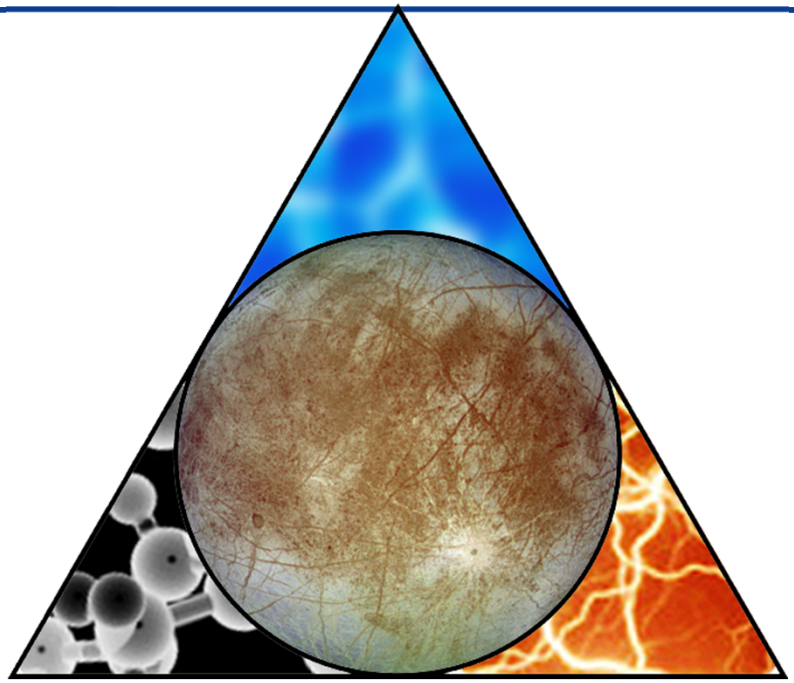

Europa Clipper Pre-Project - Update to ICEE Teams

Valerie Thomas, Pre-Project Payload Manager
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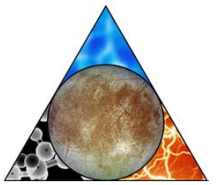
Kenneth Klassen, Pre-Project Payload System Engineer
David Brinza, Pre-Project Environments Engineer

January 6, 2014

Introduction



- The material in this package is a compilation of answers to questions the Europa Clipper Pre-Project team has received from the ICEE teams. It also includes updated spacecraft configuration information that the ICEE teams may find helpful.
- The spacecraft information is still notional and subject to change as the design matures.
- For additional information or questions, please contact:

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818-653-9252

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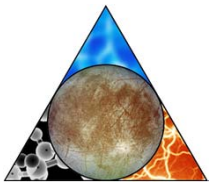
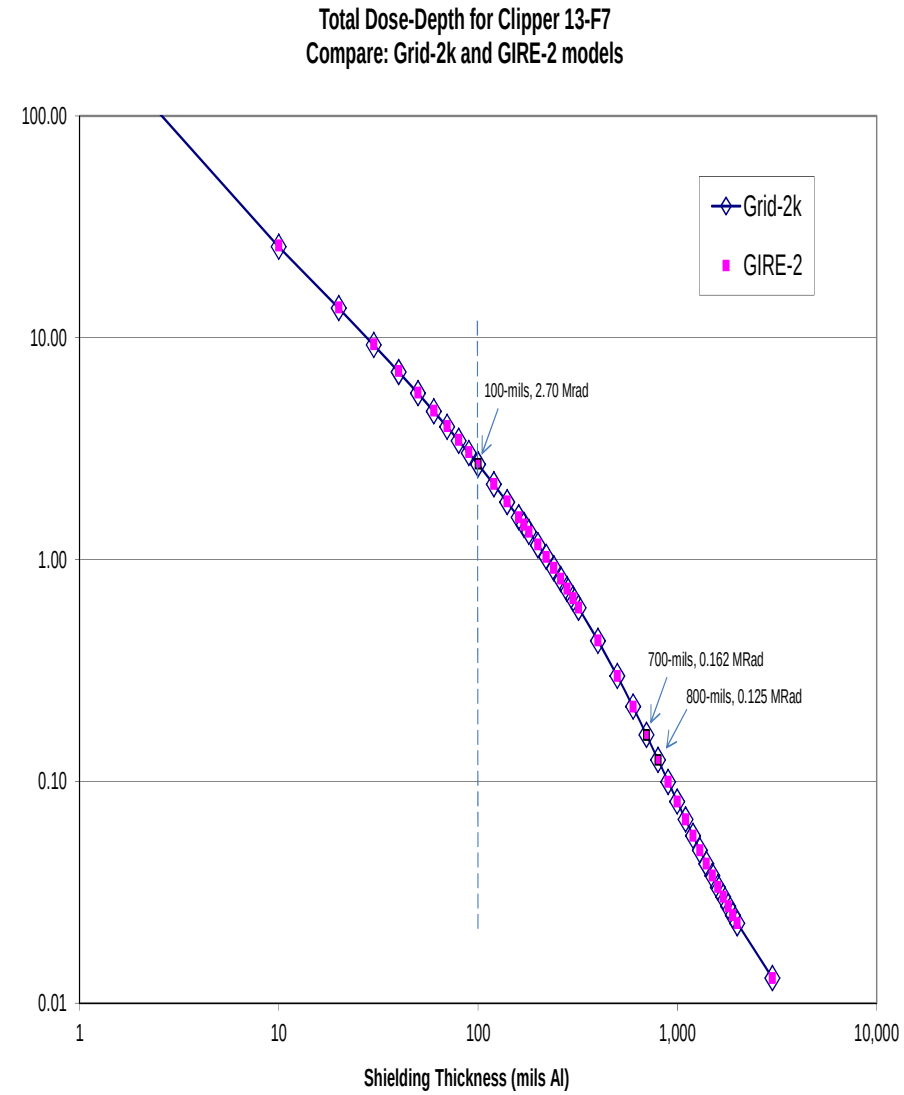
General Questions and Answers



- Is there a spacecraft CAD model available?
  - A 3D pdf of the current spacecraft configuration is available on the website:

    http://solarsystem.nasa.gov/europa/technical.cfm
- Can you provide a current estimate of the radiation environment, including particle energy and flux?
  - See the plots on charts 4, 5 and 6 for the 13-F7 trajectory. Chart 6 is the average peak flux for Europa Clipper's 51st perijove pass (which is actually an orbit in which there is a Callisto fly-by (Oct 4, 2030). The peak flux should be similar for the next Europa Flyby (E29) on Dec 9, 2030. Note this peak flux is the prediction from GIRE-2, which represents averaged equatorial crossing fluxes from measurements by Galileo. The environment is quite dynamic at Jupiter and fluctuations of almost 2 orders of magnitude were observed on some GLL passes. The Environmental Requirements Document, expected to be available in February, will include anticipated worst case peak flux environments.
  - The Project team is working to get the software code for the simplified radiation model, Grid2, reviewed and released to the public.

