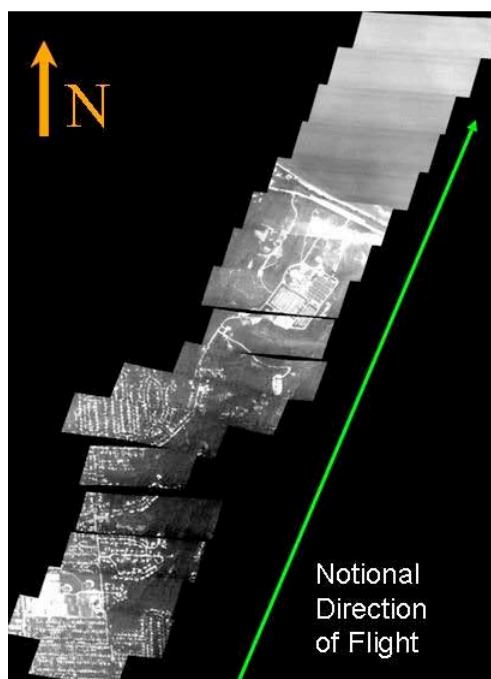
### ***(FOUO) COMPASS Megacollect Data***

(FOUO) As mentioned previously, COMPASS was one of the sensors which had imaged the calibration tarps during the Megacollect. Figure 10 is an example of COMPASS imagery collected during the Megacollect. Both images were opened in ENVI and loaded with channel 34 in the red, channel 21 in the green, and channel 8 in the blue displays. Neither image has been stretched or altered. The image on the left (Figure 10 - a) is uncalibrated and the image on the right (Figure 10 – b) has been through processing and is calibrated. A black region is visible in the uncalibrated image. This area was present in between each sweep of the whiskbroom in the scene. In the calibrated image, this area has been decreased significantly to just a pixel or two in-between sweeps of the whiskbroom. As both images were loaded in the same fashion into ENVI 4.6, it can be inferred that the image gets “flipped” during processing as the two are mirror opposites of each other. In addition, what was very noticeable banding in the uncalibrated image is virtually nonexistent in the calibrated data.



**Figure 10 – (FOUO) Uncalibrated (a - on left) and Calibrated (b - on right) COMPASS Images of the Camp Eastman Area Collected 07 June 2004**

(FOUO) Figure 10 is only a portion of a flight line. Figure 11 is an example of a full calibrated, georectified flight. North is up, and the green arrow represents the notional direction of the flight. The whiskbroom scanned perpendicular to the flight line, each sweep generating an image comprised of a 256 pixel wide by a length determined by the speed and motion of the aircraft. This particular flight line contains the portion extracted in Figure 11



**Figure 11 – (FOUO) An Entire COMPASS HSI Flight Line**

(FOUO) Processing software was received from Robert Moss and run on the calibrated COMPASS data received (Raqueño). A byproduct of running this geocoding software was the creation of graphs of all of the flight information included in the flightpath files

(Raqueño). The graphs included information about the coordinate location of the plane, altitude, heading and attitude. Figure 12 shows the flightpath information specific to the Camp Eastman flight line shown in Figure 11.

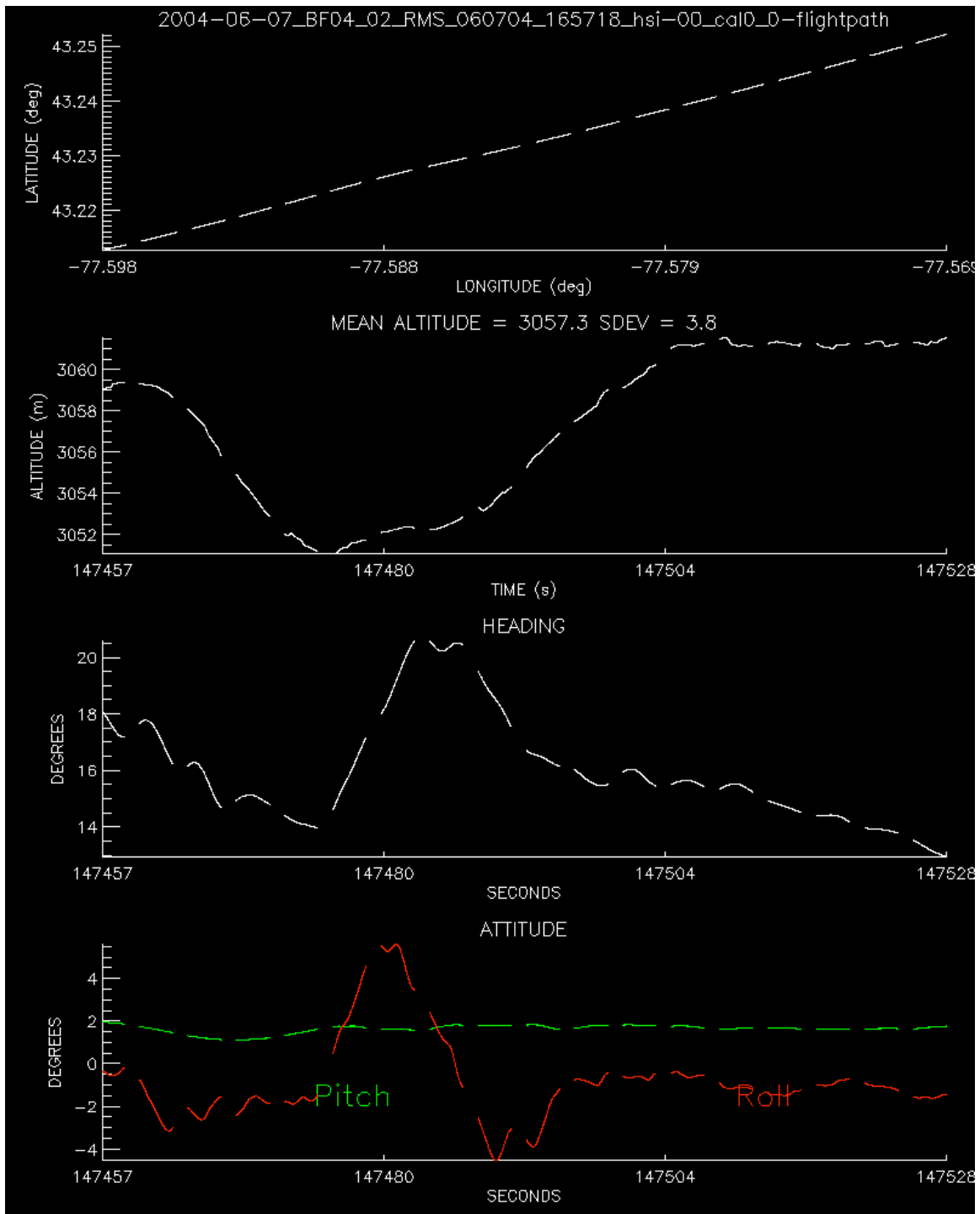


Figure 12 – (FOUO) Flightpath Metadata from Camp Eastman Flight Line



## DIRSIG Simulation

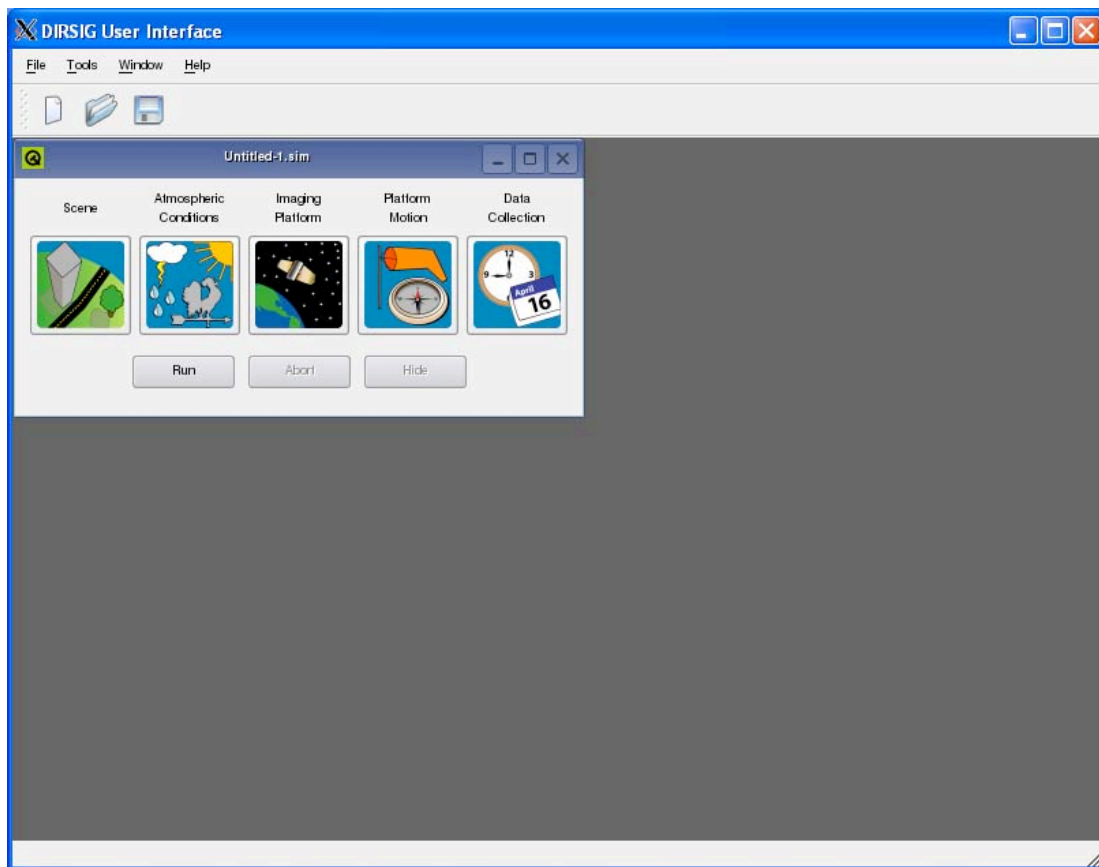
All DIRSIG simulations were created using `dirsig_edit-4.2.3`, `dirsig_4.2.3`, and `Modtranv4r3`. In order to run DIRSIG at all, `DIRSIG_HOME` must be specified in “.cshrc” file. Figure 13 is an example of what was in the author’s “.cshrc” file to fill this requirement. The section starting with “setenv QTDIR” was added to be able to use the program bulldozer.

```
setenv DIRSIG_HOME /dirs/pkg/dirsig
set path = ($path ${DIRSIG_HOME}/bin /dirs/bin)
setenv LD_LIBRARY_PATH ${DIRSIG_HOME}/lib:${LD_LIBRARY_PATH}

setenv QTDIR /dirs/lib/gqt-3.1.1
set path = ($path $QTDIR/bin)
setenv LD_LIBRARY_PATH ${LD_LIBRARY_PATH}:$QTDIR/lib
```

**Figure 13 – Required Additions to the “.cshrc” File**

At the core of using `dirsig_edit-4.2.3` is a simulation file called a “\*.sim”. This file cannot be saved through the `dirsig_edit` GUI until all 5 areas have been specified, which are: scene, atmospheric conditions, imaging platform, platform motion, and data collection.



**Figure 14 – DIRSIG User Interface From "dirsig\_edit-4.2.3"**



## Scene

As mentioned previously, the area of interest for this study was Camp Eastman, which is located in tile 4 of Megascene 1. Figure 15 is a high-resolution rendering of tile 4 using DIRSIG. This served as the base for the simulation.

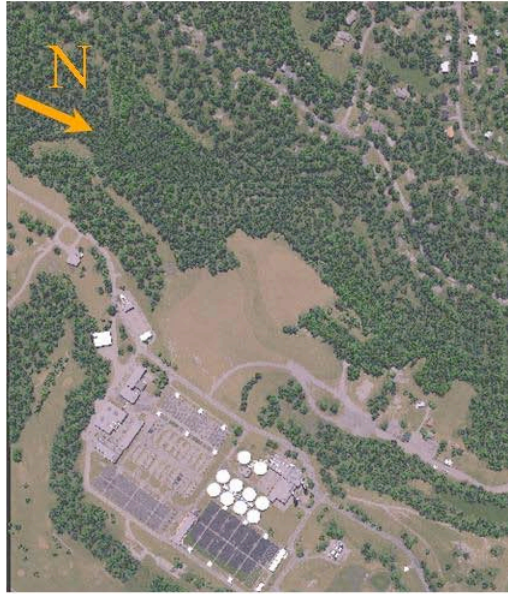
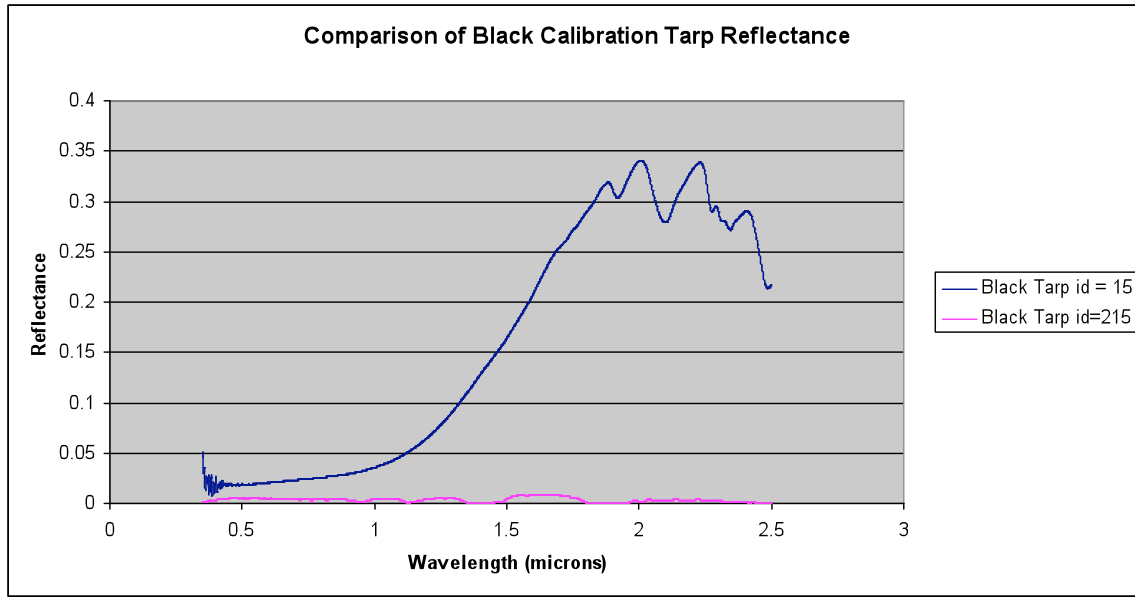


Figure 15 – High-Resolution DIRSIG Rendering of Megascene 1, Tile 4

## Creation of Calibration Tarps

### Emissivity Files

In order to have a comparison between the simulated data and the actual sensor imagery, the calibration tarps needed to be placed into the scene. The first step in creating these objects was to create emissivity files for the two tarps. Spectra of these two targets were plentiful as ASD spectrometer measurements were being taken of each corner of both tarps throughout the day. This spectra was placed into the spectral database which is accessible online by logging into at [www.dirsig.org/spectraldb](http://www.dirsig.org/spectraldb). From here spectra are searchable by many different fields and tags. By entering information pertaining to the targets of interest, the query returned with multiple spectra from the gray and black calibration tarps. An initial iteration used spectra of the two calibration tarps during the Megacollect (spectral database ids 215 and 217). Unfortunately, there was a problem with the spectra as the reflectance values for both were much lower than they should have been. Figure 16 shows a comparison of the initial black calibration tarp spectrum (id=215) from the Megacollect with spectrum (id=15) collected at Camp Eastman in August 2004.



**Figure 16 – Comparison of Black Tarp Reflectance Spectra**

Instead of the Megacollect spectra, two spectra were selected which were measurements of both tarps at Camp Eastman, but in August 2002. DIRSIG emissivity files were downloaded from the site of the gray tarp (database number 10) and the black tarp (database number 15) by following the links to the individual measurements one at a time. Files were not downloaded via the “add to cart” function.

Each emissivity file downloaded was checked to make sure that they follow the format of a DIRSIG emissivity file. The wavelength values were in micron. Rows 1 through 92 (in column 1) contained the value “1” as per the “DIRSIG User’s Manual” (406-409). Row 1 contained the value “1” because there was only one spectrum in each emissivity file. Rows 2 through 91 contained the normal spectral emissivity weighting factor for each angle from 0 through 90 from normal (“DIRSIG User’s Manual” 406-409). All weighting factors were set to “1” as the tarps are assumed to be Lambertian and thus is weighted equally in each angular direction. The words “CURVE\_BEGIN” were located row 93, column 1, with the wavelengths and emissivity values following in columns 1 and 2 respectively for however many rows there were spectral data for as a function of the spectral resolution of the reflectance data (“DIRSIG User’s Manual” 406-409).

These files were initially each renamed as, “gray\_cal\_tarp\_megacollect.ems” and “black\_cal\_tarp\_megacollect.ems” during a previous iteration when the Megacollect spectra were used. Though potentially misleading, this filename convention was kept the same. Figure 17 is an excerpt of “black\_cal\_tarp\_megacollect.ems”, showing the transition from the weighting value to the actual emissivity spectrum.

```

.
.
.
1
1
1
1
1
1
1
1
1
1
1
CURVE_BEGIN
0.35 0.954844
0.351 0.948447
0.352 0.953748
0.353 0.964085
0.354 0.970199
0.355 0.96844
0.356 0.964264
.
.
.

```

**Figure 17 – Excerpt From "black\_cal\_tarp\_megacollect.ems" Emissivity File**

## Material File

Once the emissivity files were created, material entries needed to be created for both calibration tarps in a material file. Material files contain information pertaining to each material attributed to a facet of an object to be rendered. Since these materials had to be added to the material file that the Megascene1 simulation used, a copy of /dirs/home/dirsig/megascene1/materials/megascene.mat was created and renamed "megascene\_megacollect.mat". A tutorial regarding the material file was found in pages 88-93 of the "DIRSIG User's Manual".

Material entries for "Gray Panel" – id: 11 and "Black Panel" – id: 12 were copied to the end of the main group of materials, just after entry for material 8194 and inserted before the material entries for "DIRSIG MOVIE". Unique material IDs needed to be assigned to each new material entry, thus id = 10,000 and 10,001 were designated for materials "Gray Cal Panel from Megacollect" and "Black Cal Panel from Megacollect". Figure 18 shows the full material entries for both the gray and black calibration panels. The only fields changed from the initial gray and black panel entries were: the name, id, thickness (which was approximated to be 0.5cm for both panels and kept consistent later with the actual object information in the "\*.gdb" file), emissivity file, and editor color. The emissivity file pointed to the full path because later during the DIRSIG scene entry, the emissivity directory pointed to the folder containing the 161 other emissivity files that the rest of the material file would be looking for, rather than copying them all to the directory where the two new emissivity files were. The editor colors were set to a light gray for the gray panel and a near black for the black panel so that when the object was checked in

bulldozer (DIRSIG object visualizing and editing software) it could be verified that they had the correct materials attributed to them.

```
MATERIAL_ENTRY {
    NAME = Gray Cal Panel from Megacollect
    ID = 10000
    SPECIFIC_HEAT = 0
    THERMAL_CONDUCTIVITY = 0
    MASS_DENSITY = 0
    SPECULARITY = 0
    THERMAL_EMISSIVITY = 0.9
    EXPOSED_AREA = 0.5
    THICKNESS = 0.5
    OPTICAL_DESCRIPTION = OPAQUE
    EMISSIVITY_FILE = /dirs/home/FOUO/DIRSIG_COMPASS/emissivity/gray_cal_tarp_megacollect.ems
    EDITOR_COLOR = 0.7804, 0.7804, 0.7804
    DOUBLE_SIDED = FALSE
}
MATERIAL_ENTRY {
    NAME = Black Cal Panel from Megacollect
    ID = 10001
    SPECIFIC_HEAT = 0
    THERMAL_CONDUCTIVITY = 0
    MASS_DENSITY = 0
    SPECULARITY = 0
    THERMAL_EMISSIVITY = 0.9
    EXPOSED_AREA = 0.5
    THICKNESS = 0.5
    OPTICAL_DESCRIPTION = OPAQUE
    EMISSIVITY_FILE = /dirs/home/FOUO/DIRSIG_COMPASS/emissivity/black_cal_tarp_megacollect.ems
    EDITOR_COLOR = 0.1000, 0.1000, 0.1000
    DOUBLE_SIDED = FALSE
}
```

**Figure 18 – Material Entries for the Gray and Black Calibration Tarps**

## Geometric Database “\*.gdb” File

The next step in simulation the calibration panels was to create the \*.gdb file. This is a DIRSIG file that contains the facets and material information of an object for rendering. Pages 412-413 of the “DIRSIG User’s Manual” contain information regarding the structure of a “\*.gdb” file.

The file “ThreeMeterPanel1.gdb” from /dirs/home/dirsig/megascene1/gdb/Panels was copied and used as a starting point for creating the geometric database file for the panels. For ease of object insertion and rotation later, and to keep in the same object centered on the origin coordinates that the rest of the Megascene 1 objects, the panels were created into one object, centered at xyz coordinates (0,0,0). The panels used were both 25ft by 25ft, which needed to be converted to 7.62 meters by 7.62 meters to stay the same as the units used for Megascene 1.

Figure 19 shows the contents of the geometric database file created for the two calibration panels called “megacollect\_cal\_panels.gdb”. Each part is named appropriately and the material id defined earlier in the material file is attributed to each panel. This file created two panels adjacent to each other, centered at xy coordinates (0,0) and using the ThreeMeterPanel1.gdb z coordinate of 0.1m). Both panels were assigned a thickness of 0.5cm here as well, which is mirrored in the material entries.

```

OBJECT
MegacollectCalPanels
1-0-0
PART
GreyCalPanel
1-1-0
FACE
GROUND_1
1-1-1
GreyCalPanel
10000
FACET
0.0
0.50
0.0
0.0
NULL
NULL
NULL
4
3.81000e+00 7.62000e+00 1.000000e-01
3.81000e+00 0000000e+00 1.000000e-01
-3.81000e+00 0000000e+00 1.000000e-01
-3.81000e+00 7.62000e+00 1.000000e-01
0.00000000000000000000e+00 -0.00000000000000000000e+00
1.00000000000000000000e+00
0.000000e+00
0.000000e+00
1-1-0
PART
BlackCalPanel
1-1-1
FACE
GROUND_1
1-1-2
BlackCalPanel
10001
FACET
0.0
0.50
0.0
0.0
NULL
NULL
NULL
4
3.81000e+00 0000000e+00 1.000000e-01
3.81000e+00 -7.62000e+00 1.000000e-01
-3.81000e+00 -7.62000e+00 1.000000e-01
-3.81000e+00 0000000e+00 1.000000e-01
0.00000000000000000000e+00 -0.00000000000000000000e+00
1.00000000000000000000e+00
0.000000e+00
0.000000e+00
5.000000e-01
END

```

**Figure 19 – "megacollect\_cal\_panels.gdb" File**

As a sanity check on both the material and gdb files, “megacollect\_materials.mat” and “megacollect\_cal\_panels.gdb” were opened in bulldozer from /dirs/pkg/dirsig/bin/. Figure 20 is a screen capture of the bulldozer GUI with these files opened. Here we can see that indeed, both panels are the same dimensions, they are adjacent, and by looking up the color key in the material file pane on the right we can see that the top panel is attributed with the gray cal panel material (id = 10,000) and the bottom is attributed with the black cal panel material (id = 10,001). From here, the objects were rotated using the controls on the bottom to make sure that the panels were flat and in the same plane.

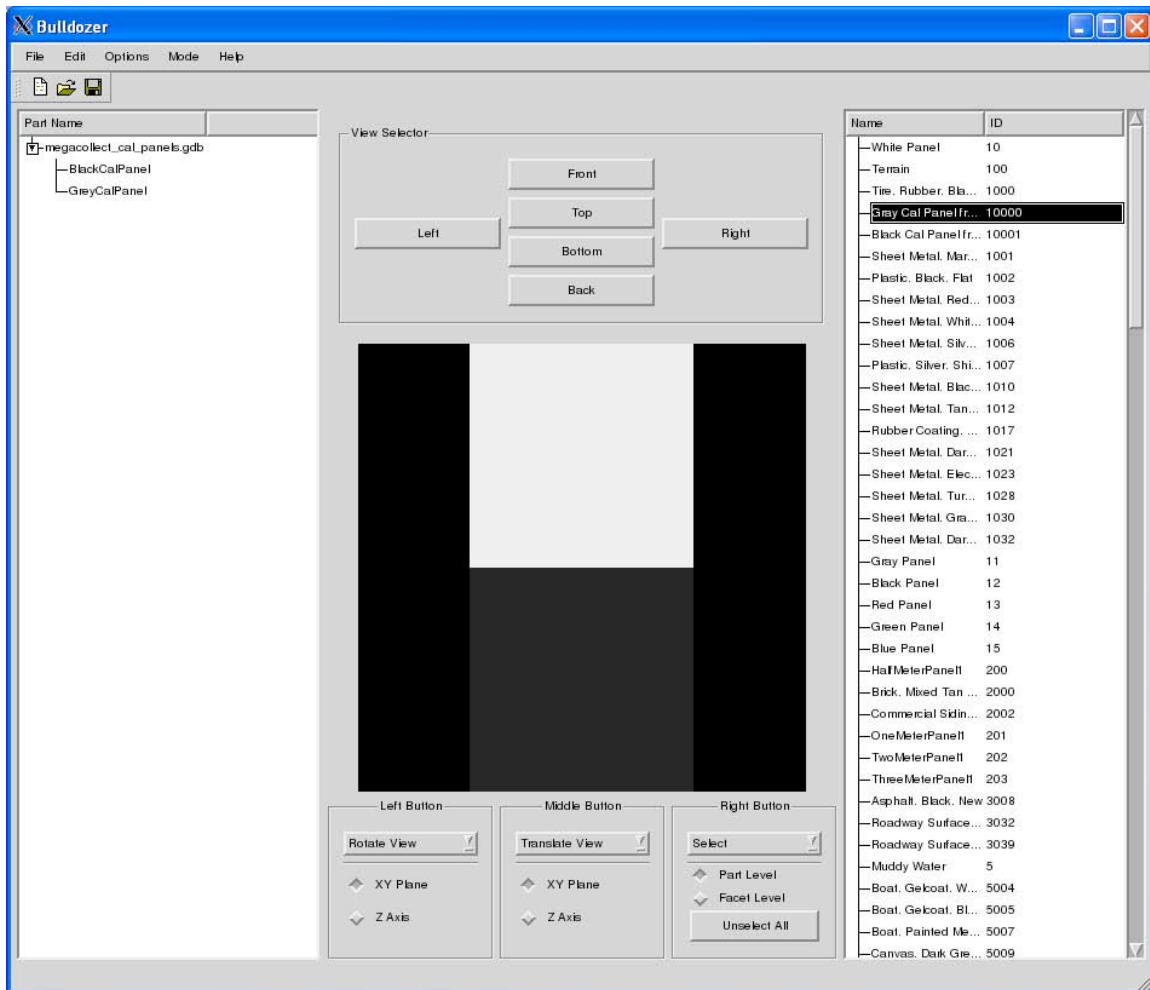


Figure 20 – Files “megacollect\_cal\_panels.gdb” and “megacollect\_materials.mat” Opened in Bulldozer

## Object Database “\*.odb” File

Once the geometric database file is made, an object database file needed to be created. This file is what takes the object from its object centered coordinates and translates that into the scene coordinates. Information about the object database file format was found in pages 417-418 of the “DIRSIG User’s Manual”.

In order to determine where in the scene these panels should be, a preliminary DIRSIG run was created using the tile 4 area of Megascene 1 and a simple RGB framing array.

Once this was run in preview mode with the truth image option enabled, the resulting truth image was opened in ENVI 4.6. The x, y, and z coordinate location bands were opened in the red, green, blue channels of the viewer. A location which appeared to be similar to where the calibration tarps were during the Megacollect was identified and in xyz coordinates using the cursor location/value function of ENVI. The z coordinate had to be modified to be slightly higher than the values from ENVI as the original attempt had only part of the panels showing as the rest were buried under the terrain. The z coordinate and the z rotation were modified using a trial and error method. Values were modified, rerun, and modified again until the panels were rotated into an acceptable orientation which roughly matched the actual orientation of the panels during the Megacollect.

```
DIRSIG_ODB = 1.0
OBJECT {
  GDB_FILENAME = /dirs/home/FOUO/DIRSIG_COMPASS/gdb/megacollect_cal_panels.gdb
  UNITS = METERS
  INSTANCES {
    INFO = 1821.64, 2811.31, 100.00, 1, 1, 1, 0, 0, 300
  }
}
```

**Figure 21 – "Megacollect\_Cal\_Panels.odb" File**

Once the object database file was created for the panels, it was then added to the object database file for tile 4. A copy of "tile\_4.odb" was made. This was altered to put the full paths of the existing ".odb" entries there as well as add the new "Megacollect\_Cal\_Panels.odb". Figure 22 shows what the finished file looked like.

```
DIRSIG_ODB = 1.0

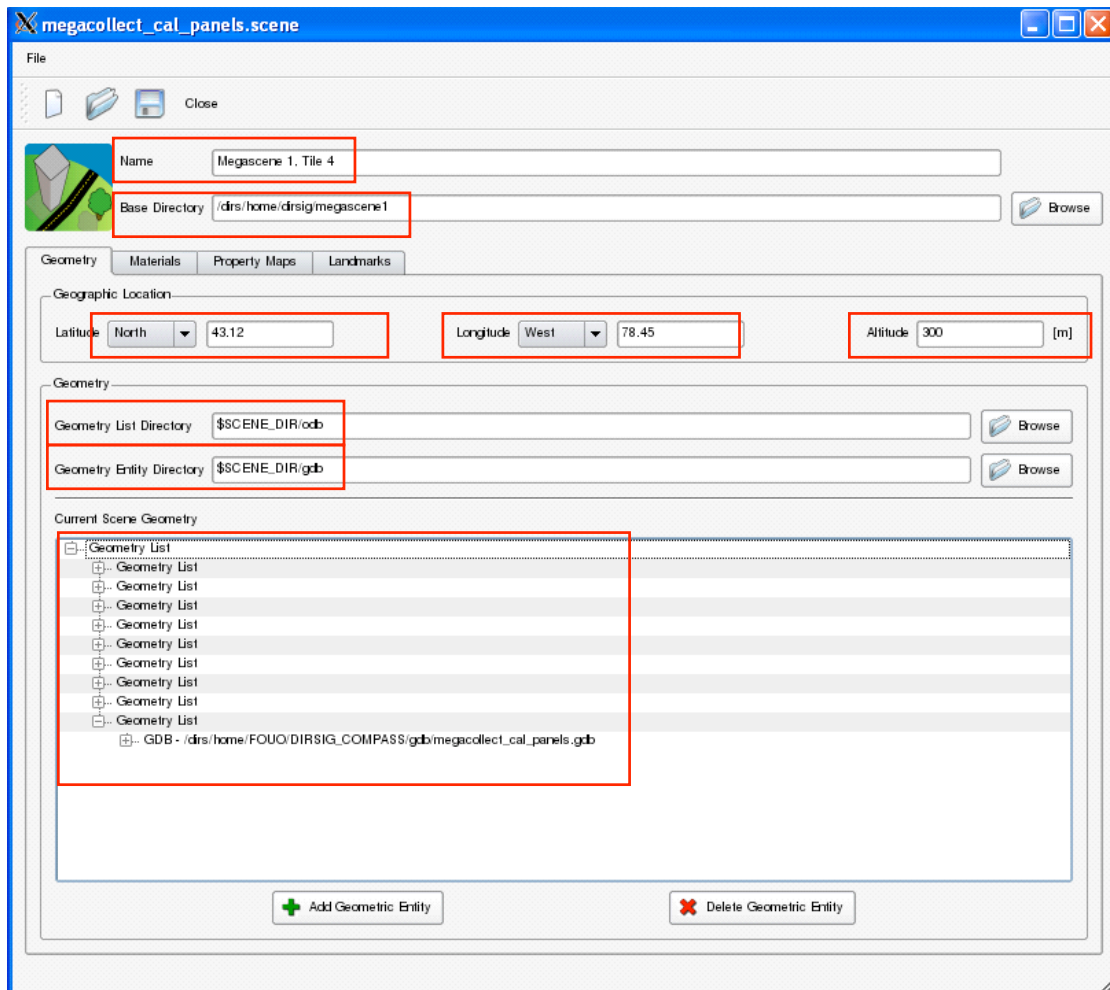
INCLUDE_FILE = /dirs/home/dirsig/megascene1/odb/tile_4/Redneck_Rd.odb
INCLUDE_FILE = /dirs/home/dirsig/megascene1/odb/tile_4/Bottom_Left_Trees.odb
INCLUDE_FILE = /dirs/home/dirsig/megascene1/odb/tile_4/Bottom_Right_Trees.odb
INCLUDE_FILE = /dirs/home/dirsig/megascene1/odb/tile_4/First_Rd.odb
INCLUDE_FILE = /dirs/home/dirsig/megascene1/odb/tile_4/Second_Rd.odb
INCLUDE_FILE = /dirs/home/dirsig/megascene1/odb/tile_4/Water.odb
INCLUDE_FILE = /dirs/home/dirsig/megascene1/odb/tile_4/Waterplant_Lowerhalf.odb
INCLUDE_FILE = /dirs/home/dirsig/megascene1/odb/tile_4/Waterplant_Upperhalf.odb
INCLUDE_FILE = /dirs/home/FOUO/DIRSIG_COMPASS/odb/Megacollect_Cal_Panels.odb
```

**Figure 22 – "tile\_4.odb"**

## Scene File

One of the required elements of using the new DIRSIG ".sim" file is a scene file. Once all items were entered, it was saved as a ".scene file". As specified earlier, Megascene 1, tile 4 was used as the base for this project, with the changes that the newly edited "megascene\_materials.mat" be used along with the addition of the "Megacollect\_Cal\_Panels.odb" be added to the list of geometry lists included. Figure 23 shows a screen capture of the inputs for the scene editor geometry tab, as well as the name and base directory. Once the base directory is selected, other directories will point to that location as "\$SCENE\_DIR/" unless otherwise specified. The name and base directory are displayed independent of the tab selected. Most important entry on this tab

is the inclusion of the “Megacollect\_Cal\_Panels.odt” in the list of current scene geometry. It can also be entered in a text editor after the scene file is saved by entering the line shown in Figure 24 .



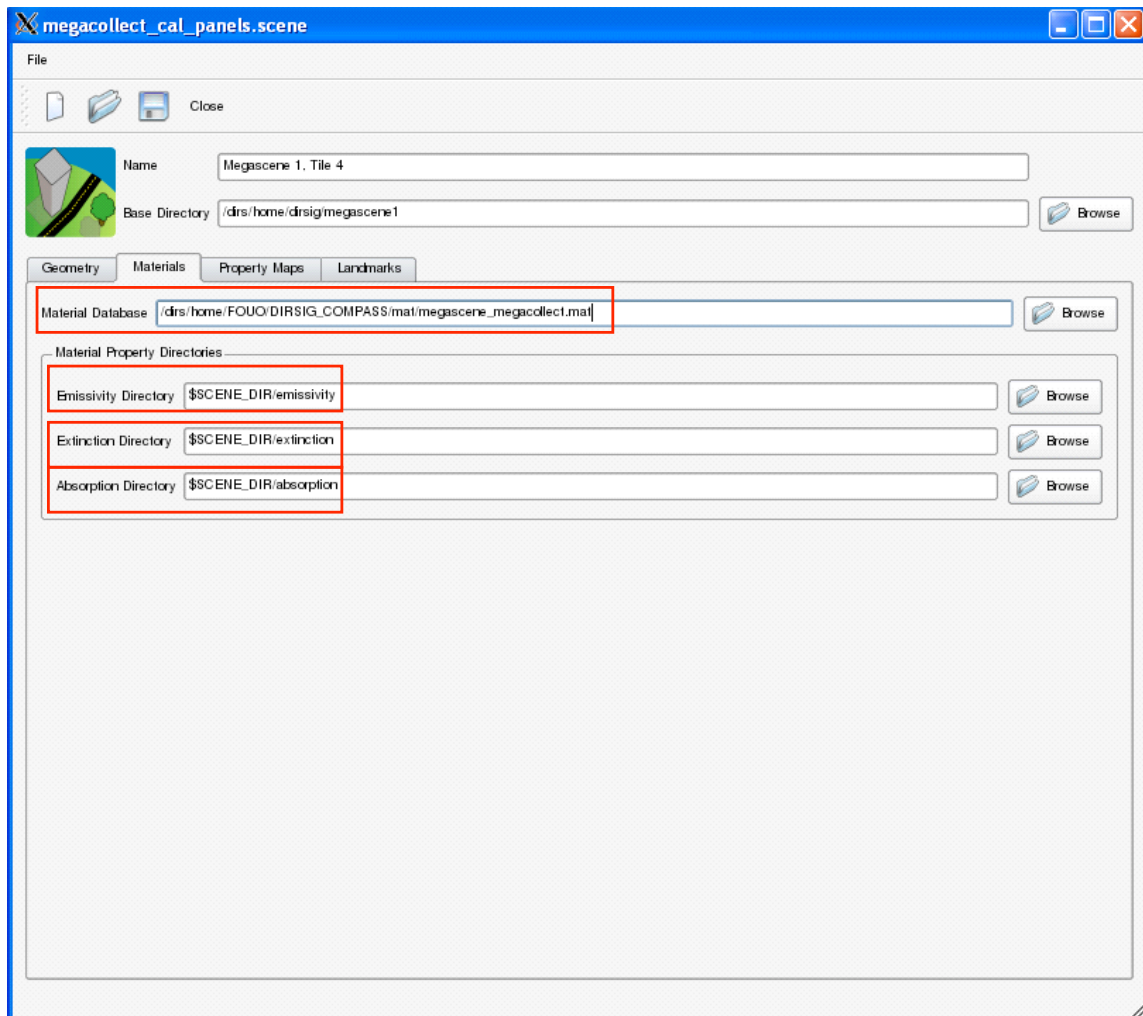
**Figure 23 – Scene GUI - Geometry Tab**

```
<geometrylistinclude name="Cal_Panels"
enabled="true">/dirs/home/FOUO/DIRSIG_COMPASS/odb/Megacollect_Cal_Panels.odt</geometry
listinclude>
```

**Figure 24 – Text Entry of "Megacollect\_Cal\_Panels.odt" to the Geometry List of the Scene File**

Figure 25 lists the inputs entered on the material tab of the scene GUI. This is where the newly created “megascene\_megacollect.mat” file is specified, along with the directories for emissivity, extinction, and absorption files.





**Figure 25 – Scene GUI - Material Tab**

Figure 26 and Figure 27 show the property maps tab of the scene GUI. Information regarding the addition of terrain maps to the simulation are shown in Figure 26. Texture maps are specified and enabled in Figure 27. The last tab in the scene GUI is called “landmarks”. This was left blank.

