DE LA RECHERCHE À L'INDUSTRIE

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LMJ VISAR & SOP CALIBRATION

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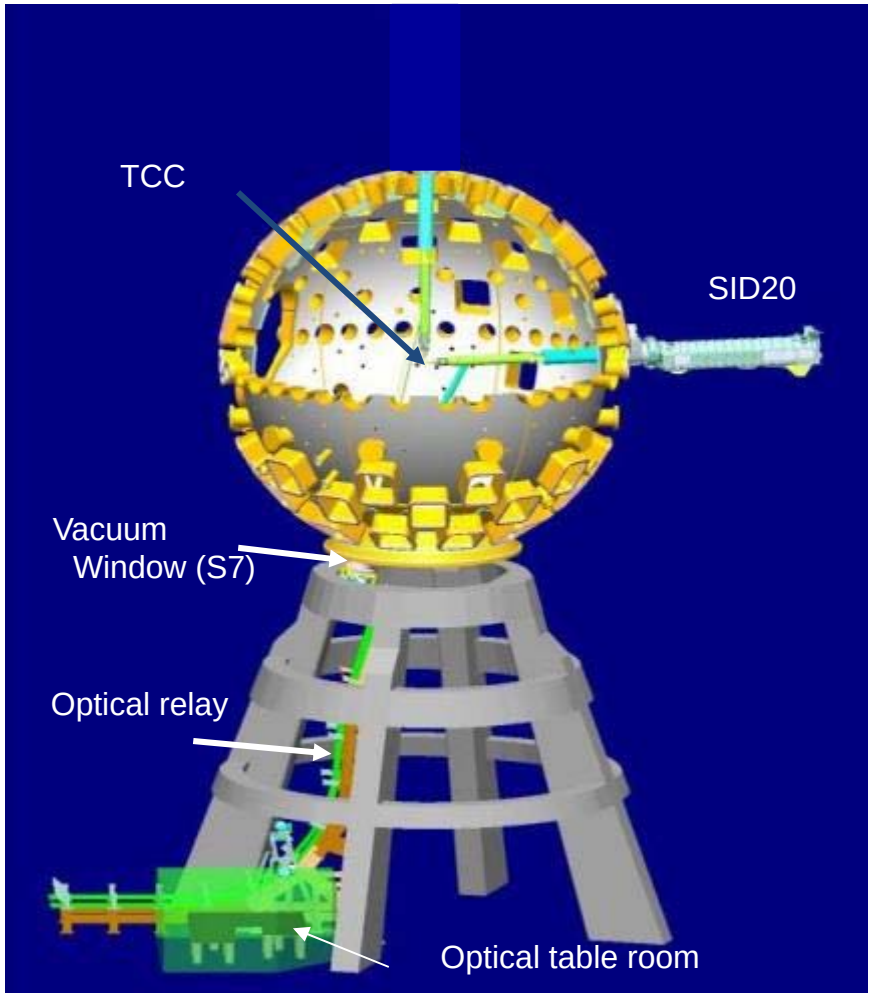
LMJ VISAR OPTICAL CHARACTERISTICS

Diagnostics & Setting		Characteristics	Measurement range	Spectral range (nm)	Field of view (mm) / Spatial resol. (µm)	dynamic (ns) / Temp. resol. (ps)
EOS Pack Diagnostics set for EOS experiments SID	Active Channels	2 VISARs (Infra-Red and/or Green)	0.5 - 200 km/s	1064 and/or 532	1 mm / 10 µm up to 5 mm / 50 µm	5 ns / 50 ps up to 100 ns / 100 ps
		Active Shock Break Out (ASBO)	Target reflectivity > 10%			
		Reflectivity				
	Passive Channels	Passive Shock Break Out (PSBO)	Target temperature > 0.1 eV	[550-750]	1 mm / 10 µm up to 10 mm / 100 µm	5 ns / 50 ps up to 100 ns / 500 ps
		Pyrometer				
		Passive 2D Image	2 images			[5 – 20] ns / [75 – 200] ps

