HStrayWG mtg#4 - MOM

Herschel/HSC/MOM/1378

Göran Pilbratt, 29 March 2009

The fourth meeting of the Herschel Straylight Characterisation Working Group (HStrayWG#4) took place in ESTEC, Noordwijk on 27 Feb 2009 with two people participating via a video and a telephone link, respectively. The meeting started at 09:15 hours and finished at 16:00 hours.

The draft minutes were circulated on 10 Mar 2009, comments from UK and JF and a few improvements were incorporated in the final minutes.

Attendance

Bruno Altieri (BA)
Dominic Doyle (DD)
Marc Ferlet (MF)
Jackie Fischer (JF) - by video from NRL
Ulrich Klaas (UK) - by phone from MPE
Koryo Okumura (KO)
Göran Pilbratt (GLP)

1. Welcome and Agenda

- GLP asked for additional comments on the circulated draft agenda *(attached as Appendix 1)*. No further comments were provided, the agenda was adopted for the meeting.

2. Review of actions

HStrayWG3-Action#

1. Clarify whether the standard SPIRE/PACS parallel mode is adequate for PACS straylight characterisation (cf. Sec.3). Actionee: KO. Deadline: 10 Feb 2009.

CLOSED. Report circulated on 5 Feb 2009 *(attached as Appendix 2)*. In order to cover PACS requirements for straylight 2x2 deg in parallel mode we need to perform the measurement 3 times, thus 3 times 3 hours of observations. SPIRE data taken this way are sufficient for the SPIRE requirements. If PACS was observing in ‘prime’ (rather than ‘parallel’) mode it still would take 3 x 3 hours, thus by observing in parallel mode we get SPIRE ‘for free’. Both SPIRE and PACS would want a strong close to point-like source for this observation, the planets (Mars, Jupiter, Saturn, Uranus, Neptune) are suitable.

Note: As raised by UK the relative centres of the three maps need to be specified.

2. Perform ASAP calculations for PACS and SPIRE photometer FOVs (cf. Sec.4). Actionee: MF. Deadline: 10 Feb 2009.

CLOSED. See agenda point 3.

3. Systematically review all the existing CPV observations, modify, and identify additional observations as required in the context of straylight characterisation for the PACS photometer (cf. Sec.5). Actionee: KO. Deadline: 25 Feb Jan 2009.

CLOSED. See agenda point 4.

4. Systematically review all the existing CPV observations, modify, and identify additional observations as required in the context of straylight characterisation for SPIRE (cf. Sec.5). Actionee: MF. Deadline: 25 Feb Jan 2009.

CLOSED. See agenda point 5.

5. Systematically review all the existing CPV observations, modify, and identify additional observations as required in the context of straylight characterisation for the PACS spectrometer (cf. Sec.5). Actionee: UK. Deadline: 25 Feb Jan 2009.

CLOSED. See agenda point 6.

6. Summarise the properties of the three different kapton materials employed in a written note (cf. Sec.5). Actionee: DD. Deadline: 10 Feb 2009.

CLOSED. DD circulated the required information on 23 Jan 2009 *(attached as Appendix 3)*. DD has samples of these materials now, samples will be sent to JF for transmission measurements *(Action_4-1 on DD)*, she expects that to be accomplished on a timescale of about a month *(Action_4-2 on JF)*.

7. Suggest final report TOC. Actionee: GLP. Deadline: 25 Feb 2009.

CLOSED. See agenda point 7.

8. Review the list of actions in the draft MOM. Actionee: all. Deadline: 4 Feb 2009.

CLOSED. Final minutes were issued on 9 Feb 2009.

3. Review result of Action_3-2: MF

- Perform ASAP calculations for PACS and SPIRE photometer FOVs

Report circulated on 20 Feb 2009, with an update on 24 Feb 2009 *(attached as Appendix 4)*. The ~20Mrays correspond to sampling the M1 every ~0.5 mm which is fully adequate for SPIRE, and considered acceptable for PACS. It is important to realise that the total power for particular paths is spread out, thus in order to 'collect' the 'total straylight power' an extended source filling the 'spot' is required.

The data from the ASAP runs is available and can be provided by MF on request. MF will look to into putting it on a TWiki-type site.

4. Review result of Action_3-3: KO

- Systematically review all the existing CPV observations, modify, and identify additional observations as required in the context of straylight characterisation for the PACS photometer.

In the current PACS PV plan, a 3.8 hr straylight PACS observation (PACS only) is included, it will be modified for parallel mode to cover both PACS and SPIRE as discussed under point 2 action#3/1. (The current observation is of Mira which is approximately the same strength as Neptune - a couple of 100 Jy for PACS.)

For the rest there is nothing of interest for the HStrayWG in the current plan. The additional observations required to cover the needs for straylight characterisation of the PACS photometer will be listed in the HStrayWG report.

5. Review result of Action_3-4: MF

- Systematically review all the existing CPV observations, modify, and identify additional observations as required in the context of straylight characterisation for SPIRE.

In addition to the inside of the FOV of SPIRE and the parallel mode observation already discussed, MF expects that information can be derived from a combination of existing PV plan observations. The additional observations required to cover the needs for straylight characterisation of SPIRE will be listed in the HStray-WG report.

6. Review result of Action_3-5: UK

- Systematically review all the existing CPV observations, modify, and identify additional observations as required in the context of straylight characterisation for PACS spectrometer.

UK provided the following overview on PACS spectrometer straylight observations currently planned in the Commissioning Phase (COP) and Performance Verification Phase (PVP).

Ghosts (inside instrument FOV straylight):

50 x 50 chopped raster, raster step size = 2.5", chopper throw = 3' (also used for distortion assessment)

PVSpecSpatial_413_414_nStd_50x50RC_00_Neptune_0001 47686s

not yet scheduled, since Neptune is not visible for major part of PVP.

Close to instrument FOV (inside - or close to - telescope FOV) straylight:

Chopped scan maps, scan speed 3"/s, 15' leg, 31 legs with 30" separation 5 stripes each centered on position with Jupiter and with Jupiter moved away

PVSpecSpatial_415_nStd_Sca_Jupiter_Stripe1_0001 2224s

PVSpecSpatial_415_nStd_Sca_Jupiter_Stripe2_0001 2234s

PVSpecSpatial_415_nStd_Sca_Jupiter_Stripe3_0001 2234s

PVSpecSpatial_415_nStd_Sca_Jupiter_Stripe4_0001 2214s

PVSpecSpatial_415_nStd_Sca_Jupiter_Stripe5_0001 2224s

PVSpecSpatial_415_nStd_Sca_WO_Jupiter_Stripe1_0001 2224s

PVSpecSpatial_415_nStd_Sca_WO_Jupiter_Stripe2_0001 2234s

PVSpecSpatial_415_nStd_Sca_WO_Jupiter_Stripe3_0001 2234s

PVSpecSpatial_415_nStd_Sca_WO_Jupiter_Stripe4_0001 2214s

PVSpecSpatial_415_nStd_Sca_WO_Jupiter_Stripe5_0001 2224s

As stated in Response to HStrayWG2-Action#2, the design and orientation of the stripes would be optimised following straylight results with the PACS photometer camera. Jupiter is anyhow not visible for major part of the PVP.

Self-emission:

OD0022 (then current day of cryo-cover opening) medium resolution scan

CPSpecMisc_IST410_nStdWaveCal_FilA_na_0001 1584s

CPSpecMisc_IST410_nStdWaveCal_FilB_na_0001 1584s

[There are identical reference measurements during PACS Full Functional Test, when cryo-cover is still closed (currently OD0017):

CPFFT_IST410_nStdWaveCalNoChop_FilA_na_0001 1584s

CPFFT_IST410_nStdWaveCalNoChop_FilB_na_0001 1584s]

There are currently no further measurements foreseen. One could consider putting further measurements of this type onto OD0032 (COP) and onto OD0063 (PVP).

[GLP note in proof: Post the HStrayWG mtg#4 it has been established that the cryo-cover will be opened at a physical telescope temperature of 120 K. The cryo-cover opening in the meantime has been pushed further into the mission beyond OD22. In HCOP timeline build 1_0_02 opening is on 2 Jun for a 29 Apr launch.]

6b. (Far) outside the field of view characterisation discussion

Discussion about putting a source in a ‘sore spot’. Need a strong ‘relatively small’ source, but smaller than ‘spot size’. Possible sources are Moon, the planets Mars, Jupiter, Saturn, Uranus, Neptune, the galaxies M82, NGC253, and possibly some others. The benefit of a planet is that the spot can be verified as a straylight spot when the planet moves wrt the telescope. Otherwise to verify this it has to be checked when the observatory orbit has moved such that the relative positions of the telescope and bright source are different (not always possible).

BA will start looking into how such observations actually could be planned in time and geometry. BA will discuss with the mission planning people in HSC. *(Action_4-3 on BA)*

For the strongest spots (the three pairs of two) caused by the hexapod legs the Moon is out of range, but for the hexapod ‘lines’ and nearby ‘spots’ (caused by the barrel) in principle the Moon could be used.

We will need to address to details of these observations, sizes of ‘fields’, depths of observations, etc.

- Regarding the size of fields GLP reminded the meeting that Philippe Martin had previously estimated that his predictions of where in the sky the ‘sore spots’ are had errors of a few arcmin. This is actually small compared to the size of the spots. The plan is to perform 2x2 deg parallel mode maps placing the straylight sources in the centre of the sore spots.
- Standard observation is 2x2 deg parallel mode 3 hours observation which basically brings us to the SPIRE confusion limit (1σ).

It was pointed out that the hexapod is ‘better defined’ in terms of its optical properties (since it is taped with VDA kapton), than the barrel is (which is covered by SLI); thus it is likely that the predictions for location in the sky is better for reflections in the hexapod compared to from the barrel structure.

It was also agreed that the existing simulation data should be extracted and ‘blown up’ (in effect we should ‘zoom in’) to cover a field approx 5 deg around the boresight. The reason is to assess the possible straylight problem in connection with observing crowded fields e.g. the galactic centre. MF will do this. *(Action_4-4 on MF)*

7. Review result of Action_3-7: GLP

- Suggest final report TOC

The circulated TOC was discussed *(attached as Appendix 5)*. The way forward is for everyone to provide input, GLP will provide a consolidation of inputs for commenting, and based on the comments a consolidated first draft will be produced and circulated. By incorporating comments on the draft report the final report can be produced. GLP will circulate an updated TOC based on the discussion held today. *(Action_4-5 on GLP)*

There was a short discussion on the tools/formats to be used for the production of the final report; LaTeX and Word were mentioned. GLP will use Framemaker to produce the report; any reasonable format such as Word, OpenOffice, and plain text from your favourite editor are acceptable input formats; GLP will produce a PDF document and Word files for commenting. Initial inputs are due on Monday 16 Mar 2009.

8. Next meetings

No meeting scheduled. Will consider the need for telecons/meetings at the time of producing the report.

9. Action review

- Open old ones (should be none!)
- New actions

10. AOB

None.

GLP thanked everyone, especially Jackie given her local time of the day, for participating in the meeting and closed it.

List of Actions - HStrayWG#4-Action#

1. Send material samples to JF for transmission measurements (cf. Sec.2). Actionee: DD. Deadline: 6 Mar 2009
2. Perform transmission measurements (cf. Sec.2). Actionee: JF. Deadline: 16 Apr 2009
3. Start looking into how far outside the telescope FOV straylight observations, involving fixed and/or solar system objects, could be planned in time and geometry, and discuss with the mission planning people in HSC (cf. Sec.6). Actionee: BA. Deadline: 16 Mar 2009.
4. The existing simulation data should be extracted and 'blown up' (in effect we should 'zoom in') to cover a field approx 5 deg around the boresight. (cf. Sec.6). Actionee: MF. Deadline: 16 Mar 2009.
5. Circulate an updated final report TOC (cf. Sec.7). Actionee: GLP. Deadline: 2 Mar 2009.

List of Appendices - HStrayWG#4-Appendix#

1. Draft agenda
2. Clarify whether the standard SPIRE/PACS parallel mode is adequate for PACS straylight characterisation by KO
3. Provide the properties of the three different kapton materials employed by DD
4. Report on ASAP for outside the telescope FOV for PACS and SPIRE FOVS by MF (*with extra material provided after the meeting closing Action_4-4*)
5. Final report TOC input by GLP (*with update provided after the meeting closing Action_4-5*)

Appendix 1

DRAFT agenda for HStrayWG#4

ESTEC room Aj030, Noordwijk, 27 Feb 2009, 09:15-16:00 hours

1. Welcome and agenda - GLP

2. Actions review - GLP
   - HStrayWG#3 actions closure

3. Review result of Action_3-2: MF
   - Perform ASAP calculations for PACS and SPIRE photometer FOVs

4. Review result of Action_3-3: KO
   - Systematically review all the existing CPV observations, modify, and identify additional observations as required in the context of straylight characterisation for the PACS photometer

5. Review result of Action_3-4: MF
   - Systematically review all the existing CPV observations, modify, and identify additional observations as required in the context of straylight characterisation for SPIRE

6. Review result of Action_3-5: UK
   - Systematically review all the existing CPV observations, modify, and identify additional observations as required in the context of straylight characterisation for PACS spectrometer

7. Review result of Action_3-7: GLP
   - Suggest final report TOC

8. Next meetings

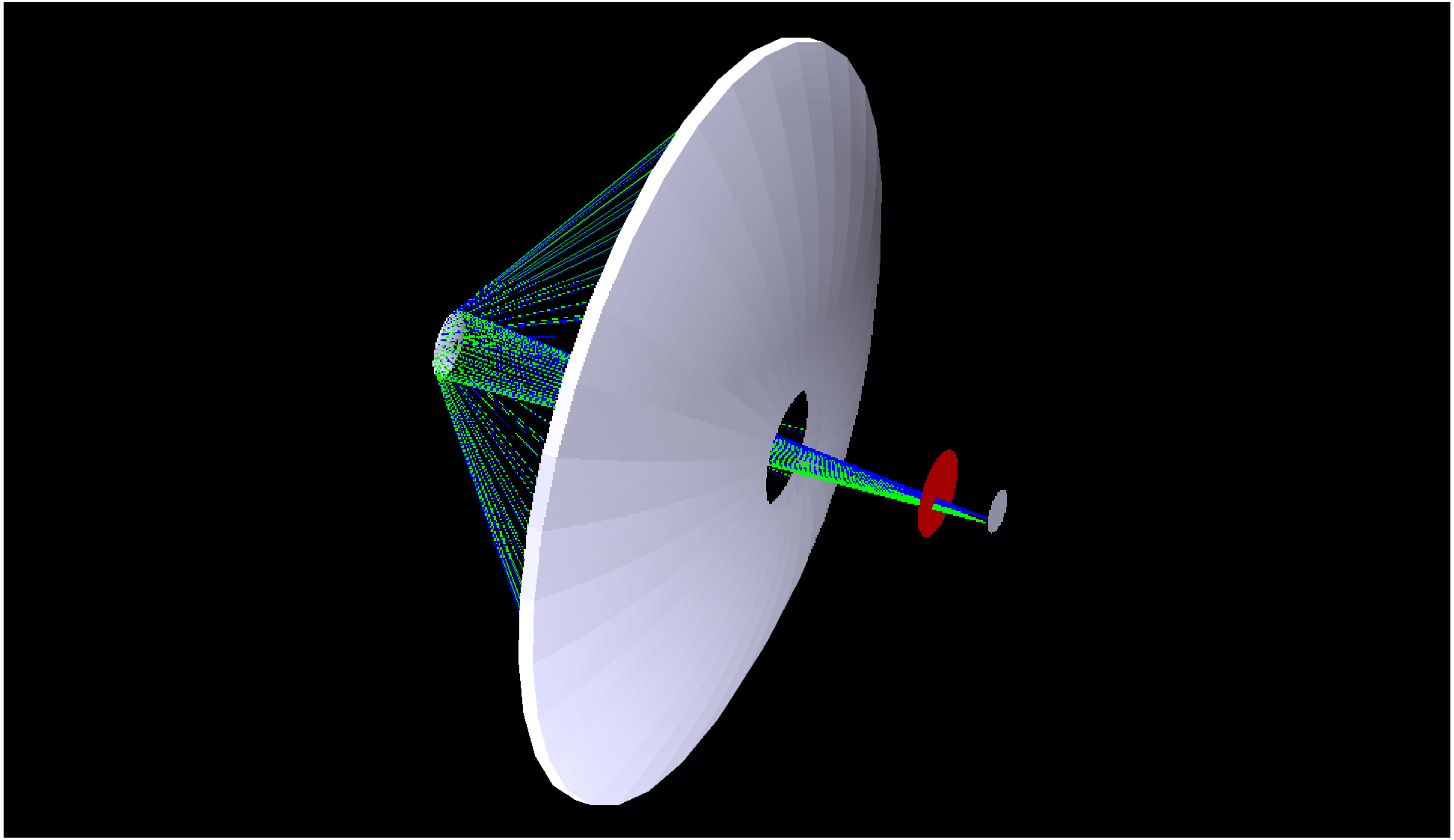
9. Action review
   - Open old ones (should be none!)
   - New actions

10. AOB
    - You tell me

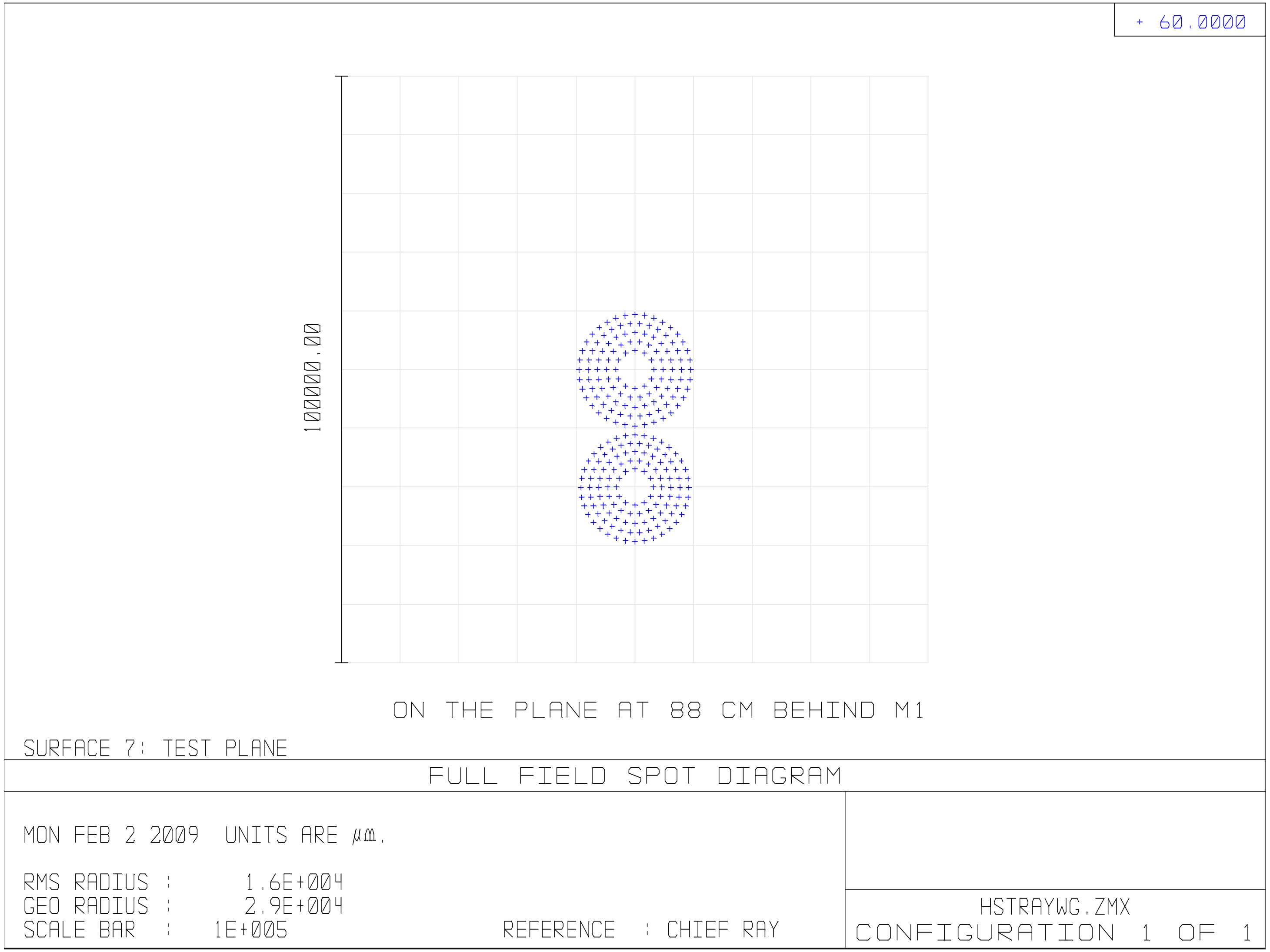
Completeness assessment of a scan map in parallel mode to check the stray light arising from the area between 2 instrument apertures

K. Okumura
With inputs from
Marc Ferlet and Norbert Geis
(February 5 2009)

Point source beams from a separation corresponding to the minimum distance of 2 scans in parallel mode (155 arcsec)

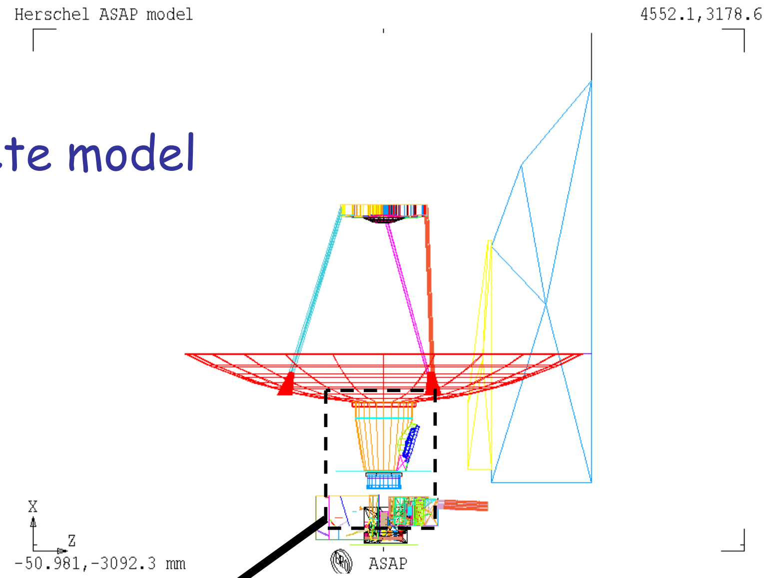


If the beam encounters an scattering surface further than 88 cm behind M1, the parallel mode scan can miss it.

