

OPSYS ILLUMINATION SYSTEM – Objective

1

- The purpose of the illumination system consists in providing the required illumination to METIS in order to verify the stray-light rejection capabilities of the instrument.
- The system must illuminate the aperture of the coronagraph with a radiance level high enough to allow the measurement of the stray-light.
- The system shall be designed by taking into account for the configuration of the existing facility, in terms of available space and mechanical / optical interfaces.

Requirement ID	Description	Value	Unit
R001	Source angular diameter	0.52 – 1.73	deg
R002	Uniformity	3%	-
R003	Radiant flux	TBD	W/cm ² / sr
R004	Stray-light	TBD	

Table 1 Source requirements.

➤ Radiance level

After calculation performed by OATo the required radiance level has been defined as:

$$B_{source} \sim 1.-0.5 \text{ kWsr}^{-1}\text{cm}^{-2} (400 - 700\text{nm})$$



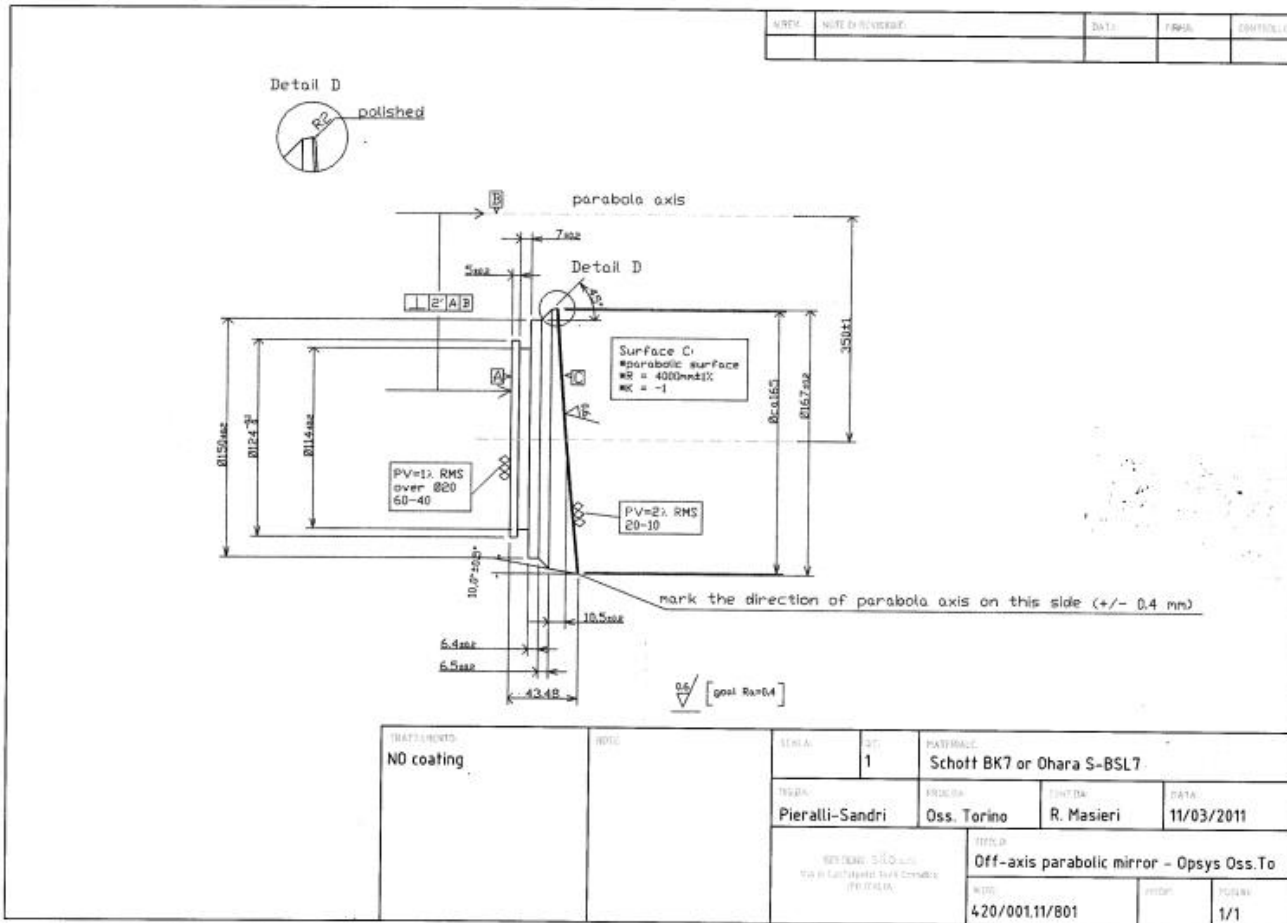
➤ Configurations

It is required to simulate at least the following configurations:

1. Sun at 0.50 AU
2. Sun at 0.38 AU
3. Sun at 0.30 AU

The simulation of the Sun at 1 AU is also of interest.