Dose-Depth Curve 13-F7 Trajectory



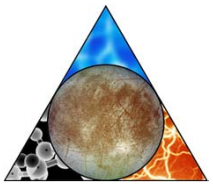
13-F7 Trajectory Energetic Particles Estimated Fluences from Grid2 Model

Energy (MeV)	Electrons Integral Fluence (cm^{-2})	Protons Integral Fluence (cm^{-2})
0.1	2.83E+15	2.68E+16
0.2	1.43E+15	4.70E+15
0.3	9.59E+14	1.72E+15
0.5	5.72E+14	4.93E+14
1	2.68E+14	9.40E+13
2	1.13E+14	1.89E+13
3	6.46E+13	7.61E+12
5	3.01E+13	2.48E+12
10	8.82E+12	5.59E+11
20	1.83E+12	1.06E+11
30	6.77E+11	2.74E+10
50	1.92E+11	2.68E+09
100	3.52E+10	6.29E+07
200	6.48E+09	1.89E+06
300	2.40E+09	4.08E+05
500	6.79E+08	9.42E+04
1000	1.08E+08	1.68E+04

13-F7 Trajectory - Energetic Particles Estimated Peak Fluxes - Grid2 Model (Averaged)

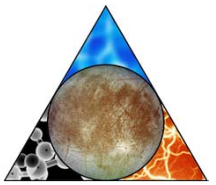
Energy	Electrons Integral Peak Flux	Protons Integral Peak Flux
(MeV)	(cm^{-2} s^{-1})	(cm^{-2} s^{-1})
0.1	2.02E+08	2.35E+10
0.2	1.26E+08	3.40E+09
0.3	9.44E+07	1.10E+09
0.5	6.52E+07	2.68E+08
1	3.86E+07	4.02E+07
2	2.22E+07	6.53E+06
3	1.59E+07	2.46E+06
5	9.86E+06	8.22E+05
10	3.75E+06	2.29E+05
20	7.56E+05	5.65E+04
30	2.66E+05	1.64E+04
50	7.41E+04	1.70E+03
100	1.42E+04	4.01E+01
200	2.86E+03	1.24E+00
300	1.12E+03	2.76E-01
500	3.41E+02	6.42E-02
1000	5.86E+01	1.13E-02

General Questions (cont'd)



- What are the assumptions for instrument mass estimates?
  - See charts on pages 10-17
- What is the approximate spacecraft mass during Europa operations?
  - The approximate post-JOI wet mass is 3216 kg
  - At end of mission, the approximate wet mass is 2755 kg
- Do you have any attitude files for Clipper during the flybys?
  - See the attitude (C-kernel) posted on the website
- Is there a thermal model of the spacecraft? Even simplistic?
  - We don't have a model that we can release, however if there are specific questions please contact us.
- Is the Project considering doing any bulk buys of electronic parts (FPGAs, etc.)?
  - Not at this time

General Questions (cont'd)



- Can we get an estimate of the distance (harness lengths) from the electronics vault to the nominal instrument sensor locations?
  - Instruments on the nadir deck to inside the vault is 3 m
  - NMS to inside the vault is 4 m
  - IPR transmitter box to inside vault is 3 m
  - Magnetometer canister to inside the vault is 5 m; from canister to end of boom is 10 m
  - Langmuir Probe to base of boom is 8 m

General Questions (cont'd)

- Preferred/approved parts lists – are they available?
  - The APML developed previously for JEO is being reviewed for content and for gaps in part types (such as A/D converters). Potential candidates will be added to the list and scheduled for radiation testing. The updated list, which will represent a Europa Preferred Parts List (with caveats for future testing), will be available approximately March 1.
- Is it ok to fly FPGAs? Virtex-5? Actel (Micro-Semi)?
  - There is a risk reduction effort currently in-process which is radiation testing the following FPGAs: Micro-Semi RTAX-2000, Xilinx Virtex-5 (commercial), and Xilinx Virtex-7. It is anticipated that Micro-Semi RTAX-2000 and Xilinx Virtex-5 (space qualified) will meet the 300 KRad radiation requirement. Other issues (such as packaging) may make the space-qualified Virtex-5 usage problematic, thus the testing being performed on the commercial version.
  - This is not a guarantee that there will be an FPGA solution for Europa Clipper, but there is an across the board interest and momentum in finding an FPGA solution.

Topo Imager Mass Breakdown

Mass Estimate	kg
TI detector electronics	0.35
TI detector housing - rad-shield	1.5
TI optics/telescope	0.5
TI radiator assembly	0.2
TI harness	0.45
TI door	0.1
Board - TI power / digital	0.9
TOTAL	4

- Boards are based on 6U cPCI format located in chassis inside vault

SWIRS Mass Breakdown

Mass Estimate		kg
IR detector electronics		0.5
Thermal insulation		1
Additional structure due to shield mass		1
VIS/IR optics/telescope		1
VIS/IR spectrograph		1.75
VIS/IR radiator assembly		1
VIS/IR calibration hardware		0.9
Scan mirror assembly		1.5
Door		0.25
Straylight baffle		0
Harness		1.2
	Subtotal	10.1
IR detector rad-shield		4.6
IR detector electronics rad-shield		1.3
Board - power supply		1
Board - detector processing		0.9
Board – interface		0.9
TOTAL		18.8

- Boards are based on 6U cPCI format located in chassis inside vault

IPR Mass Breakdown

Mass Estimate	kg
15-m dipole plus 7.5 m dipole array	9.2
harness and antenna feeds	3
HCIPE transmitter	8
board # 1 - receiver 1	1
board # 2 - receiver 2	1
board #3 - receiver 3	1
board #4 - receiver 4	1
board #5 - waveform memory	1
board # 6 - system controller	1
board # 7 - power supply	1
board # 8 - digital processor	1
shielding for external electronics	5
TOTAL	33.2

- Boards are based on 6U cPCI format located in chassis inside vault

Magnetometer Mass Breakdown

Mass Estimate	kg
Mag sensor #1	0.25
Mag #1 harness (from local electronics to sensor)	0.11
Mag sensor #2	0.25
Mag #2 harness (from local electronics to sensor)	0.11
Board	0.9
TOTAL	1.62

- Boards are based on 6U cPCI format located in chassis inside vault

Langmuir Probe Mass Breakdown

Mass Estimate	kg
Sensor #1	0.2
Harness (from base of booms to sensors)	0.08
Sensor #2	0.2
Booms (2)	0.3
Shielding for 2 pre-amps	0.4
Bias & analyzer board	0.9
Power converter and DPU board	0.9
TOTAL	2.98

- Boards are based on 6U cPCI format located in chassis inside vault

NMS Mass Breakdown

Mass Estimate	kg
Instrument head (electronics reduced)	2.44
Harness	0.50
Detector radiation shield	0.75
Front end electronics rad-shield (2)	1.29
Board#1 - RF/ HVPS	0.90
Board#2 - LVPS/ Processor/ Electron Gun electronics	0.90
TOTAL	6.78

- Boards are based on 6U cPCI format located in chassis inside vault

Recon Camera Mass Breakdown

Mass Estimate	kg
Detector electronics	0.5
Detector housing - rad-shield	2
Optics/telescope	4
Radiator assembly	0.4
Harness	0.6
Door	0.7
Flip mirror & baffle	4
Board - digital	0.9
TOTAL	13.1

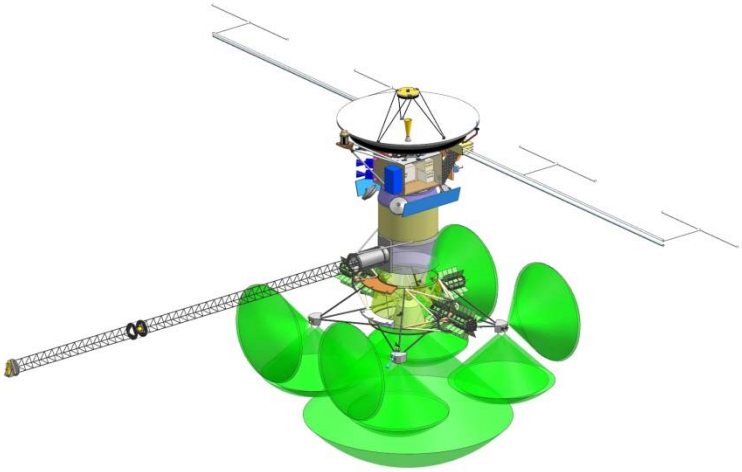
- Boards are based on 6U cPCI format located in chassis inside vault

