Status of The KAGRA Project

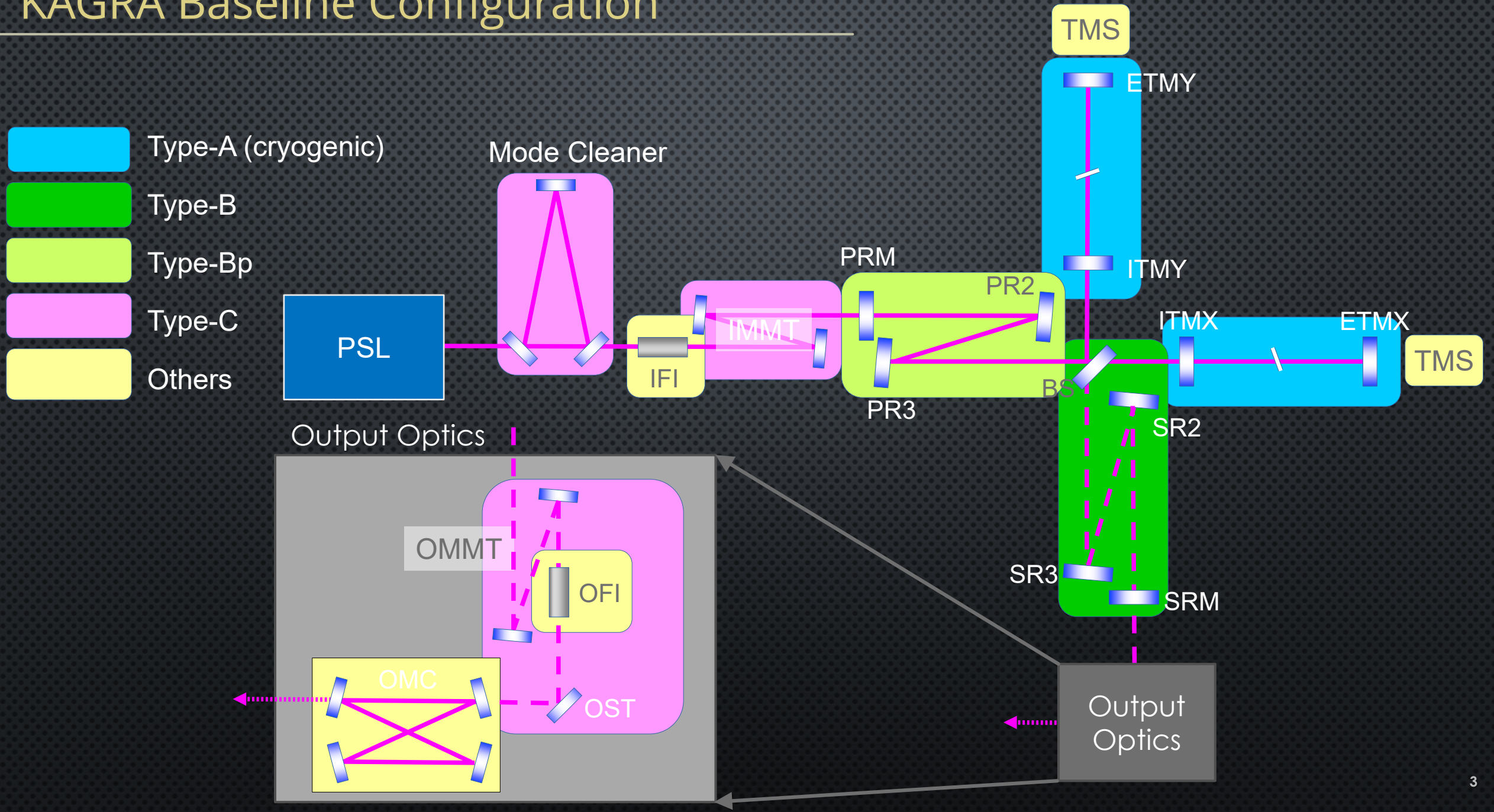
2019/4/17@LIGO PAC

National Astronomical Observatory of Japan
Yoichi Aso
On Behalf of The KAGRA Project

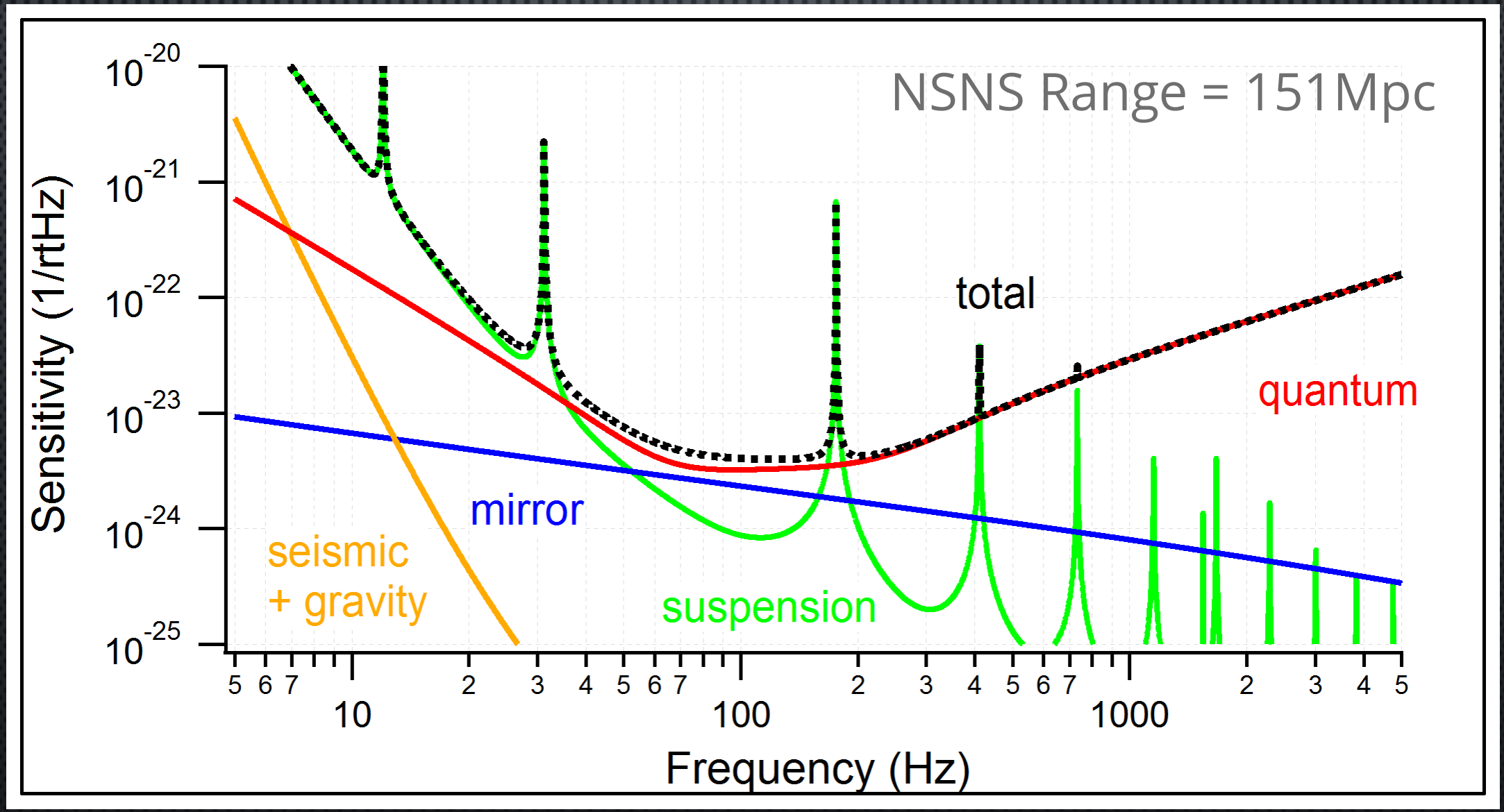
The KAGRA Project

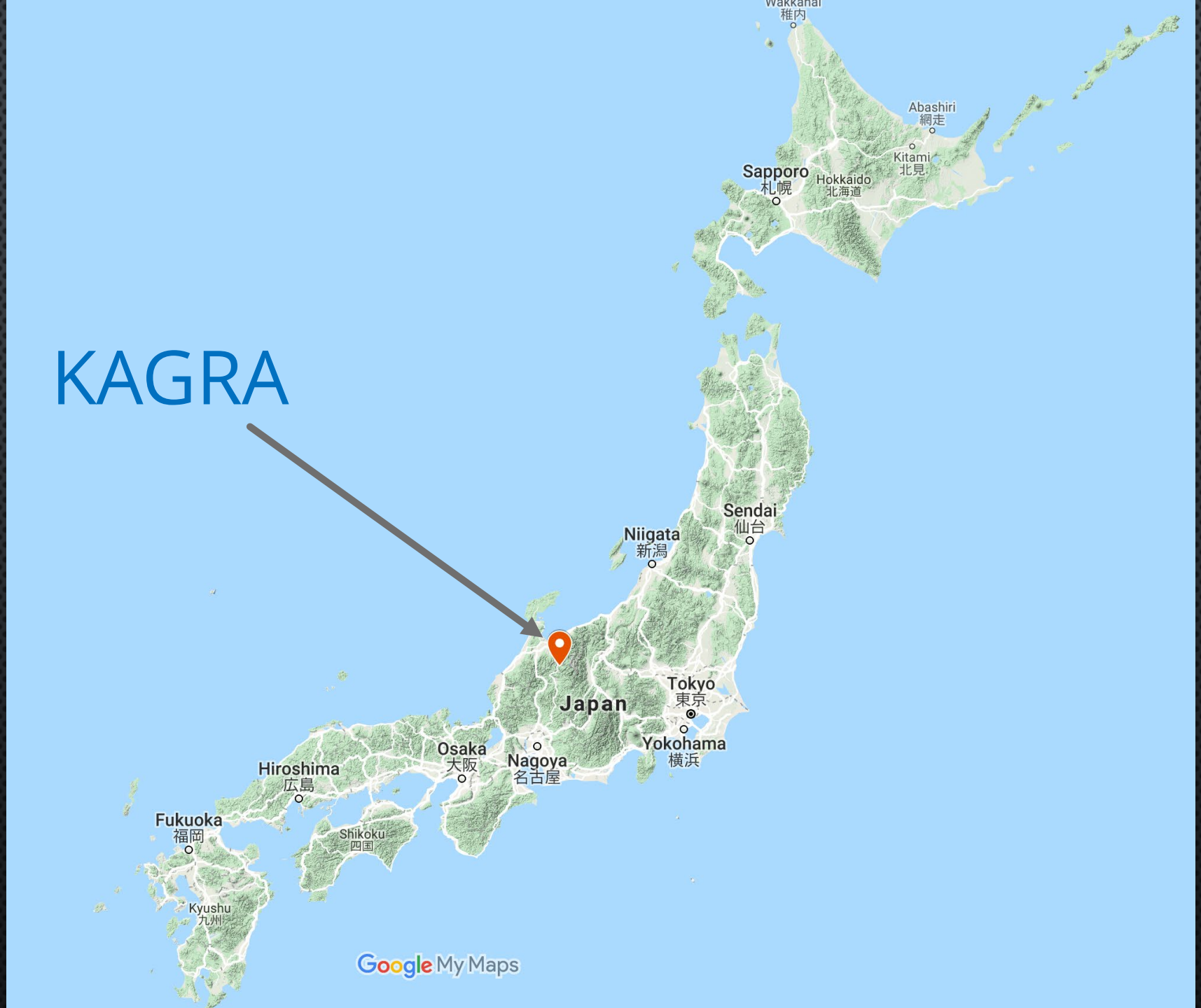
- About 300 collaborators
- Over 30 Japanese institutes, over 40 international institutes