Optical interface



OFF AXIS PARABOLA

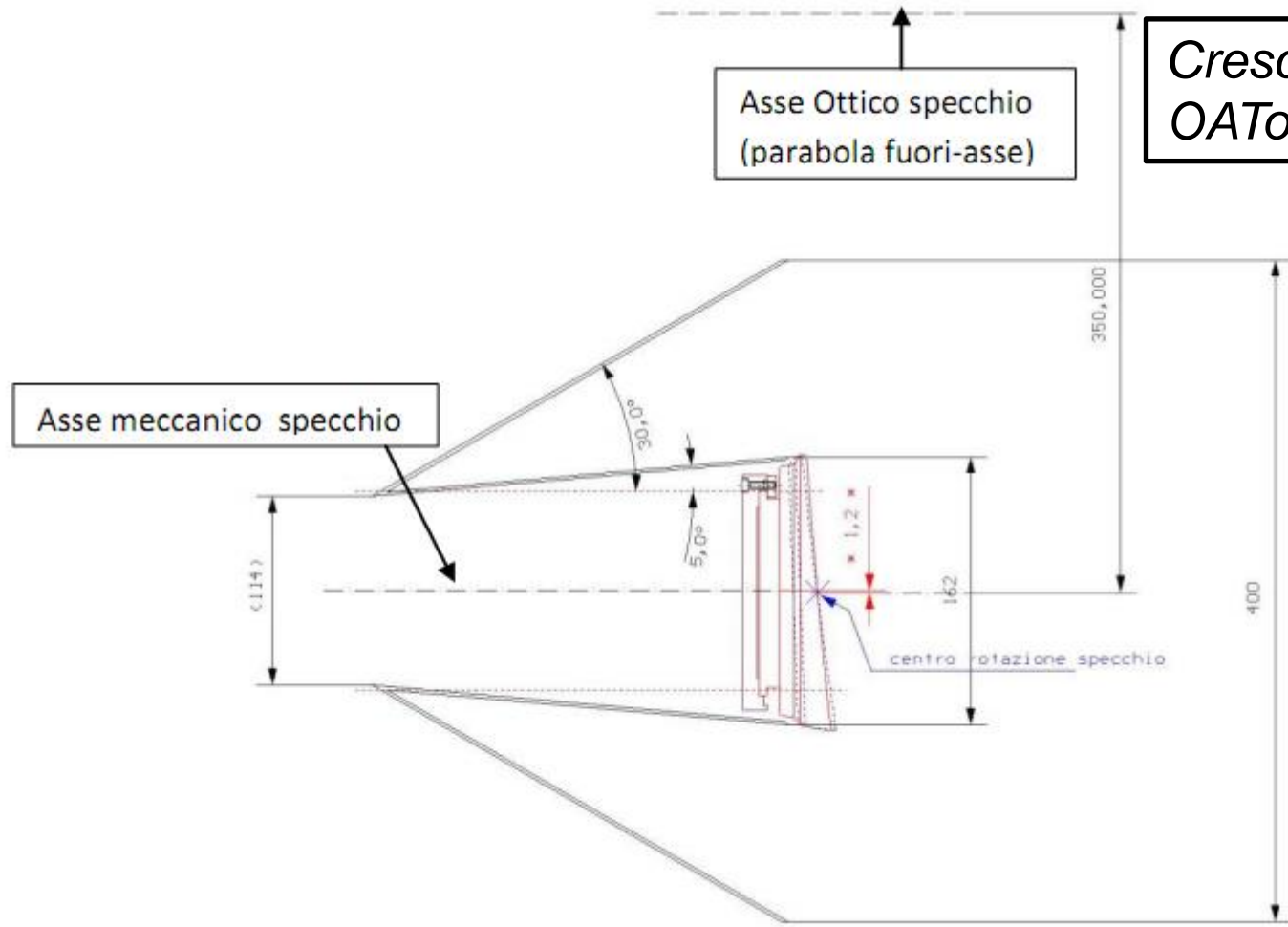
- Focal length 2000 mm
- Clear aperture 165 mm
- Off-axis distance 350 mm
- VIS Reflectance 50% (TBC)

VIEWPORT

- CF100 Fused silica window
- AR coating
- Thickness 10 mm (TBC)

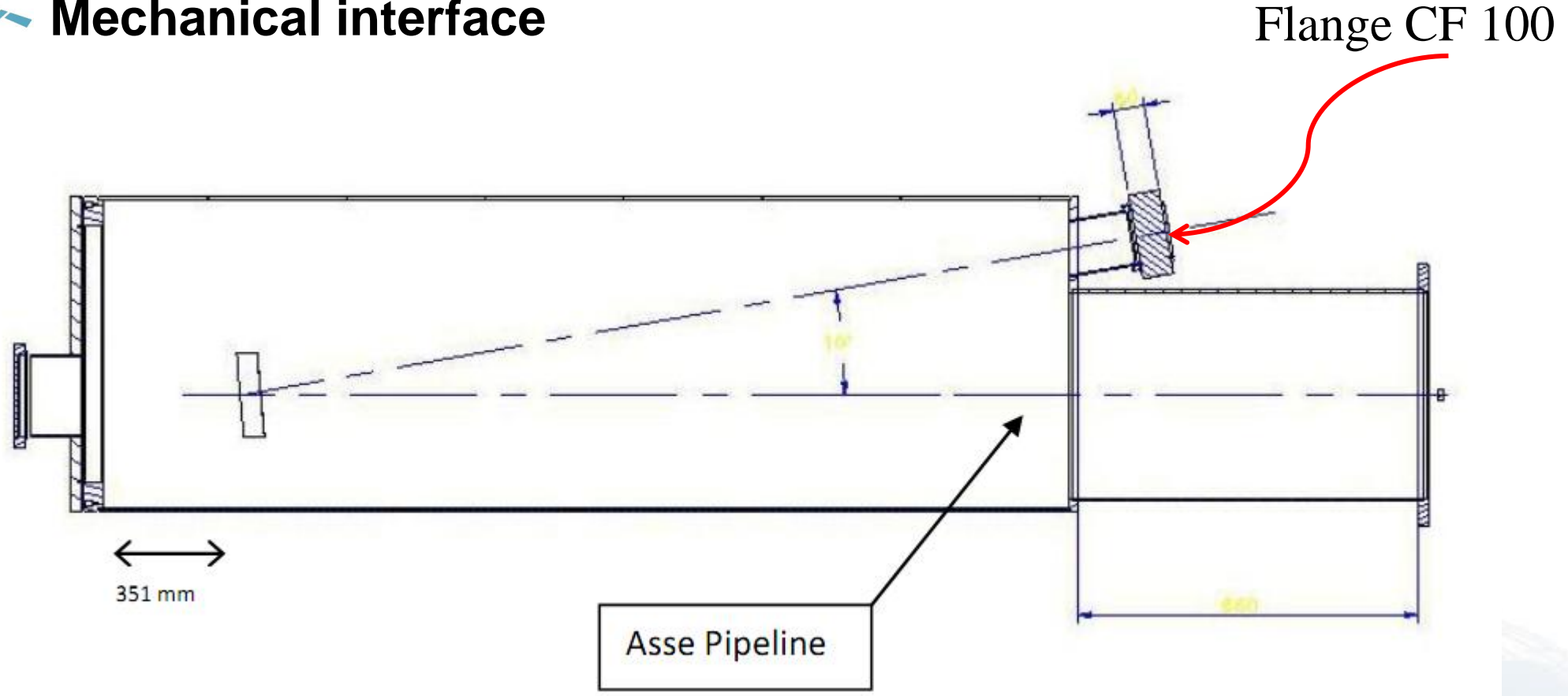
Off-axis parabola (courtesy OATo)