Need absolute calibration

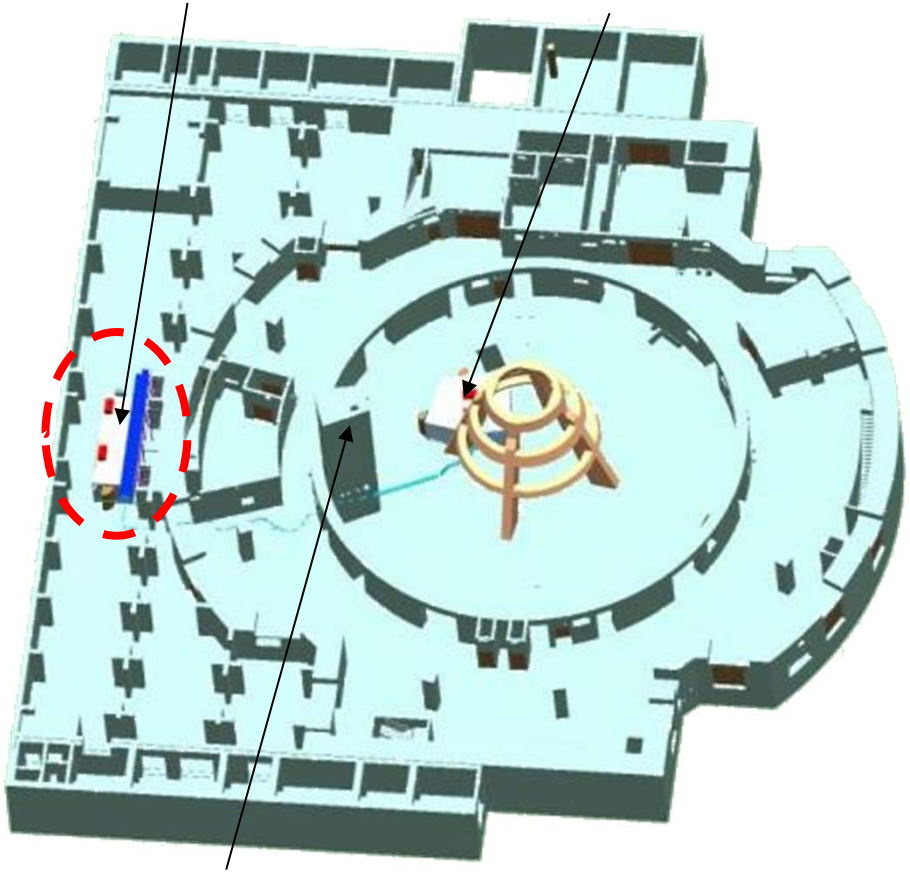
Need relative calibration

GLOBAL SETUP



Probe laser room

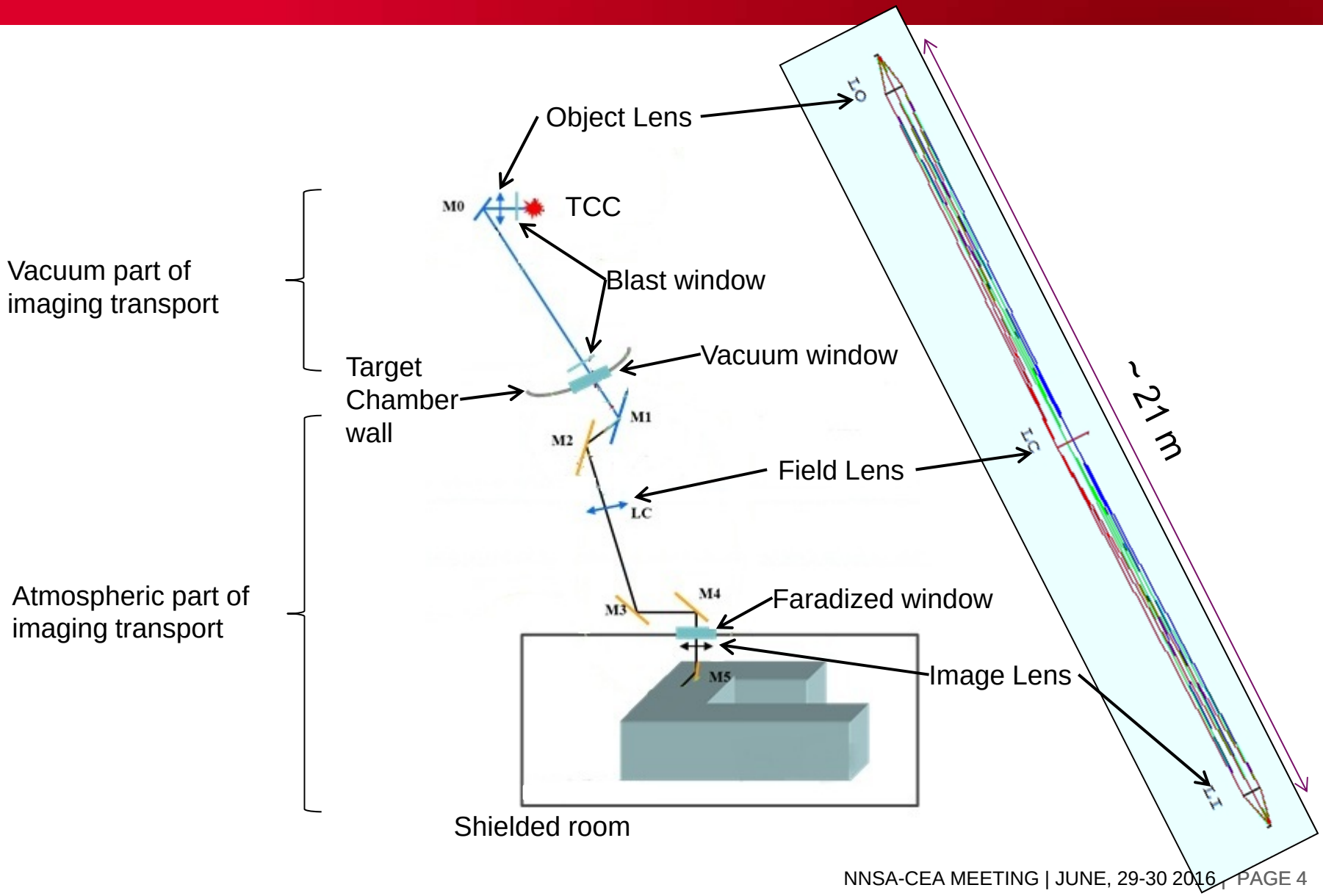
Optical table room



Casemate SWI

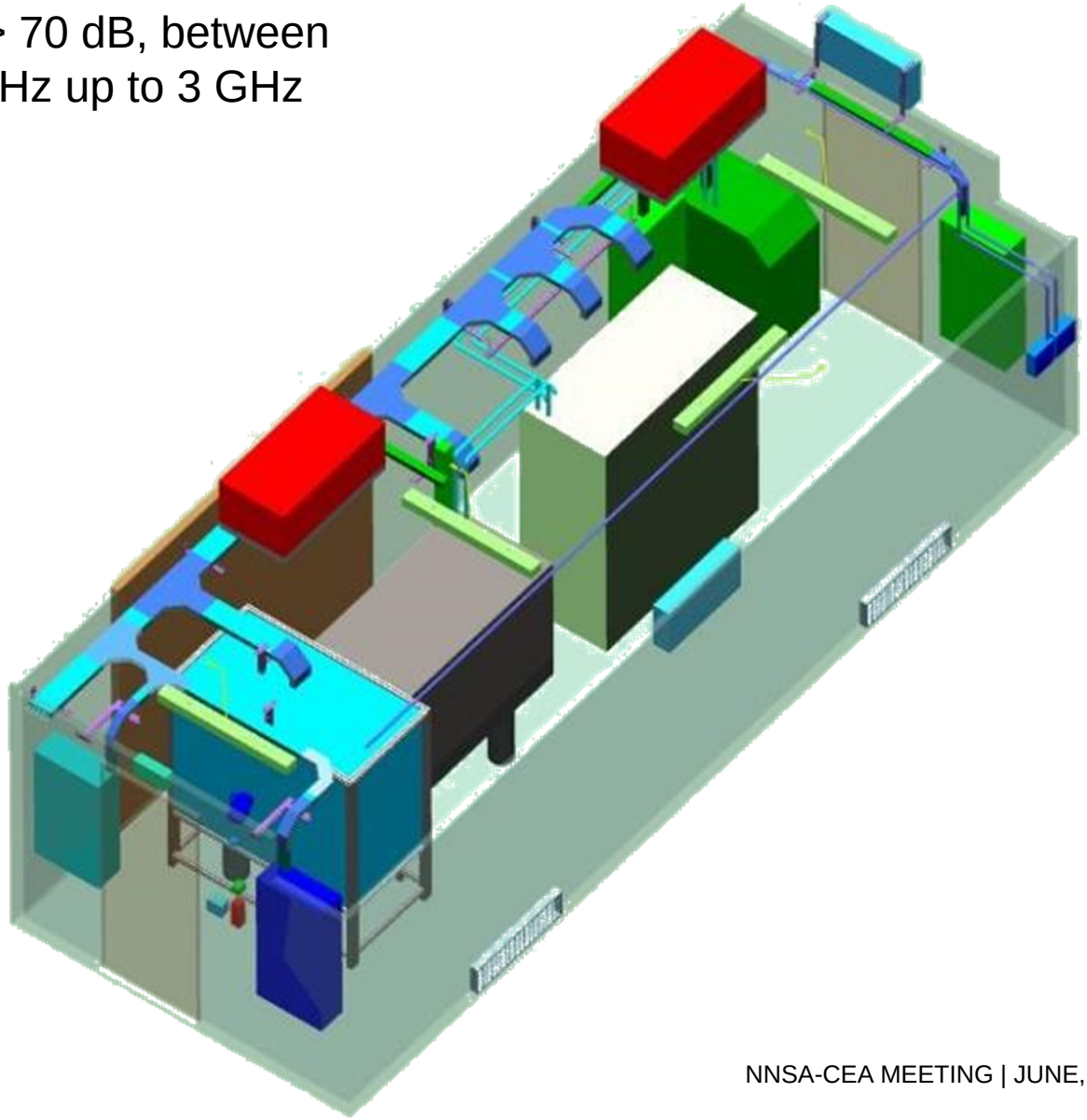
SS2 floor

IMAGING TRANSPORT BETWEEN TCC AND OPTICAL TABLE

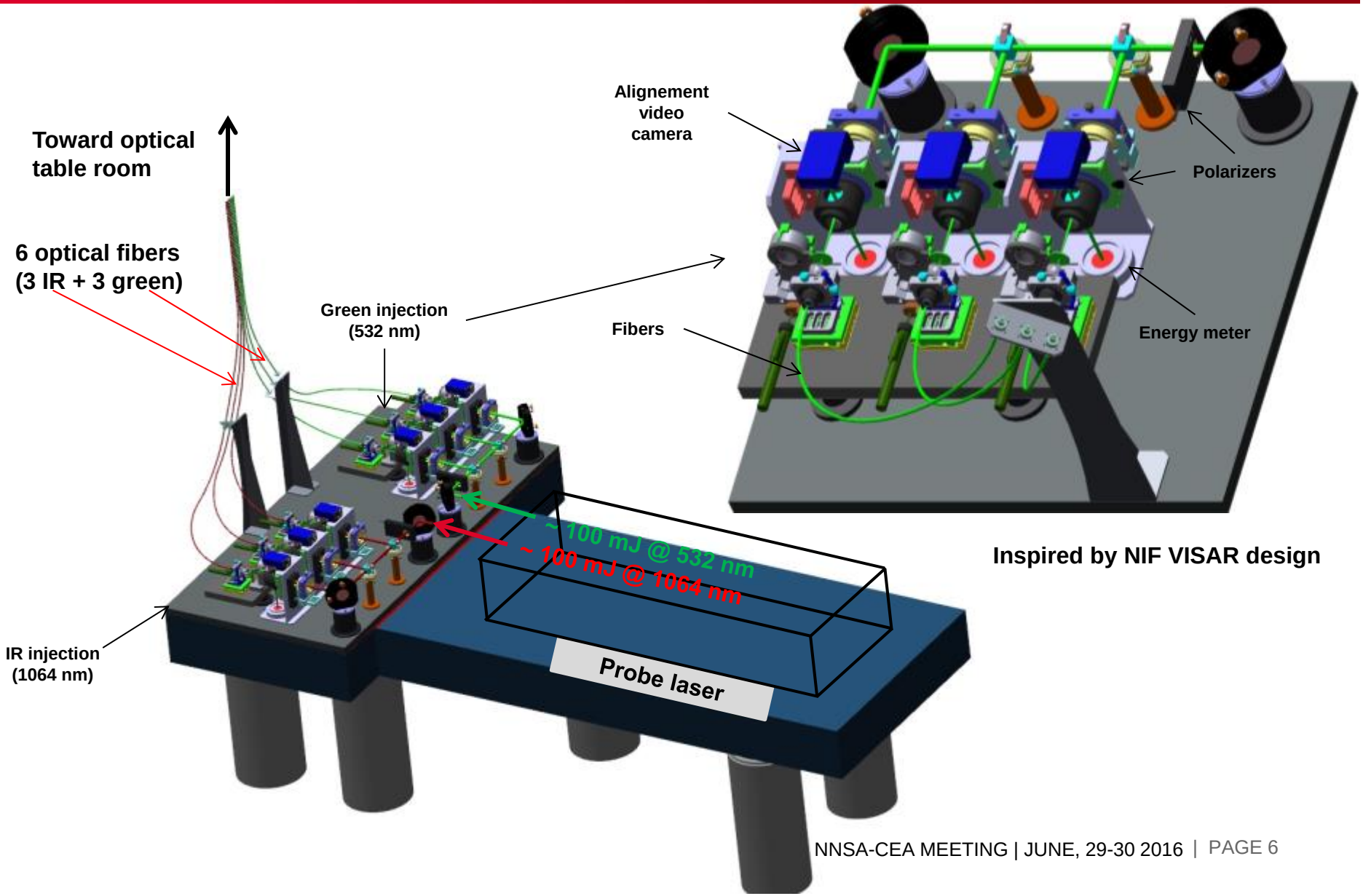