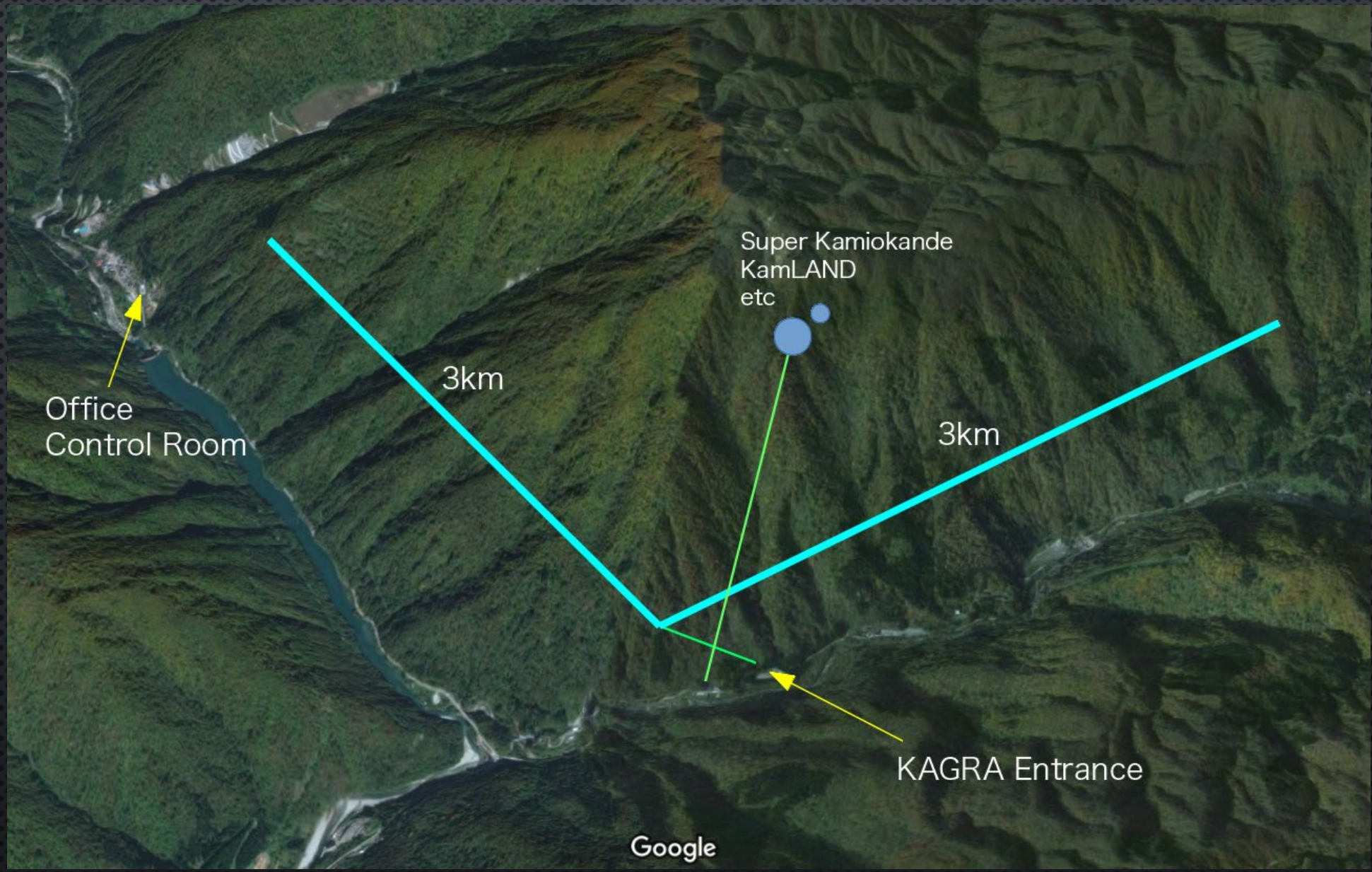
KAGRA Baseline Configuration



KAGRA Baseline Sensitivity

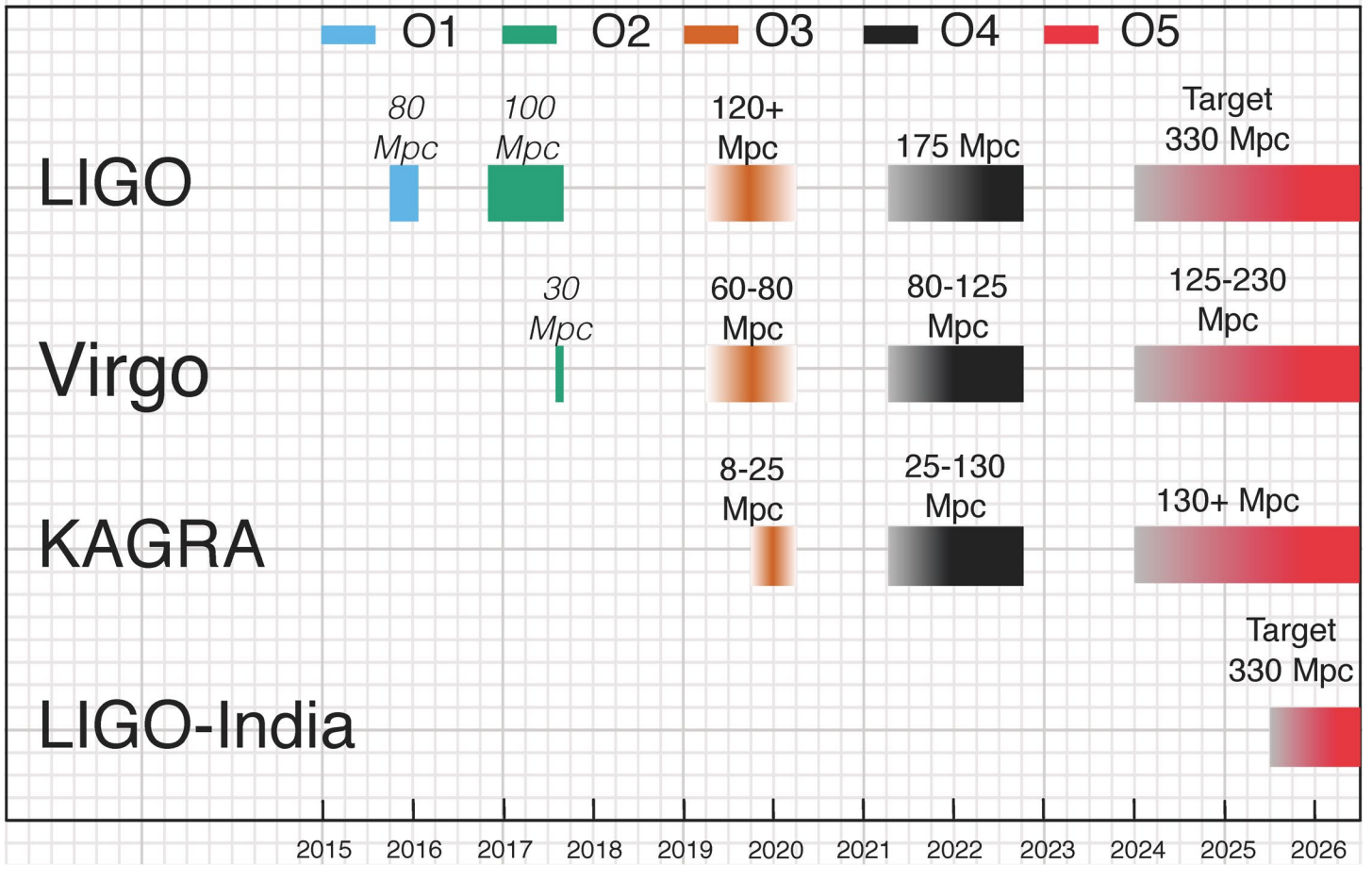


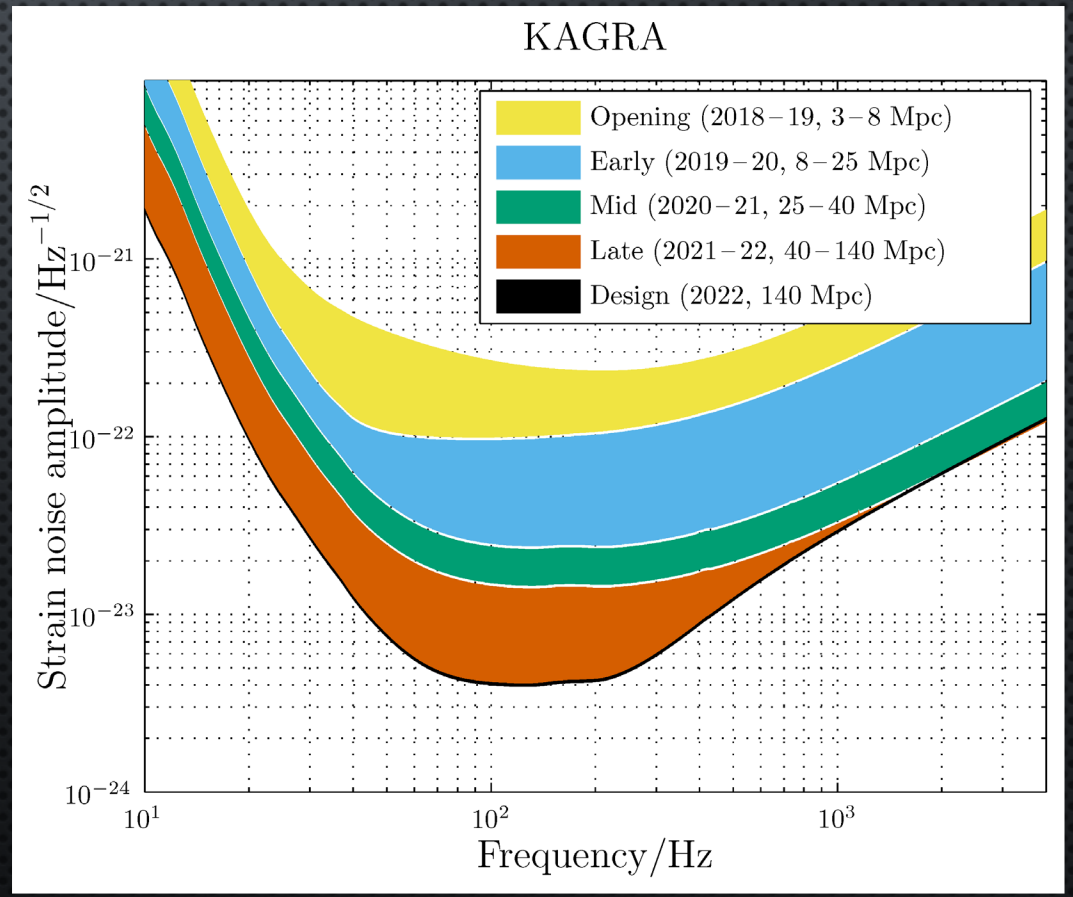

KAGRA
Wakkanai
稚内
Abashiri
網走
Kitami
北見
Sapporo
札幌
Hokkaido
北海道
Sendai
仙台
Niigata
新潟
Tokyo
東京
Japan
Yokohama
横浜
Osaka
大阪
Nagoya
名古屋
Hiroshima
広島
Fukuoka
福岡
Shikoku
四国
Kyushu
九州
Google My Maps


Super Kamiokande
KamLAND
etc
3km
3km
Office
Control Room
KAGRA Entrance
Google

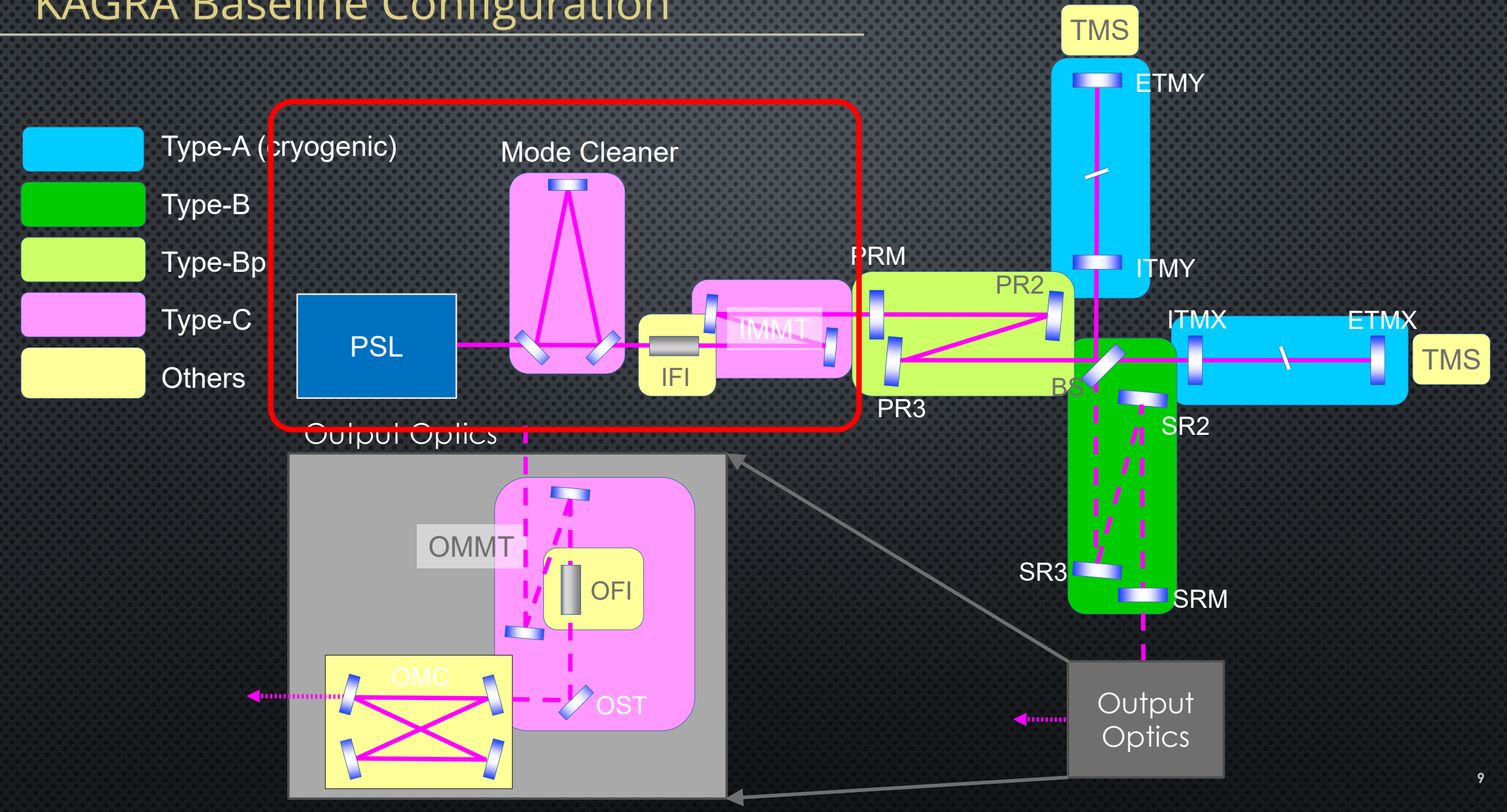
Project Time Line

- 2010: Funded
- 2012-2014: Tunnel Excavation
- 2016 March: Room Temperature Michelson
- 2018 May: Cryogenic Michelson
- 2019 Fall: Start scientific observation


O1
O2
O3
O4
O5
LIGO
80 Mpc
100 Mpc
120+ Mpc
175 Mpc
Target 330 Mpc
Virgo
30 Mpc
60-80 Mpc
80-125 Mpc
125-230 Mpc
KAGRA
8-25 Mpc
25-130 Mpc
130+ Mpc
LIGO-India
Target 330 Mpc
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026

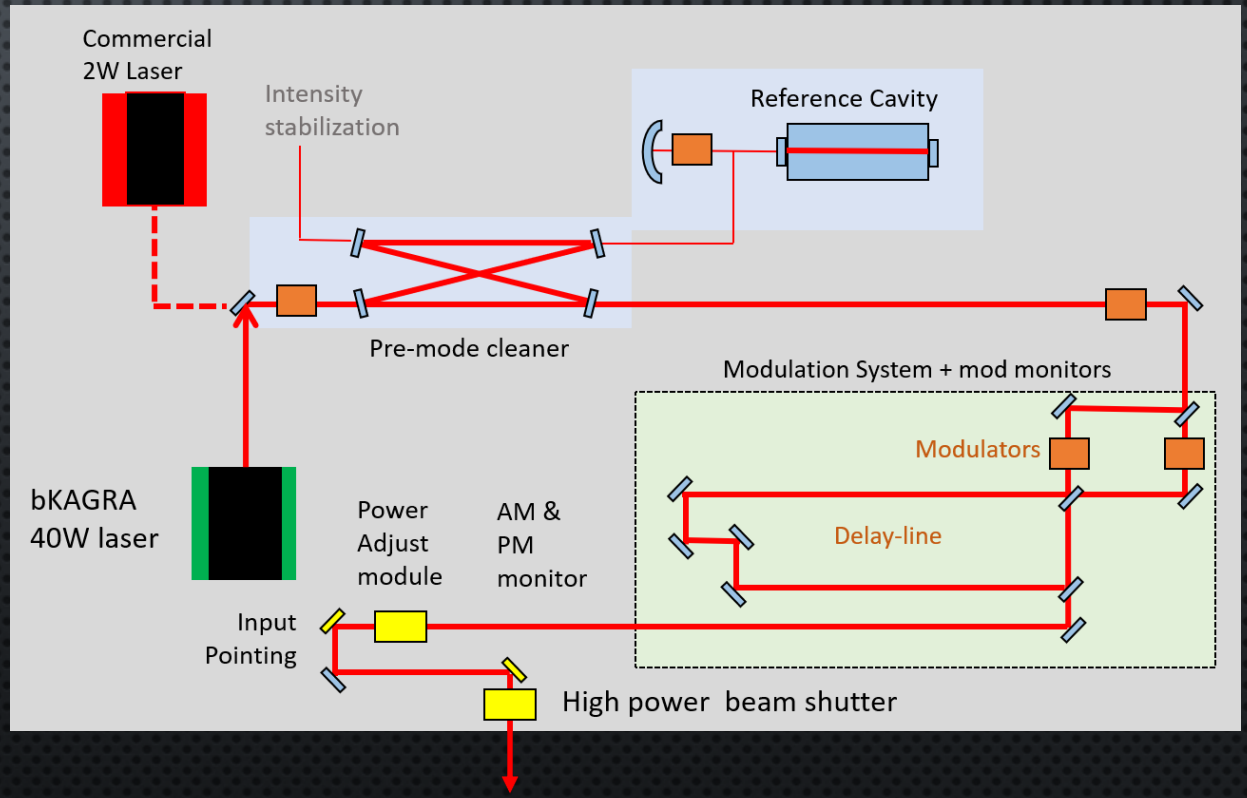

KAGRA
Opening (2018–19, 3–8 Mpc)
Early (2019–20, 8–25 Mpc)
Mid (2020–21, 25–40 Mpc)
Late (2021–22, 40–140 Mpc)
Design (2022, 140 Mpc)
Strain noise amplitude/Hz$^{-1/2}$
10^{-21}
10^{-22}
10^{-23}
10^{-24}
10^{1}
10^{2}
10^{3}
Frequency/Hz

KAGRA Baseline Configuration



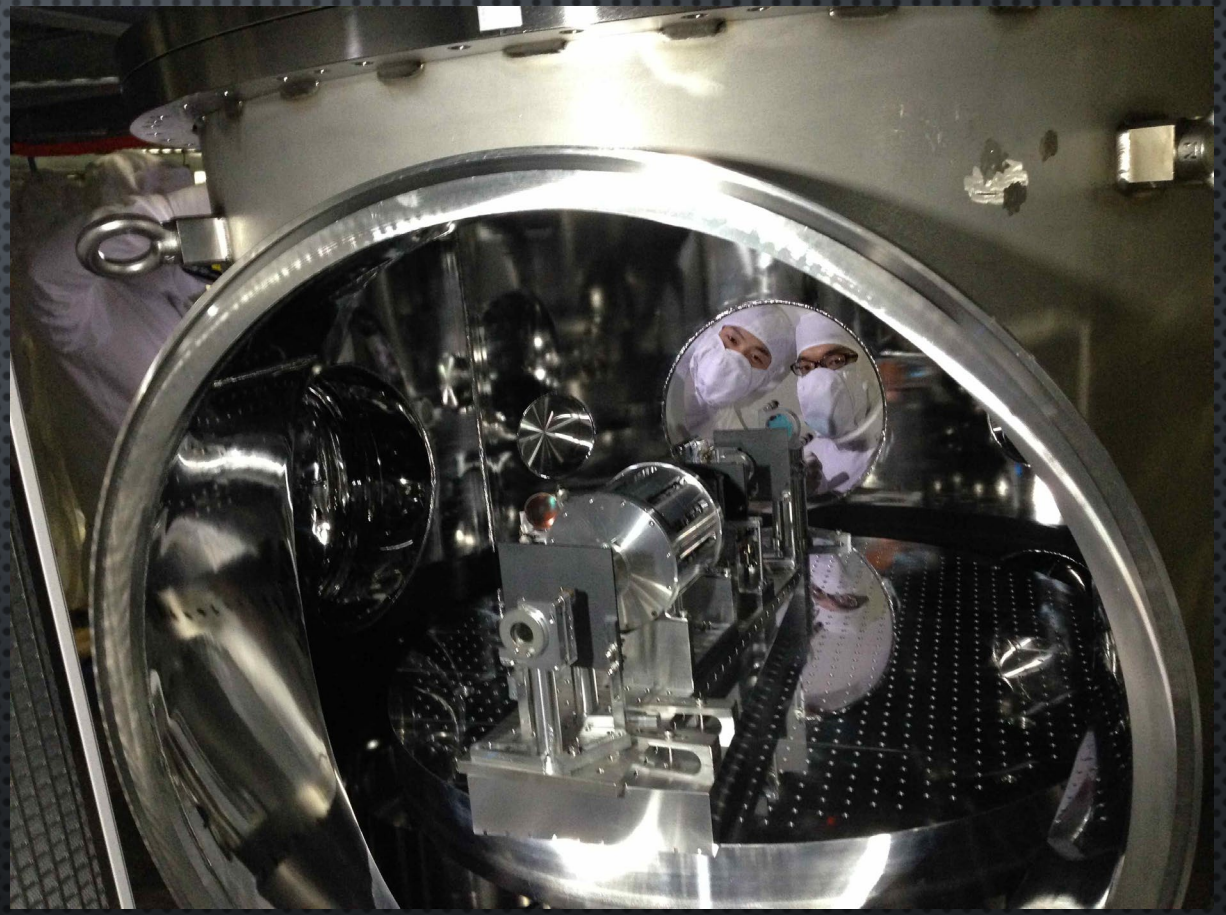
Input Optics

- Pre-Stabilized Laser (PSL)
  - 40W output now
  - To be upgraded to over 100W
- Mode Cleaner
  - 25m long
  - Operation with 20W output confirmed
- Input Faraday Isolator
  - Similar to aLIGO design
  - Produced at UFL