Optical interface



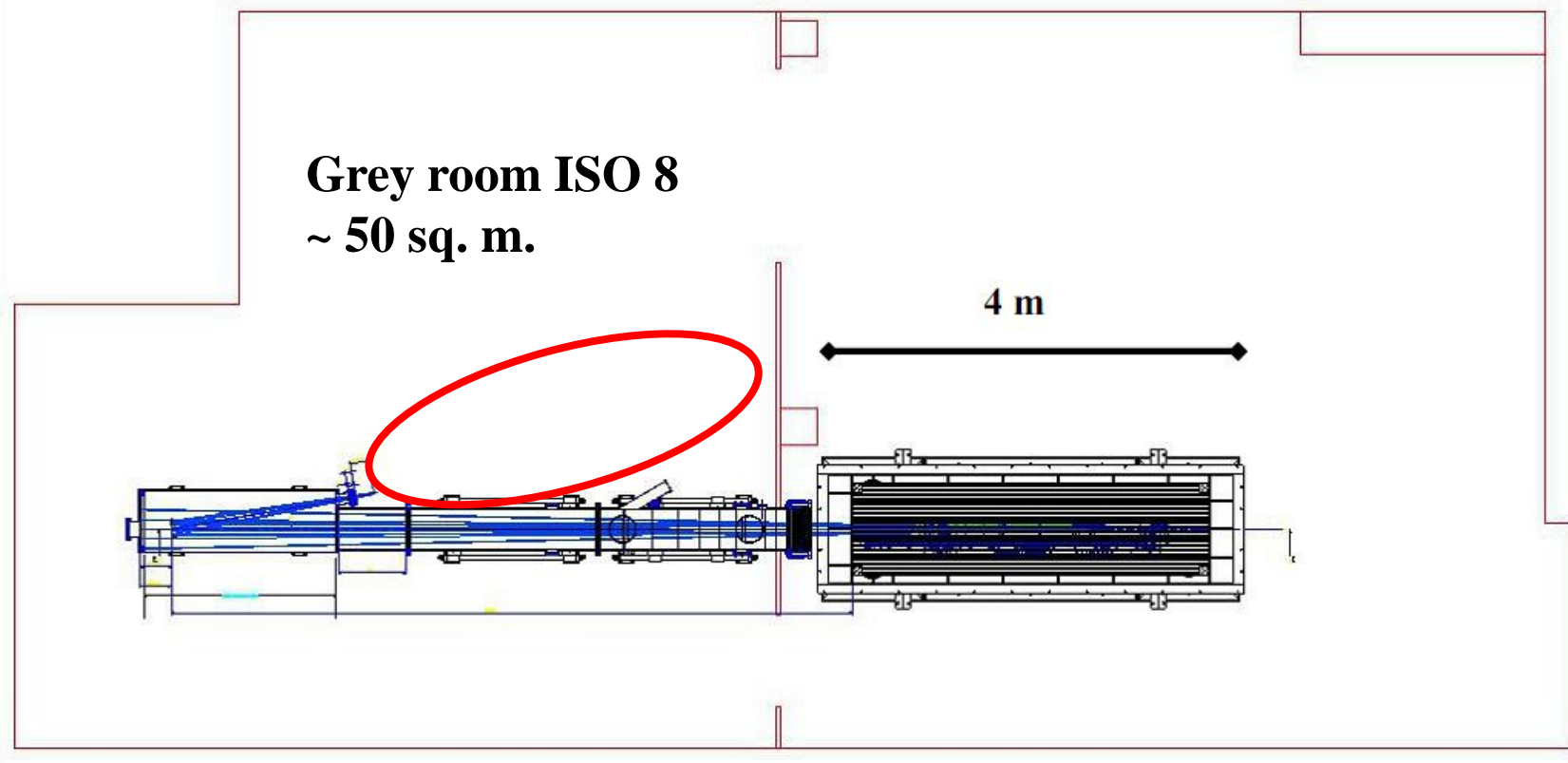
Crescenzo, Fineschi & Massone, INAF-OATo Tech. Rep. n. 147