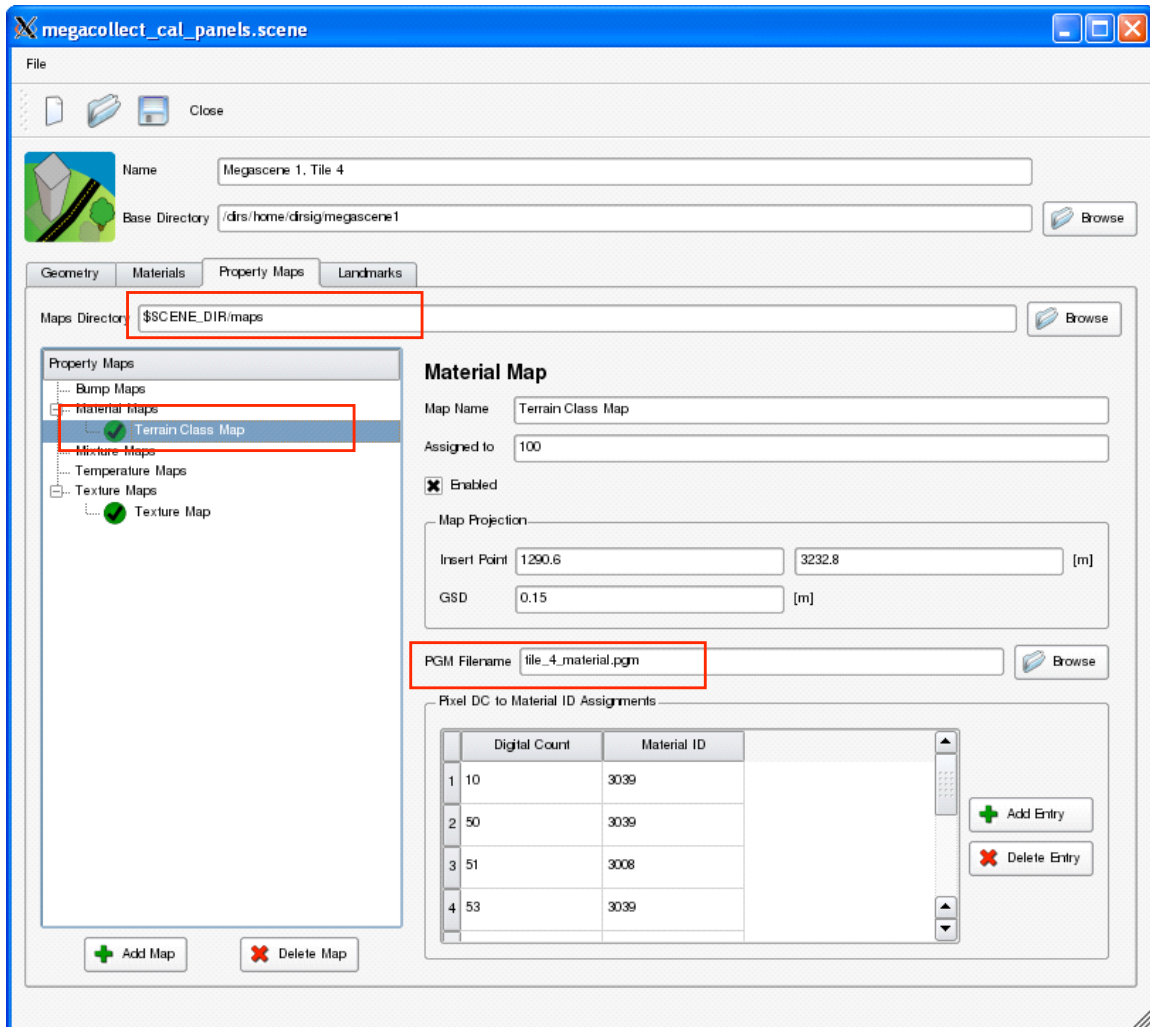


Figure 26 – Scene GUI - Property Maps Tab: Terrain Class Map

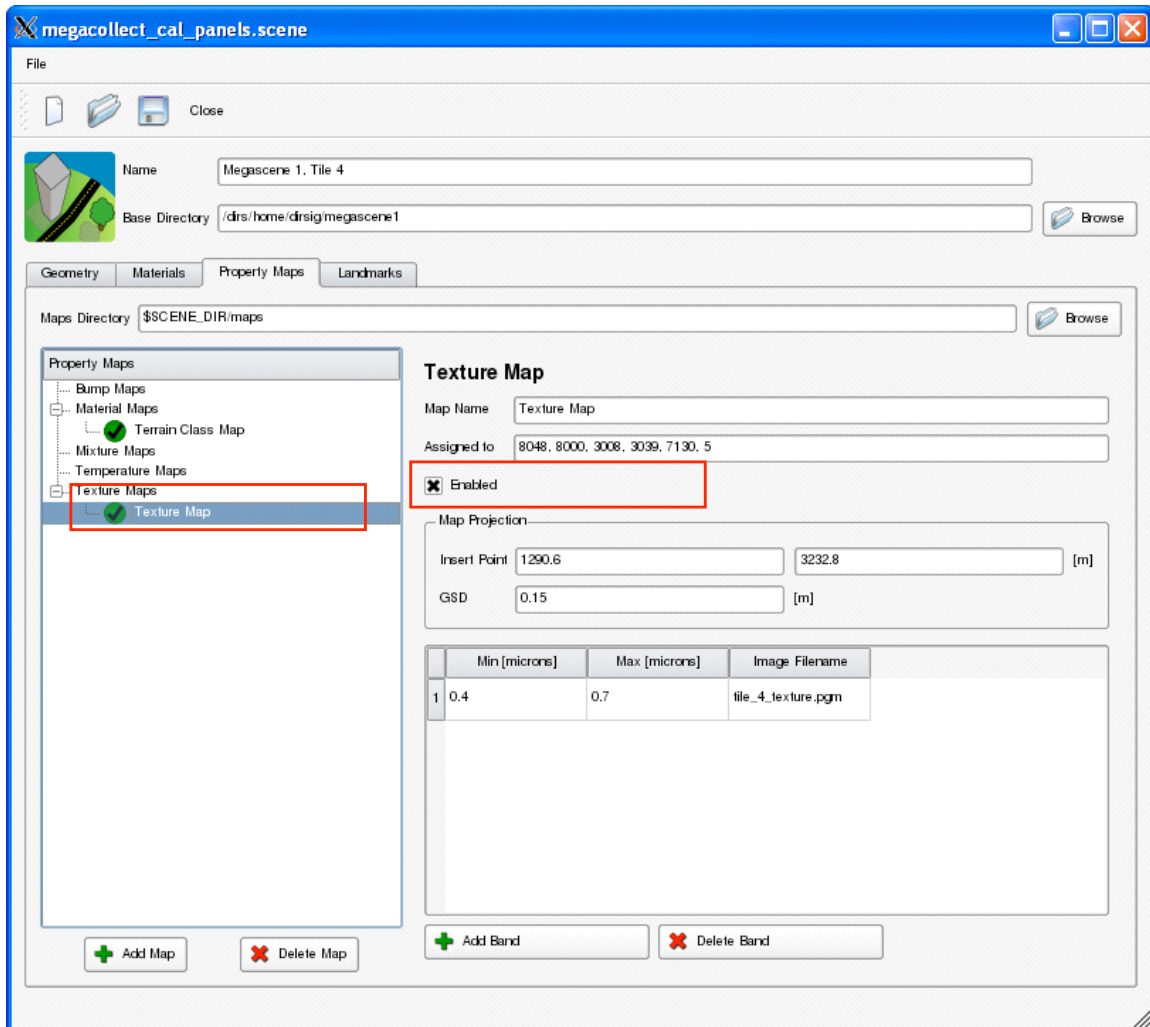
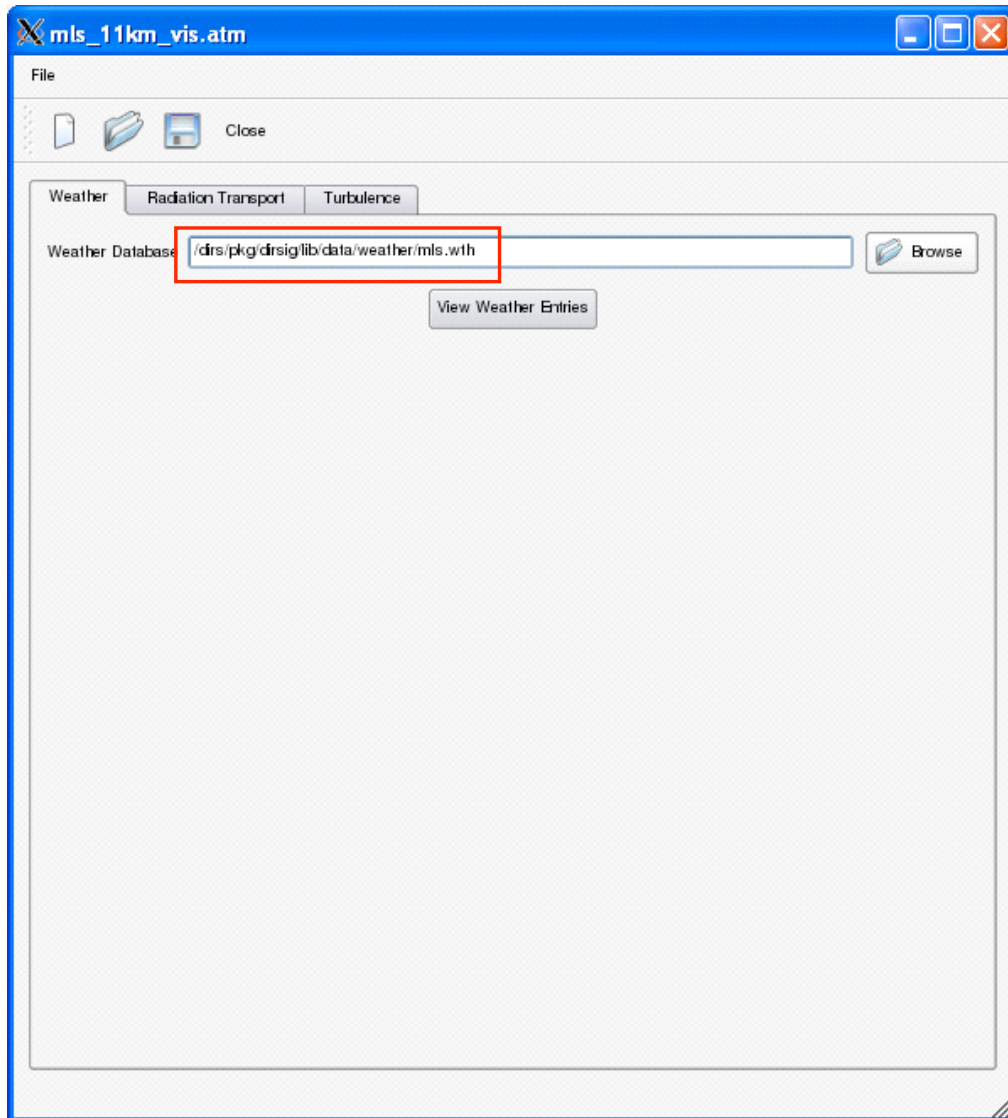


Figure 27 – Scene GUI - Property Maps Tab: Texture Maps

After all input was added, the scene was saved as “megacollect\_cal\_panels.scene”, which can be found in the appendix.

## Atmosphere

The atmosphere file utilized the mid-latitude summer weather file, “mls.wth” which is listed in the appendix under weather file. This file contains weather information for a 48 hour period. Since COMPASS is sensitive only to 0.4-2.35 micron range, this generic weather was used instead of generating a weather file data specific to 07 June 2004 at Camp Eastman.



**Figure 28 – Atmospheric Conditions GUI - Weather Tab**

The tape5 file used was a slightly modified mid-latitude summer tape5 file. The file “mls.tp5” was opened using the “tape5\_edit” program from /dirs/pkg/dirsig/bin/. From here, card 2 was opened and the visibility was changed to 11km as shown in Figure 30. After the value of 11 was typed into the cell for visibility, the ENTER key must be pressed prior to selecting “OK”, otherwise the change is not kept. This value was based on visibility data from the Rochester Airport for 07 June 2004. The modified tape5 file was then saved as “mls\_11km\_vis.tp5”. The original “mls.tp5” tape5 file can be found in the appendix as well as the modified version “mls\_11km\_vis.tp5”.

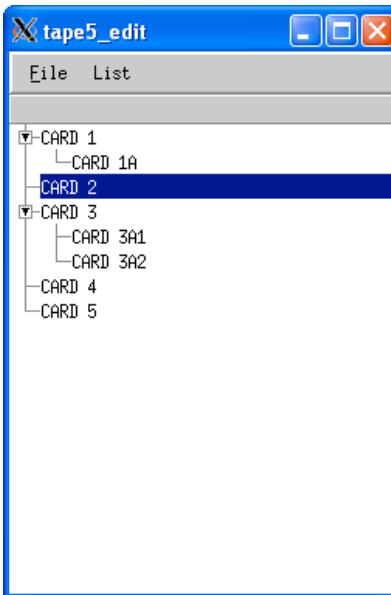


Figure 29 – "tape5\_edit" Window

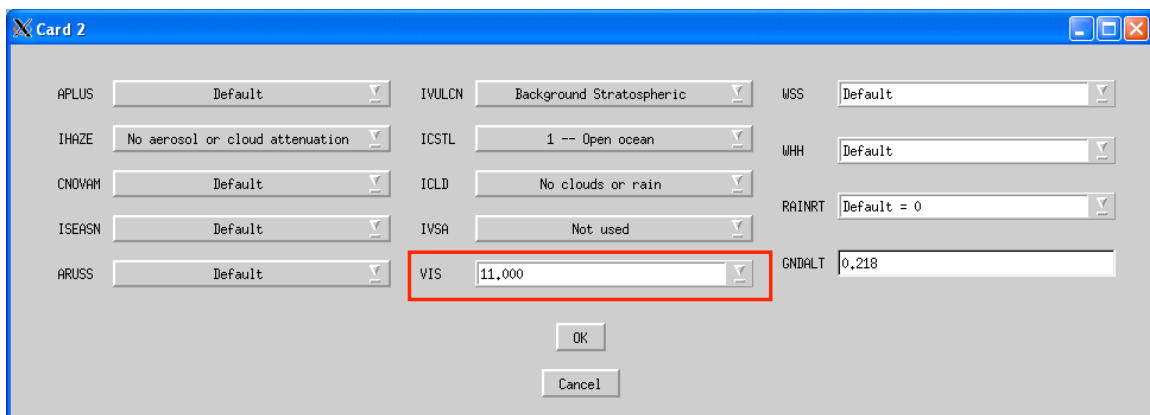
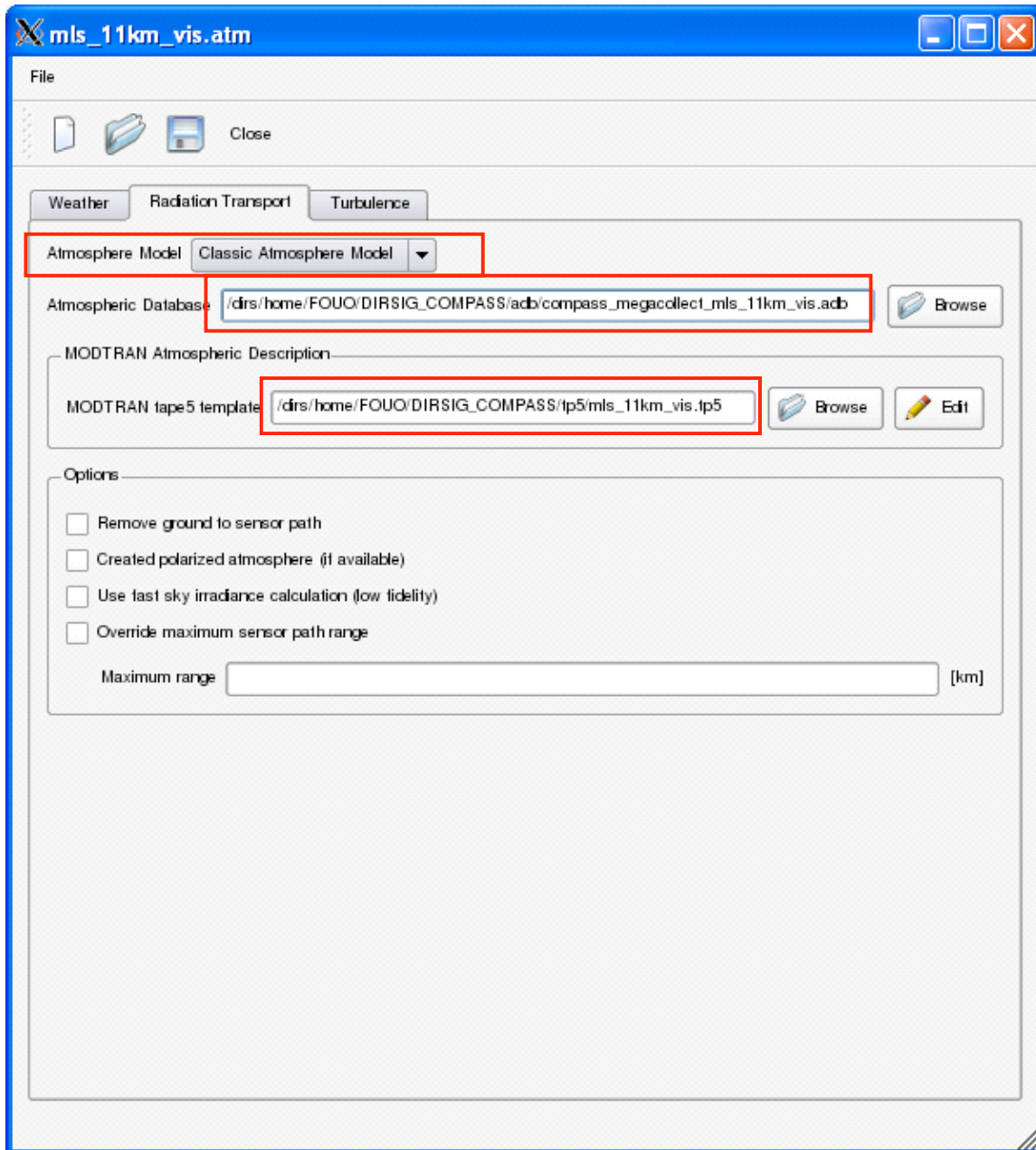


Figure 30 – "tape5\_edit" View of Card 2

Figure 31 shows the radiation transport tab of the atmospheric conditions GUI, highlighting the areas of interest. The classic atmosphere model was chosen from the atmosphere model drop down menu. Then an atmospheric database filename was specified for the "\*.adb" to be written to once DIRSIG was run. The newly created "mls\_11km\_vis.tp5" file was entered for the MODTRAN tape5 template parameter.



**Figure 31 – Atmospheric Conditions GUI - Radiation Transport Tab**

Lastly, “Enable turbulence model” was deselected on the turbulence tab as shown in Figure 32. The resulting atmosphere file can be found in the appendix listed as “mls\_11km\_vis.atm”.

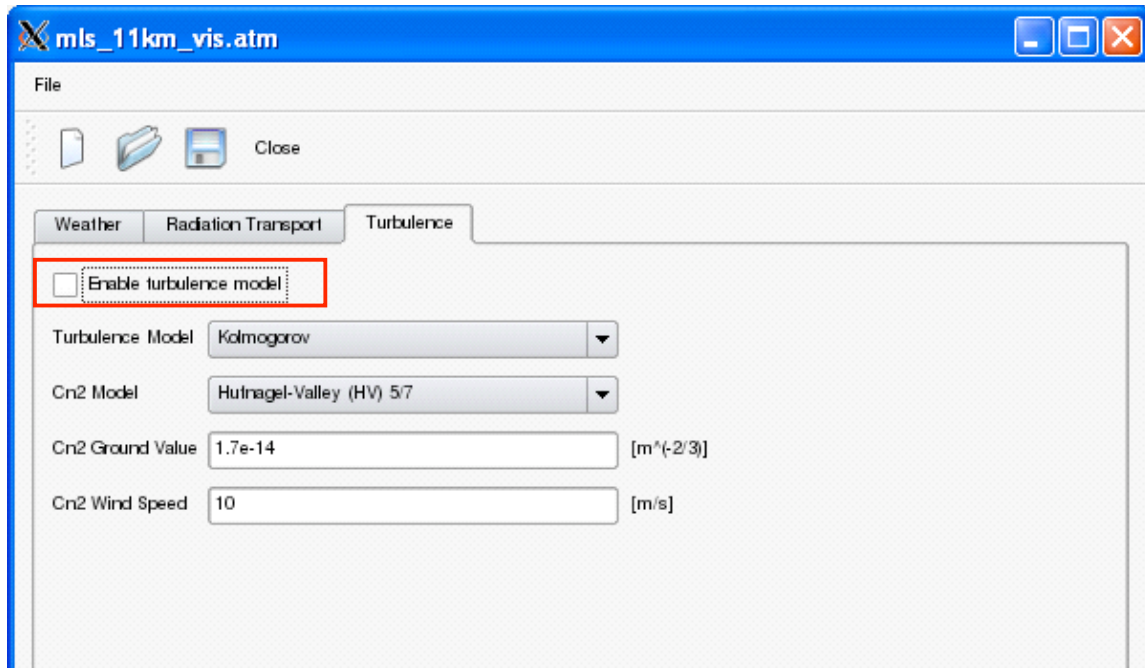


Figure 32 – Atmospheric Conditions GUI - Turbulence Tab

## Response File

The spectral response of COMPASS ranges from 0.4-2.35 microns, with 256 channels and an average spectral bandwidth of 8.0nm +/- 0.5nm over the instrument range (Zadnik et al. 182). Also according to Zadnik et al. the spectral response curves have a Gaussian shape (183). Using Figure 9 as a backdrop, 256 channels starting at 0.4 microns were spaced 8nm apart sequentially as shown as the green line in Figure 33. This resulted in a spectral range of 0.4 to 2.44 microns and had a slightly higher slope than the original black line from Figure 9. As mentioned in the text just after Table 1, a previous release of the “Calibration Procedures and Measurements for the COMPASS Hyperspectral Imager” listed the average spectral bandwidth as 7.8nm. Again, using Figure 9 as a backdrop, 256 channels starting at 0.4 microns were spaced 7.8nm apart sequentially as shown as the pink line in Figure 33. This resulted in a spectral range of 0.4 to 2.389 microns and as this more closely matched the black line from Figure 9, these values were used as the wavelength centers for the input response file. These band center wavelengths, FWHM values of 7.8nm, and known shape of the responses were inputs into the DIRSIG response file. Format for this file was found in pages 430-431 of the “DIRSIG User’s Manual”. The file was created in Excel, using the proper header information listed in the documentation followed by the two columns of wavelength centers and FWHM values in microns. This worksheet was then saved out as a tab-delimited file and given an extension of “\*.rsp”. The file used for these simulations was “COMPASS\_7\_8\_nm.rsp” and is located in the appendices.

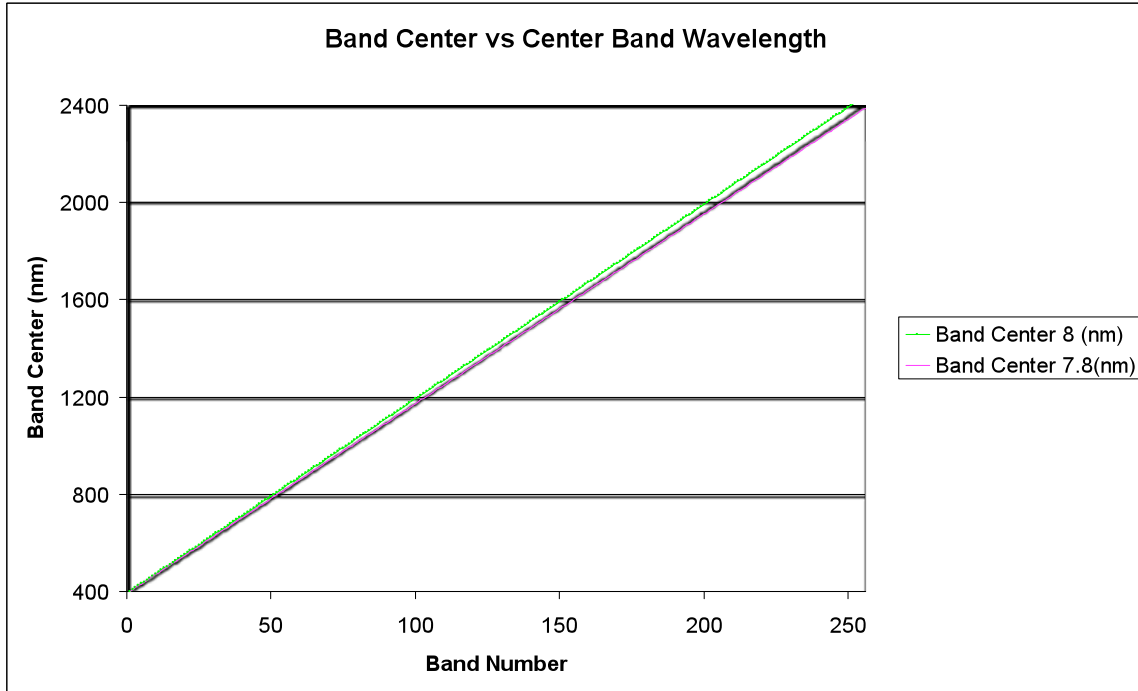


Figure 33 – Band Center vs. Wavelength Comparison of Published Values

## Platform

Figure 34 shows the overview of the platform GUI. This shows the top level of the system components which is the name and description of the system.

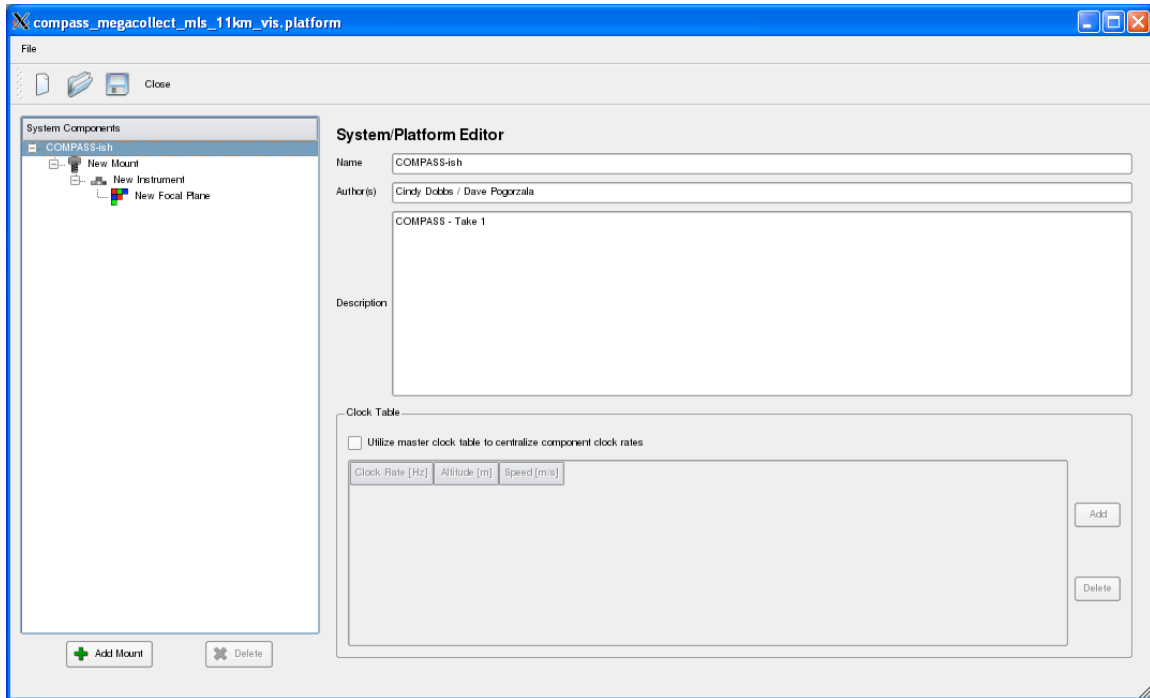
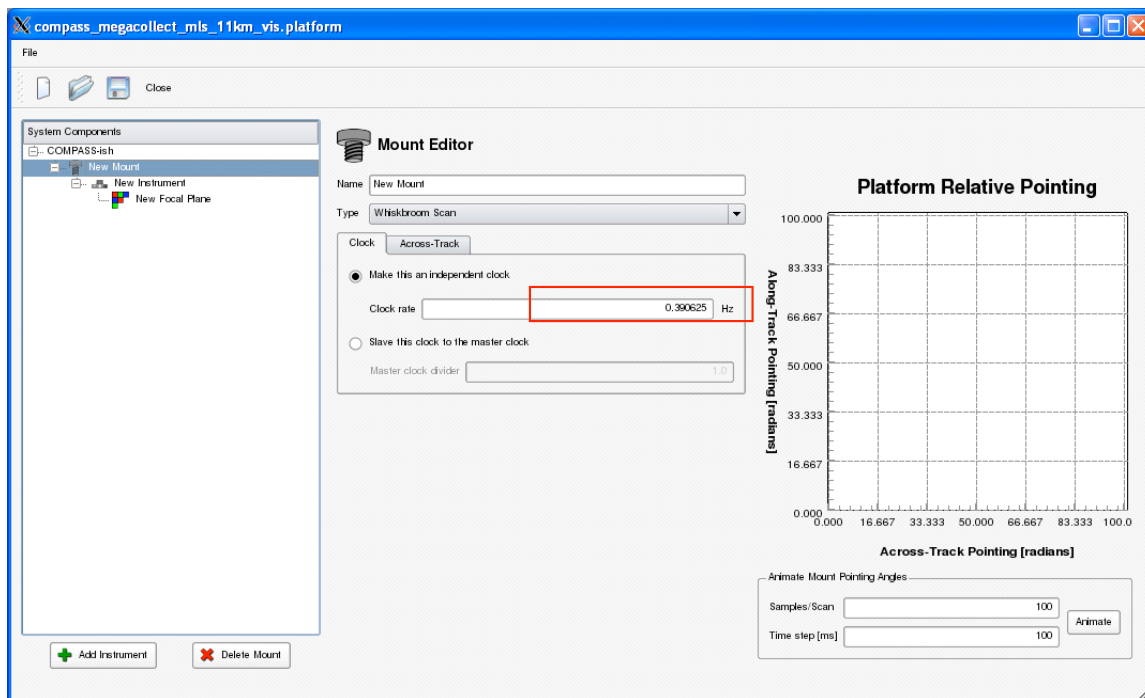


Figure 34 – Platform GUI - System/Platform Editor



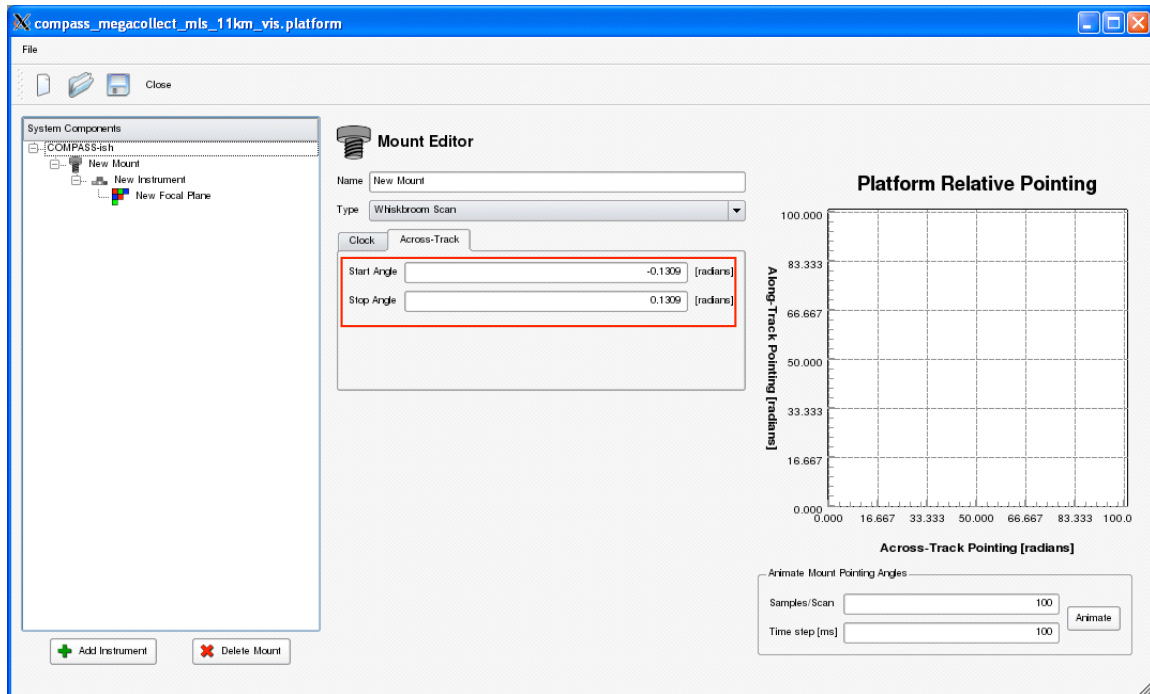
(FOUO) Much of the information entered into the platform section of the simulation was derived from Table 1 – COMPASS System Characteristics. A large driver in specifications was the flightpath metadata in Figure 12. As the flightpath file was not available during when the aircraft characteristics were decided, approximations were made based on Figure 12. It should be noted that these text files have since been recovered and can be used to create future simulations. Among the values approximated were: an altitude 3057.3m, heading of 16.5 degrees, 71 seconds of image capture, start coordinates of 43.21N, -77.598W, ending coordinates of 43.25N, -77.569. These start and end coordinates translated to a flightpath of 5.03km. By dividing the flightpath by the duration the approximate velocity of the aircraft was 70.85 m/s.

(FOUO) It was decided that a scan length of 256 lines would be simulated over the calibration tarps at Camp Eastman. A nominal frame rate of 200Hz was selected as it fit within the range listed in Table 1. The length of scan needed to create a 256 line image from one sweep of the mirror was calculated by dividing the number of lines desired (256) by 200Hz, which resulted in 1.28 seconds (Pogorzala). Since the platform editor input for clock rate is the time it takes to complete one scan and have the mirror sweep back to the starting position, this doubled the length of time from 1.28 seconds to 2.56 seconds (Pogorzala). Since the DIRSIG field for clock rate required the value be in hertz, 0.390625 Hz was used (Pogorzala). This can be seen in Figure 35.



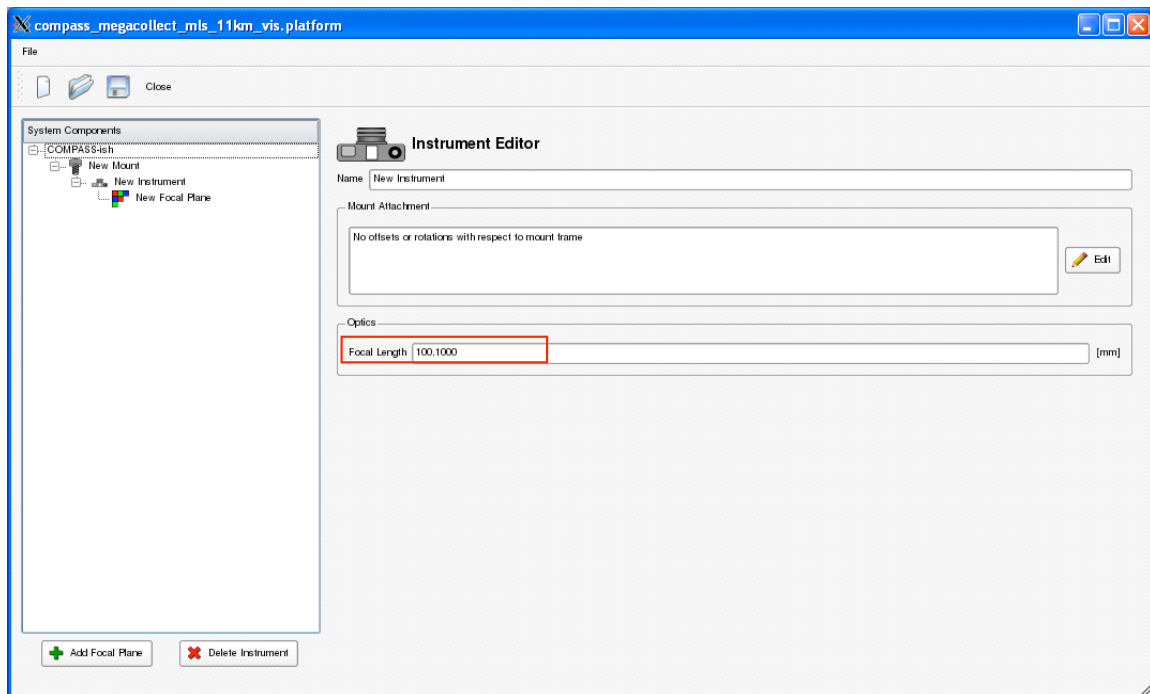
**Figure 35 – (FOUO) Platform GUI - Mount Editor: Clock**

(FOUO) Since the flight altitude was approximated to be 3057.3m, which is close to 10,000ft, the FOV value used was 15 degrees based on information from Table 1. Once converted to radians, the value was divided in half to give the start and stop angle of -0.1309 and 0.1309 radians respectively. This is shown in Figure 36.



**Figure 36 – Platform GUI - Mount Editor: Across-Track**

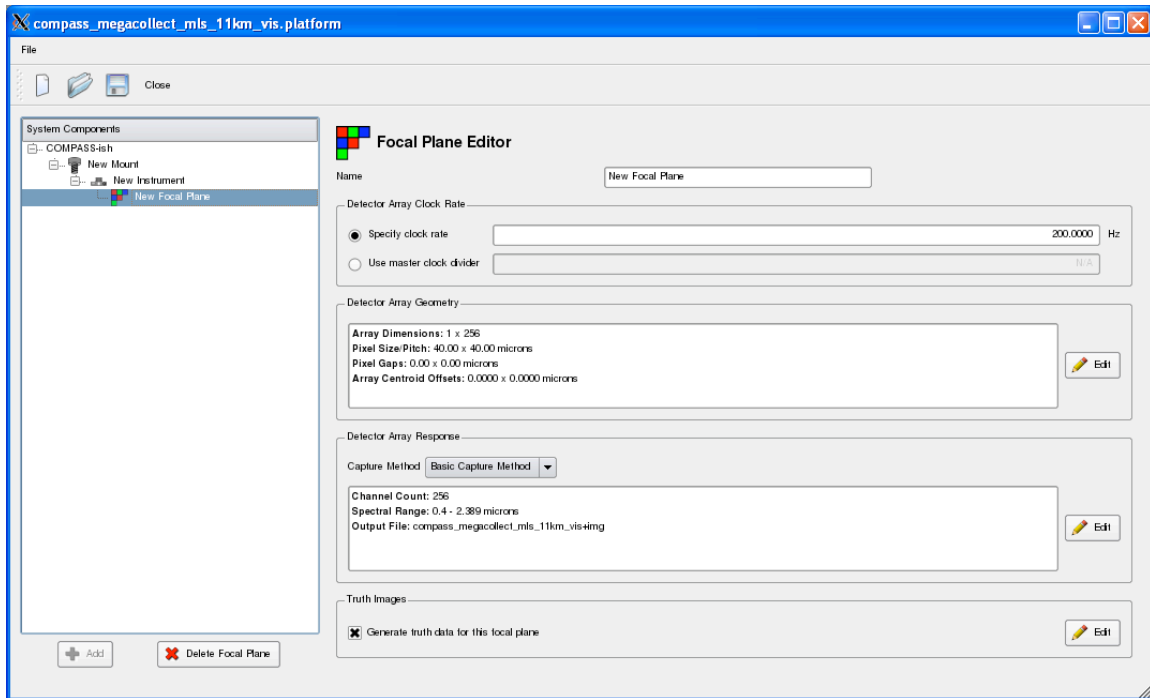
A focal length of 100.1mm was entered into the instrument editor of the platform BUI based on the data in Table 1 (see Figure 37).



**Figure 37 – Platform GUI - Instrument Editor**

Figure 38 shows the overview of the focal plane editor window. Data was entered here in four ways. The first is a clock rate of 200Hz was entered directly into this window,

which was previously selected. The detector array geometry, detector array response, and truth image information were all entered via selecting the “edit” buttons to the right of their respective section.



**Figure 38 – Platform GUI - Focal Plane Editor**

Figure 39 shows the window that appears when the “edit” button next to the detector array geometry is selected. Here a 1x256 element array was defined, where each pixel element was 40 by 40 microns in size which was based on information in Table 1.

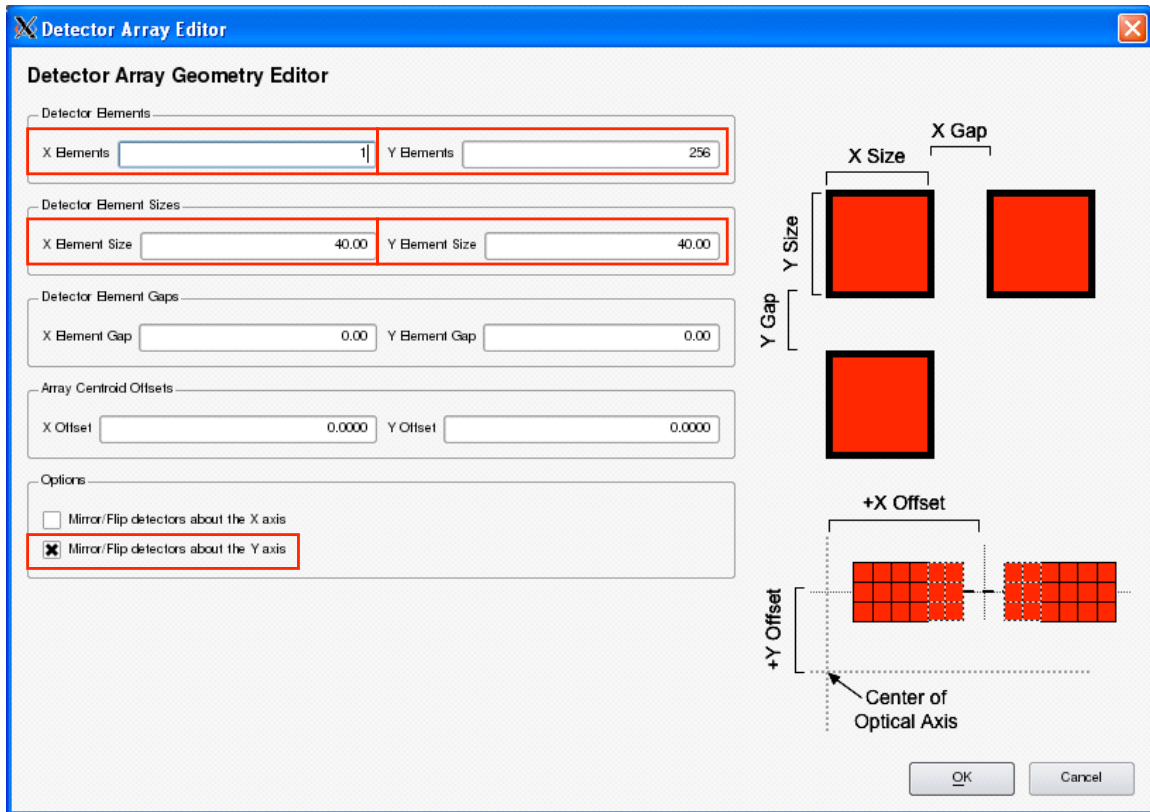


Figure 39 – Platform GUI - Detector Array Editor

Figure 40 shows the window that appears when the “Basic Capture” is selected from the drop-down menu and then the “edit” button next to the detector array response is selected. The first tab is the spectral response. Information was entered by selecting “Import Channels” and selecting the “COMPASS\_7\_8\_nm.rsp” response file created previously.