PROBE LASER SHIELDED ROOM

Attenuation > 70 dB, between
at least 30 MHz up to 3 GHz

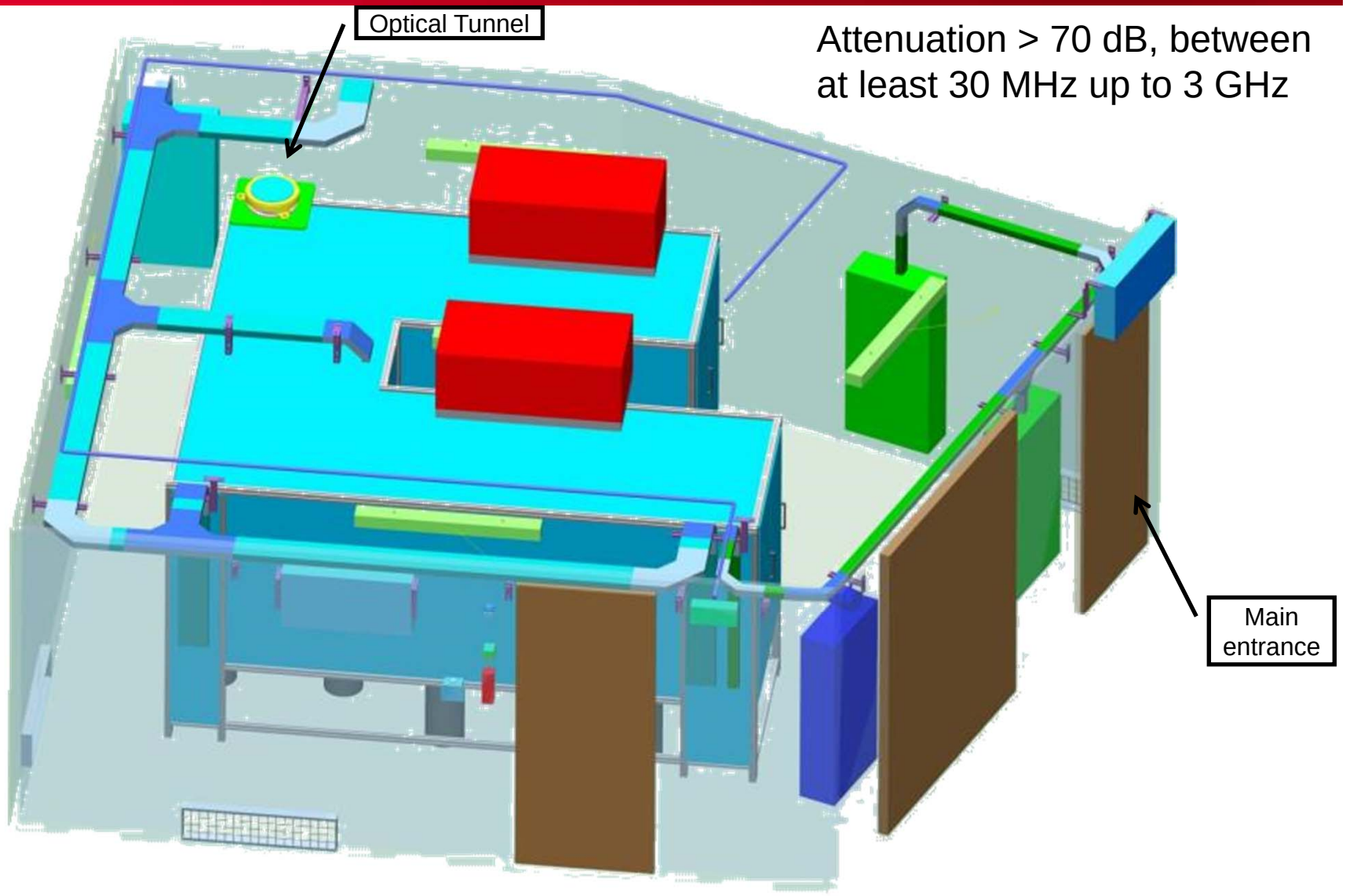


PROBE LASER OPTICAL TABLE



Inspired by NIF VISAR design

OPTICAL TABLE SHIELDED ROOM

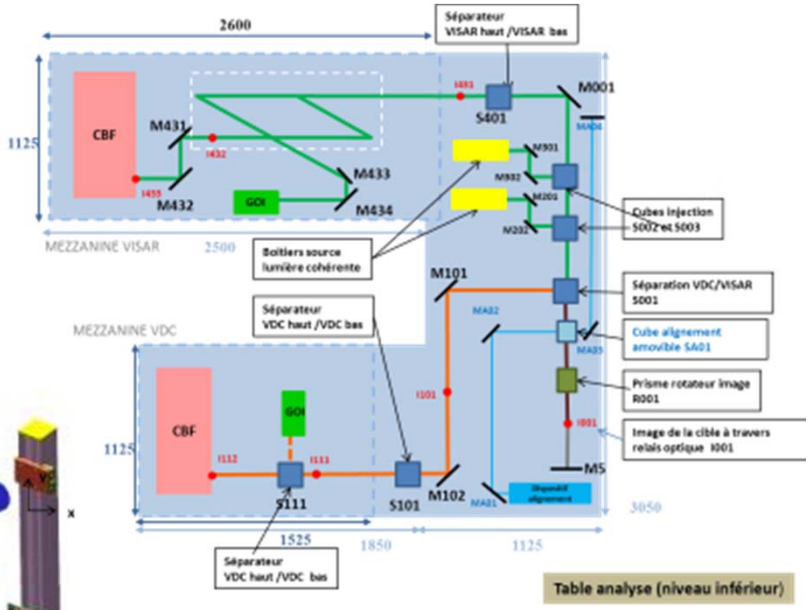


OPTICAL TABLE

Sydor Ross 5100 Streak cameras with autocalibration module