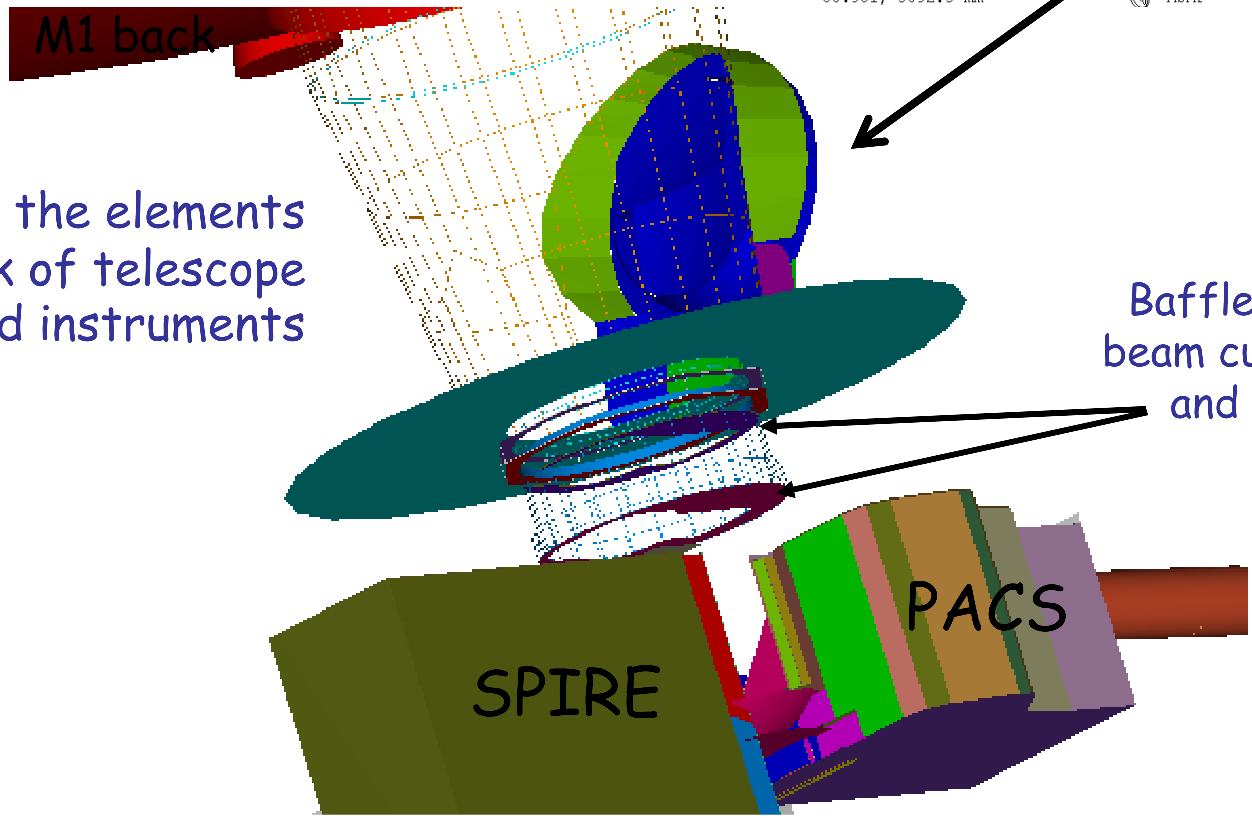


Marc Ferlet's input showing mainly between M1 and instruments

Complete model

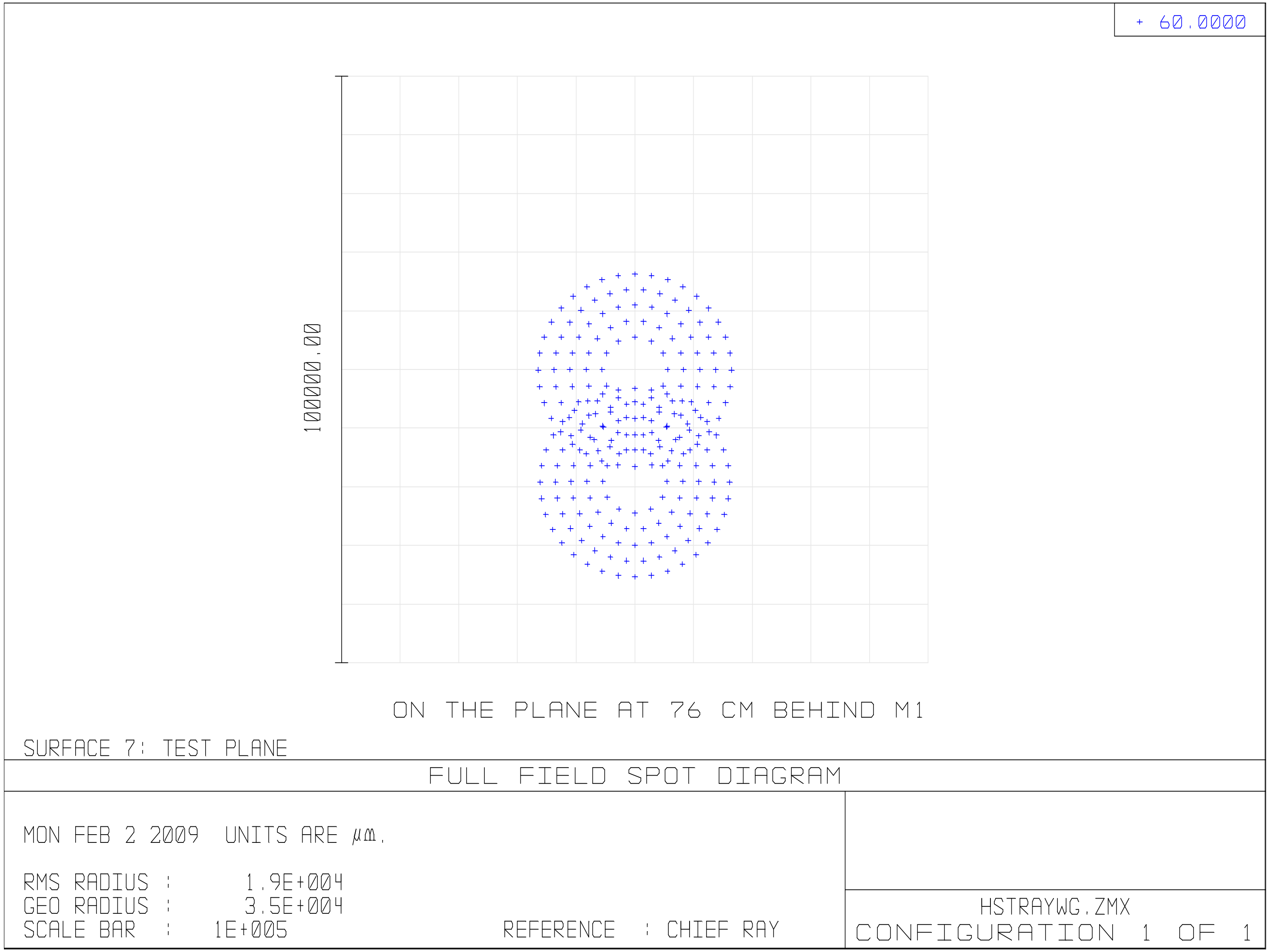


Zoom-in on the elements between back of telescope M1 and instruments



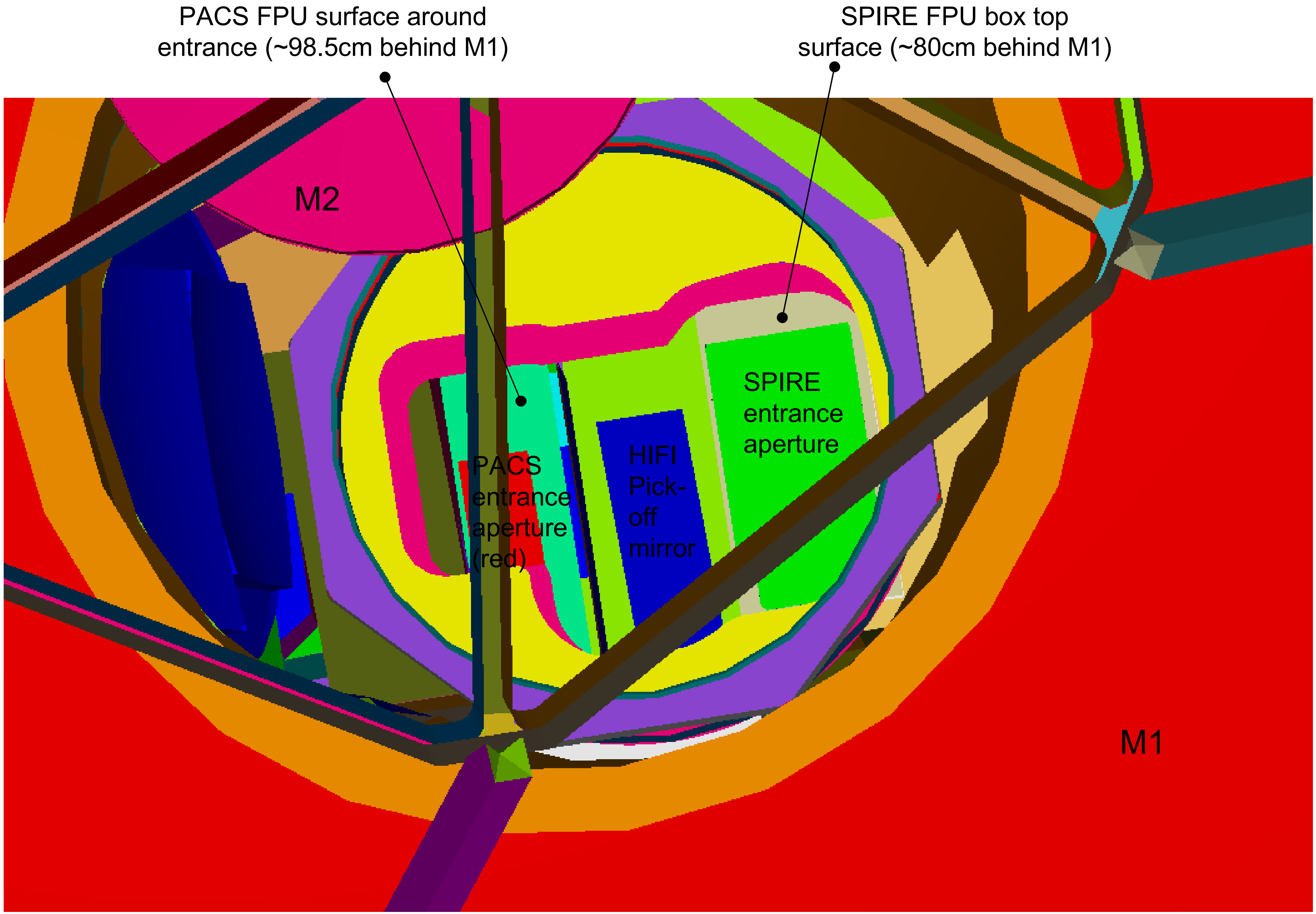
Baffle with composite beam cut-out at ~66cm and ~76cm from M1 respectively

But if the furthest surface behind M1 is at 76cm as the ASAP model suggest (see Marc Ferlet), then the beam can well sample this surface.



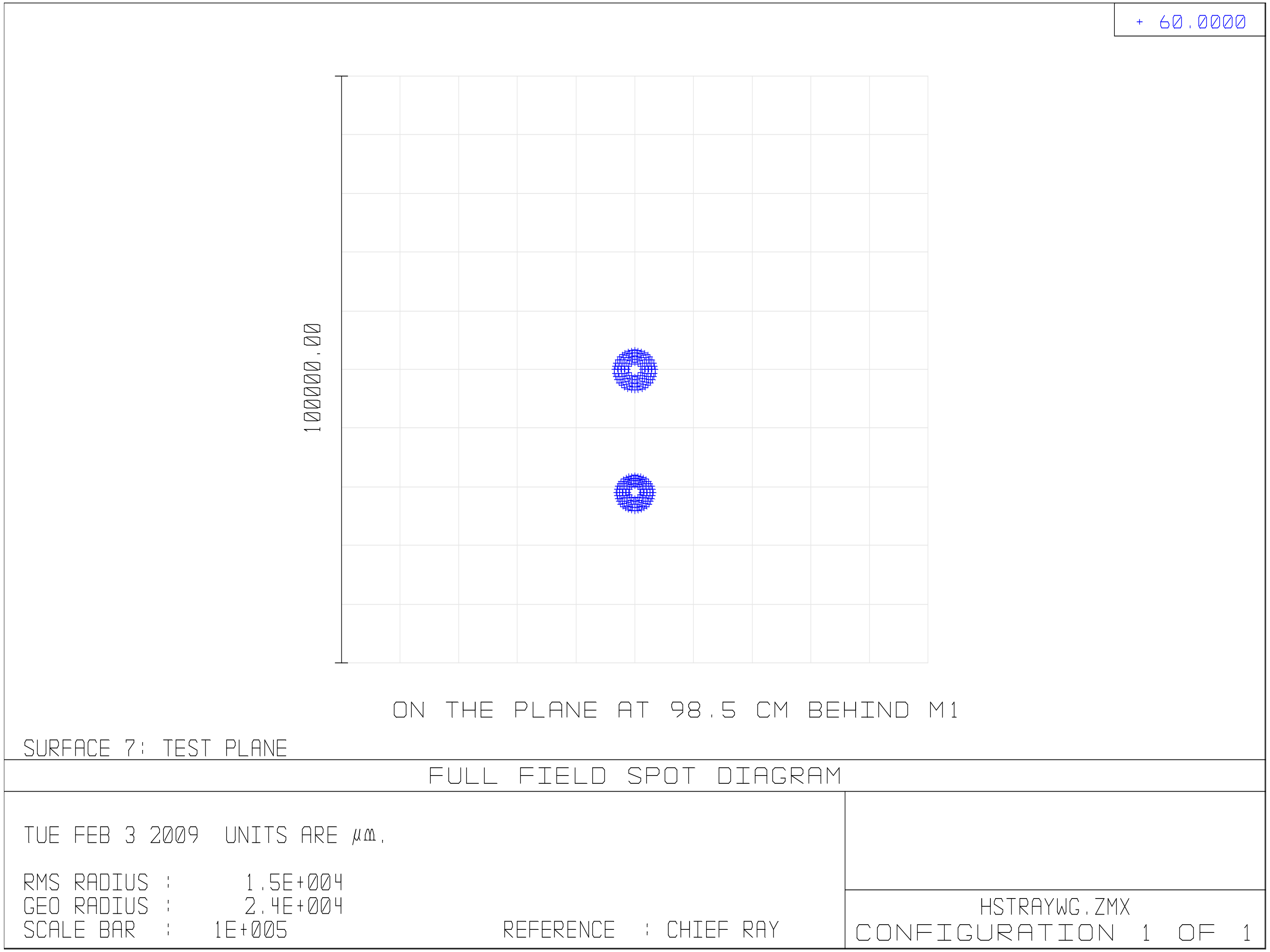
However, within these baffles, the beam goes through between 2 instrument apertures and encounters other further surfaces

- If the intervening surface furthest from M1 is 76 cm, the parallel mode scanning can well sample the stray light space.
- But, if a beam can reach directly the instrument boxes between PACS and HIFI or between SPIRE and HIFI, the beam size at this level can be critically small and a single scan map in parallel mode may miss some surfaces. (see next ASAP model view from M. Ferlet).



PACS FPU surface around entrance (~98.5cm behind M1)
SPIRE FPU box top surface (~80cm behind M1)
M2
SPIRE entrance aperture
PACS entrance aperture (red)
HIFI Pick-off mirror
M1

If the beam encounter a surface at 98.5cm behind M1, the beam between 2 scans in parallel mode can not sample correctly this surface



Possible surfaces the beam can encounter around the PACS aperture is quite near the focal bowl, so indeed rather far from M1 (PACS IIDB p.52, N.Geis)

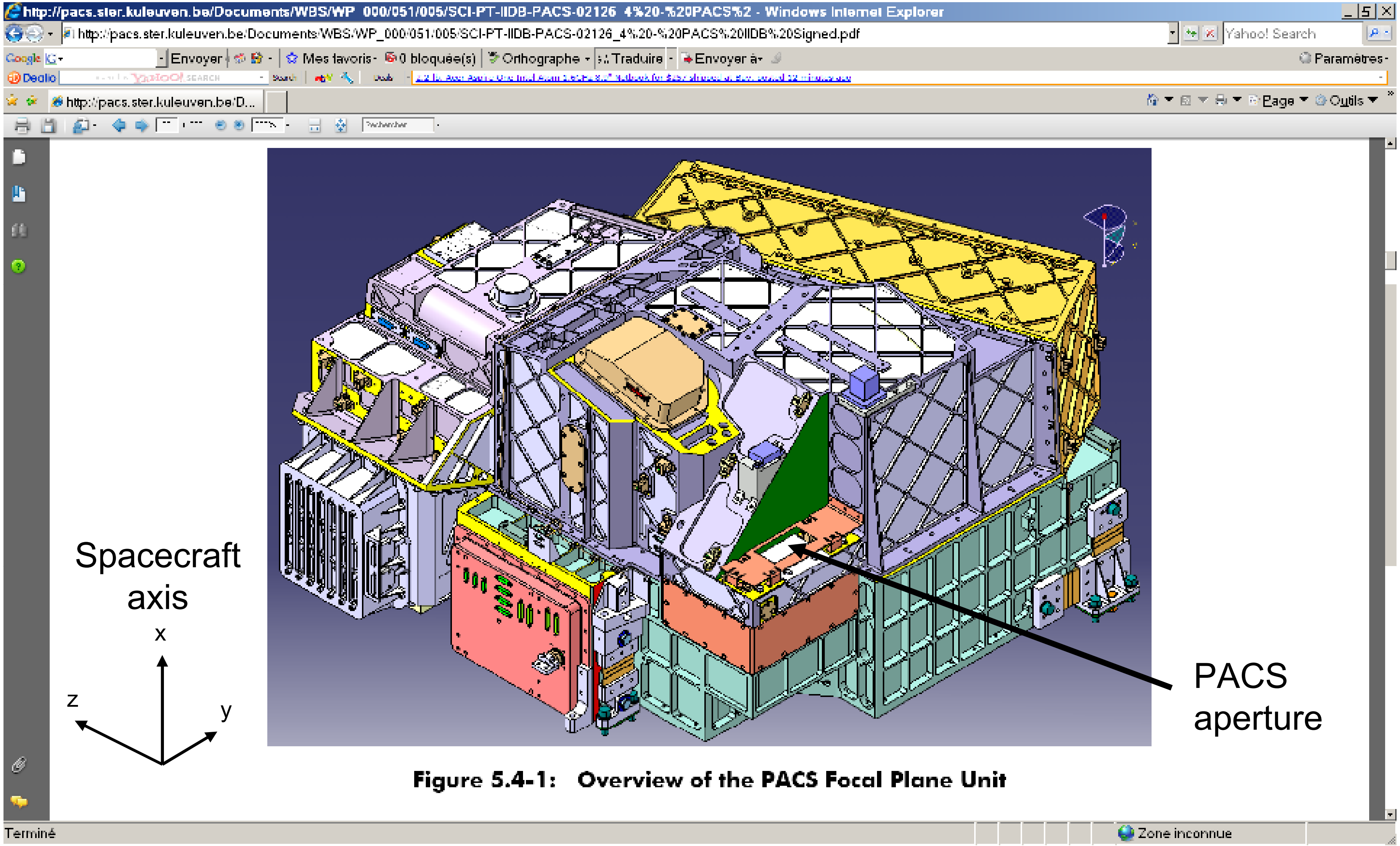
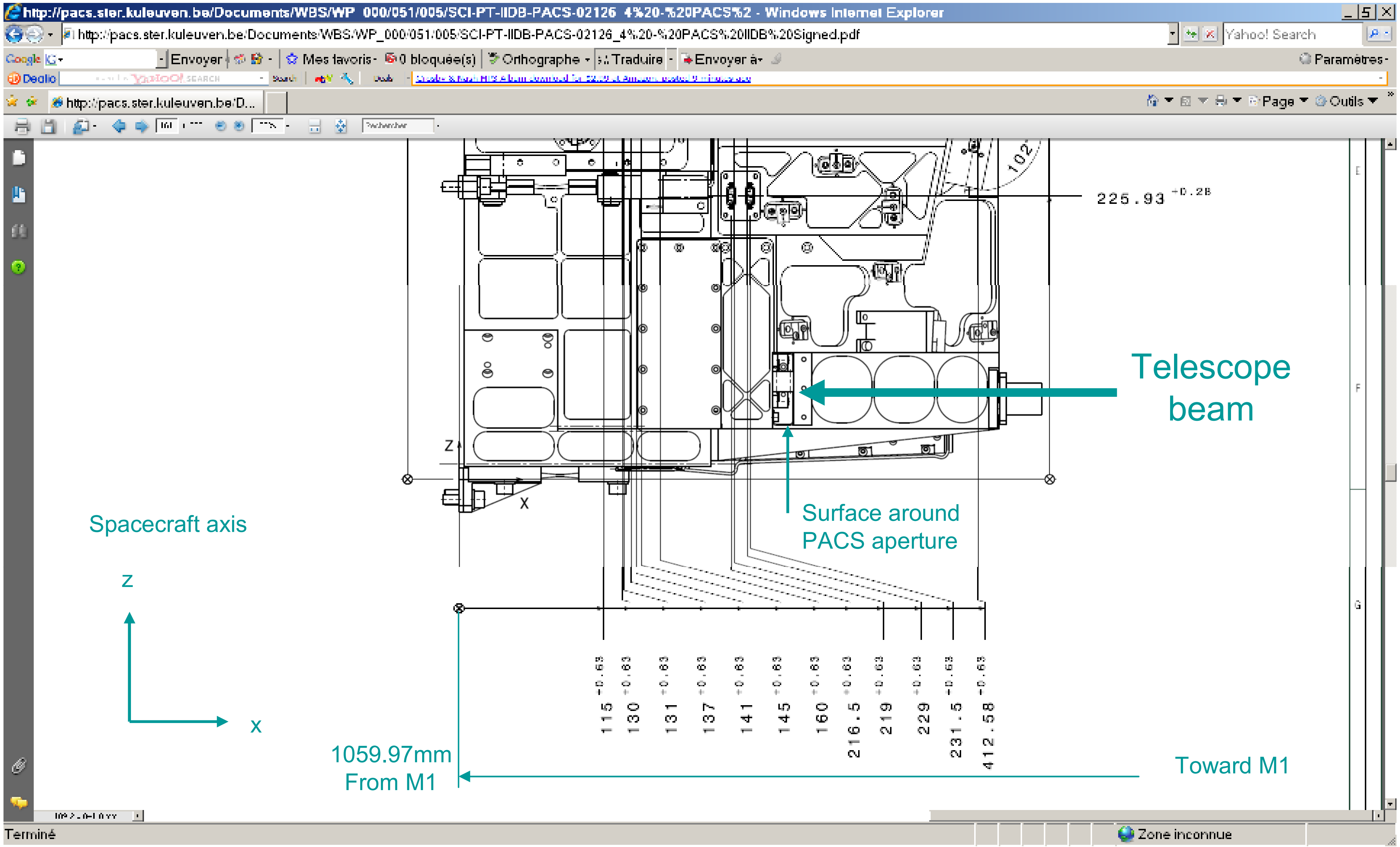
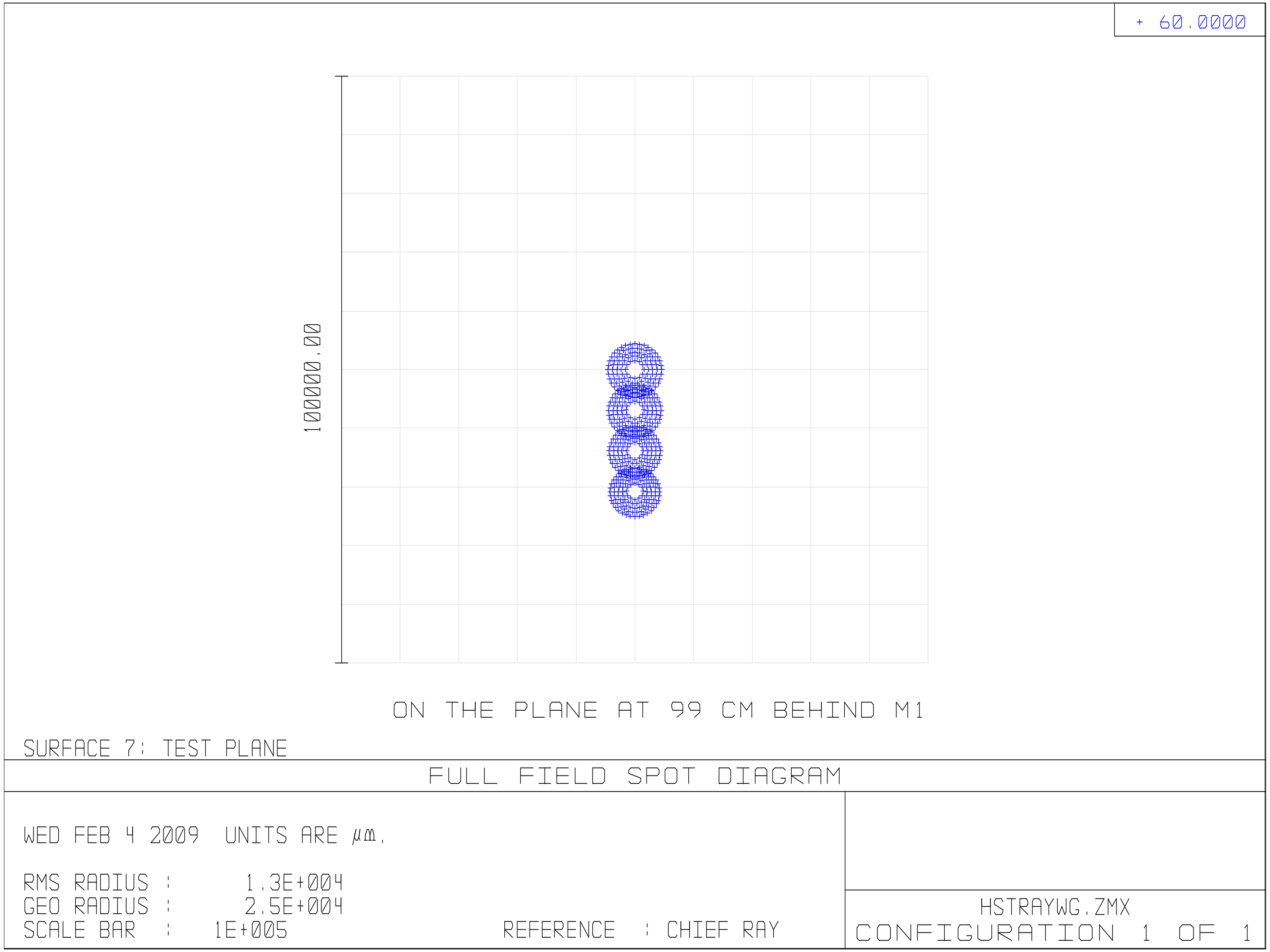


Figure 5.4-1: Overview of the PACS Focal Plane Unit

PACS aperture is about 99cm from M1
(PACS IIDB p.161 and according to N.Geis)



If 3 parallel scan maps are carried out in such a way to fill the gap between 2 scans of one map, the point source beam can spatially sample correctly until 99cm behind M1



Conclusions

- There are surfaces further than 88cm from M1 around PACS aperture.
- The beam can miss surfaces with a single parallel scanning at least between PACS and HIFI.
- In order to sample correctly all the known surfaces which encounter directly the beam, we need 2 additional parallel scans to fill the scan distance of 155 arcsec.
- This conclusion is based on the PACS aperture, which may be the worst of the 3 instruments, but HIFI aperture is not known to us for now.
- Doing 3 parallel mode scans is time consuming.
- We will need a trade off between sampling and sensitivity of the measurements.

3M

Aluminum Foil Tape

425 • 427 (Linered)

Technical Data

Product Description

A 5-mil nominal dead Soft aluminum foil backing combined with a transparent acrylic adhesive. 427 tape offers an easy-release film liner. Can be used indoors or out for many long term applications.

Product Construction

Backing	Adhesive	Color	Liner	Standard Roll Length
Dead soft aluminum	Acrylic	Shiny silver	Easy-release paper	60 yds. (55 m)

Typical Physical Properties

Note: The following technical information and data should be considered representative or typical only and should not be used for specification purposes.