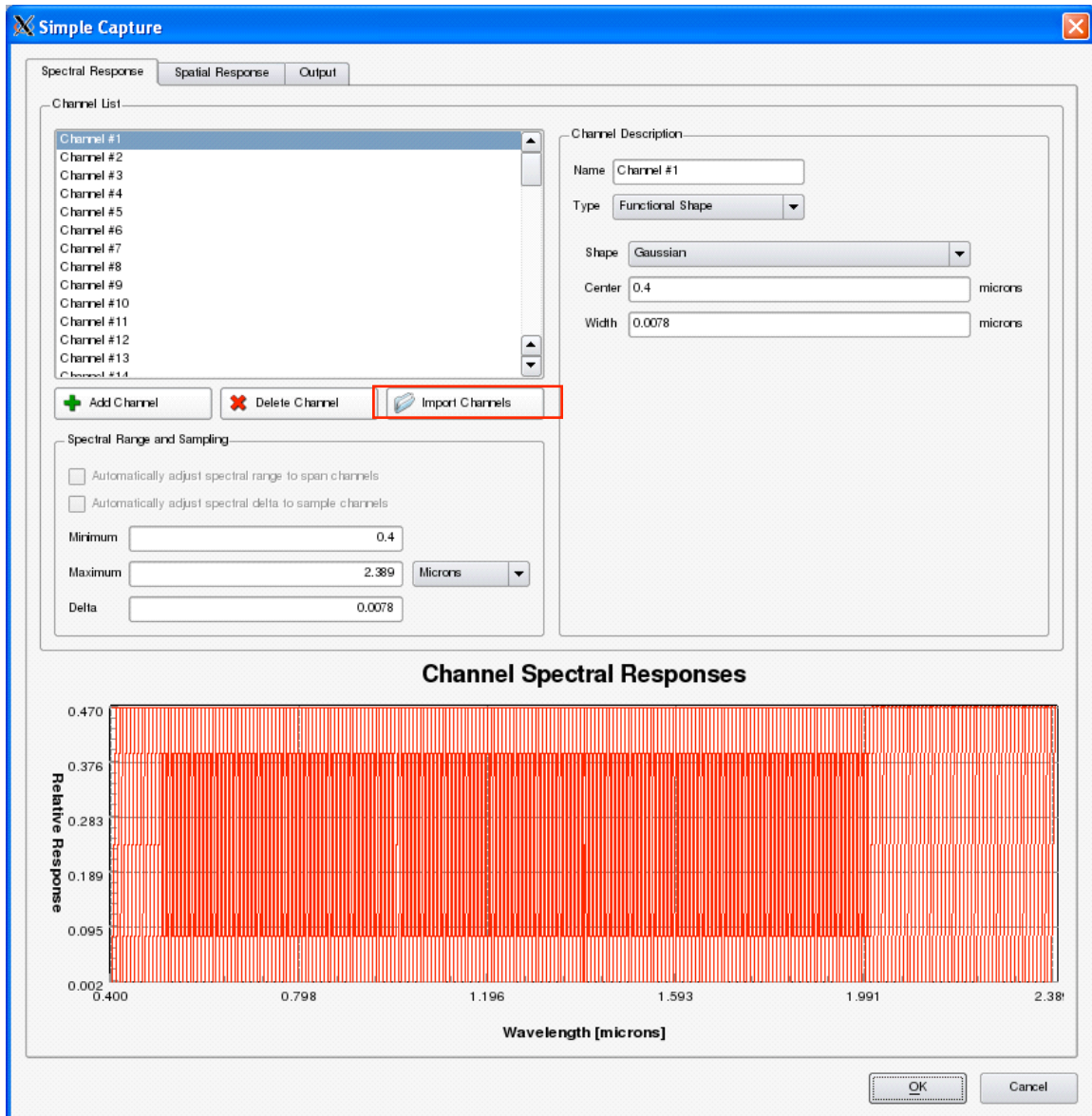
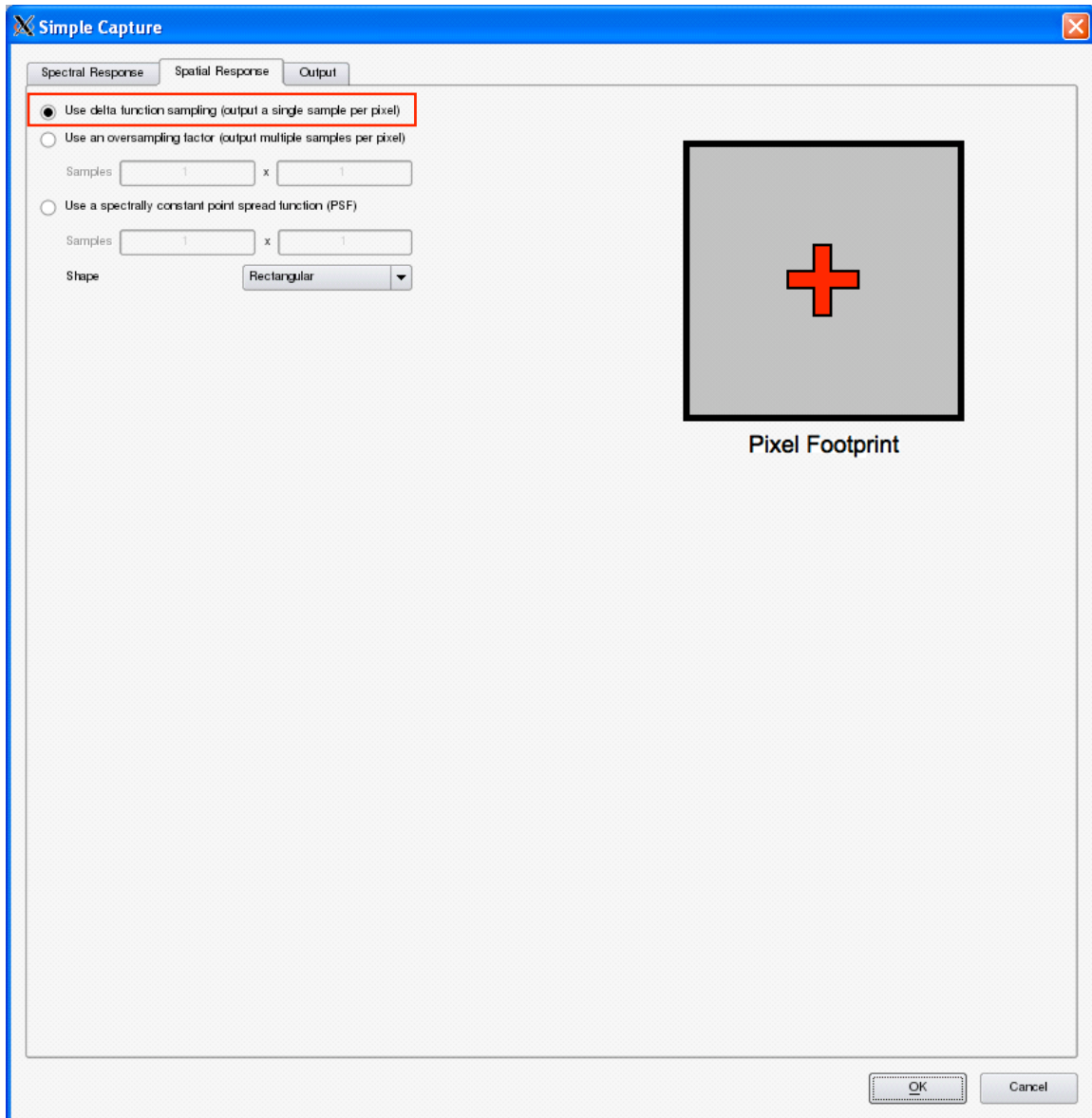


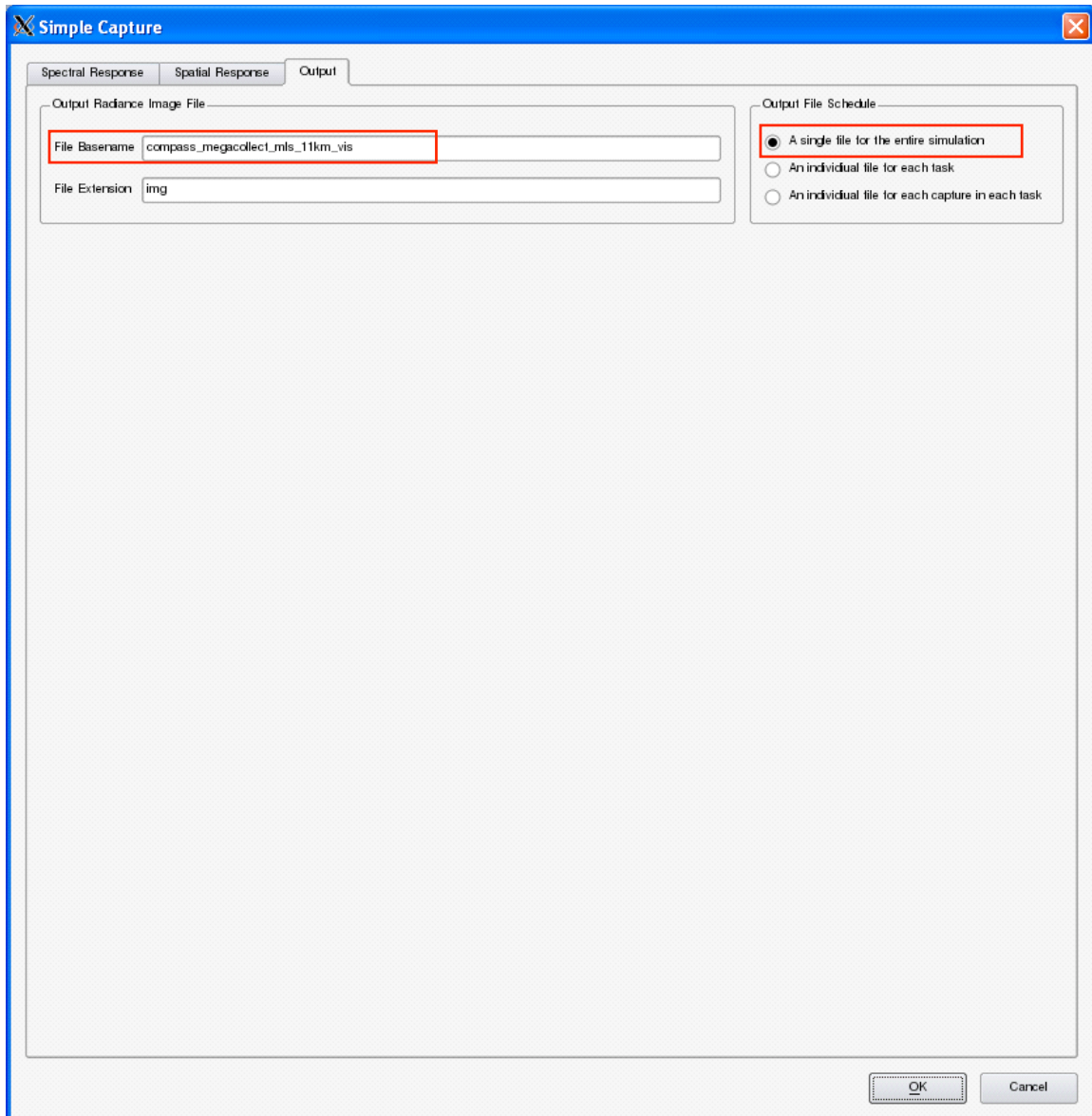
Figure 40 – Platform GUI – Basic Capture Detector Array Response Editor: Spectral Response

Figure 41 shows the next tab in the simple capture window which is spatial response. For these simulations, a delta sampling function was selected.



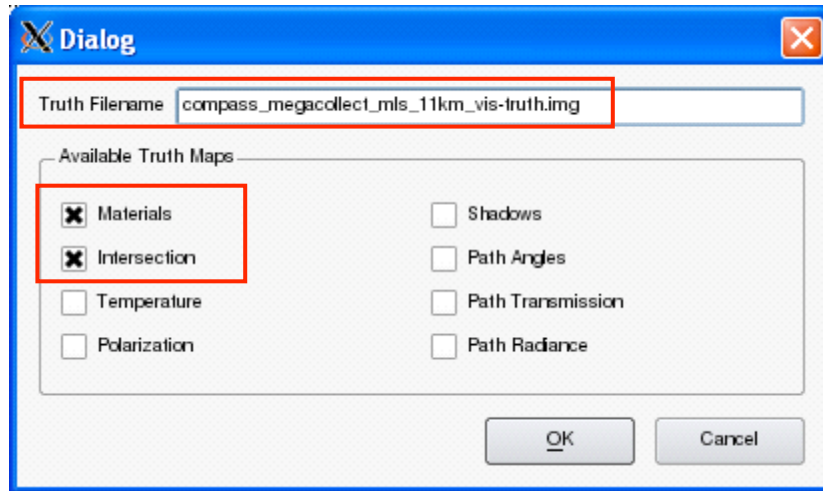
**Figure 41 – Platform GUI – Basic Capture Detector Array Response Editor: Spatial Response**

The third and final tab in the basic capture editor was specifying the output filename “compass\_megacollect\_mls\_11km\_vis.img” and selecting a single file for the entire simulation (see Figure 42).



**Figure 42 – Basic Capture Detector Array Response Editor: Output**

The final entry for the focal plane editor was to select “edit” next to the truth image section. Figure 43 shows this window, the truth maps selected and the truth image filename “compass\_megacollect\_mls\_11km\_vis-truth”.



**Figure 43 – Platform GUI - Focal Plane Editor: Truth Image Dialog Box**

The entire platform file was then saved as “compass\_megacollect\_mls\_11km\_vis.platform”. This file is in the appendix.

## ***Platform Motion***

(FOUO) The platform motion file was generated through the use of the “Dynamic Position Wizard” found under the “Tool” menu on the “Platform Motion” window. Figure 44 is a screen capture of dynamic position wizard with required parameters entered. These values were entered based upon the flightpath data (see Figure 12) for the entire COMPASS flight line shown in Figure 11. Among the values approximated from Figure 12 were: an altitude, heading of 16.5 degrees, 71 seconds of image capture, start coordinates of 43.21N, -77.598W, ending coordinates of 43.25N, -77.569. These start and end coordinates translated to a flightpath of 5.03km. By dividing the flightpath by the duration the approximate velocity of the aircraft was 70.85 m/s. The initial altitude of 3057.3m needed to be adjusted for the height of the terrain in the scene, which resulted in a new altitude of 3155.3m (Pogorzala). These values, along with a time delta of 0.5 seconds were entered into the wizard as shown in Figure 44.

(FOUO) After these values were accepted by clicking “OK”, the wizard generated 143 entries into a tabular array for: the time [seconds], X Location [m], Y Location [m], Z Location [m], X Rotation [rad], Y Rotation [rad], Z Rotation [rad], as seen in Figure 45 through Figure 51. These figures show all of the 143 entries created.



**Parameters for Dynamic Platform Motion**

Altitude [m] 3155.3

Velocity [m/s] 70.85

Heading [degrees] 16.5 W

Time Delta [s] 0.500

Total Time [s] 71

Reference Location

☐ Specify a starting location

☒ Specify a mid-point location

☐ Specify an ending location

Location

X 1850 [m]

Y 2750 [m]

OK Cancel

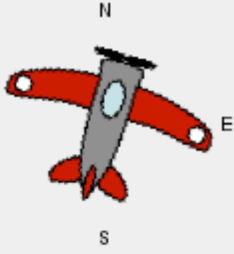


Figure 44 – (FOUO) Parameters Entered into the Dynamic Position Wizard

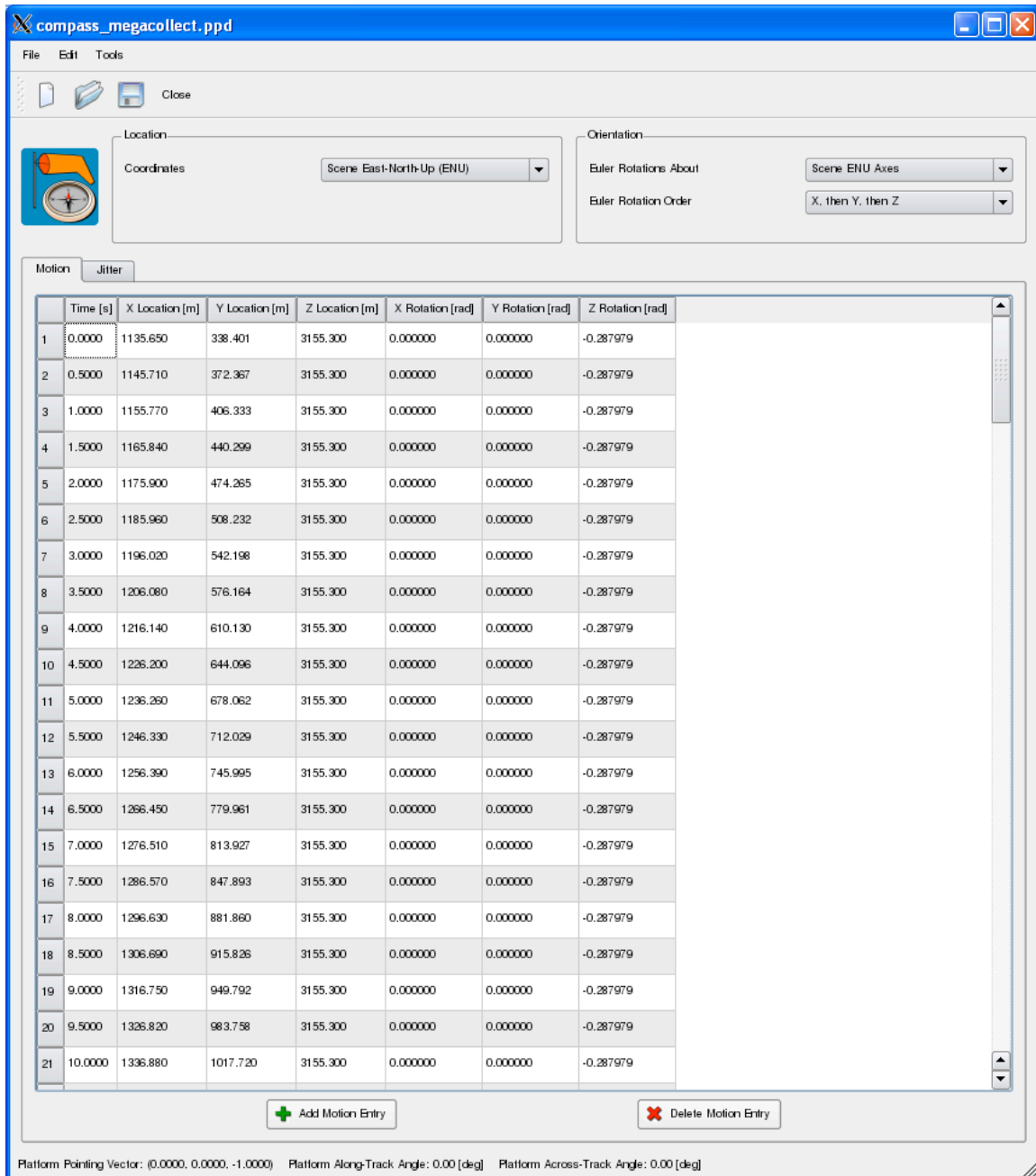


Figure 45 – (FOUO) Results of Dynamic Position Wizard: Rows 1-21

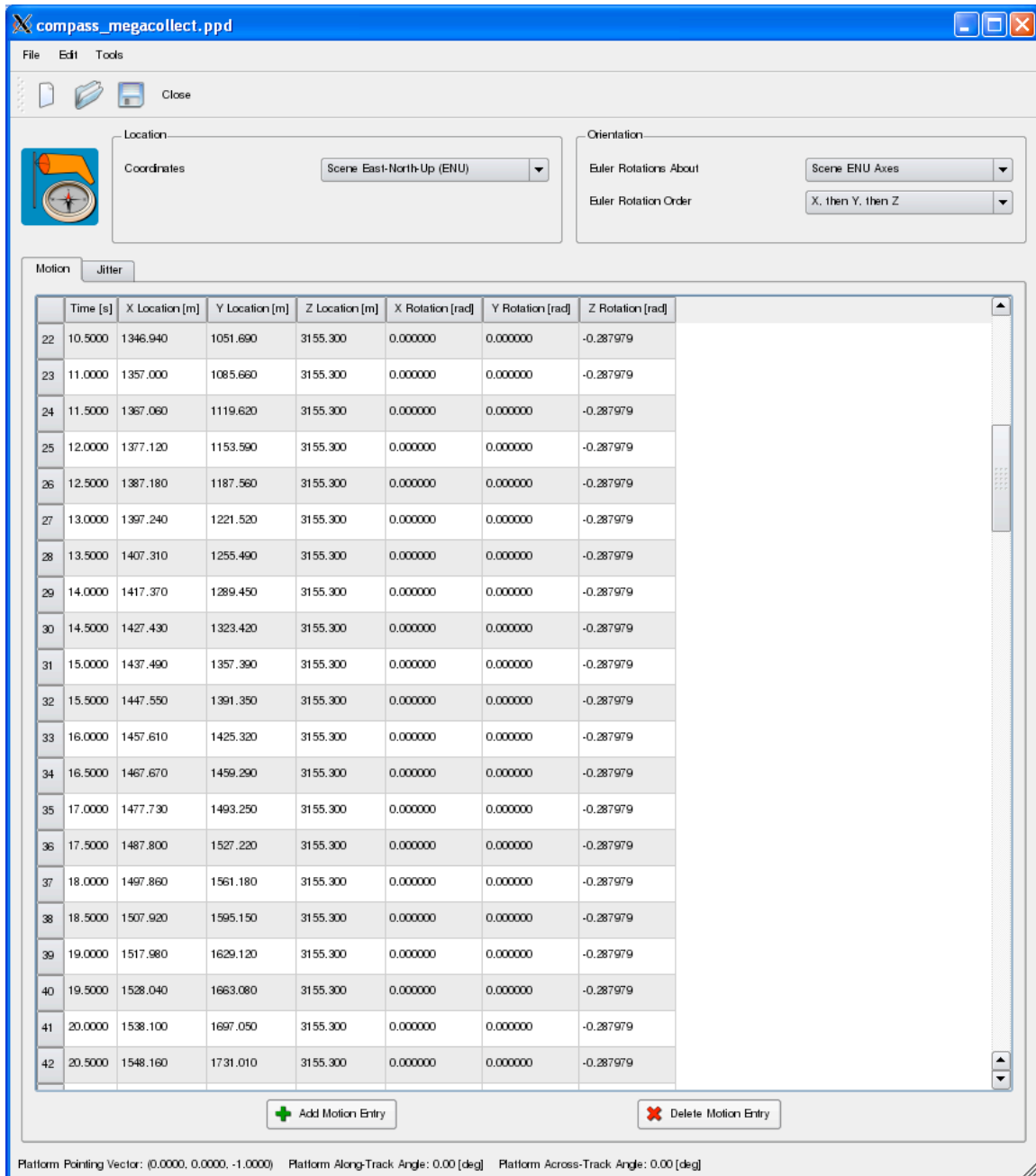


Figure 46 – (FOUO) Results of Dynamic Position Wizard: Rows 22-42

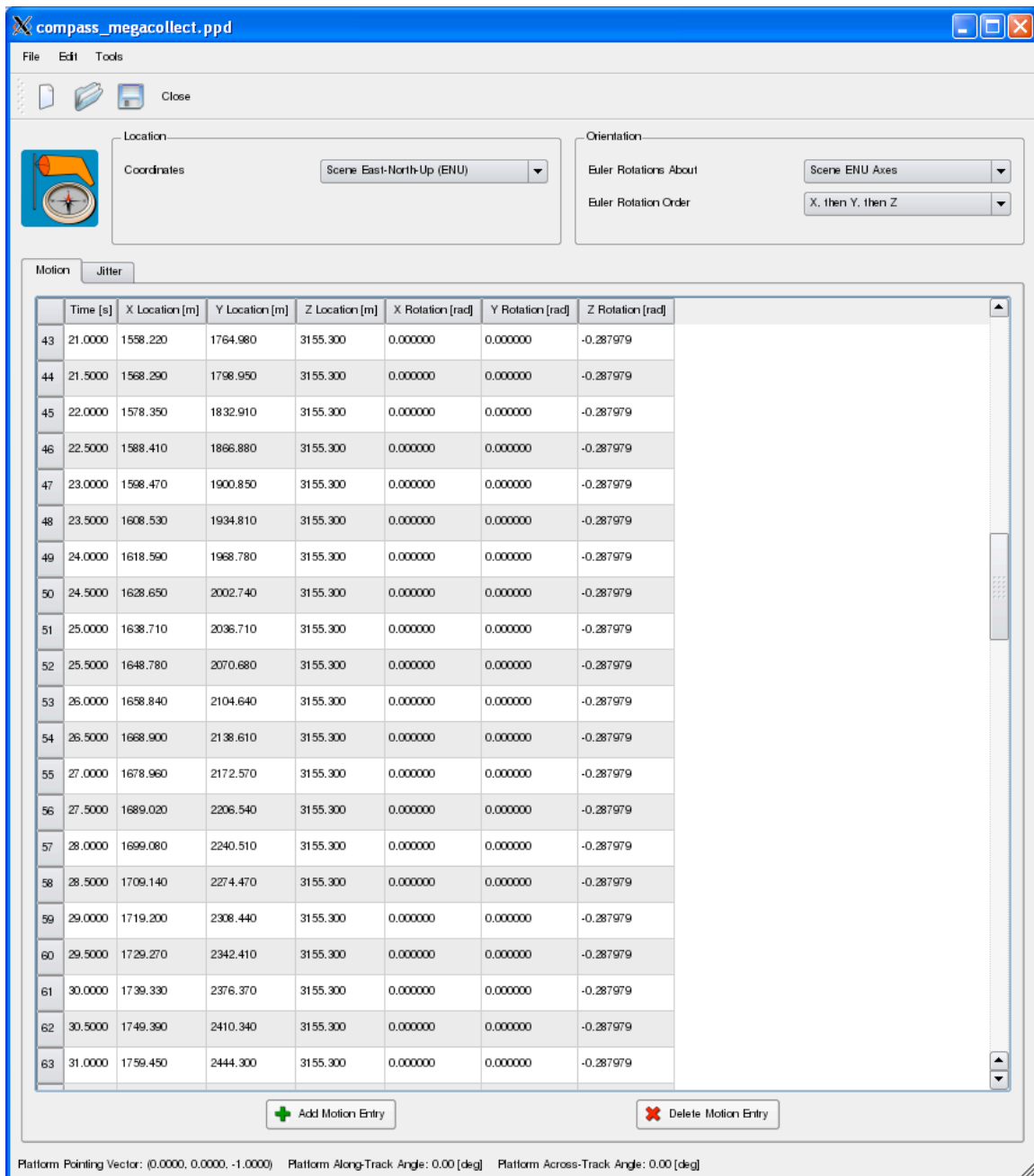
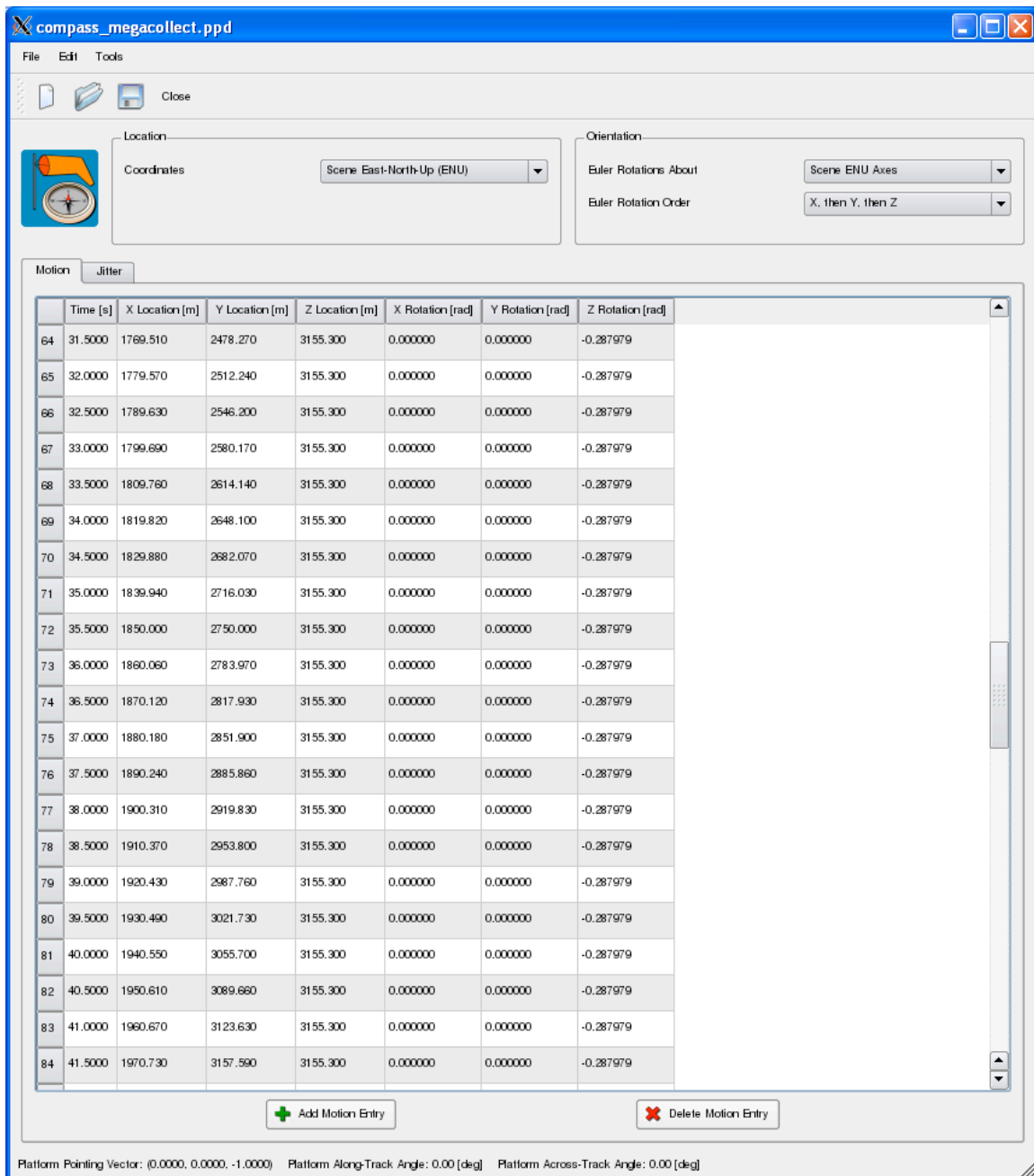


Figure 47 – (FOUO) Results of Dynamic Position Wizard: Rows 43-63



**Figure 48 – (FOUO) Results of Dynamic Position Wizard: Rows 64-84**

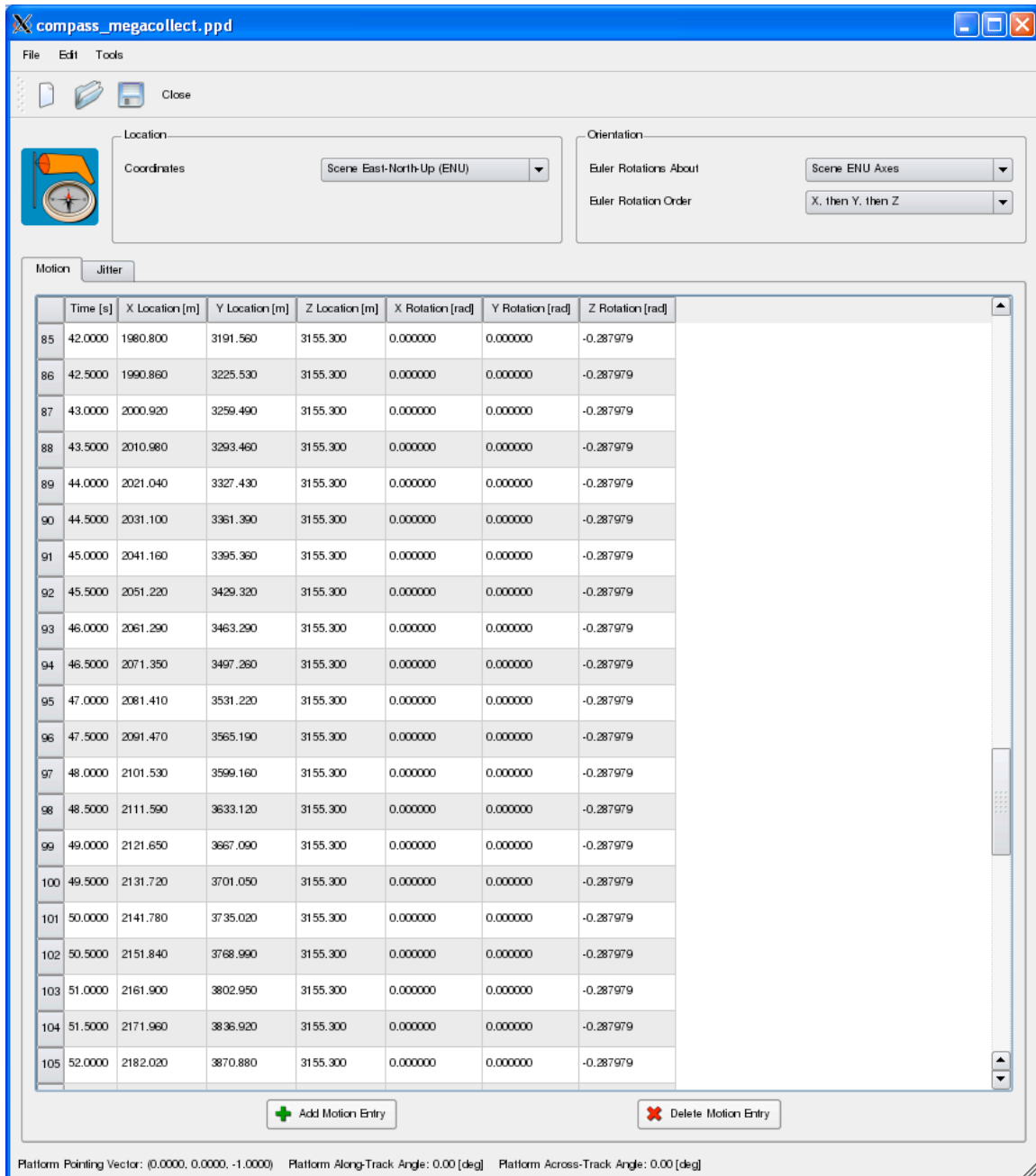
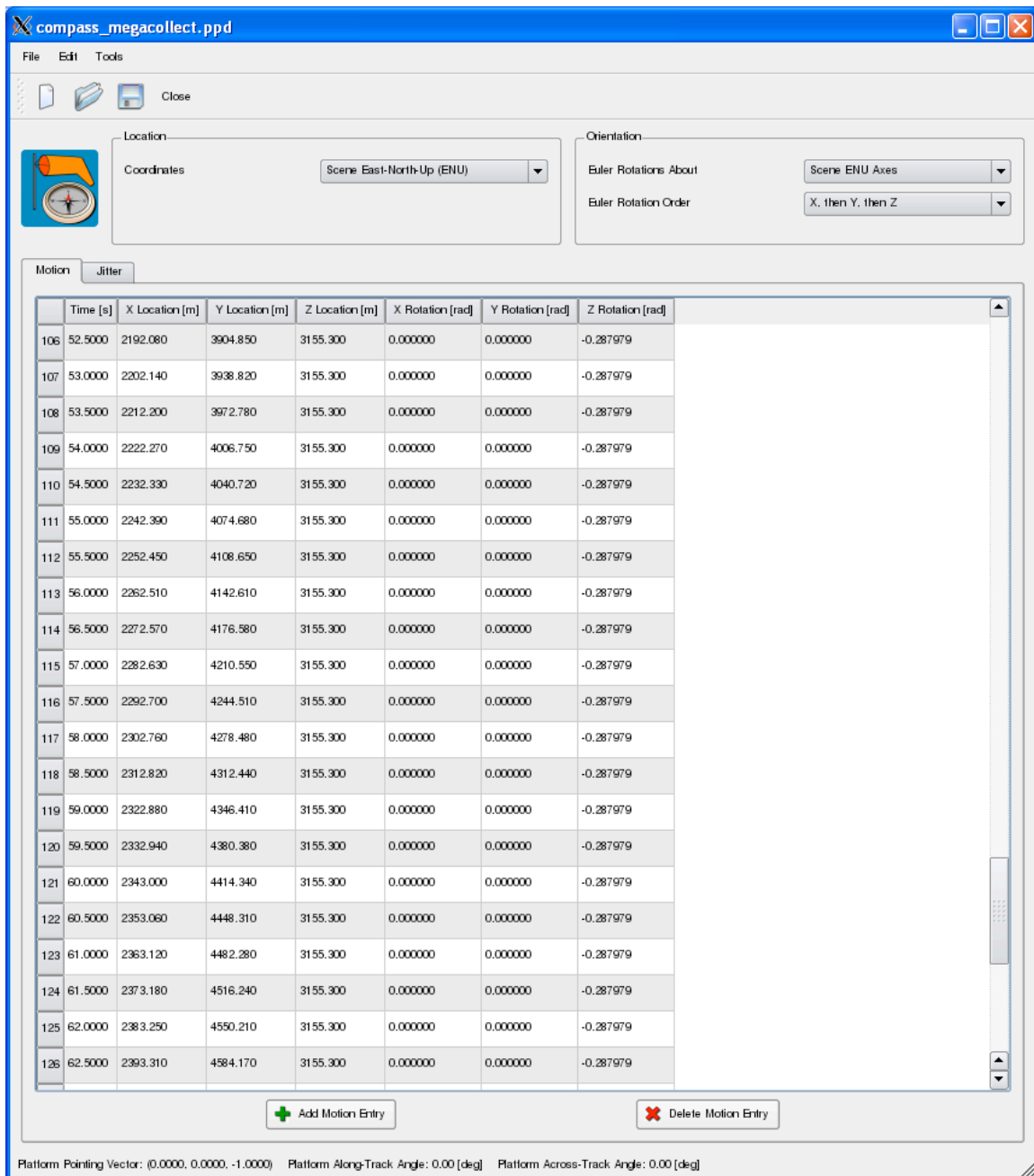


Figure 49 – (FOUO) Results of Dynamic Position Wizard: Rows 85-105



**Figure 50 – (FOUO) Results of Dynamic Position Wizard: Rows 106-126**

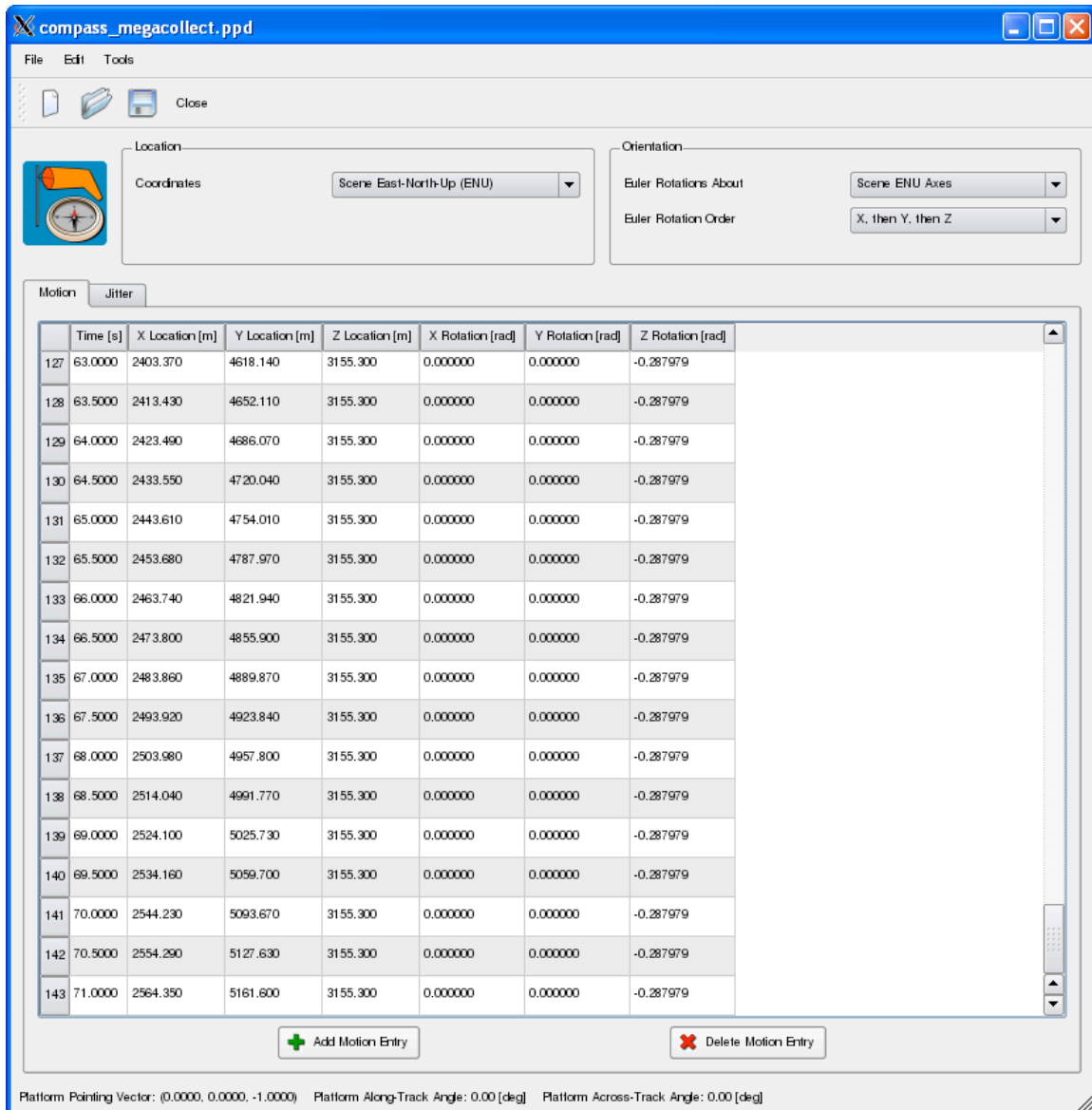


Figure 51 – (FOUO) Results of Dynamic Position Wizard: Rows 127-143

## Data Collection

(FOUO) The time of the image capture for the COMPASS file “2004-06-07\_BF04\_02\_RMS\_060704\_165718\_hsi-00\_cal0\_0” is 16:57:18 Zulu based on the information in the document “COMPASS File Naming Convention”. The DIRSIG data collection GUI needs the reference date/time entered as local time. This works out to be the equivalent of 12:57pm local time Eastern Daylight Savings Time. Figure 52 is a screenshot of the data collection window showing the parameters entered into the “compass\_megacollect.tasks” task file used.

(FOUO) The other items specified in Figure 52 were related to a task. The task is what tells the platform when to collect data during the flight line specified in the previous



platform section. For the purposes of capturing a full sweep of the sensor at the midpoint of the flight line, 35.5 seconds was determined to be the nearest multiple of 1.28 seconds to the center (Pogorzala). The capture window start and stop time were then calculated to be 35.5 seconds +/- 0.64 seconds (half of the 1.28 seconds required for one full sweep).

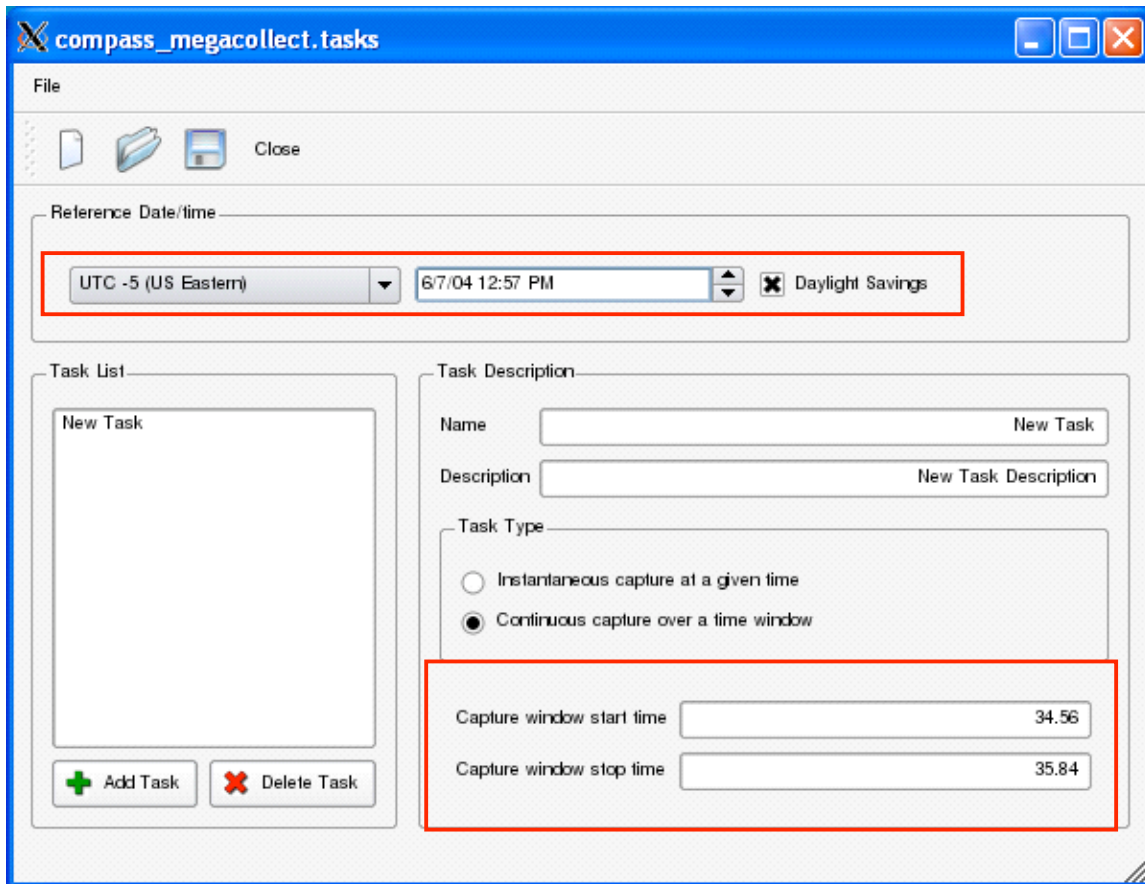


Figure 52 – (FOUO) "compass\_megacollect.tasks" File

## Simulation

Once all of 5 areas of the dirsig\_edit GUI were specified, (scene, atmospheric conditions, imaging platform, platform motion, and data collection) simulation file was saved as "compass\_megacollect\_mls\_11km\_vis.sim" and run through the GUI. This file is included in the appendix

## Results

The simulation created “compass\_megacollect\_mls\_11km\_vis.img”, which has 256 samples by 256 lines and 256 spectral bands. Upon opening this file into ENVI 4.6, the header information needed to be altered to reflect these dimensions (see Figure 53)

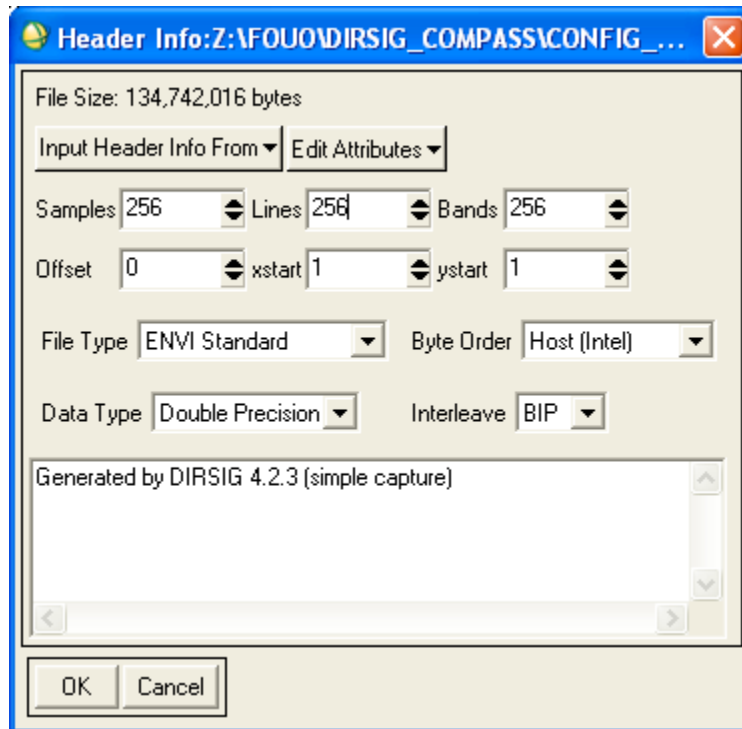
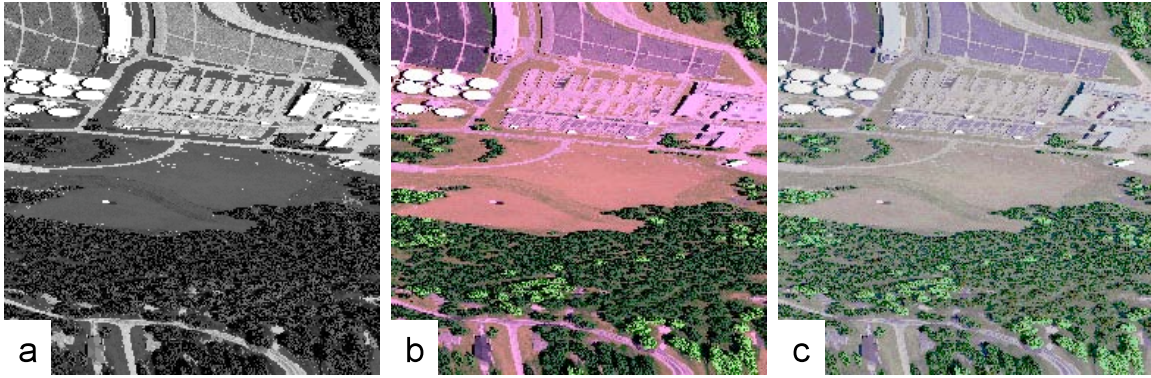


Figure 53 – ENVI Header for “compass\_megacollect\_mls\_11km\_vis.img”

(FOUO) The resulting image is shown in Figure 54. The leftmost image labeled “a” is channel 8 which corresponds to a wavelength of 0.4546 micron based on the response file used. The center image is an RGB display of the same file. The red band selected was channel 34 (0.6574 micron), while the green was channel 21 (0.5560 micron), and the blue band was channel 8 (0.4546 micron). The rightmost image labeled “c” is the same RGB image as “b” but with a Gaussian stretch applied. These images display characteristics of a whiskbroom, as the pixels at top and bottom of the images appear to be larger than the center. In comparison to the actual COMPASS data in Figure 10, the simulated data has a noticeably smaller GSD over the calibration tarps.