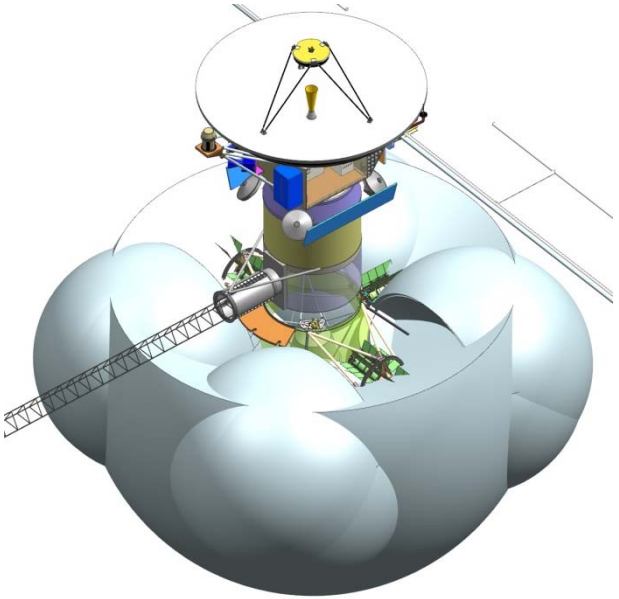
Thermal Imager Mass Breakdown

Mass Estimate	kg
Receiver telescope	1.25
Detector electronics	0.25
Calibration system	2.5
harness	1
Detector electronics rad-shield	1.28
Board - LVPS / timing / interface	0.9
TOTAL	7.18

- Boards are based on 6U cPCI format located in chassis inside vault

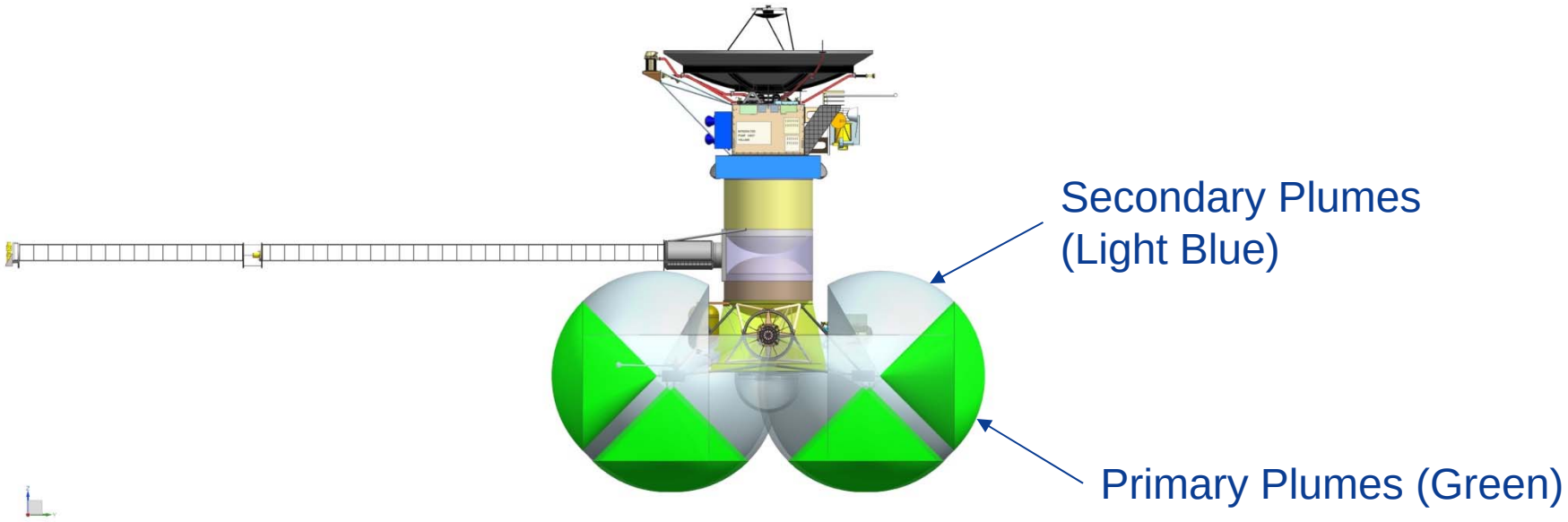
Thruster Plume Projections





- Primary Plumes are ±45 degrees (left image).
- Secondary Plumes are ±120 degrees (right image).
- The current propulsion system is Mono-prop, but there is a possibility that it could change to a Bi-prop system.

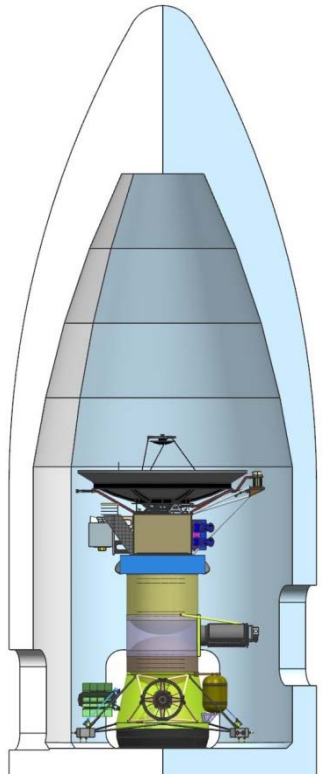
Thruster Plume Projections

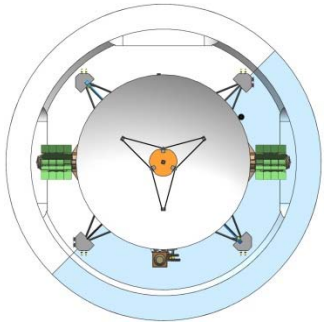


- Secondary plumes decrease in particulate density in a gradated manner from the primary plume.

Current Launch Vehicle Accommodation

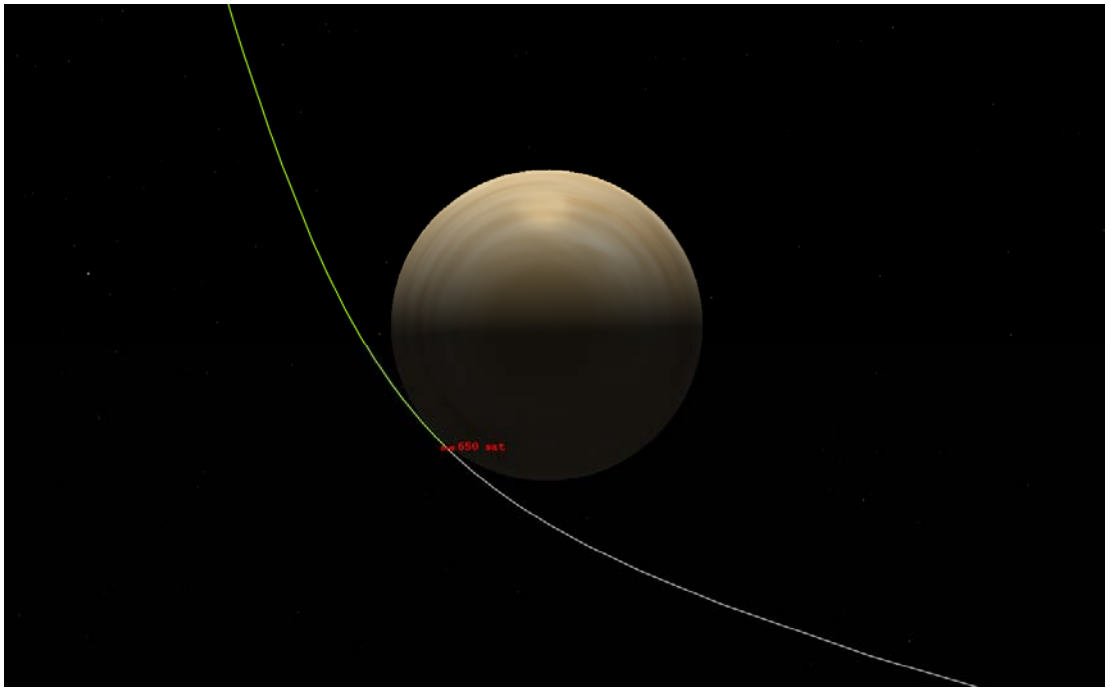
- Atlas V 551 with a Short 5m Fairing
- D1666 Marmon Clamp Based Separation System
- Access Doors for
  - Fill & Drain Plugs
  - Enabling Plugs
  - MMRTG Integration