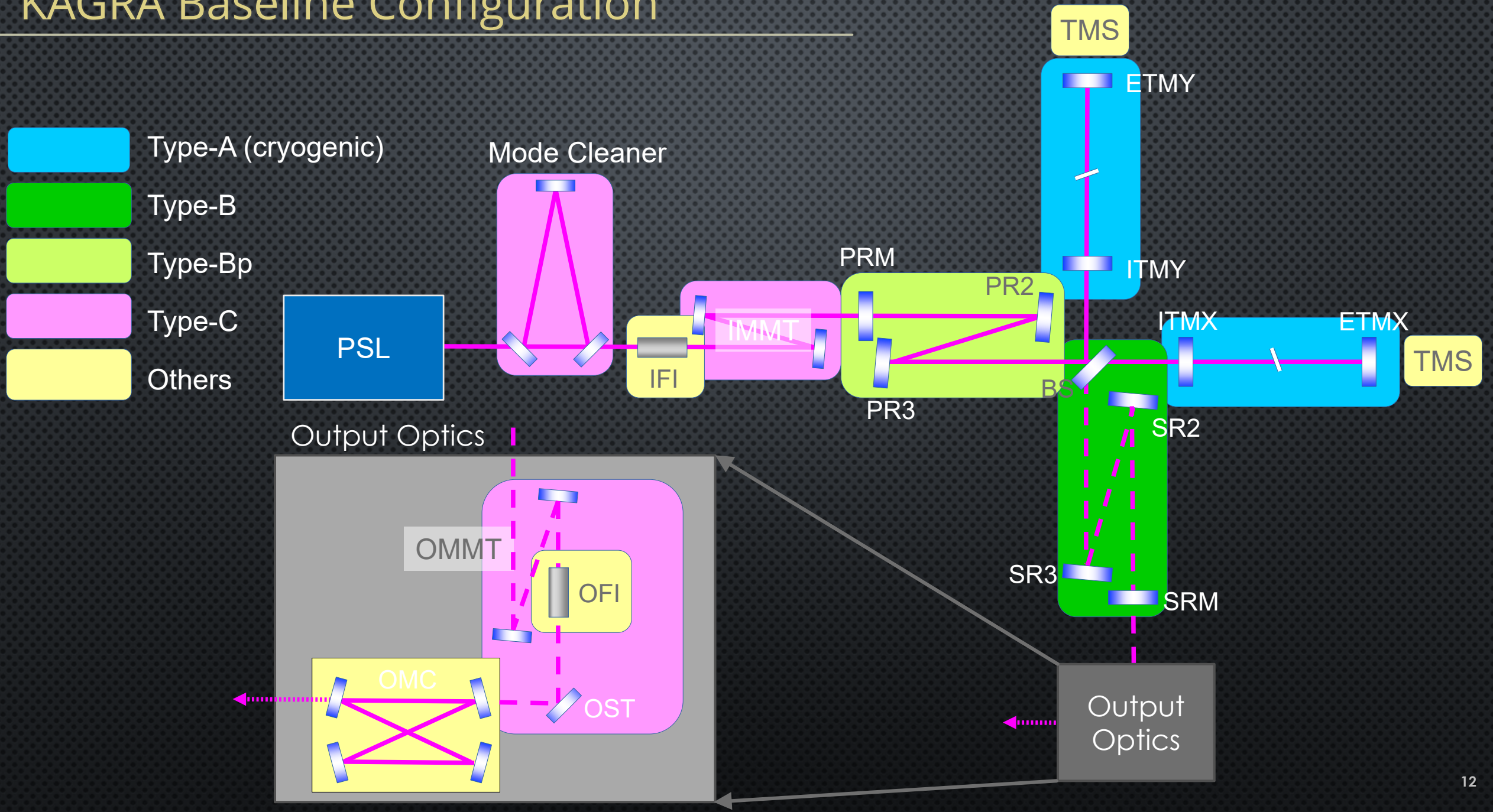


PSL

Input Faraday

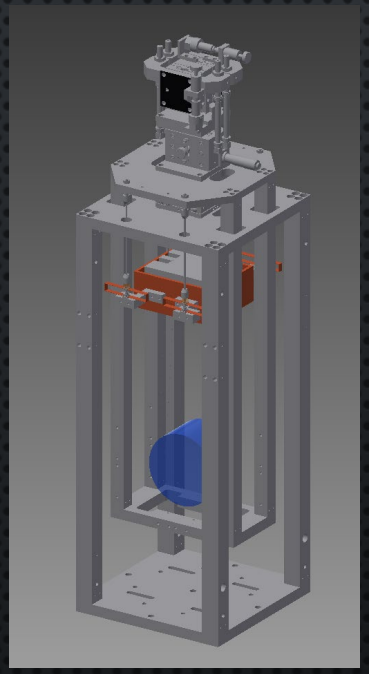


KAGRA Baseline Configuration

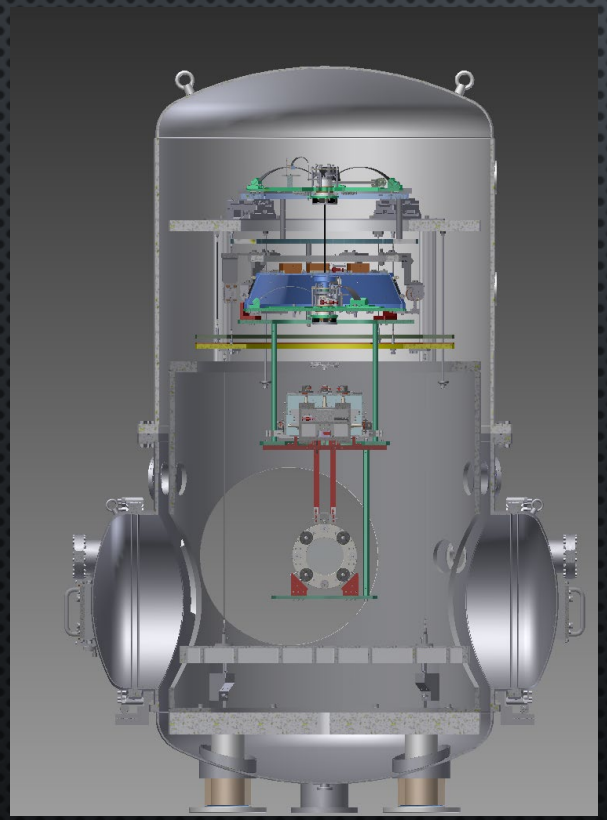


KAGRA Mirror Suspensions

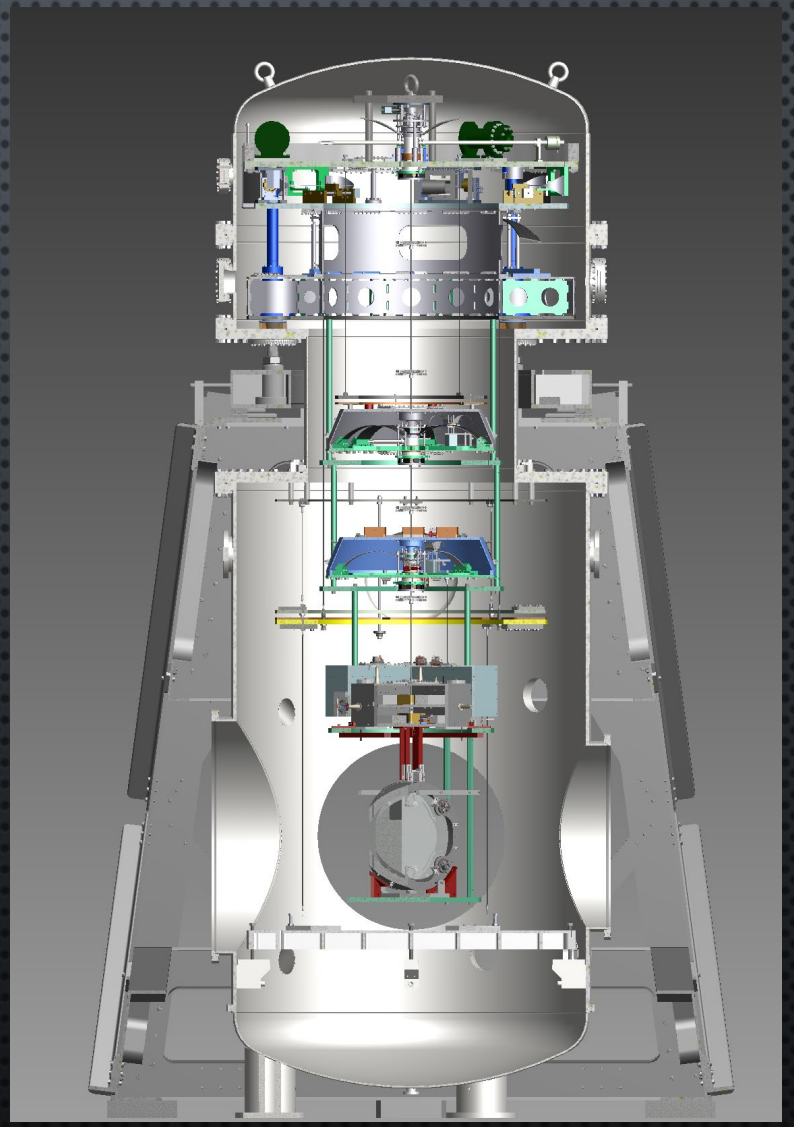
Type-C



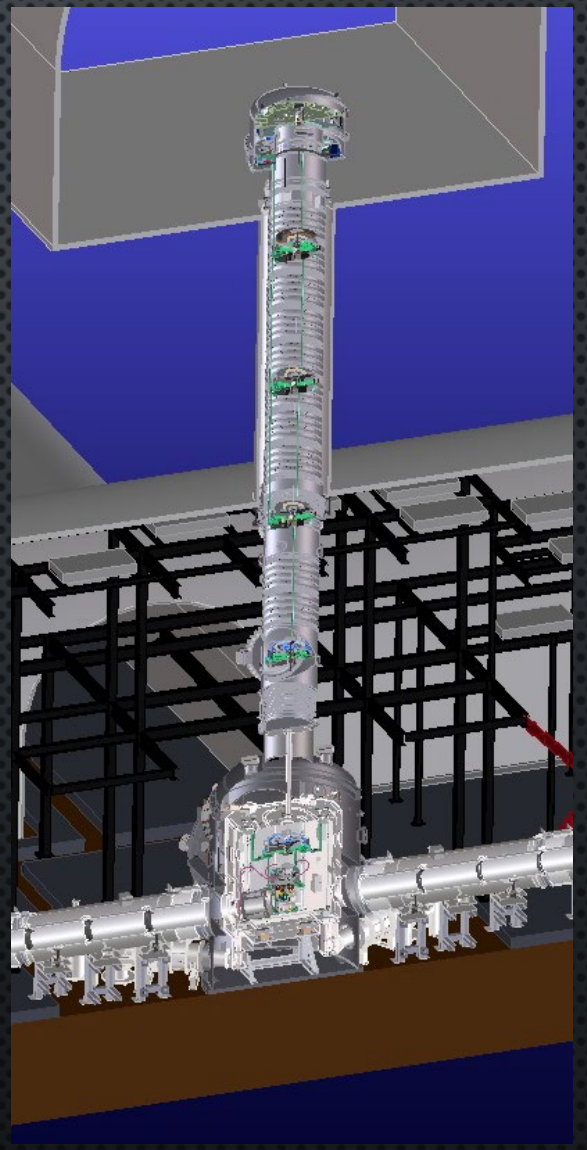
Type-Bp