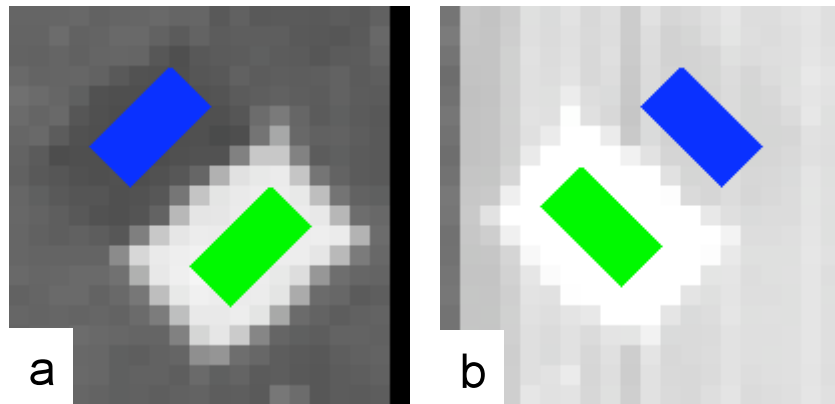


**Figure 54 – (FOUO) “compass\_megacollect\_mls\_11km\_vis.img” Displayed in ENVI: a) Channel 8, b) RGB Display with Channels 34,21,8 Respectively and c) RGB Display with Channels 34,21,8 Respectively with a Gaussian Stretch Applied.**

(FOUO) Regions of interest (ROIs) were created in ENVI over the gray and black calibration panels in the simulated data and in the COMPASS data. Figure 55 shows the designation of ROIs (8 pixels per target) in the DIRSIG generated data while Figure 56 shows the designation of the ROIs (22 pixels each) in the COMPASS calibrated and uncalibrated data.

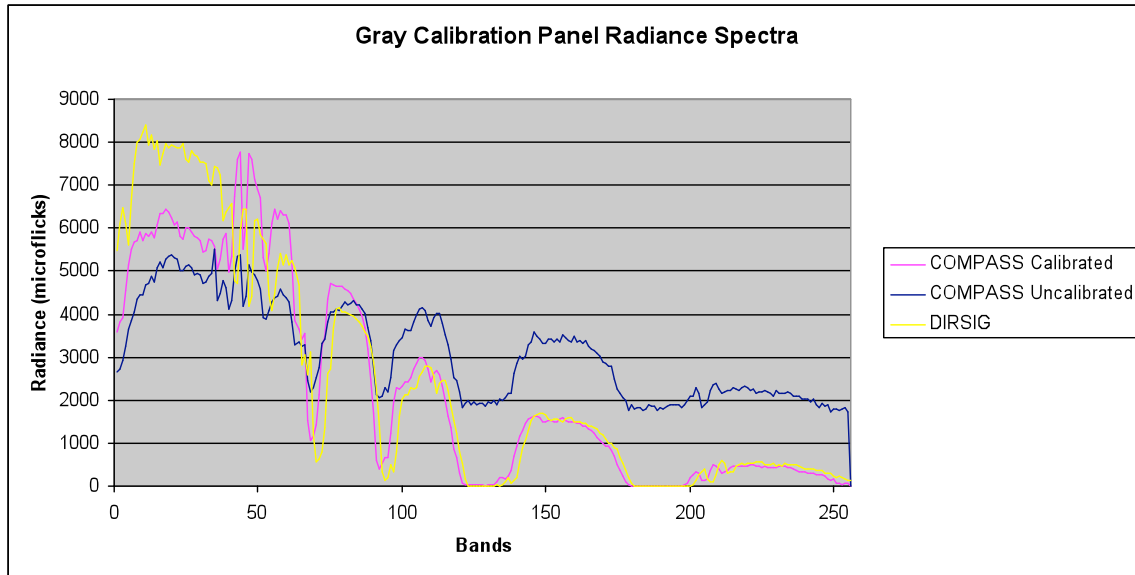


**Figure 55 – (FOUO) ROI Designation in DIRSIG Data**

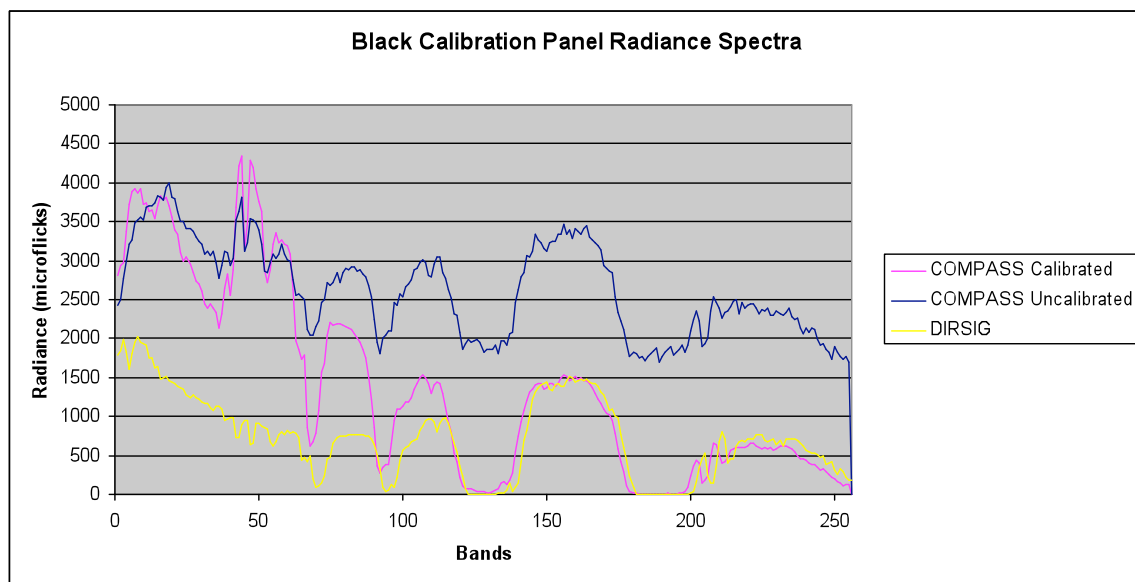


**Figure 56 – (FOUO) ROI Designation in COMPASS Data a) Calibrated Data b) Uncalibrated Data**

(FOUO) Figure 57 and Figure 58 are comparisons of the average pixel values extracted from the ROIs. The DIRSIG radiance spectra were converted from flicks [ $\text{W}/\text{cm}^2 \cdot \text{sr} \cdot \text{micron}$ ] to microflicks to be in the same units as the COMPASS data (Moss 2). These spectra were plotted by band number instead of wavelength as it is not fully understood where the wavelength values for the bands came from for the COMPASS calibrated data. In each case, the gray and the black calibration panel spectra from DIRSIG seems to be shifted slightly off a few bands from the COMPASS spectra. It is possible that the offset in spectrum could be due to the notional spectral response file used which had 7.8nm spacing instead of using the same band centers and FWHM of the calibrated data. It is noted that sometimes the offset between the two changes. In the higher band number area (equivalent to the SWIR), the DIRSIG spectrum is shifted to the right of the calibrated COMPASS spectrum. However, in the lower band numbers (equivalent to VIS wavelengths) the DIRSIG spectrum is offset to the left of the calibrated COMPASS data. In the gray panel spectra, this transition between offsets occurs around band number 80, while the transition occurs around band 120 in the black panel spectra. In both cases the DIRSIG spectrum for the panels somewhat closely matches the shapes of the COMPASS data for bands 70 and higher. In the lower band number regions for both, the curves fail to match as closely. The gray panel spectra are much closer to matching between the simulated and modeled than the black panel spectra. The DIRSIG spectrum for the black calibration panel is off by a more than just a scaling factor in the lower bands. An entire feature occurs in the calibrated COMPASS data around band 50.



**Figure 57 – (FOUO) Comparison of Gray Calibration Panel Spectra**



**Figure 58 – (FOUO) Comparison of Black Calibration Panel Spectra**

(FOUO) There could be a number of reasons for the discrepancy between the simulated and the real sensor data, starting with the nearly two year difference between measurement dates for the panels. The panels could have weathered from exposure and use in the field, or have become contaminated. Unfortunately, as this spectra was not collected concurrent to the COMPASS over-flight, it difficult to pinpoint any one reason for the differences between spectra.

## **Recommendations for Follow On Research**

(FOUO) Based on these results, the rest of the tarp spectra from the Megacollect should be investigated for validity and error. Should the opportunity to collect ground truth concurrent with COMPASS arise again, these calibration panels should be placed in the field of view and measured. This would possibly give insight as to why the radiance curves are not identical between the calibrated COMPASS and the simulate data. The best case scenario for future ground truth collects is for there to be a local radiosonde and a weather station recording at least one 24hr period to meet DIRSIG input file and simulation criteria.

(FOUO) As the flightpath file was not available during when the aircraft characteristics for simulations were decided, approximations were made based on Figure 12. As these text files have since been recovered, they can be used to create future simulations.

An area that was looked into was the use of radiosonde data to more accurately model the atmosphere from 07 June 2004. This data could be integrated into a tape5 file and run with the simulation instead of the modified mid-latitude summer atmosphere used in this project. The radiosonde file “buf20040607\_12.txt” is located at the end of the Appendix.

## Works Cited

“COMPASS File Naming Convention.” Online Posting. 2005. 29 June 2009.  
<[http://twiki.cis.rit.edu/pub/DIRSX/CompassSensorDocumentation/COMP  
ASSFi  
eNamingConvention.doc](http://twiki.cis.rit.edu/pub/DIRSX/CompassSensorDocumentation/COMPASSFi<br/>eNamingConvention.doc)>

Digital Imaging and Remote Sensing Laboratory. The DIRSIG User’s Manual.  
Rochester: RIT 2007. 5 June 2009 < [http://www.dirsig.org/docs/manual-  
2006-11.pdf](http://www.dirsig.org/docs/manual-2006-11.pdf)>.

Moss, Robert. “COMPASS RTP Calibrated Data Format Specification.” 04 Mar  
2005. 29  
Jun 2009.  
<[http://twiki.cis.rit.edu/pub/DIRSX/CompassSensorDocumentation/COMP  
ASSRT  
PCalibratedDataFormatSpecification.pdf](http://twiki.cis.rit.edu/pub/DIRSX/CompassSensorDocumentation/COMPASSRT<br/>PCalibratedDataFormatSpecification.pdf)>

Pogorzala, David. “Re: Compass simulation trial and error.” E-mail to Cynthia  
Scigaj. 24  
June 2009.

Raqueño, Rolando. “How to Compass Geocode.” Online posting. 07 Sept. 2007.  
29  
June 2009.  
<<http://twiki.cis.rit.edu/bin/view/DIRSX/HowToCompassGeocode>>

Schaff, W., A. Copeland, M. Steffen, R. O’Connor, C. Simi, J. Zadnik, E. Winter, G.  
Healey. “Real-Time Data Processor For the COMPASS Hyperspectral  
Sensory  
System.” Imaging Spectrometry IX Vol 5159. (2003): 1-13.

Simi, Christopher. “Re: a few more.” E-mail to Cynthia Scigaj. 14 Oct. 2004.

---. “Re: more questions.” E-mail to Cynthia Scigaj. 14 Oct. 2004.

Simi, C., E. Winter, M. Williams, and D. Driscoll, “Compact Airborne Spectral  
Sensor  
(COMPASS).” Algorithms for Multispectral. Hyperspectral. and  
Ultraspectral  
Imagery VII Proc of SPIE Vol. 4381. (2001): 129-136.

Algorithms for Multispectral, Hyperspectral, and Ultraspectral Imagery VII  
Proc of SPIE Vol 4381. (2001): 137-142.

Zadnik, J., D. Guerin, R. Moss, A. Orbeta, R. Dixon, C. Simi, S. Dunbar, and A. Hill.  
“Calibration Procedures and Measurements for the COMPASS  
Hyperspectral  
Imager.” Algorithms and Technologies for Multispectral, Hyperspectral,  
and  
Ultraspectral Imagery X Proc of SPIE Vol 5425. (2004): 182–188.

“gray\_cal\_tarp\_megacollect.ems”

[illegible]



[illegible]

1  
1  
1  
1  
1  
1  
1  
1  
1  
1  
1  
1  
1  
1  
1  
CURVE\_BEGIN  
0.35 0.830201  
0.351 0.808974  
0.352 0.802791  
0.353 0.804751  
0.354 0.830787  
0.355 0.840829  
0.356 0.835888  
0.357 0.831271  
0.358 0.839333  
0.359 0.849868  
0.36 0.849041  
0.361 0.860871  
0.362 0.874535  
0.363 0.886235  
0.364 0.879002  
0.365 0.872821  
0.366 0.8676  
0.367 0.850636  
0.368 0.84324  
0.369 0.843302  
0.37 0.852125  
0.371 0.851596  
0.372 0.854991  
0.373 0.868765  
0.374 0.866775  
0.375 0.864909  
0.376 0.864078  
0.377 0.861803  
0.378 0.865543  
0.379 0.87224  
0.38 0.877919  
0.381 0.878439  
0.382 0.872031  
0.383 0.856581  
0.384 0.860101  
0.385 0.856415  
0.386 0.846367  
0.387 0.856064  
0.388 0.866149  
0.389 0.872971  
0.39 0.868351  
0.391 0.865577  
0.392 0.862574

0.393 0.858393  
0.394 0.861573  
0.395 0.864  
0.396 0.865265  
0.397 0.866952  
0.398 0.862533  
0.399 0.857162  
0.4 0.858604  
0.401 0.85878  
0.402 0.86002  
0.403 0.863519  
0.404 0.865156  
0.405 0.864959  
0.406 0.863473  
0.407 0.864607  
0.408 0.863809  
0.409 0.862236  
0.41 0.861259  
0.411 0.861957  
0.412 0.862799  
0.413 0.863211  
0.414 0.864746  
0.415 0.863978  
0.416 0.861407  
0.417 0.861331  
0.418 0.860824  
0.419 0.860656  
0.42 0.862276  
0.421 0.864221  
0.422 0.864585  
0.423 0.862294  
0.424 0.861397  
0.425 0.86065  
0.426 0.859861  
0.427 0.857944  
0.428 0.85935  
0.429 0.861588  
0.43 0.861258  
0.431 0.861741  
0.432 0.861675  
0.433 0.860442  
0.434 0.860033  
0.435 0.859832  
0.436 0.85986  
0.437 0.86089  
0.438 0.861526  
0.439 0.861719  
0.44 0.861108  
0.441 0.858781  
0.442 0.85749  
0.443 0.858493  
0.444 0.858339  
0.445 0.858249  
0.446 0.858316  
0.447 0.858771  
0.448 0.858012  
0.449 0.856917

0.45 0.856761  
0.451 0.856898  
0.452 0.857085  
0.453 0.857237  
0.454 0.857249  
0.455 0.85715  
0.456 0.856916  
0.457 0.856192  
0.458 0.855972  
0.459 0.856082  
0.46 0.856415  
0.461 0.856572  
0.462 0.856558  
0.463 0.856333  
0.464 0.856518  
0.465 0.855988  
0.466 0.854875  
0.467 0.854996  
0.468 0.854551  
0.469 0.854023  
0.47 0.854145  
0.471 0.854504  
0.472 0.854526  
0.473 0.853894  
0.474 0.853824  
0.475 0.853762  
0.476 0.853661  
0.477 0.853419  
0.478 0.853761  
0.479 0.854116  
0.48 0.853559  
0.481 0.853168  
0.482 0.852708  
0.483 0.852064  
0.484 0.852182  
0.485 0.852475  
0.486 0.852836  
0.487 0.852713  
0.488 0.8527  
0.489 0.852663  
0.49 0.852362  
0.491 0.852046  
0.492 0.851799  
0.493 0.851674  
0.494 0.851281  
0.495 0.851301  
0.496 0.851617  
0.497 0.851062  
0.498 0.850754  
0.499 0.850595  
0.5 0.850515  
0.501 0.850061  
0.502 0.849971  
0.503 0.850619  
0.504 0.850372  
0.505 0.850269  
0.506 0.850287

0.507 0.849844  
0.508 0.849549  
0.509 0.849421  
0.51 0.849598  
0.511 0.849456  
0.512 0.849315  
0.513 0.849301  
0.514 0.849178  
0.515 0.849024  
0.516 0.848852  
0.517 0.848697  
0.518 0.848814  
0.519 0.848985  
0.52 0.848905  
0.521 0.848587  
0.522 0.848276  
0.523 0.848062  
0.524 0.847974  
0.525 0.847774  
0.526 0.847488  
0.527 0.84738  
0.528 0.847335  
0.529 0.847308  
0.53 0.84724  
0.531 0.847107  
0.532 0.84699  
0.533 0.846921  
0.534 0.846812  
0.535 0.846616  
0.536 0.846371  
0.537 0.846393  
0.538 0.846348  
0.539 0.846199  
0.54 0.845836  
0.541 0.845675  
0.542 0.845516  
0.543 0.845287  
0.544 0.84537  
0.545 0.845358  
0.546 0.845254  
0.547 0.84519  
0.548 0.844995  
0.549 0.84474  
0.55 0.844491  
0.551 0.844389  
0.552 0.844364  
0.553 0.844404  
0.554 0.844223  
0.555 0.844142  
0.556 0.844118  
0.557 0.843693  
0.558 0.843486  
0.559 0.843403  
0.56 0.843381  
0.561 0.843229  
0.562 0.843037  
0.563 0.842828

0.564 0.842556  
0.565 0.842295  
0.566 0.842052  
0.567 0.841852  
0.568 0.841699  
0.569 0.841568  
0.57 0.841434  
0.571 0.84115  
0.572 0.840876  
0.573 0.840672  
0.574 0.840345  
0.575 0.840125  
0.576 0.839991  
0.577 0.839753  
0.578 0.839502  
0.579 0.839276  
0.58 0.839143  
0.581 0.838852  
0.582 0.83854  
0.583 0.838252  
0.584 0.838066  
0.585 0.837841  
0.586 0.837593  
0.587 0.837494  
0.588 0.83725  
0.589 0.836975  
0.59 0.836821  
0.591 0.836648  
0.592 0.836465  
0.593 0.836271  
0.594 0.836238  
0.595 0.836128  
0.596 0.835948  
0.597 0.835828  
0.598 0.83564  
0.599 0.835444  
0.6 0.835323  
0.601 0.835316  
0.602 0.835276  
0.603 0.835142  
0.604 0.835009  
0.605 0.834865  
0.606 0.834714  
0.607 0.834611  
0.608 0.834465  
0.609 0.83429  
0.61 0.8341  
0.611 0.833979  
0.612 0.833784  
0.613 0.833441  
0.614 0.833093  
0.615 0.832844  
0.616 0.832687  
0.617 0.832536  
0.618 0.832594  
0.619 0.832735  
0.62 0.832796

0.621 0.832797  
0.622 0.832729  
0.623 0.832574  
0.624 0.832435  
0.625 0.832238  
0.626 0.831993  
0.627 0.831788  
0.628 0.831596  
0.629 0.831397  
0.63 0.831152  
0.631 0.830788  
0.632 0.830483  
0.633 0.830298  
0.634 0.830131  
0.635 0.830077  
0.636 0.83011  
0.637 0.830084  
0.638 0.829998  
0.639 0.829875  
0.64 0.829716  
0.641 0.829557  
0.642 0.82947  
0.643 0.829487  
0.644 0.829434  
0.645 0.82941  
0.646 0.829404  
0.647 0.82931  
0.648 0.82921  
0.649 0.829119  
0.65 0.829063  
0.651 0.828978  
0.652 0.828877  
0.653 0.828759  
0.654 0.82856  
0.655 0.828382  
0.656 0.828237  
0.657 0.828191  
0.658 0.828129  
0.659 0.82805  
0.66 0.827941  
0.661 0.827837  
0.662 0.82772  
0.663 0.827578  
0.664 0.827361  
0.665 0.827168  
0.666 0.82701  
0.667 0.826952  
0.668 0.826875  
0.669 0.826783  
0.67 0.826669  
0.671 0.826564  
0.672 0.826437  
0.673 0.826272  
0.674 0.826154  
0.675 0.826027  
0.676 0.825899  
0.677 0.825835

0.678 0.825726  
0.679 0.825589  
0.68 0.825436  
0.681 0.825358  
0.682 0.825231  
0.683 0.825006  
0.684 0.824951  
0.685 0.824909  
0.686 0.824862  
0.687 0.824722  
0.688 0.824602  
0.689 0.824478  
0.69 0.824312  
0.691 0.82421  
0.692 0.824123  
0.693 0.824038  
0.694 0.823887  
0.695 0.82375  
0.696 0.823624  
0.697 0.823487  
0.698 0.82334  
0.699 0.82321  
0.7 0.823146  
0.701 0.823032  
0.702 0.822942  
0.703 0.822902  
0.704 0.822799  
0.705 0.822644  
0.706 0.822459  
0.707 0.822368  
0.708 0.822252  
0.709 0.82214  
0.71 0.822071  
0.711 0.821951  
0.712 0.821819  
0.713 0.821686  
0.714 0.821588  
0.715 0.821487  
0.716 0.821385  
0.717 0.821288  
0.718 0.821174  
0.719 0.82105  
0.72 0.820921  
0.721 0.82083  
0.722 0.820717  
0.723 0.820561  
0.724 0.820445  
0.725 0.820315  
0.726 0.820182  
0.727 0.820114  
0.728 0.820023  
0.729 0.81992  
0.73 0.819817  
0.731 0.819711  
0.732 0.819597  
0.733 0.819469  
0.734 0.819395



0.735 0.819327  
0.736 0.819253  
0.737 0.819101  
0.738 0.818992  
0.739 0.818882  
0.74 0.818716  
0.741 0.81862  
0.742 0.818526  
0.743 0.818413  
0.744 0.818353  
0.745 0.818274  
0.746 0.818166  
0.747 0.817959  
0.748 0.817868  
0.749 0.817808  
0.75 0.817687  
0.751 0.817565  
0.752 0.817451  
0.753 0.817349  
0.754 0.817249  
0.755 0.817129  
0.756 0.817  
0.757 0.816916  
0.758 0.816817  
0.759 0.816727  
0.76 0.816679  
0.761 0.816567  
0.762 0.816436  
0.763 0.816296  
0.764 0.816233  
0.765 0.816118  
0.766 0.815964  
0.767 0.815852  
0.768 0.815729  
0.769 0.815618  
0.77 0.81555  
0.771 0.815447  
0.772 0.815328  
0.773 0.815197  
0.774 0.815128  
0.775 0.815054  
0.776 0.814972  
0.777 0.814866  
0.778 0.814733  
0.779 0.814596  
0.78 0.814478  
0.781 0.81436  
0.782 0.814248  
0.783 0.814145  
0.784 0.814031  
0.785 0.813936  
0.786 0.813852  
0.787 0.813741  
0.788 0.81362  
0.789 0.813505  
0.79 0.813419  
0.791 0.813328

0.792 0.813233  
0.793 0.813135  
0.794 0.813034  
0.795 0.812952  
0.796 0.812878  
0.797 0.81274  
0.798 0.812628  
0.799 0.812543  
0.8 0.812499  
0.801 0.81236  
0.802 0.812229  
0.803 0.812137  
0.804 0.812046  
0.805 0.811913  
0.806 0.811754  
0.807 0.81165  
0.808 0.811513  
0.809 0.811379  
0.81 0.811289  
0.811 0.811177  
0.812 0.811057  
0.813 0.810934  
0.814 0.810885  
0.815 0.810802  
0.816 0.810697  
0.817 0.810642  
0.818 0.810584  
0.819 0.810497  
0.82 0.810329  
0.821 0.810243  
0.822 0.81016  
0.823 0.810061  
0.824 0.809946  
0.825 0.809844  
0.826 0.809745  
0.827 0.809611  
0.828 0.809516  
0.829 0.809434  
0.83 0.809343  
0.831 0.809237  
0.832 0.80915  
0.833 0.809096  
0.834 0.809016  
0.835 0.808969  
0.836 0.808933  
0.837 0.808785  
0.838 0.80865  
0.839 0.808534  
0.84 0.808453  
0.841 0.808348  
0.842 0.808263  
0.843 0.808213  
0.844 0.808116  
0.845 0.808025  
0.846 0.807943  
0.847 0.807891  
0.848 0.807808

0.849 0.807722  
0.85 0.807663  
0.851 0.807577  
0.852 0.807461  
0.853 0.807309  
0.854 0.80718  
0.855 0.807071  
0.856 0.806982  
0.857 0.806931  
0.858 0.806861  
0.859 0.806782  
0.86 0.806701  
0.861 0.806607  
0.862 0.806511  
0.863 0.806415  
0.864 0.806371  
0.865 0.806288  
0.866 0.806176  
0.867 0.806077  
0.868 0.80601  
0.869 0.80596  
0.87 0.805918  
0.871 0.8058  
0.872 0.805654  
0.873 0.805491  
0.874 0.805423  
0.875 0.805388  
0.876 0.805363  
0.877 0.805248  
0.878 0.805186  
0.879 0.805097  
0.88 0.804875  
0.881 0.804791  
0.882 0.804773  
0.883 0.804815  
0.884 0.804748  
0.885 0.804645  
0.886 0.804508  
0.887 0.804327  
0.888 0.804226  
0.889 0.804189  
0.89 0.804235  
0.891 0.804154  
0.892 0.804059  
0.893 0.803976  
0.894 0.803827  
0.895 0.80369  
0.896 0.803572  
0.897 0.803504  
0.898 0.803412  
0.899 0.803329  
0.9 0.803296  
0.901 0.803234  
0.902 0.803187  
0.903 0.803167  
0.904 0.803163  
0.905 0.803049

0.906 0.802858  
0.907 0.802739  
0.908 0.802627  
0.909 0.80252  
0.91 0.802417  
0.911 0.802357  
0.912 0.802301  
0.913 0.802238  
0.914 0.802199  
0.915 0.802138  
0.916 0.802082  
0.917 0.802168  
0.918 0.802134  
0.919 0.802038  
0.92 0.801914  
0.921 0.801803  
0.922 0.80171  
0.923 0.801637  
0.924 0.801471  
0.925 0.801391  
0.926 0.801365  
0.927 0.801263  
0.928 0.801119  
0.929 0.800997  
0.93 0.800976  
0.931 0.800824  
0.932 0.800712  
0.933 0.800685  
0.934 0.800698  
0.935 0.800646  
0.936 0.800551  
0.937 0.800504  
0.938 0.800353  
0.939 0.800178  
0.94 0.800055  
0.941 0.799968  
0.942 0.799884  
0.943 0.799796  
0.944 0.799797  
0.945 0.799722  
0.946 0.799614  
0.947 0.799673  
0.948 0.799719  
0.949 0.799711  
0.95 0.799577  
0.951 0.799534  
0.952 0.799444  
0.953 0.799273  
0.954 0.799073  
0.955 0.798908  
0.956 0.798792  
0.957 0.79881  
0.958 0.79874  
0.959 0.798678  
0.96 0.798729  
0.961 0.798623  
0.962 0.798507

0.963 0.798413  
0.964 0.798232  
0.965 0.798098  
0.966 0.79802  
0.967 0.798055  
0.968 0.797875  
0.969 0.797675  
0.97 0.799889  
0.971 0.799712  
0.972 0.799565  
0.973 0.799418  
0.974 0.799307  
0.975 0.799293  
0.976 0.799284  
0.977 0.799216  
0.978 0.799158  
0.979 0.799067  
0.98 0.798963  
0.981 0.798927  
0.982 0.798945  
0.983 0.798826  
0.984 0.798621  
0.985 0.798512  
0.986 0.798511  
0.987 0.798496  
0.988 0.798423  
0.989 0.798336  
0.99 0.798236  
0.991 0.798145  
0.992 0.798099  
0.993 0.798054  
0.994 0.797915  
0.995 0.797771  
0.996 0.797742  
0.997 0.79775  
0.998 0.79764  
0.999 0.797456  
1 0.797314  
1.001 0.79722  
1.002 0.797144  
1.003 0.797121  
1.004 0.797127  
1.005 0.7972  
1.006 0.797252  
1.007 0.797063  
1.008 0.796877  
1.009 0.796753  
1.01 0.796654  
1.011 0.796563  
1.012 0.796419  
1.013 0.796317  
1.014 0.796274  
1.015 0.796209  
1.016 0.796135  
1.017 0.796053  
1.018 0.795957  
1.019 0.795861

1.02 0.795806  
1.021 0.795748  
1.022 0.795609  
1.023 0.795463  
1.024 0.795321  
1.025 0.795169  
1.026 0.795132  
1.027 0.795113  
1.028 0.795032  
1.029 0.79494  
1.03 0.794842  
1.031 0.794708  
1.032 0.794589  
1.033 0.794556  
1.034 0.794508  
1.035 0.794377  
1.036 0.794248  
1.037 0.794188  
1.038 0.794134  
1.039 0.794059  
1.04 0.794005  
1.041 0.793964  
1.042 0.793865  
1.043 0.793725  
1.044 0.79356  
1.045 0.793439  
1.046 0.793456  
1.047 0.793424  
1.048 0.793271  
1.049 0.793147  
1.05 0.793109  
1.051 0.793054  
1.052 0.792929  
1.053 0.792805  
1.054 0.792715  
1.055 0.792646  
1.056 0.792591  
1.057 0.792524  
1.058 0.792461  
1.059 0.792347  
1.06 0.792193  
1.061 0.792106  
1.062 0.792057  
1.063 0.791975  
1.064 0.791884  
1.065 0.791824  
1.066 0.791775  
1.067 0.791691  
1.068 0.791579  
1.069 0.791487  
1.07 0.791415  
1.071 0.791301  
1.072 0.791196  
1.073 0.791105  
1.074 0.790946  
1.075 0.790806  
1.076 0.790754

1.077 0.790721  
1.078 0.790666  
1.079 0.79059  
1.08 0.790498  
1.081 0.790403  
1.082 0.790309  
1.083 0.790199  
1.084 0.790093  
1.085 0.790024  
1.086 0.789951  
1.087 0.789828  
1.088 0.789721  
1.089 0.789649  
1.09 0.789549  
1.091 0.789438  
1.092 0.789368  
1.093 0.789307  
1.094 0.789216  
1.095 0.789128  
1.096 0.789049  
1.097 0.788941  
1.098 0.788812  
1.099 0.788728  
1.1 0.78868  
1.101 0.788583  
1.102 0.788455  
1.103 0.78836  
1.104 0.78826  
1.105 0.788178  
1.106 0.788116  
1.107 0.787981  
1.108 0.787837  
1.109 0.787737  
1.11 0.787631  
1.111 0.787511  
1.112 0.787405  
1.113 0.787342  
1.114 0.787272  
1.115 0.787133  
1.116 0.786985  
1.117 0.786915  
1.118 0.786885  
1.119 0.786836  
1.12 0.786731  
1.121 0.786611  
1.122 0.786462  
1.123 0.786333  
1.124 0.786294  
1.125 0.786253  
1.126 0.786224  
1.127 0.786192  
1.128 0.786086  
1.129 0.785962  
1.13 0.785841  
1.131 0.785732  
1.132 0.785631  
1.133 0.785528

1.134 0.785461  
1.135 0.785393  
1.136 0.7853  
1.137 0.785206  
1.138 0.785136  
1.139 0.78509  
1.14 0.785058  
1.141 0.785031  
1.142 0.784983  
1.143 0.784896  
1.144 0.784819  
1.145 0.784821  
1.146 0.78482  
1.147 0.78473  
1.148 0.784632  
1.149 0.784566  
1.15 0.784495  
1.151 0.784432  
1.152 0.784386  
1.153 0.784331  
1.154 0.784267  
1.155 0.784192  
1.156 0.78411  
1.157 0.784046  
1.158 0.784015  
1.159 0.783976  
1.16 0.783919  
1.161 0.783865  
1.162 0.783783  
1.163 0.783704  
1.164 0.783649  
1.165 0.783598  
1.166 0.783559  
1.167 0.783519  
1.168 0.783464  
1.169 0.783414  
1.17 0.783356  
1.171 0.783289  
1.172 0.783222  
1.173 0.783154  
1.174 0.783092  
1.175 0.783041  
1.176 0.782995  
1.177 0.782952  
1.178 0.782918  
1.179 0.782924  
1.18 0.782921  
1.181 0.782851  
1.182 0.782784  
1.183 0.782755  
1.184 0.782727  
1.185 0.782673  
1.186 0.782618  
1.187 0.782579  
1.188 0.782544  
1.189 0.782491  
1.19 0.782427



1.191 0.782356  
1.192 0.782281  
1.193 0.78223  
1.194 0.782213  
1.195 0.782184  
1.196 0.782127  
1.197 0.782073  
1.198 0.782025  
1.199 0.781977  
1.2 0.781923  
1.201 0.78187  
1.202 0.781815  
1.203 0.781762  
1.204 0.781738  
1.205 0.78172  
1.206 0.781669  
1.207 0.781609  
1.208 0.781549  
1.209 0.78149  
1.21 0.781424  
1.211 0.781353  
1.212 0.781288  
1.213 0.78123  
1.214 0.781164  
1.215 0.78108  
1.216 0.780996  
1.217 0.780905  
1.218 0.780815  
1.219 0.780737  
1.22 0.780658  
1.221 0.780581  
1.222 0.780504  
1.223 0.780403  
1.224 0.780299  
1.225 0.780208  
1.226 0.780123  
1.227 0.780019  
1.228 0.779908  
1.229 0.779809  
1.23 0.779715  
1.231 0.779619  
1.232 0.779522  
1.233 0.779428  
1.234 0.779342  
1.235 0.779245  
1.236 0.779123  
1.237 0.779008  
1.238 0.778925  
1.239 0.778844  
1.24 0.778742  
1.241 0.77864  
1.242 0.778513  
1.243 0.778386  
1.244 0.778306  
1.245 0.778235  
1.246 0.778161  
1.247 0.778088

1.248 0.778006  
1.249 0.777921  
1.25 0.777813  
1.251 0.777692  
1.252 0.777605  
1.253 0.777554  
1.254 0.777492  
1.255 0.777403  
1.256 0.77732  
1.257 0.777271  
1.258 0.777217  
1.259 0.777129  
1.26 0.777046  
1.261 0.776977  
1.262 0.776906  
1.263 0.776816  
1.264 0.776727  
1.265 0.776653  
1.266 0.77658  
1.267 0.776516  
1.268 0.776455  
1.269 0.776369  
1.27 0.776276  
1.271 0.776185  
1.272 0.776098  
1.273 0.776007  
1.274 0.775902  
1.275 0.775818  
1.276 0.775764  
1.277 0.775695  
1.278 0.775601  
1.279 0.775508  
1.28 0.775417  
1.281 0.775328  
1.282 0.775234  
1.283 0.775136  
1.284 0.775017  
1.285 0.774897  
1.286 0.774792  
1.287 0.774693  
1.288 0.774618  
1.289 0.77454  
1.29 0.774452  
1.291 0.774362  
1.292 0.774285  
1.293 0.774212  
1.294 0.774148  
1.295 0.774092  
1.296 0.774016  
1.297 0.773921  
1.298 0.773825  
1.299 0.77373  
1.3 0.773648  
1.301 0.77358  
1.302 0.773499  
1.303 0.773398  
1.304 0.773304

1.305 0.773236  
1.306 0.773168  
1.307 0.773104  
1.308 0.77304  
1.309 0.772953  
1.31 0.772861  
1.311 0.7728  
1.312 0.772751  
1.313 0.772701  
1.314 0.772643  
1.315 0.772566  
1.316 0.772485  
1.317 0.772418  
1.318 0.772352  
1.319 0.772284  
1.32 0.772219  
1.321 0.772162  
1.322 0.77211  
1.323 0.772045  
1.324 0.771963  
1.325 0.771901  
1.326 0.771869  
1.327 0.771826  
1.328 0.77176  
1.329 0.771698  
1.33 0.771682  
1.331 0.771663  
1.332 0.771602  
1.333 0.771541  
1.334 0.771496  
1.335 0.771454  
1.336 0.771421  
1.337 0.771389  
1.338 0.771341  
1.339 0.771294  
1.34 0.771263  
1.341 0.77123  
1.342 0.77121  
1.343 0.771195  
1.344 0.771192  
1.345 0.771196  
1.346 0.771211  
1.347 0.771236  
1.348 0.771268  
1.349 0.771315  
1.35 0.771366  
1.351 0.771423  
1.352 0.771477  
1.353 0.771522  
1.354 0.771569  
1.355 0.771615  
1.356 0.771663  
1.357 0.771702  
1.358 0.771743  
1.359 0.77182  
1.36 0.771893  
1.361 0.771929

1.362 0.771958  
1.363 0.771964  
1.364 0.771966  
1.365 0.771951  
1.366 0.771932  
1.367 0.771898  
1.368 0.771857  
1.369 0.771808  
1.37 0.771755  
1.371 0.771698  
1.372 0.771649  
1.373 0.771617  
1.374 0.771593  
1.375 0.77158  
1.376 0.771579  
1.377 0.77156  
1.378 0.771528  
1.379 0.7715  
1.38 0.77147  
1.381 0.771439  
1.382 0.771405  
1.383 0.771366  
1.384 0.771324  
1.385 0.771289  
1.386 0.77125  
1.387 0.771201  
1.388 0.771165  
1.389 0.771133  
1.39 0.771089  
1.391 0.771048  
1.392 0.771032  
1.393 0.771022  
1.394 0.771045  
1.395 0.771076  
1.396 0.771142  
1.397 0.771216  
1.398 0.771288  
1.399 0.771355  
1.4 0.77144  
1.401 0.771531  
1.402 0.77164  
1.403 0.771749  
1.404 0.77188  
1.405 0.772022  
1.406 0.772184  
1.407 0.772361  
1.408 0.772526  
1.409 0.772686  
1.41 0.772896  
1.411 0.773148  
1.412 0.773404  
1.413 0.773659  
1.414 0.773927  
1.415 0.774227  
1.416 0.774527  
1.417 0.774827  
1.418 0.775121

1.419 0.775387  
1.42 0.77566  
1.421 0.775965  
1.422 0.776268  
1.423 0.776547  
1.424 0.776823  
1.425 0.77708  
1.426 0.777331  
1.427 0.777542  
1.428 0.77775  
1.429 0.777947  
1.43 0.778143  
1.431 0.778317  
1.432 0.778483  
1.433 0.778627  
1.434 0.778776  
1.435 0.778892  
1.436 0.779004  
1.437 0.779103  
1.438 0.779195  
1.439 0.77928  
1.44 0.779357  
1.441 0.779441  
1.442 0.779534  
1.443 0.779619  
1.444 0.779699  
1.445 0.77979  
1.446 0.779886  
1.447 0.77997  
1.448 0.780048  
1.449 0.780124  
1.45 0.780196  
1.451 0.780272  
1.452 0.780345  
1.453 0.780433  
1.454 0.780551  
1.455 0.780669  
1.456 0.780784  
1.457 0.780906  
1.458 0.781053  
1.459 0.781192  
1.46 0.781308  
1.461 0.781438  
1.462 0.781609  
1.463 0.781773  
1.464 0.78191  
1.465 0.782046  
1.466 0.782197  
1.467 0.782354  
1.468 0.782529  
1.469 0.782701  
1.47 0.782815  
1.471 0.782928  
1.472 0.783069  
1.473 0.783211  
1.474 0.783334  
1.475 0.783455

1.476 0.783552  
1.477 0.783644  
1.478 0.783721  
1.479 0.783795  
1.48 0.783865  
1.481 0.783935  
1.482 0.783976  
1.483 0.78401  
1.484 0.78403  
1.485 0.784039  
1.486 0.784001  
1.487 0.783942  
1.488 0.783916  
1.489 0.783909  
1.49 0.783861  
1.491 0.78379  
1.492 0.783723  
1.493 0.78366  
1.494 0.783591  
1.495 0.78351  
1.496 0.783418  
1.497 0.783316  
1.498 0.783212  
1.499 0.783113  
1.5 0.783005  
1.501 0.782884  
1.502 0.782756  
1.503 0.782614  
1.504 0.782466  
1.505 0.782307  
1.506 0.782152  
1.507 0.782005  
1.508 0.781855  
1.509 0.781701  
1.51 0.781547  
1.511 0.781393  
1.512 0.781244  
1.513 0.781111  
1.514 0.78098  
1.515 0.780865  
1.516 0.780755  
1.517 0.780667  
1.518 0.780578  
1.519 0.780475  
1.52 0.780376  
1.521 0.780299  
1.522 0.780222  
1.523 0.780172  
1.524 0.78012  
1.525 0.78006  
1.526 0.780002  
1.527 0.779934  
1.528 0.779867  
1.529 0.779814  
1.53 0.779762  
1.531 0.779714  
1.532 0.779666