VISAR optical path

Kentech GOI



6 optical fibers (3 IR + 3 green) from probe laser room

Green injection

IR injection

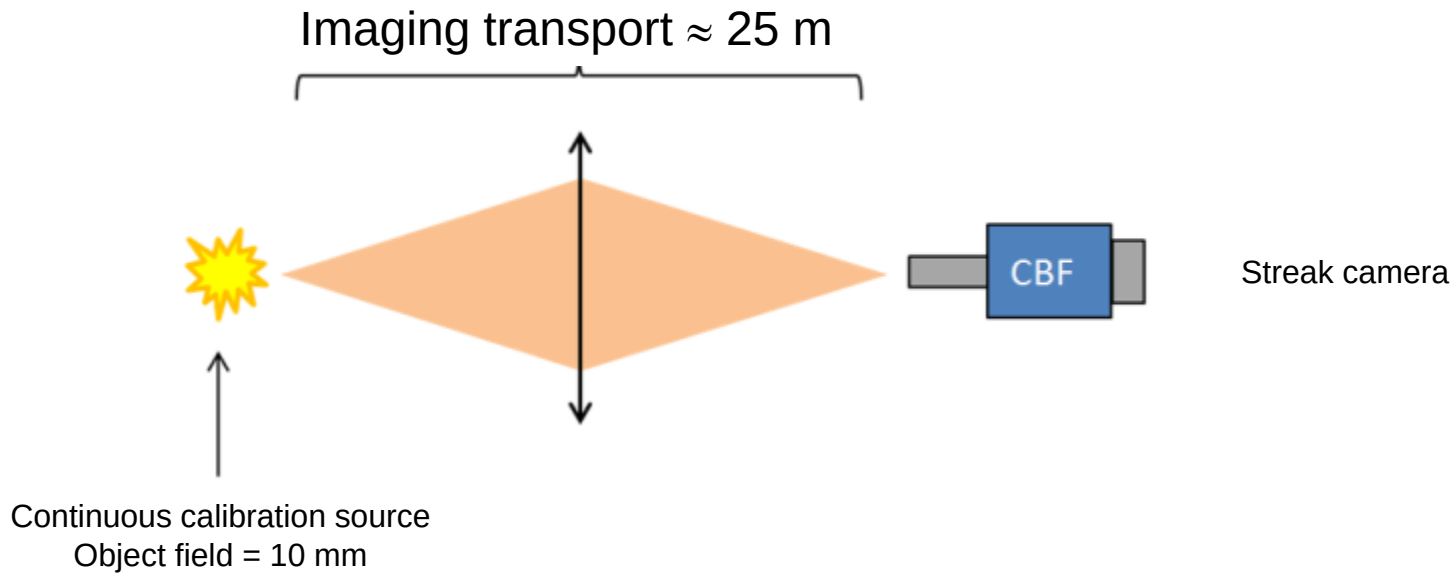
Common optical path

Optical path from TCC

PSBO and SOP optical path

CALIBRATION METHOD

Goal: global absolute photometric calibration for each channel from TCC to streak cameras.