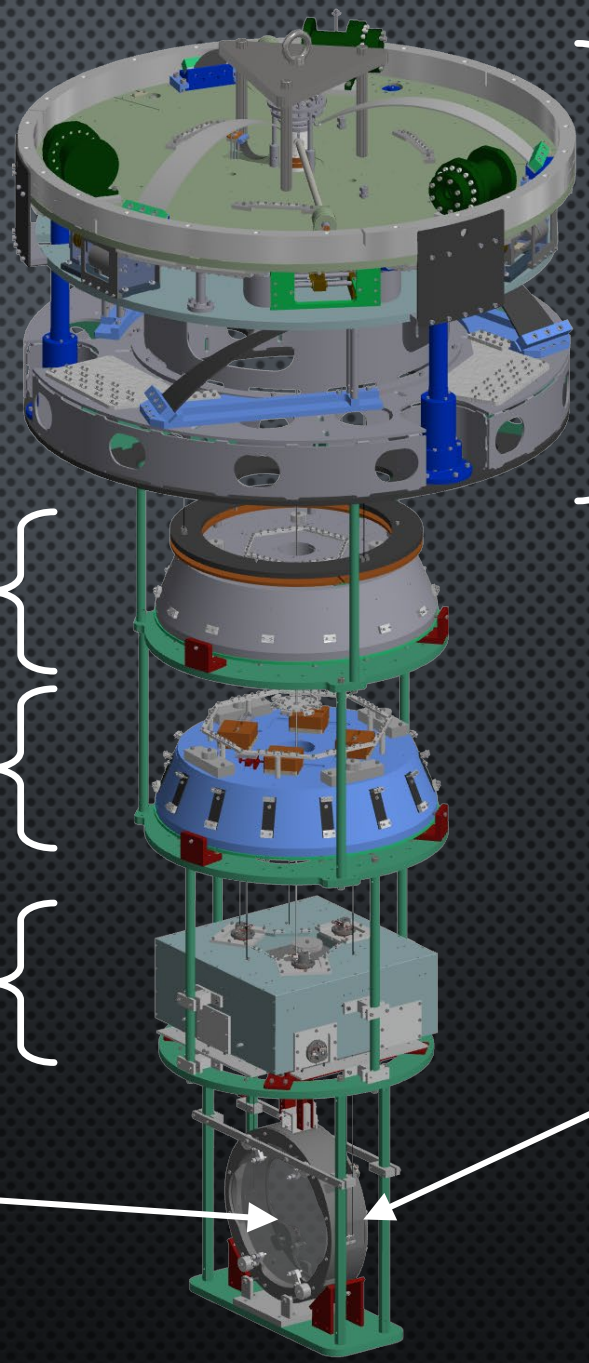
Type-B



Type-A



Beam Splitter Suspension



Pre-Isolator

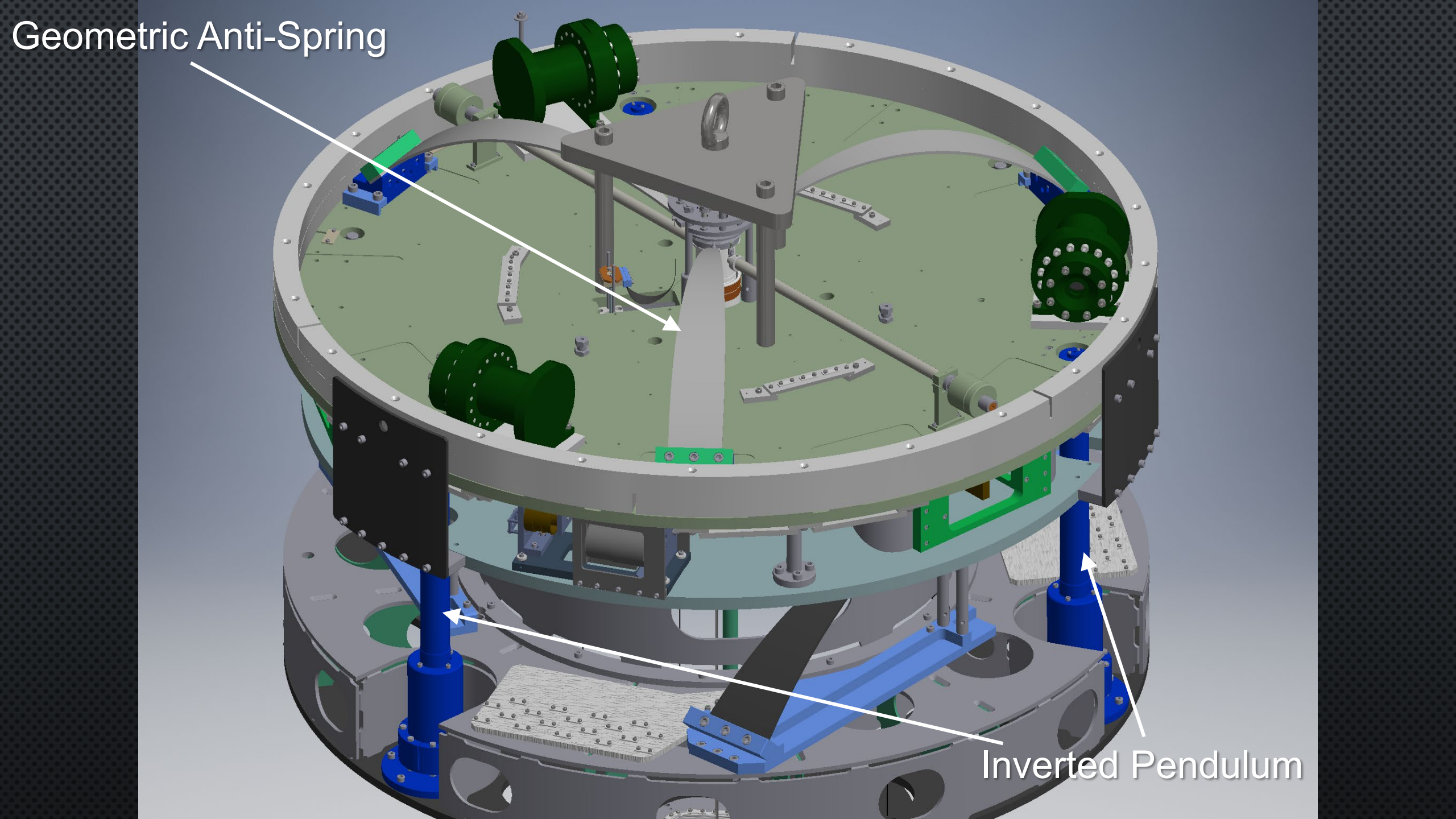
Standard Filter

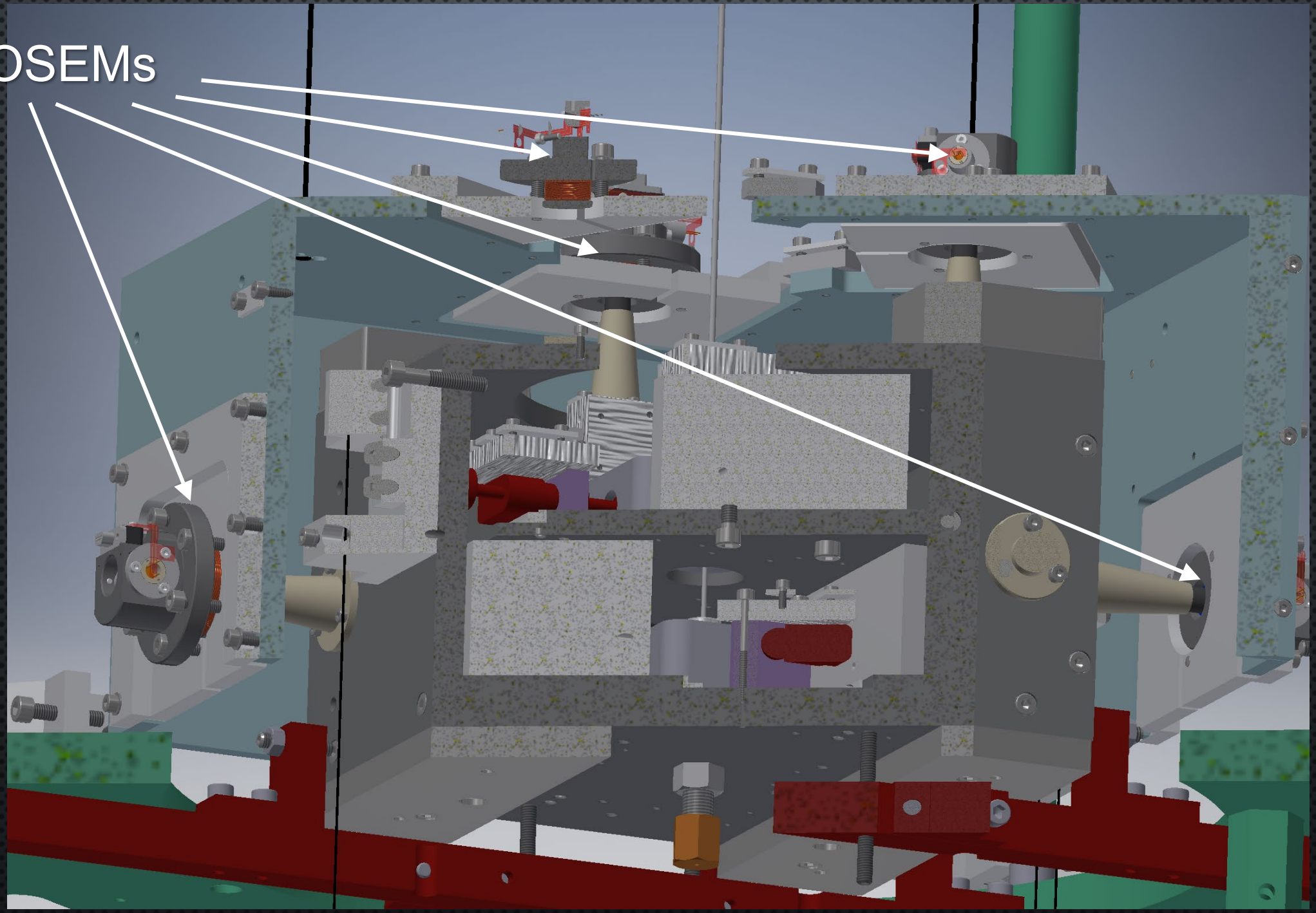
Bottom Filter

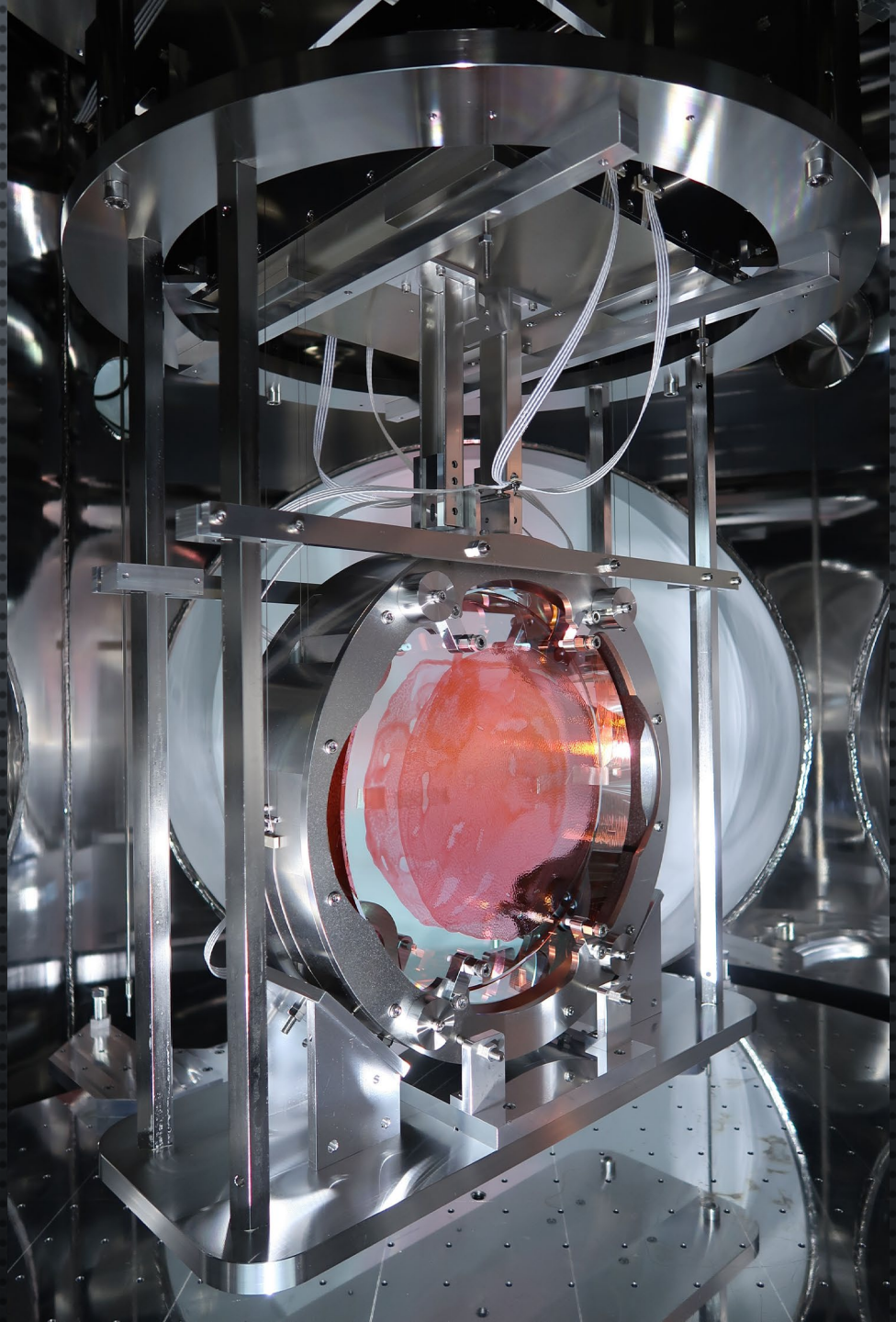
Intermediate Mass

Recoil Mass

Mirror

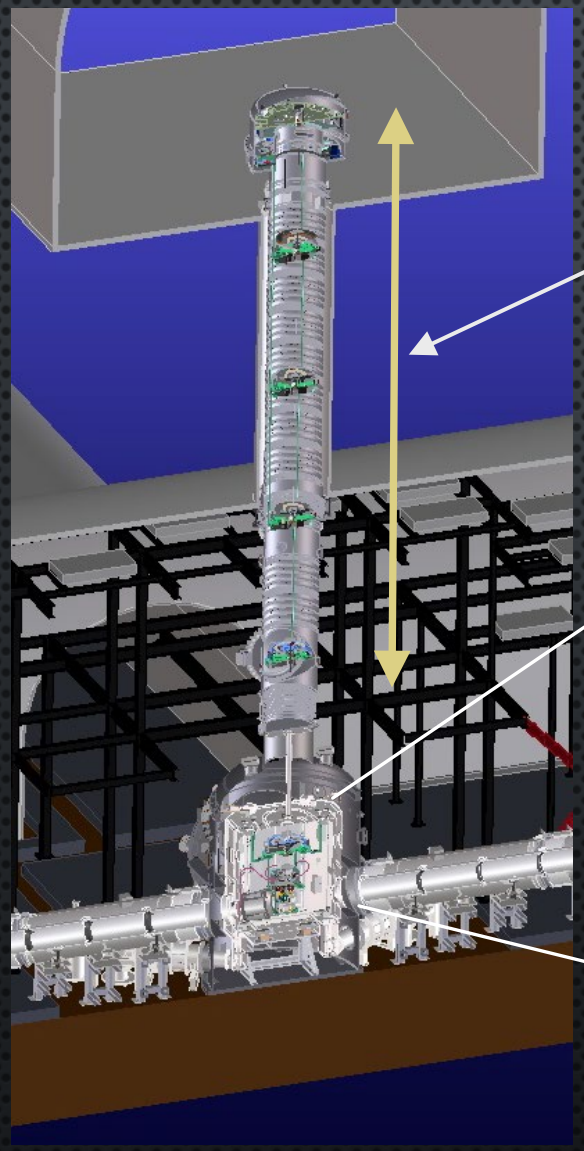