1.533 0.779626  
1.534 0.779587  
1.535 0.779514  
1.536 0.779439  
1.537 0.779398  
1.538 0.779361  
1.539 0.77927  
1.54 0.77917  
1.541 0.779082  
1.542 0.778996  
1.543 0.778921  
1.544 0.778851  
1.545 0.778779  
1.546 0.778703  
1.547 0.778582  
1.548 0.778449  
1.549 0.778318  
1.55 0.778187  
1.551 0.77806  
1.552 0.777933  
1.553 0.777798  
1.554 0.77766  
1.555 0.777546  
1.556 0.777443  
1.557 0.777325  
1.558 0.777201  
1.559 0.777086  
1.56 0.776977  
1.561 0.776862  
1.562 0.776743  
1.563 0.776629  
1.564 0.776515  
1.565 0.776408  
1.566 0.776307  
1.567 0.776193  
1.568 0.776067  
1.569 0.775973  
1.57 0.775903  
1.571 0.775817  
1.572 0.775718  
1.573 0.775617  
1.574 0.775514  
1.575 0.775415  
1.576 0.775319  
1.577 0.77522  
1.578 0.775117  
1.579 0.77501  
1.58 0.774898  
1.581 0.77479  
1.582 0.774684  
1.583 0.77458  
1.584 0.774476  
1.585 0.774352  
1.586 0.774207  
1.587 0.774055  
1.588 0.773898  
1.589 0.773714

1.59 0.773497  
1.591 0.773291  
1.592 0.773102  
1.593 0.772897  
1.594 0.772671  
1.595 0.772423  
1.596 0.772145  
1.597 0.771878  
1.598 0.771628  
1.599 0.771371  
1.6 0.771107  
1.601 0.770834  
1.602 0.77055  
1.603 0.770267  
1.604 0.769986  
1.605 0.769704  
1.606 0.769423  
1.607 0.769144  
1.608 0.768868  
1.609 0.768596  
1.61 0.768332  
1.611 0.768079  
1.612 0.767845  
1.613 0.767584  
1.614 0.767277  
1.615 0.766983  
1.616 0.766714  
1.617 0.766453  
1.618 0.766206  
1.619 0.76595  
1.62 0.765681  
1.621 0.765427  
1.622 0.7652  
1.623 0.764975  
1.624 0.764751  
1.625 0.764526  
1.626 0.764301  
1.627 0.76407  
1.628 0.763832  
1.629 0.763622  
1.63 0.763457  
1.631 0.763273  
1.632 0.763058  
1.633 0.762848  
1.634 0.762644  
1.635 0.762436  
1.636 0.762229  
1.637 0.76204  
1.638 0.761873  
1.639 0.7617  
1.64 0.761514  
1.641 0.761327  
1.642 0.761143  
1.643 0.760968  
1.644 0.760799  
1.645 0.760625  
1.646 0.760444



1.647 0.760258  
1.648 0.760069  
1.649 0.759882  
1.65 0.75969  
1.651 0.759511  
1.652 0.759348  
1.653 0.759182  
1.654 0.75902  
1.655 0.758876  
1.656 0.758754  
1.657 0.758629  
1.658 0.758494  
1.659 0.758349  
1.66 0.758201  
1.661 0.758065  
1.662 0.757935  
1.663 0.757801  
1.664 0.757668  
1.665 0.75754  
1.666 0.757417  
1.667 0.757308  
1.668 0.757213  
1.669 0.75711  
1.67 0.757002  
1.671 0.75692  
1.672 0.756846  
1.673 0.756777  
1.674 0.756716  
1.675 0.756686  
1.676 0.756677  
1.677 0.756658  
1.678 0.756631  
1.679 0.756615  
1.68 0.756605  
1.681 0.756602  
1.682 0.756603  
1.683 0.756583  
1.684 0.756558  
1.685 0.756562  
1.686 0.756575  
1.687 0.756573  
1.688 0.756567  
1.689 0.756587  
1.69 0.756618  
1.691 0.756666  
1.692 0.75672  
1.693 0.756784  
1.694 0.756851  
1.695 0.75694  
1.696 0.757033  
1.697 0.757116  
1.698 0.757197  
1.699 0.757302  
1.7 0.75741  
1.701 0.757488  
1.702 0.757564  
1.703 0.757632

1.704 0.757698  
1.705 0.75772  
1.706 0.757734  
1.707 0.757736  
1.708 0.75774  
1.709 0.757714  
1.71 0.757685  
1.711 0.757675  
1.712 0.757667  
1.713 0.757636  
1.714 0.757607  
1.715 0.757603  
1.716 0.757602  
1.717 0.757639  
1.718 0.757674  
1.719 0.75769  
1.72 0.757705  
1.721 0.757714  
1.722 0.757735  
1.723 0.757812  
1.724 0.757882  
1.725 0.757915  
1.726 0.757935  
1.727 0.757941  
1.728 0.757952  
1.729 0.757956  
1.73 0.757939  
1.731 0.757875  
1.732 0.757805  
1.733 0.757726  
1.734 0.757648  
1.735 0.757569  
1.736 0.757479  
1.737 0.757381  
1.738 0.757291  
1.739 0.757205  
1.74 0.757115  
1.741 0.757017  
1.742 0.756947  
1.743 0.756915  
1.744 0.756898  
1.745 0.756873  
1.746 0.756847  
1.747 0.756835  
1.748 0.756815  
1.749 0.75679  
1.75 0.756776  
1.751 0.756763  
1.752 0.756774  
1.753 0.756791  
1.754 0.756803  
1.755 0.756814  
1.756 0.756864  
1.757 0.756927  
1.758 0.756958  
1.759 0.756983  
1.76 0.757006

1.761 0.757032  
1.762 0.757027  
1.763 0.75701  
1.764 0.756972  
1.765 0.756938  
1.766 0.758091  
1.767 0.758036  
1.768 0.757993  
1.769 0.757963  
1.77 0.757959  
1.771 0.757948  
1.772 0.757865  
1.773 0.757757  
1.774 0.757716  
1.775 0.757747  
1.776 0.757751  
1.777 0.757702  
1.778 0.75765  
1.779 0.757547  
1.78 0.757439  
1.781 0.757265  
1.782 0.757079  
1.783 0.756991  
1.784 0.756957  
1.785 0.756917  
1.786 0.756861  
1.787 0.756782  
1.788 0.756696  
1.789 0.756629  
1.79 0.756504  
1.791 0.756378  
1.792 0.756281  
1.793 0.756194  
1.794 0.756177  
1.795 0.756188  
1.796 0.756098  
1.797 0.755931  
1.798 0.755818  
1.799 0.755805  
1.8 0.755784  
1.801 0.755668  
1.802 0.755557  
1.803 0.755543  
1.804 0.755539  
1.805 0.755458  
1.806 0.755359  
1.807 0.755261  
1.808 0.755165  
1.809 0.7551  
1.81 0.755075  
1.811 0.755055  
1.812 0.755053  
1.813 0.755044  
1.814 0.754998  
1.815 0.754952  
1.816 0.754851  
1.817 0.754742

1.818 0.754696  
1.819 0.754674  
1.82 0.754638  
1.821 0.754588  
1.822 0.754539  
1.823 0.754478  
1.824 0.754416  
1.825 0.754364  
1.826 0.75431  
1.827 0.754249  
1.828 0.754193  
1.829 0.754073  
1.83 0.753927  
1.831 0.753792  
1.832 0.753659  
1.833 0.753503  
1.834 0.753331  
1.835 0.753176  
1.836 0.753049  
1.837 0.752919  
1.838 0.752741  
1.839 0.752563  
1.84 0.752387  
1.841 0.752223  
1.842 0.752098  
1.843 0.751977  
1.844 0.751814  
1.845 0.751617  
1.846 0.751434  
1.847 0.751276  
1.848 0.751123  
1.849 0.750985  
1.85 0.750845  
1.851 0.750669  
1.852 0.750492  
1.853 0.750425  
1.854 0.750385  
1.855 0.750276  
1.856 0.750126  
1.857 0.749998  
1.858 0.749886  
1.859 0.749794  
1.86 0.749753  
1.861 0.749716  
1.862 0.749716  
1.863 0.749717  
1.864 0.749719  
1.865 0.749719  
1.866 0.749727  
1.867 0.749739  
1.868 0.749801  
1.869 0.749884  
1.87 0.749926  
1.871 0.749938  
1.872 0.749946  
1.873 0.74994  
1.874 0.749937

1.875 0.749926  
1.876 0.749916  
1.877 0.749906  
1.878 0.749898  
1.879 0.749987  
1.88 0.750104  
1.881 0.750295  
1.882 0.750529  
1.883 0.750729  
1.884 0.750891  
1.885 0.751091  
1.886 0.751387  
1.887 0.751686  
1.888 0.752023  
1.889 0.752361  
1.89 0.75287  
1.891 0.753384  
1.892 0.753914  
1.893 0.754452  
1.894 0.755027  
1.895 0.755623  
1.896 0.75626  
1.897 0.756931  
1.898 0.757624  
1.899 0.758356  
1.9 0.759076  
1.901 0.759762  
1.902 0.760448  
1.903 0.761115  
1.904 0.76178  
1.905 0.762411  
1.906 0.763034  
1.907 0.763661  
1.908 0.764289  
1.909 0.764862  
1.91 0.765386  
1.911 0.765868  
1.912 0.766284  
1.913 0.766692  
1.914 0.767081  
1.915 0.767458  
1.916 0.767727  
1.917 0.767994  
1.918 0.768167  
1.919 0.768329  
1.92 0.768431  
1.921 0.768517  
1.922 0.768584  
1.923 0.768639  
1.924 0.768676  
1.925 0.768691  
1.926 0.768679  
1.927 0.768607  
1.928 0.768525  
1.929 0.768388  
1.93 0.768249  
1.931 0.768064

1.932 0.767878  
1.933 0.767674  
1.934 0.767471  
1.935 0.767271  
1.936 0.767069  
1.937 0.766871  
1.938 0.766679  
1.939 0.766455  
1.94 0.766191  
1.941 0.765905  
1.942 0.765564  
1.943 0.76522  
1.944 0.764866  
1.945 0.764512  
1.946 0.764166  
1.947 0.763821  
1.948 0.763491  
1.949 0.763161  
1.95 0.762857  
1.951 0.762564  
1.952 0.762224  
1.953 0.761853  
1.954 0.761515  
1.955 0.761216  
1.956 0.760917  
1.957 0.760617  
1.958 0.760315  
1.959 0.759996  
1.96 0.759682  
1.961 0.759442  
1.962 0.759201  
1.963 0.758841  
1.964 0.758467  
1.965 0.758137  
1.966 0.757823  
1.967 0.757565  
1.968 0.757344  
1.969 0.757096  
1.97 0.756814  
1.971 0.756533  
1.972 0.756248  
1.973 0.755968  
1.974 0.755712  
1.975 0.755457  
1.976 0.755228  
1.977 0.754999  
1.978 0.754733  
1.979 0.754464  
1.98 0.7542  
1.981 0.753937  
1.982 0.753686  
1.983 0.753439  
1.984 0.75323  
1.985 0.753054  
1.986 0.752878  
1.987 0.7527  
1.988 0.752505

1.989 0.75227  
1.99 0.75205  
1.991 0.75191  
1.992 0.751771  
1.993 0.751605  
1.994 0.751439  
1.995 0.751304  
1.996 0.751171  
1.997 0.751073  
1.998 0.750985  
1.999 0.750885  
2 0.750778  
2.001 0.75068  
2.002 0.750592  
2.003 0.750497  
2.004 0.750381  
2.005 0.7503  
2.006 0.750319  
2.007 0.750344  
2.008 0.750373  
2.009 0.750401  
2.01 0.750507  
2.011 0.750612  
2.012 0.750682  
2.013 0.750747  
2.014 0.750862  
2.015 0.750985  
2.016 0.751121  
2.017 0.75127  
2.018 0.751469  
2.019 0.751694  
2.02 0.751943  
2.021 0.752235  
2.022 0.752541  
2.023 0.752855  
2.024 0.753177  
2.025 0.753532  
2.026 0.753885  
2.027 0.754282  
2.028 0.754683  
2.029 0.755157  
2.03 0.755635  
2.031 0.756126  
2.032 0.756617  
2.033 0.75709  
2.034 0.757557  
2.035 0.758125  
2.036 0.758743  
2.037 0.759326  
2.038 0.759891  
2.039 0.760506  
2.04 0.761186  
2.041 0.761872  
2.042 0.76255  
2.043 0.763245  
2.044 0.764026  
2.045 0.764793

2.046 0.765424  
2.047 0.766061  
2.048 0.766764  
2.049 0.767471  
2.05 0.76817  
2.051 0.76887  
2.052 0.769579  
2.053 0.770299  
2.054 0.770977  
2.055 0.771632  
2.056 0.772294  
2.057 0.772954  
2.058 0.773595  
2.059 0.774223  
2.06 0.774841  
2.061 0.775434  
2.062 0.776025  
2.063 0.776611  
2.064 0.777219  
2.065 0.777904  
2.066 0.778578  
2.067 0.77922  
2.068 0.779863  
2.069 0.780437  
2.07 0.781004  
2.071 0.781545  
2.072 0.782081  
2.073 0.782625  
2.074 0.783179  
2.075 0.783699  
2.076 0.784205  
2.077 0.784657  
2.078 0.785076  
2.079 0.785466  
2.08 0.785833  
2.081 0.786216  
2.082 0.786599  
2.083 0.786965  
2.084 0.787295  
2.085 0.787595  
2.086 0.787804  
2.087 0.78802  
2.088 0.788287  
2.089 0.788559  
2.09 0.788811  
2.091 0.789058  
2.092 0.78921  
2.093 0.78936  
2.094 0.789492  
2.095 0.789621  
2.096 0.789703  
2.097 0.789776  
2.098 0.789845  
2.099 0.78991  
2.1 0.789913  
2.101 0.789871  
2.102 0.789801



2.103 0.789709  
2.104 0.789598  
2.105 0.789455  
2.106 0.789264  
2.107 0.788991  
2.108 0.788715  
2.109 0.788406  
2.11 0.788097  
2.111 0.787794  
2.112 0.787479  
2.113 0.787138  
2.114 0.786789  
2.115 0.786357  
2.116 0.785921  
2.117 0.785511  
2.118 0.785098  
2.119 0.784654  
2.12 0.784202  
2.121 0.78377  
2.122 0.783355  
2.123 0.782862  
2.124 0.782326  
2.125 0.781852  
2.126 0.781407  
2.127 0.780964  
2.128 0.780532  
2.129 0.780073  
2.13 0.779588  
2.131 0.779139  
2.132 0.778731  
2.133 0.77832  
2.134 0.777936  
2.135 0.777534  
2.136 0.777033  
2.137 0.776529  
2.138 0.776106  
2.139 0.775695  
2.14 0.775284  
2.141 0.774872  
2.142 0.774488  
2.143 0.774106  
2.144 0.77373  
2.145 0.773354  
2.146 0.773064  
2.147 0.772782  
2.148 0.772409  
2.149 0.772027  
2.15 0.771738  
2.151 0.771462  
2.152 0.771142  
2.153 0.770826  
2.154 0.77055  
2.155 0.770283  
2.156 0.77005  
2.157 0.769834  
2.158 0.769607  
2.159 0.769396

2.16 0.769198  
2.161 0.768988  
2.162 0.768776  
2.163 0.768571  
2.164 0.768351  
2.165 0.768131  
2.166 0.767945  
2.167 0.767785  
2.168 0.767612  
2.169 0.767432  
2.17 0.767245  
2.171 0.767039  
2.172 0.76683  
2.173 0.766591  
2.174 0.766354  
2.175 0.766152  
2.176 0.765951  
2.177 0.76574  
2.178 0.76553  
2.179 0.765262  
2.18 0.76498  
2.181 0.764735  
2.182 0.764493  
2.183 0.764248  
2.184 0.764004  
2.185 0.763795  
2.186 0.763603  
2.187 0.763397  
2.188 0.763185  
2.189 0.76292  
2.19 0.762609  
2.191 0.762407  
2.192 0.762299  
2.193 0.762121  
2.194 0.761891  
2.195 0.761693  
2.196 0.761531  
2.197 0.761375  
2.198 0.76118  
2.199 0.760981  
2.2 0.760786  
2.201 0.760587  
2.202 0.760394  
2.203 0.760236  
2.204 0.760157  
2.205 0.760055  
2.206 0.759896  
2.207 0.759743  
2.208 0.759598  
2.209 0.75946  
2.21 0.75941  
2.211 0.759354  
2.212 0.759245  
2.213 0.759146  
2.214 0.759062  
2.215 0.758976  
2.216 0.758854

2.217 0.758728  
2.218 0.758658  
2.219 0.758595  
2.22 0.758545  
2.221 0.758495  
2.222 0.75842  
2.223 0.758343  
2.224 0.758289  
2.225 0.758227  
2.226 0.758224  
2.227 0.758237  
2.228 0.758211  
2.229 0.75819  
2.23 0.758255  
2.231 0.758344  
2.232 0.758504  
2.233 0.758678  
2.234 0.758863  
2.235 0.759056  
2.236 0.759323  
2.237 0.759607  
2.238 0.76  
2.239 0.760458  
2.24 0.760899  
2.241 0.761341  
2.242 0.761843  
2.243 0.762379  
2.244 0.76302  
2.245 0.763728  
2.246 0.764444  
2.247 0.765169  
2.248 0.765942  
2.249 0.76676  
2.25 0.767612  
2.251 0.768515  
2.252 0.769414  
2.253 0.770303  
2.254 0.771278  
2.255 0.772367  
2.256 0.773449  
2.257 0.77448  
2.258 0.775566  
2.259 0.776731  
2.26 0.777875  
2.261 0.779012  
2.262 0.78017  
2.263 0.781371  
2.264 0.782516  
2.265 0.783475  
2.266 0.784418  
2.267 0.785383  
2.268 0.786269  
2.269 0.786945  
2.27 0.787574  
2.271 0.788056  
2.272 0.788452  
2.273 0.788641

2.274 0.788784  
2.275 0.788767  
2.276 0.788692  
2.277 0.788536  
2.278 0.788335  
2.279 0.787975  
2.28 0.787624  
2.281 0.787289  
2.282 0.786954  
2.283 0.786624  
2.284 0.786283  
2.285 0.785954  
2.286 0.785638  
2.287 0.785371  
2.288 0.785151  
2.289 0.785129  
2.29 0.785114  
2.291 0.785085  
2.292 0.785076  
2.293 0.785231  
2.294 0.785403  
2.295 0.785655  
2.296 0.785934  
2.297 0.786265  
2.298 0.786621  
2.299 0.787062  
2.3 0.787526  
2.301 0.788094  
2.302 0.788646  
2.303 0.789174  
2.304 0.789734  
2.305 0.790336  
2.306 0.790896  
2.307 0.791281  
2.308 0.791684  
2.309 0.792094  
2.31 0.792477  
2.311 0.792758  
2.312 0.793019  
2.313 0.793184  
2.314 0.793324  
2.315 0.793318  
2.316 0.79333  
2.317 0.793413  
2.318 0.793498  
2.319 0.79361  
2.32 0.793734  
2.321 0.793938  
2.322 0.794137  
2.323 0.794262  
2.324 0.794416  
2.325 0.794677  
2.326 0.794932  
2.327 0.795164  
2.328 0.795411  
2.329 0.795706  
2.33 0.796016

2.331 0.796374  
2.332 0.796697  
2.333 0.7969  
2.334 0.797081  
2.335 0.797193  
2.336 0.797339  
2.337 0.797572  
2.338 0.797783  
2.339 0.797943  
2.34 0.798105  
2.341 0.798271  
2.342 0.798406  
2.343 0.798474  
2.344 0.798485  
2.345 0.798388  
2.346 0.798328  
2.347 0.798337  
2.348 0.798222  
2.349 0.797908  
2.35 0.797626  
2.351 0.797394  
2.352 0.797159  
2.353 0.796924  
2.354 0.796622  
2.355 0.796231  
2.356 0.79588  
2.357 0.795581  
2.358 0.79531  
2.359 0.79507  
2.36 0.79484  
2.361 0.794613  
2.362 0.794485  
2.363 0.794422  
2.364 0.794285  
2.365 0.794108  
2.366 0.793859  
2.367 0.793564  
2.368 0.793319  
2.369 0.793099  
2.37 0.792998  
2.371 0.792973  
2.372 0.792742  
2.373 0.792389  
2.374 0.792105  
2.375 0.791846  
2.376 0.791555  
2.377 0.791275  
2.378 0.791055  
2.379 0.790828  
2.38 0.790596  
2.381 0.790352  
2.382 0.790121  
2.383 0.789904  
2.384 0.789869  
2.385 0.789845  
2.386 0.789729  
2.387 0.789588

2.388 0.789447  
2.389 0.789327  
2.39 0.78925  
2.391 0.789177  
2.392 0.789077  
2.393 0.788932  
2.394 0.788637  
2.395 0.788387  
2.396 0.788223  
2.397 0.788041  
2.398 0.787797  
2.399 0.787522  
2.4 0.787338  
2.401 0.787186  
2.402 0.787163  
2.403 0.787165  
2.404 0.787058  
2.405 0.787045  
2.406 0.787125  
2.407 0.787159  
2.408 0.787266  
2.409 0.787402  
2.41 0.787533  
2.411 0.787799  
2.412 0.788232  
2.413 0.788336  
2.414 0.788131  
2.415 0.788205  
2.416 0.788479  
2.417 0.788765  
2.418 0.789039  
2.419 0.789474  
2.42 0.789976  
2.421 0.78993  
2.422 0.789754  
2.423 0.79011  
2.424 0.79064  
2.425 0.791173  
2.426 0.791722  
2.427 0.792236  
2.428 0.792728  
2.429 0.793451  
2.43 0.794129  
2.431 0.794751  
2.432 0.795434  
2.433 0.796012  
2.434 0.796713  
2.435 0.797651  
2.436 0.798611  
2.437 0.799666  
2.438 0.800664  
2.439 0.801566  
2.44 0.802388  
2.441 0.803033  
2.442 0.803771  
2.443 0.8045  
2.444 0.805357

2.445 0.806391  
2.446 0.807383  
2.447 0.808273  
2.448 0.809101  
2.449 0.810005  
2.45 0.810951  
2.451 0.811955  
2.452 0.812863  
2.453 0.813689  
2.454 0.814689  
2.455 0.815759  
2.456 0.816894  
2.457 0.818015  
2.458 0.818861  
2.459 0.819831  
2.46 0.820837  
2.461 0.821679  
2.462 0.822805  
2.463 0.824236  
2.464 0.82556  
2.465 0.826387  
2.466 0.827003  
2.467 0.827928  
2.468 0.828848  
2.469 0.829736  
2.47 0.830754  
2.471 0.831475  
2.472 0.832041  
2.473 0.832601  
2.474 0.833468  
2.475 0.834468  
2.476 0.835277  
2.477 0.836153  
2.478 0.837051  
2.479 0.837743  
2.48 0.838245  
2.481 0.838515  
2.482 0.838366  
2.483 0.838301  
2.484 0.838577  
2.485 0.838845  
2.486 0.838838  
2.487 0.83896  
2.488 0.839181  
2.489 0.839046  
2.49 0.838681  
2.491 0.83832  
2.492 0.83785  
2.493 0.837317  
2.494 0.836749  
2.495 0.83589  
2.496 0.834846  
2.497 0.834447  
2.498 0.834192  
2.499 0.834037  
2.5 0.834034







[illegible]

```
CURVE BEGIN
0.35 0.954844
0.351 0.948447
0.352 0.953748
0.353 0.964085
0.354 0.970199
0.355 0.96844
0.356 0.964264
0.357 0.965024
0.358 0.964762
0.359 0.97132
0.36 0.98497
0.361 0.985957
0.362 0.986597
0.363 0.979876
0.364 0.973552
0.365 0.97329
0.366 0.980257
0.367 0.975052
```

0.368 0.975547  
0.369 0.978005  
0.37 0.977924  
0.371 0.985625  
0.372 0.990982  
0.373 0.986732  
0.374 0.982398  
0.375 0.976969  
0.376 0.97162  
0.377 0.975499  
0.378 0.983067  
0.379 0.988575  
0.38 0.985027  
0.381 0.977362  
0.382 0.972239  
0.383 0.974012  
0.384 0.974398  
0.385 0.978928  
0.386 0.984587  
0.387 0.993362  
0.388 0.991856  
0.389 0.985053  
0.39 0.982938  
0.391 0.98018  
0.392 0.978962  
0.393 0.980115  
0.394 0.981499  
0.395 0.985291  
0.396 0.989777  
0.397 0.988342  
0.398 0.984979  
0.399 0.97916  
0.4 0.972523  
0.401 0.974223  
0.402 0.980003  
0.403 0.988887  
0.404 0.988875  
0.405 0.988317  
0.406 0.987339  
0.407 0.982636  
0.408 0.98159  
0.409 0.982168  
0.41 0.982156  
0.411 0.984151  
0.412 0.984147  
0.413 0.98016  
0.414 0.98154  
0.415 0.981083  
0.416 0.978955  
0.417 0.979376  
0.418 0.982566  
0.419 0.985649  
0.42 0.983961  
0.421 0.984032  
0.422 0.983095  
0.423 0.979834  
0.424 0.978674

0.425 0.977491  
0.426 0.97661  
0.427 0.980462  
0.428 0.982092  
0.429 0.982352  
0.43 0.981799  
0.431 0.980724  
0.432 0.980289  
0.433 0.981041  
0.434 0.981253  
0.435 0.981402  
0.436 0.981658  
0.437 0.983401  
0.438 0.983286  
0.439 0.982285  
0.44 0.981405  
0.441 0.980652  
0.442 0.980801  
0.443 0.982338  
0.444 0.982924  
0.445 0.982773  
0.446 0.982055  
0.447 0.9818  
0.448 0.980867  
0.449 0.98004  
0.45 0.980734  
0.451 0.981449  
0.452 0.981846  
0.453 0.981723  
0.454 0.981359  
0.455 0.981173  
0.456 0.981101  
0.457 0.980334  
0.458 0.980823  
0.459 0.981778  
0.46 0.982124  
0.461 0.982828  
0.462 0.983023  
0.463 0.982235  
0.464 0.981547  
0.465 0.981399  
0.466 0.981682  
0.467 0.981209  
0.468 0.981577  
0.469 0.982099  
0.47 0.981748  
0.471 0.981598  
0.472 0.98146  
0.473 0.981261  
0.474 0.98123  
0.475 0.981218  
0.476 0.981284  
0.477 0.982149  
0.478 0.982451  
0.479 0.982248  
0.48 0.981317  
0.481 0.980616

0.482 0.980508  
0.483 0.981282  
0.484 0.98111  
0.485 0.981415  
0.486 0.9822  
0.487 0.982841  
0.488 0.982468  
0.489 0.981734  
0.49 0.981463  
0.491 0.981459  
0.492 0.981581  
0.493 0.981803  
0.494 0.9813  
0.495 0.981232  
0.496 0.981484  
0.497 0.980684  
0.498 0.980686  
0.499 0.981085  
0.5 0.981482  
0.501 0.981841  
0.502 0.981931  
0.503 0.981599  
0.504 0.981375  
0.505 0.9814  
0.506 0.981585  
0.507 0.981212  
0.508 0.981066  
0.509 0.98112  
0.51 0.981462  
0.511 0.981332  
0.512 0.981214  
0.513 0.981299  
0.514 0.981504  
0.515 0.981335  
0.516 0.980936  
0.517 0.981548  
0.518 0.981786  
0.519 0.981782  
0.52 0.98159  
0.521 0.981361  
0.522 0.98121  
0.523 0.981192  
0.524 0.981076  
0.525 0.980927  
0.526 0.980787  
0.527 0.980964  
0.528 0.98101  
0.529 0.981019  
0.53 0.981117  
0.531 0.98102  
0.532 0.980991  
0.533 0.981135  
0.534 0.981192  
0.535 0.981189  
0.536 0.981153  
0.537 0.981259  
0.538 0.981085

0.539 0.980807  
0.54 0.980628  
0.541 0.98058  
0.542 0.980712  
0.543 0.981079  
0.544 0.981003  
0.545 0.98102  
0.546 0.981098  
0.547 0.980795  
0.548 0.980672  
0.549 0.980682  
0.55 0.980823  
0.551 0.98086  
0.552 0.980781  
0.553 0.980559  
0.554 0.980411  
0.555 0.980334  
0.556 0.980316  
0.557 0.980313  
0.558 0.980416  
0.559 0.980555  
0.56 0.980658  
0.561 0.980532  
0.562 0.980372  
0.563 0.980241  
0.564 0.980263  
0.565 0.98023  
0.566 0.980157  
0.567 0.980239  
0.568 0.980309  
0.569 0.98034  
0.57 0.980264  
0.571 0.98012  
0.572 0.98004  
0.573 0.98009  
0.574 0.980072  
0.575 0.980067  
0.576 0.980094  
0.577 0.980279  
0.578 0.980185  
0.579 0.979991  
0.58 0.979905  
0.581 0.979869  
0.582 0.979887  
0.583 0.979972  
0.584 0.979922  
0.585 0.979909  
0.586 0.979937  
0.587 0.979981  
0.588 0.979835  
0.589 0.9797  
0.59 0.979881  
0.591 0.97984  
0.592 0.979809  
0.593 0.979878  
0.594 0.979793  
0.595 0.979697

0.596 0.979594  
0.597 0.979444  
0.598 0.979356  
0.599 0.979346  
0.6 0.979486  
0.601 0.979555  
0.602 0.979561  
0.603 0.979497  
0.604 0.979496  
0.605 0.979411  
0.606 0.979253  
0.607 0.979168  
0.608 0.979228  
0.609 0.979332  
0.61 0.979335  
0.611 0.979255  
0.612 0.979184  
0.613 0.979159  
0.614 0.979265  
0.615 0.979248  
0.616 0.979146  
0.617 0.979347  
0.618 0.979404  
0.619 0.979333  
0.62 0.979081  
0.621 0.978979  
0.622 0.978939  
0.623 0.978942  
0.624 0.97875  
0.625 0.978737  
0.626 0.978875  
0.627 0.978896  
0.628 0.978768  
0.629 0.97862  
0.63 0.978618  
0.631 0.978672  
0.632 0.978769  
0.633 0.978915  
0.634 0.978764  
0.635 0.978699  
0.636 0.978706  
0.637 0.978629  
0.638 0.978554  
0.639 0.978511  
0.64 0.978559  
0.641 0.978572  
0.642 0.97857  
0.643 0.978557  
0.644 0.978501  
0.645 0.97842  
0.646 0.978321  
0.647 0.978224  
0.648 0.978263  
0.649 0.978336  
0.65 0.978323  
0.651 0.978306  
0.652 0.978251

0.653 0.978141  
0.654 0.978043  
0.655 0.977952  
0.656 0.977879  
0.657 0.977894  
0.658 0.977974  
0.659 0.978044  
0.66 0.977995  
0.661 0.977919  
0.662 0.977866  
0.663 0.977857  
0.664 0.977907  
0.665 0.977891  
0.666 0.977833  
0.667 0.977909  
0.668 0.97788  
0.669 0.977773  
0.67 0.97758  
0.671 0.977595  
0.672 0.977665  
0.673 0.977749  
0.674 0.977722  
0.675 0.977694  
0.676 0.977668  
0.677 0.977654  
0.678 0.977524  
0.679 0.977369  
0.68 0.977303  
0.681 0.977322  
0.682 0.977342  
0.683 0.977337  
0.684 0.977336  
0.685 0.977341  
0.686 0.977335  
0.687 0.977206  
0.688 0.97716  
0.689 0.977159  
0.69 0.977173  
0.691 0.977163  
0.692 0.977141  
0.693 0.977107  
0.694 0.977058  
0.695 0.977019  
0.696 0.976983  
0.697 0.976895  
0.698 0.976954  
0.699 0.977038  
0.7 0.976992  
0.701 0.976967  
0.702 0.976913  
0.703 0.976808  
0.704 0.976795  
0.705 0.976759  
0.706 0.976708  
0.707 0.976705  
0.708 0.976721  
0.709 0.976724



0.71 0.976665  
0.711 0.976585  
0.712 0.976524  
0.713 0.976499  
0.714 0.976515  
0.715 0.976522  
0.716 0.976526  
0.717 0.976573  
0.718 0.976516  
0.719 0.976425  
0.72 0.976368  
0.721 0.976297  
0.722 0.976265  
0.723 0.976294  
0.724 0.976243  
0.725 0.976238  
0.726 0.976263  
0.727 0.976207  
0.728 0.97614  
0.729 0.976092  
0.73 0.976114  
0.731 0.976147  
0.732 0.976146  
0.733 0.976092  
0.734 0.976057  
0.735 0.97605  
0.736 0.976049  
0.737 0.975912  
0.738 0.975885  
0.739 0.975899  
0.74 0.975889  
0.741 0.975895  
0.742 0.975884  
0.743 0.975843  
0.744 0.975811  
0.745 0.975746  
0.746 0.975661  
0.747 0.975628  
0.748 0.97563  
0.749 0.975645  
0.75 0.975649  
0.751 0.975605  
0.752 0.975545  
0.753 0.975474  
0.754 0.975529  
0.755 0.975516  
0.756 0.975458  
0.757 0.975477  
0.758 0.97547  
0.759 0.975438  
0.76 0.975367  
0.761 0.975322  
0.762 0.975298  
0.763 0.975295  
0.764 0.975262  
0.765 0.975232  
0.766 0.975212

0.767 0.975227  
0.768 0.975171  
0.769 0.975094  
0.77 0.975046  
0.771 0.975017  
0.772 0.975011  
0.773 0.975031  
0.774 0.974956  
0.775 0.974959  
0.776 0.975003  
0.777 0.974887  
0.778 0.974798  
0.779 0.974747  
0.78 0.974767  
0.781 0.974799  
0.782 0.974802  
0.783 0.974759  
0.784 0.974762  
0.785 0.974735  
0.786 0.974675  
0.787 0.974561  
0.788 0.974547  
0.789 0.974572  
0.79 0.974578  
0.791 0.974538  
0.792 0.974488  
0.793 0.974439  
0.794 0.974399  
0.795 0.974334  
0.796 0.974266  
0.797 0.974332  
0.798 0.97437  
0.799 0.974359  
0.8 0.974251  
0.801 0.974143  
0.802 0.974081  
0.803 0.974086  
0.804 0.974077  
0.805 0.974079  
0.806 0.974088  
0.807 0.974081  
0.808 0.974066  
0.809 0.974023  
0.81 0.973916  
0.811 0.973846  
0.812 0.973814  
0.813 0.973828  
0.814 0.973836  
0.815 0.973838  
0.816 0.973832  
0.817 0.973811  
0.818 0.97369  
0.819 0.973558  
0.82 0.973515  
0.821 0.973543  
0.822 0.973568  
0.823 0.973565

0.824 0.973547  
0.825 0.973535  
0.826 0.973512  
0.827 0.973392  
0.828 0.973319  
0.829 0.973295  
0.83 0.973348  
0.831 0.973368  
0.832 0.973333  
0.833 0.973228  
0.834 0.973149  
0.835 0.97309  
0.836 0.973044  
0.837 0.972992  
0.838 0.973066  
0.839 0.973145  
0.84 0.973087  
0.841 0.973003  
0.842 0.972938  
0.843 0.972907  
0.844 0.972892  
0.845 0.972823  
0.846 0.972735  
0.847 0.972808  
0.848 0.972845  
0.849 0.972804  
0.85 0.972596  
0.851 0.972573  
0.852 0.972574  
0.853 0.97256  
0.854 0.97251  
0.855 0.972486  
0.856 0.972487  
0.857 0.972511  
0.858 0.972452  
0.859 0.97235  
0.86 0.972232  
0.861 0.972185  
0.862 0.972181  
0.863 0.972222  
0.864 0.972247  
0.865 0.972232  
0.866 0.972188  
0.867 0.972171  
0.868 0.97206  
0.869 0.971953  
0.87 0.971964  
0.871 0.971922  
0.872 0.97191  
0.873 0.971952  
0.874 0.971867  
0.875 0.97181  
0.876 0.971765  
0.877 0.971637  
0.878 0.971608  
0.879 0.971608  
0.88 0.971576

0.881 0.971569  
0.882 0.971545  
0.883 0.97149  
0.884 0.971485  
0.885 0.97143  
0.886 0.971339  
0.887 0.971282  
0.888 0.971306  
0.889 0.971297  
0.89 0.971121  
0.891 0.97106  
0.892 0.971032  
0.893 0.97102  
0.894 0.970947  
0.895 0.970886  
0.896 0.970855  
0.897 0.970962  
0.898 0.970984  
0.899 0.970936  
0.9 0.970801  
0.901 0.970676  
0.902 0.970591  
0.903 0.970559  
0.904 0.970548  
0.905 0.970574  
0.906 0.970615  
0.907 0.970577  
0.908 0.970431  
0.909 0.970296  
0.91 0.970312  
0.911 0.970287  
0.912 0.970257  
0.913 0.970231  
0.914 0.970194  
0.915 0.970168  
0.916 0.970128  
0.917 0.969945  
0.918 0.969803  
0.919 0.969736  
0.92 0.969819  
0.921 0.969836  
0.922 0.969792  
0.923 0.96968  
0.924 0.969613  
0.925 0.969587  
0.926 0.969573  
0.927 0.969434  
0.928 0.969378  
0.929 0.969364  
0.93 0.969368  
0.931 0.969329  
0.932 0.969265  
0.933 0.969181  
0.934 0.96903  
0.935 0.968917  
0.936 0.968849  
0.937 0.968882

0.938 0.968969  
0.939 0.969006  
0.94 0.968853  
0.941 0.968733  
0.942 0.968597  
0.943 0.968429  
0.944 0.968511  
0.945 0.968506  
0.946 0.968459  
0.947 0.968584  
0.948 0.968465  
0.949 0.96827  
0.95 0.968147  
0.951 0.968044  
0.952 0.968004  
0.953 0.968043  
0.954 0.967977  
0.955 0.967928  
0.956 0.967915  
0.957 0.968036  
0.958 0.96784  
0.959 0.967588  
0.96 0.967537  
0.961 0.967441  
0.962 0.967363  
0.963 0.967321  
0.964 0.967247  
0.965 0.967224  
0.966 0.967207  
0.967 0.966971  
0.968 0.966846  
0.969 0.966823  
0.97 0.966297  
0.971 0.966232  
0.972 0.966173  
0.973 0.966086  
0.974 0.966007  
0.975 0.965965  
0.976 0.965924  
0.977 0.965881  
0.978 0.965836  
0.979 0.965714  
0.98 0.965587  
0.981 0.965602  
0.982 0.965646  
0.983 0.965599  
0.984 0.965513  
0.985 0.965404  
0.986 0.965276  
0.987 0.965161  
0.988 0.965075  
0.989 0.965003  
0.99 0.964956  
0.991 0.964906  
0.992 0.964839  
0.993 0.964772  
0.994 0.964639

0.995 0.964501  
0.996 0.964461  
0.997 0.964454  
0.998 0.964385  
0.999 0.964275  
1 0.964182  
1.001 0.964104  
1.002 0.964025  
1.003 0.963945  
1.004 0.963896  
1.005 0.963975  
1.006 0.964032  
1.007 0.963816  
1.008 0.963605  
1.009 0.963612  
1.01 0.963649  
1.011 0.963502  
1.012 0.963251  
1.013 0.963113  
1.014 0.963069  
1.015 0.962986  
1.016 0.962844  
1.017 0.962684  
1.018 0.962548  
1.019 0.962431  
1.02 0.962382  
1.021 0.962335  
1.022 0.962281  
1.023 0.962229  
1.024 0.962138  
1.025 0.962015  
1.026 0.961894  
1.027 0.961814  
1.028 0.96174  
1.029 0.961626  
1.03 0.961503  
1.031 0.961392  
1.032 0.96128  
1.033 0.961142  
1.034 0.961015  
1.035 0.960956  
1.036 0.960901  
1.037 0.960784  
1.038 0.960656  
1.039 0.960569  
1.04 0.960493  
1.041 0.9604  
1.042 0.960316  
1.043 0.960272  
1.044 0.9602  
1.045 0.960104  
1.046 0.960006  
1.047 0.959898  
1.048 0.959785  
1.049 0.959672  
1.05 0.959544  
1.051 0.959408

1.052 0.959277  
1.053 0.959154  
1.054 0.959046  
1.055 0.958953  
1.056 0.958848  
1.057 0.9587  
1.058 0.958571  
1.059 0.958483  
1.06 0.958411  
1.061 0.958335  
1.062 0.95821  
1.063 0.958038  
1.064 0.957893  
1.065 0.957783  
1.066 0.95764  
1.067 0.957458  
1.068 0.957327  
1.069 0.957272  
1.07 0.957186  
1.071 0.957059  
1.072 0.956933  
1.073 0.956763  
1.074 0.956608  
1.075 0.956473  
1.076 0.95636  
1.077 0.956251  
1.078 0.956107  
1.079 0.955962  
1.08 0.955835  
1.081 0.955693  
1.082 0.955535  
1.083 0.955386  
1.084 0.955234  
1.085 0.955082  
1.086 0.954966  
1.087 0.954843  
1.088 0.954691  
1.089 0.954575  
1.09 0.95443  
1.091 0.954246  
1.092 0.95409  
1.093 0.953984  
1.094 0.953904  
1.095 0.95379  
1.096 0.953645  
1.097 0.953512  
1.098 0.953364  
1.099 0.953196  
1.1 0.95306  
1.101 0.95294  
1.102 0.95278  
1.103 0.952639  
1.104 0.952516  
1.105 0.952361  
1.106 0.952203  
1.107 0.95204  
1.108 0.95187

1.109 0.951708  
1.11 0.95155  
1.111 0.951388  
1.112 0.951227  
1.113 0.951061  
1.114 0.950896  
1.115 0.950759  
1.116 0.950633  
1.117 0.950462  
1.118 0.950283  
1.119 0.950145  
1.12 0.95  
1.121 0.949835  
1.122 0.949674  
1.123 0.949497  
1.124 0.949321  
1.125 0.949172  
1.126 0.948997  
1.127 0.948816  
1.128 0.948671  
1.129 0.948528  
1.13 0.948347  
1.131 0.948167  
1.132 0.948025  
1.133 0.947887  
1.134 0.947717  
1.135 0.947541  
1.136 0.947347  
1.137 0.94715  
1.138 0.946967  
1.139 0.9468  
1.14 0.946628  
1.141 0.946446  
1.142 0.946267  
1.143 0.946063  
1.144 0.945861  
1.145 0.945682  
1.146 0.945512  
1.147 0.945351  
1.148 0.945189  
1.149 0.945004  
1.15 0.944822  
1.151 0.944634  
1.152 0.944448  
1.153 0.944273  
1.154 0.944097  
1.155 0.943897  
1.156 0.943692  
1.157 0.943489  
1.158 0.94329  
1.159 0.943111  
1.16 0.942944  
1.161 0.942763  
1.162 0.942564  
1.163 0.94237  
1.164 0.942159  
1.165 0.941948



1.166 0.94173  
1.167 0.941514  
1.168 0.941322  
1.169 0.941138  
1.17 0.940928  
1.171 0.940709  
1.172 0.940511  
1.173 0.940325  
1.174 0.940128  
1.175 0.939917  
1.176 0.93972  
1.177 0.939547  
1.178 0.939364  
1.179 0.939141  
1.18 0.93892  
1.181 0.938699  
1.182 0.938481  
1.183 0.938288  
1.184 0.938097  
1.185 0.937881  
1.186 0.937664  
1.187 0.937454  
1.188 0.937251  
1.189 0.937018  
1.19 0.93677  
1.191 0.936545  
1.192 0.93634  
1.193 0.936128  
1.194 0.935905  
1.195 0.935681  
1.196 0.935454  
1.197 0.935229  
1.198 0.935007  
1.199 0.934785  
1.2 0.934542  
1.201 0.934302  
1.202 0.934083  
1.203 0.933865  
1.204 0.933626  
1.205 0.933384  
1.206 0.933161  
1.207 0.932945  
1.208 0.932722  
1.209 0.932495  
1.21 0.932261  
1.211 0.932019  
1.212 0.931773  
1.213 0.931524  
1.214 0.93128  
1.215 0.931049  
1.216 0.930814  
1.217 0.930561  
1.218 0.930311  
1.219 0.93008  
1.22 0.929848  
1.221 0.929573  
1.222 0.929299