			ASTM Test Method
Adhesion to Steel: Tape	425	47 oz./in. width (51 N/100 mm)	D-3330
	427	50 oz./in. width (55 N/100 mm)	
Tensile Strength:	425/427	30 lbs./in. width (525 N/100 mm)	D-3759
Backing Thickness:	425/427	2.8 mils (0.07 mm)	D-3652
Total Tape Thickness:	425/427	4.6 mils (0.12 mm)	D-3652
Liner Thickness:	427	3.1 mils (0.08 mm)	D-3652
Elongation at Break:	425/427	8%	D-3759
Temperature Use Range:		-65° to 300°F (-54° to 149°C)	
Water Vapor Transmission Rate:	425/427	0.1g H_2O/100 sq. in./24 hrs. (1.55 g/m^2/.24 hrs.)	D-3833
Approximate Weight:	425/427	0.115 lbs./yd./in. width (4.77 gms/m/24 mm)	

General Information

- Flame resistant. Meets U.L. 764C and 723, Class "L" low flammability rating (File R 7311).
- Can be certified to meet SAE-AMS-T-23397 and L-T-80B.
- Meets requirements of F.A.R. 25.853(a).
- The very low moisture vapor transmission rate makes 425 and 427 tapes a good sealant.
- The acrylic adhesive combined with the durable aluminum backing offers ideal properties for long serviceable life both indoors and out.
- Good candidate as a maskant in electroplating of aluminum because it will not contaminate the bath.
- Aluminum backing provides excellent reflection of both heat and light.
- Performance range from -65° to 300°F (-54° to 150°C). Higher temperatures for shorter periods.
- Best results obtained when applied to a clean, dry surface above 32°F (0°C).

IMPORTANT: The 3M™ Aluminum Foil Tape 425 and 427 (Linered) are not intended for medical usage. Neither 3M nor the Food and Drug Administration have evaluated or reviewed this tape for medical application. 3M does not recommend or endorse the usage of the aluminum tape for medical application. User assumes all risk and liability whatsoever in connection with usage of product in a medical application.

Aluminum Foil Tape

425 • 427 (Linered)

Shelf Life

To obtain best performance, use this product within 24 months from date of manufacture and store under normal conditions of 60º to 80ºF (16º to 27ºC) and 40 to 60% R.H. in the original carton.

Application Ideas

- Aircraft paint stripping maskant.
- Moisture barrier in "white goods" appliances.
- General purpose heat reflector and heat dissipator.
- Mechanically hold wires and cooling coils in "white goods" appliances.
- Repair tears on truck trailers and aircraft.
- Splicing of thin gauge foils.
- General purpose holding, patching, sealing applications – indoors and out.

Features

Features	Advantages	Benefits
• Aluminum foil backing	• Long term protection	• Helps protect parts from water, dust or chemical damage
	• Heat reflective	• Helps protect parts from heat
	• Flame resistant	• Will not support combustion
• Acrylic adhesive	• Long aging	• Helps reduce need for replacing

Technical Information and Data

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P-224 AMB

1 MIL KAPTON® POLYIMIDE FILM

Acrylic Adhesive, Amber, UL-510

P-224 is a thin, highly conformable tape with high thermal rating and exceptionally high dielectric strength with excellent solvent and Freon resistance. This product is a perfect non-silicone product for fixing Lithium Ion Batteries and a fine choice as bar code over laminate.

Features

- Provides unique properties of polyimide tapes: Boasts unique combination of thinness, conformability, tear resistance and high adhesion.
- Excellent solvent and Freon resistance of its thermosetting acrylic adhesive permits its use in hermetic motor applications and for insulating and protecting components subjected to Freon-type cleaning agents.
- High performance Kapton® backing ensures consistent quality.

Product Construction

Kapton® Polyimide Film
Adhesive Layer

Application

- Well suited for continuous high temperature operating conditions.
- Offers high thermal rating and exceptionally high dielectric strength with excellent solvent and Freon resistance.
- P-224's thinness and conformability, in combination with tear resistance and high adhesion, make it ideal for wrapping around small diameters and holding fine magnet wire.
- Used for a wide array of insulating and holding functions in the manufacture of high reliability relays, chokes, toroids, transformers, reactors and solenoids used in computer and data processing, aerospace, and military equipment.

Properties

Backing material	1-mil Kapton® polyimide film	
Adhesive	Acrylic, thermosetting	
Color	Amber	
	Imperial	**Metric**

Insulation Class	155°C	155°C
Total Tape Thickness	2.9 mils	0.074 mm
Tensile Strength	36 lbs/in	63 N/10 mm
Elongation	85%	85%
Adhesion to Steel	37 oz/in	4.0 N/10 mm
Dielectric Strength	7,000 volts	7.0 kV

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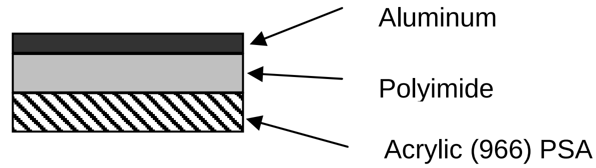
*__CAUTION:__ The above are typical values and should not be used in writing specifications. Customer is responsible to ensure product meets intended application requirements before approved for use.

UL component Recognition Guide OANZ2, File E20392, CSA C-22.2. RoHS Compliant.

PRODUCT BULLETIN



First Surface Aluminum Coated Polyimide Tape with 966 Acrylic Adhesive

Sheldahl's first surface aluminized polyimide tape with 966 adhesive is used whenever a low emittance and low solar absorptance surface is needed. The 966 acrylic adhesive is nominally 2.3 mils thick, provides a strong bond with low outgassing, and can be used over a moderate temperature range. These tapes may be bonded to structures to reduce radiative heat transfer. They can also be used on multilayer insulation blankets to close the edges or repair rips in the outer layers.

This product may be ordered with 0.5, 1, or 2 mil thick polyimide that conforms to the requirements of ASTM D-5213. The aluminum coating is nominally 1000 Å thick. Although the standard widths for this tape are 1, 2, 3, and 4 inches, it may be ordered in any width needed. Each roll is 108 feet (33 m) long.

PRODUCT CHARACTERISTICS

Parameter (independent of film thickness)	Specified Value
Solar absorptance (α)	$\leq$ 0.14
Hemispherical emittance (ε_H)	$\leq$ 0.035
Normal emittance (ε_N)	$\leq$ 0.035
Typical α/ε	4 - 5
Adhesion to stainless steel	$\geq$ 20 oz./inch of width
Intermittent temperature range	-185° C to 230° C (-300° F to 450° F)[A]
Continuous temperature range	-60° C to 120° C (-75° F to 250° F)[A]

[A] Zero peel strength of acrylic pressure sensitive adhesive is at about –45°C (-50°F).

Standard Item Number	Thickness mil (μm)	Typical Weight (g/m^2)	Item Number if Perforated
146390	0.5 (12.5)	81	TBD
146385	1.0 (25)	98	146386
146389	2.0 (51)	133	TBD

POST PROCESSING – PERFORATING & COVERLAY

This product may be processed after metalizing and combining the adhesive to the film to enhance its functionality. We offer a standard perforation pattern with 0.76 mm (0.03 in.) diameter holes on 6.35 mm (0.25 in.) centers, with a nominal 1.1% open area. We can also place a coverlay on the tape to protect it from accidental damage during handling and application.

SHELF LIFE

This product shall meet specified values for a minimum of 12 months after the date of shipment provided that the material is stored in its original unopened container at normal interior temperatures (10° C to 27° C / 50° F to 80° F).

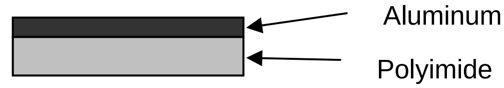
OLD PART NUMBERS

Sheldahl's old designation for this product family was G4010XX. The tables below give a translation between the old and new numbers.

Standard Part Numbers		Thickness	Perforated Part Numbers	
Old	**New**		**Old**	**New**
G401000	146385	1.0 mil	G401001	146386
G401020	146389	2.0 mil	G401021	TBD
G401060	146390	0.5 mil	G401061	TBD

Sheldahl manufactures a broad range of vacuum deposited films, laminates and tapes. Ask for additional product bulletins describing other Sheldahl products.

PRODUCT BULLETIN



Aluminum Coated (One Side) Polyimide

Sheldahl's family of polyimide films that are aluminized on one side can be used as either first or second surface mirrors, and are often used in multi-layer insulation (MLI) blankets when a wide temperature range is desired. When used as a first surface mirror, these products provide low emittance and low solar absorptance. When used as a second surface mirror, these products have moderate absorptance and moderate emittance, and the polyimide film gives them an amber or gold color.

This product may be ordered with 0.3, 0.5, 1, 2, 3, or 5 mil thick polyimide that conforms to the requirements of ASTM D-5213. The aluminum coating is nominally 1000 Å thick, and the most common width is 48 inches (1.22 m).

PRODUCT CHARACTERISTICS

Parameter (independent of film thickness)	Specified Value
First surface solar absorptance (α)	$\leq$ 0.14
First surface hemispherical emittance (ε_H)	$\leq$ 0.035
First surface normal emittance (ε_N)	$\leq$ 0.035
Typical first surface α/ε	4 - 5
Aluminum surface resistivity	$\leq$1 Ω/square
Intermittent temperature range	-250° C to 400° C (-420° F to 750° F)
Continuous temperature range	-250° C to 290° C (-420° F to 550° F)

Standard Item Number	Thickness mil (μm)	Second Surface Mirror Properties			Typical Weight (g/m^2)	Item Number if Perforated
		α	ε_N	ε_H		
146455	0.3 (8)	$\leq$ 0.35	$\geq$ 0.40	$\geq$ 0.40	11	160478
146454	0.5 (12.5)	$\leq$ 0.36	$\geq$ 0.50	$\geq$ 0.52	19	TBD
146446	1.0 (25)	$\leq$ 0.39	$\geq$ 0.62	$\geq$ 0.64	36	160013
146448	2.0 (51)	$\leq$ 0.44	$\geq$ 0.71	$\geq$ 0.75	71	159946
146450	3.0 (76)	$\leq$ 0.46	$\geq$ 0.77	$\geq$ 0.81	109	160824
146452	5.0 (127)	$\leq$ 0.49	$\geq$ 0.81	$\geq$ 0.89	181	TBD

POST PROCESSING – PERFORATING & EMBOSSING

This product may be processed after metalizing to enhance its functionality. The film may be perforated to facilitate air passage during launch. Sheldahl's standard perforating patterns are given below.

Hole Diameter	Open Area
0.045 inch (1.14 mm)	0.5%, 1.0%, 1.1%,
0.051 inch (1.30 mm)	0.02%, 0.21%
0.059 inch (1.50 mm)	0.27%, 0.54%, 0.9%, 1.0%, 2.1%, 2.8%
0.125 inch (3.18 mm)	0.08%
0.187 inch (4.75 mm)	0.12%

Materials may also be embossed to provide separation between the layers of an MLI blanket instead of, or in addition to, using fabric spacer layers.

SHELF LIFE

This product shall meet specified values for a minimum of 12 months after the date of shipment provided that the material is stored in its original unopened container at normal interior temperatures (10° C to 27° C / 50° F to 80° F).

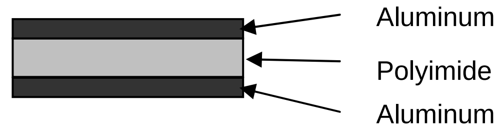
OLD PART NUMBERS

Sheldahl's old designation for this product family was G4051XX. The tables below give a translation between the old and new numbers.

Standard Part Numbers		Thickness	Perforated Part Numbers	
Old	New		Old	New
G405110	146446	1.0 mil	G405114	160013
G405120	146448	2.0 mil	G405124	159946
G405130	146450	3.0 mil	G405134	160824
G405150	146452	5.0 mil	G405154	TBD
G405160	146454	0.5 mil	G405164	TBD
G405170	146455	0.3 mil	G405174	160478

Sheldahl manufactures a broad range of vacuum deposited films, laminates and tapes. Ask for additional product bulletins describing other Sheldahl products.

![SHELDAHL]



PRODUCT BULLETIN

Aluminum Coated (Two Sides) Polyimide

Sheldahl's family of polyimide films that are aluminized on both sides can be used as first surface mirrors, and are often used in multi-layer insulation (MLI) blankets when a wide temperature range is desired. These products provide low emittance and low solar absorptance.

This product may be ordered with 0.3, 0.5, 1, 2, 3, or 5 mil thick polyimide that conforms to the requirements of ASTM D-5213. The aluminum coating is nominally 1000 Å thick, and the most common width is 48 inches (1.22 m).

PRODUCT CHARACTERISTICS

Parameter (independent of film thickness)	Specified Value
Solar absorptance (α)	≤ 0.14
Hemispherical emittance (ε_H)	≤ 0.035
Normal emittance (ε_N)	≤ 0.035
Typical α/ε	4 - 5
Aluminum surface resistivity	≤ 1 Ω/square
Intermittent temperature range	-250° C to 400° C (-420° F to 750° F)
Continuous temperature range	-250° C to 290° C (-420° F to 550° F)

Standard Item Number	Thickness mil (µm)	Typical Weight (g/m^2)	Item Number if Perforated
146426	0.3 (8)	11	160090
146424	0.5 (12)	19	160028
146417	1.0 (25)	36	159281
146419	2.0 (51)	71	161411
146421	3.0 (76)	109	161344
146423	5.0 (127)	181	TBD

POST PROCESSING – PERFORATING & EMBOSSING

This product may be processed after metalizing to enhance its functionality. The film may be perforated to facilitate air passage during launch. Sheldahl's standard perforating patterns are given below.

Hole Diameter	Open Area
0.045 inch (1.14 mm)	0.5%, 1.0%, 1.1%,
0.051 inch (1.30 mm)	0.02%, 0.21%
0.059 inch (1.50 mm)	0.27%, 0.54%, 0.9%, 1.0%, 2.1%, 2.8%
0.125 inch (3.18 mm)	0.08%
0.187 inch (4.75 mm)	0.12%

Materials may also be embossed to provide separation between the layers of MLI blankets instead of, or in addition to, using fabric spacer layers.

SHELF LIFE

This product shall meet specified values for a minimum of 12 months after the date of shipment provided that the material is stored in its original unopened container at normal interior temperatures (10° C to 27° C / 50° F to 80° F).

OLD PART NUMBERS

Sheldahl's old designation for this product family was G4024XX. The tables below give a translation between the old and new numbers.

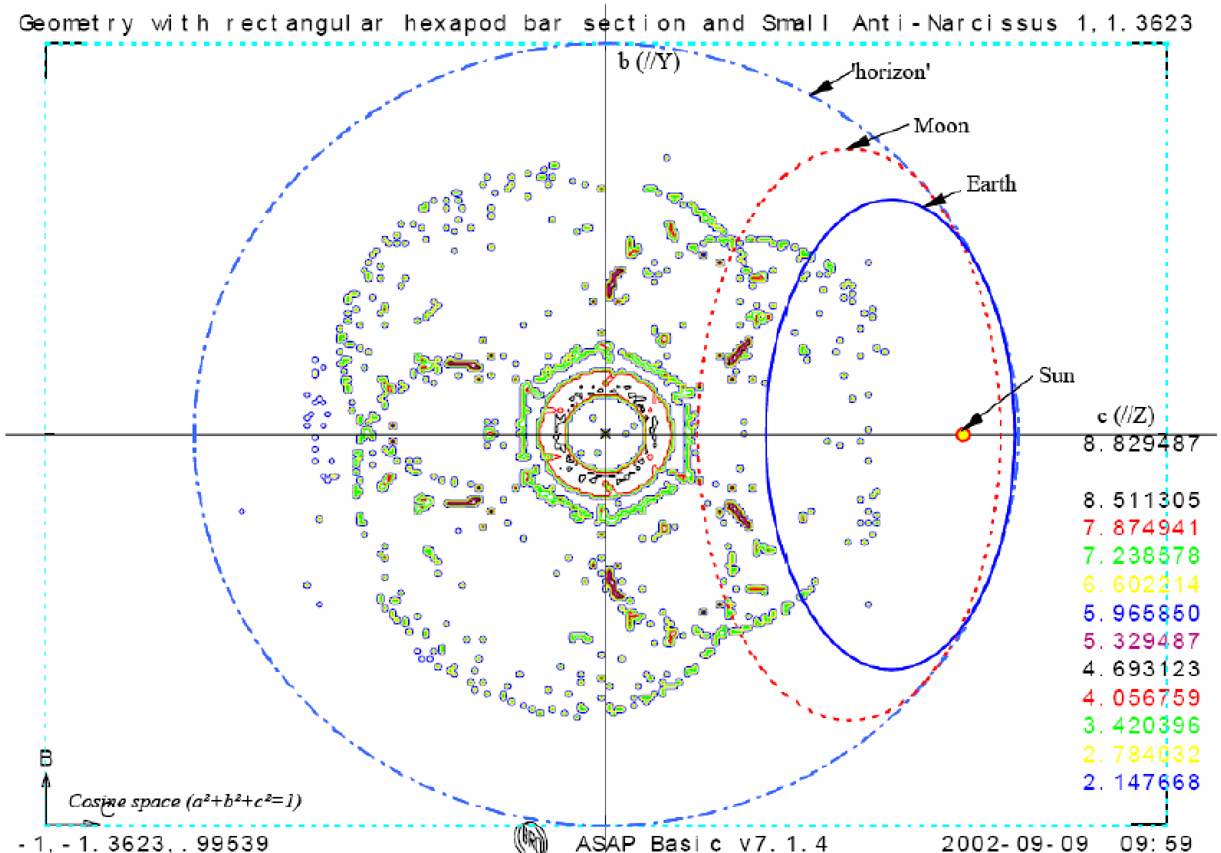
Standard Part Numbers		Thickness	Perforated Part Numbers	
Old	New		Old	New
G402410	146417	1.0 mil	G402414	159281
G402420	146419	2.0 mil	G402424	161411
G402430	146421	3.0 mil	G402434	161344
G402450	146423	5.0 mil	G402454	TBD
G402460	146424	0.5 mil	G402464	160028
G402470	146426	0.3 mil	G402474	160090

Herschel out-of-field simulations with ASAP

Marc Ferlet (STFC-RAL/SSTD, last update: 02/03/09)

Introduction

• **Aims:** simulating the Herschel telescope wide-angle hemispherical geometric (i.e. no convolution by any diffraction patterns) pattern based on official most up-to-date optical model (under ASAP) in order to provide wherever possible updated (i.e. compared to nominal results from 2002, see below) and quantified results



Assumptions

• Use of most recent ASAP model "H_iss4_2006.inr" (assumed associated with Ph. Martin et al.'s SPIE 2008 paper) delivered by Dominic Doyle (ESA)

• Model run as-is once with settings for FM, reduced HIFI model (to speed up), simplified SPIRE surface reflectivity model (to speed up) and set for moon/earth case hence assumed ok for out-of-field straylight simulations runs then generated model geometry used for out-of-field simulations based on dedicated script

• Ray/source set-up:

- based on uniform grid of rays (with central blockage for SPIRE because of PCAL) at telescope pupil (M2) with focus at the PACS and SPIRE reference FoV centre in telescope focal plane => for backward raytrace from instruments

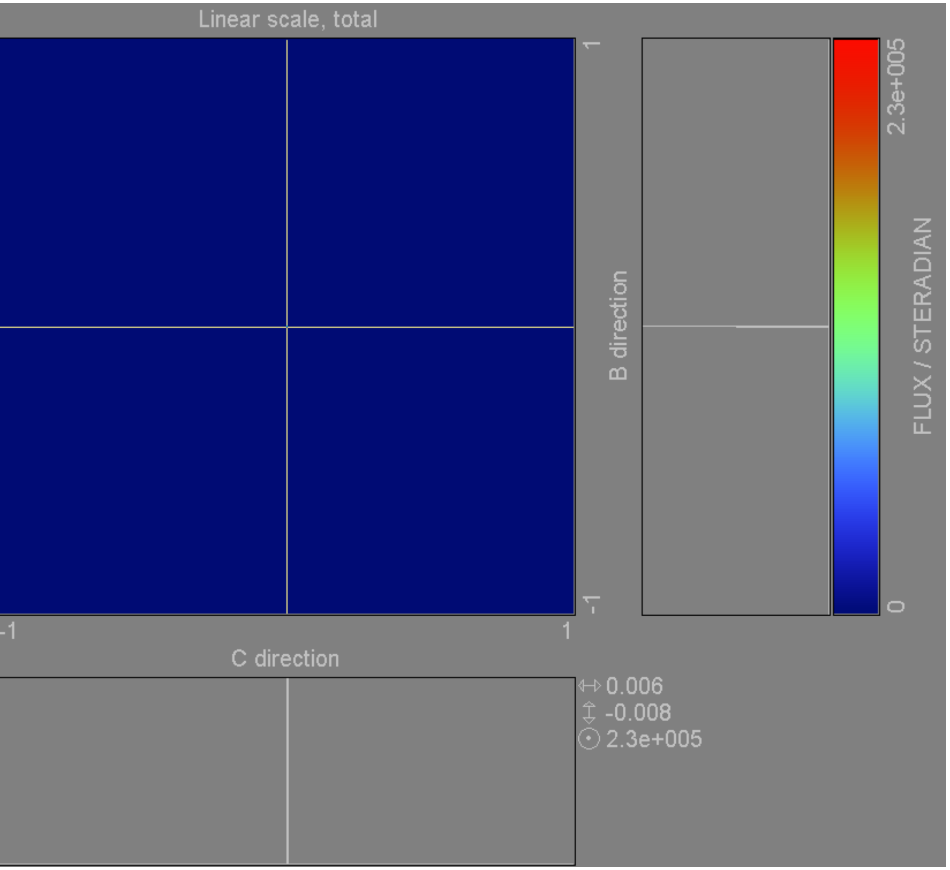
- normalised in power at creation to 1 and only specular paths (no scattering)

- incremental number of rays used: to check stability/representativity fo features; max nb per source ~19.5M rays leading to temporary ray datafile of 3.6Gb generated and to be handled/accessed for each analysis (possibility to increase source ray number ~x4 but fastest run, raytrace only, then expected >6hours minimum if no crash)

Results (linear scale)

The specular in-field path: major contributor as expected (fortunately…)

Not too impressive in linear scale…



Path	Rays	SumTO	Percent	Hits	Curr	Prev	Split/Scatter ...
2	18093940	1.0E+00	95.0	-4	443	52	0.000
3	554197	2.6E-02	2.5	-5	443	52	0.000
157	118212	5.7E-03	0.5	-4	443	86	0.000
10	53318	2.4E-03	0.2	-8	443	52	0.000
37	40534	1.8E-03	0.2	-7	443	52	0.000
69	37290	1.7E-03	0.2	-6	443	25	0.000
22	30523	1.4E-03	0.1	-5	443	12	0.000
476	30261	1.4E-03	0.1	-5	443	18	0.000
538	30207	1.4E-03	0.1	-5	443	9	0.000
167	29948	1.4E-03	0.1	-5	443	21	0.000
524	29795	1.4E-03	0.1	-5	443	24	0.000
32	29563	1.4E-03	0.1	-5	443	15	0.000
9	28413	1.3E-03	0.1	-6	443	52	0.000
1	23027	1.1E-03	0.1	-3	443	76	0.000

566	19233528	1.1E+00					

566 = total nb of paths found; only the one contributing $>10^{-3}$ of the initial power are listed here

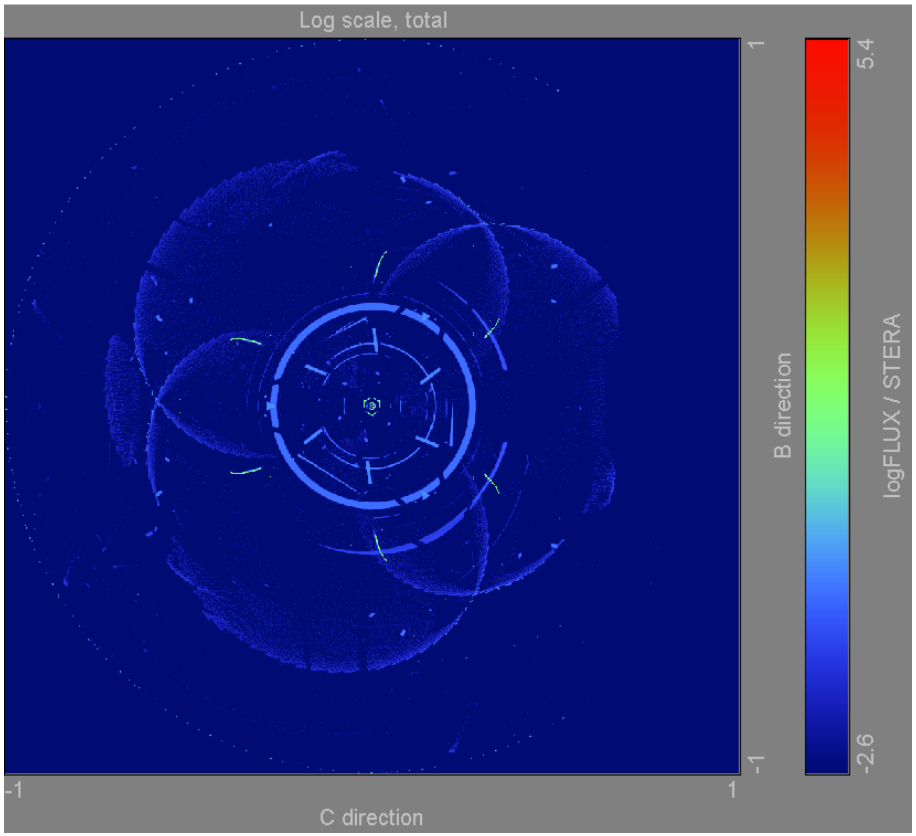
(note that $1/\sqrt{N_{total}}$~2.3E-4 so all of the above are statistically relevant)

Results (log scale)

…. better visualization in log scale.