Mechanical interface



Crescenzo, Fineschi & Massone, INAF-OATo Tech. Rep. n. 147

Laboratory

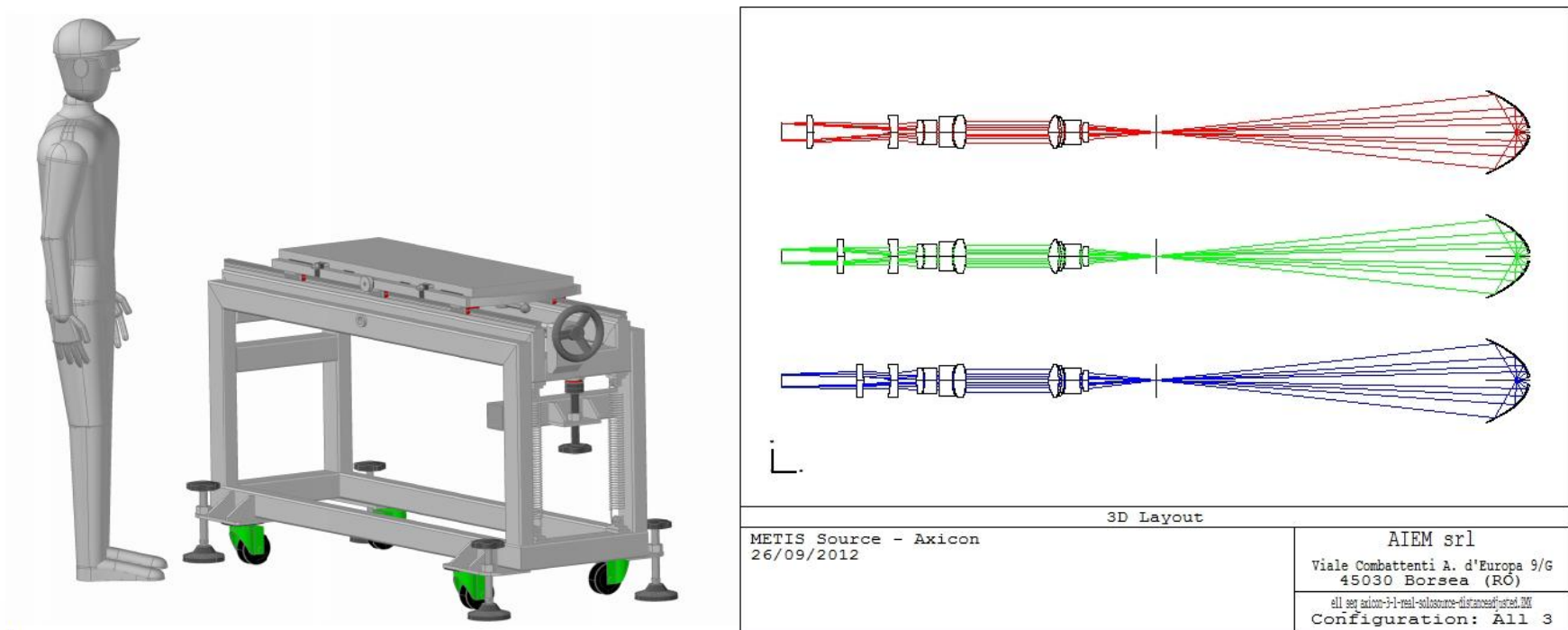


The source shall be placed in the grey room area, approximately inside the red zone.

Fineschi et al., Proc. SPIE 8148-31 (2011)

OPSYS ILLUMINATION SYSTEM – Configuration

In the course of the project several modifications to the initial configuration, based on the solar simulator developed for Bepi Colombo, have been implemented, in order to simplify the system reducing costs while achieving the performances required for the stray-light measurement.