Calibration → LSB/pixel = f($Flux_{source}$) → $Radiance_{source}$= f(LSB/pixel)

Experience → LSB/pixel → $Radiance_{Target\ Black\ Body}$ → $T_{target\ Black\ Body}$

CALIBRATION METHOD

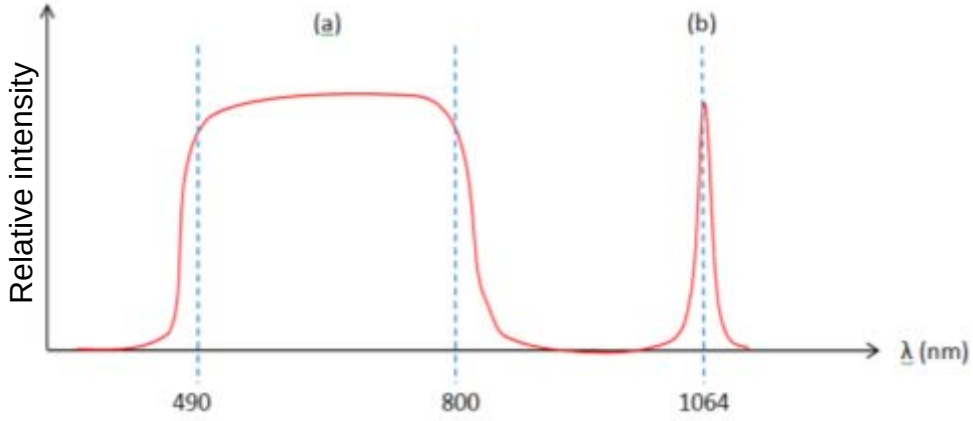
Goal: global photometric calibration for each channel from TCC to cameras.