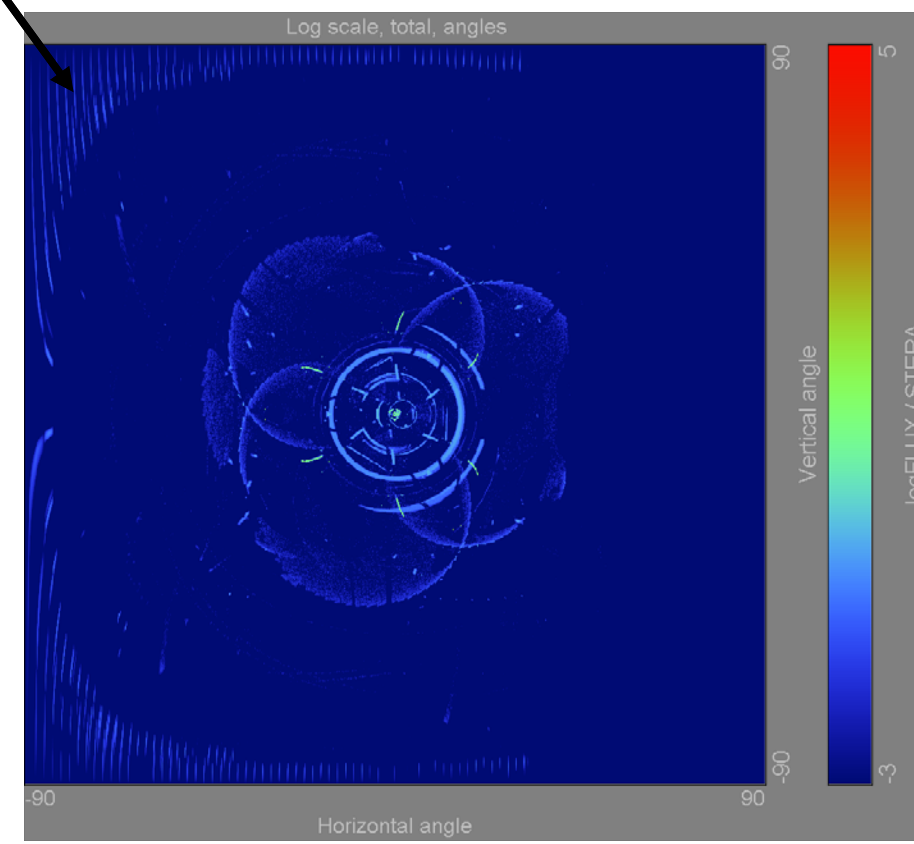
NB: this is for SPIRE FoV centre

Artefacts of the conversion in angles at very large angle from boresight; not relevant



In direction cosine space

(image is 961x961 pixels)

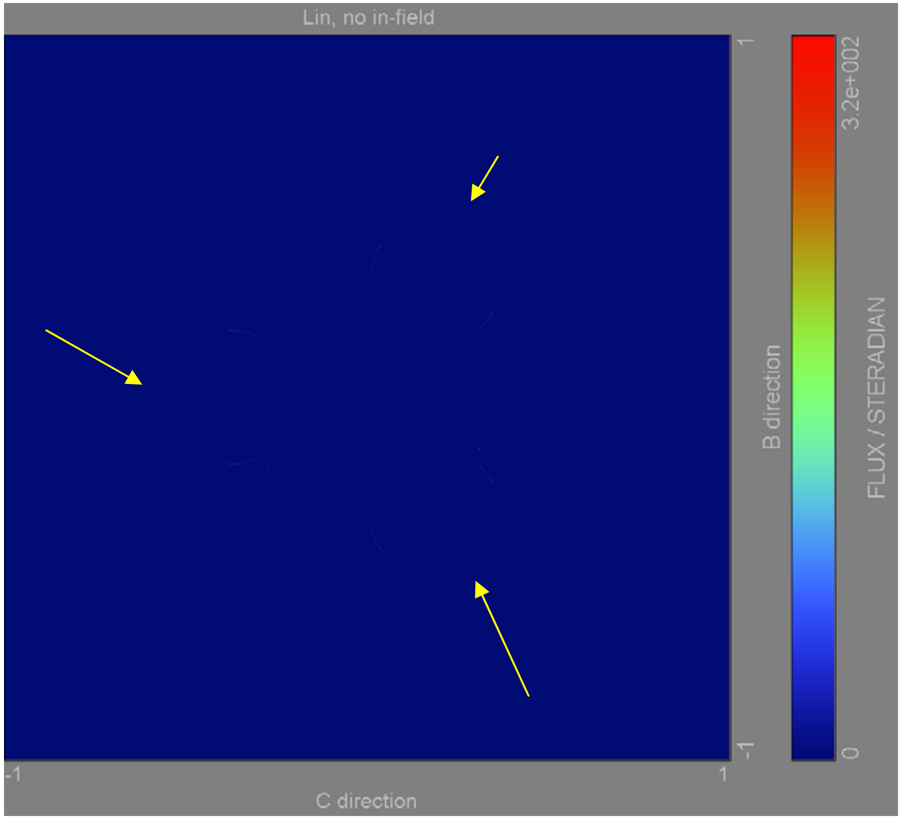


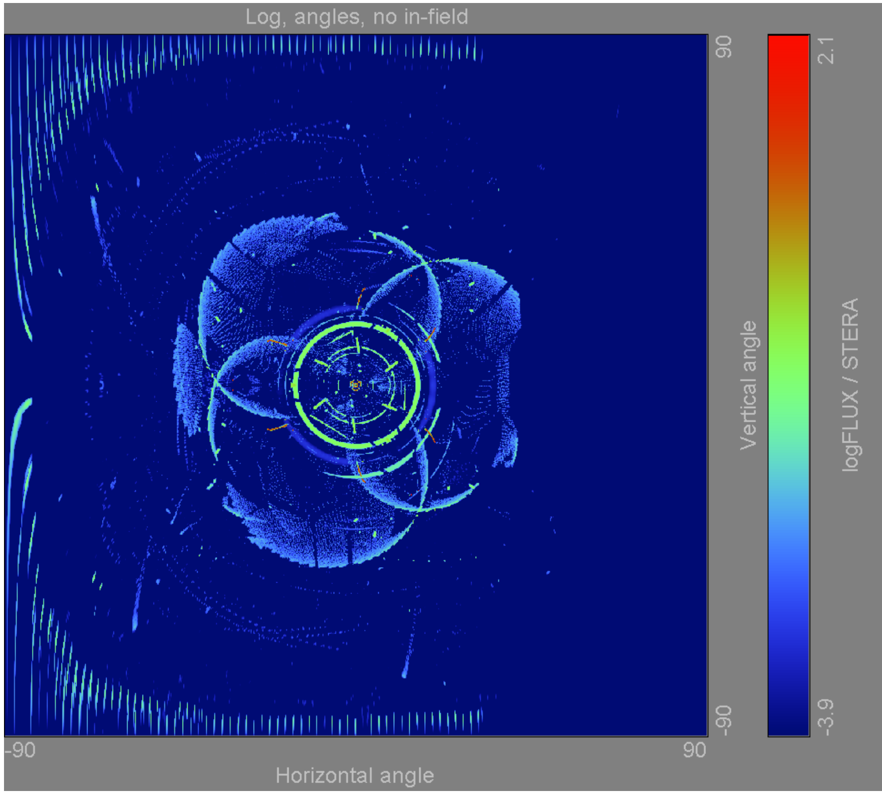
In angle space (conversion under ASAP)

(same sampling so approx ~11-15arcmin resolution in the central zone depending on angular position)

Results without the imaged/in-field path

… to identify the worst zone: 3 pairs of hot spots at relative level ~$10^{-3.05+/-0.25}$





NB: Horizontal angle is for the z angular coordinates

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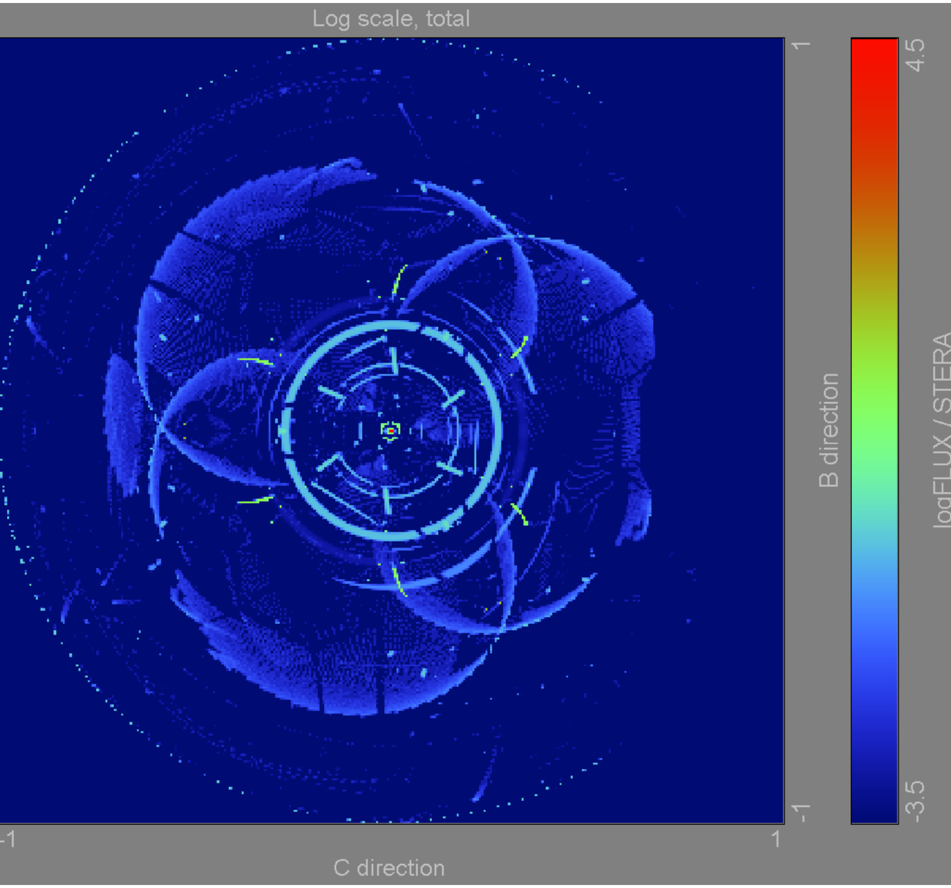
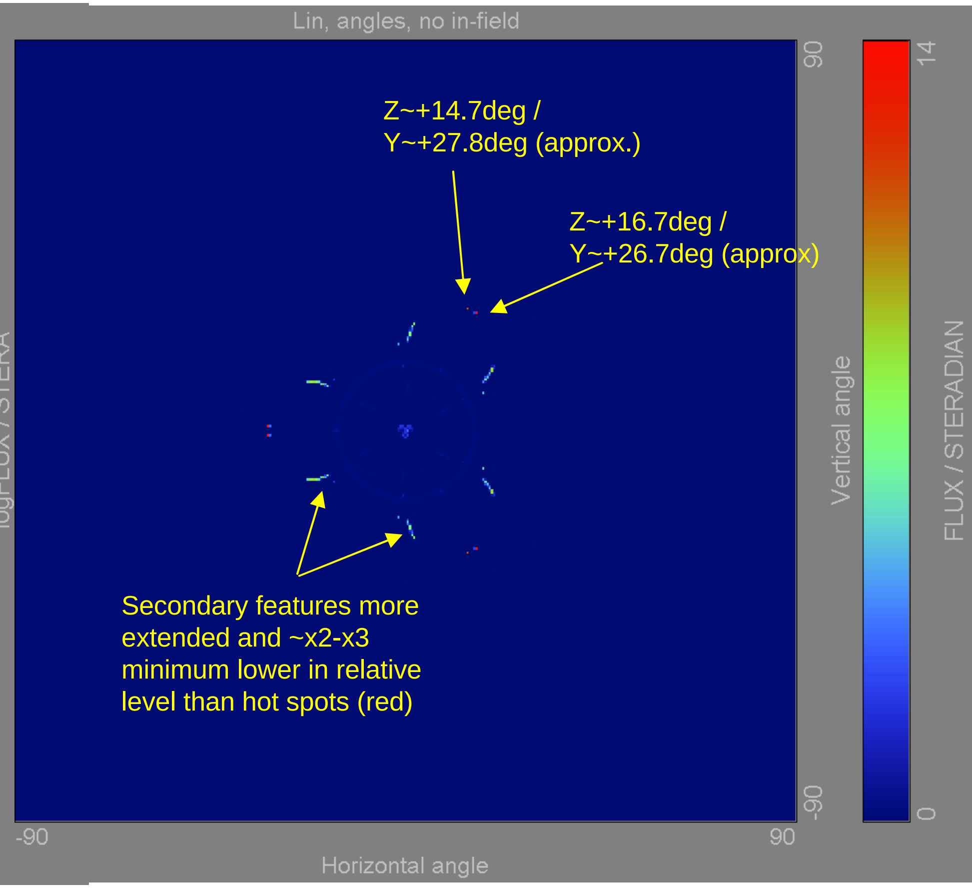
Results at lower angular resolution

Idem as results in slide 4 & 5 but with lower angular resolution (typically ~0.5deg)



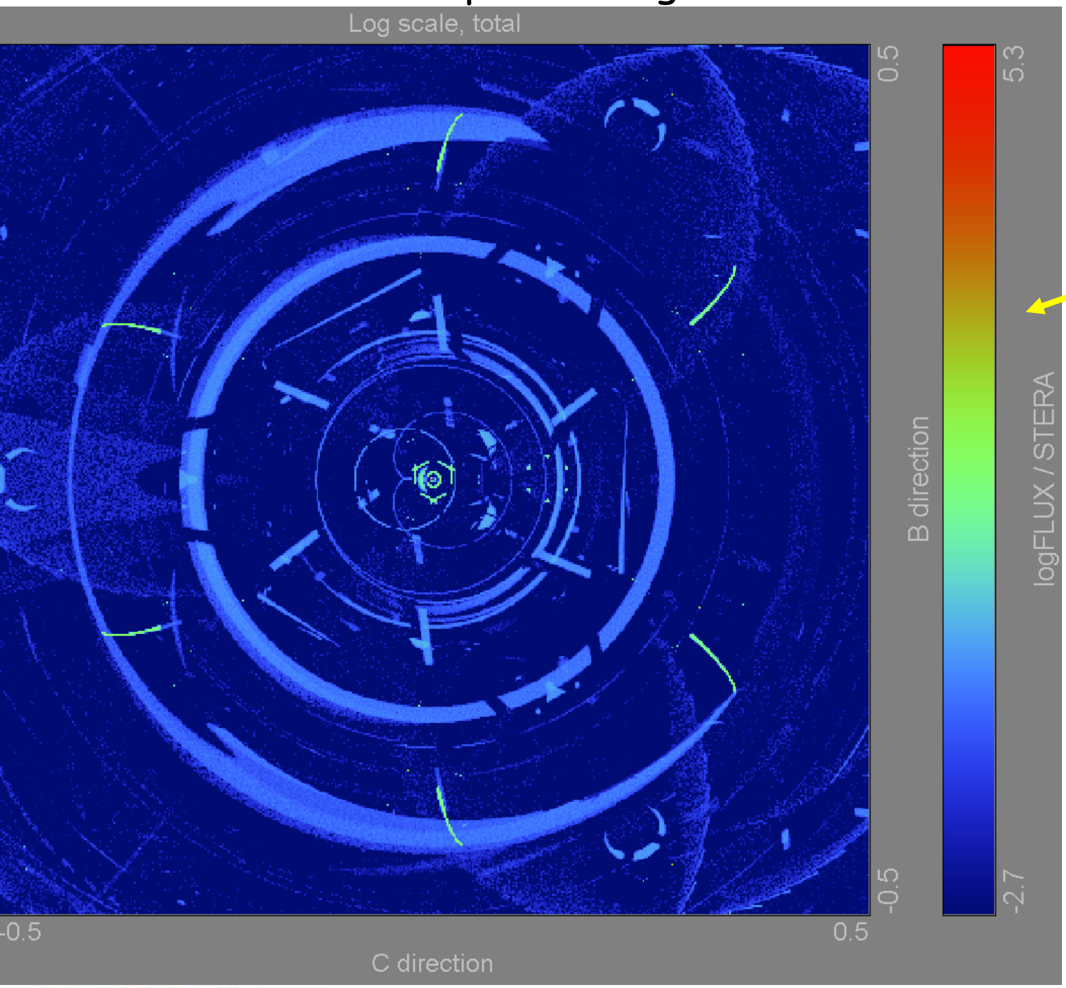


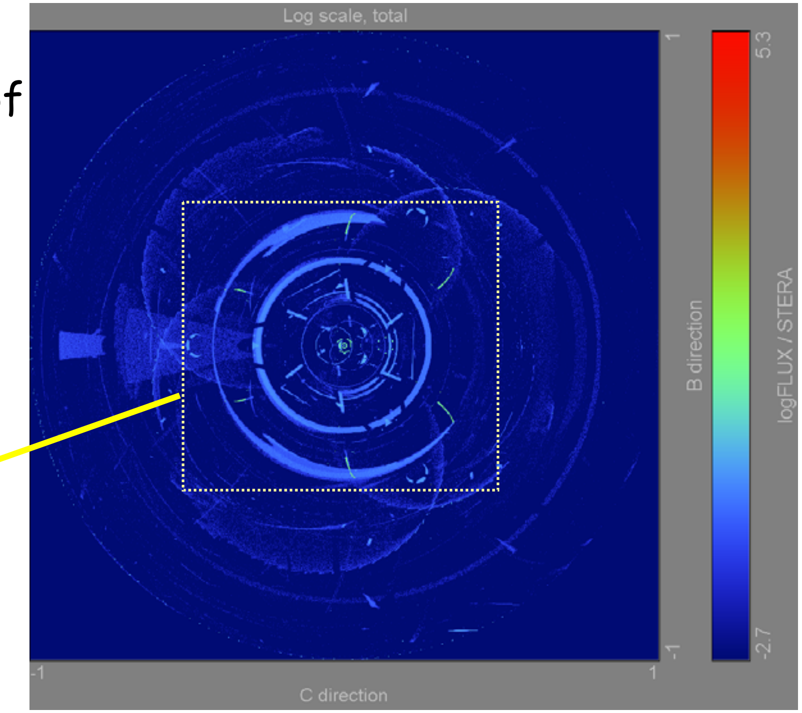
SPIRE

<u>NB</u>: Results shown here are available as ASCII file, with a homemade IDL script to read the simple data table it contains (and/or image file format such as bmp)

Results for PACS (I)

Same simulations parameters as in the case of SPIRE except starting at PACS FoV centre





Path	Rays	SumTO	Percent	Hits	Curr	Prev	Split/Scatter ...
3	18102893	1.0E+00	94.6	-4	443	52	0.000
6	554189	2.6E-02	2.4	-5	443	52	0.000
119	151083	7.2E-03	0.7	-4	443	86	0.000
13	54676	2.4E-03	0.2	-8	443	52	0.000
43	52237	2.3E-03	0.2	-7	443	52	0.000
120	39845	1.8E-03	0.2	-5	443	101	0.000
67	37249	1.7E-03	0.2	-6	443	25	0.000
667	31137	1.5E-03	0.1	-5	443	18	0.000
754	30690	1.4E-03	0.1	-5	443	24	0.000
128	30582	1.4E-03	0.1	-5	443	21	0.000
40	30334	1.4E-03	0.1	-5	443	15	0.000
34	29902	1.4E-03	0.1	-5	443	12	0.000
768	29597	1.4E-03	0.1	-5	443	9	0.000
19	29367	1.4E-03	0.1	-6	443	52	0.000

----

782 19381177 1.1E+00

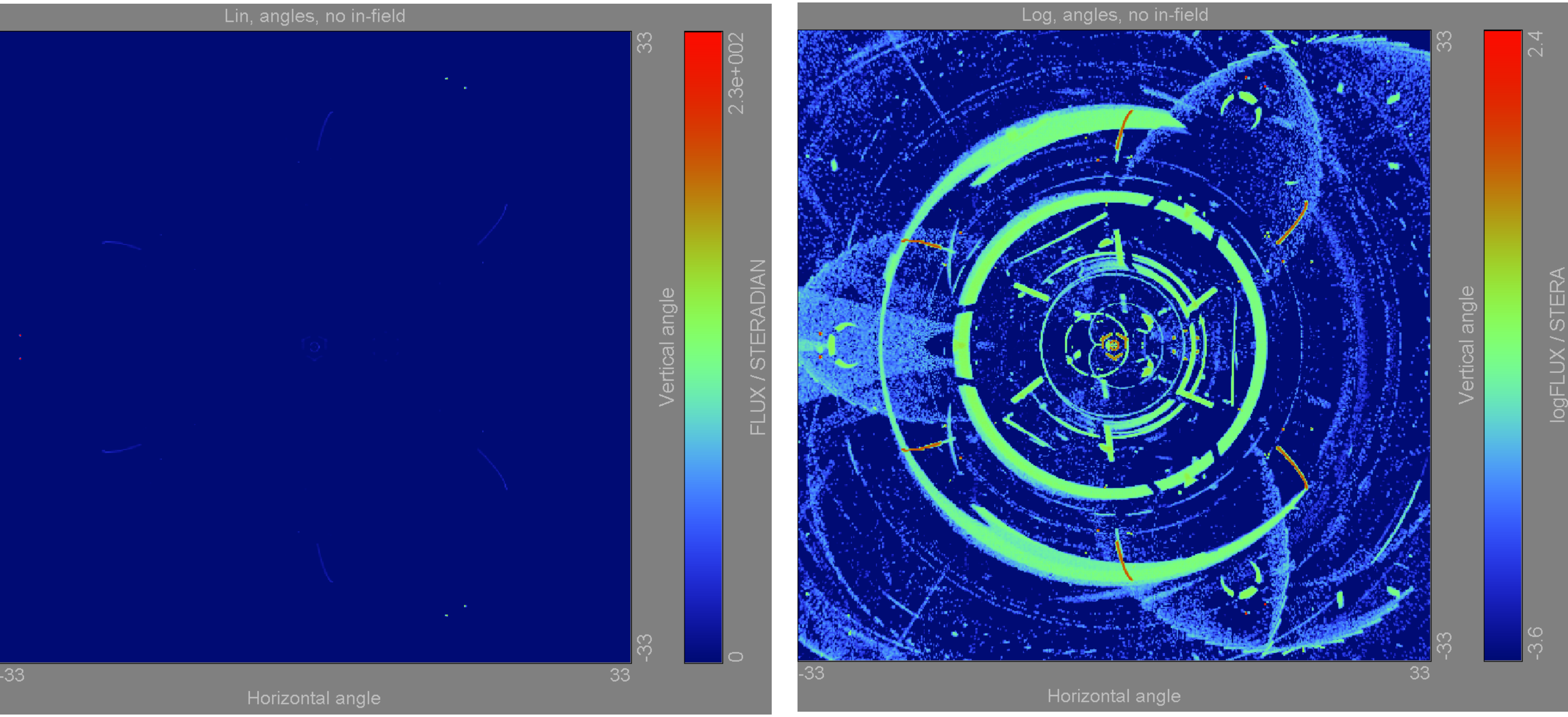
In direction cosine space, central region

(image is 961x961 pixels for full range)

Results for PACS (II)

Without the in-field and on angular space:

same 6 main "hot spots" at ~$10^{-3.05+/-0.25}$ relative level

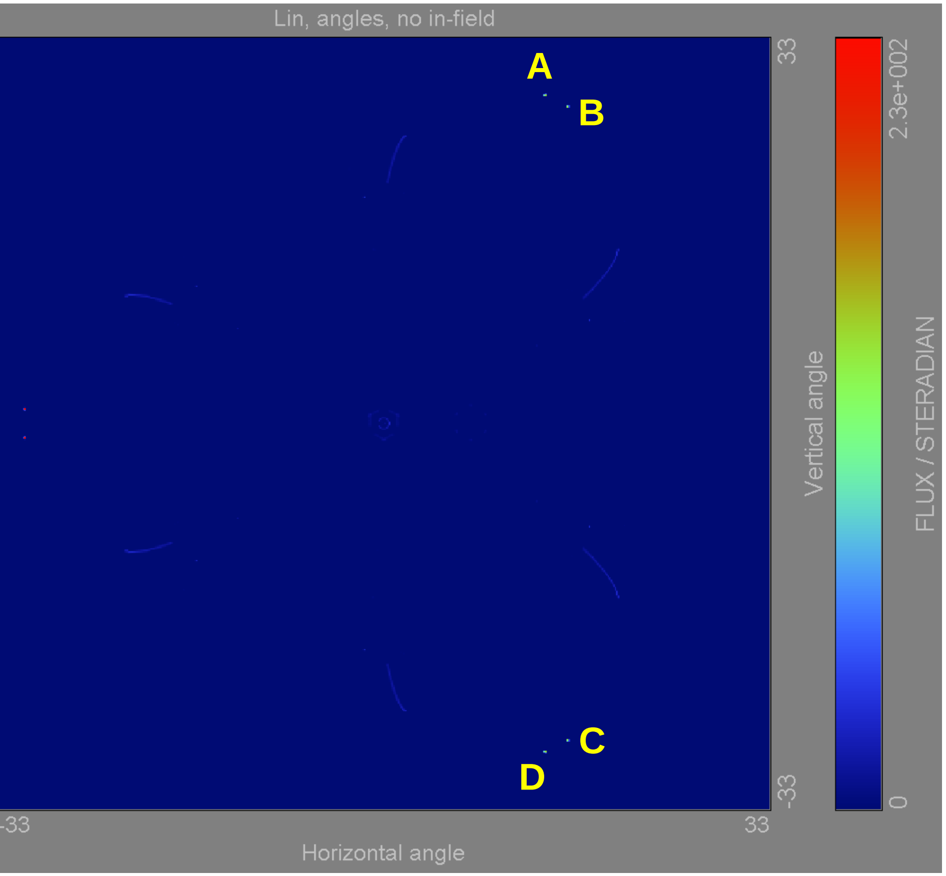


Linear (left) and log scale (right) with zoom on the central region

(image is 961x961 pixels for full range)