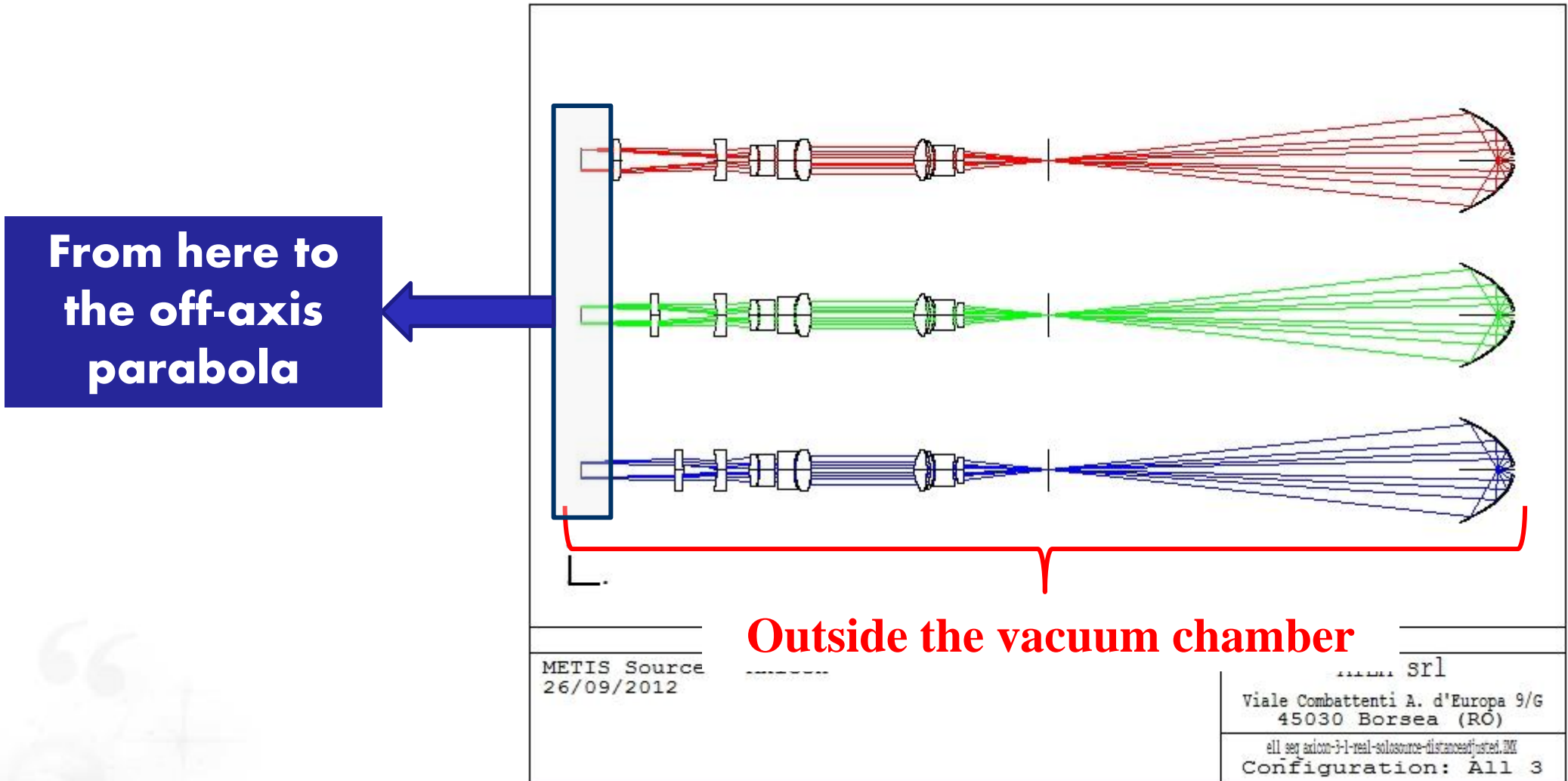
TO THIS

THALES ALENIA SPACE INTERNAL

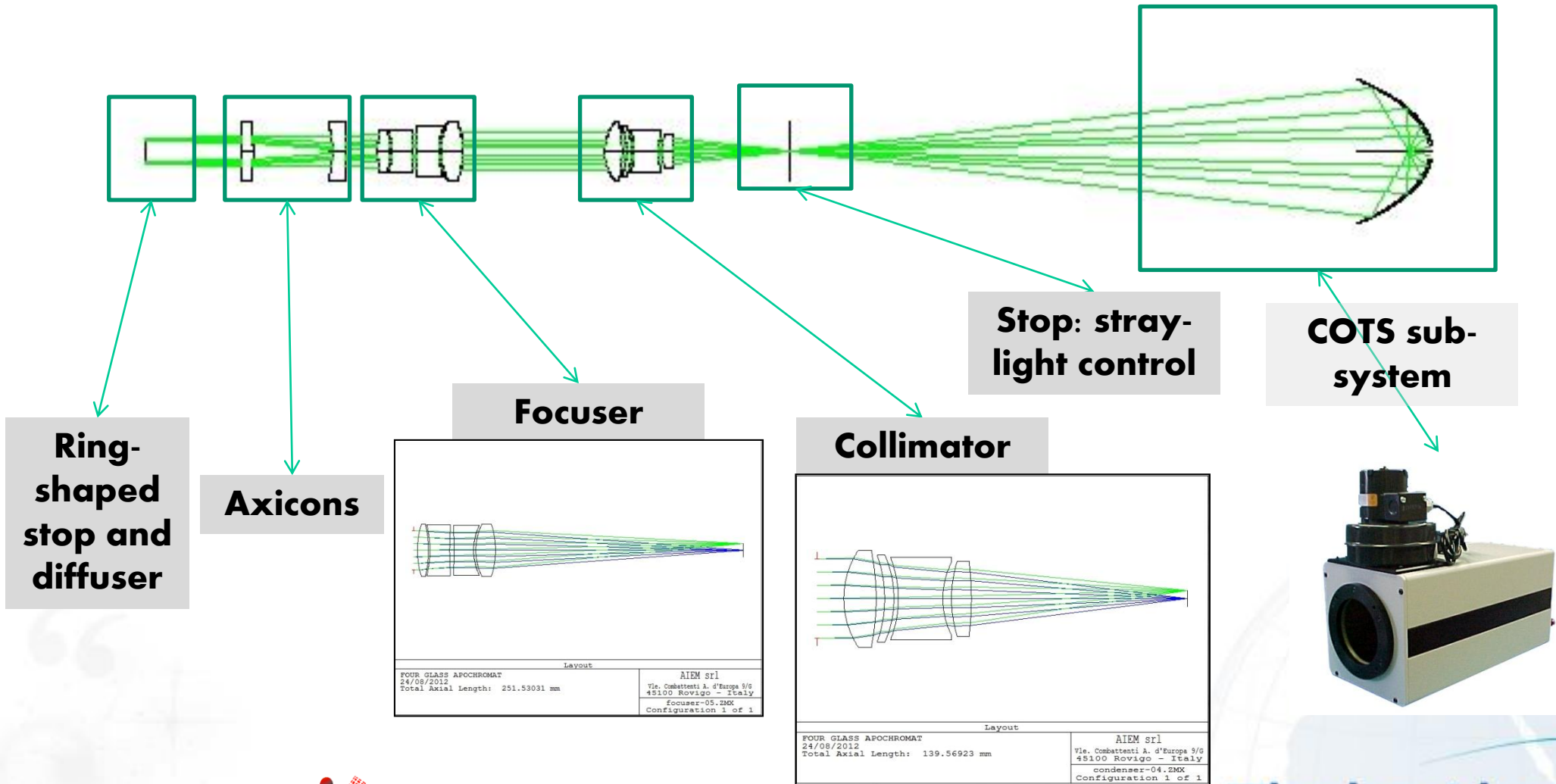
➤ Proposed configuration

- Following *Fineschi et al., Proc. SPIE 8148-31 (2011)* it is proposed to illuminate the external occulter of METIS in a finite conjugate mode using a ring-shaped source.
- The ring diameter and its position w.r.t. the OAP are such that its image is on the edge of the instrument aperture and the f-ratio in image space is such that it gives the correct angular diameter of the Sun.
- Motivation:
 - no available space inside the vacuum tube for the simulation of the Sun at 0.3 AU with a collimated beam [infinity-conjugated]
 - It is necessary to avoid direct illumination of M0, as reflected light would scatter inside the chamber contaminating the stray-light measurement

➤ Optical layout of the axicon configuration



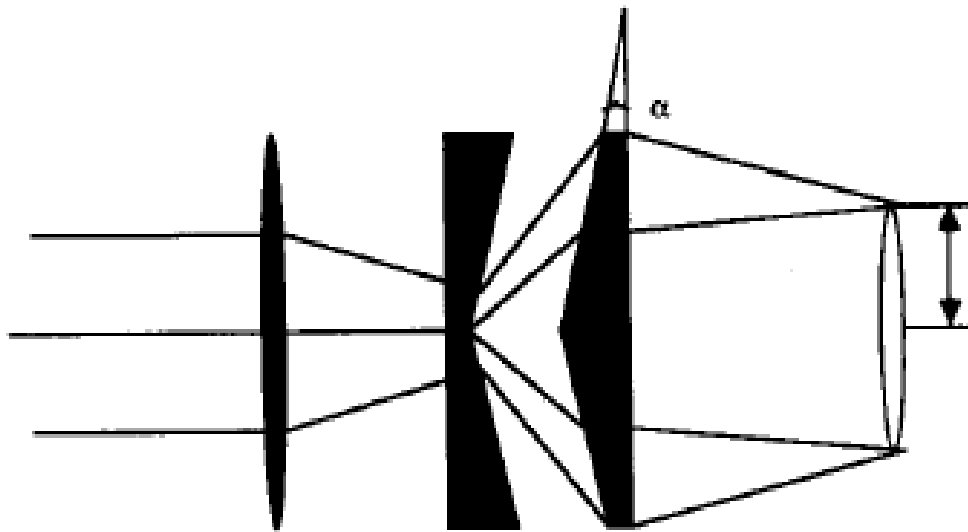
Optical layout of the axicon configuration