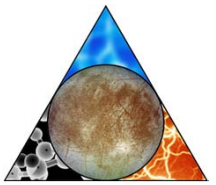


Venus Flyby

- The closest approach to Venus is 314 km (which occurs on Venus' dark side)
- The max s/c velocity relative to Venus is ~12 km/s
- The time to go from inbound (20k km) to outbound (20k km) is ~1.5 hrs
- The spacecraft's closest approach to the Sun (occurring between launch and the Venus flyby) is ~0.65 AU



Notional SWIRS Observing Scenario



- For each Europa flyby, obtain global-scale pushbroom coverage on approach and departure at ranges below 66,000 km altitude using some combination of internal mirror scanning and S/C off-nadir pointing or scanning (although S/C off-nadir pointing is currently not in the baseline).
- Observe for up to 5 min each on approach and departure.
- Also obtain pushbroom coverage of selected regions along the ground track at altitudes below 2000 km using the internal scan mirror for motion compensation to maintain image line adjacency and increase integration time.
- Observing period below 2000 km of up to 4.5 min.
- Raw data are generated at a rate of up to 2.4 Mb/s.
- Data may be buffered and compressed 3:1 internal to the SWIRS instrument prior to transfer to the S/C CDH for storage and later downlinking. Alternatively, the compression could be performed in the CDH (TBD).
- A total of up to 0.53 Gb of data will be generated per flyby.
- For our lowest flyby altitude of 25 km and a typical flyby velocity of 4.5 km/s, the maximum angular rate needed to track nadir is 4.5/(1565+25)km = 2.8 mrad/s = 0.16 deg/s

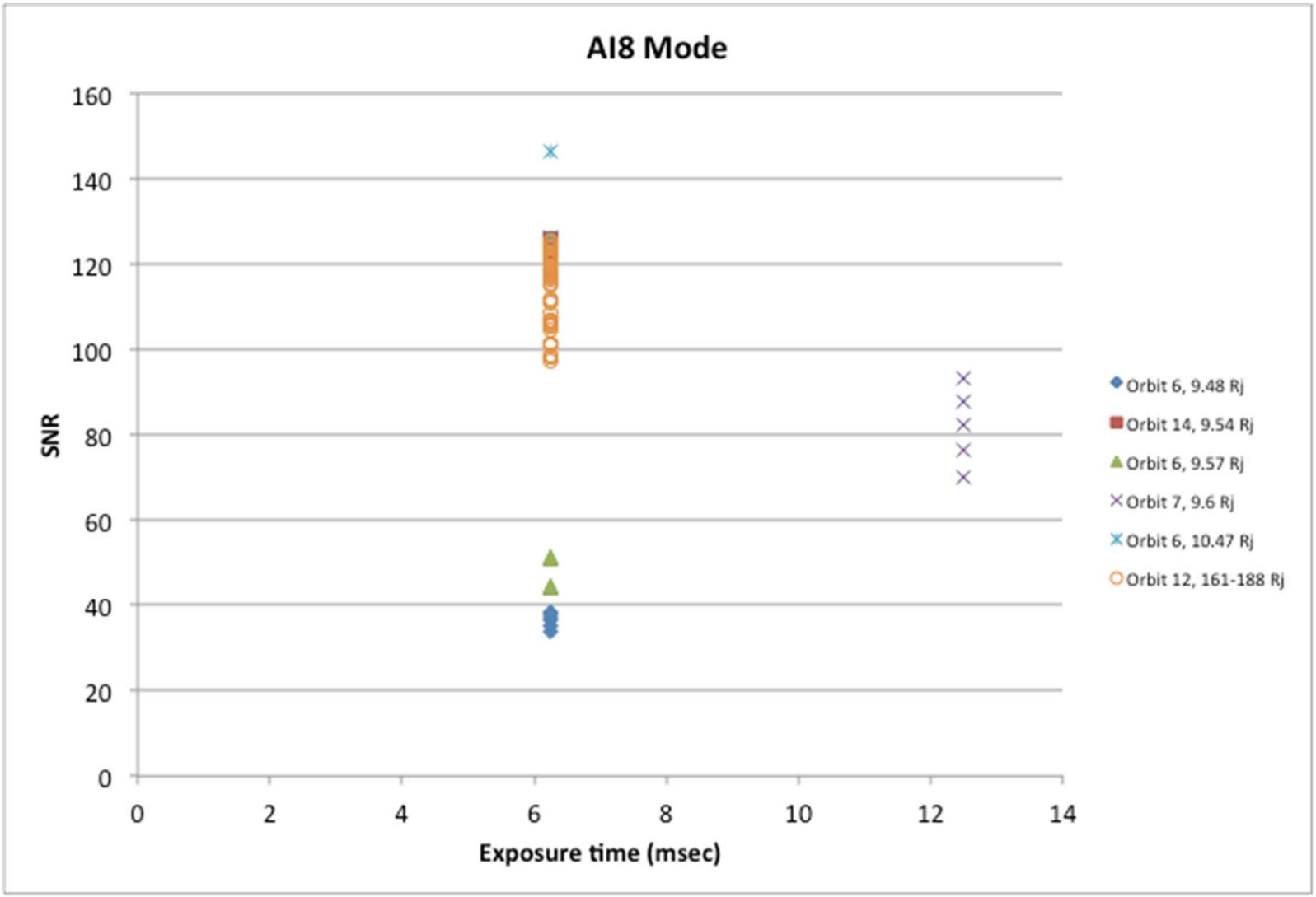
Recon Camera SNR calculations

- Signal-to-noise calculations for the notional Recon Camera have been done as follows:
  - Europa albedo = 0.9, photometric function value = 0.5, solar illumination at 5.2 AU
  - Optics f/# = 10, transmission = 0.75
  - Pixel size = 8.75 micron, QE = 0.3, read noise = 40 electrons
  - Spectral bandpass from 500 - 900 nm
  - Integration time = t sec
  - System response = t * (pi/4 f/#^2) * pixel area * QE * transmission *radiance * bandpass * photons/erg
  - Europa radiance = Solar irradiance at 1 AU and 700 nm * albedo *photometric function / (5.2 AU ^2 * pi)
  - Solar irradiance at 1 AU and 700 nm = 144 erg/ (cm^2-Angstrom-sec)
  - SNR = 100 requires signal of 11403 electrons/pixel (not counting any radiation-induced noise)
  - Required integration time t = 7.84 ms
  - Minimum line time for 25-km altitude flyby and 10 urad/pixel IFOV = 55.5 microsec. So 128 lines of TDI yields 7.1 msec total integration time and SNR near 100.
- The effects of radiation interactions is determined as follows:
  - As given in the May 2012 report, the rate of energetic electrons hitting a detector at Europa behind 1 cm of tantalum shielding is 4.3x10^5 particles/cm2/s. For an integration time of 7.84 msec, the 8.75-micron pixels of the notional Recon Camera would be hit an average of 0.26% of the time behind this amount of shielding. Therefore, only a very small fraction of pixels will be affected by radiation noise.