Results for PACS (III)

Out of the 3 highest level/best focus zones, 4 are on the +Z half-space/hemisphere



Zone	Angular coordinates of "hot spot" peak
A	Z=+13.94deg Y=+28.40deg
B	Z=+16.00deg Y=+27.50deg
C	Z=+16.00deg Y=-27.50deg
D	Z=+13.94deg Y=-28.40deg

- Apparent size of each zone is:

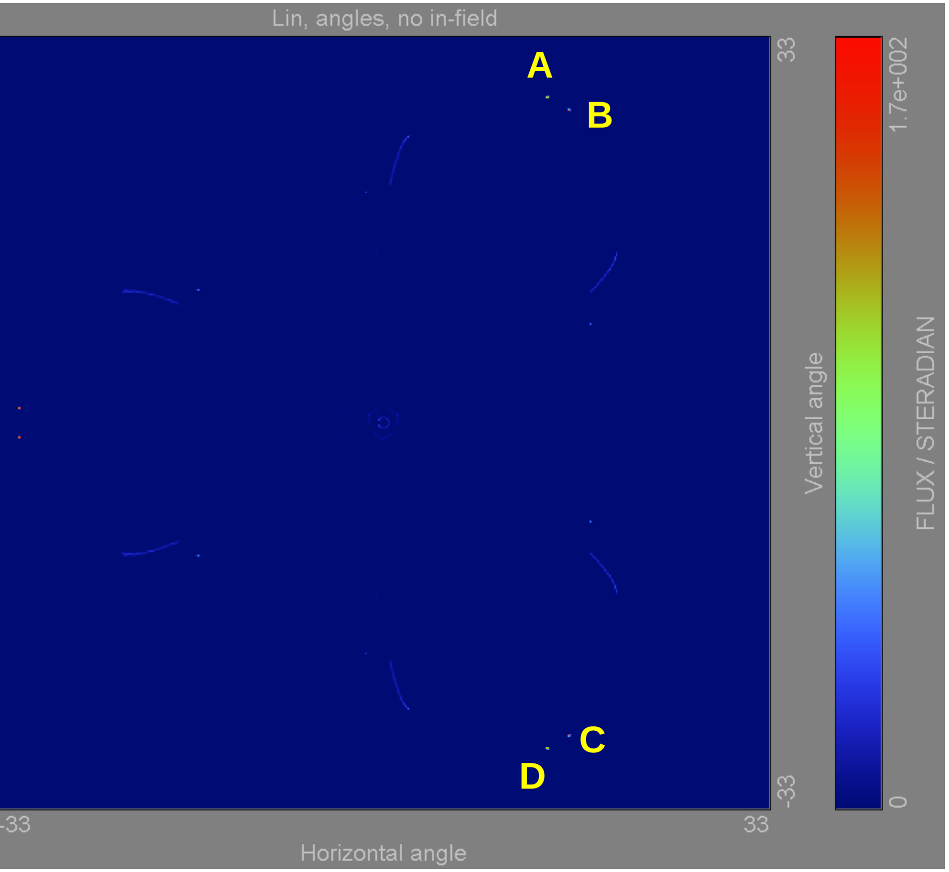
  ~0.5deg max x ~0.3deg max

- Average relative level is ~$10^{-3.6}$ peaking at $10^{-3.3+/-0.2}$ over ¼ of each zone

Possibly reachable by the Moon but not by Earth (TBC)

Comparison with SPIRE results

For comparison: similar results for SPIRE show a dependence on field position, with larger on-sky separation of “hot spots” positions compared to SPIRE/PACS FoV separation



Zone	Angular coordinates of “hot spot” peak
A	Z=+14.17deg Y=+28.12deg
B	Z=+16.18deg Y=+27.08deg
C	Z=+16.18deg Y=-27.08deg
D	Z=+14.17deg Y=-28.12deg

- **Higher resolution map (same sampling but reduced window at ~0.1deg resolution) indicates apparent size of each zone is: ~0.3degx~0.2deg**
- **Same average relative level i.e. still ~$10^{-3.6}$ peaking at $10^{-3.3+/-0.2}$**

Uncertainty on zone location estimated <0.25deg radius around the given above coordinates but possible extra bias & error due to model relevance

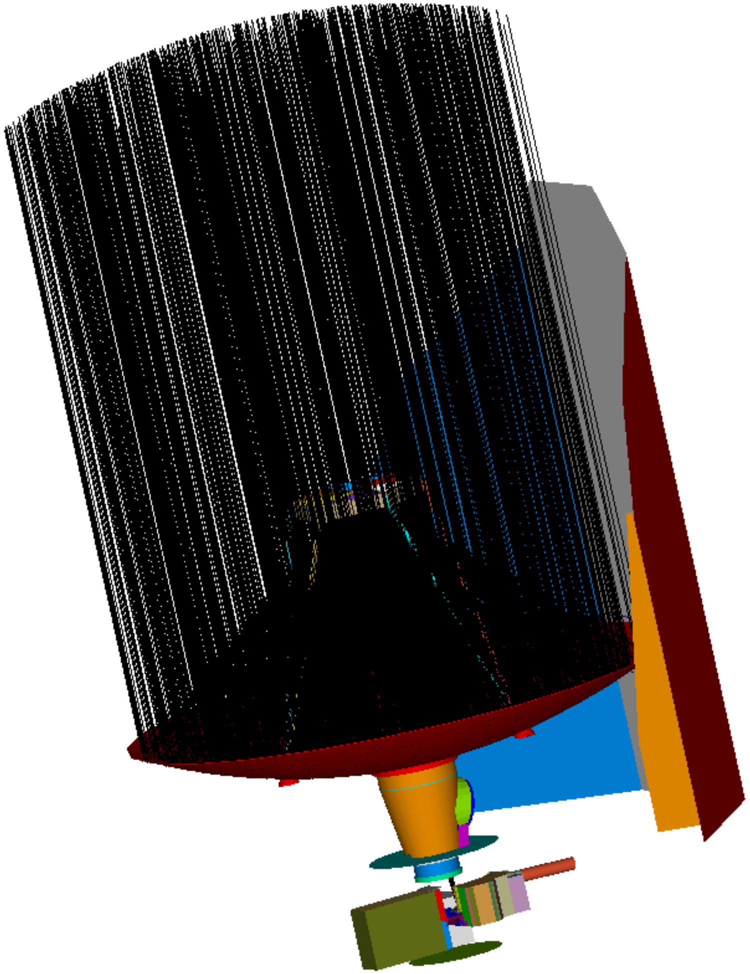
Analysis of main out-of-field paths

- Next slides show in more details the individual contribution of the 14 main paths (13 + 1 for in-field)
- Simulation started at PACS FoV centre, with reduced rayset including 1.25M rays total to speed up and final representation of contribution on sky in direction cosine space over 401x401 pixels and linear scale

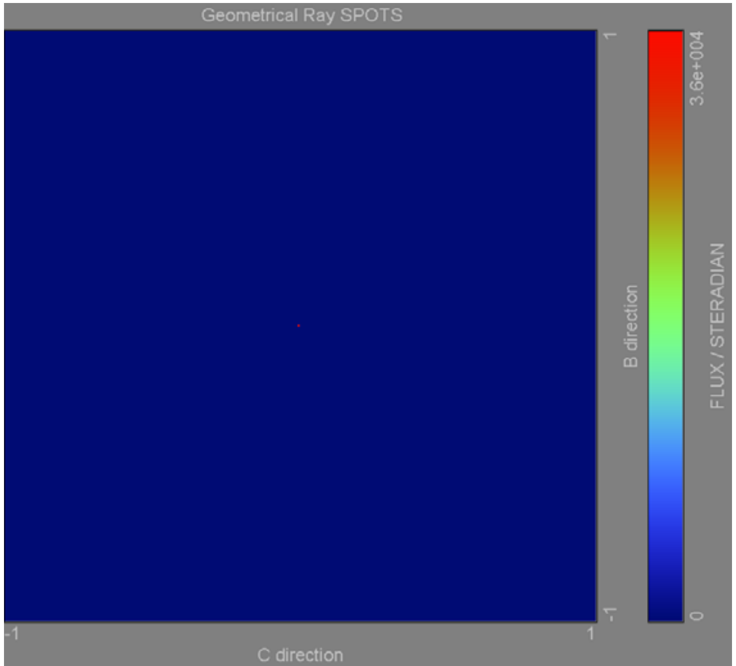
Analysis of main out-of-field paths (0)

Path	Rays	SumTO	Percent	Hits	Curr	Prev	Split/Scatter ...
3	1132176	8.9E-01	94.4	-4	443	52	0.000
4	34670	2.6E-02	2.8	-5	443	52	0.000
70	7408	5.7E-03	0.6	-4	443	86	0.000
13	3393	2.5E-03	0.3	-8	443	52	0.000
23	2495	1.8E-03	0.2	-7	443	52	0.000
38	2340	1.7E-03	0.2	-6	443	25	0.000
278	1917	1.5E-03	0.2	-5	443	24	0.000
22	1896	1.4E-03	0.2	-5	443	15	0.000
239	1888	1.4E-03	0.2	-5	443	18	0.000
20	1878	1.4E-03	0.2	-5	443	12	0.000
73	1856	1.4E-03	0.1	-5	443	21	0.000
282	1850	1.4E-03	0.1	-5	443	9	0.000
10	1774	1.3E-03	0.1	-6	443	52	0.000
1	1492	1.2E-03	0.1	-3	443	76	0.000

295	1203969	9.5E-01					



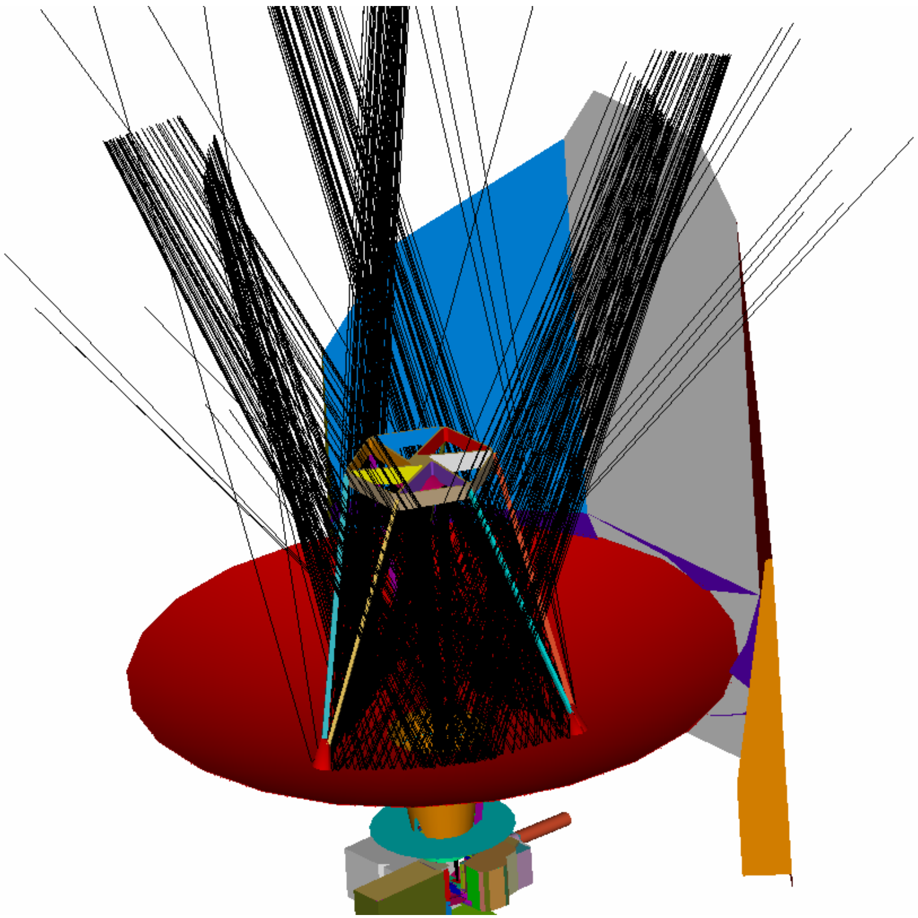
The specular in-field path via telescope M2 and M1



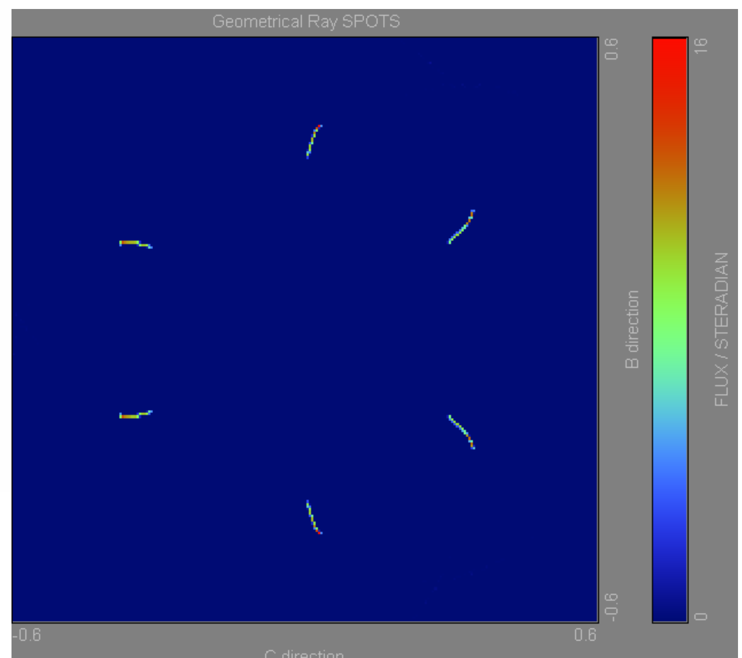
Analysis of main out-of-field paths (I)

Path	Rays	SumTO	Percent	Hits	Curr	Prev	Split/Scatter ...
3	1132176	8.9E-01	94.4	-4	443	52	0.000
4	34670	2.6E-02	2.8	-5	443	52	0.000
70	7408	5.7E-03	0.6	-4	443	86	0.000
13	3393	2.5E-03	0.3	-8	443	52	0.000
23	2495	1.8E-03	0.2	-7	443	52	0.000
38	2340	1.7E-03	0.2	-6	443	25	0.000
278	1917	1.5E-03	0.2	-5	443	24	0.000
22	1896	1.4E-03	0.2	-5	443	15	0.000
239	1888	1.4E-03	0.2	-5	443	18	0.000
20	1878	1.4E-03	0.2	-5	443	12	0.000
73	1856	1.4E-03	0.1	-5	443	21	0.000
282	1850	1.4E-03	0.1	-5	443	9	0.000
10	1774	1.3E-03	0.1	-6	443	52	0.000
1	1492	1.2E-03	0.1	-3	443	76	0.000

295	1203969	9.5E-01					



Path with extra reflection on legs



Analysis of main out-of-field paths (II)

Path	Rays	SumTO	Percent	Hits	Curr	Prev	Split/Scatter ...
3	1132176	8.9E-01	94.4	-4	443	52	0.000
4	34670	2.6E-02	2.8	-5	443	52	0.000
70	7408	5.7E-03	0.6	-4	443	86	0.000
13	3393	2.5E-03	0.3	-8	443	52	0.000
23	2495	1.8E-03	0.2	-7	443	52	0.000
38	2340	1.7E-03	0.2	-6	443	25	0.000
278	1917	1.5E-03	0.2	-5	443	24	0.000
22	1896	1.4E-03	0.2	-5	443	15	0.000
239	1888	1.4E-03	0.2	-5	443	18	0.000
20	1878	1.4E-03	0.2	-5	443	12	0.000
73	1856	1.4E-03	0.1	-5	443	21	0.000
282	1850	1.4E-03	0.1	-5	443	9	0.000
10	1774	1.3E-03	0.1	-6	443	52	0.000
1	1492	1.2E-03	0.1	-3	443	76	0.000

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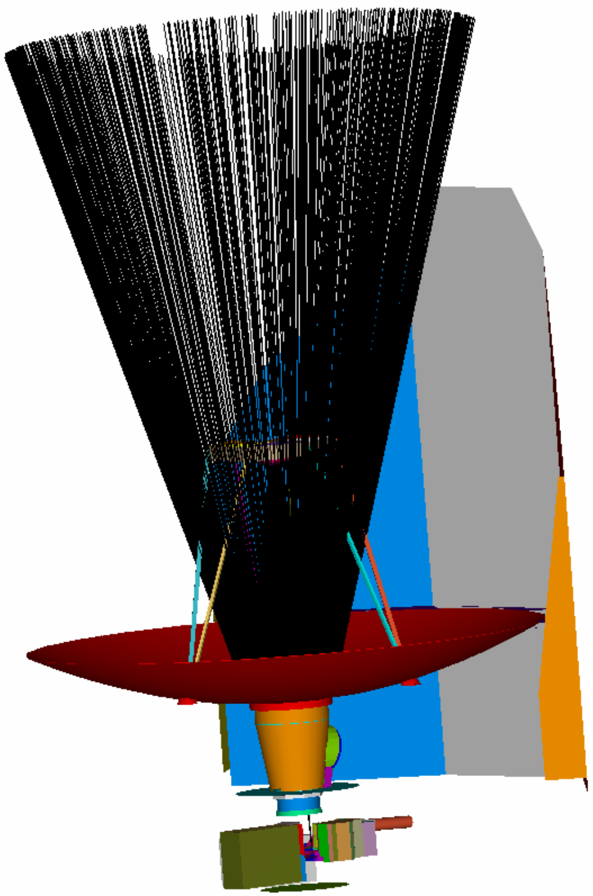
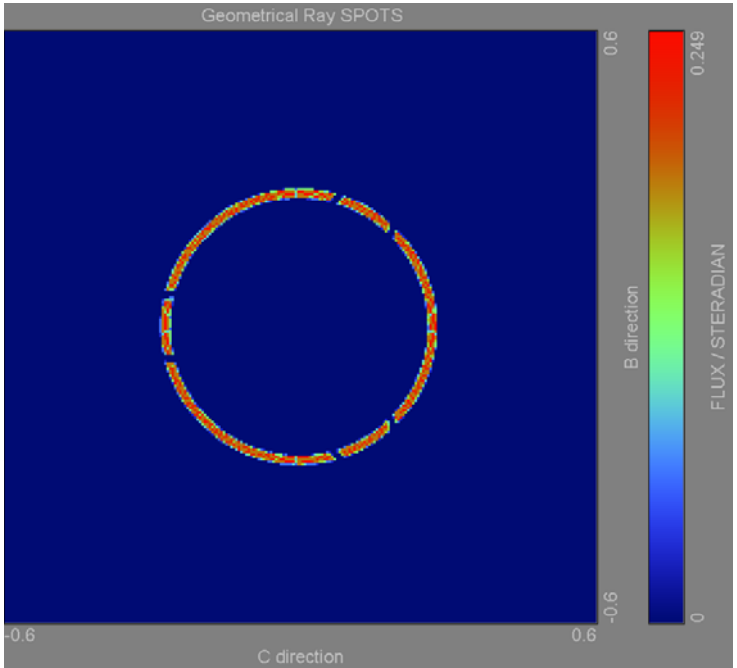
295 1203969 9.5E-01





Via centre of M2 and M1 cone baffle top flange

Analysis of main out-of-field paths (III)

Path	Rays	SumTO	Percent	Hits	Curr	Prev	Split/Scatter ...
3	1132176	8.9E-01	94.4	-4	443	52	0.000
4	34670	2.6E-02	2.8	-5	443	52	0.000
70	7408	5.7E-03	0.6	-4	443	86	0.000
13	3393	2.5E-03	0.3	-8	443	52	0.000
23	2495	1.8E-03	0.2	-7	443	52	0.000
38	2340	1.7E-03	0.2	-6	443	25	0.000
278	1917	1.5E-03	0.2	-5	443	24	0.000
22	1896	1.4E-03	0.2	-5	443	15	0.000
239	1888	1.4E-03	0.2	-5	443	18	0.000
20	1878	1.4E-03	0.2	-5	443	12	0.000
73	1856	1.4E-03	0.1	-5	443	21	0.000
282	1850	1.4E-03	0.1	-5	443	9	0.000
10	1774	1.3E-03	0.1	-6	443	52	0.000
1	1492	1.2E-03	0.1	-3	443	76	0.000

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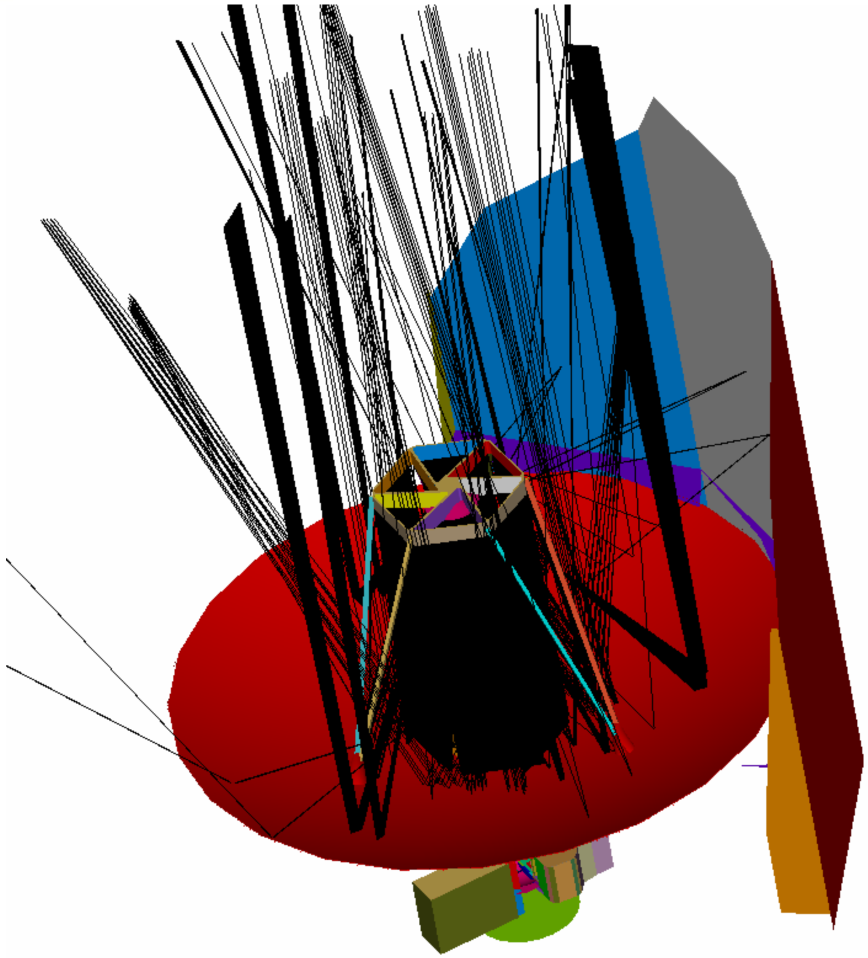
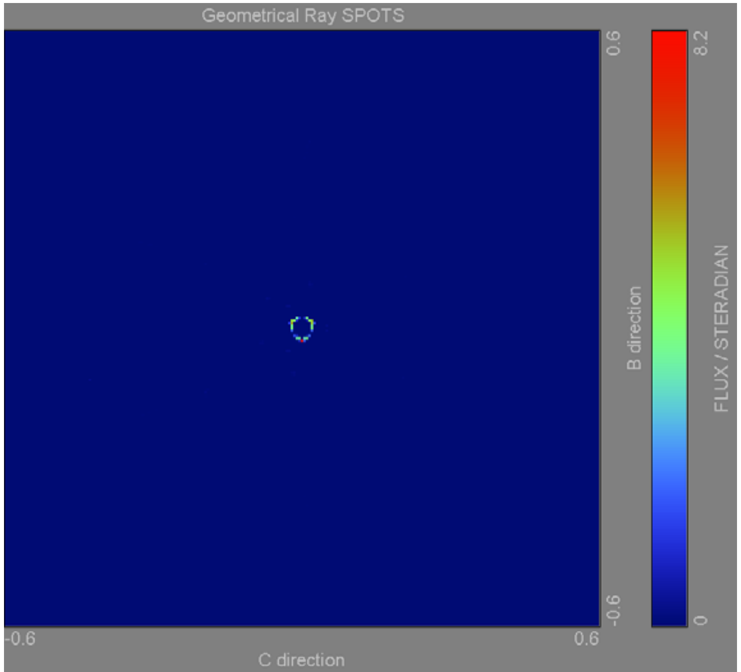
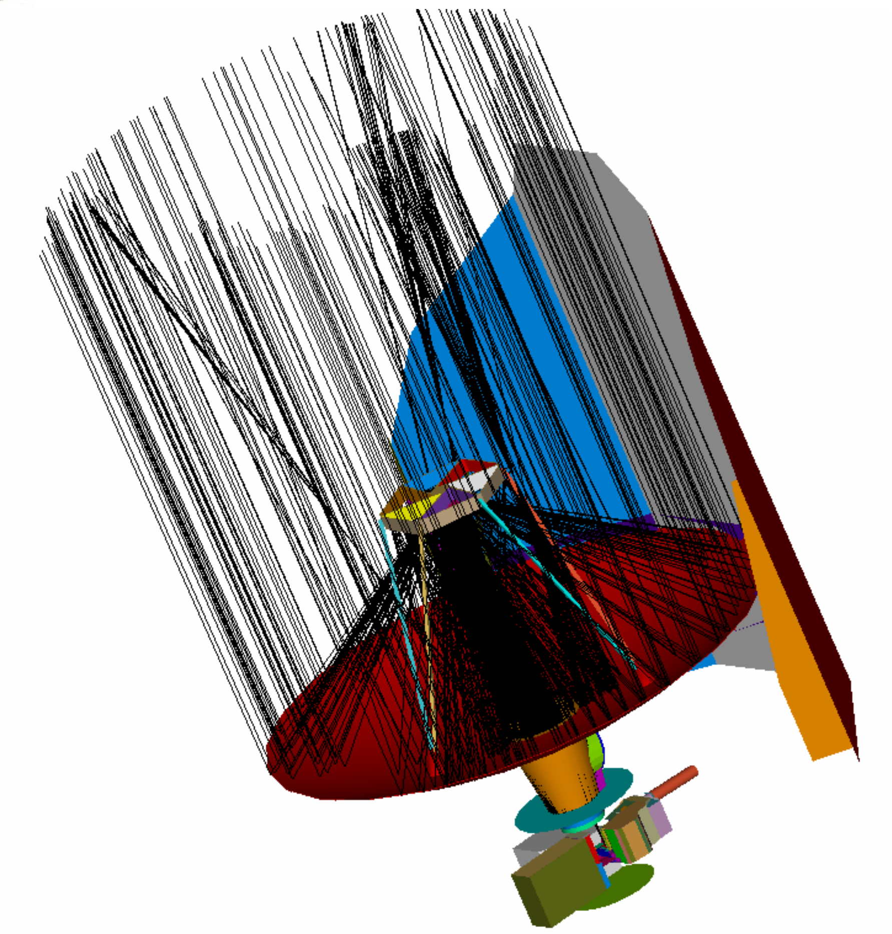
295 1203969 9.5E-01