How the axicons work

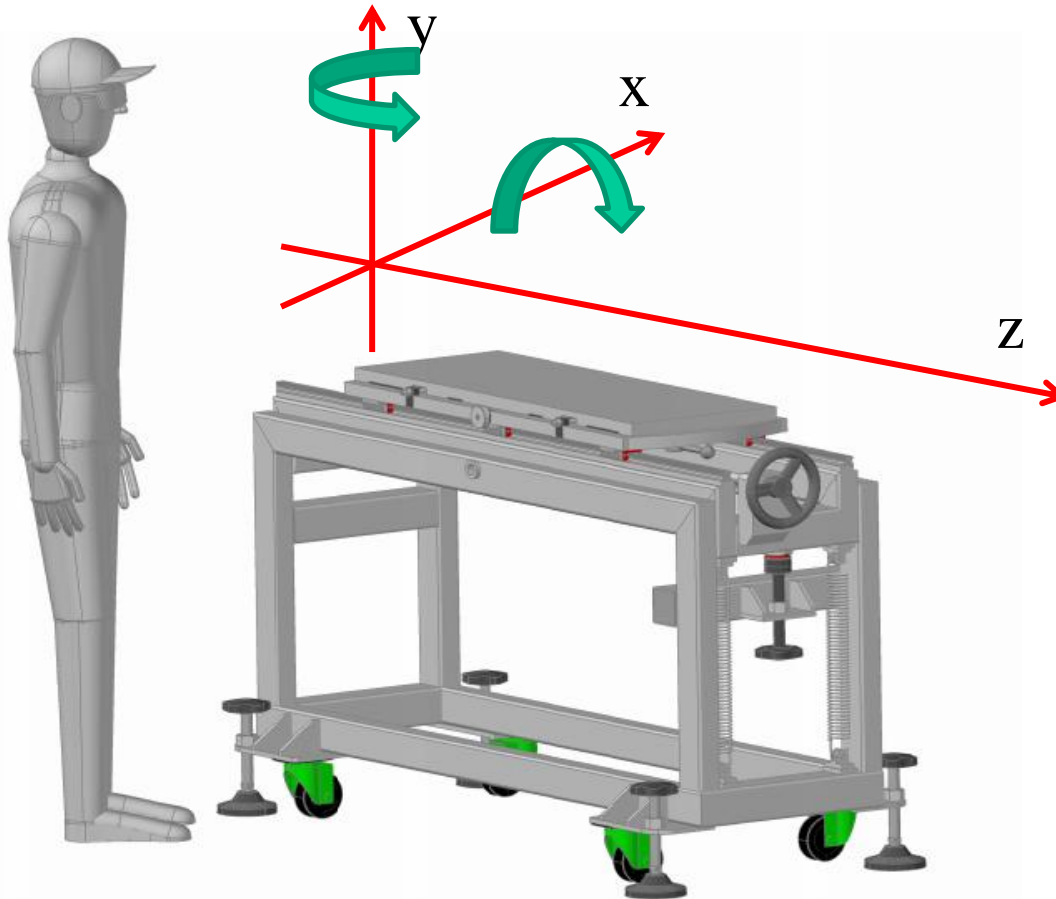
$$R = d \cdot \alpha \cdot (n - 1)$$

d is the distance between the axicons, α is the angle of the axicon and n is the refractive index of the glass of the axicon.



The switch between the configurations is obtained by (1) moving the last axicon (that closer to the ring-stop) w.r.t. the first one and (2) translating the whole system w.r.t. the OAP