Geometric Anti-Spring
Inverted Pendulum


OSEMs



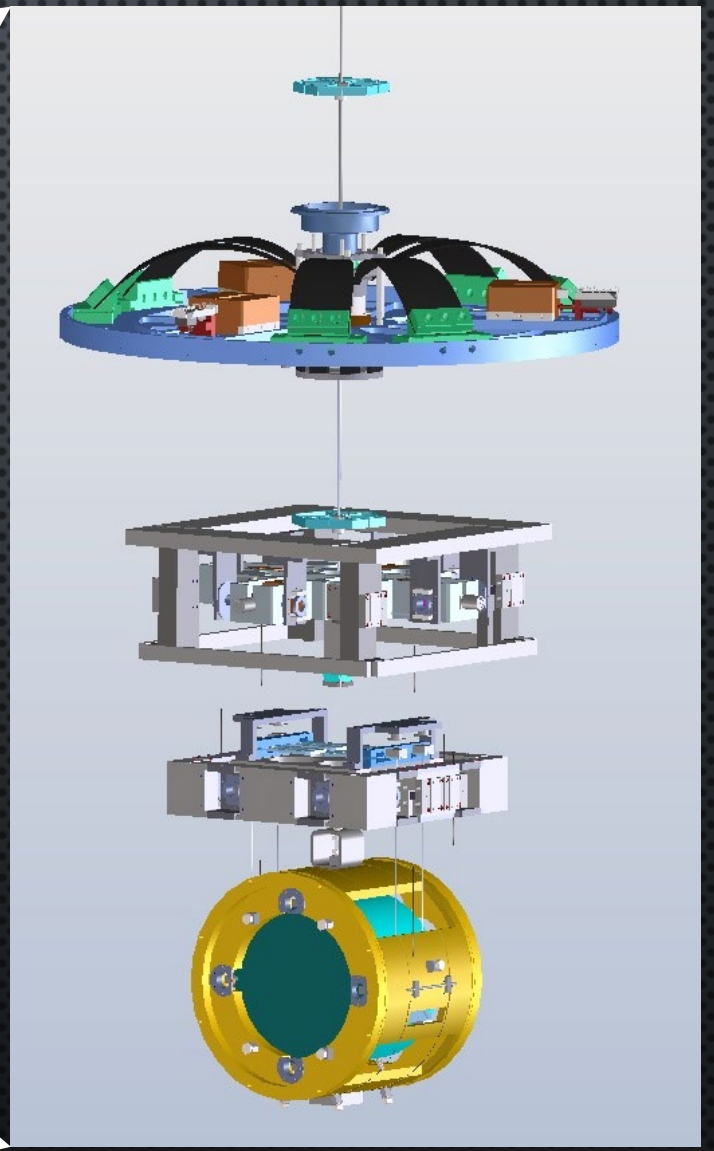
Type-A Suspension

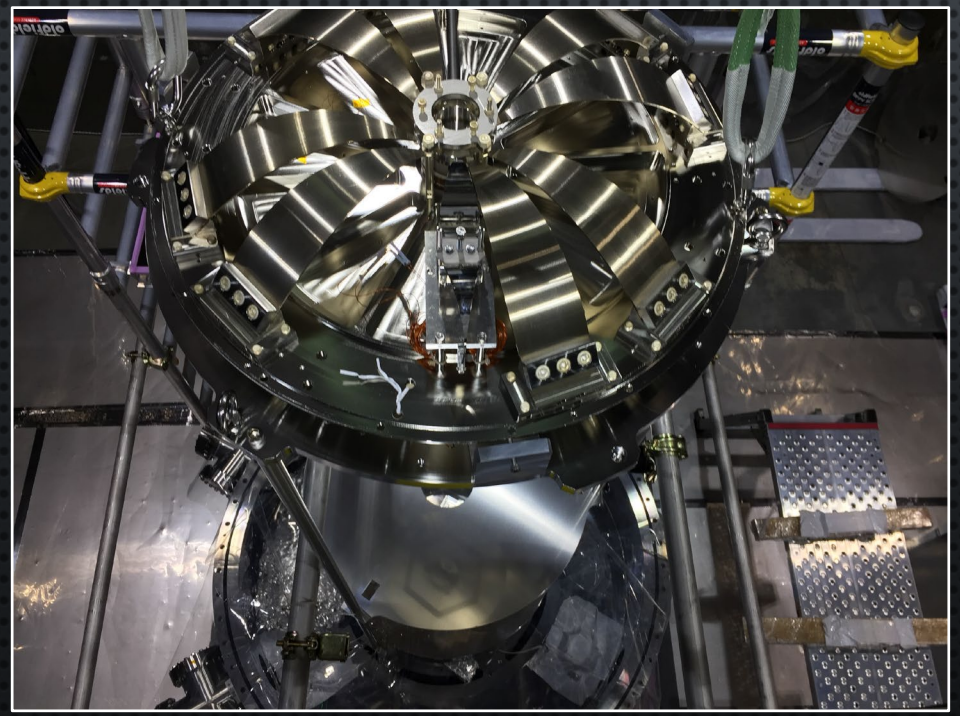
14m



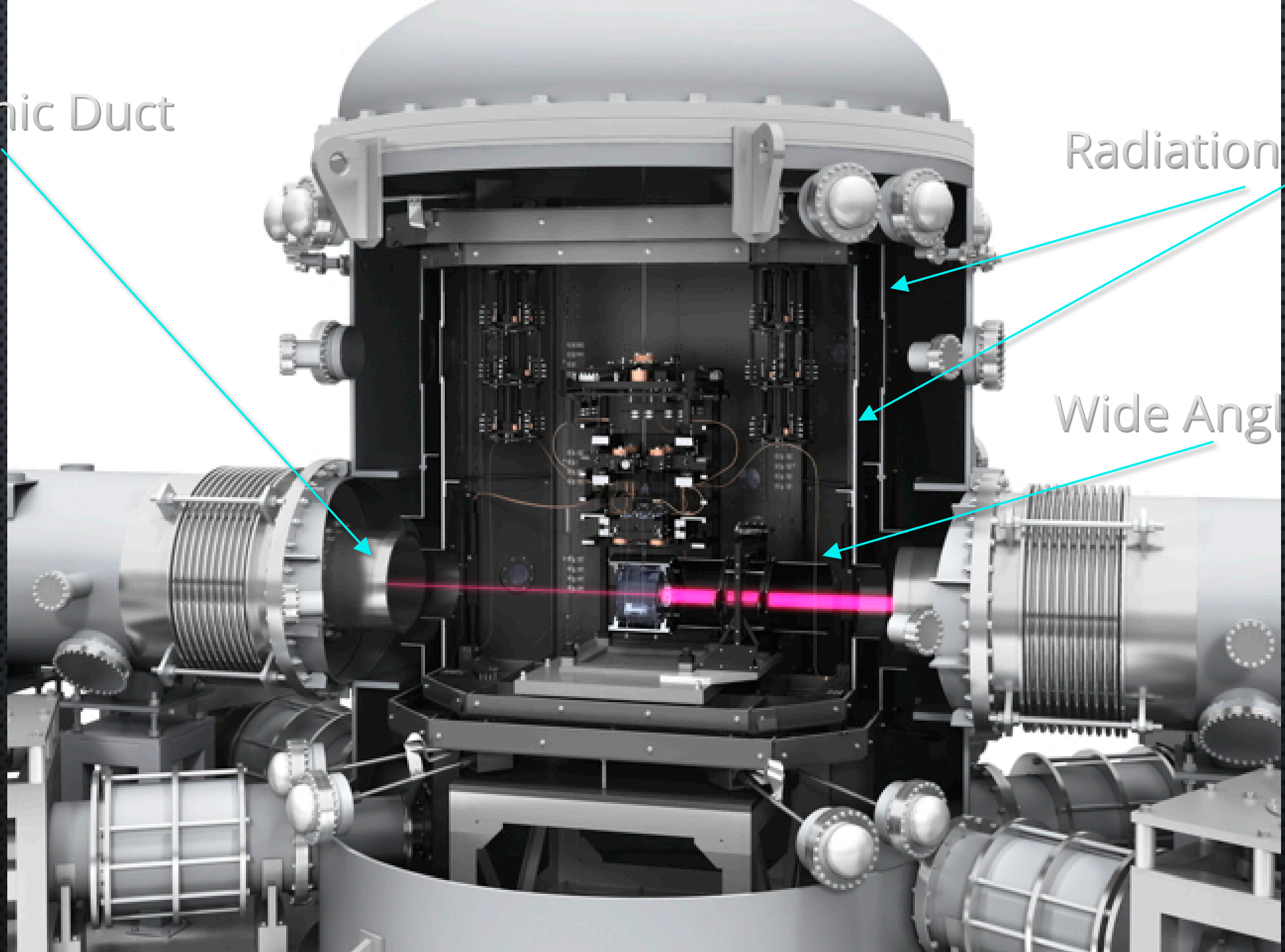
Type-A Tower
(room temp.)

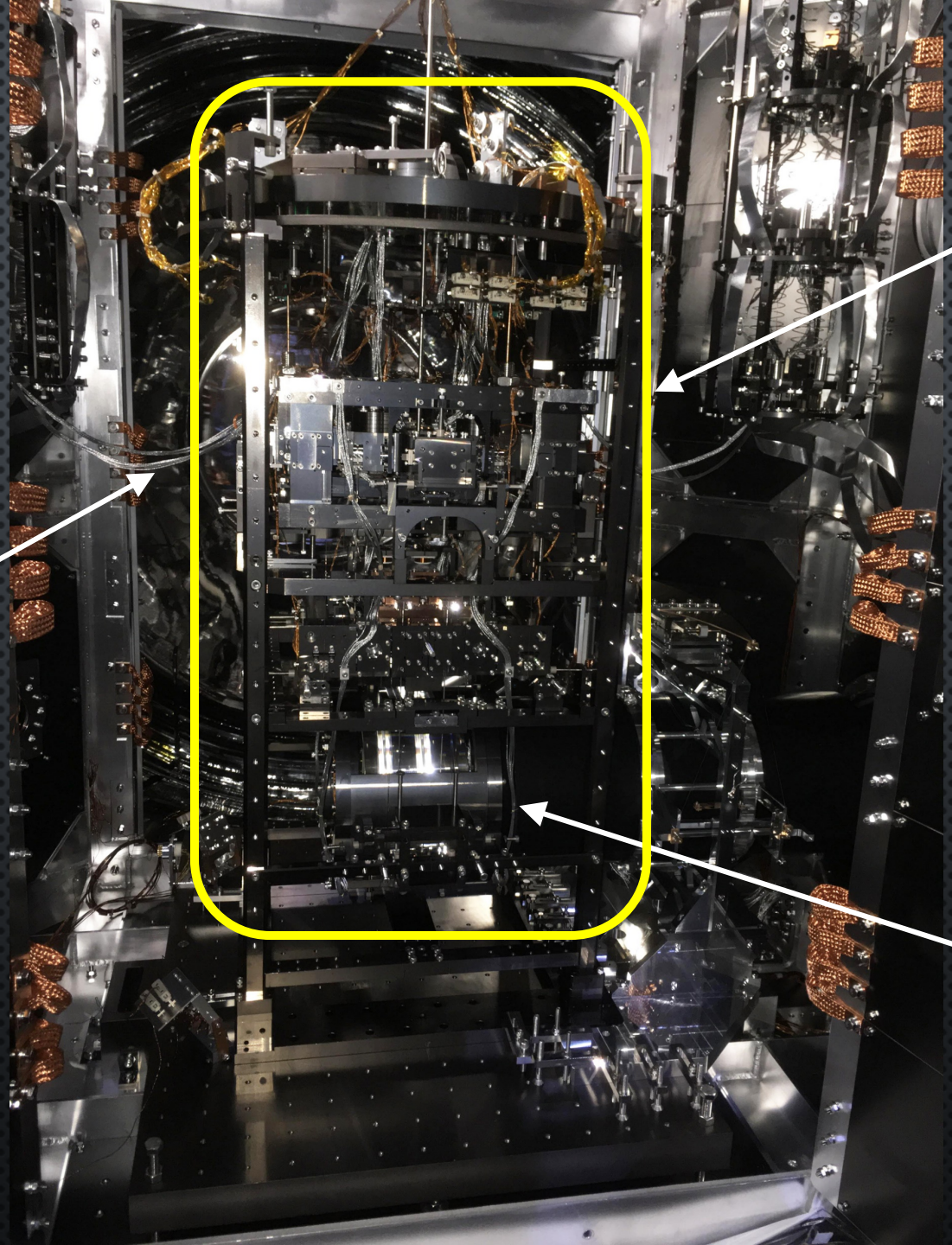
Cryogenic Payload
(20K)