1.223 0.92905  
1.224 0.928804  
1.225 0.928554  
1.226 0.928301  
1.227 0.928046  
1.228 0.927794  
1.229 0.927541  
1.23 0.92729  
1.231 0.927032  
1.232 0.926766  
1.233 0.926497  
1.234 0.926218  
1.235 0.925945  
1.236 0.925692  
1.237 0.925435  
1.238 0.925169  
1.239 0.924905  
1.24 0.924643  
1.241 0.92438  
1.242 0.924086  
1.243 0.923791  
1.244 0.923514  
1.245 0.923241  
1.246 0.922984  
1.247 0.922733  
1.248 0.922477  
1.249 0.922221  
1.25 0.92195  
1.251 0.921661  
1.252 0.921365  
1.253 0.921075  
1.254 0.920795  
1.255 0.920523  
1.256 0.920249  
1.257 0.919957  
1.258 0.91966  
1.259 0.919365  
1.26 0.919073  
1.261 0.918791  
1.262 0.918511  
1.263 0.918226  
1.264 0.91794  
1.265 0.91765  
1.266 0.91736  
1.267 0.917075  
1.268 0.916795  
1.269 0.91651  
1.27 0.916219  
1.271 0.915918  
1.272 0.915607  
1.273 0.915301  
1.274 0.915003  
1.275 0.914706  
1.276 0.914403  
1.277 0.914101  
1.278 0.913805  
1.279 0.913507

1.28 0.913193  
1.281 0.912878  
1.282 0.91257  
1.283 0.912264  
1.284 0.911974  
1.285 0.911682  
1.286 0.911376  
1.287 0.911066  
1.288 0.910724  
1.289 0.910375  
1.29 0.910077  
1.291 0.90979  
1.292 0.909479  
1.293 0.909161  
1.294 0.908842  
1.295 0.908515  
1.296 0.908186  
1.297 0.907857  
1.298 0.90753  
1.299 0.907211  
1.3 0.906888  
1.301 0.90656  
1.302 0.90623  
1.303 0.905902  
1.304 0.905569  
1.305 0.905227  
1.306 0.904886  
1.307 0.904539  
1.308 0.90419  
1.309 0.903866  
1.31 0.90354  
1.311 0.903196  
1.312 0.902856  
1.313 0.902517  
1.314 0.902174  
1.315 0.901827  
1.316 0.901478  
1.317 0.901129  
1.318 0.900787  
1.319 0.900443  
1.32 0.900097  
1.321 0.899747  
1.322 0.899399  
1.323 0.89905  
1.324 0.898704  
1.325 0.898371  
1.326 0.898042  
1.327 0.897697  
1.328 0.897361  
1.329 0.897033  
1.33 0.896672  
1.331 0.896316  
1.332 0.895987  
1.333 0.895659  
1.334 0.895311  
1.335 0.894966  
1.336 0.894623

1.337 0.894282  
1.338 0.893928  
1.339 0.893579  
1.34 0.893232  
1.341 0.892888  
1.342 0.892542  
1.343 0.892196  
1.344 0.891842  
1.345 0.891488  
1.346 0.891146  
1.347 0.890809  
1.348 0.890467  
1.349 0.89013  
1.35 0.889798  
1.351 0.889466  
1.352 0.889149  
1.353 0.888849  
1.354 0.888534  
1.355 0.888187  
1.356 0.887845  
1.357 0.887515  
1.358 0.887183  
1.359 0.886822  
1.36 0.886463  
1.361 0.886091  
1.362 0.885718  
1.363 0.885338  
1.364 0.884963  
1.365 0.884585  
1.366 0.884211  
1.367 0.883828  
1.368 0.883446  
1.369 0.883069  
1.37 0.882694  
1.371 0.882311  
1.372 0.881927  
1.373 0.881554  
1.374 0.881181  
1.375 0.880802  
1.376 0.880422  
1.377 0.880064  
1.378 0.879717  
1.379 0.87936  
1.38 0.878988  
1.381 0.878615  
1.382 0.878243  
1.383 0.877857  
1.384 0.877448  
1.385 0.877041  
1.386 0.876657  
1.387 0.876274  
1.388 0.875873  
1.389 0.875481  
1.39 0.875109  
1.391 0.874734  
1.392 0.874347  
1.393 0.873966

1.394 0.873591  
1.395 0.873214  
1.396 0.872831  
1.397 0.872451  
1.398 0.87208  
1.399 0.87171  
1.4 0.871328  
1.401 0.870943  
1.402 0.87059  
1.403 0.870254  
1.404 0.869908  
1.405 0.869549  
1.406 0.869188  
1.407 0.868831  
1.408 0.868478  
1.409 0.868128  
1.41 0.867791  
1.411 0.867466  
1.412 0.867126  
1.413 0.86678  
1.414 0.866452  
1.415 0.866132  
1.416 0.865809  
1.417 0.865487  
1.418 0.865171  
1.419 0.86487  
1.42 0.864562  
1.421 0.864234  
1.422 0.863905  
1.423 0.863565  
1.424 0.863229  
1.425 0.862901  
1.426 0.862571  
1.427 0.862243  
1.428 0.861912  
1.429 0.861559  
1.43 0.861206  
1.431 0.860865  
1.432 0.86052  
1.433 0.860157  
1.434 0.859792  
1.435 0.859438  
1.436 0.859087  
1.437 0.858717  
1.438 0.858342  
1.439 0.857968  
1.44 0.85759  
1.441 0.857218  
1.442 0.856844  
1.443 0.856479  
1.444 0.856129  
1.445 0.855772  
1.446 0.855399  
1.447 0.855033  
1.448 0.854681  
1.449 0.854319  
1.45 0.853944

1.451 0.853569  
1.452 0.853198  
1.453 0.85283  
1.454 0.852465  
1.455 0.852107  
1.456 0.851772  
1.457 0.851437  
1.458 0.851105  
1.459 0.850773  
1.46 0.850432  
1.461 0.850091  
1.462 0.849751  
1.463 0.849406  
1.464 0.849054  
1.465 0.848706  
1.466 0.848384  
1.467 0.84806  
1.468 0.84772  
1.469 0.847377  
1.47 0.847024  
1.471 0.846672  
1.472 0.846357  
1.473 0.846043  
1.474 0.845674  
1.475 0.845295  
1.476 0.844956  
1.477 0.844623  
1.478 0.844258  
1.479 0.843882  
1.48 0.843498  
1.481 0.843118  
1.482 0.842745  
1.483 0.842373  
1.484 0.842005  
1.485 0.841639  
1.486 0.841247  
1.487 0.840842  
1.488 0.840456  
1.489 0.840082  
1.49 0.839694  
1.491 0.839299  
1.492 0.838915  
1.493 0.838536  
1.494 0.838125  
1.495 0.83768  
1.496 0.837244  
1.497 0.836818  
1.498 0.836395  
1.499 0.835976  
1.5 0.835558  
1.501 0.835138  
1.502 0.834705  
1.503 0.834259  
1.504 0.833812  
1.505 0.833361  
1.506 0.832914  
1.507 0.832468

1.508 0.832018  
1.509 0.831568  
1.51 0.831121  
1.511 0.830686  
1.512 0.830254  
1.513 0.829819  
1.514 0.829382  
1.515 0.82894  
1.516 0.828502  
1.517 0.828083  
1.518 0.82766  
1.519 0.827219  
1.52 0.826781  
1.521 0.826366  
1.522 0.825952  
1.523 0.82555  
1.524 0.825147  
1.525 0.824767  
1.526 0.824385  
1.527 0.823975  
1.528 0.823564  
1.529 0.823156  
1.53 0.822747  
1.531 0.82233  
1.532 0.821914  
1.533 0.821514  
1.534 0.821112  
1.535 0.820696  
1.536 0.82028  
1.537 0.819863  
1.538 0.819444  
1.539 0.819032  
1.54 0.818622  
1.541 0.818197  
1.542 0.817768  
1.543 0.817355  
1.544 0.816943  
1.545 0.816521  
1.546 0.816095  
1.547 0.815648  
1.548 0.815193  
1.549 0.814748  
1.55 0.814307  
1.551 0.813856  
1.552 0.813401  
1.553 0.812967  
1.554 0.81254  
1.555 0.812092  
1.556 0.811636  
1.557 0.81118  
1.558 0.810723  
1.559 0.810286  
1.56 0.80986  
1.561 0.809436  
1.562 0.809011  
1.563 0.808563  
1.564 0.808099

1.565 0.807644  
1.566 0.807194  
1.567 0.806761  
1.568 0.806338  
1.569 0.805909  
1.57 0.805476  
1.571 0.805042  
1.572 0.804606  
1.573 0.804179  
1.574 0.803761  
1.575 0.803319  
1.576 0.802858  
1.577 0.802418  
1.578 0.801996  
1.579 0.801567  
1.58 0.801129  
1.581 0.800703  
1.582 0.800289  
1.583 0.79985  
1.584 0.799385  
1.585 0.798922  
1.586 0.798461  
1.587 0.798007  
1.588 0.797563  
1.589 0.7971  
1.59 0.796612  
1.591 0.796106  
1.592 0.795576  
1.593 0.79506  
1.594 0.794562  
1.595 0.794044  
1.596 0.793499  
1.597 0.792969  
1.598 0.792461  
1.599 0.79194  
1.6 0.791404  
1.601 0.790862  
1.602 0.790312  
1.603 0.789763  
1.604 0.789217  
1.605 0.788683  
1.606 0.788167  
1.607 0.787635  
1.608 0.787075  
1.609 0.786522  
1.61 0.78598  
1.611 0.785429  
1.612 0.784866  
1.613 0.784318  
1.614 0.783797  
1.615 0.783262  
1.616 0.782708  
1.617 0.782158  
1.618 0.781618  
1.619 0.781081  
1.62 0.780552  
1.621 0.780019



1.622 0.779481  
1.623 0.778947  
1.624 0.778418  
1.625 0.777915  
1.626 0.777453  
1.627 0.77696  
1.628 0.776411  
1.629 0.775878  
1.63 0.775376  
1.631 0.774873  
1.632 0.774371  
1.633 0.773862  
1.634 0.773339  
1.635 0.772819  
1.636 0.772311  
1.637 0.771812  
1.638 0.771323  
1.639 0.770829  
1.64 0.770325  
1.641 0.769834  
1.642 0.769363  
1.643 0.768859  
1.644 0.768314  
1.645 0.767795  
1.646 0.767307  
1.647 0.766819  
1.648 0.766331  
1.649 0.765825  
1.65 0.765303  
1.651 0.764799  
1.652 0.764312  
1.653 0.763825  
1.654 0.763339  
1.655 0.76285  
1.656 0.762357  
1.657 0.761849  
1.658 0.761326  
1.659 0.760823  
1.66 0.76034  
1.661 0.759864  
1.662 0.759395  
1.663 0.758921  
1.664 0.758441  
1.665 0.757983  
1.666 0.757542  
1.667 0.757078  
1.668 0.756594  
1.669 0.756128  
1.67 0.755677  
1.671 0.755215  
1.672 0.754739  
1.673 0.754304  
1.674 0.753902  
1.675 0.753478  
1.676 0.753043  
1.677 0.752621  
1.678 0.752209

1.679 0.751786  
1.68 0.751358  
1.681 0.750953  
1.682 0.750556  
1.683 0.750186  
1.684 0.749831  
1.685 0.749489  
1.686 0.749145  
1.687 0.748798  
1.688 0.748454  
1.689 0.748129  
1.69 0.747812  
1.691 0.747504  
1.692 0.747197  
1.693 0.746927  
1.694 0.746664  
1.695 0.746401  
1.696 0.746137  
1.697 0.745906  
1.698 0.745682  
1.699 0.745457  
1.7 0.745231  
1.701 0.744975  
1.702 0.74471  
1.703 0.744437  
1.704 0.744167  
1.705 0.74389  
1.706 0.743607  
1.707 0.743292  
1.708 0.742976  
1.709 0.742672  
1.71 0.742368  
1.711 0.742058  
1.712 0.741745  
1.713 0.741424  
1.714 0.741102  
1.715 0.740808  
1.716 0.740516  
1.717 0.740293  
1.718 0.740065  
1.719 0.739769  
1.72 0.739476  
1.721 0.739253  
1.722 0.739028  
1.723 0.738775  
1.724 0.738513  
1.725 0.738234  
1.726 0.737945  
1.727 0.737598  
1.728 0.737234  
1.729 0.736841  
1.73 0.73643  
1.731 0.735981  
1.732 0.735508  
1.733 0.734999  
1.734 0.734488  
1.735 0.733971

1.736 0.733466  
1.737 0.73298  
1.738 0.732508  
1.739 0.732045  
1.74 0.731577  
1.741 0.73112  
1.742 0.730689  
1.743 0.730268  
1.744 0.729908  
1.745 0.729592  
1.746 0.729254  
1.747 0.728916  
1.748 0.728624  
1.749 0.728348  
1.75 0.728069  
1.751 0.727792  
1.752 0.727563  
1.753 0.727345  
1.754 0.727133  
1.755 0.726925  
1.756 0.726743  
1.757 0.726561  
1.758 0.72634  
1.759 0.726112  
1.76 0.725833  
1.761 0.72555  
1.762 0.725246  
1.763 0.724939  
1.764 0.724614  
1.765 0.72428  
1.766 0.723996  
1.767 0.723585  
1.768 0.723168  
1.769 0.722762  
1.77 0.722378  
1.771 0.721981  
1.772 0.721448  
1.773 0.720915  
1.774 0.720448  
1.775 0.720063  
1.776 0.719663  
1.777 0.719218  
1.778 0.718814  
1.779 0.718515  
1.78 0.718213  
1.781 0.717724  
1.782 0.717219  
1.783 0.716828  
1.784 0.716468  
1.785 0.716094  
1.786 0.715728  
1.787 0.715351  
1.788 0.714965  
1.789 0.714584  
1.79 0.714211  
1.791 0.713845  
1.792 0.713494

1.793 0.713153  
1.794 0.712738  
1.795 0.712289  
1.796 0.711886  
1.797 0.71153  
1.798 0.711168  
1.799 0.710778  
1.8 0.710408  
1.801 0.710128  
1.802 0.709846  
1.803 0.709503  
1.804 0.709164  
1.805 0.708838  
1.806 0.708514  
1.807 0.708199  
1.808 0.70789  
1.809 0.707562  
1.81 0.707188  
1.811 0.706815  
1.812 0.706502  
1.813 0.706192  
1.814 0.705812  
1.815 0.70543  
1.816 0.705094  
1.817 0.704766  
1.818 0.704468  
1.819 0.704192  
1.82 0.70384  
1.821 0.703413  
1.822 0.702998  
1.823 0.702617  
1.824 0.702243  
1.825 0.701847  
1.826 0.701454  
1.827 0.701074  
1.828 0.700699  
1.829 0.700282  
1.83 0.699857  
1.831 0.699454  
1.832 0.699065  
1.833 0.69865  
1.834 0.698196  
1.835 0.697736  
1.836 0.697235  
1.837 0.696739  
1.838 0.69623  
1.839 0.695723  
1.84 0.695217  
1.841 0.694722  
1.842 0.694214  
1.843 0.69369  
1.844 0.69313  
1.845 0.692546  
1.846 0.691984  
1.847 0.691468  
1.848 0.690979  
1.849 0.690582

1.85 0.690183  
1.851 0.68966  
1.852 0.689137  
1.853 0.688679  
1.854 0.688238  
1.855 0.687829  
1.856 0.687425  
1.857 0.687015  
1.858 0.686613  
1.859 0.686246  
1.86 0.68595  
1.861 0.685653  
1.862 0.685368  
1.863 0.685084  
1.864 0.68482  
1.865 0.684553  
1.866 0.684348  
1.867 0.684161  
1.868 0.683923  
1.869 0.68366  
1.87 0.683375  
1.871 0.683058  
1.872 0.682782  
1.873 0.682595  
1.874 0.682397  
1.875 0.682119  
1.876 0.681844  
1.877 0.681571  
1.878 0.681302  
1.879 0.681127  
1.88 0.680977  
1.881 0.680963  
1.882 0.681037  
1.883 0.681133  
1.884 0.681252  
1.885 0.681374  
1.886 0.681504  
1.887 0.681651  
1.888 0.681937  
1.889 0.682224  
1.89 0.682626  
1.891 0.683028  
1.892 0.683482  
1.893 0.683952  
1.894 0.684504  
1.895 0.685103  
1.896 0.685739  
1.897 0.686415  
1.898 0.68712  
1.899 0.687874  
1.9 0.688625  
1.901 0.689358  
1.902 0.690088  
1.903 0.690808  
1.904 0.691527  
1.905 0.692139  
1.906 0.692734

1.907 0.693302  
1.908 0.693854  
1.909 0.694291  
1.91 0.694632  
1.911 0.694978  
1.912 0.695329  
1.913 0.695645  
1.914 0.695839  
1.915 0.696023  
1.916 0.696109  
1.917 0.696196  
1.918 0.6962  
1.919 0.696196  
1.92 0.696121  
1.921 0.696025  
1.922 0.695892  
1.923 0.69574  
1.924 0.69552  
1.925 0.695217  
1.926 0.694905  
1.927 0.694575  
1.928 0.694216  
1.929 0.693732  
1.93 0.693251  
1.931 0.692839  
1.932 0.69243  
1.933 0.691948  
1.934 0.691455  
1.935 0.690909  
1.936 0.690348  
1.937 0.689787  
1.938 0.689225  
1.939 0.68867  
1.94 0.688123  
1.941 0.687518  
1.942 0.686782  
1.943 0.686066  
1.944 0.685447  
1.945 0.684828  
1.946 0.684202  
1.947 0.683576  
1.948 0.682976  
1.949 0.682378  
1.95 0.681725  
1.951 0.681051  
1.952 0.680424  
1.953 0.679832  
1.954 0.679253  
1.955 0.678691  
1.956 0.678124  
1.957 0.677544  
1.958 0.67697  
1.959 0.676425  
1.96 0.675879  
1.961 0.675374  
1.962 0.67487  
1.963 0.674268

1.964 0.673651  
1.965 0.673091  
1.966 0.672554  
1.967 0.672027  
1.968 0.671504  
1.969 0.671019  
1.97 0.670572  
1.971 0.670099  
1.972 0.669574  
1.973 0.669046  
1.974 0.668518  
1.975 0.66799  
1.976 0.667479  
1.977 0.666966  
1.978 0.666491  
1.979 0.666016  
1.98 0.66556  
1.981 0.665104  
1.982 0.664686  
1.983 0.664288  
1.984 0.663908  
1.985 0.663545  
1.986 0.663195  
1.987 0.66286  
1.988 0.66253  
1.989 0.662216  
1.99 0.661906  
1.991 0.661628  
1.992 0.661347  
1.993 0.661099  
1.994 0.66085  
1.995 0.6606  
1.996 0.660347  
1.997 0.660166  
1.998 0.659998  
1.999 0.659815  
2 0.659625  
2.001 0.659498  
2.002 0.659425  
2.003 0.659348  
2.004 0.659274  
2.005 0.659236  
2.006 0.659277  
2.007 0.65932  
2.008 0.659377  
2.009 0.659444  
2.01 0.659641  
2.011 0.659838  
2.012 0.660019  
2.013 0.660204  
2.014 0.660466  
2.015 0.660742  
2.016 0.660998  
2.017 0.661246  
2.018 0.661582  
2.019 0.661986  
2.02 0.66244

2.021 0.662949  
2.022 0.663463  
2.023 0.663972  
2.024 0.66449  
2.025 0.665061  
2.026 0.665653  
2.027 0.666388  
2.028 0.667129  
2.029 0.667958  
2.03 0.668792  
2.031 0.669607  
2.032 0.670423  
2.033 0.671268  
2.034 0.672128  
2.035 0.673066  
2.036 0.674043  
2.037 0.675004  
2.038 0.675948  
2.039 0.676932  
2.04 0.677975  
2.041 0.679027  
2.042 0.680101  
2.043 0.6812  
2.044 0.682351  
2.045 0.683495  
2.046 0.684567  
2.047 0.685642  
2.048 0.68677  
2.049 0.687903  
2.05 0.688986  
2.051 0.690059  
2.052 0.691074  
2.053 0.692083  
2.054 0.693105  
2.055 0.694129  
2.056 0.695125  
2.057 0.69611  
2.058 0.697052  
2.059 0.697932  
2.06 0.698855  
2.061 0.699862  
2.062 0.70085  
2.063 0.70178  
2.064 0.702719  
2.065 0.703697  
2.066 0.704674  
2.067 0.705623  
2.068 0.706575  
2.069 0.707485  
2.07 0.708391  
2.071 0.709193  
2.072 0.709987  
2.073 0.710827  
2.074 0.71169  
2.075 0.71247  
2.076 0.713212  
2.077 0.713879



2.078 0.714489  
2.079 0.715106  
2.08 0.715734  
2.081 0.716341  
2.082 0.716923  
2.083 0.717456  
2.084 0.717869  
2.085 0.718288  
2.086 0.718709  
2.087 0.719114  
2.088 0.719467  
2.089 0.719821  
2.09 0.720127  
2.091 0.720431  
2.092 0.720674  
2.093 0.720914  
2.094 0.721078  
2.095 0.721226  
2.096 0.72124  
2.097 0.721224  
2.098 0.721214  
2.099 0.721203  
2.1 0.721179  
2.101 0.721134  
2.102 0.721009  
2.103 0.720813  
2.104 0.720561  
2.105 0.720238  
2.106 0.719873  
2.107 0.719442  
2.108 0.719013  
2.109 0.718556  
2.11 0.718095  
2.111 0.717588  
2.112 0.717072  
2.113 0.716561  
2.114 0.716041  
2.115 0.715425  
2.116 0.714801  
2.117 0.714059  
2.118 0.713297  
2.119 0.712537  
2.12 0.711776  
2.121 0.71102  
2.122 0.710259  
2.123 0.709518  
2.124 0.708783  
2.125 0.708022  
2.126 0.707257  
2.127 0.706442  
2.128 0.705583  
2.129 0.704782  
2.13 0.704028  
2.131 0.703241  
2.132 0.702418  
2.133 0.701626  
2.134 0.700905

2.135 0.700189  
2.136 0.699485  
2.137 0.698791  
2.138 0.6982  
2.139 0.697609  
2.14 0.696955  
2.141 0.696305  
2.142 0.695739  
2.143 0.695175  
2.144 0.694569  
2.145 0.693958  
2.146 0.693407  
2.147 0.692862  
2.148 0.692335  
2.149 0.691817  
2.15 0.691325  
2.151 0.690831  
2.152 0.690318  
2.153 0.689797  
2.154 0.689246  
2.155 0.688674  
2.156 0.688197  
2.157 0.687774  
2.158 0.687359  
2.159 0.686977  
2.16 0.686565  
2.161 0.686113  
2.162 0.685646  
2.163 0.685145  
2.164 0.684674  
2.165 0.684292  
2.166 0.683898  
2.167 0.683444  
2.168 0.682983  
2.169 0.682549  
2.17 0.68212  
2.171 0.681706  
2.172 0.681283  
2.173 0.680757  
2.174 0.680227  
2.175 0.679763  
2.176 0.679307  
2.177 0.678867  
2.178 0.67842  
2.179 0.677926  
2.18 0.67743  
2.181 0.676975  
2.182 0.676531  
2.183 0.67603  
2.184 0.67552  
2.185 0.675053  
2.186 0.674592  
2.187 0.674108  
2.188 0.673608  
2.189 0.673145  
2.19 0.672705  
2.191 0.67225

2.192 0.671795  
2.193 0.671374  
2.194 0.670968  
2.195 0.670611  
2.196 0.67031  
2.197 0.669921  
2.198 0.669415  
2.199 0.668975  
2.2 0.668667  
2.201 0.66835  
2.202 0.667972  
2.203 0.667601  
2.204 0.667265  
2.205 0.666919  
2.206 0.666566  
2.207 0.666229  
2.208 0.665915  
2.209 0.665573  
2.21 0.665211  
2.211 0.66487  
2.212 0.664587  
2.213 0.664298  
2.214 0.66398  
2.215 0.663671  
2.216 0.663476  
2.217 0.663287  
2.218 0.663103  
2.219 0.66291  
2.22 0.662612  
2.221 0.662309  
2.222 0.662096  
2.223 0.661896  
2.224 0.661831  
2.225 0.661775  
2.226 0.661689  
2.227 0.661603  
2.228 0.661608  
2.229 0.661628  
2.23 0.661581  
2.231 0.661513  
2.232 0.661579  
2.233 0.661691  
2.234 0.661863  
2.235 0.662071  
2.236 0.662344  
2.237 0.662637  
2.238 0.663004  
2.239 0.66342  
2.24 0.663967  
2.241 0.664578  
2.242 0.665358  
2.243 0.666232  
2.244 0.667108  
2.245 0.668002  
2.246 0.669019  
2.247 0.670148  
2.248 0.671342

2.249 0.672584  
2.25 0.673924  
2.251 0.675362  
2.252 0.676904  
2.253 0.678556  
2.254 0.680237  
2.255 0.681985  
2.256 0.683807  
2.257 0.685679  
2.258 0.687542  
2.259 0.689386  
2.26 0.691264  
2.261 0.693185  
2.262 0.69515  
2.263 0.697203  
2.264 0.699162  
2.265 0.700906  
2.266 0.702612  
2.267 0.704242  
2.268 0.705747  
2.269 0.70696  
2.27 0.70804  
2.271 0.708788  
2.272 0.709429  
2.273 0.709817  
2.274 0.710131  
2.275 0.710196  
2.276 0.710144  
2.277 0.709813  
2.278 0.709455  
2.279 0.709034  
2.28 0.708579  
2.281 0.707994  
2.282 0.707395  
2.283 0.706803  
2.284 0.706238  
2.285 0.70577  
2.286 0.705326  
2.287 0.705014  
2.288 0.704746  
2.289 0.704618  
2.29 0.70455  
2.291 0.704749  
2.292 0.704986  
2.293 0.705445  
2.294 0.705959  
2.295 0.706724  
2.296 0.707517  
2.297 0.70835  
2.298 0.709226  
2.299 0.710246  
2.3 0.711312  
2.301 0.712527  
2.302 0.713673  
2.303 0.714539  
2.304 0.71543  
2.305 0.716307

2.306 0.717157  
2.307 0.717881  
2.308 0.718533  
2.309 0.718784  
2.31 0.718995  
2.311 0.718978  
2.312 0.718949  
2.313 0.71892  
2.314 0.718878  
2.315 0.718757  
2.316 0.718652  
2.317 0.718653  
2.318 0.71867  
2.319 0.718727  
2.32 0.718814  
2.321 0.719019  
2.322 0.71926  
2.323 0.719654  
2.324 0.720036  
2.325 0.720342  
2.326 0.720673  
2.327 0.721102  
2.328 0.721566  
2.329 0.722149  
2.33 0.722738  
2.331 0.723312  
2.332 0.723897  
2.333 0.72451  
2.334 0.725126  
2.335 0.725738  
2.336 0.726257  
2.337 0.726516  
2.338 0.726805  
2.339 0.727169  
2.34 0.727535  
2.341 0.727899  
2.342 0.728197  
2.343 0.72835  
2.344 0.728442  
2.345 0.728423  
2.346 0.728319  
2.347 0.728056  
2.348 0.727701  
2.349 0.727206  
2.35 0.726657  
2.351 0.726033  
2.352 0.72535  
2.353 0.724594  
2.354 0.723896  
2.355 0.723273  
2.356 0.722684  
2.357 0.722123  
2.358 0.721642  
2.359 0.721256  
2.36 0.72083  
2.361 0.720359  
2.362 0.719986

2.363 0.719698  
2.364 0.719421  
2.365 0.719148  
2.366 0.718944  
2.367 0.71879  
2.368 0.71855  
2.369 0.718246  
2.37 0.717924  
2.371 0.717599  
2.372 0.717498  
2.373 0.717482  
2.374 0.717049  
2.375 0.716496  
2.376 0.716055  
2.377 0.715626  
2.378 0.715336  
2.379 0.715068  
2.38 0.714681  
2.381 0.71425  
2.382 0.713863  
2.383 0.713502  
2.384 0.713235  
2.385 0.712998  
2.386 0.712991  
2.387 0.712985  
2.388 0.712911  
2.389 0.712821  
2.39 0.712606  
2.391 0.712377  
2.392 0.712028  
2.393 0.711672  
2.394 0.711402  
2.395 0.711146  
2.396 0.711044  
2.397 0.710905  
2.398 0.710539  
2.399 0.710193  
2.4 0.709853  
2.401 0.709573  
2.402 0.709585  
2.403 0.709558  
2.404 0.70947  
2.405 0.709561  
2.406 0.709838  
2.407 0.709908  
2.408 0.70985  
2.409 0.709926  
2.41 0.709955  
2.411 0.710097  
2.412 0.710429  
2.413 0.710734  
2.414 0.710964  
2.415 0.711137  
2.416 0.711354  
2.417 0.711804  
2.418 0.712429  
2.419 0.712871

2.42 0.71312  
2.421 0.713486  
2.422 0.713797  
2.423 0.713995  
2.424 0.714405  
2.425 0.715357  
2.426 0.716476  
2.427 0.717357  
2.428 0.718113  
2.429 0.718963  
2.43 0.719876  
2.431 0.720777  
2.432 0.721723  
2.433 0.722896  
2.434 0.724176  
2.435 0.725694  
2.436 0.727014  
2.437 0.728045  
2.438 0.72937  
2.439 0.730938  
2.44 0.732405  
2.441 0.733994  
2.442 0.73547  
2.443 0.7365  
2.444 0.73772  
2.445 0.739299  
2.446 0.740717  
2.447 0.741902  
2.448 0.742785  
2.449 0.743855  
2.45 0.745424  
2.451 0.746929  
2.452 0.748488  
2.453 0.750117  
2.454 0.751572  
2.455 0.75288  
2.456 0.754236  
2.457 0.755625  
2.458 0.756987  
2.459 0.758704  
2.46 0.760478  
2.461 0.762075  
2.462 0.763472  
2.463 0.764675  
2.464 0.766297  
2.465 0.767936  
2.466 0.769329  
2.467 0.770848  
2.468 0.772008  
2.469 0.773064  
2.47 0.774402  
2.471 0.775667  
2.472 0.777123  
2.473 0.778583  
2.474 0.779816  
2.475 0.78095  
2.476 0.781917

2.477 0.782676  
2.478 0.783442  
2.479 0.784174  
2.48 0.784792  
2.481 0.785374  
2.482 0.785811  
2.483 0.786222  
2.484 0.786446  
2.485 0.78656  
2.486 0.786488  
2.487 0.786141  
2.488 0.78603  
2.489 0.786155  
2.49 0.786068  
2.491 0.785621  
2.492 0.7849  
2.493 0.7848  
2.494 0.785173  
2.495 0.785058  
2.496 0.78474  
2.497 0.784396  
2.498 0.783474  
2.499 0.782963  
2.5 0.783004



## Geometric Database File – “megacollect\_cal\_panels.gdb”

```
OBJECT
MegacollectCalPanels
1-0-0
PART
GreyCalPanel
1-1-0
FACE
GROUND_1
1-1-1
GreyCalPanel
10000
FACET
0.0
0.50
0.0
0.0
NULL
NULL
NULL
4
  3.81000e+00  7.62000e+00  1.000000e-01
  3.81000e+00  0000000e+00  1.000000e-01
 -3.81000e+00  0000000e+00  1.000000e-01
 -3.81000e+00  7.62000e+00  1.000000e-01
 0.00000000000000000000e+00 -0.00000000000000000000e+00
 1.00000000000000000000e+00
 0.000000e+00
 0.000000e+00
1-1-0
PART
BlackCalPanel
1-1-1
FACE
GROUND_1
1-1-2
BlackCalPanel
10001
FACET
0.0
0.50
0.0
0.0
NULL
NULL
NULL
4
  3.81000e+00  0000000e+00  1.000000e-01
  3.81000e+00 -7.62000e+00  1.000000e-01
 -3.81000e+00 -7.62000e+00  1.000000e-01
 -3.81000e+00  0000000e+00  1.000000e-01
 0.00000000000000000000e+00 -0.00000000000000000000e+00
 1.00000000000000000000e+00
 0.000000e+00
```

```

0.000000e+00
5.000000e-01
END

```

## Object Database Files

“Megacollect\_Cal\_Panels.odb”

```

DIRSIG_ODB = 1.0
OBJECT {
    GDB_FILENAME = /dirs/home/FOUO/DIRSIG_COMPASS/gdb/megacollect_cal_panels.gdb
    UNITS = METERS
    INSTANCES {
        INFO = 1821.64, 2811.31, 100.00, 1, 1, 1, 0, 0, 300
    }
}

```

“tile\_4.odb”

```

DIRSIG_ODB = 1.0

INCLUDE_FILE = /dirs/home/dirsig/megascene1/odb/tile_4/Redneck_Rd.odb
INCLUDE_FILE = /dirs/home/dirsig/megascene1/odb/tile_4/Bottom_Left_Trees.odb
INCLUDE_FILE = /dirs/home/dirsig/megascene1/odb/tile_4/Bottom_Right_Trees.odb
INCLUDE_FILE = /dirs/home/dirsig/megascene1/odb/tile_4/First_Rd.odb
INCLUDE_FILE = /dirs/home/dirsig/megascene1/odb/tile_4/Second_Rd.odb
INCLUDE_FILE = /dirs/home/dirsig/megascene1/odb/tile_4/Water.odb
INCLUDE_FILE = /dirs/home/dirsig/megascene1/odb/tile_4/Waterplant_Lowerhalf.odb
INCLUDE_FILE = /dirs/home/dirsig/megascene1/odb/tile_4/Waterplant_Upperhalf.odb
INCLUDE_FILE = /dirs/home/FOUO/DIRSIG_COMPASS/odb/Megacollect_Cal_Panels.odb

```

## Scene File – “megacollect\_cal\_panels.scene”

```

<classicscene name="Megascene 1, Tile 4">
  <scenebasedirectory>/dirs/home/dirsig/megascene1</scenebasedirectory>

  <sceneorigin>
    <geodeticlocation>
      <latitude>43.12</latitude>
      <longitude>-78.45</longitude>
      <altitude>300</altitude>
    </geodeticlocation>
  </sceneorigin>

  <odbdirectory>$SCENE_DIR/odb</odbdirectory>
  <gdbdirectory>$SCENE_DIR/gdb</gdbdirectory>

  <geometrylist enabled="true">
    <geometrylistinclude name="Redneck_Rd"
enabled="true">tile_4/Redneck_Rd.odb</geometrylistinclude>

```

```

    <geometrylistinclude name="Bottom_Left_Trees"
enabled="true">tile_4/Bottom_Left_Trees.odb</geometrylistinclude>
    <geometrylistinclude name="Bottom_Right_Trees"
enabled="true">tile_4/Bottom_Right_Trees.odb</geometrylistinclude>
    <geometrylistinclude name="First_Rd"
enabled="true">tile_4/First_Rd.odb</geometrylistinclude>
    <geometrylistinclude name="Second_Rd"
enabled="true">tile_4/Second_Rd.odb</geometrylistinclude>
    <geometrylistinclude name="Water"
enabled="true">tile_4/Water.odb</geometrylistinclude>
    <geometrylistinclude name="Waterplant_Lowerhalf"
enabled="true">tile_4/Waterplant_Lowerhalf.odb</geometrylistinclude>
    <geometrylistinclude name="Waterplant_Upperhalf"
enabled="true">tile_4/Waterplant_Upperhalf.odb</geometrylistinclude>
    <geometrylistinclude name="Cal_Panels"
enabled="true">/dirs/home/FOUO/DIRSIG_COMPASS/odb/Megacollect_Cal_Panels.odb</geometry
listinclude>
  </geometrylist>

  <landmarks>
</landmarks>

<matfilename>/dirs/home/FOUO/DIRSIG_COMPASS/mat/megascene_megacollect.mat</matfilename
>
  <emsdirectory>$SCENE_DIR/emissivity</emsdirectory>
  <extdirectory>$SCENE_DIR/extinction</extdirectory>
  <absdirectory>$SCENE_DIR/absorption</absdirectory>

  <mapdirectory>$SCENE_DIR/maps</mapdirectory>
  <maplist>
    <materialmap name="Terrain Class Map" enabled="true">
      <matidlist>
        <matid>100</matid>
      </matidlist>
      <projector>
        <tileprojector>
          <insertpoint>
            <point><x>1290.6</x><y>3232.8</y><z>0</z></point>
          </insertpoint>
          <gsd>0.15</gsd>
          <rotation>0</rotation>
        </tileprojector>
      </projector>
      <dcmatlut>
        <entry>
          <dc>10</dc><matid>3039</matid>
        </entry>
        <entry>
          <dc>50</dc><matid>3039</matid>
        </entry>
        <entry>
          <dc>51</dc><matid>3008</matid>
        </entry>
        <entry>
          <dc>53</dc><matid>3039</matid>
        </entry>
      </dcmatlut>
    </materialmap>
  </maplist>

```

```

    <entry>
      <dc>102</dc><matid>8048</matid>
    </entry>
    <entry>
      <dc>153</dc><matid>8048</matid>
    </entry>
    <entry>
      <dc>170</dc><matid>5</matid>
    </entry>
    <entry>
      <dc>204</dc><matid>8000</matid>
    </entry>
    <entry>
      <dc>255</dc><matid>3039</matid>
    </entry>
  </dcmatlut>
  <image format="pgm">
    <filename>tile_4_material.pgm</filename>
  </image>
</materialmap>
<texturemap name="Texture Map" enabled="true">
  <matidlist>
    <matid>8048</matid>
    <matid>8000</matid>
    <matid>3008</matid>
    <matid>3039</matid>
    <matid>7130</matid>
    <matid>5</matid>
  </matidlist>
  <projector>
    <tileprojector>
      <insertpoint>
        <point><x>1290.6</x><y>3232.8</y><z>0</z></point>
      </insertpoint>
      <gsd>0.15</gsd>
      <rotation>0</rotation>
    </tileprojector>
  </projector>
  <bandlist>
    <band>
      <bandpass>
        <min>0.4</min>
        <max>0.7</max>
      </bandpass>
      <image format="pgm">
        <filename>tile_4_texture.pgm</filename>
      </image>
    </band>
  </bandlist>
</texturemap>
</maplist>
</classicscene>

```

## Weather File – “mls.wth”

193 0.250000

0.00	10.01	1000.00	0.99	10.00	5.00	0.00	0.00	1.00	0	0	0.00	0.00
0.25	10.01	1000.00	0.99	10.00	5.00	0.00	0.00	1.00	0	0	0.00	0.00
0.50	10.01	1000.00	0.99	10.00	5.00	0.00	0.00	1.00	0	0	0.00	0.00
0.75	10.01	1000.00	0.99	10.00	5.00	0.00	0.00	1.00	0	0	0.00	0.00
1.00	10.00	1000.00	0.99	10.00	5.00	0.00	0.00	1.00	0	0	0.00	0.00
1.25	10.00	1000.00	0.99	10.00	5.00	0.00	0.00	1.00	0	0	0.00	0.00
1.50	10.00	1000.00	0.99	10.00	5.00	0.00	0.00	1.00	0	0	0.00	0.00
1.75	10.00	1000.00	0.99	10.00	5.00	0.00	0.00	1.00	0	0	0.00	0.00
2.00	10.00	1000.00	0.99	10.00	5.00	0.00	0.00	1.00	0	0	0.00	0.00
2.25	10.00	1000.00	0.99	10.00	5.00	0.00	0.00	1.00	0	0	0.00	0.00
2.50	10.00	1000.00	0.99	10.00	5.00	0.00	0.00	1.00	0	0	0.00	0.00
2.75	10.00	1000.00	0.99	10.00	5.00	0.00	0.00	1.00	0	0	0.00	0.00
3.00	10.00	1000.00	0.99	10.00	5.00	0.00	0.00	1.00	0	0	0.00	0.00
3.25	10.00	1000.00	0.99	10.00	5.00	0.00	0.00	1.00	0	0	0.00	0.00
3.50	10.00	1000.00	0.99	10.00	5.00	0.00	0.00	1.00	0	0	0.00	0.00
3.75	10.00	1000.00	0.99	10.00	5.00	0.00	0.00	1.00	0	0	0.00	0.00
4.00	10.00	1000.00	0.99	10.00	5.00	0.00	0.00	1.00	0	0	0.00	0.00
4.25	10.00	1000.00	0.99	10.00	5.00	0.00	0.00	1.00	0	0	0.00	0.00
4.50	10.00	1000.00	0.99	10.00	5.00	0.00	0.00	1.00	0	0	0.00	0.00
4.75	10.00	1000.00	0.99	10.00	5.00	0.00	0.00	1.00	0	0	0.00	0.00
5.00	10.00	1000.00	0.99	10.00	5.00	42.09	0.14	1.00	0	0	0.00	0.00
5.25	10.02	1000.00	0.99	10.00	5.00	56.74	0.55	1.00	0	0	0.00	0.00
5.50	10.25	1000.00	0.97	10.00	5.00	63.23	1.03	1.00	0	0	0.00	0.00
5.75	10.67	1000.00	0.95	10.00	5.00	67.39	1.51	1.00	0	0	0.00	0.00
6.00	11.25	1000.00	0.91	10.00	5.00	70.47	1.98	1.00	0	0	0.00	0.00
6.25	11.93	1000.00	0.87	10.00	5.00	72.94	2.44	1.00	0	0	0.00	0.00
6.50	12.69	1000.00	0.83	10.00	5.00	75.01	2.87	1.00	0	0	0.00	0.00
6.75	13.51	1000.00	0.79	10.00	5.00	76.80	3.27	1.00	0	0	0.00	0.00
7.00	14.36	1000.00	0.74	10.00	5.00	78.39	3.63	1.00	0	0	0.00	0.00
7.25	15.24	1000.00	0.70	10.00	5.00	79.81	3.96	1.00	0	0	0.00	0.00
7.50	16.12	1000.00	0.66	10.00	5.00	81.10	4.26	1.00	0	0	0.00	0.00
7.75	17.01	1000.00	0.63	10.00	5.00	82.27	4.51	1.00	0	0	0.00	0.00
8.00	17.89	1000.00	0.59	10.00	5.00	83.36	4.73	1.00	0	0	0.00	0.00
8.25	18.76	1000.00	0.56	10.00	5.00	84.35	4.91	1.00	0	0	0.00	0.00
8.50	19.61	1000.00	0.53	10.00	5.00	85.27	5.06	1.00	0	0	0.00	0.00
8.75	20.43	1000.00	0.51	10.00	5.00	86.11	5.18	1.00	0	0	0.00	0.00
9.00	21.23	1000.00	0.48	10.00	5.00	86.89	5.27	1.00	0	0	0.00	0.00
9.25	21.99	1000.00	0.46	10.00	5.00	87.60	5.33	1.00	0	0	0.00	0.00
9.50	22.72	1000.00	0.44	10.00	5.00	88.24	5.37	1.00	0	0	0.00	0.00
9.75	23.41	1000.00	0.42	10.00	5.00	88.83	5.40	1.00	0	0	0.00	0.00
10.00	24.06	1000.00	0.41	10.00	5.00	89.36	5.40	1.00	0	0	0.00	0.00
10.25	24.67	1000.00	0.39	10.00	5.00	89.82	5.40	1.00	0	0	0.00	0.00
10.50	25.23	1000.00	0.38	10.00	5.00	90.23	5.39	1.00	0	0	0.00	0.00
10.75	25.75	1000.00	0.37	10.00	5.00	90.59	5.37	1.00	0	0	0.00	0.00
11.00	26.21	1000.00	0.36	10.00	5.00	90.88	5.35	1.00	0	0	0.00	0.00
11.25	26.62	1000.00	0.35	10.00	5.00	91.12	5.33	1.00	0	0	0.00	0.00
11.50	26.99	1000.00	0.34	10.00	5.00	91.30	5.32	1.00	0	0	0.00	0.00
11.75	27.29	1000.00	0.34	10.00	5.00	91.42	5.31	1.00	0	0	0.00	0.00
12.00	27.55	1000.00	0.33	10.00	5.00	91.49	5.30	1.00	0	0	0.00	0.00
12.25	27.74	1000.00	0.33	10.00	5.00	91.50	5.30	1.00	0	0	0.00	0.00
12.50	27.89	1000.00	0.32	10.00	5.00	91.45	5.30	1.00	0	0	0.00	0.00
12.75	27.97	1000.00	0.32	10.00	5.00	91.35	5.31	1.00	0	0	0.00	0.00
13.00	28.00	1000.00	0.32	10.00	5.00	91.19	5.33	1.00	0	0	0.00	0.00