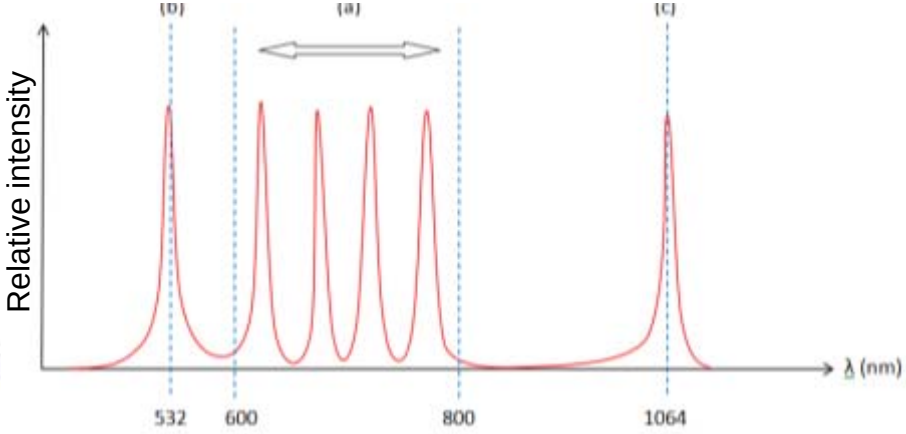
Based on:

- slow sweep ramp capability (1-10 sec) of ROSS autocalibration module,
- custom multi wavelengths, continuous, calibrated light source placed at TCC by an inserter

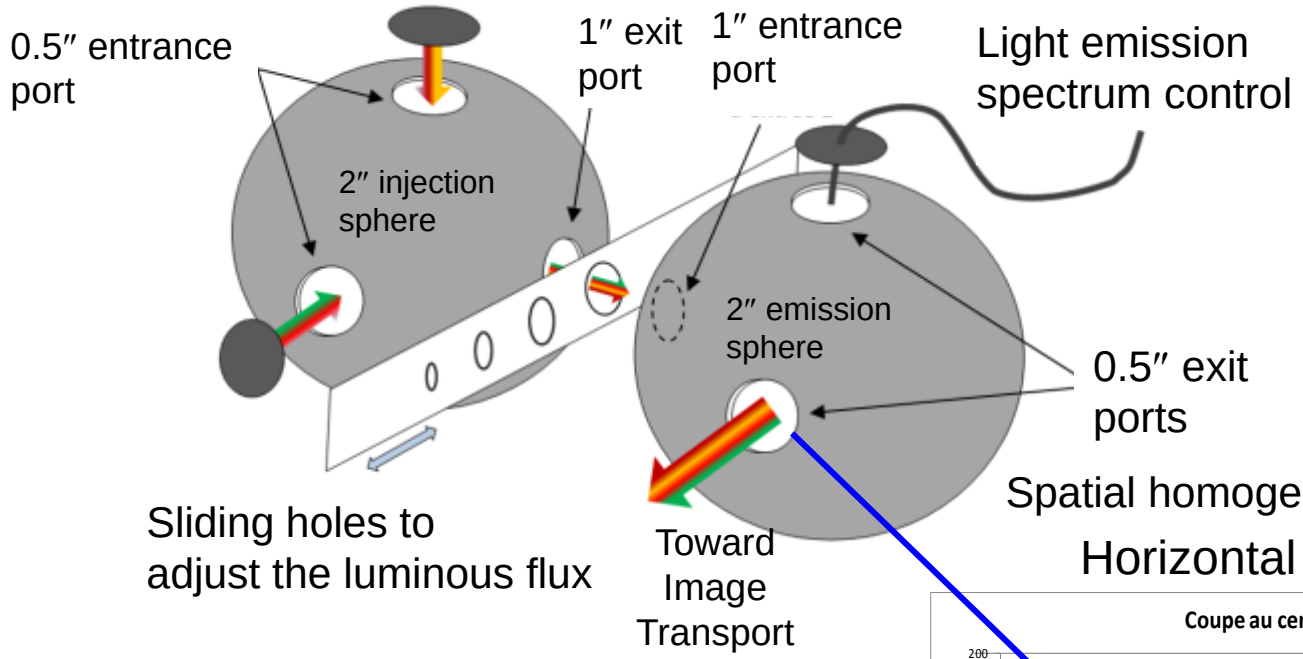
Wavelengths domains:

- VISAR: 532 and 1064 nm (can be achieved using laser diodes)
- SOP: 600, 650, 700 and 750 nm (can be achieved using four laser diodes or four LEDs or broad band spectrum)