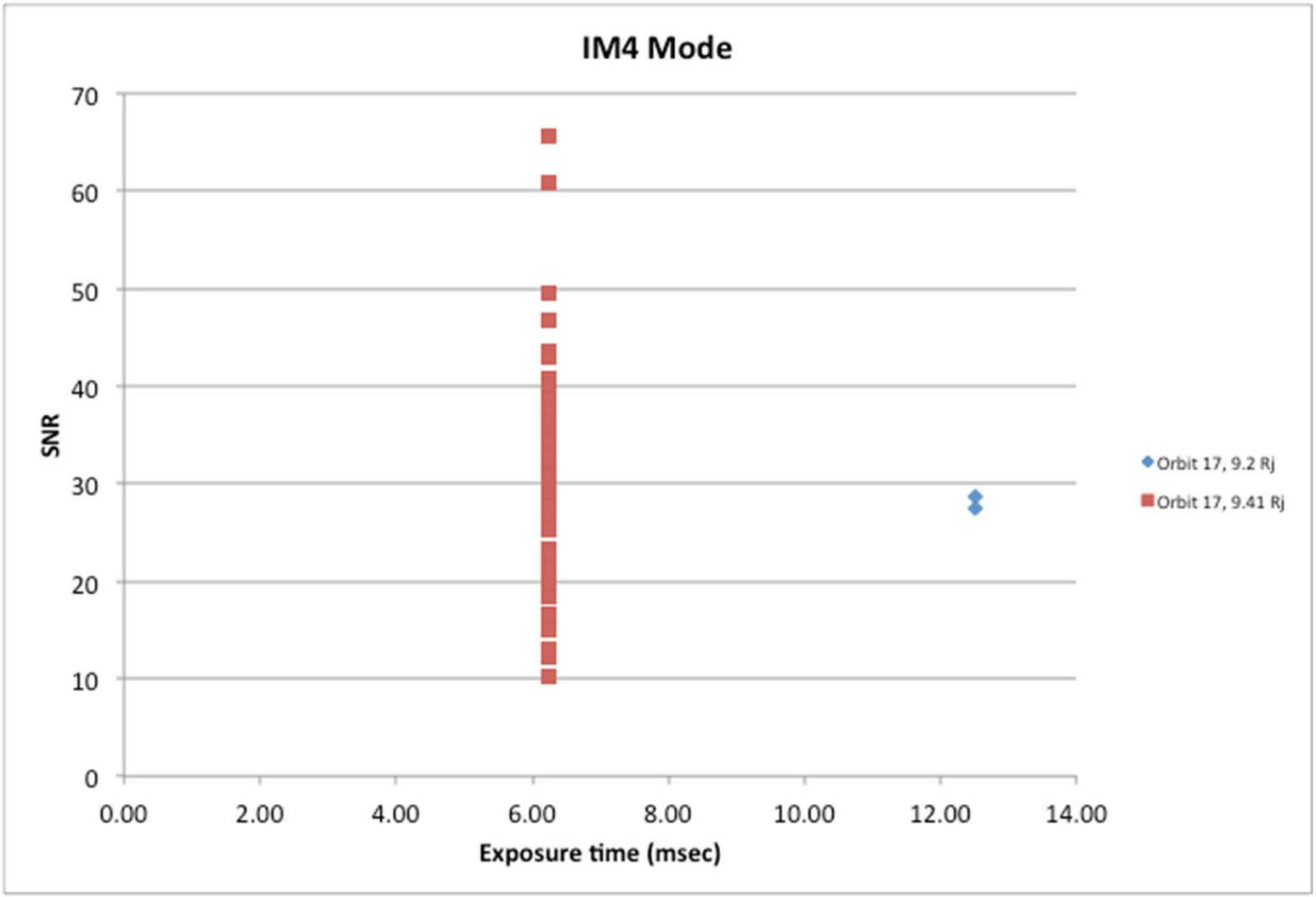
Galileo SSI CLR filter SNR

- Following are some plots of GLL SSI SNR values for Europa clear-filter imaging
- A total of 9 orbits containing Europa imaging were used.
- The plots below show the predicted SNR values from the GLL SSI EXPOSURE program.
- Separate charts were created for each SSI imaging mode used.
- Recall that the AI8 mode includes 2x2-pixel summation and so gives up spatial resolution to improve SNR.
- Scatter plots of predicted SNR vs. exposure time are presented with different symbols used for different observations denoted by Orbit number and Rj range.
- The SNRs for a given exposure time vary significantly depending on the lighting and viewing conditions that apply for a given observation.

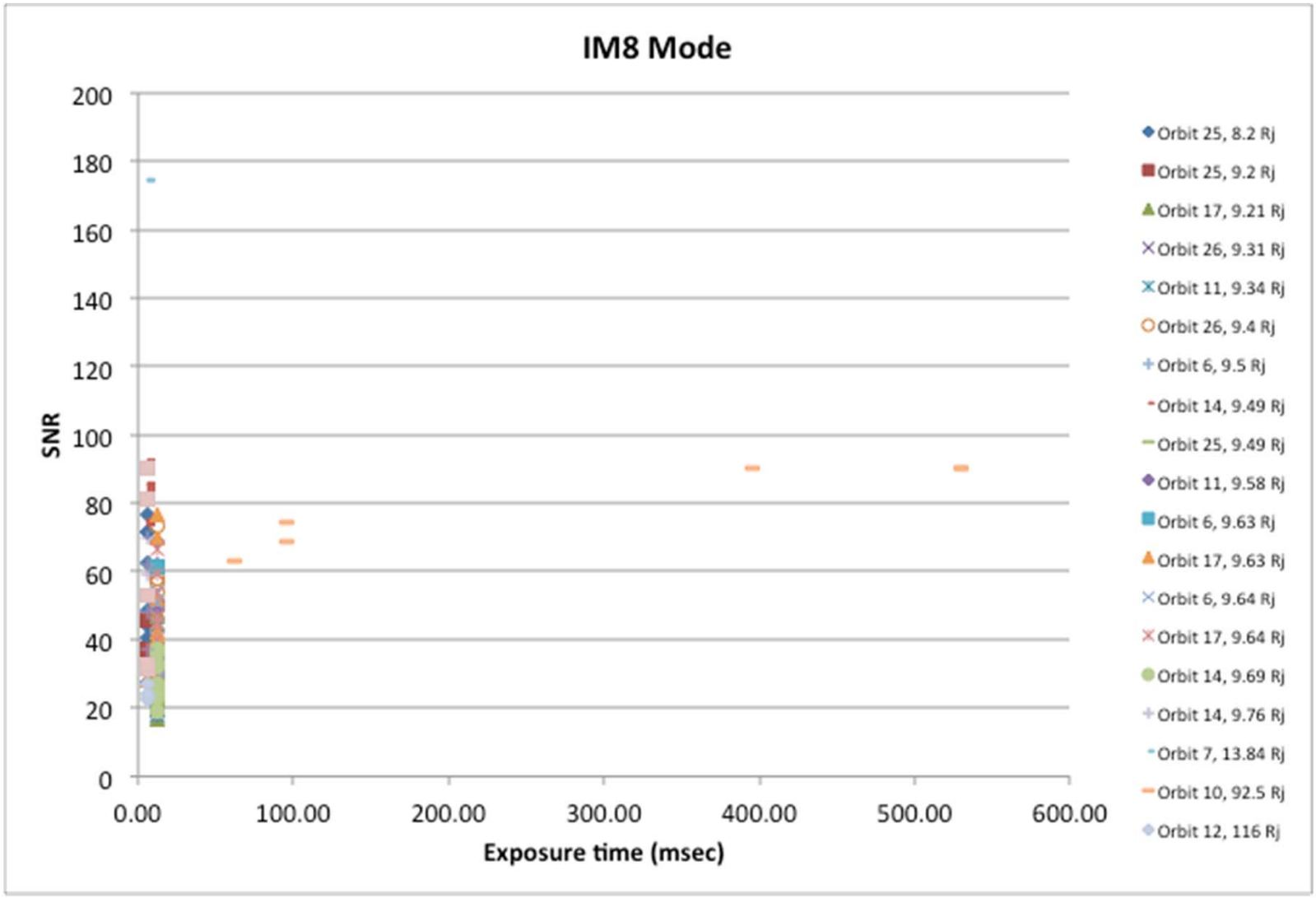
Galileo SSI CLR filter SNR



Galileo SSI CLR filter SNR



Galileo SSI CLR filter SNR



Data used for GLL the SNR plots

A total of 9 orbits containing Europa imaging were used. The plots below show the predicted SNR values from the GLL SSI EXPOSURE program. Separate charts were created for each SSI imaging mode used. Recall that the AI8 mode includes 2x2-pixel summation and so gives up spatial resolution to improve SNR. Scatter plots of predicted SNR vs. exposure time are presented with different symbols used for different observations denoted by Orbit number and Rj range. The SNRs for a given exposure time vary significantly depending on the lighting and viewing conditions that apply for a given observation.