After multiple extra reflections (4) between M1 and M2 barrel structure

Analysis of main out-of-field paths (IV)



Path	Rays	SumTO	Percent	Hits	Curr	Prev	Split/Scatter ...
3	1132176	8.9E-01	94.4	-4	443	52	0.000
4	34670	2.6E-02	2.8	-5	443	52	0.000
70	7408	5.7E-03	0.6	-4	443	86	0.000
13	3393	2.5E-03	0.3	-8	443	52	0.000
23	2495	1.8E-03	0.2	-7	443	52	0.000
38	2340	1.7E-03	0.2	-6	443	25	0.000
278	1917	1.5E-03	0.2	-5	443	24	0.000
22	1896	1.4E-03	0.2	-5	443	15	0.000
239	1888	1.4E-03	0.2	-5	443	18	0.000
20	1878	1.4E-03	0.2	-5	443	12	0.000
73	1856	1.4E-03	0.1	-5	443	21	0.000
282	1850	1.4E-03	0.1	-5	443	9	0.000
10	1774	1.3E-03	0.1	-6	443	52	0.000
1	1492	1.2E-03	0.1	-3	443	76	0.000

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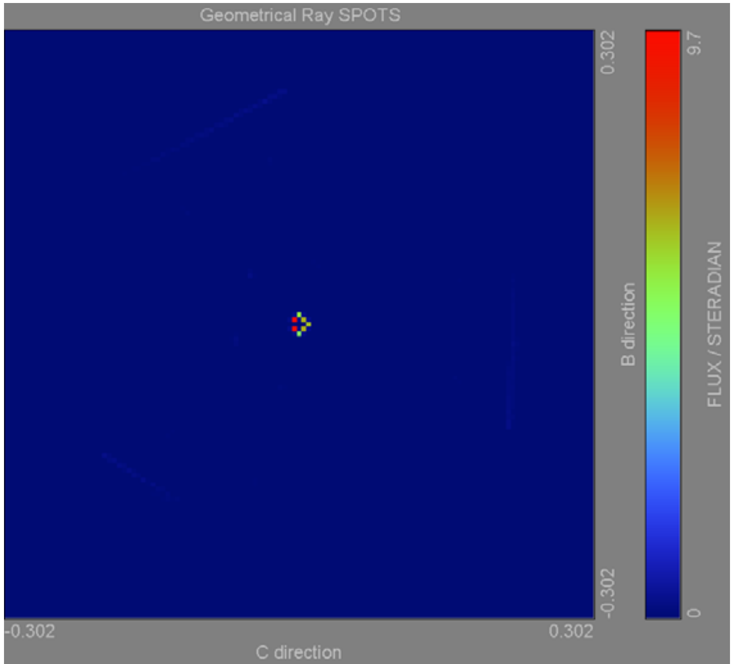
295 1203969 9.5E-01

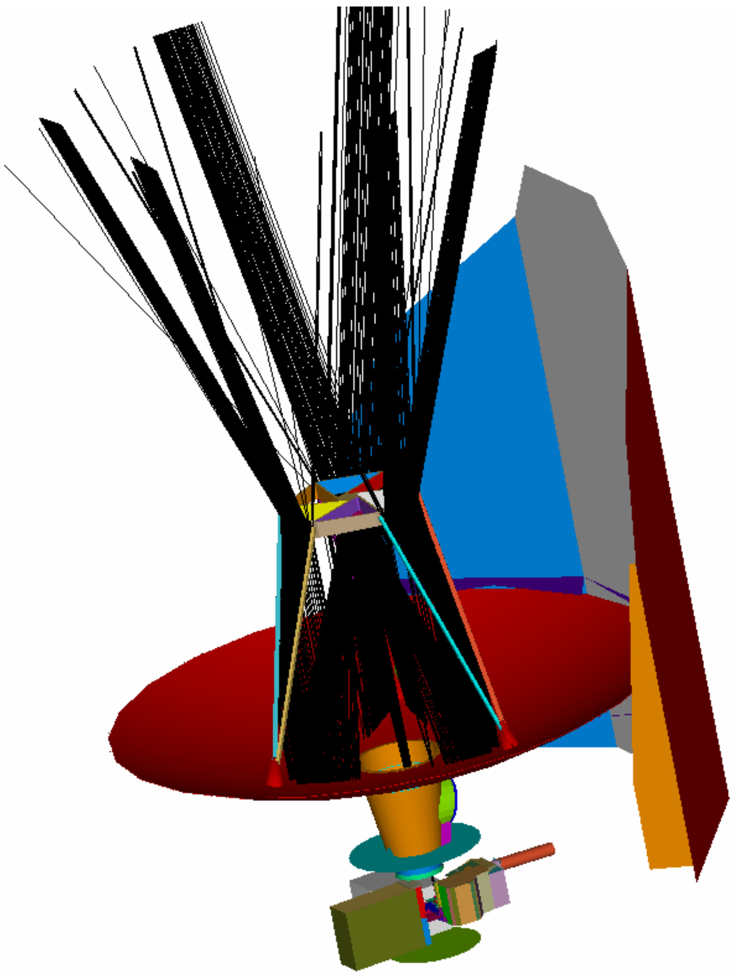


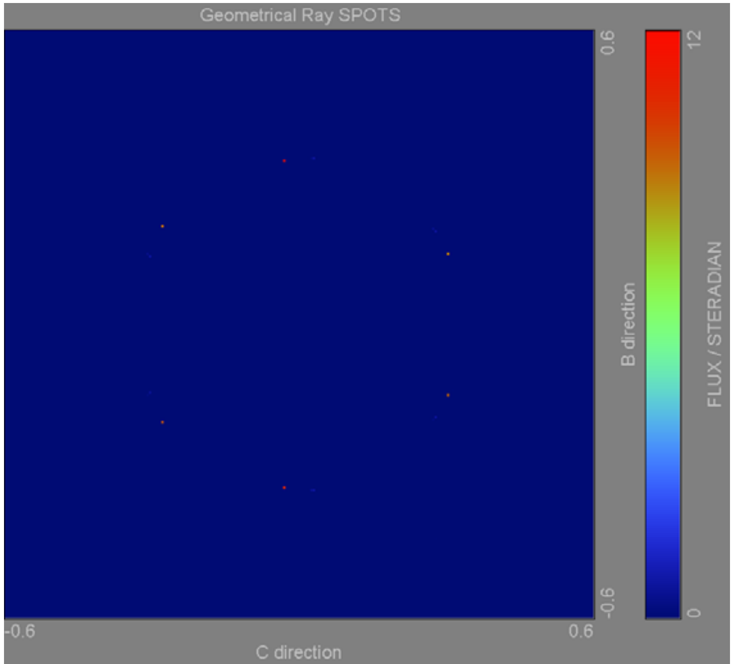
Similar to previous one,
only 3 extra reflections

Analysis of main out-of-field paths (V)

Path	Rays	SumTO	Percent	Hits	Curr	Prev	Split/Scatter ...
3	1132176	8.9E-01	94.4	-4	443	52	0.000
4	34670	2.6E-02	2.8	-5	443	52	0.000
70	7408	5.7E-03	0.6	-4	443	86	0.000
13	3393	2.5E-03	0.3	-8	443	52	0.000
23	2495	1.8E-03	0.2	-7	443	52	0.000
38	2340	1.7E-03	0.2	-6	443	25	0.000
278	1917	1.5E-03	0.2	-5	443	24	0.000
22	1896	1.4E-03	0.2	-5	443	15	0.000
239	1888	1.4E-03	0.2	-5	443	18	0.000
20	1878	1.4E-03	0.2	-5	443	12	0.000
73	1856	1.4E-03	0.1	-5	443	21	0.000
282	1850	1.4E-03	0.1	-5	443	9	0.000
10	1774	1.3E-03	0.1	-6	443	52	0.000
1	1492	1.2E-03	0.1	-3	443	76	0.000

295	1203969	9.5E-01					



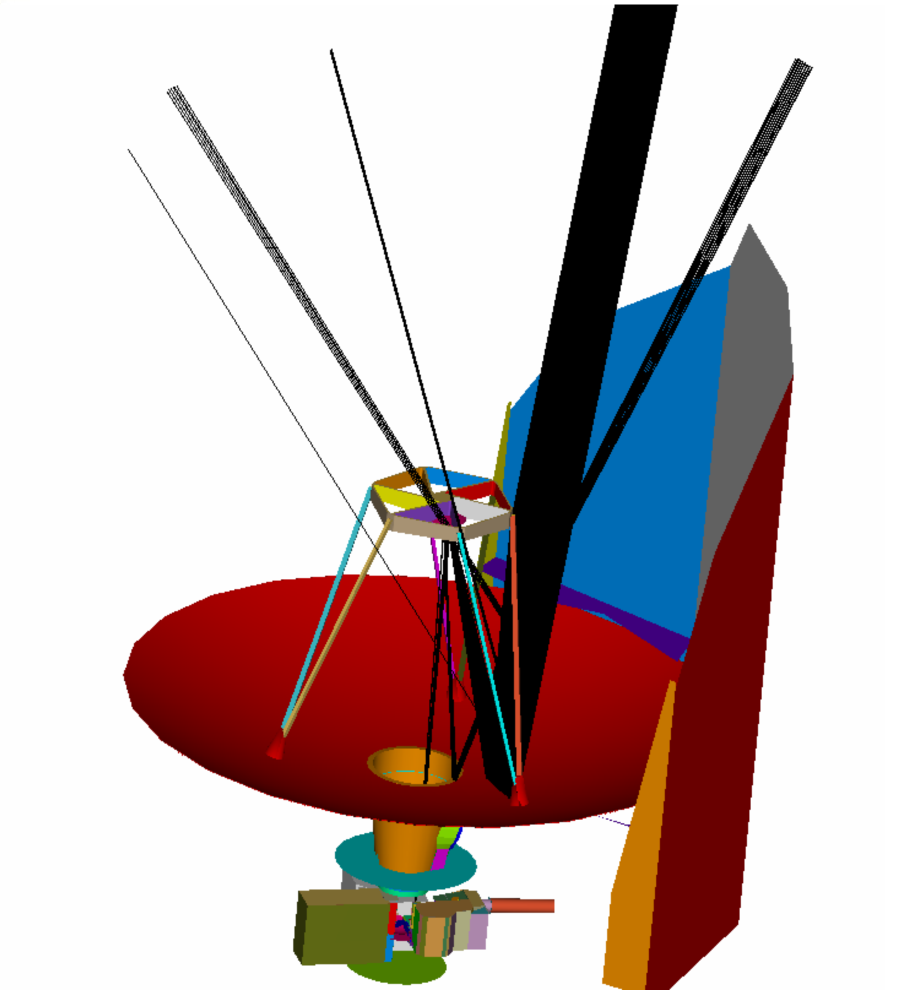


Path via the M2 barrel structure lateral facets

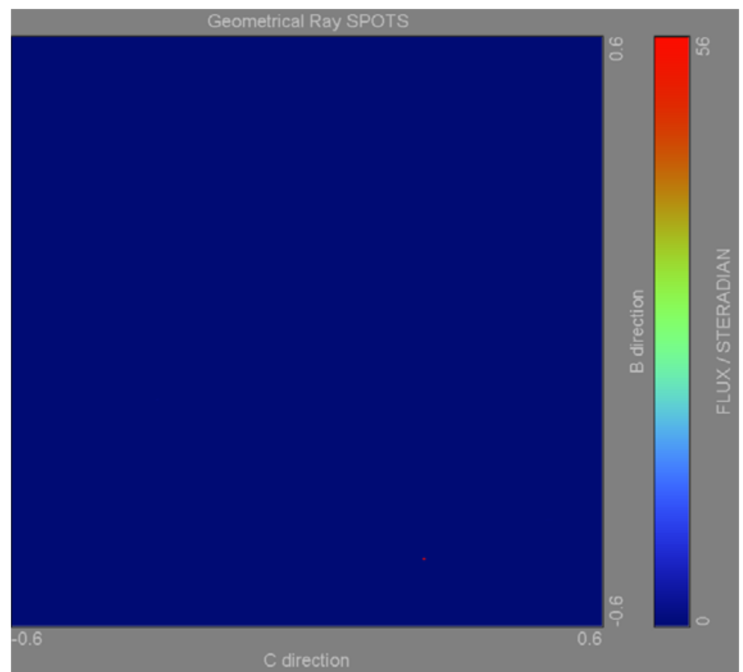
Analysis of main out-of-field paths (VI)

Path	Rays	SumTO	Percent	Hits	Curr	Prev	Split/Scatter ...
3	1132176	8.9E-01	94.4	-4	443	52	0.000
4	34670	2.6E-02	2.8	-5	443	52	0.000
70	7408	5.7E-03	0.6	-4	443	86	0.000
13	3393	2.5E-03	0.3	-8	443	52	0.000
23	2495	1.8E-03	0.2	-7	443	52	0.000
38	2340	1.7E-03	0.2	-6	443	25	0.000
278	1917	1.5E-03	0.2	-5	443	24	0.000
22	1896	1.4E-03	0.2	-5	443	15	0.000
239	1888	1.4E-03	0.2	-5	443	18	0.000
20	1878	1.4E-03	0.2	-5	443	12	0.000
73	1856	1.4E-03	0.1	-5	443	21	0.000
282	1850	1.4E-03	0.1	-5	443	9	0.000
10	1774	1.3E-03	0.1	-6	443	52	0.000
1	1492	1.2E-03	0.1	-3	443	76	0.000

295	1203969	9.5E-01					



Path via surface of one of the hexapod leg

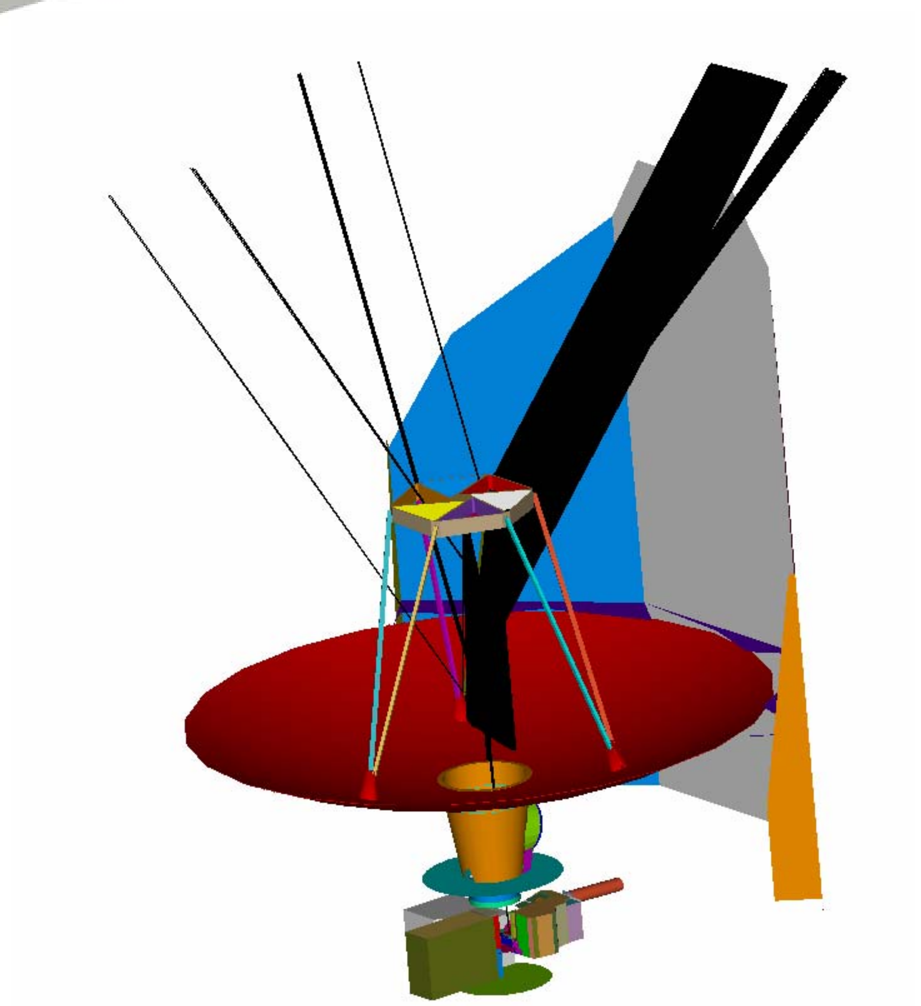


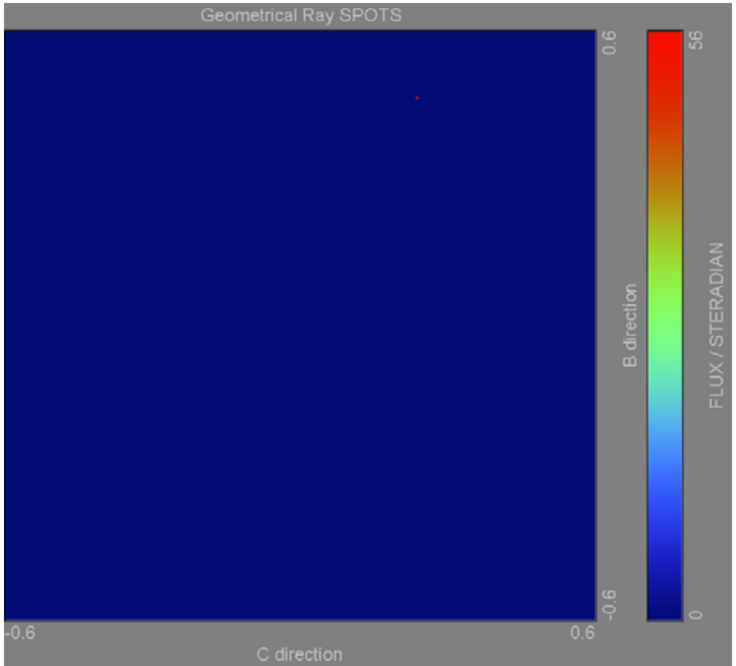
Analysis of main out-of-field paths (VII)

Science & Technology Facilities Council

Path	Rays	SumTO	Percent	Hits	Curr	Prev	Split/Scatter ...
3	1132176	8.9E-01	94.4	-4	443	52	0.000
4	34670	2.6E-02	2.8	-5	443	52	0.000
70	7408	5.7E-03	0.6	-4	443	86	0.000
13	3393	2.5E-03	0.3	-8	443	52	0.000
23	2495	1.8E-03	0.2	-7	443	52	0.000
38	2340	1.7E-03	0.2	-6	443	25	0.000
278	1917	1.5E-03	0.2	-5	443	24	0.000
22	1896	1.4E-03	0.2	-5	443	15	0.000
239	1888	1.4E-03	0.2	-5	443	18	0.000
20	1878	1.4E-03	0.2	-5	443	12	0.000
73	1856	1.4E-03	0.1	-5	443	21	0.000
282	1850	1.4E-03	0.1	-5	443	9	0.000
10	1774	1.3E-03	0.1	-6	443	52	0.000
1	1492	1.2E-03	0.1	-3	443	76	0.000

295	1203969	9.5E-01					





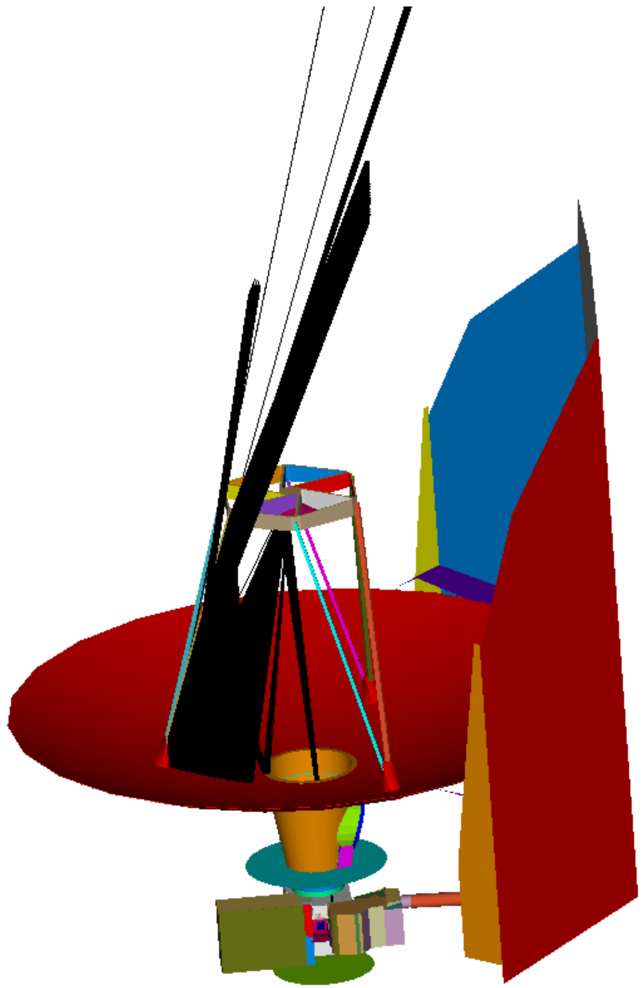
Path via surface of one of the hexapod leg

SPIRE

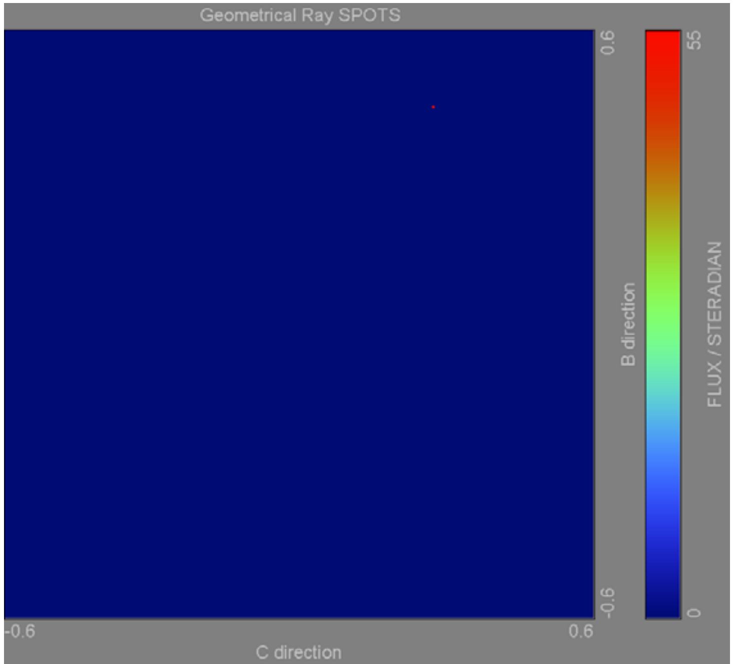
Analysis of main out-of-field paths (VIII)

Path	Rays	SumTO	Percent	Hits	Curr	Prev	Split/Scatter ...
3	1132176	8.9E-01	94.4	-4	443	52	0.000
4	34670	2.6E-02	2.8	-5	443	52	0.000
70	7408	5.7E-03	0.6	-4	443	86	0.000
13	3393	2.5E-03	0.3	-8	443	52	0.000
23	2495	1.8E-03	0.2	-7	443	52	0.000
38	2340	1.7E-03	0.2	-6	443	25	0.000
278	1917	1.5E-03	0.2	-5	443	24	0.000
22	1896	1.4E-03	0.2	-5	443	15	0.000
239	1888	1.4E-03	0.2	-5	443	18	0.000
20	1878	1.4E-03	0.2	-5	443	12	0.000
73	1856	1.4E-03	0.1	-5	443	21	0.000
282	1850	1.4E-03	0.1	-5	443	9	0.000
10	1774	1.3E-03	0.1	-6	443	52	0.000
1	1492	1.2E-03	0.1	-3	443	76	0.000