13.25	27.97	1000.00	0.32	10.00	5.00	90.97	5.35	1.00	0	0	0.00	0.00
13.50	27.89	1000.00	0.32	10.00	5.00	90.69	5.37	1.00	0	0	0.00	0.00
13.75	27.74	1000.00	0.33	10.00	5.00	90.36	5.38	1.00	0	0	0.00	0.00
14.00	27.55	1000.00	0.33	10.00	5.00	89.97	5.40	1.00	0	0	0.00	0.00
14.25	27.29	1000.00	0.34	10.00	5.00	89.52	5.40	1.00	0	0	0.00	0.00
14.50	26.98	1000.00	0.34	10.00	5.00	89.02	5.40	1.00	0	0	0.00	0.00
14.75	26.62	1000.00	0.35	10.00	5.00	88.45	5.38	1.00	0	0	0.00	0.00
15.00	26.21	1000.00	0.36	10.00	5.00	87.82	5.35	1.00	0	0	0.00	0.00
15.25	25.74	1000.00	0.37	10.00	5.00	87.14	5.29	1.00	0	0	0.00	0.00
15.50	25.22	1000.00	0.38	10.00	5.00	86.38	5.21	1.00	0	0	0.00	0.00
15.75	24.66	1000.00	0.39	10.00	5.00	85.56	5.10	1.00	0	0	0.00	0.00
16.00	24.05	1000.00	0.41	10.00	5.00	84.67	4.97	1.00	0	0	0.00	0.00
16.25	23.39	1000.00	0.42	10.00	5.00	83.70	4.79	1.00	0	0	0.00	0.00
16.50	22.70	1000.00	0.44	10.00	5.00	82.65	4.59	1.00	0	0	0.00	0.00
16.75	21.96	1000.00	0.46	10.00	5.00	81.50	4.34	1.00	0	0	0.00	0.00
17.00	21.18	1000.00	0.48	10.00	5.00	80.25	4.06	1.00	0	0	0.00	0.00
17.25	20.37	1000.00	0.51	10.00	5.00	78.87	3.75	1.00	0	0	0.00	0.00
17.50	19.53	1000.00	0.54	10.00	5.00	77.34	3.39	1.00	0	0	0.00	0.00
17.75	18.65	1000.00	0.57	10.00	5.00	75.62	3.00	1.00	0	0	0.00	0.00
18.00	17.75	1000.00	0.60	10.00	5.00	73.65	2.58	1.00	0	0	0.00	0.00
18.25	16.83	1000.00	0.63	10.00	5.00	71.32	2.13	1.00	0	0	0.00	0.00
18.50	15.88	1000.00	0.67	10.00	5.00	68.47	1.66	1.00	0	0	0.00	0.00
18.75	14.91	1000.00	0.72	10.00	5.00	64.72	1.18	1.00	0	0	0.00	0.00
19.00	13.93	1000.00	0.76	10.00	5.00	59.19	0.70	1.00	0	0	0.00	0.00
19.25	12.98	1000.00	0.81	10.00	5.00	48.61	0.26	1.00	0	0	0.00	0.00
19.50	12.24	1000.00	0.85	10.00	5.00	0.00	0.00	1.00	0	0	0.00	0.00
19.75	11.69	1000.00	0.88	10.00	5.00	0.00	0.00	1.00	0	0	0.00	0.00
20.00	11.27	1000.00	0.91	10.00	5.00	0.00	0.00	1.00	0	0	0.00	0.00
20.25	10.96	1000.00	0.93	10.00	5.00	0.00	0.00	1.00	0	0	0.00	0.00
20.50	10.72	1000.00	0.94	10.00	5.00	0.00	0.00	1.00	0	0	0.00	0.00
20.75	10.54	1000.00	0.95	10.00	5.00	0.00	0.00	1.00	0	0	0.00	0.00
21.00	10.41	1000.00	0.96	10.00	5.00	0.00	0.00	1.00	0	0	0.00	0.00
21.25	10.31	1000.00	0.97	10.00	5.00	0.00	0.00	1.00	0	0	0.00	0.00
21.50	10.23	1000.00	0.97	10.00	5.00	0.00	0.00	1.00	0	0	0.00	0.00
21.75	10.17	1000.00	0.98	10.00	5.00	0.00	0.00	1.00	0	0	0.00	0.00
22.00	10.13	1000.00	0.98	10.00	5.00	0.00	0.00	1.00	0	0	0.00	0.00
22.25	10.10	1000.00	0.98	10.00	5.00	0.00	0.00	1.00	0	0	0.00	0.00
22.50	10.07	1000.00	0.98	10.00	5.00	0.00	0.00	1.00	0	0	0.00	0.00
22.75	10.06	1000.00	0.99	10.00	5.00	0.00	0.00	1.00	0	0	0.00	0.00
23.00	10.04	1000.00	0.99	10.00	5.00	0.00	0.00	1.00	0	0	0.00	0.00
23.25	10.03	1000.00	0.99	10.00	5.00	0.00	0.00	1.00	0	0	0.00	0.00
23.50	10.02	1000.00	0.99	10.00	5.00	0.00	0.00	1.00	0	0	0.00	0.00
23.75	10.02	1000.00	0.99	10.00	5.00	0.00	0.00	1.00	0	0	0.00	0.00
24.00	10.01	1000.00	0.99	10.00	5.00	0.00	0.00	1.00	0	0	0.00	0.00
24.25	10.01	1000.00	0.99	10.00	5.00	0.00	0.00	1.00	0	0	0.00	0.00
24.50	10.01	1000.00	0.99	10.00	5.00	0.00	0.00	1.00	0	0	0.00	0.00
24.75	10.01	1000.00	0.99	10.00	5.00	0.00	0.00	1.00	0	0	0.00	0.00
25.00	10.00	1000.00	0.99	10.00	5.00	0.00	0.00	1.00	0	0	0.00	0.00
25.25	10.00	1000.00	0.99	10.00	5.00	0.00	0.00	1.00	0	0	0.00	0.00
25.50	10.00	1000.00	0.99	10.00	5.00	0.00	0.00	1.00	0	0	0.00	0.00
25.75	10.00	1000.00	0.99	10.00	5.00	0.00	0.00	1.00	0	0	0.00	0.00
26.00	10.00	1000.00	0.99	10.00	5.00	0.00	0.00	1.00	0	0	0.00	0.00
26.25	10.00	1000.00	0.99	10.00	5.00	0.00	0.00	1.00	0	0	0.00	0.00
26.50	10.00	1000.00	0.99	10.00	5.00	0.00	0.00	1.00	0	0	0.00	0.00
26.75	10.00	1000.00	0.99	10.00	5.00	0.00	0.00	1.00	0	0	0.00	0.00
27.00	10.00	1000.00	0.99	10.00	5.00	0.00	0.00	1.00	0	0	0.00	0.00
27.25	10.00	1000.00	0.99	10.00	5.00	0.00	0.00	1.00	0	0	0.00	0.00

27.50	10.00	1000.00	0.99	10.00	5.00	0.00	0.00	1.00	0	0	0.00	0.00
27.75	10.00	1000.00	0.99	10.00	5.00	0.00	0.00	1.00	0	0	0.00	0.00
28.00	10.00	1000.00	0.99	10.00	5.00	0.00	0.00	1.00	0	0	0.00	0.00
28.25	10.00	1000.00	0.99	10.00	5.00	0.00	0.00	1.00	0	0	0.00	0.00
28.50	10.00	1000.00	0.99	10.00	5.00	0.00	0.00	1.00	0	0	0.00	0.00
28.75	10.00	1000.00	0.99	10.00	5.00	0.00	0.00	1.00	0	0	0.00	0.00
29.00	10.00	1000.00	0.99	10.00	5.00	42.09	0.14	1.00	0	0	0.00	0.00
29.25	10.02	1000.00	0.99	10.00	5.00	56.74	0.55	1.00	0	0	0.00	0.00
29.50	10.25	1000.00	0.97	10.00	5.00	63.23	1.03	1.00	0	0	0.00	0.00
29.75	10.67	1000.00	0.95	10.00	5.00	67.39	1.51	1.00	0	0	0.00	0.00
30.00	11.25	1000.00	0.91	10.00	5.00	70.47	1.98	1.00	0	0	0.00	0.00
30.25	11.93	1000.00	0.87	10.00	5.00	72.94	2.44	1.00	0	0	0.00	0.00
30.50	12.69	1000.00	0.83	10.00	5.00	75.01	2.87	1.00	0	0	0.00	0.00
30.75	13.51	1000.00	0.79	10.00	5.00	76.80	3.27	1.00	0	0	0.00	0.00
31.00	14.36	1000.00	0.74	10.00	5.00	78.39	3.63	1.00	0	0	0.00	0.00
31.25	15.24	1000.00	0.70	10.00	5.00	79.81	3.96	1.00	0	0	0.00	0.00
31.50	16.12	1000.00	0.66	10.00	5.00	81.10	4.26	1.00	0	0	0.00	0.00
31.75	17.01	1000.00	0.63	10.00	5.00	82.27	4.51	1.00	0	0	0.00	0.00
32.00	17.89	1000.00	0.59	10.00	5.00	83.36	4.73	1.00	0	0	0.00	0.00
32.25	18.76	1000.00	0.56	10.00	5.00	84.35	4.91	1.00	0	0	0.00	0.00
32.50	19.61	1000.00	0.53	10.00	5.00	85.27	5.06	1.00	0	0	0.00	0.00
32.75	20.43	1000.00	0.51	10.00	5.00	86.11	5.18	1.00	0	0	0.00	0.00
33.00	21.23	1000.00	0.48	10.00	5.00	86.89	5.27	1.00	0	0	0.00	0.00
33.25	21.99	1000.00	0.46	10.00	5.00	87.60	5.33	1.00	0	0	0.00	0.00
33.50	22.72	1000.00	0.44	10.00	5.00	88.24	5.37	1.00	0	0	0.00	0.00
33.75	23.41	1000.00	0.42	10.00	5.00	88.83	5.40	1.00	0	0	0.00	0.00
34.00	24.06	1000.00	0.41	10.00	5.00	89.36	5.40	1.00	0	0	0.00	0.00
34.25	24.67	1000.00	0.39	10.00	5.00	89.82	5.40	1.00	0	0	0.00	0.00
34.50	25.23	1000.00	0.38	10.00	5.00	90.23	5.39	1.00	0	0	0.00	0.00
34.75	25.75	1000.00	0.37	10.00	5.00	90.59	5.37	1.00	0	0	0.00	0.00
35.00	26.21	1000.00	0.36	10.00	5.00	90.88	5.35	1.00	0	0	0.00	0.00
35.25	26.62	1000.00	0.35	10.00	5.00	91.12	5.33	1.00	0	0	0.00	0.00
35.50	26.99	1000.00	0.34	10.00	5.00	91.30	5.32	1.00	0	0	0.00	0.00
35.75	27.29	1000.00	0.34	10.00	5.00	91.42	5.31	1.00	0	0	0.00	0.00
36.00	27.55	1000.00	0.33	10.00	5.00	91.49	5.30	1.00	0	0	0.00	0.00
36.25	27.74	1000.00	0.33	10.00	5.00	91.50	5.30	1.00	0	0	0.00	0.00
36.50	27.89	1000.00	0.32	10.00	5.00	91.45	5.30	1.00	0	0	0.00	0.00
36.75	27.97	1000.00	0.32	10.00	5.00	91.35	5.31	1.00	0	0	0.00	0.00
37.00	28.00	1000.00	0.32	10.00	5.00	91.19	5.33	1.00	0	0	0.00	0.00
37.25	27.97	1000.00	0.32	10.00	5.00	90.97	5.35	1.00	0	0	0.00	0.00
37.50	27.89	1000.00	0.32	10.00	5.00	90.69	5.37	1.00	0	0	0.00	0.00
37.75	27.74	1000.00	0.33	10.00	5.00	90.36	5.38	1.00	0	0	0.00	0.00
38.00	27.55	1000.00	0.33	10.00	5.00	89.97	5.40	1.00	0	0	0.00	0.00
38.25	27.29	1000.00	0.34	10.00	5.00	89.52	5.40	1.00	0	0	0.00	0.00
38.50	26.98	1000.00	0.34	10.00	5.00	89.02	5.40	1.00	0	0	0.00	0.00
38.75	26.62	1000.00	0.35	10.00	5.00	88.45	5.38	1.00	0	0	0.00	0.00
39.00	26.21	1000.00	0.36	10.00	5.00	87.82	5.35	1.00	0	0	0.00	0.00
39.25	25.74	1000.00	0.37	10.00	5.00	87.14	5.29	1.00	0	0	0.00	0.00
39.50	25.22	1000.00	0.38	10.00	5.00	86.38	5.21	1.00	0	0	0.00	0.00
39.75	24.66	1000.00	0.39	10.00	5.00	85.56	5.10	1.00	0	0	0.00	0.00
40.00	24.05	1000.00	0.41	10.00	5.00	84.67	4.97	1.00	0	0	0.00	0.00
40.25	23.39	1000.00	0.42	10.00	5.00	83.70	4.79	1.00	0	0	0.00	0.00
40.50	22.70	1000.00	0.44	10.00	5.00	82.65	4.59	1.00	0	0	0.00	0.00
40.75	21.96	1000.00	0.46	10.00	5.00	81.50	4.34	1.00	0	0	0.00	0.00
41.00	21.18	1000.00	0.48	10.00	5.00	80.25	4.06	1.00	0	0	0.00	0.00
41.25	20.37	1000.00	0.51	10.00	5.00	78.87	3.75	1.00	0	0	0.00	0.00
41.50	19.53	1000.00	0.54	10.00	5.00	77.34	3.39	1.00	0	0	0.00	0.00

41.75	18.65	1000.00	0.57	10.00	5.00	75.62	3.00	1.00	0	0	0.00	0.00
42.00	17.75	1000.00	0.60	10.00	5.00	73.65	2.58	1.00	0	0	0.00	0.00
42.25	16.83	1000.00	0.63	10.00	5.00	71.32	2.13	1.00	0	0	0.00	0.00
42.50	15.88	1000.00	0.67	10.00	5.00	68.47	1.66	1.00	0	0	0.00	0.00
42.75	14.91	1000.00	0.72	10.00	5.00	64.72	1.18	1.00	0	0	0.00	0.00
43.00	13.93	1000.00	0.76	10.00	5.00	59.19	0.70	1.00	0	0	0.00	0.00
43.25	12.98	1000.00	0.81	10.00	5.00	48.61	0.26	1.00	0	0	0.00	0.00
43.50	12.24	1000.00	0.85	10.00	5.00	0.00	0.00	1.00	0	0	0.00	0.00
43.75	11.69	1000.00	0.88	10.00	5.00	0.00	0.00	1.00	0	0	0.00	0.00
44.00	11.27	1000.00	0.91	10.00	5.00	0.00	0.00	1.00	0	0	0.00	0.00
44.25	10.96	1000.00	0.93	10.00	5.00	0.00	0.00	1.00	0	0	0.00	0.00
44.50	10.72	1000.00	0.94	10.00	5.00	0.00	0.00	1.00	0	0	0.00	0.00
44.75	10.54	1000.00	0.95	10.00	5.00	0.00	0.00	1.00	0	0	0.00	0.00
45.00	10.41	1000.00	0.96	10.00	5.00	0.00	0.00	1.00	0	0	0.00	0.00
45.25	10.31	1000.00	0.97	10.00	5.00	0.00	0.00	1.00	0	0	0.00	0.00
45.50	10.23	1000.00	0.97	10.00	5.00	0.00	0.00	1.00	0	0	0.00	0.00
45.75	10.17	1000.00	0.98	10.00	5.00	0.00	0.00	1.00	0	0	0.00	0.00
46.00	10.13	1000.00	0.98	10.00	5.00	0.00	0.00	1.00	0	0	0.00	0.00
46.25	10.10	1000.00	0.98	10.00	5.00	0.00	0.00	1.00	0	0	0.00	0.00
46.50	10.07	1000.00	0.98	10.00	5.00	0.00	0.00	1.00	0	0	0.00	0.00
46.75	10.06	1000.00	0.99	10.00	5.00	0.00	0.00	1.00	0	0	0.00	0.00
47.00	10.04	1000.00	0.99	10.00	5.00	0.00	0.00	1.00	0	0	0.00	0.00
47.25	10.03	1000.00	0.99	10.00	5.00	0.00	0.00	1.00	0	0	0.00	0.00
47.50	10.02	1000.00	0.99	10.00	5.00	0.00	0.00	1.00	0	0	0.00	0.00
47.75	10.02	1000.00	0.99	10.00	5.00	0.00	0.00	1.00	0	0	0.00	0.00
48.00	10.01	1000.00	0.99	10.00	5.00	0.00	0.00	1.00	0	0	0.00	0.00

## Tape5 Files

“mls.tp5”

M	2	2	2	0	0	0	0	0	0	1	1	1	0.000	0.00
	0	0	0	1	0	0	0.000	0.000	0.000	0.000	0.000		0.218	
	20.218		0.218	180.000		0.000	0.000	0.000	0.000	0				
	1	2	236	0										
	43.000		77.000	0.000	0.000	12.000	0.000	0.000	0.000					
	450		35050	100	2									
	0													

“mls\_11km\_vis.tp5”

M	2	2	2	0	0	0	0	0	0	1	1	1	0.000	0.00
F	0F	0	0.00000					F	F	F	0.000			
	0	0	0	1	0	0	11.000	0.000	0.000	0.000	0.000		0.218	
	20.218		0.218	180.000		0.000	0.000	0.000	0.000	0			0.000	
	1	2	236	0										
	43.000		77.000	0.000	0.000	12.000	0.000	0.000	0.000					
	450.000		35050.000	100.000	2.000									
	0													



## Atmosphere File – “mls\_11km\_vis.atm”

“mls\_11km\_vis.atm”

```
<atmosphericconditions>
  <metadata/>
  <uniformweather>
    <classicdata>
      <filename>$DIRSIG_HOME/lib/data/weather/mls.wth</filename>
    </classicdata>
  </uniformweather>
  <turbulence model="kolmogorov" enabled="0" >
    <cn2 model="hv57" >
      <windspeed>10</windspeed>
      <ground>1.7e-14</ground>
    </cn2>
  </turbulence>
  <classicradiativetransfer>
    <modtrantape5file externalfile="/dirs/home/FOUO/DIRSIG_COMPASS/tp5/mls_11km_vis.tp5" />
    <adbfile>/dirs/home/FOUO/DIRSIG_COMPASS/adb/compass_megacollect_mls_11km_vis.adb</adbfile>
    <removesensorpath>false</removesensorpath>
  </classicradiativetransfer>
</atmosphericconditions>
```

## Response File – “COMPASS\_7\_8\_nm.rsp”

```
DIRSIG_RSP
#
# NAME:      COMPASS
# PURPOSE:   Channel response functions for the COMPASS imaging
#            spectrometer
#
BAND {
    NAME = COMPASS Spectrometer
    MINIMUM_WAVELENGTH = 0.4
    MAXIMUM_WAVELENGTH = 2.389
    DELTA_WAVELENGTH = 0.0078
}

TYPE = SPECTROMETER
SHAPE = GAUSSIAN

RESPONSE {
0.4000      0.0078
0.4078      0.0078
0.4156      0.0078
0.4234      0.0078
0.4312      0.0078
0.4390      0.0078
0.4468      0.0078
0.4546      0.0078
0.4624      0.0078
0.4702      0.0078
0.4780      0.0078
0.4858      0.0078
0.4936      0.0078
0.5014      0.0078
0.5092      0.0078
0.5170      0.0078
0.5248      0.0078
0.5326      0.0078
0.5404      0.0078
0.5482      0.0078
0.5560      0.0078
0.5638      0.0078
0.5716      0.0078
0.5794      0.0078
0.5872      0.0078
0.5950      0.0078
0.6028      0.0078
0.6106      0.0078
0.6184      0.0078
0.6262      0.0078
0.6340      0.0078
0.6418      0.0078
0.6496      0.0078
0.6574      0.0078
0.6652      0.0078
0.6730      0.0078
0.6808      0.0078
```

0.6886	0.0078
0.6964	0.0078
0.7042	0.0078
0.7120	0.0078
0.7198	0.0078
0.7276	0.0078
0.7354	0.0078
0.7432	0.0078
0.7510	0.0078
0.7588	0.0078
0.7666	0.0078
0.7744	0.0078
0.7822	0.0078
0.7900	0.0078
0.7978	0.0078
0.8056	0.0078
0.8134	0.0078
0.8212	0.0078
0.8290	0.0078
0.8368	0.0078
0.8446	0.0078
0.8524	0.0078
0.8602	0.0078
0.8680	0.0078
0.8758	0.0078
0.8836	0.0078
0.8914	0.0078
0.8992	0.0078
0.9070	0.0078
0.9148	0.0078
0.9226	0.0078
0.9304	0.0078
0.9382	0.0078
0.9460	0.0078
0.9538	0.0078
0.9616	0.0078
0.9694	0.0078
0.9772	0.0078
0.9850	0.0078
0.9928	0.0078
1.0006	0.0078
1.0084	0.0078
1.0162	0.0078
1.0240	0.0078
1.0318	0.0078
1.0396	0.0078
1.0474	0.0078
1.0552	0.0078
1.0630	0.0078
1.0708	0.0078
1.0786	0.0078
1.0864	0.0078
1.0942	0.0078
1.1020	0.0078
1.1098	0.0078
1.1176	0.0078
1.1254	0.0078

1.1332	0.0078
1.1410	0.0078
1.1488	0.0078
1.1566	0.0078
1.1644	0.0078
1.1722	0.0078
1.1800	0.0078
1.1878	0.0078
1.1956	0.0078
1.2034	0.0078
1.2112	0.0078
1.2190	0.0078
1.2268	0.0078
1.2346	0.0078
1.2424	0.0078
1.2502	0.0078
1.2580	0.0078
1.2658	0.0078
1.2736	0.0078
1.2814	0.0078
1.2892	0.0078
1.2970	0.0078
1.3048	0.0078
1.3126	0.0078
1.3204	0.0078
1.3282	0.0078
1.3360	0.0078
1.3438	0.0078
1.3516	0.0078
1.3594	0.0078
1.3672	0.0078
1.3750	0.0078
1.3828	0.0078
1.3906	0.0078
1.3984	0.0078
1.4062	0.0078
1.4140	0.0078
1.4218	0.0078
1.4296	0.0078
1.4374	0.0078
1.4452	0.0078
1.4530	0.0078
1.4608	0.0078
1.4686	0.0078
1.4764	0.0078
1.4842	0.0078
1.4920	0.0078
1.4998	0.0078
1.5076	0.0078
1.5154	0.0078
1.5232	0.0078
1.5310	0.0078
1.5388	0.0078
1.5466	0.0078
1.5544	0.0078
1.5622	0.0078
1.5700	0.0078

1.5778	0.0078
1.5856	0.0078
1.5934	0.0078
1.6012	0.0078
1.6090	0.0078
1.6168	0.0078
1.6246	0.0078
1.6324	0.0078
1.6402	0.0078
1.6480	0.0078
1.6558	0.0078
1.6636	0.0078
1.6714	0.0078
1.6792	0.0078
1.6870	0.0078
1.6948	0.0078
1.7026	0.0078
1.7104	0.0078
1.7182	0.0078
1.7260	0.0078
1.7338	0.0078
1.7416	0.0078
1.7494	0.0078
1.7572	0.0078
1.7650	0.0078
1.7728	0.0078
1.7806	0.0078
1.7884	0.0078
1.7962	0.0078
1.8040	0.0078
1.8118	0.0078
1.8196	0.0078
1.8274	0.0078
1.8352	0.0078
1.8430	0.0078
1.8508	0.0078
1.8586	0.0078
1.8664	0.0078
1.8742	0.0078
1.8820	0.0078
1.8898	0.0078
1.8976	0.0078
1.9054	0.0078
1.9132	0.0078
1.9210	0.0078
1.9288	0.0078
1.9366	0.0078
1.9444	0.0078
1.9522	0.0078
1.9600	0.0078
1.9678	0.0078
1.9756	0.0078
1.9834	0.0078
1.9912	0.0078
1.9990	0.0078
2.0068	0.0078
2.0146	0.0078

2.0224	0.0078
2.0302	0.0078
2.0380	0.0078
2.0458	0.0078
2.0536	0.0078
2.0614	0.0078
2.0692	0.0078
2.0770	0.0078
2.0848	0.0078
2.0926	0.0078
2.1004	0.0078
2.1082	0.0078
2.1160	0.0078
2.1238	0.0078
2.1316	0.0078
2.1394	0.0078
2.1472	0.0078
2.1550	0.0078
2.1628	0.0078
2.1706	0.0078
2.1784	0.0078
2.1862	0.0078
2.1940	0.0078
2.2018	0.0078
2.2096	0.0078
2.2174	0.0078
2.2252	0.0078
2.2330	0.0078
2.2408	0.0078
2.2486	0.0078
2.2564	0.0078
2.2642	0.0078
2.2720	0.0078
2.2798	0.0078
2.2876	0.0078
2.2954	0.0078
2.3032	0.0078
2.3110	0.0078
2.3188	0.0078
2.3266	0.0078
2.3344	0.0078
2.3422	0.0078
2.3500	0.0078
2.3578	0.0078
2.3656	0.0078
2.3734	0.0078
2.3812	0.0078
2.3890	0.0078

}

## Platform File – “compass\_megacollect\_mls\_11km\_vis.platform”

```
<platform>
  <metadata>
    <entry>
      <name>Author(s)</name>
      <value><![CDATA[Cindy Dobbs / Dave Pogorzala]]></value>
    </entry>
    <entry>
      <name>Description</name>
      <value><![CDATA[COMPASS - Take 1]]></value>
    </entry>
    <entry>
      <name>Name</name>
      <value><![CDATA[COMPASS-ish]]></value>
    </entry>
  </metadata>
</clocktable/>
<attachment>
  <affinetransform/>
  <mount type="whisk" name="New Mount" >
    <data angularunits="radians" temporalunits="hertz" >
      <clockrate>0.390625</clockrate>
      <scanrange>
        <start>-0.1309</start>
        <stop>0.1309</stop>
      </scanrange>
    </data>
  </attachment>
  <affinetransform/>
  <instrument type="generic" name="New Instrument" >
    <properties>
      <focallength>100.1</focallength>
    </properties>
    <focalplane name="New Focal Plane" >
      <capturemethod type="simple" >
        <imagefile>
          <basename>compass_megacollect_mls_11km_vis</basename>
          <extension>img</extension>
          <schedule>simulation</schedule>
        </imagefile>
        <spectralresponse>
          <bandpass spectralunits="microns" >
            <minimum>0.4</minimum>
            <maximum>2.389</maximum>
            <delta>0.0078</delta>
          </bandpass>
          <channellist>
            <channel spectralunits="microns" shape="gaussian" name="Channel #1" >
              <center>0.4000</center>
              <width>0.0078</width>
            </channel>
            <channel spectralunits="microns" shape="gaussian" name="Channel #2" >
              <center>0.4078</center>
              <width>0.0078</width>
            </channel>
            <channel spectralunits="microns" shape="gaussian" name="Channel #3" >
```

```

        <center>0.4156</center>
        <width>0.0078</width>
    </channel>
    <channel spectralunits="microns" shape="gaussian" name="Channel #4" >
        <center>0.4234</center>
        <width>0.0078</width>
    </channel>
    <channel spectralunits="microns" shape="gaussian" name="Channel #5" >
        <center>0.4312</center>
        <width>0.0078</width>
    </channel>
    <channel spectralunits="microns" shape="gaussian" name="Channel #6" >
        <center>0.4390</center>
        <width>0.0078</width>
    </channel>
    <channel spectralunits="microns" shape="gaussian" name="Channel #7" >
        <center>0.4468</center>
        <width>0.0078</width>
    </channel>
    <channel spectralunits="microns" shape="gaussian" name="Channel #8" >
        <center>0.4546</center>
        <width>0.0078</width>
    </channel>
    <channel spectralunits="microns" shape="gaussian" name="Channel #9" >
        <center>0.4624</center>
        <width>0.0078</width>
    </channel>
    <channel spectralunits="microns" shape="gaussian" name="Channel #10" >
        <center>0.4702</center>
        <width>0.0078</width>
    </channel>
    <channel spectralunits="microns" shape="gaussian" name="Channel #11" >
        <center>0.4780</center>
        <width>0.0078</width>
    </channel>
    <channel spectralunits="microns" shape="gaussian" name="Channel #12" >
        <center>0.4858</center>
        <width>0.0078</width>
    </channel>
    <channel spectralunits="microns" shape="gaussian" name="Channel #13" >
        <center>0.4936</center>
        <width>0.0078</width>
    </channel>
    <channel spectralunits="microns" shape="gaussian" name="Channel #14" >
        <center>0.5014</center>
        <width>0.0078</width>
    </channel>
    <channel spectralunits="microns" shape="gaussian" name="Channel #15" >
        <center>0.5092</center>
        <width>0.0078</width>
    </channel>
    <channel spectralunits="microns" shape="gaussian" name="Channel #16" >
        <center>0.5170</center>
        <width>0.0078</width>
    </channel>
    <channel spectralunits="microns" shape="gaussian" name="Channel #17" >
        <center>0.5248</center>

```



```

    <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #18" >
    <center>0.5326</center>
    <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #19" >
    <center>0.5404</center>
    <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #20" >
    <center>0.5482</center>
    <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #21" >
    <center>0.5560</center>
    <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #22" >
    <center>0.5638</center>
    <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #23" >
    <center>0.5716</center>
    <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #24" >
    <center>0.5794</center>
    <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #25" >
    <center>0.5872</center>
    <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #26" >
    <center>0.5950</center>
    <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #27" >
    <center>0.6028</center>
    <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #28" >
    <center>0.6106</center>
    <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #29" >
    <center>0.6184</center>
    <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #30" >
    <center>0.6262</center>
    <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #31" >
    <center>0.6340</center>
    <width>0.0078</width>

```

```

</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #32" >
  <center>0.6418</center>
  <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #33" >
  <center>0.6496</center>
  <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #34" >
  <center>0.6574</center>
  <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #35" >
  <center>0.6652</center>
  <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #36" >
  <center>0.6730</center>
  <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #37" >
  <center>0.6808</center>
  <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #38" >
  <center>0.6886</center>
  <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #39" >
  <center>0.6964</center>
  <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #40" >
  <center>0.7042</center>
  <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #41" >
  <center>0.7120</center>
  <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #42" >
  <center>0.7198</center>
  <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #43" >
  <center>0.7276</center>
  <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #44" >
  <center>0.7354</center>
  <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #45" >
  <center>0.7432</center>
  <width>0.0078</width>
</channel>

```

```

<channel spectralunits="microns" shape="gaussian" name="Channel #46" >
  <center>0.7510</center>
  <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #47" >
  <center>0.7588</center>
  <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #48" >
  <center>0.7666</center>
  <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #49" >
  <center>0.7744</center>
  <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #50" >
  <center>0.7822</center>
  <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #51" >
  <center>0.7900</center>
  <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #52" >
  <center>0.7978</center>
  <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #53" >
  <center>0.8056</center>
  <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #54" >
  <center>0.8134</center>
  <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #55" >
  <center>0.8212</center>
  <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #56" >
  <center>0.8290</center>
  <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #57" >
  <center>0.8368</center>
  <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #58" >
  <center>0.8446</center>
  <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #59" >
  <center>0.8524</center>
  <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #60" >

```

```

        <center>0.8602</center>
        <width>0.0078</width>
    </channel>
    <channel spectralunits="microns" shape="gaussian" name="Channel #61" >
        <center>0.8680</center>
        <width>0.0078</width>
    </channel>
    <channel spectralunits="microns" shape="gaussian" name="Channel #62" >
        <center>0.8758</center>
        <width>0.0078</width>
    </channel>
    <channel spectralunits="microns" shape="gaussian" name="Channel #63" >
        <center>0.8836</center>
        <width>0.0078</width>
    </channel>
    <channel spectralunits="microns" shape="gaussian" name="Channel #64" >
        <center>0.8914</center>
        <width>0.0078</width>
    </channel>
    <channel spectralunits="microns" shape="gaussian" name="Channel #65" >
        <center>0.8992</center>
        <width>0.0078</width>
    </channel>
    <channel spectralunits="microns" shape="gaussian" name="Channel #66" >
        <center>0.9070</center>
        <width>0.0078</width>
    </channel>
    <channel spectralunits="microns" shape="gaussian" name="Channel #67" >
        <center>0.9148</center>
        <width>0.0078</width>
    </channel>
    <channel spectralunits="microns" shape="gaussian" name="Channel #68" >
        <center>0.9226</center>
        <width>0.0078</width>
    </channel>
    <channel spectralunits="microns" shape="gaussian" name="Channel #69" >
        <center>0.9304</center>
        <width>0.0078</width>
    </channel>
    <channel spectralunits="microns" shape="gaussian" name="Channel #70" >
        <center>0.9382</center>
        <width>0.0078</width>
    </channel>
    <channel spectralunits="microns" shape="gaussian" name="Channel #71" >
        <center>0.9460</center>
        <width>0.0078</width>
    </channel>
    <channel spectralunits="microns" shape="gaussian" name="Channel #72" >
        <center>0.9538</center>
        <width>0.0078</width>
    </channel>
    <channel spectralunits="microns" shape="gaussian" name="Channel #73" >
        <center>0.9616</center>
        <width>0.0078</width>
    </channel>
    <channel spectralunits="microns" shape="gaussian" name="Channel #74" >
        <center>0.9694</center>

```

```

    <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #75" >
    <center>0.9772</center>
    <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #76" >
    <center>0.9850</center>
    <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #77" >
    <center>0.9928</center>
    <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #78" >
    <center>1.0006</center>
    <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #79" >
    <center>1.0084</center>
    <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #80" >
    <center>1.0162</center>
    <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #81" >
    <center>1.0240</center>
    <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #82" >
    <center>1.0318</center>
    <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #83" >
    <center>1.0396</center>
    <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #84" >
    <center>1.0474</center>
    <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #85" >
    <center>1.0552</center>
    <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #86" >
    <center>1.0630</center>
    <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #87" >
    <center>1.0708</center>
    <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #88" >
    <center>1.0786</center>
    <width>0.0078</width>

```

```

</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #89" >
  <center>1.0864</center>
  <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #90" >
  <center>1.0942</center>
  <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #91" >
  <center>1.1020</center>
  <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #92" >
  <center>1.1098</center>
  <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #93" >
  <center>1.1176</center>
  <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #94" >
  <center>1.1254</center>
  <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #95" >
  <center>1.1332</center>
  <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #96" >
  <center>1.1410</center>
  <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #97" >
  <center>1.1488</center>
  <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #98" >
  <center>1.1566</center>
  <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #99" >
  <center>1.1644</center>
  <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #100" >
  <center>1.1722</center>
  <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #101" >
  <center>1.1800</center>
  <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #102" >
  <center>1.1878</center>
  <width>0.0078</width>
</channel>

```

```

<channel spectralunits="microns" shape="gaussian" name="Channel #103" >
  <center>1.1956</center>
  <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #104" >
  <center>1.2034</center>
  <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #105" >
  <center>1.2112</center>
  <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #106" >
  <center>1.2190</center>
  <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #107" >
  <center>1.2268</center>
  <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #108" >
  <center>1.2346</center>
  <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #109" >
  <center>1.2424</center>
  <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #110" >
  <center>1.2502</center>
  <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #111" >
  <center>1.2580</center>
  <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #112" >
  <center>1.2658</center>
  <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #113" >
  <center>1.2736</center>
  <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #114" >
  <center>1.2814</center>
  <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #115" >
  <center>1.2892</center>
  <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #116" >
  <center>1.2970</center>
  <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #117" >

```

```

        <center>1.3048</center>
        <width>0.0078</width>
    </channel>
    <channel spectralunits="microns" shape="gaussian" name="Channel #118" >
        <center>1.3126</center>
        <width>0.0078</width>
    </channel>
    <channel spectralunits="microns" shape="gaussian" name="Channel #119" >
        <center>1.3204</center>
        <width>0.0078</width>
    </channel>
    <channel spectralunits="microns" shape="gaussian" name="Channel #120" >
        <center>1.3282</center>
        <width>0.0078</width>
    </channel>
    <channel spectralunits="microns" shape="gaussian" name="Channel #121" >
        <center>1.3360</center>
        <width>0.0078</width>
    </channel>
    <channel spectralunits="microns" shape="gaussian" name="Channel #122" >
        <center>1.3438</center>
        <width>0.0078</width>
    </channel>
    <channel spectralunits="microns" shape="gaussian" name="Channel #123" >
        <center>1.3516</center>
        <width>0.0078</width>
    </channel>
    <channel spectralunits="microns" shape="gaussian" name="Channel #124" >
        <center>1.3594</center>
        <width>0.0078</width>
    </channel>
    <channel spectralunits="microns" shape="gaussian" name="Channel #125" >
        <center>1.3672</center>
        <width>0.0078</width>
    </channel>
    <channel spectralunits="microns" shape="gaussian" name="Channel #126" >
        <center>1.3750</center>
        <width>0.0078</width>
    </channel>
    <channel spectralunits="microns" shape="gaussian" name="Channel #127" >
        <center>1.3828</center>
        <width>0.0078</width>
    </channel>
    <channel spectralunits="microns" shape="gaussian" name="Channel #128" >
        <center>1.3906</center>
        <width>0.0078</width>
    </channel>
    <channel spectralunits="microns" shape="gaussian" name="Channel #129" >
        <center>1.3984</center>
        <width>0.0078</width>
    </channel>
    <channel spectralunits="microns" shape="gaussian" name="Channel #130" >
        <center>1.4062</center>
        <width>0.0078</width>
    </channel>
    <channel spectralunits="microns" shape="gaussian" name="Channel #131" >
        <center>1.4140</center>

```



```

    <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #132" >
    <center>1.4218</center>
    <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #133" >
    <center>1.4296</center>
    <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #134" >
    <center>1.4374</center>
    <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #135" >
    <center>1.4452</center>
    <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #136" >
    <center>1.4530</center>
    <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #137" >
    <center>1.4608</center>
    <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #138" >
    <center>1.4686</center>
    <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #139" >
    <center>1.4764</center>
    <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #140" >
    <center>1.4842</center>
    <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #141" >
    <center>1.4920</center>
    <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #142" >
    <center>1.4998</center>
    <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #143" >
    <center>1.5076</center>
    <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #144" >
    <center>1.5154</center>
    <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #145" >
    <center>1.5232</center>
    <width>0.0078</width>

```

```

</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #146" >
  <center>1.5310</center>
  <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #147" >
  <center>1.5388</center>
  <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #148" >
  <center>1.5466</center>
  <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #149" >
  <center>1.5544</center>
  <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #150" >
  <center>1.5622</center>
  <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #151" >
  <center>1.5700</center>
  <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #152" >
  <center>1.5778</center>
  <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #153" >
  <center>1.5856</center>
  <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #154" >
  <center>1.5934</center>
  <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #155" >
  <center>1.6012</center>
  <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #156" >
  <center>1.6090</center>
  <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #157" >
  <center>1.6168</center>
  <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #158" >
  <center>1.6246</center>
  <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #159" >
  <center>1.6324</center>
  <width>0.0078</width>
</channel>

```

```

<channel spectralunits="microns" shape="gaussian" name="Channel #160" >
  <center>1.6402</center>
  <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #161" >
  <center>1.6480</center>
  <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #162" >
  <center>1.6558</center>
  <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #163" >
  <center>1.6636</center>
  <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #164" >
  <center>1.6714</center>
  <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #165" >
  <center>1.6792</center>
  <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #166" >
  <center>1.6870</center>
  <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #167" >
  <center>1.6948</center>
  <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #168" >
  <center>1.7026</center>
  <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #169" >
  <center>1.7104</center>
  <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #170" >
  <center>1.7182</center>
  <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #171" >
  <center>1.7260</center>
  <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #172" >
  <center>1.7338</center>
  <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #173" >
  <center>1.7416</center>
  <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #174" >

```

```

        <center>1.7494</center>
        <width>0.0078</width>
    </channel>
    <channel spectralunits="microns" shape="gaussian" name="Channel #175" >
        <center>1.7572</center>
        <width>0.0078</width>
    </channel>
    <channel spectralunits="microns" shape="gaussian" name="Channel #176" >
        <center>1.7650</center>
        <width>0.0078</width>
    </channel>
    <channel spectralunits="microns" shape="gaussian" name="Channel #177" >
        <center>1.7728</center>
        <width>0.0078</width>
    </channel>
    <channel spectralunits="microns" shape="gaussian" name="Channel #178" >
        <center>1.7806</center>
        <width>0.0078</width>
    </channel>
    <channel spectralunits="microns" shape="gaussian" name="Channel #179" >
        <center>1.7884</center>
        <width>0.0078</width>
    </channel>
    <channel spectralunits="microns" shape="gaussian" name="Channel #180" >
        <center>1.7962</center>
        <width>0.0078</width>
    </channel>
    <channel spectralunits="microns" shape="gaussian" name="Channel #181" >
        <center>1.8040</center>
        <width>0.0078</width>
    </channel>
    <channel spectralunits="microns" shape="gaussian" name="Channel #182" >
        <center>1.8118</center>
        <width>0.0078</width>
    </channel>
    <channel spectralunits="microns" shape="gaussian" name="Channel #183" >
        <center>1.8196</center>
        <width>0.0078</width>
    </channel>
    <channel spectralunits="microns" shape="gaussian" name="Channel #184" >
        <center>1.8274</center>
        <width>0.0078</width>
    </channel>
    <channel spectralunits="microns" shape="gaussian" name="Channel #185" >
        <center>1.8352</center>
        <width>0.0078</width>
    </channel>
    <channel spectralunits="microns" shape="gaussian" name="Channel #186" >
        <center>1.8430</center>
        <width>0.0078</width>
    </channel>
    <channel spectralunits="microns" shape="gaussian" name="Channel #187" >
        <center>1.8508</center>
        <width>0.0078</width>
    </channel>
    <channel spectralunits="microns" shape="gaussian" name="Channel #188" >
        <center>1.8586</center>

```

```

    <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #189" >
    <center>1.8664</center>
    <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #190" >
    <center>1.8742</center>
    <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #191" >
    <center>1.8820</center>
    <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #192" >
    <center>1.8898</center>
    <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #193" >
    <center>1.8976</center>
    <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #194" >
    <center>1.9054</center>
    <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #195" >
    <center>1.9132</center>
    <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #196" >
    <center>1.9210</center>
    <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #197" >
    <center>1.9288</center>
    <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #198" >
    <center>1.9366</center>
    <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #199" >
    <center>1.9444</center>
    <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #200" >
    <center>1.9522</center>
    <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #201" >
    <center>1.9600</center>
    <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #202" >
    <center>1.9678</center>
    <width>0.0078</width>