PICNO	MODE	FILTER	EXP. TIME (ms)	GAIN	RES (KM/LP)	SMEAR (PIX)	RANGE (Rj)	MAX SNR
E6E0060	AI8	CLR	6.24	1	0.115	0.79	9.48	33.5
E6E0061	AI8	CLR	6.24	1	0.114	0.78	9.48	35.1
E6E0062	AI8	CLR	6.24	1	0.113	0.78	9.48	36.3
E6E0063	AI8	CLR	6.24	1	0.112	0.78	9.48	36.9
E6E0064	AI8	CLR	6.24	1	0.111	0.77	9.48	38.1
E6E0065	AI8	CLR	6.24	1	0.111	0.76	9.48	38
14E0027	AI8	CLR	6.24	1	0.133	0.81	9.54	124
14E0028	AI8	CLR	6.24	1	0.132	0.82	9.54	124
14E0029	AI8	CLR	6.24	1	0.132	0.82	9.54	126
14E0030	AI8	CLR	6.24	1	0.132	0.83	9.54	126
14E0031	AI8	CLR	6.24	1	0.138	0.81	9.54	117
14E0032	AI8	CLR	6.24	1	0.138	0.81	9.54	122
14E0033	AI8	CLR	6.24	1	0.137	0.82	9.54	126
14E0034	AI8	CLR	6.24	1	0.136	0.83	9.54	125
E6E0030	AI8	CLR	6.24	1	0.481	0.79	9.57	51.4
E6E0031	AI8	CLR	6.24	1	0.485	0.79	9.57	44.4
E6E0032	AI8	CLR	6.24	1	0.48	0.79	9.57	51
E6E0033	AI8	CLR	6.24	1	0.482	0.79	9.57	44
G7E0054	AI8	CLR	12.5	1	1.06	0.03	9.57	70.10
G7E0053	AI8	CLR	12.5	1	1.03	0.03	9.59	76.40
G7E0052	AI8	CLR	12.5	1	1.00	0.03	9.60	82.40
G7E0051	AI8	CLR	12.5	1	0.99	0.03	9.61	87.80
G7E0050	AI8	CLR	12.5	1	0.97	0.03	9.63	93.00
E6E0001	AI8	CLR	6.24	1	3.313	0.79	10.47	146.4
E6E0002	AI8	CLR	6.24	1	3.274	0.79	10.47	126.3
12E0046	AI8	clr	6.24	1		0.63	161	115.1
12E0068	AI8	clr	6.24	1		0.79	161	111.8
12E0045	AI8	clr	6.24	1		0.59	162	115.4
12E0047	AI8	clr	6.24	1		0.66	164	117.3
12E0048	AI8	clr	6.24	1		0.70	164	117.1
12E0051	AI8	clr	6.24	1		0.78	164	117.3
12E0088	AI8	clr	6.24	1		0.88	164	97.1
12E0049	AI8	clr	6.24	1		0.72	165	117.7

Data used for GLL the SNR plots

12E0050	AI8	clr	6.24	1		0.76	165	117.5
12E0087	AI8	clr	6.24	1		0.87	165	98.0
12E0086	AI8	clr	6.24	1		0.86	166	98.3
12E0052	AI8	clr	6.24	1		0.82	167	119.0
12E0067	AI8	clr	6.24	1		0.78	167	116.3
12E0082	AI8	clr	6.24	1		0.83	167	98.7
12E0064	AI8	clr	6.24	1		0.73	168	117.6
12E0065	AI8	clr	6.24	1		0.74	168	117.2
12E0066	AI8	clr	6.24	1		0.76	168	116.8
12E0063	AI8	clr	6.24	1		0.70	169	118.0
12E0085	AI8	clr	6.24	1		0.85	171	101.1
12E0062	AI8	clr	6.24	1		0.70	172	120.3
12E0083	AI8	clr	6.24	1		0.83	172	101.4
12E0084	AI8	clr	6.24	1		0.84	172	101.3
12E0060	AI8	clr	6.24	1		0.66	173	121.2
12E0061	AI8	clr	6.24	1		0.67	173	120.8
12E0058	AI8	clr	6.24	1		0.63	174	122.2
12E0059	AI8	clr	6.24	1		0.64	174	121.7
12E0057	AI8	clr	6.24	1		0.60	175	122.7
12E0056	AI8	clr	6.24	1		0.60	176	123.6
12E0055	AI8	clr	6.24	1		0.57	177	124.1
12E0053	AI8	clr	6.24	1		0.54	178	125.4
12E0054	AI8	clr	6.24	1		0.56	178	124.8
12E0075	AI8	clr	6.24	1		0.76	180	104.7
12E0081	AI8	clr	6.24	1		0.82	180	105.5
12E0076	AI8	clr	6.24	1		0.77	181	105.6
12E0080	AI8	clr	6.24	1		0.81	181	105.9
12E0071	AI8	clr	6.24	1		0.73	182	106.8
12E0072	AI8	clr	6.24	1		0.74	182	106.6
12E0073	AI8	clr	6.24	1		0.74	182	106.8
12E0074	AI8	clr	6.24	1		0.75	182	106.7
12E0079	AI8	clr	6.24	1		0.80	182	106.3
12E0078	AI8	clr	6.24	1		0.79	183	106.6
12E0077	AI8	clr	6.24	1		0.78	186	108.5
12E0069	AI8	clr	6.24	1		0.80	188	111.3
12E0070	AI8	clr	6.24	1		0.82	188	111.0
17E0097	IM4	CLR	12.50	2	0.462	0.06	9.20	***28***
17E0098	IM4	CLR	12.50	2	0.468	0.06	9.20	***29***
17E0071	IM4	CLR	6.24	2	0.076	0.03	9.40	***27***
17E0072	IM4	CLR	6.24	2	0.076	0.03	9.40	***22***
17E0073	IM4	CLR	6.24	2	0.077	0.03	9.40	***17***
17E0074	IM4	CLR	6.24	2	0.077	0.03	9.40	***38***
17E0075	IM4	CLR	6.24	2	0.080	0.03	9.40	***29***
17E0076	IM4	CLR	6.24	2	0.081	0.03	9.40	***28***
17E0077	IM4	CLR	6.24	2	0.082	0.03	9.40	***27***
17E0078	IM4	CLR	6.24	2	0.083	0.03	9.40	***25***
17E0079	IM4	CLR	6.24	2	0.084	0.04	9.40	***23***