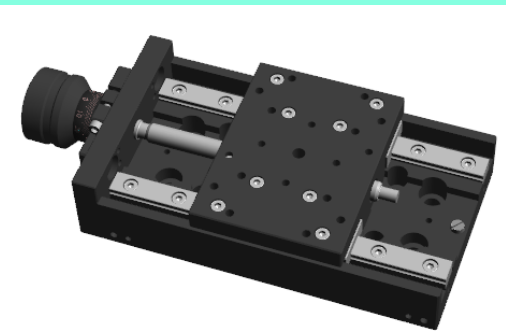
Mounting platform



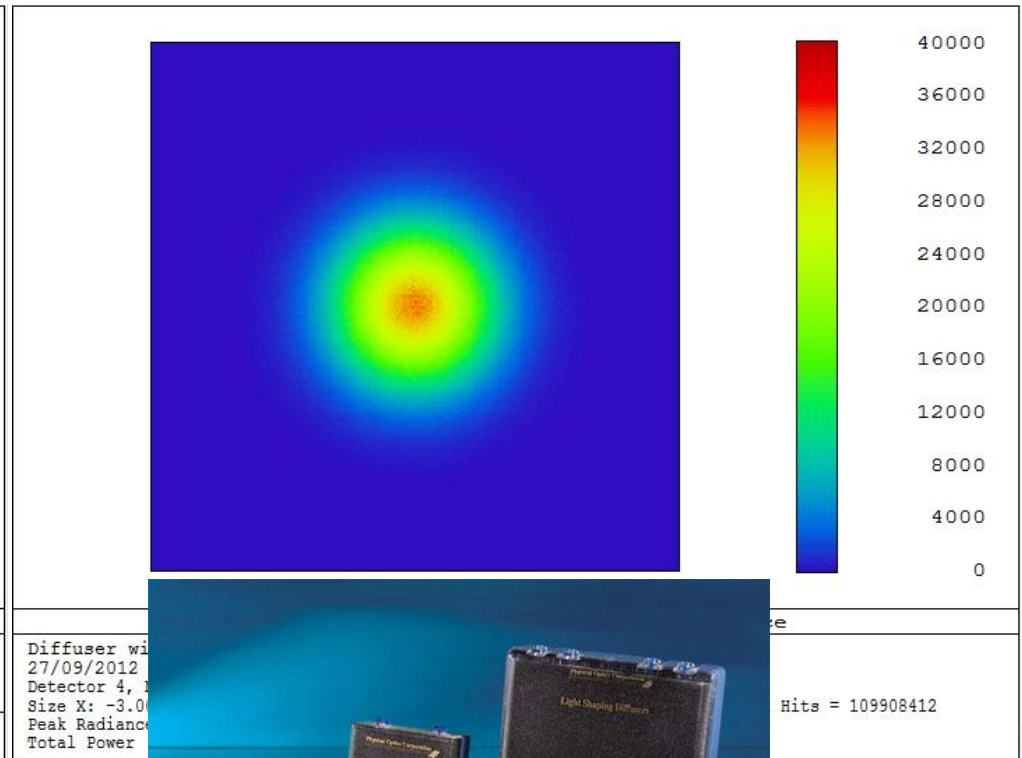
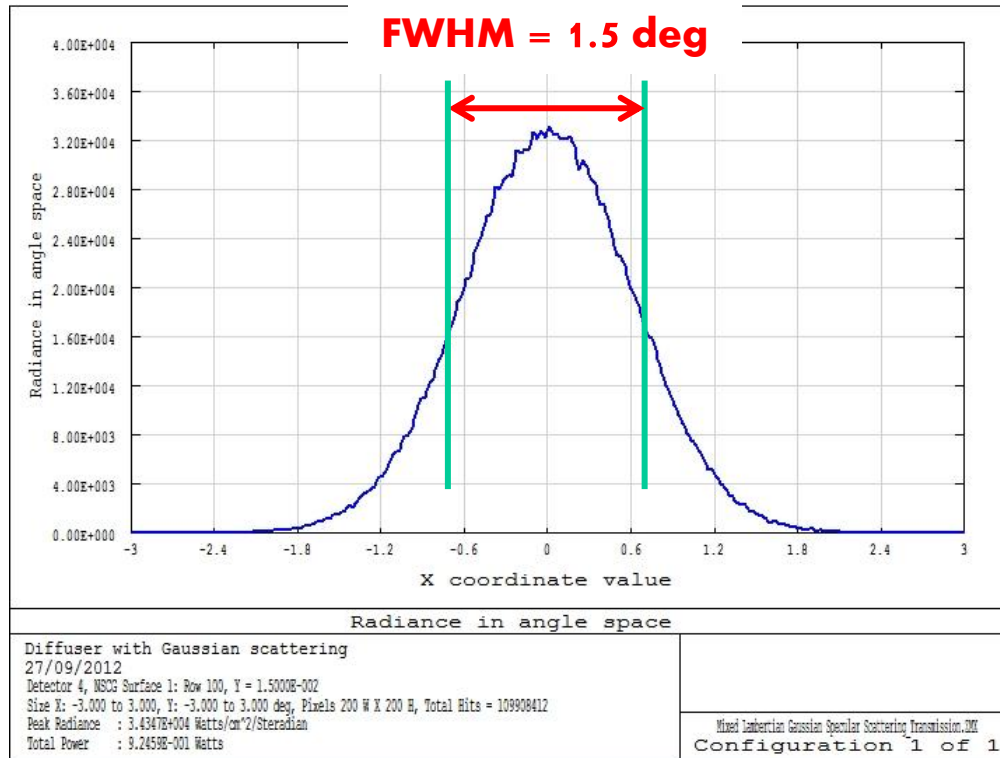
	Range	Accuracy
Translation z	± 300 mm	± 0.5 mm
Decenter x	± 20 mm	± 0.1 mm
Decenter y	± 20 mm	± 0.1 mm
Tilt x (pitch)	± 2.5 degrees	± 0.25 degrees
Tilt y (yaw)	± 2.5 degrees	± 0.25 degrees

- Mounting platform position referenced to the ISO flange
- Cross talk between tiltX and decY/decZ