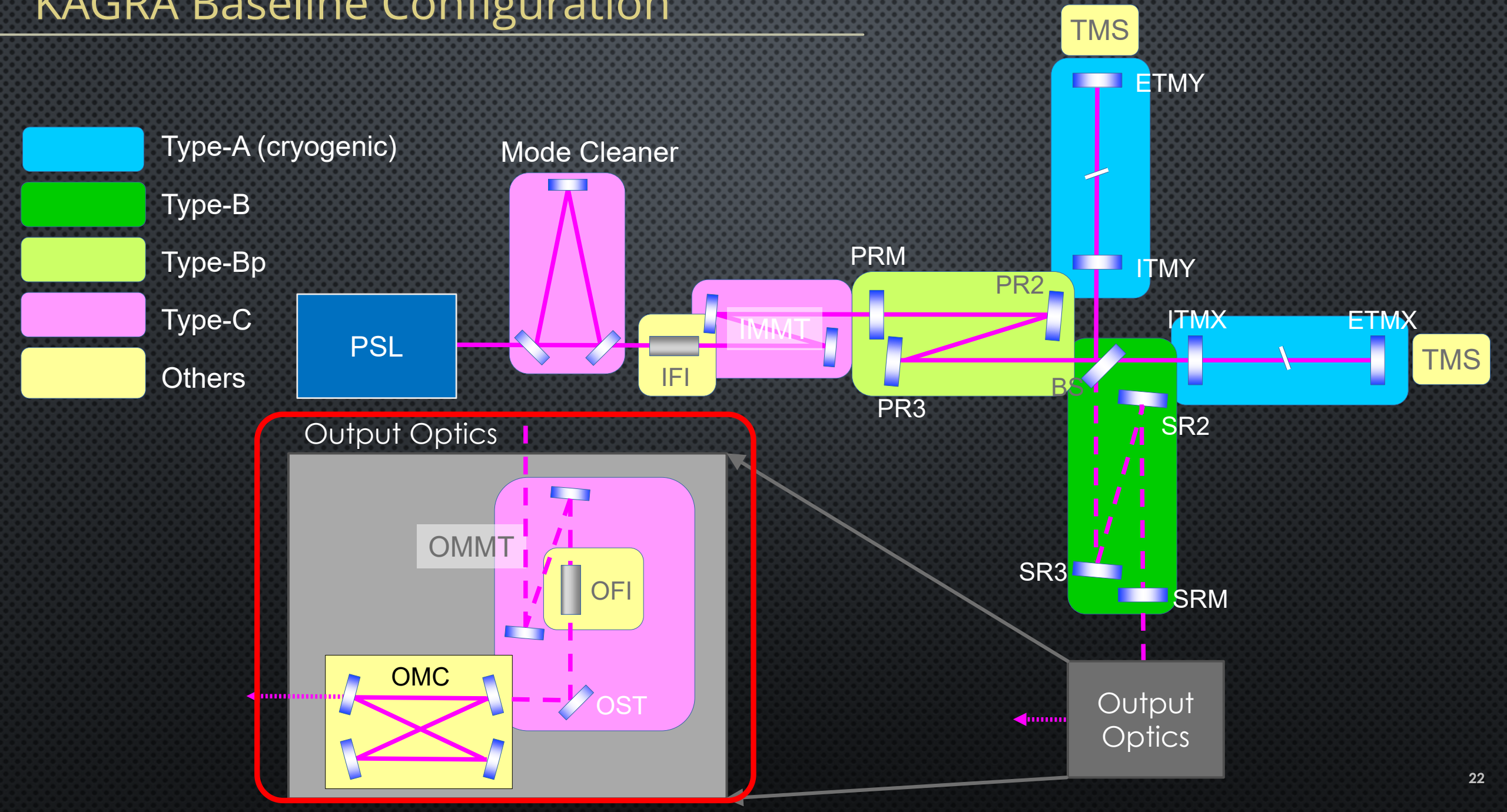


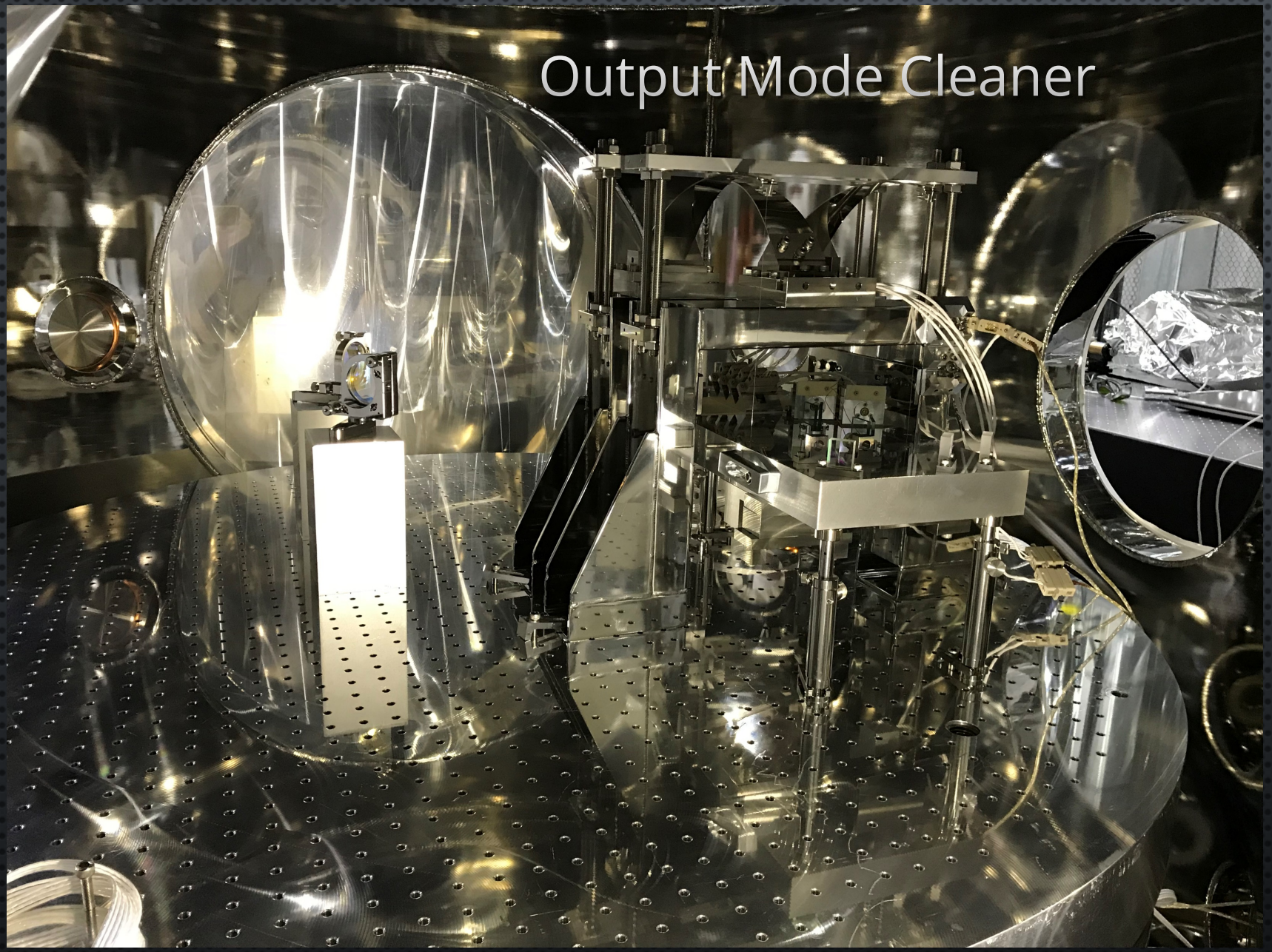

ZIPPY SCAFF

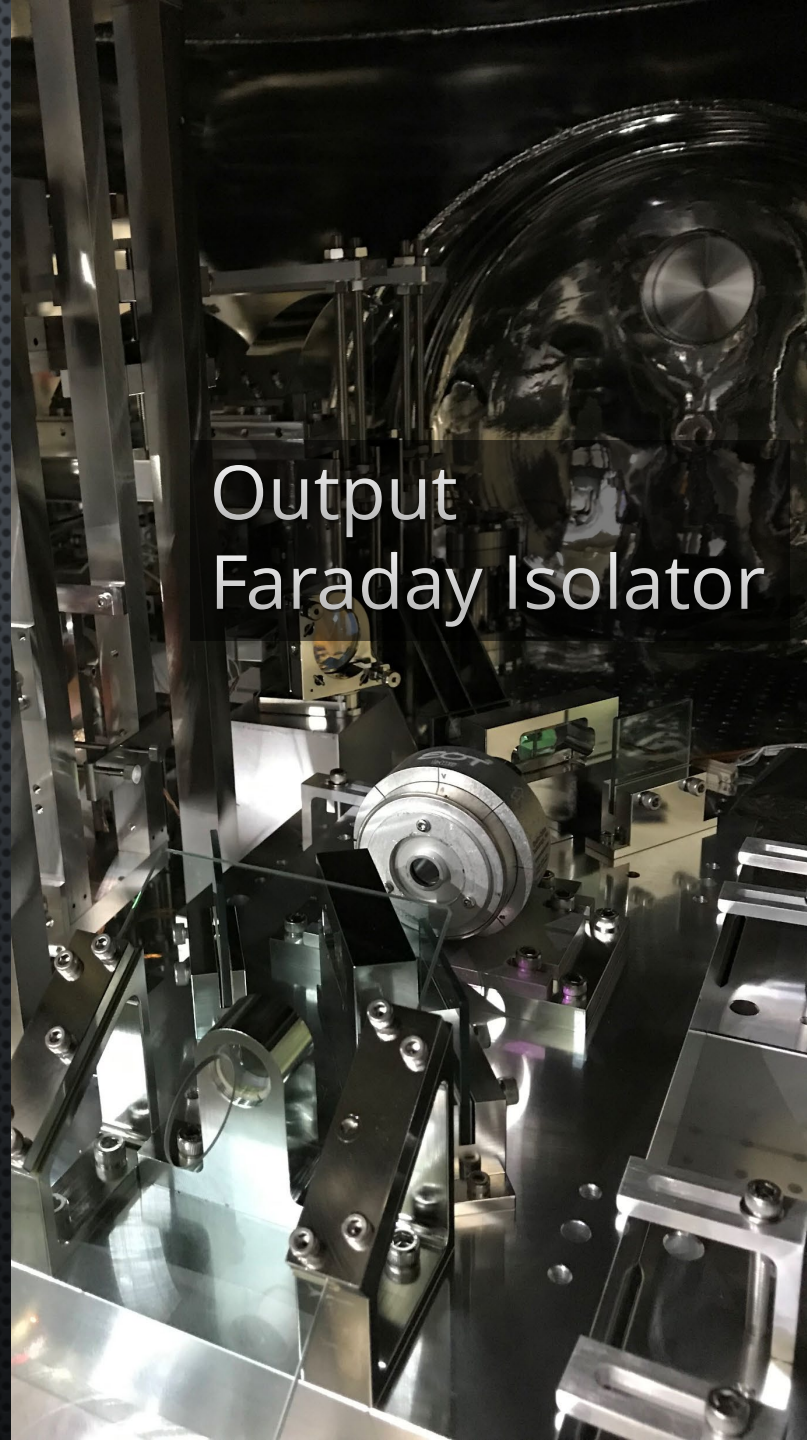



Cryogenic
Payload
Heat Links
Sapphire mirror

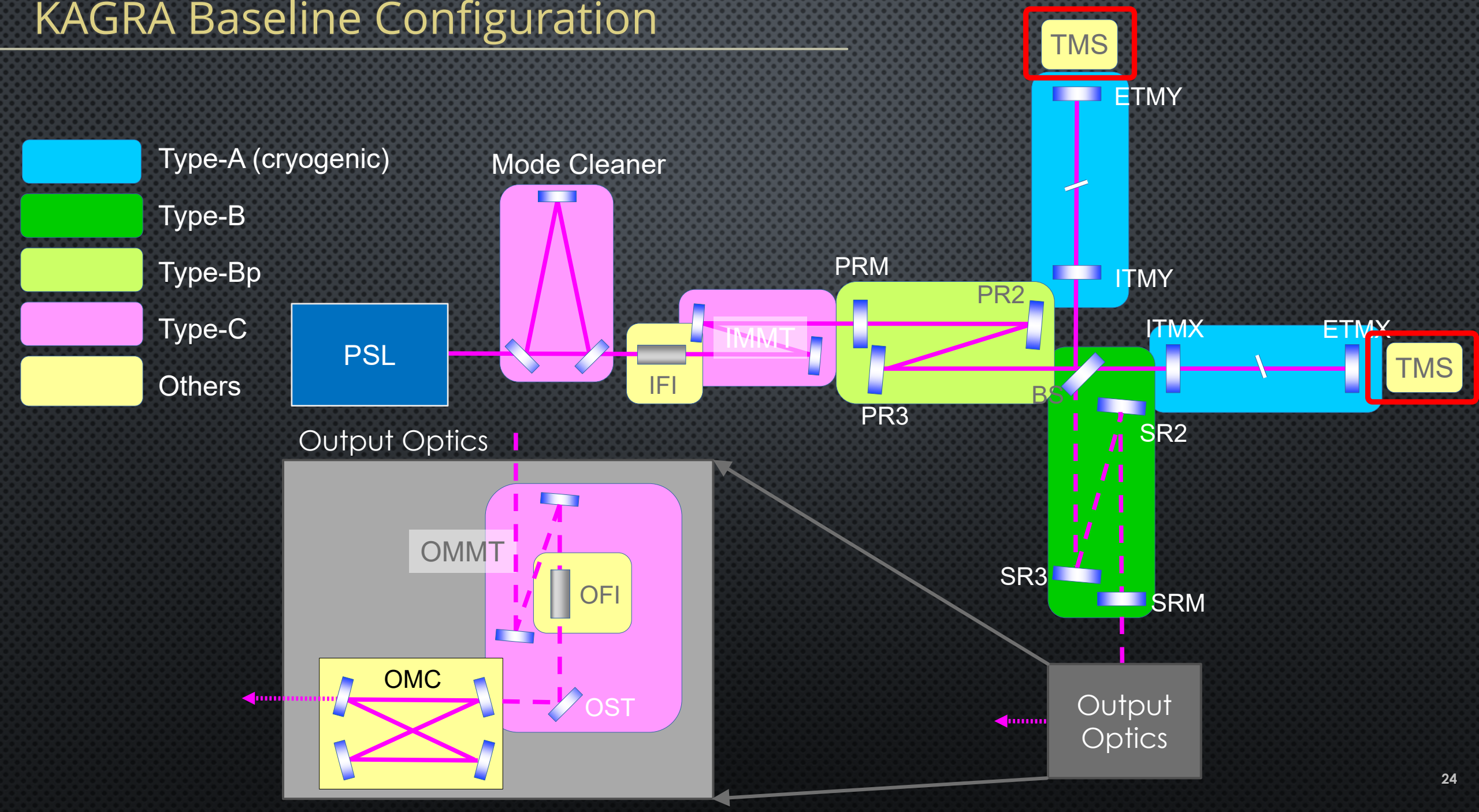
KAGRA Baseline Configuration



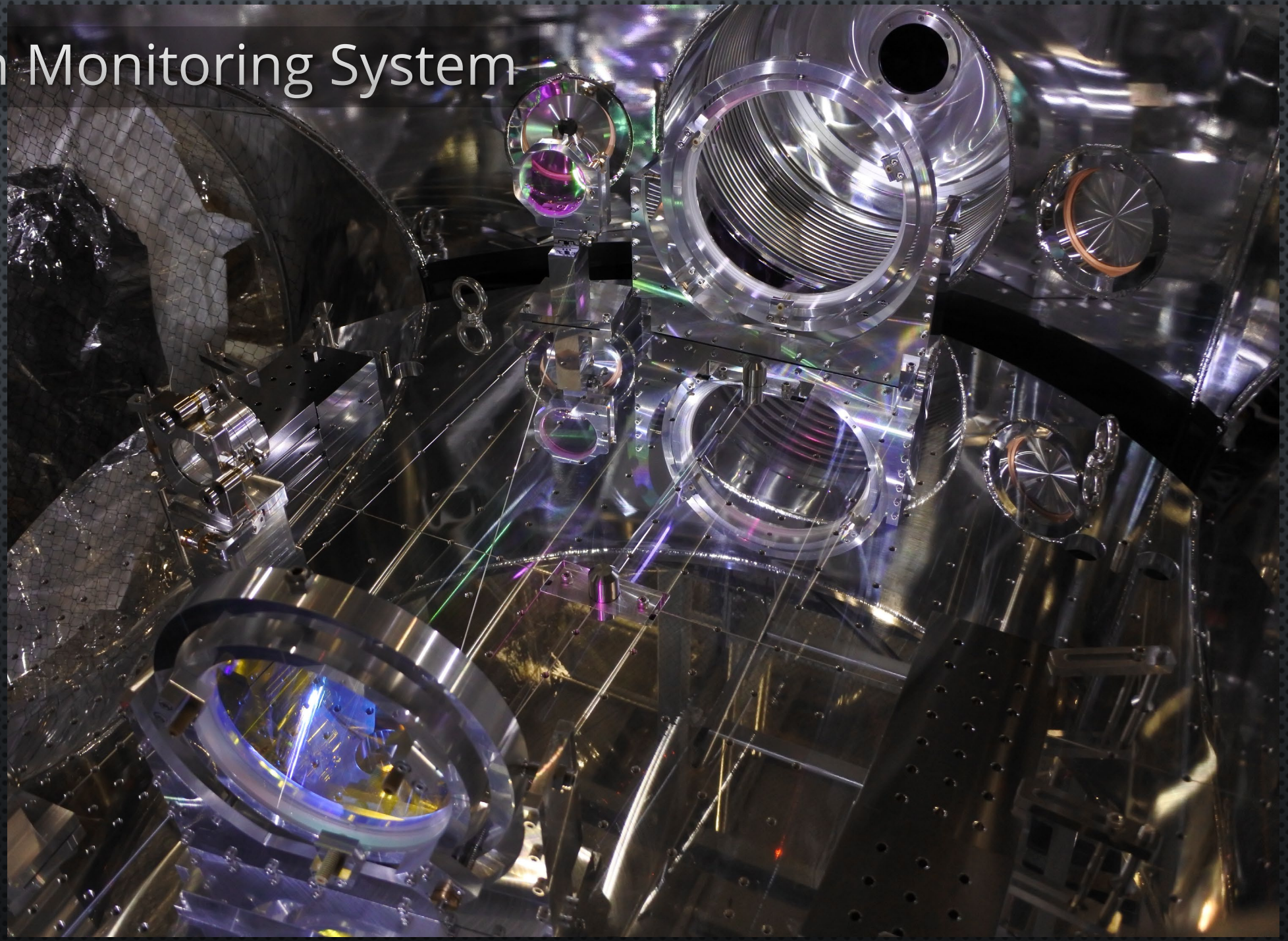

Output Mode Cleaner