295	1203969	9.5E-01					



Path via surface of one of the hexapod leg



Science & Technology Facilities Council

Analysis of main out-of-field paths (IX)

Path	Rays	SumTO	Percent	Hits	Curr	Prev	Split/Scatter ...
3	1132176	8.9E-01	94.4	-4	443	52	0.000
4	34670	2.6E-02	2.8	-5	443	52	0.000
70	7408	5.7E-03	0.6	-4	443	86	0.000
13	3393	2.5E-03	0.3	-8	443	52	0.000
23	2495	1.8E-03	0.2	-7	443	52	0.000
38	2340	1.7E-03	0.2	-6	443	25	0.000
278	1917	1.5E-03	0.2	-5	443	24	0.000
22	1896	1.4E-03	0.2	-5	443	15	0.000
239	1888	1.4E-03	0.2	-5	443	18	0.000
20	1878	1.4E-03	0.2	-5	443	12	0.000
73	1856	1.4E-03	0.1	-5	443	21	0.000
282	1850	1.4E-03	0.1	-5	443	9	0.000
10	1774	1.3E-03	0.1	-6	443	52	0.000
1	1492	1.2E-03	0.1	-3	443	76	0.000

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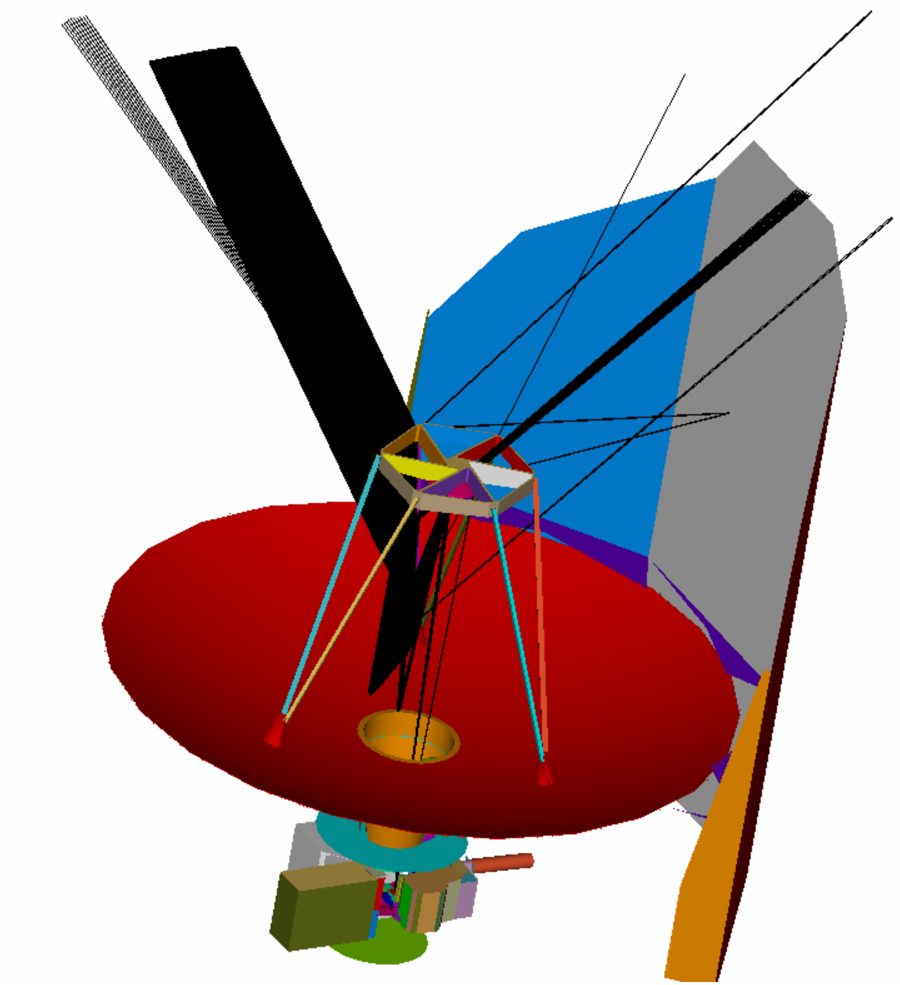
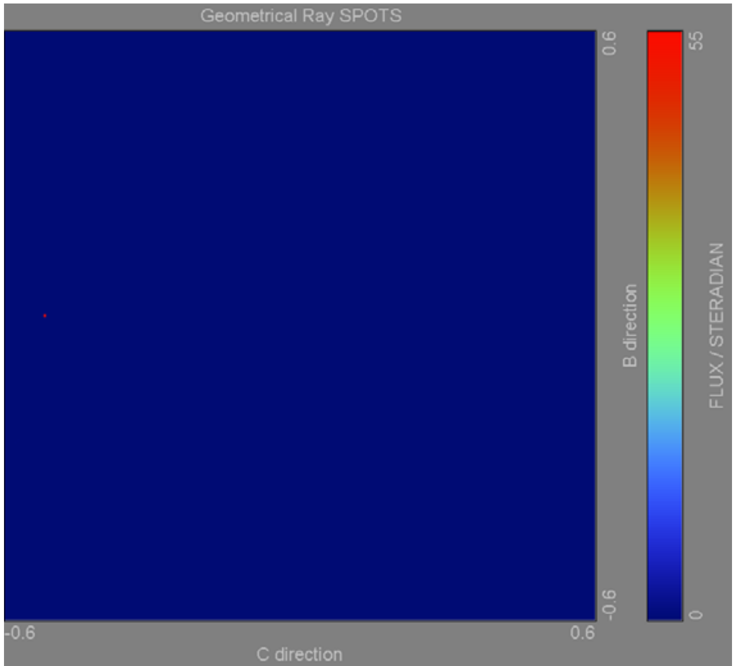
295 1203969 9.5E-01



Path via surface of one of the hexapod leg

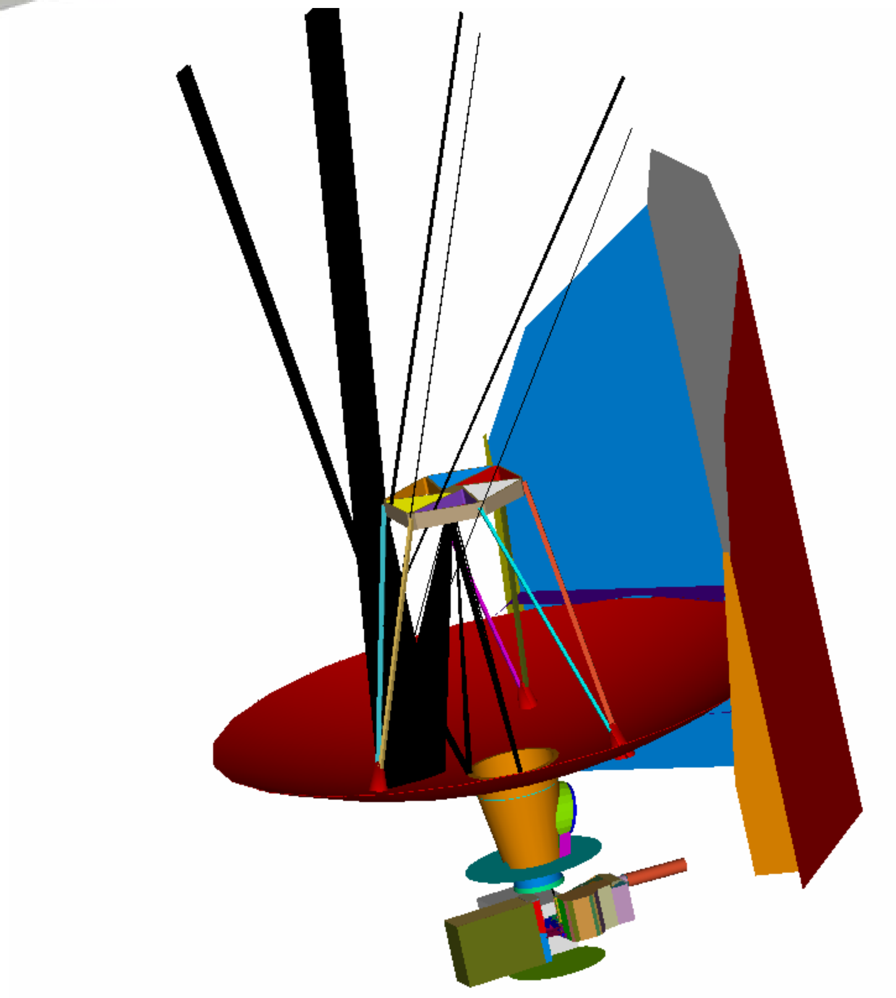


SPIRE

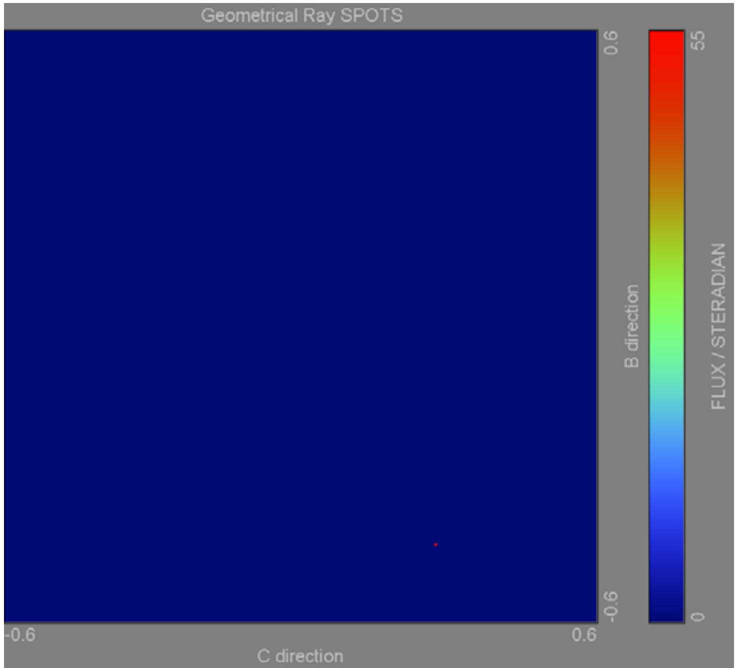
Analysis of main out-of-field paths (X)

Path	Rays	SumTO	Percent	Hits	Curr	Prev	Split/Scatter ...
3	1132176	8.9E-01	94.4	-4	443	52	0.000
4	34670	2.6E-02	2.8	-5	443	52	0.000
70	7408	5.7E-03	0.6	-4	443	86	0.000
13	3393	2.5E-03	0.3	-8	443	52	0.000
23	2495	1.8E-03	0.2	-7	443	52	0.000
38	2340	1.7E-03	0.2	-6	443	25	0.000
278	1917	1.5E-03	0.2	-5	443	24	0.000
22	1896	1.4E-03	0.2	-5	443	15	0.000
239	1888	1.4E-03	0.2	-5	443	18	0.000
20	1878	1.4E-03	0.2	-5	443	12	0.000
73	1856	1.4E-03	0.1	-5	443	21	0.000
282	1850	1.4E-03	0.1	-5	443	9	0.000
10	1774	1.3E-03	0.1	-6	443	52	0.000
1	1492	1.2E-03	0.1	-3	443	76	0.000

295	1203969	9.5E-01					



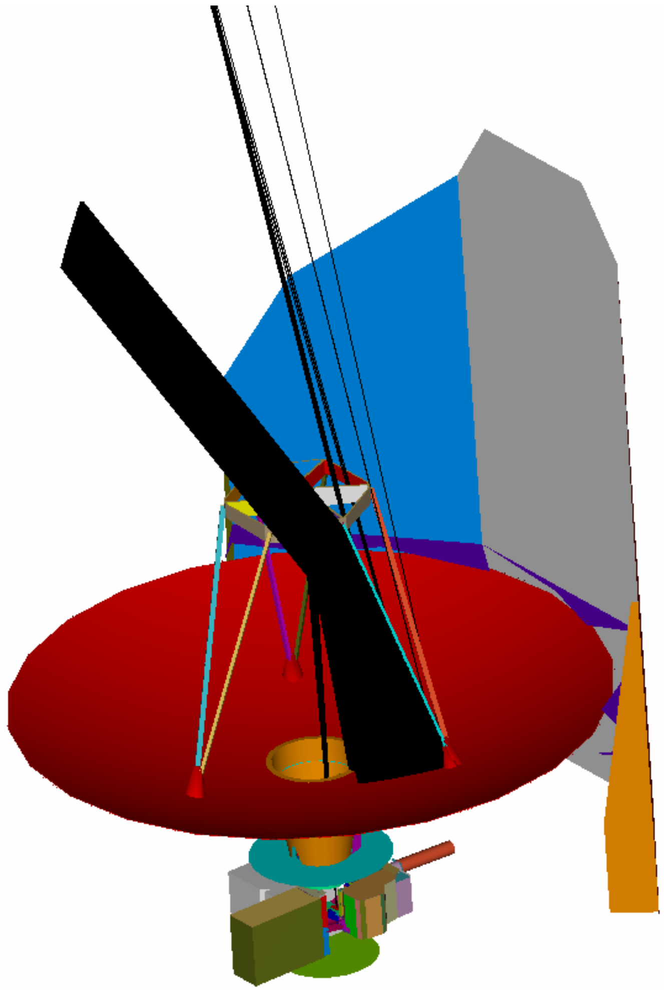
Path via surface of one of the hexapod leg

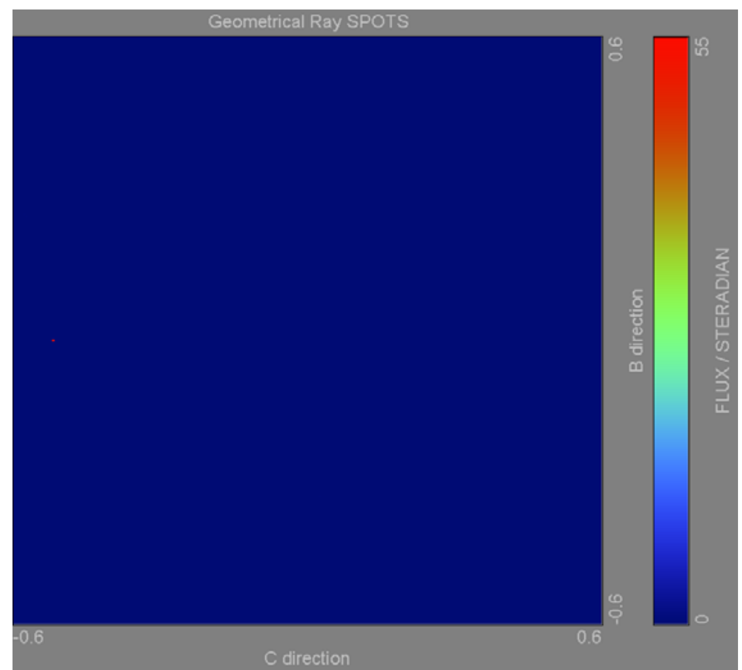


Analysis of main out-of-field paths (XI)

Path	Rays	SumTO	Percent	Hits	Curr	Prev	Split/Scatter ...
3	1132176	8.9E-01	94.4	-4	443	52	0.000
4	34670	2.6E-02	2.8	-5	443	52	0.000
70	7408	5.7E-03	0.6	-4	443	86	0.000
13	3393	2.5E-03	0.3	-8	443	52	0.000
23	2495	1.8E-03	0.2	-7	443	52	0.000
38	2340	1.7E-03	0.2	-6	443	25	0.000
278	1917	1.5E-03	0.2	-5	443	24	0.000
22	1896	1.4E-03	0.2	-5	443	15	0.000
239	1888	1.4E-03	0.2	-5	443	18	0.000
20	1878	1.4E-03	0.2	-5	443	12	0.000
73	1856	1.4E-03	0.1	-5	443	21	0.000
282	1850	1.4E-03	0.1	-5	443	9	0.000
10	1774	1.3E-03	0.1	-6	443	52	0.000
1	1492	1.2E-03	0.1	-3	443	76	0.000

295	1203969	9.5E-01					



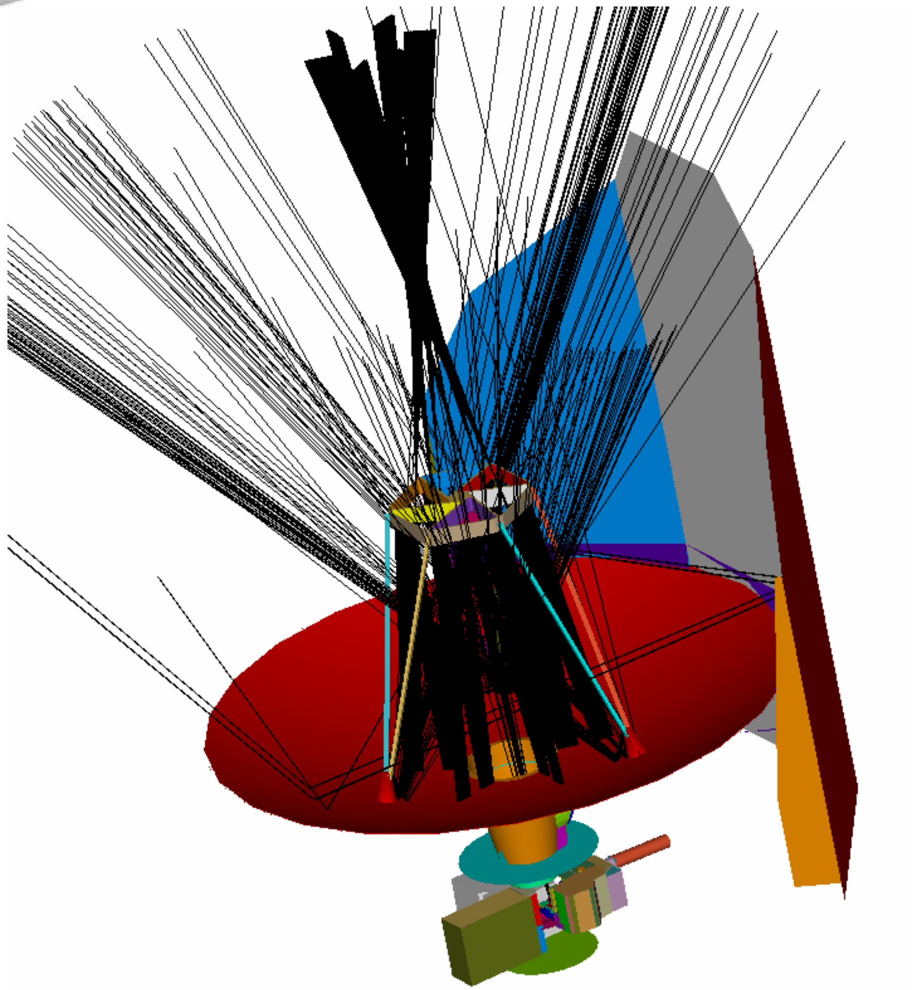


Path via surface of one of the hexapod leg

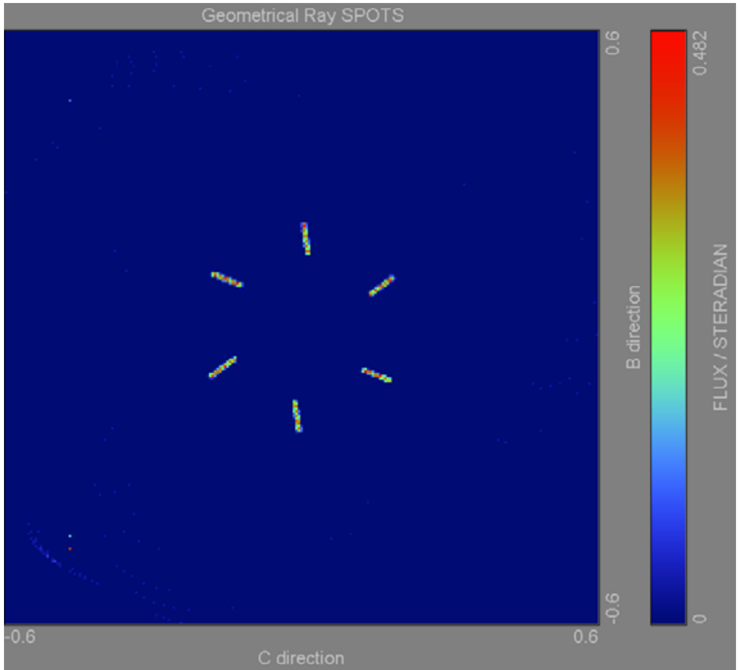
Analysis of main out-of-field paths (XII)

Path	Rays	SumTO	Percent	Hits	Curr	Prev	Split/Scatter ...
3	1132176	8.9E-01	94.4	-4	443	52	0.000
4	34670	2.6E-02	2.8	-5	443	52	0.000
70	7408	5.7E-03	0.6	-4	443	86	0.000
13	3393	2.5E-03	0.3	-8	443	52	0.000
23	2495	1.8E-03	0.2	-7	443	52	0.000
38	2340	1.7E-03	0.2	-6	443	25	0.000
278	1917	1.5E-03	0.2	-5	443	24	0.000
22	1896	1.4E-03	0.2	-5	443	15	0.000
239	1888	1.4E-03	0.2	-5	443	18	0.000
20	1878	1.4E-03	0.2	-5	443	12	0.000
73	1856	1.4E-03	0.1	-5	443	21	0.000
282	1850	1.4E-03	0.1	-5	443	9	0.000
10	1774	1.3E-03	0.1	-6	443	52	0.000
1	1492	1.2E-03	0.1	-3	443	76	0.000

295	1203969	9.5E-01					



Extra double bounce between M1 and M2 barrel structure bottom faces



Analysis of main out-of-field paths (XIII)

Path	Rays	SumTO	Percent	Hits	Curr	Prev	Split/Scatter ...
3	1132176	8.9E-01	94.4	-4	443	52	0.000
4	34670	2.6E-02	2.8	-5	443	52	0.000
70	7408	5.7E-03	0.6	-4	443	86	0.000
13	3393	2.5E-03	0.3	-8	443	52	0.000
23	2495	1.8E-03	0.2	-7	443	52	0.000
38	2340	1.7E-03	0.2	-6	443	25	0.000
278	1917	1.5E-03	0.2	-5	443	24	0.000
22	1896	1.4E-03	0.2	-5	443	15	0.000
239	1888	1.4E-03	0.2	-5	443	18	0.000
20	1878	1.4E-03	0.2	-5	443	12	0.000
73	1856	1.4E-03	0.1	-5	443	21	0.000
282	1850	1.4E-03	0.1	-5	443	9	0.000
10	1774	1.3E-03	0.1	-6	443	52	0.000
1	1492	1.2E-03	0.1	-3	443	76	0.000

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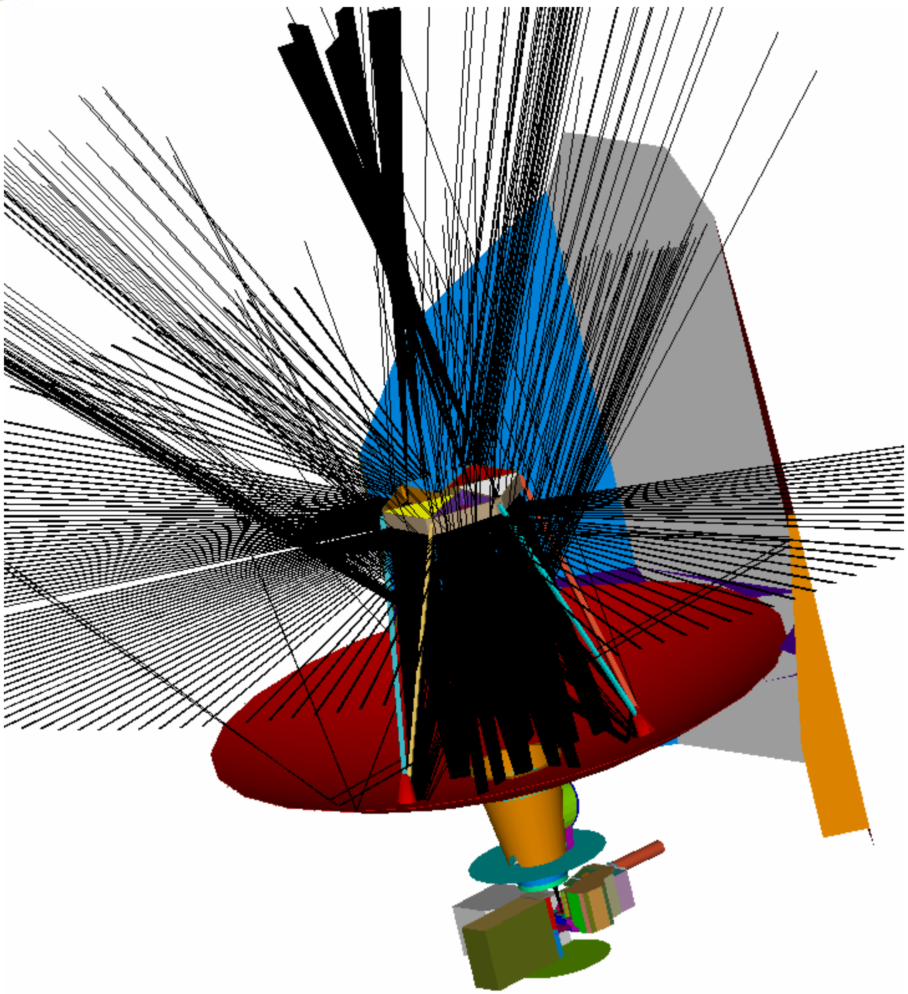
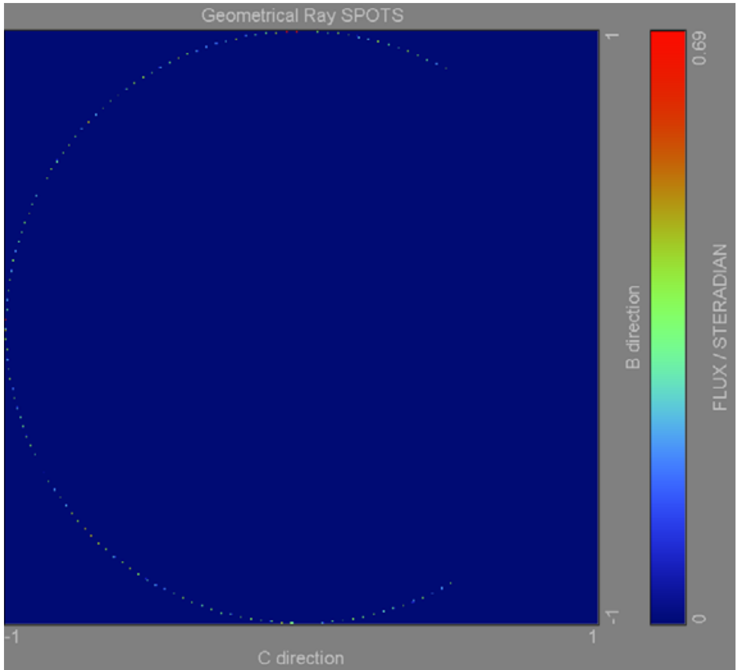
295 1203969 9.5E-01