- Axicon translation with COTS manual stage



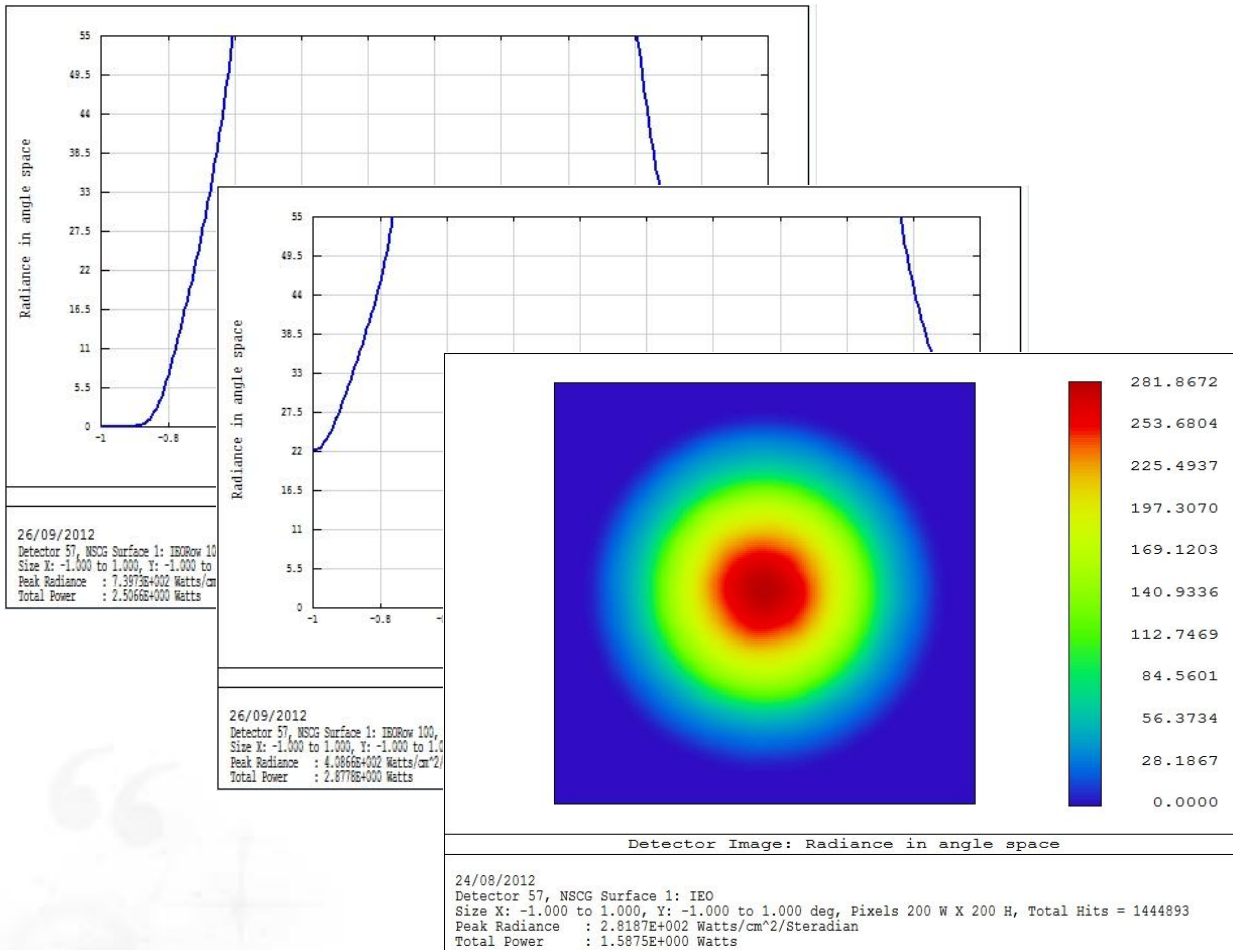
Light Shaping Diffuser



Available on stock and on request for different diffusion angles (POC, Luminit)



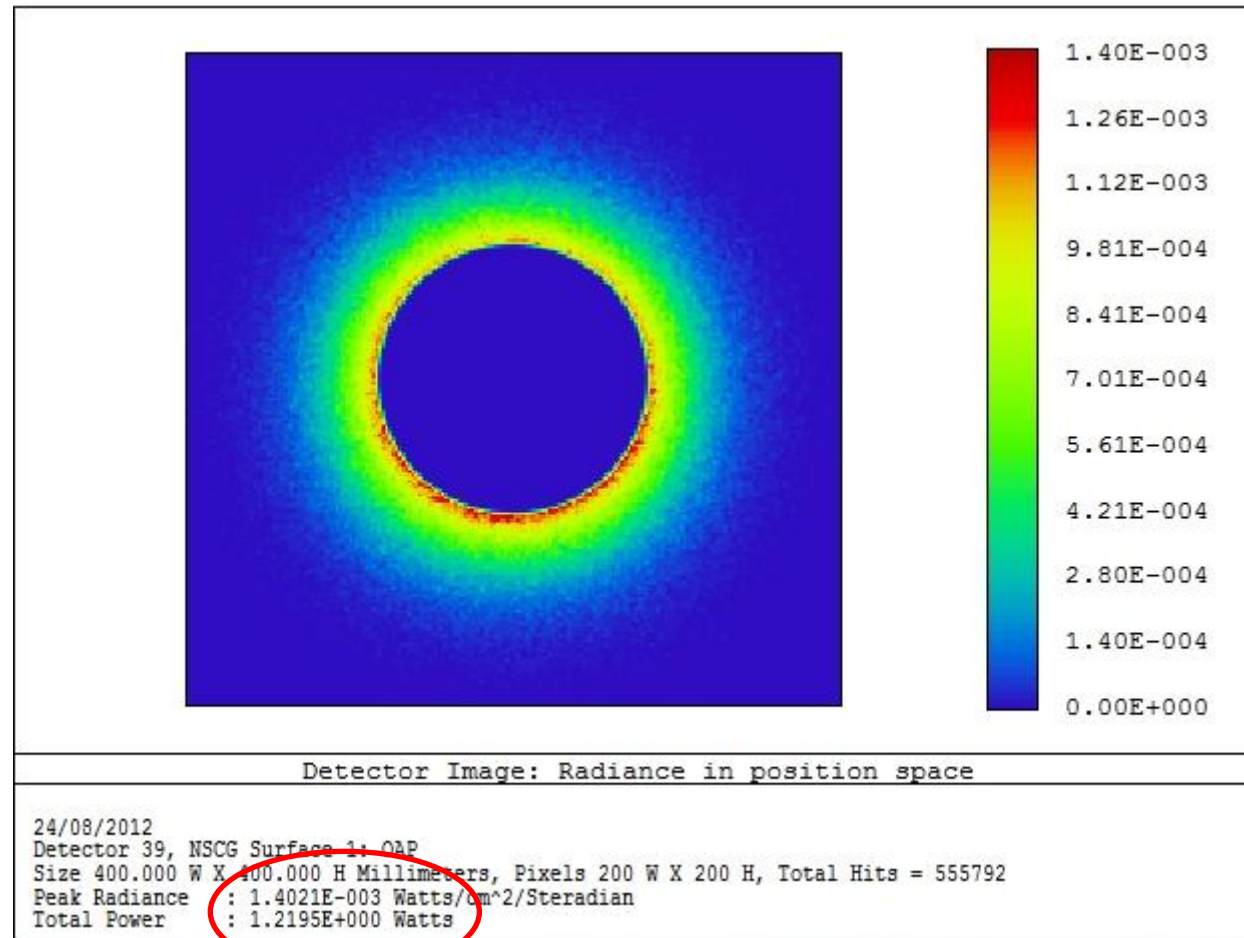
➤ Proposed configuration – performances



The system can simulate the Sun from 0.3 to 0.5 AU, optionally up to 1 AU

The system is compliant with the radiance level requirement for every configuration.

➤ Stray-light



➤ Stray-light - baffling

No stray light
inner mirror
the arc