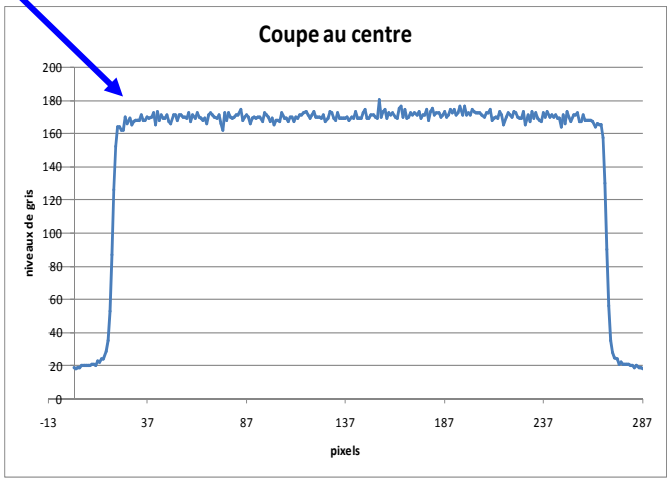


LIGHT SOURCE PRELIMINARY DESIGN

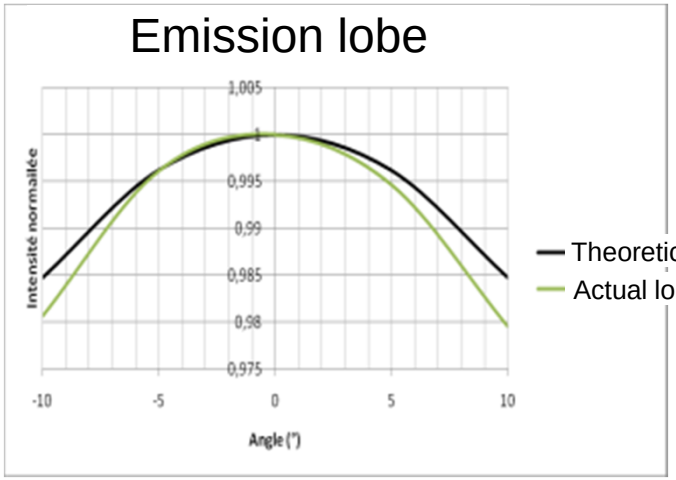


Spatial homogeneity (> 97%)

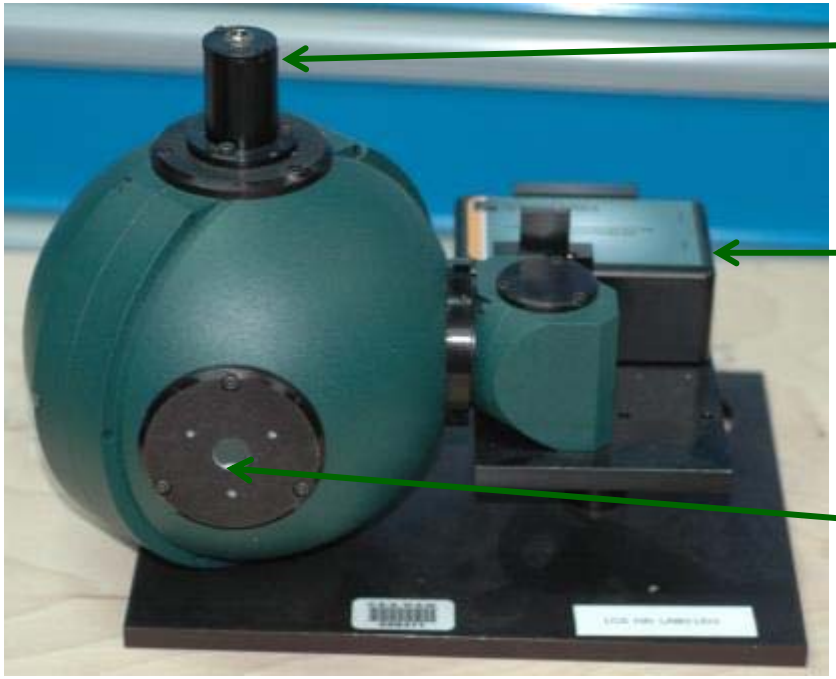
Horizontal Profile



Emission lobe



LIGHT SOURCE CALIBRATION



- Based on LCS100 (SphereOptics ®) characterization system
- Exit port of the source is placed at the entrance port of LCS characterization system
- Source lobe is lambertian by design (2π sr)
- Source emitting surface known by design (1.27 cm^2)
- Total absolute spectral flux is measured by LCS100

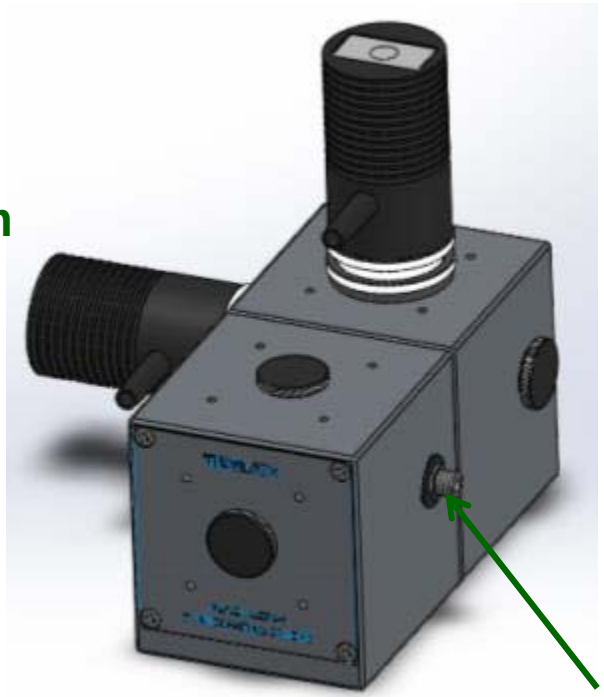
} We are able to deduce the radiance source ($W.sr^{-1}.cm^{-2}$)

TYPICAL SOURCE IRRADIANCE

Calculation of typical source Radiance taking into account of photometric transfer function of VISAR optical system and streak camera sensitivity and 1s slow ramp sweep speed

Spectral domain (nm)	Radiance (µW/sr/cm²)	LED luminous power (mW)
532	67	3
1064	3900	175
600-650	267	13
650-700	319	13
700-750	1000	45
750-800	4000	175