Data used for GLL the SNR plots

17E0068	IM4	CLR	6.24	2	0.081	0.04	9.41	***47***
17E0069	IM4	CLR	6.24	2	0.082	0.05	9.41	50
17E0070	IM4	CLR	6.24	2	0.085	0.03	9.41	***20***
17E0059	IM4	CLR	6.24	2	0.083	0.03	9.42	***30***
17E0060	IM4	CLR	6.24	2	0.083	0.03	9.42	***30***
17E0061	IM4	CLR	6.24	2	0.085	0.03	9.42	***32***
17E0062	IM4	CLR	6.24	2	0.084	0.03	9.42	***34***
17E0063	IM4	CLR	6.24	2	0.083	0.03	9.42	***36***
17E0064	IM4	CLR	6.24	2	0.083	0.03	9.42	***36***
17E0065	IM4	CLR	6.24	2	0.082	0.03	9.42	***39***
17E0066	IM4	CLR	6.24	2	0.082	0.04	9.42	***40***
17E0067	IM4	CLR	6.24	2	0.081	0.04	9.42	***44***
17E0053	IM4	CLR	6.24	2	0.093	0.10	9.43	***32***
17E0054	IM4	CLR	6.24	2	0.092	0.11	9.43	***41***
17E0055	IM4	CLR	6.24	2	0.092	0.11	9.43	66
17E0056	IM4	CLR	6.24	2	0.088	0.03	9.43	***39***
17E0057	IM4	CLR	6.24	2	0.087	0.03	9.43	61
17E0058	IM4	CLR	6.24	2	0.087	0.03	9.43	***39***
17E0044	IM4	CLR	6.24	2	0.109	0.03	9.44	***43***
17E0045	IM4	CLR	6.24	2	0.108	0.03	9.44	***40***
17E0046	IM4	CLR	6.24	2	0.105	0.03	9.44	***28***
17E0047	IM4	CLR	6.24	2	0.104	0.03	9.44	***31***
17E0048	IM4	CLR	6.24	2	0.102	0.03	9.44	***33***
17E0049	IM4	CLR	6.24	2	0.101	0.04	9.44	***35***
17E0050	IM4	CLR	6.24	2	0.100	0.04	9.44	***37***
17E0051	IM4	CLR	6.24	2	0.099	0.04	9.44	***38***
17E0052	IM4	CLR	6.24	2	0.098	0.04	9.44	***28***
17E0021	IM4	CLR	6.24	2	0.470	0.03	9.62	***16***
17E0022	IM4	CLR	6.24	2	0.461	0.03	9.62	***15***
17E0023	IM4	CLR	6.24	2	0.464	0.03	9.62	***12***
17E0024	IM4	CLR	6.24	2	0.461	0.03	9.62	***21***
17E0025	IM4	CLR	6.24	2	0.448	0.03	9.62	***23***
17E0026	IM4	CLR	6.24	2	0.453	0.03	9.62	***18***
17E0027	IM4	CLR	6.24	2	0.461	0.03	9.62	***13***
17E0028	IM4	CLR	6.24	2	0.448	0.03	9.62	***17***
17E0029	IM4	CLR	6.24	2	0.453	0.03	9.62	***10***
25E0030	IM8	CLR	12.50	2	2.09	0.06	8.20	***34***
25E0031	IM8	CLR	12.50	2	2.08	0.06	8.20	***48***
25E0028	IM8	CLR	6.24	2	2.44	0.03	8.20	***48***
25E0029	IM8	CLR	6.24	2	2.68	0.03	8.20	62
25E0021	IM8	CLR	6.24	2	2.35	0.03	8.21	***44***
25E0022	IM8	CLR	6.24	2	3.18	0.03	8.21	***41***
25E0023	IM8	CLR	6.24	2	2.48	0.03	8.21	***39***
25E0024	IM8	CLR	6.24	2	2.37	0.03	8.21	77
25E0025	IM8	CLR	6.24	2	2.59	0.03	8.21	72
25E0026	IM8	CLR	6.24	2	3.08	0.03	8.21	***28***
25E0027	IM8	CLR	6.24	2	2.64	0.03	8.21	***32***
25E0020	IM8	CLR	6.24	2	2.46	0.03	8.22	72

Data used for GLL the SNR plots

25E0010	IM8	CLR	6.24	2	0.47	0.03	9.19	***37***
25E0005	IM8	CLR	6.24	2	0.43	0.03	9.21	***46***
17E0080	IM8	CLR	12.50	2	0.424	0.06	9.21	***21***
17E0081	IM8	CLR	12.50	2	0.425	0.06	9.21	***33***
17E0082	IM8	CLR	12.50	2	0.426	0.06	9.21	***48***
17E0083	IM8	CLR	12.50	2	0.427	0.06	9.21	***32***
17E0084	IM8	CLR	12.50	2	0.428	0.06	9.21	***19***
17E0085	IM8	CLR	12.50	2	0.429	0.06	9.21	***32***
17E0086	IM8	CLR	12.50	2	0.431	0.06	9.21	***47***
17E0087	IM8	CLR	12.50	2	0.431	0.06	9.21	***22***
17E0088	IM8	CLR	12.50	2	0.434	0.06	9.21	***44***
17E0089	IM8	CLR	12.50	2	0.434	0.06	9.21	***30***
17E0090	IM8	CLR	12.50	2	0.438	0.06	9.21	***36***
17E0091	IM8	CLR	12.50	2	0.438	0.06	9.21	***20***
17E0092	IM8	CLR	12.50	2	0.442	0.06	9.21	***25***
17E0093	IM8	CLR	12.50	2	0.442	0.06	9.21	***20***
17E0094	IM8	CLR	12.50	2	0.446	0.06	9.21	***24***
17E0095	IM8	CLR	12.50	2	0.446	0.06	9.21	***17***
17E0096	IM8	CLR	12.50	2	0.453	0.06	9.21	***37***
26E0007	IM8	CLR	12.50	2	0.209	0.13	9.31	***28***
26E0008	IM8	CLR	12.50	2	0.213	0.13	9.31	***22***
26E0009	IM8	CLR	12.50	2	0.217	0.13	9.31	***18***
11E0021	IM8	CLR	12.50	2	0.06	0.06	9.34	***28***
11E0022	IM8	CLR	12.50	2	0.06	0.06	9.34	***41***
11E0023	IM8	CLR	12.50	2	0.06	0.06	9.34	***44***
11E0024	IM8	CLR	12.50	2	0.07	0.06	9.34	***21***
11E0025	IM8	CLR	12.50	2	0.07	0.06	9.34	***23***
11E0026	IM8	CLR	12.50	2	0.07	0.06	9.34	***21***
11E0027	IM8	CLR	12.50	2	0.07	0.06	9.34	***19***
11E0028	IM8	CLR	12.50	2	0.07	0.06	9.34	***18***
26E0003	IM8	CLR	12.50	2	0.089	0.25	9.39	73
26E0004	IM8	CLR	12.50	2	0.092	0.24	9.39	58
26E0005	IM8	CLR	12.50	2	0.094	0.23	9.39	57
26E0006	IM8	CLR	12.50	2	0.096	0.22	9.39	54
26E0002	IM8	CLR	12.50	2	0.023	0.11	9.44	50
26E0001	IM8	CLR	12.50	2	0.021	0.08	9.45	***49***
E6E0070	IM8	CLR	12.5	2	0.043	0.06	9.47	18.4
E6E0070	IM8	CLR	12.5	2	0.043	0.06	9.47	18.4
E6E0071	IM8	CLR	12.5	2	0.042	0.06	9.47	18.1
E6E0072	IM8	CLR	12.5	2	0.041	0.06	9.47	18
E6E0073	IM8	CLR	12.5	2	0.041	0.06	9.47	28.8
E6E0074	IM8	CLR	12.5	2	0.04	0.06	9.47	28.7
E6E0050	IM8	CLR	12.5	2	0.108	0.06	9.51	25.5