```

```

</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #203" >
  <center>1.9756</center>
  <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #204" >
  <center>1.9834</center>
  <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #205" >
  <center>1.9912</center>
  <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #206" >
  <center>1.9990</center>
  <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #207" >
  <center>2.0068</center>
  <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #208" >
  <center>2.0146</center>
  <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #209" >
  <center>2.0224</center>
  <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #210" >
  <center>2.0302</center>
  <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #211" >
  <center>2.0380</center>
  <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #212" >
  <center>2.0458</center>
  <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #213" >
  <center>2.0536</center>
  <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #214" >
  <center>2.0614</center>
  <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #215" >
  <center>2.0692</center>
  <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #216" >
  <center>2.0770</center>
  <width>0.0078</width>
</channel>

```

```

<channel spectralunits="microns" shape="gaussian" name="Channel #217" >
  <center>2.0848</center>
  <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #218" >
  <center>2.0926</center>
  <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #219" >
  <center>2.1004</center>
  <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #220" >
  <center>2.1082</center>
  <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #221" >
  <center>2.1160</center>
  <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #222" >
  <center>2.1238</center>
  <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #223" >
  <center>2.1316</center>
  <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #224" >
  <center>2.1394</center>
  <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #225" >
  <center>2.1472</center>
  <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #226" >
  <center>2.1550</center>
  <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #227" >
  <center>2.1628</center>
  <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #228" >
  <center>2.1706</center>
  <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #229" >
  <center>2.1784</center>
  <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #230" >
  <center>2.1862</center>
  <width>0.0078</width>
</channel>
<channel spectralunits="microns" shape="gaussian" name="Channel #231" >

```

```

        <center>2.1940</center>
        <width>0.0078</width>
    </channel>
    <channel spectralunits="microns" shape="gaussian" name="Channel #232" >
        <center>2.2018</center>
        <width>0.0078</width>
    </channel>
    <channel spectralunits="microns" shape="gaussian" name="Channel #233" >
        <center>2.2096</center>
        <width>0.0078</width>
    </channel>
    <channel spectralunits="microns" shape="gaussian" name="Channel #234" >
        <center>2.2174</center>
        <width>0.0078</width>
    </channel>
    <channel spectralunits="microns" shape="gaussian" name="Channel #235" >
        <center>2.2252</center>
        <width>0.0078</width>
    </channel>
    <channel spectralunits="microns" shape="gaussian" name="Channel #236" >
        <center>2.2330</center>
        <width>0.0078</width>
    </channel>
    <channel spectralunits="microns" shape="gaussian" name="Channel #237" >
        <center>2.2408</center>
        <width>0.0078</width>
    </channel>
    <channel spectralunits="microns" shape="gaussian" name="Channel #238" >
        <center>2.2486</center>
        <width>0.0078</width>
    </channel>
    <channel spectralunits="microns" shape="gaussian" name="Channel #239" >
        <center>2.2564</center>
        <width>0.0078</width>
    </channel>
    <channel spectralunits="microns" shape="gaussian" name="Channel #240" >
        <center>2.2642</center>
        <width>0.0078</width>
    </channel>
    <channel spectralunits="microns" shape="gaussian" name="Channel #241" >
        <center>2.2720</center>
        <width>0.0078</width>
    </channel>
    <channel spectralunits="microns" shape="gaussian" name="Channel #242" >
        <center>2.2798</center>
        <width>0.0078</width>
    </channel>
    <channel spectralunits="microns" shape="gaussian" name="Channel #243" >
        <center>2.2876</center>
        <width>0.0078</width>
    </channel>
    <channel spectralunits="microns" shape="gaussian" name="Channel #244" >
        <center>2.2954</center>
        <width>0.0078</width>
    </channel>
    <channel spectralunits="microns" shape="gaussian" name="Channel #245" >
        <center>2.3032</center>

```



```

        <width>0.0078</width>
    </channel>
    <channel spectralunits="microns" shape="gaussian" name="Channel #246" >
        <center>2.3110</center>
        <width>0.0078</width>
    </channel>
    <channel spectralunits="microns" shape="gaussian" name="Channel #247" >
        <center>2.3188</center>
        <width>0.0078</width>
    </channel>
    <channel spectralunits="microns" shape="gaussian" name="Channel #248" >
        <center>2.3266</center>
        <width>0.0078</width>
    </channel>
    <channel spectralunits="microns" shape="gaussian" name="Channel #249" >
        <center>2.3344</center>
        <width>0.0078</width>
    </channel>
    <channel spectralunits="microns" shape="gaussian" name="Channel #250" >
        <center>2.3422</center>
        <width>0.0078</width>
    </channel>
    <channel spectralunits="microns" shape="gaussian" name="Channel #251" >
        <center>2.3500</center>
        <width>0.0078</width>
    </channel>
    <channel spectralunits="microns" shape="gaussian" name="Channel #252" >
        <center>2.3578</center>
        <width>0.0078</width>
    </channel>
    <channel spectralunits="microns" shape="gaussian" name="Channel #253" >
        <center>2.3656</center>
        <width>0.0078</width>
    </channel>
    <channel spectralunits="microns" shape="gaussian" name="Channel #254" >
        <center>2.3734</center>
        <width>0.0078</width>
    </channel>
    <channel spectralunits="microns" shape="gaussian" name="Channel #255" >
        <center>2.3812</center>
        <width>0.0078</width>
    </channel>
    <channel spectralunits="microns" shape="gaussian" name="Channel #256" >
        <center>2.3890</center>
        <width>0.0078</width>
    </channel>
</channellist>
</spectralresponse>
    <spatialresponse yfillfactor="1" xfillfactor="1" ysamples="1"
spectralunits="microns" spatialsampling="deltasamples" xsamples="1" />
</capturemethod>
<detectorarray spatialunits="microns" >
    <clockrate>200</clockrate>
    <xelementcount>1</xelementcount>
    <yelementcount>256</yelementcount>
    <xelementsize>40.000000</xelementsize>
    <yelementsize>40.000000</yelementsize>

```

```

        <xelementsacing>40.000000</xelementsacing>
        <yelementsacing>40.000000</yelementsacing>
        <xarrayoffset>0.000000</xarrayoffset>
        <yarrayoffset>0.000000</yarrayoffset>
        <xflipaxis>0</xflipaxis>
        <yflipaxis>1</yflipaxis>
    </detectorarray>
    <truthcollection>
        <enabled>true</enabled>
        <imagebasename>compass_megacollect_mls_11km_vis-truth.img</imagebasename>
        <collectorlist>
            <collector>
                <name>Material</name>
            </collector>
            <collector>
                <name>Intersection</name>
            </collector>
        </collectorlist>
    </truthcollection>
</focalplane>
</instrument>
</attachment>
</mount>
</attachment>
</platform>

```

## Platform Motion File – “compass\_megacollect.ppd”

```
<platformmotion type="generic">
  <method type="raw" />

  <data rotationframe="sceneenu" rotationorder="xyz" angletype="absolute"
angularunits="radians" spatialunits="meters">

    <entry>
      <datetime type="relative">0</datetime>
      <position>
        <scenelocation>
          <point><x>1135.65</x><y>338.401</y><z>3155.3</z></point>
        </scenelocation>
      </position>

      <orientation>
        <eulerangles>
          <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
        </eulerangles>
      </orientation>
    </entry>

    <entry>
      <datetime type="relative">0.5</datetime>
      <position>
        <scenelocation>
          <point><x>1145.71</x><y>372.367</y><z>3155.3</z></point>
        </scenelocation>
      </position>

      <orientation>
        <eulerangles>
          <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
        </eulerangles>
      </orientation>
    </entry>

    <entry>
      <datetime type="relative">1</datetime>
      <position>
        <scenelocation>
          <point><x>1155.77</x><y>406.333</y><z>3155.3</z></point>
        </scenelocation>
      </position>

      <orientation>
        <eulerangles>
          <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
        </eulerangles>
      </orientation>
    </entry>

    <entry>
      <datetime type="relative">1.5</datetime>
      <position>
```

```

    <scenelocation>
      <point><x>1165.84</x><y>440.299</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>
    <eulerangles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerangles>
  </orientation>
</entry>

<entry>
  <datetime type="relative">2</datetime>
  <position>
    <scenelocation>
      <point><x>1175.9</x><y>474.265</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>
    <eulerangles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerangles>
  </orientation>
</entry>

<entry>
  <datetime type="relative">2.5</datetime>
  <position>
    <scenelocation>
      <point><x>1185.96</x><y>508.232</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>
    <eulerangles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerangles>
  </orientation>
</entry>

<entry>
  <datetime type="relative">3</datetime>
  <position>
    <scenelocation>
      <point><x>1196.02</x><y>542.198</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>
    <eulerangles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerangles>
  </orientation>
</entry>

```

```

<entry>
  <datetime type="relative">3.5</datetime>
  <position>
    <scenelocation>
      <point><x>1206.08</x><y>576.164</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>
    <eulerangles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerangles>
  </orientation>
</entry>

<entry>
  <datetime type="relative">4</datetime>
  <position>
    <scenelocation>
      <point><x>1216.14</x><y>610.13</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>
    <eulerangles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerangles>
  </orientation>
</entry>

<entry>
  <datetime type="relative">4.5</datetime>
  <position>
    <scenelocation>
      <point><x>1226.2</x><y>644.096</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>
    <eulerangles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerangles>
  </orientation>
</entry>

<entry>
  <datetime type="relative">5</datetime>
  <position>
    <scenelocation>
      <point><x>1236.26</x><y>678.062</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>
    <eulerangles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerangles>
  </orientation>
</entry>

```

```

    </orientation>
</entry>

<entry>
  <datetime type="relative">5.5</datetime>
  <position>
    <scenelocation>
      <point><x>1246.33</x><y>712.029</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>
    <eulerangles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerangles>
  </orientation>
</entry>

<entry>
  <datetime type="relative">6</datetime>
  <position>
    <scenelocation>
      <point><x>1256.39</x><y>745.995</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>
    <eulerangles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerangles>
  </orientation>
</entry>

<entry>
  <datetime type="relative">6.5</datetime>
  <position>
    <scenelocation>
      <point><x>1266.45</x><y>779.961</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>
    <eulerangles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerangles>
  </orientation>
</entry>

<entry>
  <datetime type="relative">7</datetime>
  <position>
    <scenelocation>
      <point><x>1276.51</x><y>813.927</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>

```

```

    <eulerangles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerangles>
  </orientation>
</entry>

<entry>
  <datetime type="relative">7.5</datetime>
  <position>
    <scenelocation>
      <point><x>1286.57</x><y>847.893</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>
    <eulerangles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerangles>
  </orientation>
</entry>

<entry>
  <datetime type="relative">8</datetime>
  <position>
    <scenelocation>
      <point><x>1296.63</x><y>881.86</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>
    <eulerangles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerangles>
  </orientation>
</entry>

<entry>
  <datetime type="relative">8.5</datetime>
  <position>
    <scenelocation>
      <point><x>1306.69</x><y>915.826</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>
    <eulerangles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerangles>
  </orientation>
</entry>

<entry>
  <datetime type="relative">9</datetime>
  <position>
    <scenelocation>
      <point><x>1316.75</x><y>949.792</y><z>3155.3</z></point>
    </scenelocation>

```

```

</position>

<orientation>
  <eulerAngles>
    <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
  </eulerAngles>
</orientation>
</entry>

<entry>
  <datetime type="relative">9.5</datetime>
  <position>
    <scenelocation>
      <point><x>1326.82</x><y>983.758</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>
    <eulerAngles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerAngles>
  </orientation>
</entry>

<entry>
  <datetime type="relative">10</datetime>
  <position>
    <scenelocation>
      <point><x>1336.88</x><y>1017.72</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>
    <eulerAngles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerAngles>
  </orientation>
</entry>

<entry>
  <datetime type="relative">10.5</datetime>
  <position>
    <scenelocation>
      <point><x>1346.94</x><y>1051.69</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>
    <eulerAngles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerAngles>
  </orientation>
</entry>

<entry>
  <datetime type="relative">11</datetime>
  <position>

```



```

    <scenelocation>
      <point><x>1357</x><y>1085.66</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>
    <eulerangles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerangles>
  </orientation>
</entry>

<entry>
  <datetime type="relative">11.5</datetime>
  <position>
    <scenelocation>
      <point><x>1367.06</x><y>1119.62</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>
    <eulerangles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerangles>
  </orientation>
</entry>

<entry>
  <datetime type="relative">12</datetime>
  <position>
    <scenelocation>
      <point><x>1377.12</x><y>1153.59</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>
    <eulerangles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerangles>
  </orientation>
</entry>

<entry>
  <datetime type="relative">12.5</datetime>
  <position>
    <scenelocation>
      <point><x>1387.18</x><y>1187.56</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>
    <eulerangles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerangles>
  </orientation>
</entry>

```

```

<entry>
  <datetime type="relative">13</datetime>
  <position>
    <scenelocation>
      <point><x>1397.24</x><y>1221.52</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>
    <eulerangles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerangles>
  </orientation>
</entry>

<entry>
  <datetime type="relative">13.5</datetime>
  <position>
    <scenelocation>
      <point><x>1407.31</x><y>1255.49</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>
    <eulerangles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerangles>
  </orientation>
</entry>

<entry>
  <datetime type="relative">14</datetime>
  <position>
    <scenelocation>
      <point><x>1417.37</x><y>1289.45</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>
    <eulerangles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerangles>
  </orientation>
</entry>

<entry>
  <datetime type="relative">14.5</datetime>
  <position>
    <scenelocation>
      <point><x>1427.43</x><y>1323.42</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>
    <eulerangles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerangles>
  </orientation>
</entry>

```

```

    </orientation>
</entry>

<entry>
  <datetime type="relative">15</datetime>
  <position>
    <scenelocation>
      <point><x>1437.49</x><y>1357.39</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>
    <eulerangles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerangles>
  </orientation>
</entry>

<entry>
  <datetime type="relative">15.5</datetime>
  <position>
    <scenelocation>
      <point><x>1447.55</x><y>1391.35</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>
    <eulerangles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerangles>
  </orientation>
</entry>

<entry>
  <datetime type="relative">16</datetime>
  <position>
    <scenelocation>
      <point><x>1457.61</x><y>1425.32</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>
    <eulerangles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerangles>
  </orientation>
</entry>

<entry>
  <datetime type="relative">16.5</datetime>
  <position>
    <scenelocation>
      <point><x>1467.67</x><y>1459.29</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>

```

```

        <eulerangles>
          <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
        </eulerangles>
      </orientation>
    </entry>

  <entry>
    <datetime type="relative">17</datetime>
    <position>
      <scenelocation>
        <point><x>1477.73</x><y>1493.25</y><z>3155.3</z></point>
      </scenelocation>
    </position>

    <orientation>
      <eulerangles>
        <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
      </eulerangles>
    </orientation>
  </entry>

  <entry>
    <datetime type="relative">17.5</datetime>
    <position>
      <scenelocation>
        <point><x>1487.8</x><y>1527.22</y><z>3155.3</z></point>
      </scenelocation>
    </position>

    <orientation>
      <eulerangles>
        <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
      </eulerangles>
    </orientation>
  </entry>

  <entry>
    <datetime type="relative">18</datetime>
    <position>
      <scenelocation>
        <point><x>1497.86</x><y>1561.18</y><z>3155.3</z></point>
      </scenelocation>
    </position>

    <orientation>
      <eulerangles>
        <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
      </eulerangles>
    </orientation>
  </entry>

  <entry>
    <datetime type="relative">18.5</datetime>
    <position>
      <scenelocation>
        <point><x>1507.92</x><y>1595.15</y><z>3155.3</z></point>
      </scenelocation>

```

```

</position>

<orientation>
  <eulerAngles>
    <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
  </eulerAngles>
</orientation>
</entry>

<entry>
  <datetime type="relative">19</datetime>
  <position>
    <scenelocation>
      <point><x>1517.98</x><y>1629.12</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>
    <eulerAngles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerAngles>
  </orientation>
</entry>

<entry>
  <datetime type="relative">19.5</datetime>
  <position>
    <scenelocation>
      <point><x>1528.04</x><y>1663.08</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>
    <eulerAngles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerAngles>
  </orientation>
</entry>

<entry>
  <datetime type="relative">20</datetime>
  <position>
    <scenelocation>
      <point><x>1538.1</x><y>1697.05</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>
    <eulerAngles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerAngles>
  </orientation>
</entry>

<entry>
  <datetime type="relative">20.5</datetime>
  <position>

```

```

    <scenelocation>
      <point><x>1548.16</x><y>1731.01</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>
    <eulerangles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerangles>
  </orientation>
</entry>

<entry>
  <datetime type="relative">21</datetime>
  <position>
    <scenelocation>
      <point><x>1558.22</x><y>1764.98</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>
    <eulerangles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerangles>
  </orientation>
</entry>

<entry>
  <datetime type="relative">21.5</datetime>
  <position>
    <scenelocation>
      <point><x>1568.29</x><y>1798.95</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>
    <eulerangles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerangles>
  </orientation>
</entry>

<entry>
  <datetime type="relative">22</datetime>
  <position>
    <scenelocation>
      <point><x>1578.35</x><y>1832.91</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>
    <eulerangles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerangles>
  </orientation>
</entry>

```

```

<entry>
  <datetime type="relative">22.5</datetime>
  <position>
    <scenelocation>
      <point><x>1588.41</x><y>1866.88</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>
    <eulerangles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerangles>
  </orientation>
</entry>

<entry>
  <datetime type="relative">23</datetime>
  <position>
    <scenelocation>
      <point><x>1598.47</x><y>1900.85</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>
    <eulerangles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerangles>
  </orientation>
</entry>

<entry>
  <datetime type="relative">23.5</datetime>
  <position>
    <scenelocation>
      <point><x>1608.53</x><y>1934.81</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>
    <eulerangles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerangles>
  </orientation>
</entry>

<entry>
  <datetime type="relative">24</datetime>
  <position>
    <scenelocation>
      <point><x>1618.59</x><y>1968.78</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>
    <eulerangles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerangles>
  </orientation>
</entry>

```

```

    </orientation>
</entry>

<entry>
  <datetime type="relative">24.5</datetime>
  <position>
    <scenelocation>
      <point><x>1628.65</x><y>2002.74</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>
    <eulerangles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerangles>
  </orientation>
</entry>

<entry>
  <datetime type="relative">25</datetime>
  <position>
    <scenelocation>
      <point><x>1638.71</x><y>2036.71</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>
    <eulerangles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerangles>
  </orientation>
</entry>

<entry>
  <datetime type="relative">25.5</datetime>
  <position>
    <scenelocation>
      <point><x>1648.78</x><y>2070.68</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>
    <eulerangles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerangles>
  </orientation>
</entry>

<entry>
  <datetime type="relative">26</datetime>
  <position>
    <scenelocation>
      <point><x>1658.84</x><y>2104.64</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>

```



```

    <eulerangles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerangles>
  </orientation>
</entry>

<entry>
  <datetime type="relative">26.5</datetime>
  <position>
    <scenelocation>
      <point><x>1668.9</x><y>2138.61</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>
    <eulerangles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerangles>
  </orientation>
</entry>

<entry>
  <datetime type="relative">27</datetime>
  <position>
    <scenelocation>
      <point><x>1678.96</x><y>2172.57</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>
    <eulerangles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerangles>
  </orientation>
</entry>

<entry>
  <datetime type="relative">27.5</datetime>
  <position>
    <scenelocation>
      <point><x>1689.02</x><y>2206.54</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>
    <eulerangles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerangles>
  </orientation>
</entry>

<entry>
  <datetime type="relative">28</datetime>
  <position>
    <scenelocation>
      <point><x>1699.08</x><y>2240.51</y><z>3155.3</z></point>
    </scenelocation>

```

```

</position>

<orientation>
  <eulerAngles>
    <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
  </eulerAngles>
</orientation>
</entry>

<entry>
  <datetime type="relative">28.5</datetime>
  <position>
    <scenelocation>
      <point><x>1709.14</x><y>2274.47</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>
    <eulerAngles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerAngles>
  </orientation>
</entry>

<entry>
  <datetime type="relative">29</datetime>
  <position>
    <scenelocation>
      <point><x>1719.2</x><y>2308.44</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>
    <eulerAngles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerAngles>
  </orientation>
</entry>

<entry>
  <datetime type="relative">29.5</datetime>
  <position>
    <scenelocation>
      <point><x>1729.27</x><y>2342.41</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>
    <eulerAngles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerAngles>
  </orientation>
</entry>

<entry>
  <datetime type="relative">30</datetime>
  <position>

```

```

    <scenelocation>
      <point><x>1739.33</x><y>2376.37</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>
    <eulerangles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerangles>
  </orientation>
</entry>

<entry>
  <datetime type="relative">30.5</datetime>
  <position>
    <scenelocation>
      <point><x>1749.39</x><y>2410.34</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>
    <eulerangles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerangles>
  </orientation>
</entry>

<entry>
  <datetime type="relative">31</datetime>
  <position>
    <scenelocation>
      <point><x>1759.45</x><y>2444.3</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>
    <eulerangles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerangles>
  </orientation>
</entry>

<entry>
  <datetime type="relative">31.5</datetime>
  <position>
    <scenelocation>
      <point><x>1769.51</x><y>2478.27</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>
    <eulerangles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerangles>
  </orientation>
</entry>

```

```

<entry>
  <datetime type="relative">32</datetime>
  <position>
    <scenelocation>
      <point><x>1779.57</x><y>2512.24</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>
    <eulerangles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerangles>
  </orientation>
</entry>

<entry>
  <datetime type="relative">32.5</datetime>
  <position>
    <scenelocation>
      <point><x>1789.63</x><y>2546.2</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>
    <eulerangles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerangles>
  </orientation>
</entry>

<entry>
  <datetime type="relative">33</datetime>
  <position>
    <scenelocation>
      <point><x>1799.69</x><y>2580.17</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>
    <eulerangles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerangles>
  </orientation>
</entry>

<entry>
  <datetime type="relative">33.5</datetime>
  <position>
    <scenelocation>
      <point><x>1809.76</x><y>2614.14</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>
    <eulerangles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerangles>
  </orientation>
</entry>

```

```

    </orientation>
</entry>

<entry>
  <datetime type="relative">34</datetime>
  <position>
    <scenelocation>
      <point><x>1819.82</x><y>2648.1</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>
    <eulerangles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerangles>
  </orientation>
</entry>

<entry>
  <datetime type="relative">34.5</datetime>
  <position>
    <scenelocation>
      <point><x>1829.88</x><y>2682.07</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>
    <eulerangles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerangles>
  </orientation>
</entry>

<entry>
  <datetime type="relative">35</datetime>
  <position>
    <scenelocation>
      <point><x>1839.94</x><y>2716.03</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>
    <eulerangles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerangles>
  </orientation>
</entry>

<entry>
  <datetime type="relative">35.5</datetime>
  <position>
    <scenelocation>
      <point><x>1850</x><y>2750</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>

```

```

    <eulerAngles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerAngles>
  </orientation>
</entry>

<entry>
  <datetime type="relative">36</datetime>
  <position>
    <scenelocation>
      <point><x>1860.06</x><y>2783.97</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>
    <eulerAngles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerAngles>
  </orientation>
</entry>

<entry>
  <datetime type="relative">36.5</datetime>
  <position>
    <scenelocation>
      <point><x>1870.12</x><y>2817.93</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>
    <eulerAngles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerAngles>
  </orientation>
</entry>

<entry>
  <datetime type="relative">37</datetime>
  <position>
    <scenelocation>
      <point><x>1880.18</x><y>2851.9</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>
    <eulerAngles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerAngles>
  </orientation>
</entry>

<entry>
  <datetime type="relative">37.5</datetime>
  <position>
    <scenelocation>
      <point><x>1890.24</x><y>2885.86</y><z>3155.3</z></point>
    </scenelocation>

```

```

</position>

<orientation>
  <eulerAngles>
    <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
  </eulerAngles>
</orientation>
</entry>

<entry>
  <datetime type="relative">38</datetime>
  <position>
    <scenelocation>
      <point><x>1900.31</x><y>2919.83</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>
    <eulerAngles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerAngles>
  </orientation>
</entry>

<entry>
  <datetime type="relative">38.5</datetime>
  <position>
    <scenelocation>
      <point><x>1910.37</x><y>2953.8</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>
    <eulerAngles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerAngles>
  </orientation>
</entry>

<entry>
  <datetime type="relative">39</datetime>
  <position>
    <scenelocation>
      <point><x>1920.43</x><y>2987.76</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>
    <eulerAngles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerAngles>
  </orientation>
</entry>

<entry>
  <datetime type="relative">39.5</datetime>
  <position>

```

```

    <scenelocation>
      <point><x>1930.49</x><y>3021.73</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>
    <eulerangles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerangles>
  </orientation>
</entry>

<entry>
  <datetime type="relative">40</datetime>
  <position>
    <scenelocation>
      <point><x>1940.55</x><y>3055.7</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>
    <eulerangles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerangles>
  </orientation>
</entry>

<entry>
  <datetime type="relative">40.5</datetime>
  <position>
    <scenelocation>
      <point><x>1950.61</x><y>3089.66</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>
    <eulerangles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerangles>
  </orientation>
</entry>

<entry>
  <datetime type="relative">41</datetime>
  <position>
    <scenelocation>
      <point><x>1960.67</x><y>3123.63</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>
    <eulerangles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerangles>
  </orientation>
</entry>

```



```

<entry>
  <datetime type="relative">41.5</datetime>
  <position>
    <scenelocation>
      <point><x>1970.73</x><y>3157.59</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>
    <eulerangles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerangles>
  </orientation>
</entry>

<entry>
  <datetime type="relative">42</datetime>
  <position>
    <scenelocation>
      <point><x>1980.8</x><y>3191.56</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>
    <eulerangles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerangles>
  </orientation>
</entry>

<entry>
  <datetime type="relative">42.5</datetime>
  <position>
    <scenelocation>
      <point><x>1990.86</x><y>3225.53</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>
    <eulerangles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerangles>
  </orientation>
</entry>

<entry>
  <datetime type="relative">43</datetime>
  <position>
    <scenelocation>
      <point><x>2000.92</x><y>3259.49</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>
    <eulerangles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerangles>
  </orientation>
</entry>

```

```

    </orientation>
</entry>

<entry>
  <datetime type="relative">43.5</datetime>
  <position>
    <scenelocation>
      <point><x>2010.98</x><y>3293.46</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>
    <eulerangles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerangles>
  </orientation>
</entry>

<entry>
  <datetime type="relative">44</datetime>
  <position>
    <scenelocation>
      <point><x>2021.04</x><y>3327.43</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>
    <eulerangles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerangles>
  </orientation>
</entry>

<entry>
  <datetime type="relative">44.5</datetime>
  <position>
    <scenelocation>
      <point><x>2031.1</x><y>3361.39</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>
    <eulerangles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerangles>
  </orientation>
</entry>

<entry>
  <datetime type="relative">45</datetime>
  <position>
    <scenelocation>
      <point><x>2041.16</x><y>3395.36</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>

```

```

        <eulerangles>
          <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
        </eulerangles>
      </orientation>
    </entry>

  <entry>
    <datetime type="relative">45.5</datetime>
    <position>
      <scenelocation>
        <point><x>2051.22</x><y>3429.32</y><z>3155.3</z></point>
      </scenelocation>
    </position>

    <orientation>
      <eulerangles>
        <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
      </eulerangles>
    </orientation>
  </entry>

  <entry>
    <datetime type="relative">46</datetime>
    <position>
      <scenelocation>
        <point><x>2061.29</x><y>3463.29</y><z>3155.3</z></point>
      </scenelocation>
    </position>

    <orientation>
      <eulerangles>
        <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
      </eulerangles>
    </orientation>
  </entry>

  <entry>
    <datetime type="relative">46.5</datetime>
    <position>
      <scenelocation>
        <point><x>2071.35</x><y>3497.26</y><z>3155.3</z></point>
      </scenelocation>
    </position>

    <orientation>
      <eulerangles>
        <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
      </eulerangles>
    </orientation>
  </entry>

  <entry>
    <datetime type="relative">47</datetime>
    <position>
      <scenelocation>
        <point><x>2081.41</x><y>3531.22</y><z>3155.3</z></point>
      </scenelocation>

```

```

</position>

<orientation>
  <eulerAngles>
    <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
  </eulerAngles>
</orientation>
</entry>

<entry>
  <datetime type="relative">47.5</datetime>
  <position>
    <scenelocation>
      <point><x>2091.47</x><y>3565.19</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>
    <eulerAngles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerAngles>
  </orientation>
</entry>

<entry>
  <datetime type="relative">48</datetime>
  <position>
    <scenelocation>
      <point><x>2101.53</x><y>3599.16</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>
    <eulerAngles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerAngles>
  </orientation>
</entry>

<entry>
  <datetime type="relative">48.5</datetime>
  <position>
    <scenelocation>
      <point><x>2111.59</x><y>3633.12</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>
    <eulerAngles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerAngles>
  </orientation>
</entry>

<entry>
  <datetime type="relative">49</datetime>
  <position>

```

```

    <scenelocation>
      <point><x>2121.65</x><y>3667.09</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>
    <eulerangles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerangles>
  </orientation>
</entry>

<entry>
  <datetime type="relative">49.5</datetime>
  <position>
    <scenelocation>
      <point><x>2131.72</x><y>3701.05</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>
    <eulerangles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerangles>
  </orientation>
</entry>

<entry>
  <datetime type="relative">50</datetime>
  <position>
    <scenelocation>
      <point><x>2141.78</x><y>3735.02</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>
    <eulerangles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerangles>
  </orientation>
</entry>

<entry>
  <datetime type="relative">50.5</datetime>
  <position>
    <scenelocation>
      <point><x>2151.84</x><y>3768.99</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>
    <eulerangles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerangles>
  </orientation>
</entry>

```

```

<entry>
  <datetime type="relative">51</datetime>
  <position>
    <scenelocation>
      <point><x>2161.9</x><y>3802.95</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>
    <eulerangles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerangles>
  </orientation>
</entry>

<entry>
  <datetime type="relative">51.5</datetime>
  <position>
    <scenelocation>
      <point><x>2171.96</x><y>3836.92</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>
    <eulerangles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerangles>
  </orientation>
</entry>

<entry>
  <datetime type="relative">52</datetime>
  <position>
    <scenelocation>
      <point><x>2182.02</x><y>3870.88</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>
    <eulerangles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerangles>
  </orientation>
</entry>

<entry>
  <datetime type="relative">52.5</datetime>
  <position>
    <scenelocation>
      <point><x>2192.08</x><y>3904.85</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>
    <eulerangles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerangles>
  </orientation>
</entry>

```

```

    </orientation>
</entry>

<entry>
  <datetime type="relative">53</datetime>
  <position>
    <scenelocation>
      <point><x>2202.14</x><y>3938.82</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>
    <eulerangles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerangles>
  </orientation>
</entry>

<entry>
  <datetime type="relative">53.5</datetime>
  <position>
    <scenelocation>
      <point><x>2212.2</x><y>3972.78</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>
    <eulerangles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerangles>
  </orientation>
</entry>

<entry>
  <datetime type="relative">54</datetime>
  <position>
    <scenelocation>
      <point><x>2222.27</x><y>4006.75</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>
    <eulerangles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerangles>
  </orientation>
</entry>

<entry>
  <datetime type="relative">54.5</datetime>
  <position>
    <scenelocation>
      <point><x>2232.33</x><y>4040.72</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>

```

```

    <eulerangles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerangles>
  </orientation>
</entry>

<entry>
  <datetime type="relative">55</datetime>
  <position>
    <scenelocation>
      <point><x>2242.39</x><y>4074.68</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>
    <eulerangles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerangles>
  </orientation>
</entry>

<entry>
  <datetime type="relative">55.5</datetime>
  <position>
    <scenelocation>
      <point><x>2252.45</x><y>4108.65</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>
    <eulerangles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerangles>
  </orientation>
</entry>

<entry>
  <datetime type="relative">56</datetime>
  <position>
    <scenelocation>
      <point><x>2262.51</x><y>4142.61</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>
    <eulerangles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerangles>
  </orientation>
</entry>

<entry>
  <datetime type="relative">56.5</datetime>
  <position>
    <scenelocation>
      <point><x>2272.57</x><y>4176.58</y><z>3155.3</z></point>
    </scenelocation>

```



```

</position>

<orientation>
  <eulerAngles>
    <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
  </eulerAngles>
</orientation>
</entry>

<entry>
  <datetime type="relative">57</datetime>
  <position>
    <scenelocation>
      <point><x>2282.63</x><y>4210.55</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>
    <eulerAngles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerAngles>
  </orientation>
</entry>

<entry>
  <datetime type="relative">57.5</datetime>
  <position>
    <scenelocation>
      <point><x>2292.7</x><y>4244.51</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>
    <eulerAngles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerAngles>
  </orientation>
</entry>

<entry>
  <datetime type="relative">58</datetime>
  <position>
    <scenelocation>
      <point><x>2302.76</x><y>4278.48</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>
    <eulerAngles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerAngles>
  </orientation>
</entry>

<entry>
  <datetime type="relative">58.5</datetime>
  <position>

```

```

    <scenelocation>
      <point><x>2312.82</x><y>4312.44</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>
    <eulerangles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerangles>
  </orientation>
</entry>

<entry>
  <datetime type="relative">59</datetime>
  <position>
    <scenelocation>
      <point><x>2322.88</x><y>4346.41</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>
    <eulerangles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerangles>
  </orientation>
</entry>

<entry>
  <datetime type="relative">59.5</datetime>
  <position>
    <scenelocation>
      <point><x>2332.94</x><y>4380.38</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>
    <eulerangles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerangles>
  </orientation>
</entry>

<entry>
  <datetime type="relative">60</datetime>
  <position>
    <scenelocation>
      <point><x>2343</x><y>4414.34</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>
    <eulerangles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerangles>
  </orientation>
</entry>

```

```

<entry>
  <datetime type="relative">60.5</datetime>
  <position>
    <scenelocation>
      <point><x>2353.06</x><y>4448.31</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>
    <eulerangles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerangles>
  </orientation>
</entry>

<entry>
  <datetime type="relative">61</datetime>
  <position>
    <scenelocation>
      <point><x>2363.12</x><y>4482.28</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>
    <eulerangles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerangles>
  </orientation>
</entry>

<entry>
  <datetime type="relative">61.5</datetime>
  <position>
    <scenelocation>
      <point><x>2373.18</x><y>4516.24</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>
    <eulerangles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerangles>
  </orientation>
</entry>

<entry>
  <datetime type="relative">62</datetime>
  <position>
    <scenelocation>
      <point><x>2383.25</x><y>4550.21</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>
    <eulerangles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerangles>
  </orientation>
</entry>

```

```

    </orientation>
</entry>

<entry>
  <datetime type="relative">62.5</datetime>
  <position>
    <scenelocation>
      <point><x>2393.31</x><y>4584.17</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>
    <eulerangles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerangles>
  </orientation>
</entry>

<entry>
  <datetime type="relative">63</datetime>
  <position>
    <scenelocation>
      <point><x>2403.37</x><y>4618.14</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>
    <eulerangles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerangles>
  </orientation>
</entry>

<entry>
  <datetime type="relative">63.5</datetime>
  <position>
    <scenelocation>
      <point><x>2413.43</x><y>4652.11</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>
    <eulerangles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerangles>
  </orientation>
</entry>

<entry>
  <datetime type="relative">64</datetime>
  <position>
    <scenelocation>
      <point><x>2423.49</x><y>4686.07</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>

```

```

        <eulerangles>
          <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
        </eulerangles>
      </orientation>
    </entry>

  <entry>
    <datetime type="relative">64.5</datetime>
    <position>
      <scenelocation>
        <point><x>2433.55</x><y>4720.04</y><z>3155.3</z></point>
      </scenelocation>
    </position>

    <orientation>
      <eulerangles>
        <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
      </eulerangles>
    </orientation>
  </entry>

  <entry>
    <datetime type="relative">65</datetime>
    <position>
      <scenelocation>
        <point><x>2443.61</x><y>4754.01</y><z>3155.3</z></point>
      </scenelocation>
    </position>

    <orientation>
      <eulerangles>
        <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
      </eulerangles>
    </orientation>
  </entry>

  <entry>
    <datetime type="relative">65.5</datetime>
    <position>
      <scenelocation>
        <point><x>2453.68</x><y>4787.97</y><z>3155.3</z></point>
      </scenelocation>
    </position>

    <orientation>
      <eulerangles>
        <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
      </eulerangles>
    </orientation>
  </entry>

  <entry>
    <datetime type="relative">66</datetime>
    <position>
      <scenelocation>
        <point><x>2463.74</x><y>4821.94</y><z>3155.3</z></point>
      </scenelocation>

```

```

</position>

<orientation>
  <eulerAngles>
    <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
  </eulerAngles>
</orientation>
</entry>

<entry>
  <datetime type="relative">66.5</datetime>
  <position>
    <scenelocation>
      <point><x>2473.8</x><y>4855.9</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>
    <eulerAngles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerAngles>
  </orientation>
</entry>

<entry>
  <datetime type="relative">67</datetime>
  <position>
    <scenelocation>
      <point><x>2483.86</x><y>4889.87</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>
    <eulerAngles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerAngles>
  </orientation>
</entry>

<entry>
  <datetime type="relative">67.5</datetime>
  <position>
    <scenelocation>
      <point><x>2493.92</x><y>4923.84</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>
    <eulerAngles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerAngles>
  </orientation>
</entry>

<entry>
  <datetime type="relative">68</datetime>
  <position>

```

```

    <scenelocation>
      <point><x>2503.98</x><y>4957.8</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>
    <eulerAngles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerAngles>
  </orientation>
</entry>

<entry>
  <datetime type="relative">68.5</datetime>
  <position>
    <scenelocation>
      <point><x>2514.04</x><y>4991.77</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>
    <eulerAngles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerAngles>
  </orientation>
</entry>

<entry>
  <datetime type="relative">69</datetime>
  <position>
    <scenelocation>
      <point><x>2524.1</x><y>5025.73</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>
    <eulerAngles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerAngles>
  </orientation>
</entry>

<entry>
  <datetime type="relative">69.5</datetime>
  <position>
    <scenelocation>
      <point><x>2534.16</x><y>5059.7</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>
    <eulerAngles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerAngles>
  </orientation>
</entry>

```

```

<entry>
  <datetime type="relative">70</datetime>
  <position>
    <scenelocation>
      <point><x>2544.23</x><y>5093.67</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>
    <eulerangles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerangles>
  </orientation>
</entry>

<entry>
  <datetime type="relative">70.5</datetime>
  <position>
    <scenelocation>
      <point><x>2554.29</x><y>5127.63</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>
    <eulerangles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerangles>
  </orientation>
</entry>

<entry>
  <datetime type="relative">71</datetime>
  <position>
    <scenelocation>
      <point><x>2564.35</x><y>5161.6</y><z>3155.3</z></point>
    </scenelocation>
  </position>

  <orientation>
    <eulerangles>
      <cartesiantriple><x>0</x><y>0</y><z>-0.287979</z></cartesiantriple>
    </eulerangles>
  </orientation>
</entry>

</data>
</platformmotion>

```

## Tasks File - “compass\_megacollect.tasks”

```

<tasklist>
  <reference>
    <datetime type="absolute" >2004-06-07T12:57:00.0000-05:00</datetime>
  </reference>

```



```

<task>
  <metadata>
    <entry>
      <name>Description</name>
      <value><![CDATA[New Task Description]]></value>
    </entry>
    <entry>
      <name>Name</name>
      <value><![CDATA[New Task]]></value>
    </entry>
  </metadata>
  <start>
    <datetime type="relative" >34.56</datetime>
  </start>
  <stop>
    <datetime type="relative" >35.84</datetime>
  </stop>
</task>
</tasklist>

```

## Simulation File - “compass\_megacollect\_mls\_11km\_vis.sim”

```

<simulation>
  <scene externalfile="/dirs/home/FOUO/DIRSIG_COMPASS/megacollect_cal_panels.scene" />
  <atmosphericconditions externalfile="/dirs/home/FOUO/DIRSIG_COMPASS/mls_11km_vis.atm" />
  <platform
externalfile="/dirs/home/FOUO/DIRSIG_COMPASS/platform/compass_megacollect_mls_11km_vis.plat
form" />
  <platformmotion externalfile="/dirs/home/FOUO/DIRSIG_COMPASS/ppd/compass_megacollect.ppd"
/>
  <tasklist externalfile="/dirs/home/FOUO/DIRSIG_COMPASS/compass_megacollect.tasks" />
</simulation>

```

# **Radiosonde Data - "buf20040607\_12.txt"**

254	12	7	JUN	2004		
1	14733	72528	42.93N	78.73W	218	99999
2	200	1971	2160	72	99999	3
3		BUF			52	kt
9	9920	218	190	130	220	8
4	10000	152	99999	99999	99999	99999
5	9870	261	192	122	99999	99999
6	9821	304	99999	99999	230	13
6	9480	609	99999	99999	260	26
4	9250	821	176	116	275	27
6	9149	914	99999	99999	275	27
6	8826	1219	99999	99999	290	27
6	8514	1524	99999	99999	295	24
4	8500	1538	116	103	295	23
5	8280	1755	98	96	99999	99999
6	8207	1828	99999	99999	295	21
6	7906	2133	99999	99999	285	20
6	7617	2438	99999	99999	285	21
5	7420	2653	46	46	99999	99999
6	7339	2743	99999	99999	285	20
4	7000	3133	10	-15	280	17
6	6810	3352	99999	99999	280	16
5	6610	3589	-27	-41	99999	99999
6	6553	3657	99999	99999	285	18
5	6320	3944	-11	-241	99999	99999
5	6270	4007	-11	-211	99999	99999
6	6065	4267	99999	99999	300	22
6	5611	4876	99999	99999	295	23
5	5270	5367	-91	-361	99999	99999
5	5190	5485	-95	-275	99999	99999
4	5000	5780	-117	-227	295	25
6	4794	6096	99999	99999	290	28
5	4380	6776	-191	-311	99999	99999
5	4150	7173	-227	-273	99999	99999
4	4000	7450	-245	-289	300	33
6	3907	7620	99999	99999	305	32
5	3730	7954	-277	-367	99999	99999
6	3287	8839	99999	99999	320	37
6	3147	9144	99999	99999	320	36
4	3000	9480	-411	-491	315	36
5	2980	9526	-415	-495	99999	99999
6	2623	10363	99999	99999	315	33
6	2505	10668	99999	99999	315	36
4	2500	10680	-521	99999	315	37
5	2420	10889	-539	99999	99999	99999
7	2160	11611	-575	99999	320	43
4	2000	12100	-577	99999	325	49
6	1971	12192	99999	99999	330	53
5	1850	12590	-577	-667	99999	99999
6	1704	13106	99999	99999	305	35
4	1500	13910	-581	-721	320	34
6	1403	14326	99999	99999	320	30

6	1211	15240	99999	99999	305	26
5	1190	15351	-619	-779	99999	99999
5	1070	16009	-605	-775	99999	99999
6	1046	16154	99999	99999	305	23
4	1000	16440	-611	-781	305	23
6	997	16459	99999	99999	305	23
5	919	16964	-601	-771	99999	99999
6	904	17068	99999	99999	300	24
5	811	17738	-619	-789	99999	99999
6	708	18592	99999	99999	330	15
4	700	18660	-589	-769	330	16
4	500	20770	-599	-789	25	8
6	457	21336	99999	99999	30	10
6	377	22555	99999	99999	80	11
4	300	24000	-539	-739	80	15
6	245	25298	99999	99999	95	16
4	200	26610	-505	-725	85	14
6	176	27432	99999	99999	75	12
6	168	27736	99999	99999	75	15
5	157	28200	-459	-689	99999	99999