LIGHT SOURCE DEMONSTRATOR



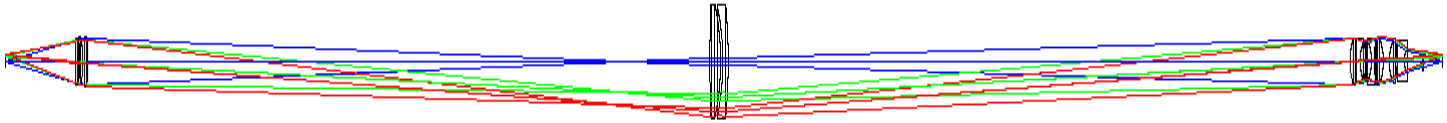
A few kg

- Demonstrator build up with THORLABS parts
- Air cooled LED

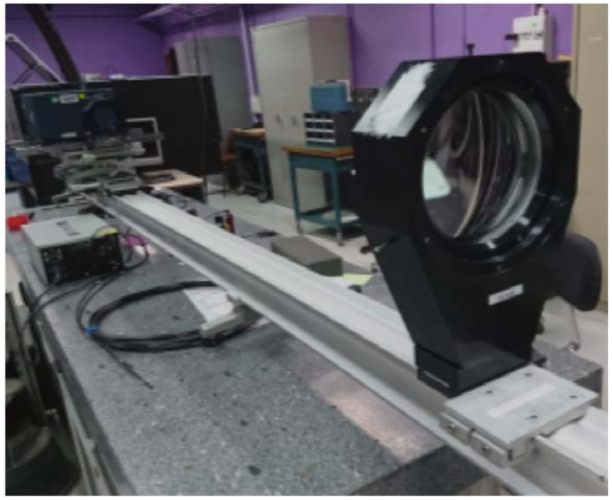
LIGHT SOURCE DEMONSTRATOR COMMISSIONING

@ CEA , on optical bench with optical relay and streak camera

4 meters long, 20mm object field of view, F#3



Source + object lens



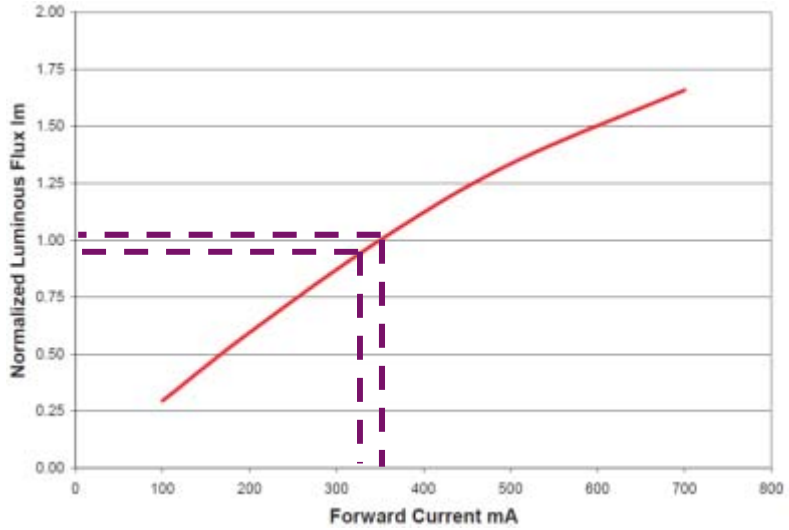
Field lens

Image lens+ detector

@ OMEGA source could be placed in TIM, aligned at TCC and imaged with VISAR's optical relay. Signal could be recorded by streak camera if equipped with calibration module or any adapted detector.
Need OMEGA Target Chamber at atmospheric pressure.
Could be linked to an EOS experiment with Quartz target.

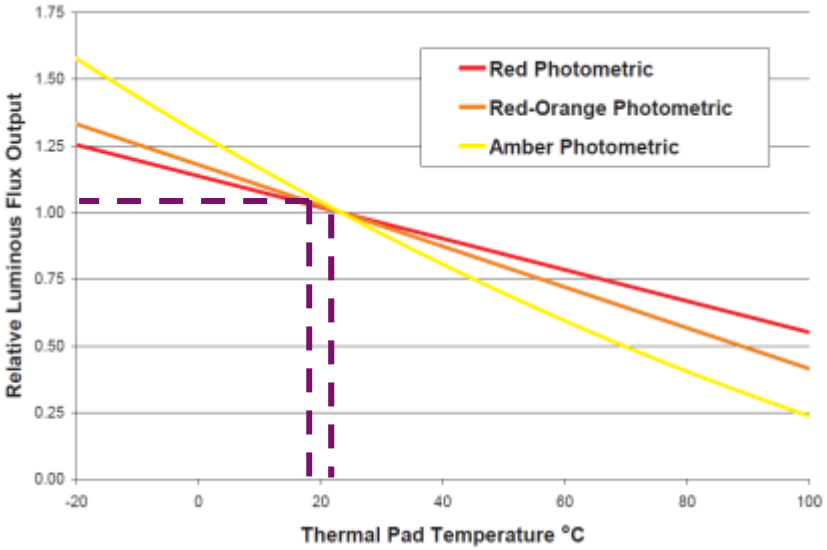
NEXT STEPS

- Water cooled source demonstrator in order to be vacuum operated and guarantee 0.1°C LED temperature control
  - LED on metal core PCB
  - Water cooled Peltier module
- Current stabilized power supply



~5%

50 mA



~5%

± 1°C

- Nominal cable length for LMJ and/or NIF
  - ↳ Another commissioning @ LLE
  - ↳ At that step, final design should be set and nominal object construction launched
- Evolution : calibration in dynamical mode (ns sweep ramps) instead of slow ramp mode