Data used for GLL the SNR plots

E6E0051	IM8	CLR	12.5	2	0.107	0.06	9.51	24.4
E6E0052	IM8	CLR	12.5	2	0.106	0.06	9.51	24.1
E6E0053	IM8	CLR	12.5	2	0.104	0.06	9.51	27.9
14E0005	IM8	CLR	6.24	2	0.042	0.03	9.49	75
14E0006	IM8	CLR	6.24	2	0.041	0.03	9.49	75
14E0007	IM8	CLR	6.24	2	0.041	0.03	9.49	74
14E0008	IM8	CLR	6.24	2	0.040	0.04	9.49	74
14E0009	IM8	CLR	6.24	2	0.039	0.05	9.49	74
14E0010	IM8	CLR	6.24	2	0.040	0.03	9.49	85
14E0011	IM8	CLR	6.24	2	0.040	0.03	9.50	86
14E0012	IM8	CLR	6.24	2	0.039	0.03	9.50	91
14E0013	IM8	CLR	6.24	2	0.039	0.05	9.50	91
14E0014	IM8	CLR	6.24	2	0.038	0.06	9.50	84
14E0015	IM8	CLR	6.24	2	0.038	0.08	9.50	93
25E0001	IM8	CLR	12.50	2	0.18	0.06	9.49	***22***
25E0002	IM8	CLR	12.50	2	0.18	0.06	9.49	***21***
25E0003	IM8	CLR	12.50	2	0.18	0.06	9.49	***21***
11E0011	IM8	CLR	12.50	2	0.44	0.06	9.58	62
11E0012	IM8	CLR	12.50	2	0.44	0.06	9.58	50
11E0013	IM8	CLR	12.50	2	0.43	0.06	9.58	69
11E0014	IM8	CLR	12.50	2	0.44	0.06	9.58	***35***
11E0015	IM8	CLR	12.50	2	0.43	0.06	9.58	***49***
11E0016	IM8	CLR	12.50	2	0.43	0.06	9.58	***23***
11E0017	IM8	CLR	12.50	2	0.43	0.06	9.58	***29***
11E0018	IM8	CLR	12.50	2	0.43	0.06	9.58	***24***
11E0019	IM8	CLR	12.50	2	0.43	0.06	9.58	***39***
11E0020	IM8	CLR	12.50	2	0.43	0.06	9.58	51
E6E0024	IM8	CLR	12.5	2	0.356	0.06	9.63	29.9
E6E0025	IM8	CLR	12.5	2	0.353	0.06	9.63	61.4
17E0013	IM8	CLR	12.50	2	0.439	0.06	9.63	77
17E0014	IM8	CLR	12.50	2	0.440	0.06	9.63	***42***
17E0015	IM8	CLR	12.50	2	0.442	0.06	9.63	***41***
17E0016	IM8	CLR	12.50	2	0.446	0.06	9.63	***30***
17E0017	IM8	CLR	12.50	2	0.446	0.06	9.63	52
17E0018	IM8	CLR	12.50	2	0.443	0.06	9.63	70
17E0019	IM8	CLR	6.24	2	0.439	0.03	9.63	***28***
17E0020	IM8	CLR	6.24	2	0.441	0.03	9.63	***28***
E6E0020	IM8	CLR	12.5	2	0.362	0.06	9.64	32.5
E6E0021	IM8	CLR	12.5	2	0.361	0.06	9.64	28.4
E6E0021	IM8	CLR	12.5	2	0.361	0.06	9.64	28.4
E6E0022	IM8	CLR	12.5	2	0.358	0.06	9.64	54.3
E6E0023	IM8	CLR	12.5	2	0.357	0.06	9.64	50.5

Data used for GLL the SNR plots

17E0002	IM8	CLR	12.50	2	0.448	0.06	9.64	54
17E0003	IM8	CLR	12.50	2	0.446	0.06	9.64	***33***
17E0004	IM8	CLR	12.50	2	0.445	0.06	9.64	***44***
17E0005	IM8	CLR	12.50	2	0.443	0.06	9.64	59
17E0006	IM8	CLR	12.50	2	0.442	0.06	9.64	***32***
17E0007	IM8	CLR	12.50	2	0.440	0.06	9.64	***45***
17E0008	IM8	CLR	12.50	2	0.439	0.06	9.64	***47***
17E0009	IM8	CLR	12.50	2	0.439	0.06	9.64	***28***
17E0010	IM8	CLR	12.50	2	0.438	0.06	9.64	***36***
17E0011	IM8	CLR	12.50	2	0.438	0.06	9.64	66
17E0012	IM8	CLR	12.50	2	0.438	0.06	9.64	***40***
14E0035	IM8	CLR	12.50	2	0.335	0.06	9.69	***33***
14E0036	IM8	CLR	12.50	2	0.337	0.06	9.69	***36***
14E0037	IM8	CLR	12.50	2	0.338	0.06	9.69	***19***
14E0038	IM8	CLR	12.50	2	0.336	0.06	9.69	***37***
14E0039	IM8	CLR	12.50	2	0.338	0.06	9.69	***27***
14E0040	IM8	CLR	12.50	2	0.339	0.06	9.69	***23***
14E0041	IM8	CLR	12.50	2	0.338	0.06	9.69	***32***
14E0042	IM8	CLR	12.50	2	0.339	0.06	9.69	***25***
14E0043	IM8	CLR	12.50	2	0.341	0.06	9.69	***24***
14E0044	IM8	CLR	6.24	2	0.455	0.03	9.76	***48***
14E0045	IM8	CLR	6.24	2	0.454	0.03	9.76	70
14E0046	IM8	CLR	6.24	2	0.454	0.03	9.76	59
14E0047	IM8	CLR	6.24	2	0.459	0.03	9.76	***37***
14E0048	IM8	CLR	6.24	2	0.460	0.03	9.76	62
14E0049	IM8	CLR	6.24	2	0.458	0.03	9.76	***24***
14E0050	IM8	CLR	6.24	2	0.462	0.03	9.76	***33***
14E0051	IM8	CLR	6.24	2	0.463	0.03	9.76	***30***
14E0052	IM8	CLR	6.24	2	0.469	0.03	9.76	***33***
14E0053	IM8	CLR	6.24	2	0.467	0.03	9.76	***32***
G7E0010	IM8	CLR	6.24	2	6.38	0.03	13.84	174.80
G7E0010	IM8	CLR	6.24	2	6.38	0.03	13.84	174.80
10E0100	IM8	CLR	62.5	4	145.08	0.31	92.54	63.00
10E0101	IM8	CLR	62.5	4	145.08	0.31	92.54	62.90
10E0102	IM8	CLR	62.5	4	145.08	0.31	92.54	62.90
10E0103	IM8	CLR	395.83	4	162.28	1.97	92.54	90.40
10E0104	IM8	CLR	395.83	4	162.28	1.97	92.54	90.40
10E0105	IM8	CLR	395.83	4	162.29	1.97	92.54	90.40
10E0110	IM8	CLR	95.83	4	145.25	0.47	92.58	74.30
10E0111	IM8	CLR	95.83	4	145.25	0.47	92.58	74.30
10E0112	IM8	CLR	95.83	4	145.25	0.47	92.58	74.20

Data used for GLL the SNR plots

10E0113	IM8	CLR	529.17	4	206.87	2.64	92.58	90.40
10E0114	IM8	CLR	529.17	4	206.87	2.64	92.58	90.40
10E0115	IM8	CLR	529.17	4	206.88	2.64	92.58	90.40
10E0120	IM8	CLR	95.83	4	145.826	0.47	92.98	68.6
10E0121	IM8	CLR	95.83	4	145.826	0.47	92.98	68.7
10E0122	IM8	CLR	95.83	4	145.826	0.47	92.98	68.7
10E0123	IM8	CLR	529.17	4	208.754	2.64	92.98	90.4
10E0124	IM8	CLR	529.17	4	208.748	2.64	92.98	90.4
10E0125	IM8	CLR	529.17	4	208.741	2.64	92.98	90.4
12E0038	IM8	clr	6.24	2		0.04	114	22.5
12E0039	IM8	clr	6.24	2		0.05	116	23.2
12E0041	IM8	clr	6.24	2		0.12	116	26.8
12E0040	IM8	clr	6.24	2		0.09	118	23.9
12E0042	IM8	clr	6.24	2		0.15	118	32.3
12E0089	IM8	clr	6.24	2		0.03	156	31.6
12E0091	IM8	clr	6.24	2		0.03	157	53.0
12E0092	IM8	clr	6.24	2		0.03	157	81.3
12E0044	IM8	clr	6.24	2		0.05	158	90.5
12E0090	IM8	clr	6.24	2		0.03	158	32.8