Wide angular spread from edge/chamfer of M2

Material added after HStrayWG meeting #4

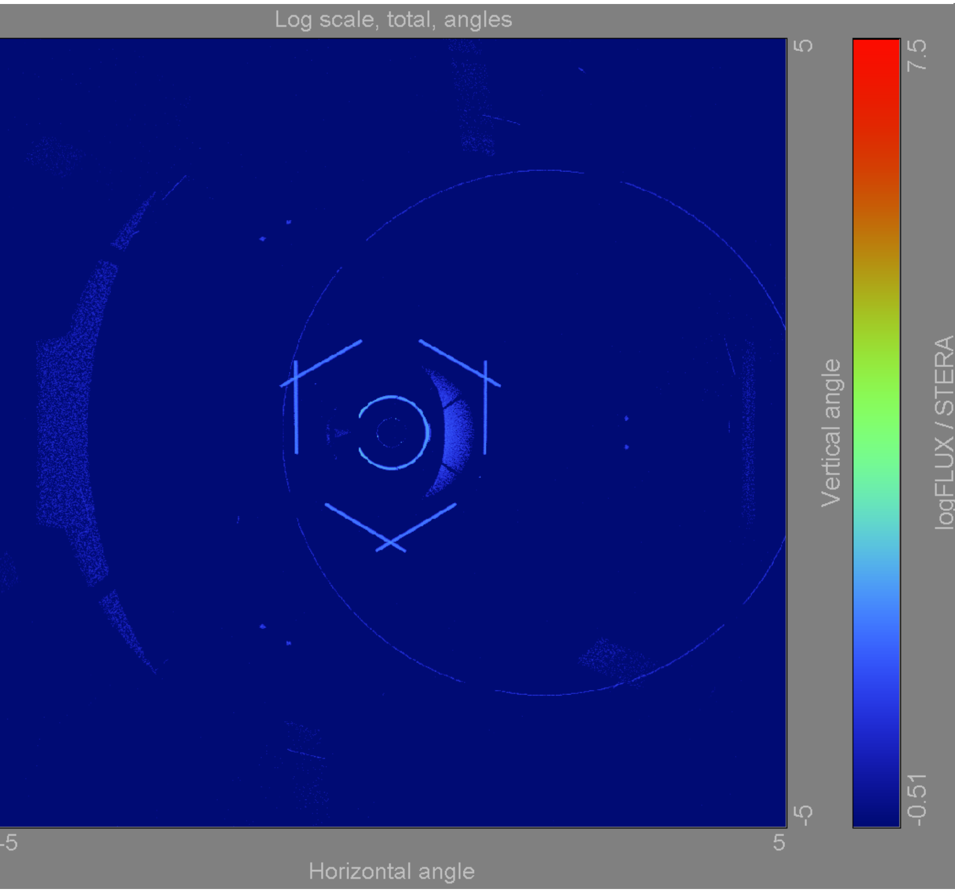
- From discussion during the meeting, additional views of the results at higher resolution over smaller window extent around boresight are displayed in the next slides

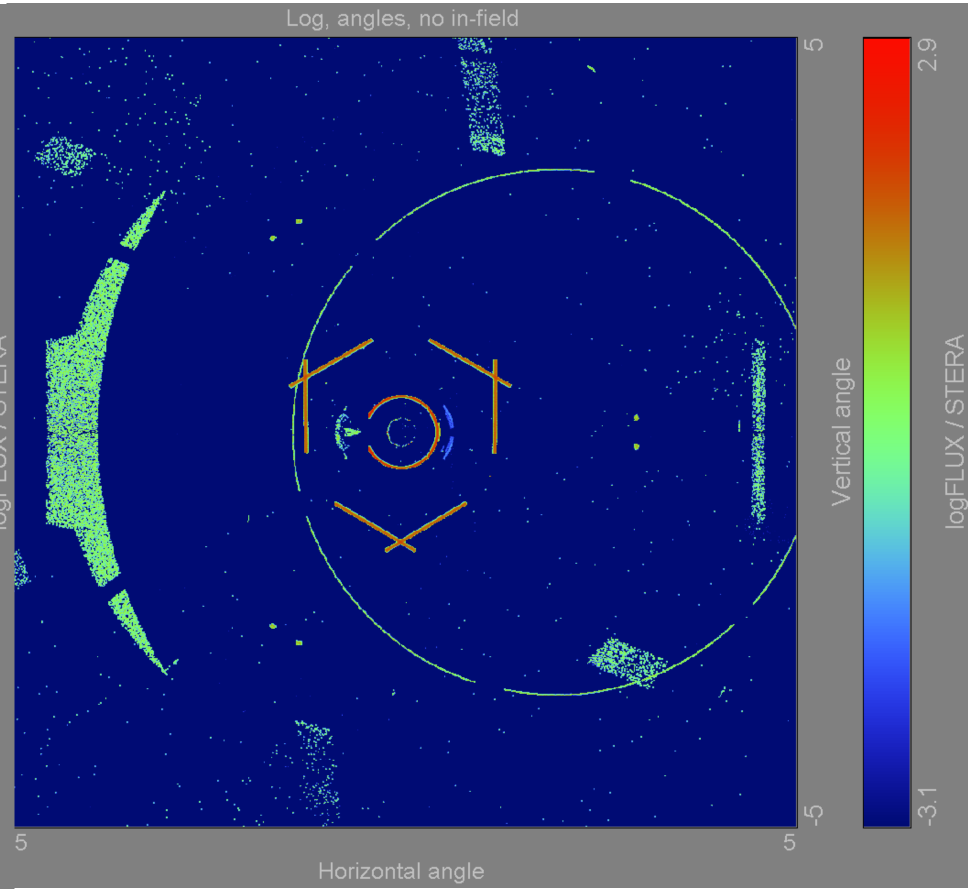
Science & Technology Facilities Council

Results at higher angular resolution (I)

SPIRE case: ~37.5" image pixel resolution over 10degx10deg about telescope boresight

Strongest feature is at ~$10^{-4.5}$ relative level compared to in-field source





With in-field point source (log scale)

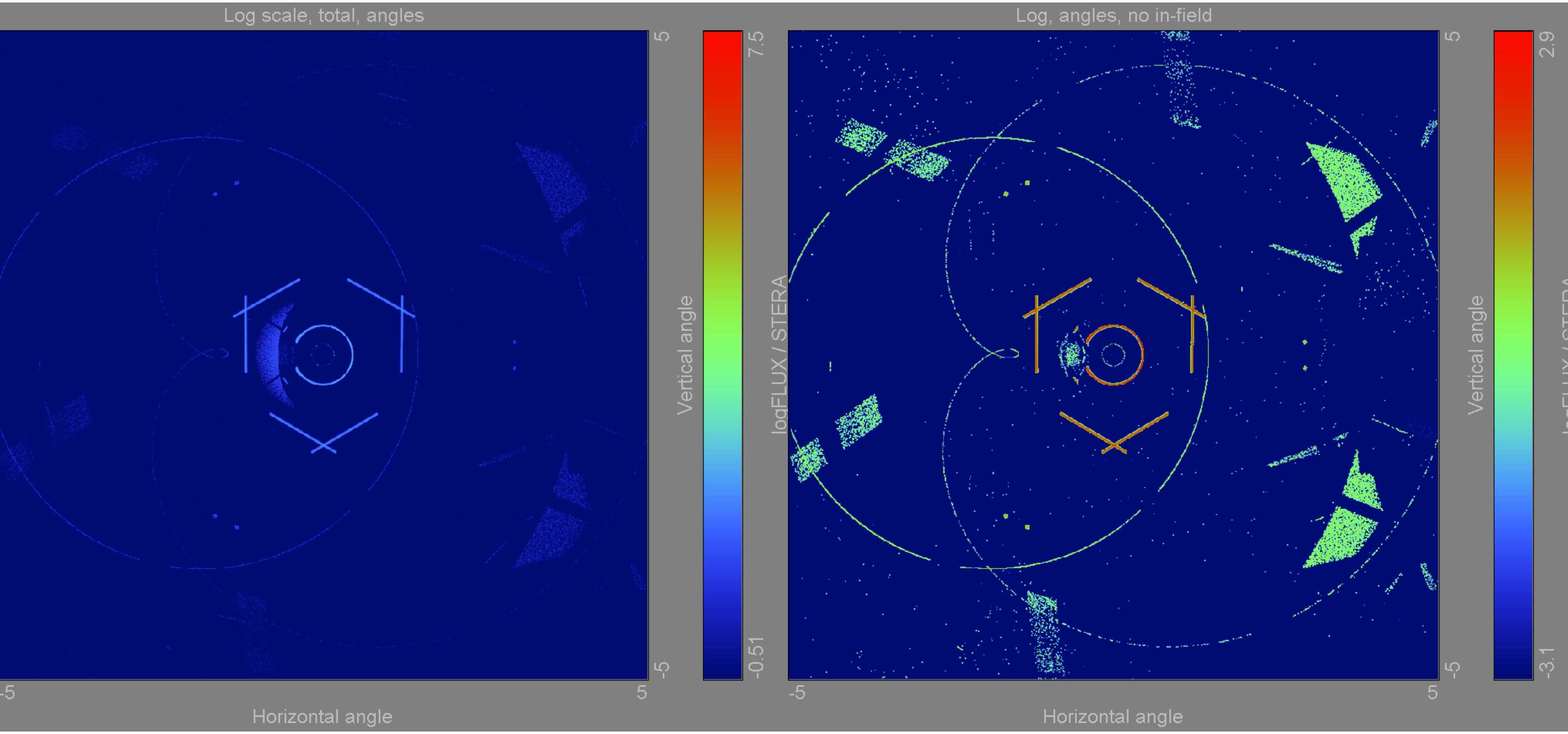
Without in-field point source (log scale)

SPIRE

Results at higher angular resolution (II)

PACS case: ~37.5" image pixel resolution over 10degx10deg about telescope boresight

Strongest feature at $\sim 10^{-4.5}$ relative level, very similar to SPIRE case



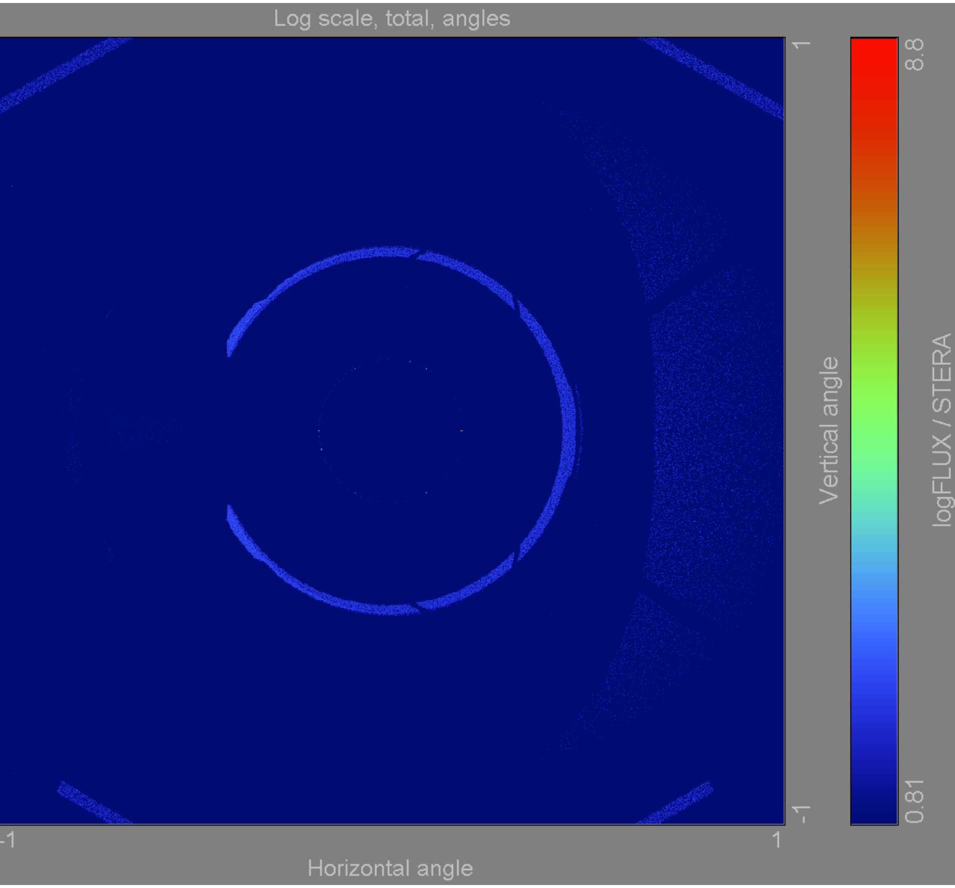
With in-field point source (log scale)

Without in-field point source (log scale)

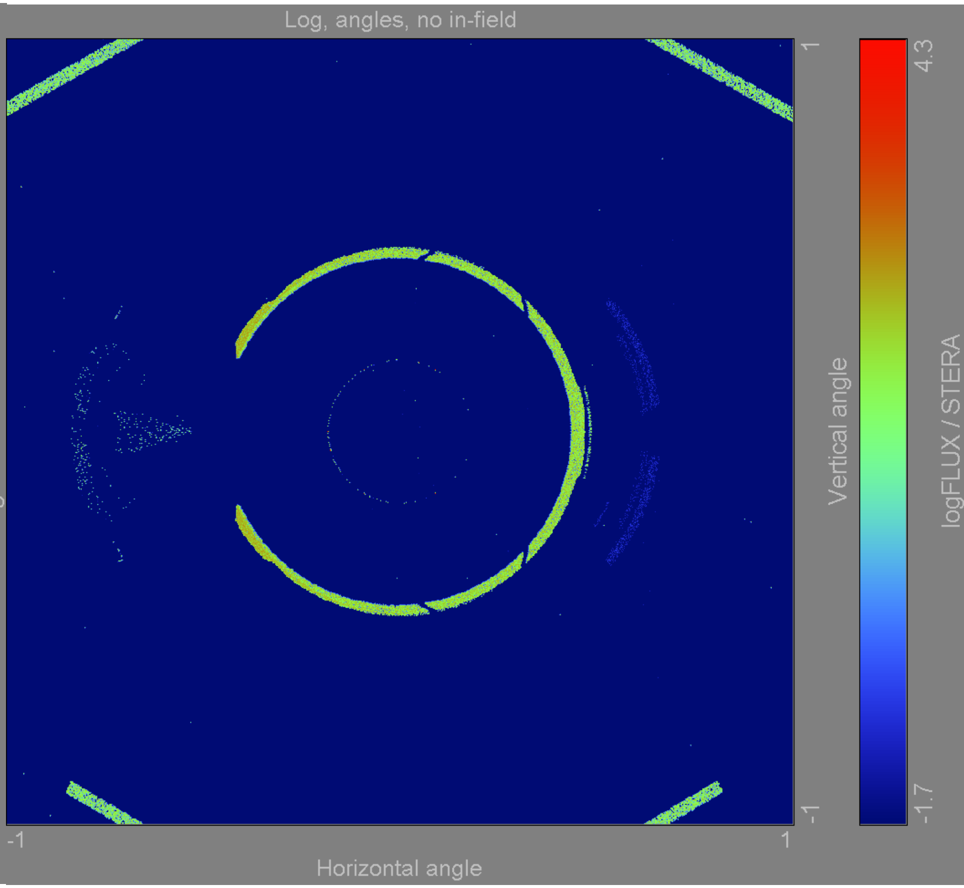
Results at higher angular resolution (III)

SPIRE case: ~7.5″ image pixel resolution over 2degx2deg about telescope boresight

<u>NB:</u> in practice this pattern will be blurred by much larger SPIRE diffraction beam patterns



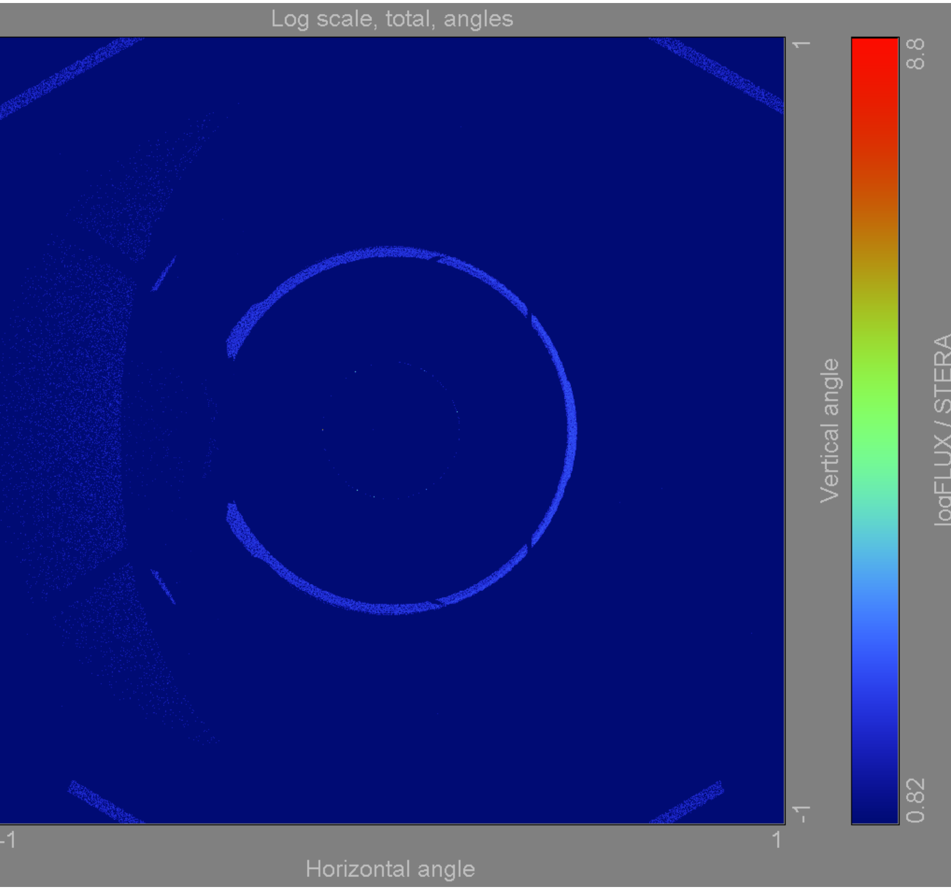
With in-field point source (log scale)

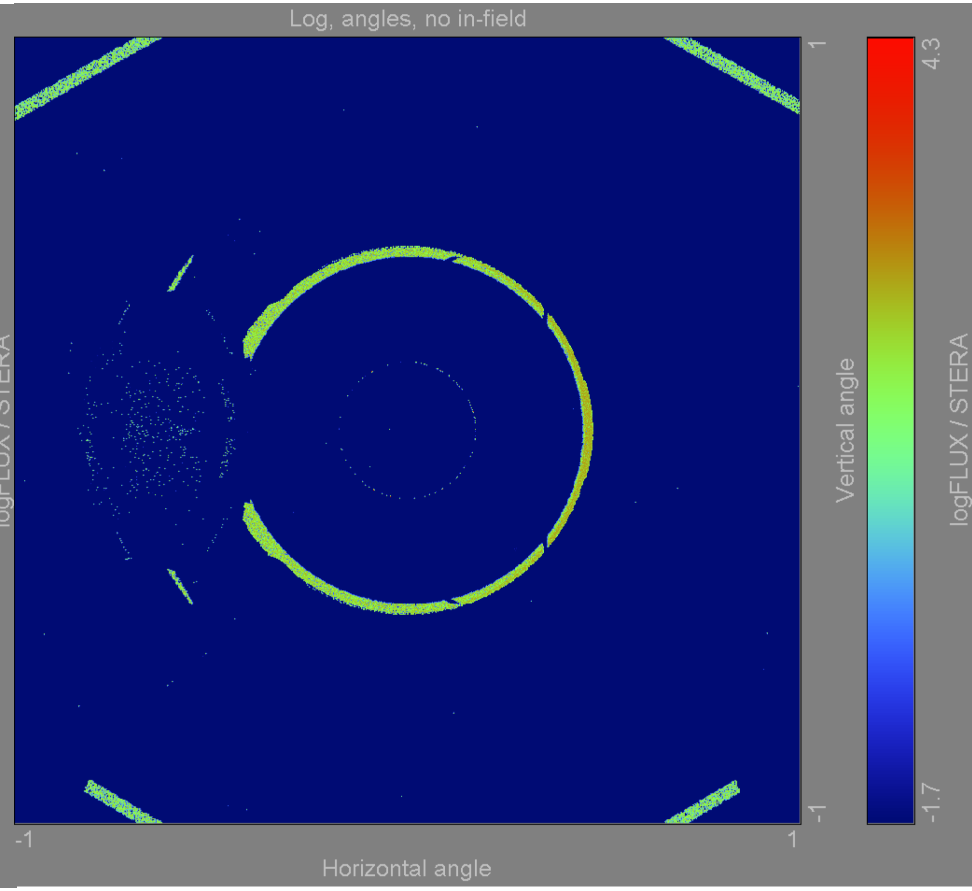


Without in-field point source (log scale)

Results at higher angular resolution (IV)

PACS case: ~7.5" image pixel resolution over 2degx2deg about telescope boresight





With in-field point source (log scale)

Without in-field point source (log scale)

- - - D R A F T - - -

HStrayWG Final Report

Table of Contents and lead draft authors

1. Introduction and scope

Describes the scope of the report: GLP.

2. Herschel straylight requirements

Describes the Herschel straylight requirements (telescope, SRS) and their reported fulfilment: GLP.

3. Task of the HStrayWG

Describes the task of the HStrayWG (refer to and append the TOR): GLP.

4. Conduct of the HStrayWG

Describes the workings of the HStrayW, meetings held, analyses made etc etc: GLP with input re analyses.

5. Straylight inside instrument FOVs

We have established this is not an issue, so we just need to mention that: GLP.

6. Straylight inside telescope FOV

PACS phot KO/BA, PACS spectr UK, SPIRE MF.

7. Straylight outside telescope FOV

PACS phot KO/BA, PACS spectr UK, SPIRE MF.

8. Selfemission

PACS phot KO/BA, PACS spectr UK, SPIRE MF.

9. Conclusions

Draft GLP.

Appendix 1

Listing of AOTs. PACS phot KO/BA, PACS spectr UK, SPIRE MF.

- - - D R A F T - - -

HStrayWG Final Report

Table of Contents and lead draft authors

Input deadline 16 March 2009

1. Introduction and scope
Describes the scope of the report: GLP.

2. Herschel straylight requirements
Describes the Herschel straylight requirements (telescope, SRS) and their reported fulfilment: GLP/DD.

3. Task of the HStrayWG
Describes the task of the HStrayWG (refer to and append the TOR): GLP.
Raise and put ground testing issue to bed.

4. Conduct of the HStrayWG
Describes the workings of the HStrayW, meetings held, analyses made etc etc: GLP with input re analyses.

5. Straylight inside instrument FOVs
We have established this is not an issue, so we just need to mention that: Intro GLP, input MF/KO/BA/UK
Meant to be short, we have established that this is all covered by existing PV plans.

6. Straylight inside telescope FOV
Intro GLP, sections: PACS phot KO/BA, PACS spectr UK, SPIRE MF.

7. Straylight outside telescope FOV
Intro GLP, sections: PACS phot KO/BA, PACS spectr UK, SPIRE MF.

8. Selfemission
Intro GLP, sections: PACS phot KO/BA, PACS spectr UK, SPIRE MF.

9. Conclusions and recommendations
Draft GLP based on above.

Appendix 1
Listing of AOTs. PACS phot KO/BA, PACS spectr UK, SPIRE MF.