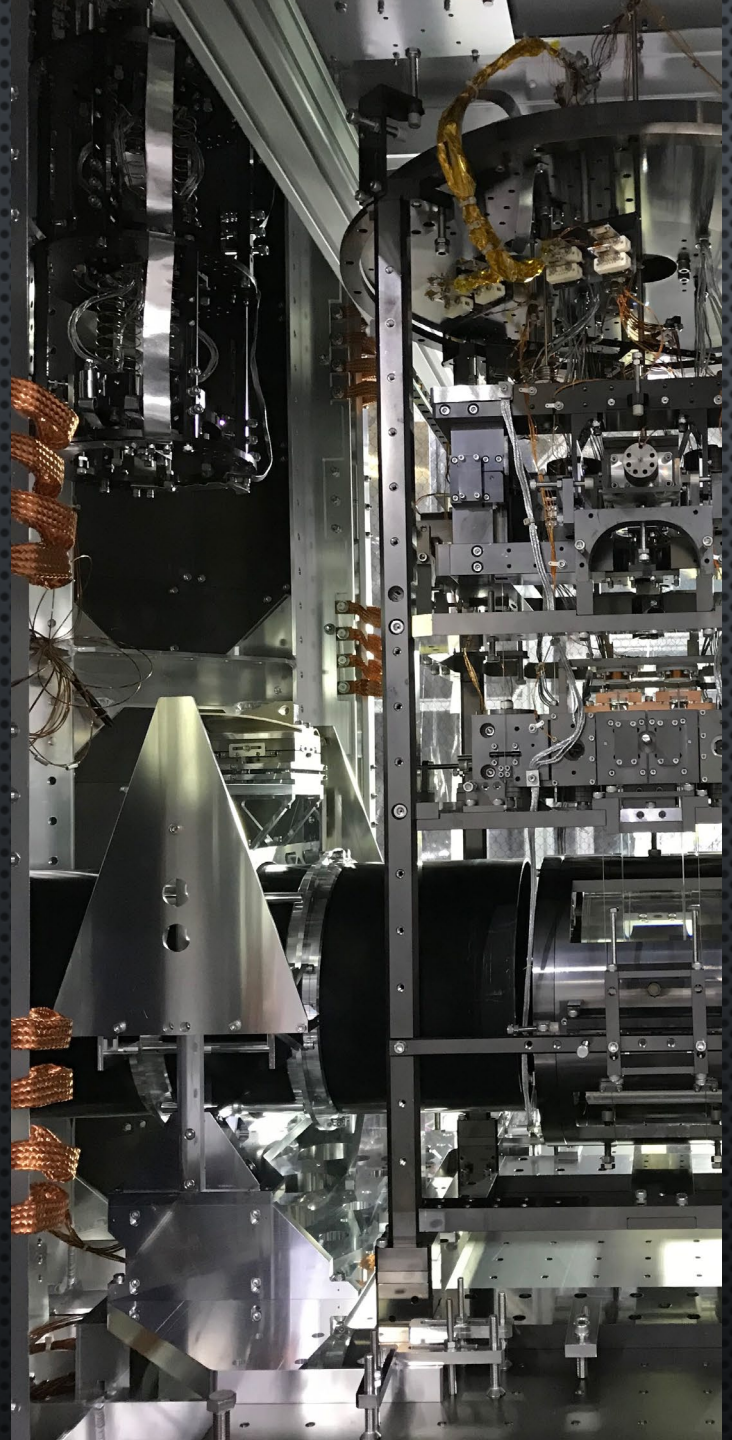

Output
Faraday Isolator

KAGRA Baseline Configuration

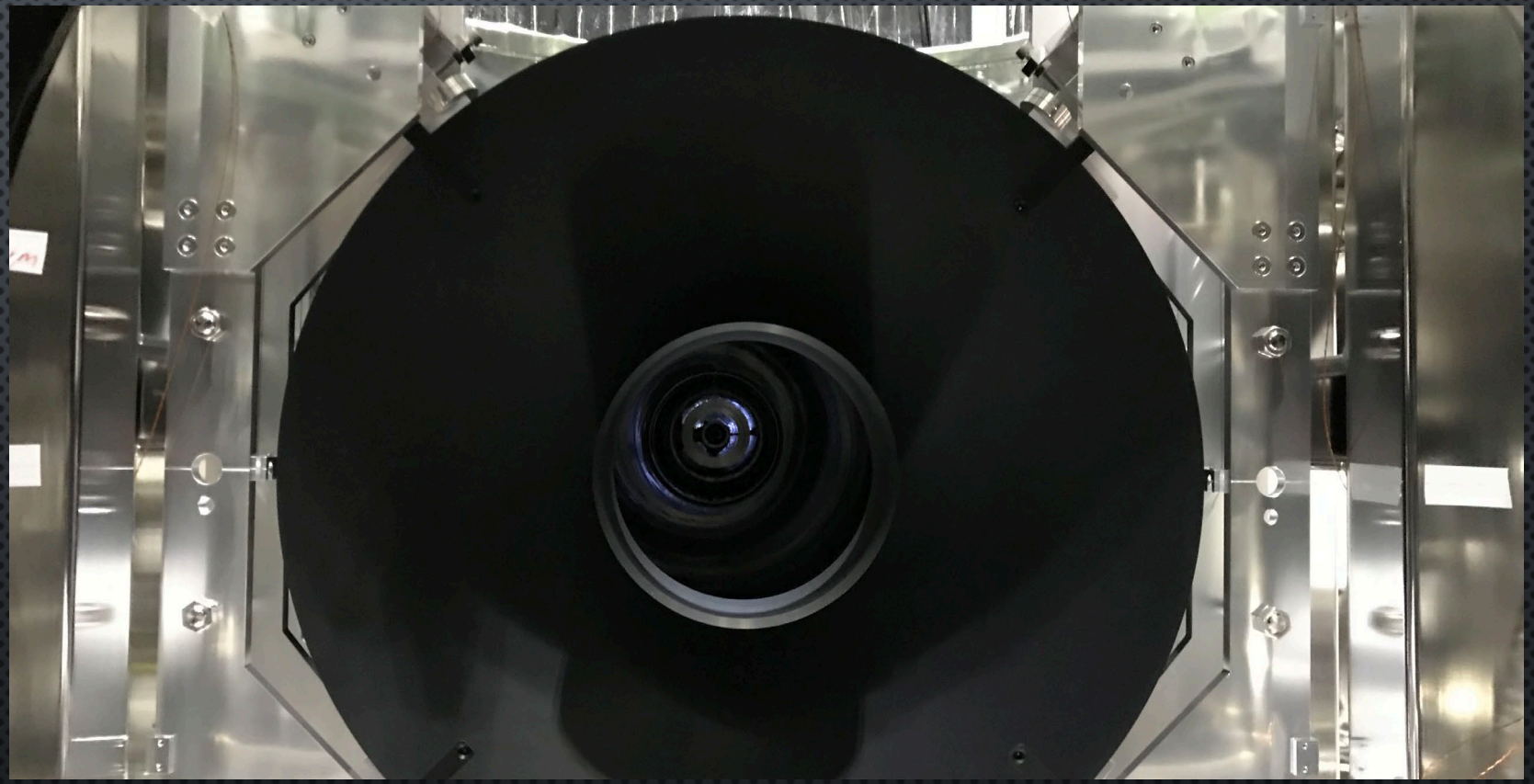


Transmission Monitoring System



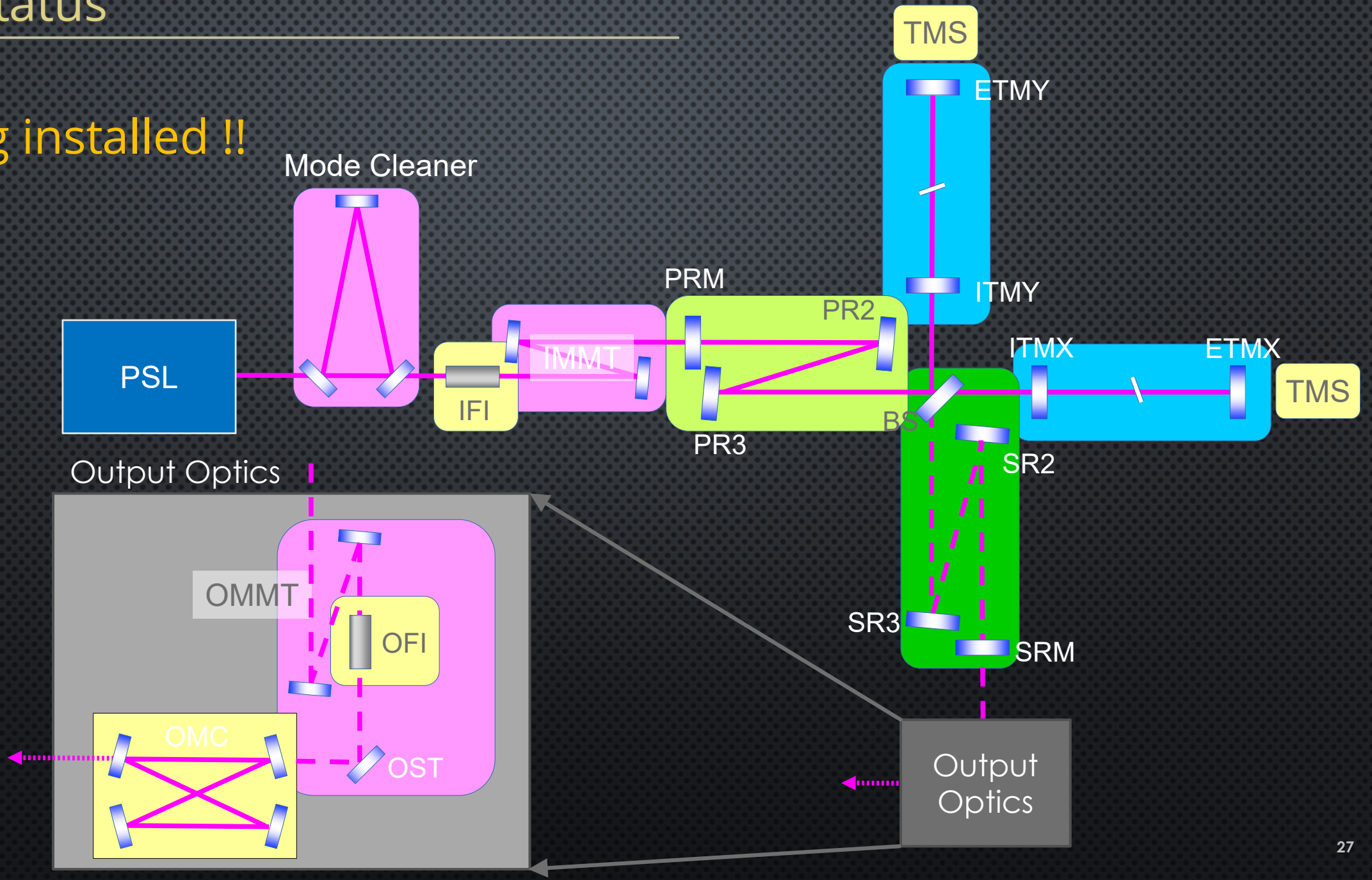


Optical Baffles



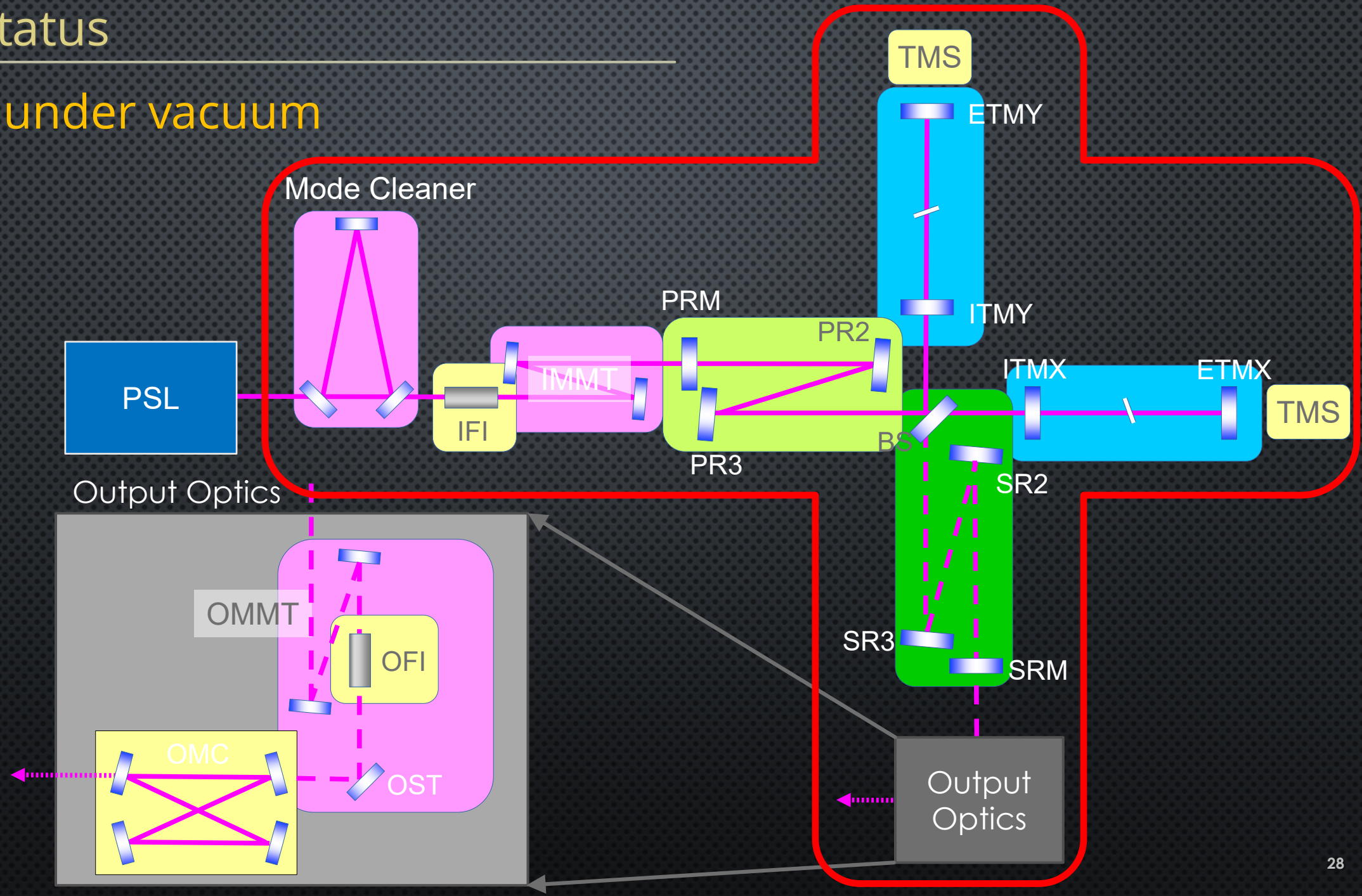
Current Status

Everything installed !!



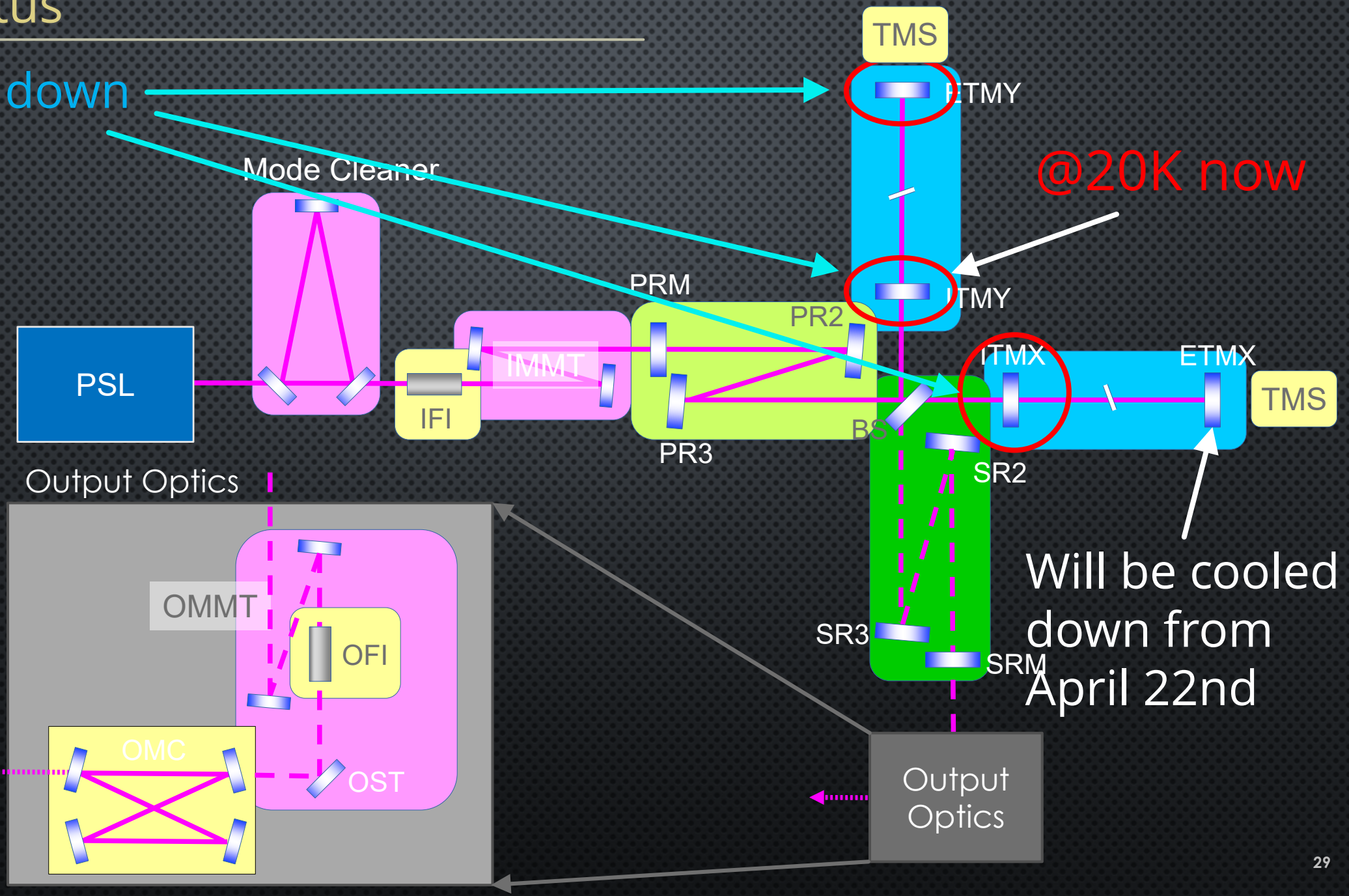
Current Status

Everything under vacuum

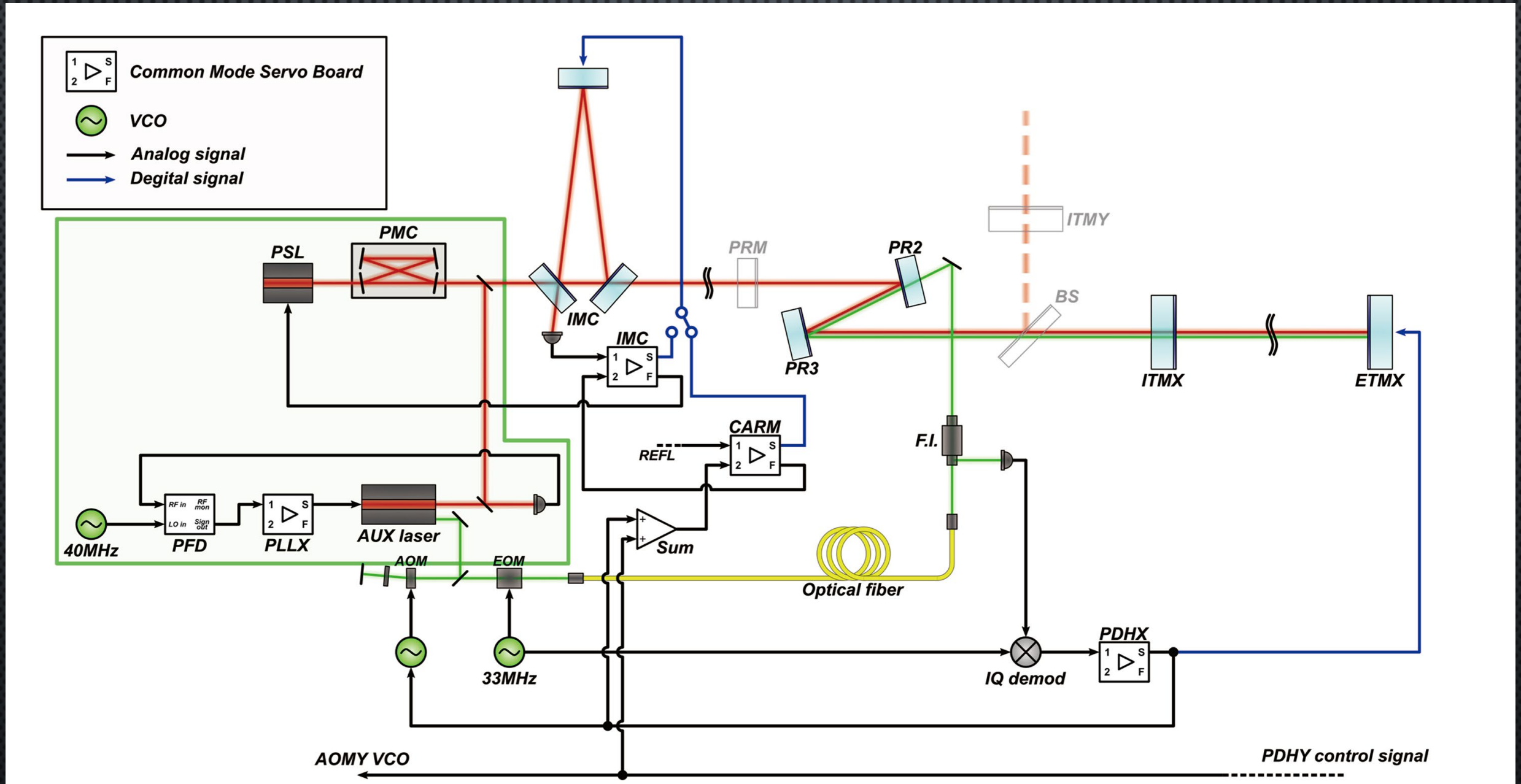


Current Status

Being cooled down



Auxiliary Length Sensing System for pre-locking the arms

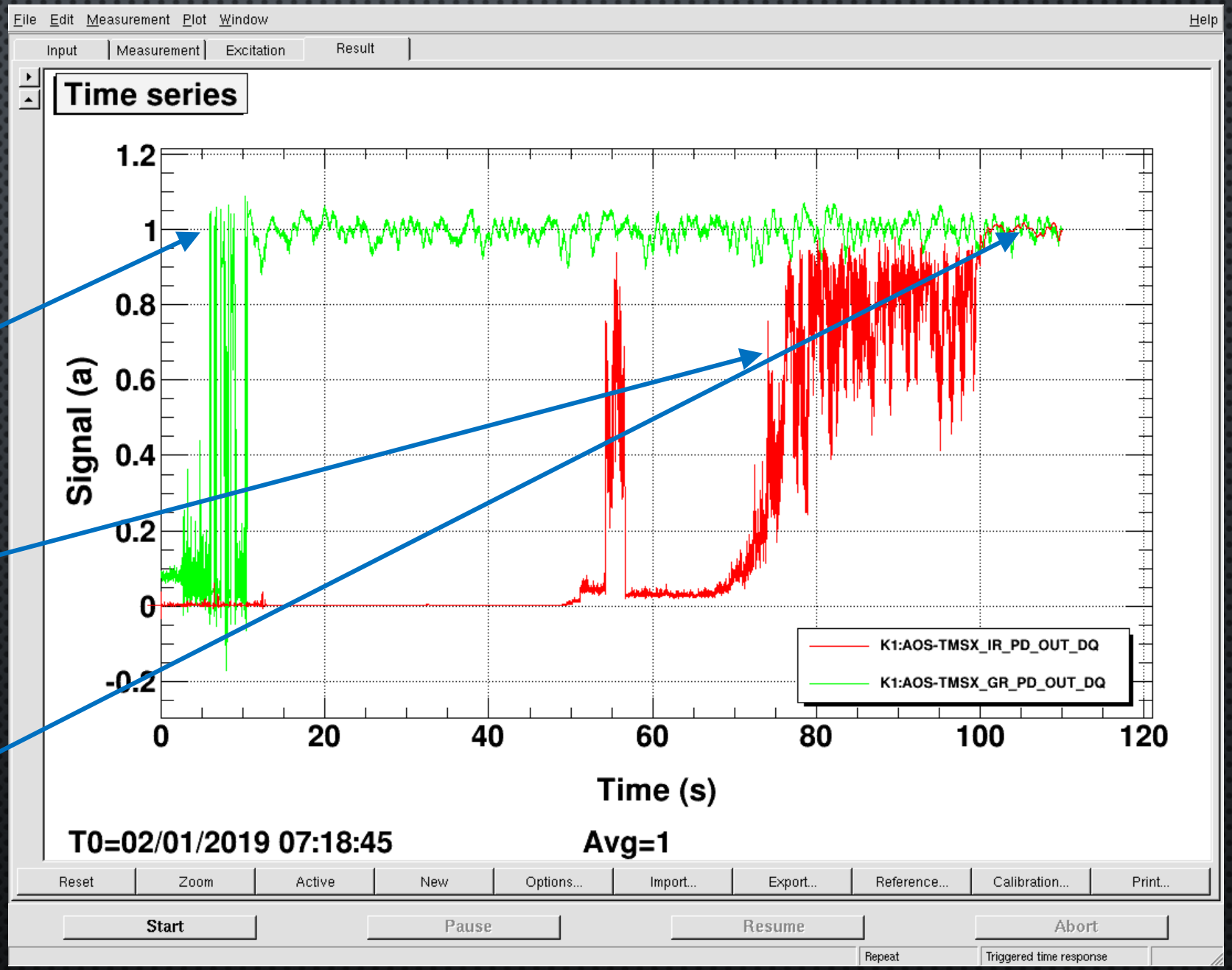


X-arm lock

Green locked

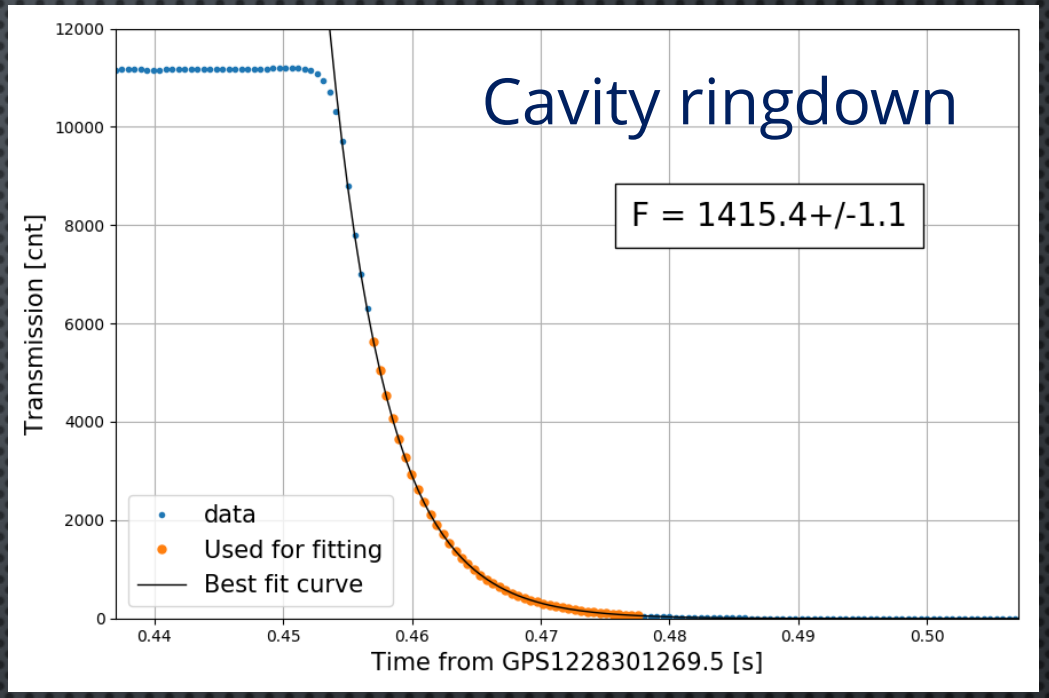
IR brought to resonance

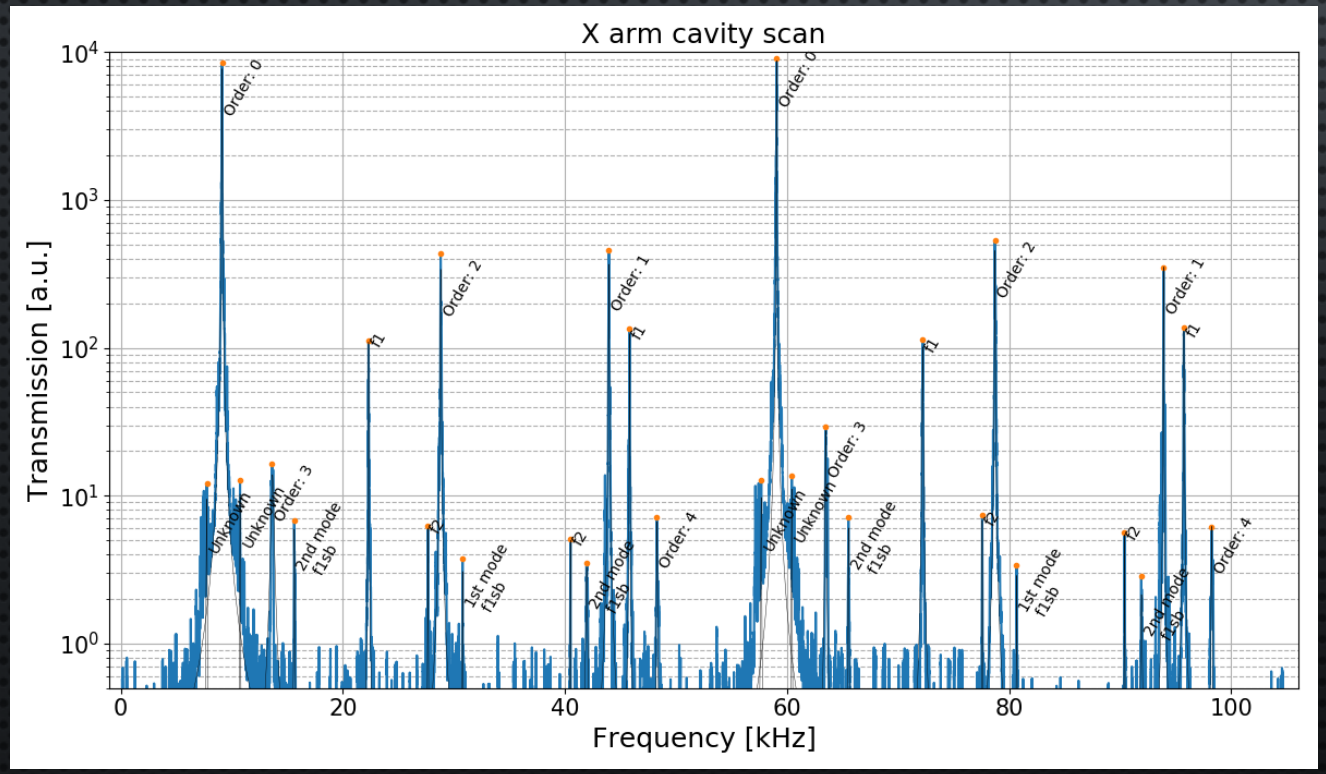
IR locked

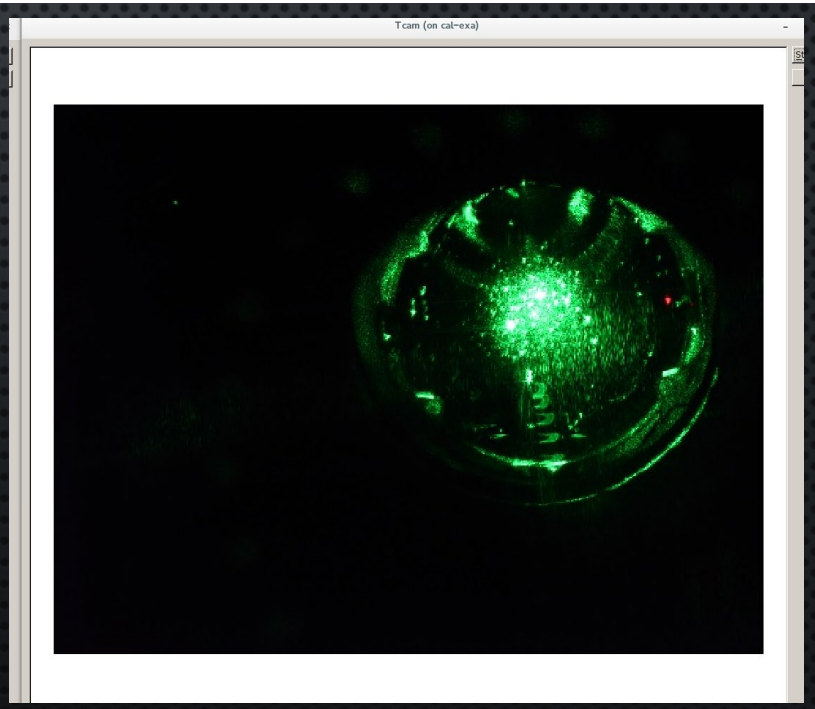


X-arm characterization

- Finesse ~ 1410
  - Design value = 1500
- Round trip loss ~ 86ppm
  - Requirement: less than 100ppm

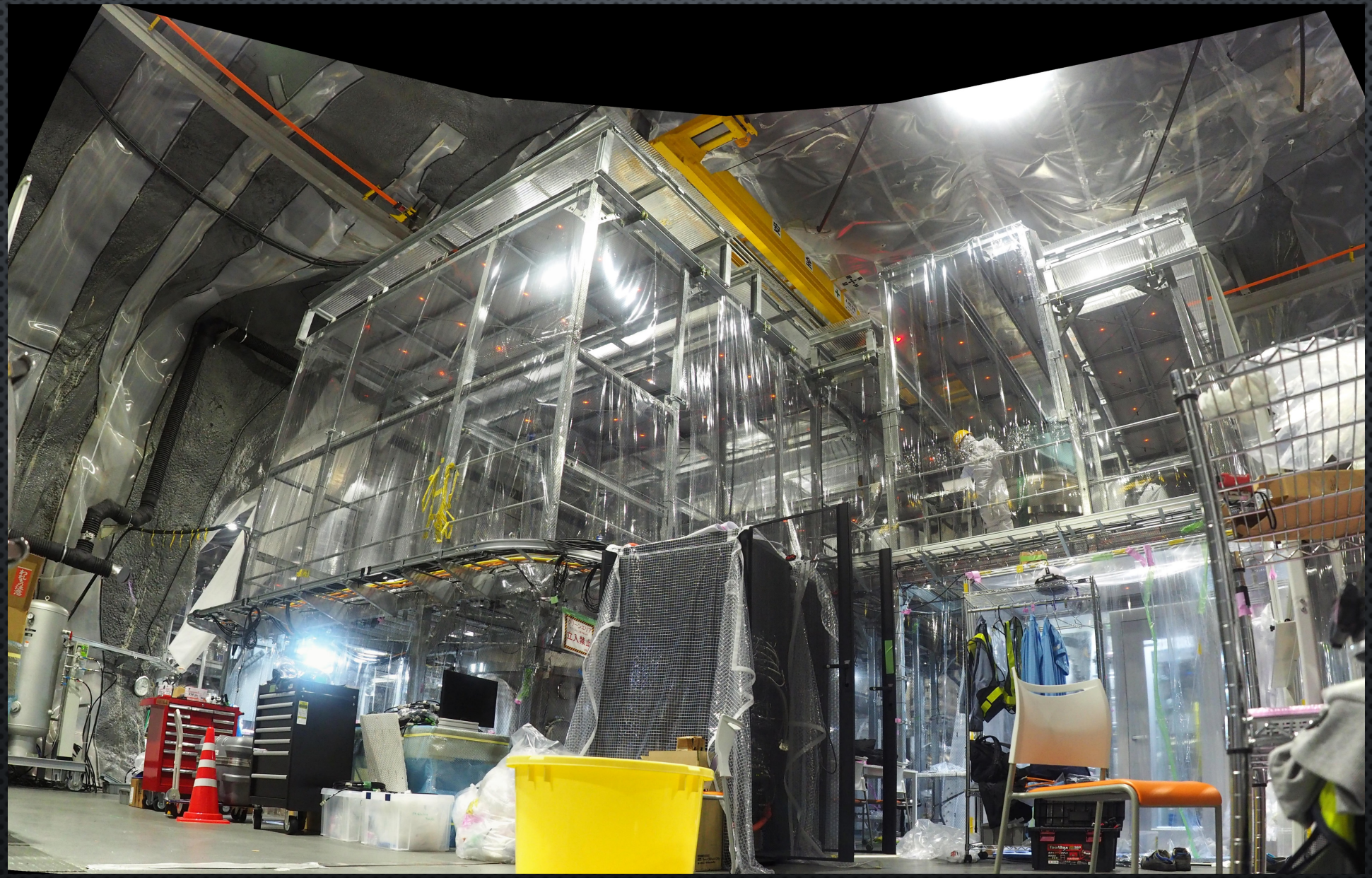






Recent Developments and Plans

- Some delay due to VIS and CRY troubles
  - Broken magnets
  - Broken in vacuum cables
  - Required vacuum vents for repair
- Interferometer commissioning plan
  - May: Y-arm and DRMI commissioning
  - June: FPMI lock => DRFPMI
  - July – Oct.(?): Noise Hunting
- Plan to vent the central area in (probably) August
  - Install scattered light mitigation baffles
  - Replace the problematic OSTM mirror




クリーンエリア
立入禁止

Life is not so easy