

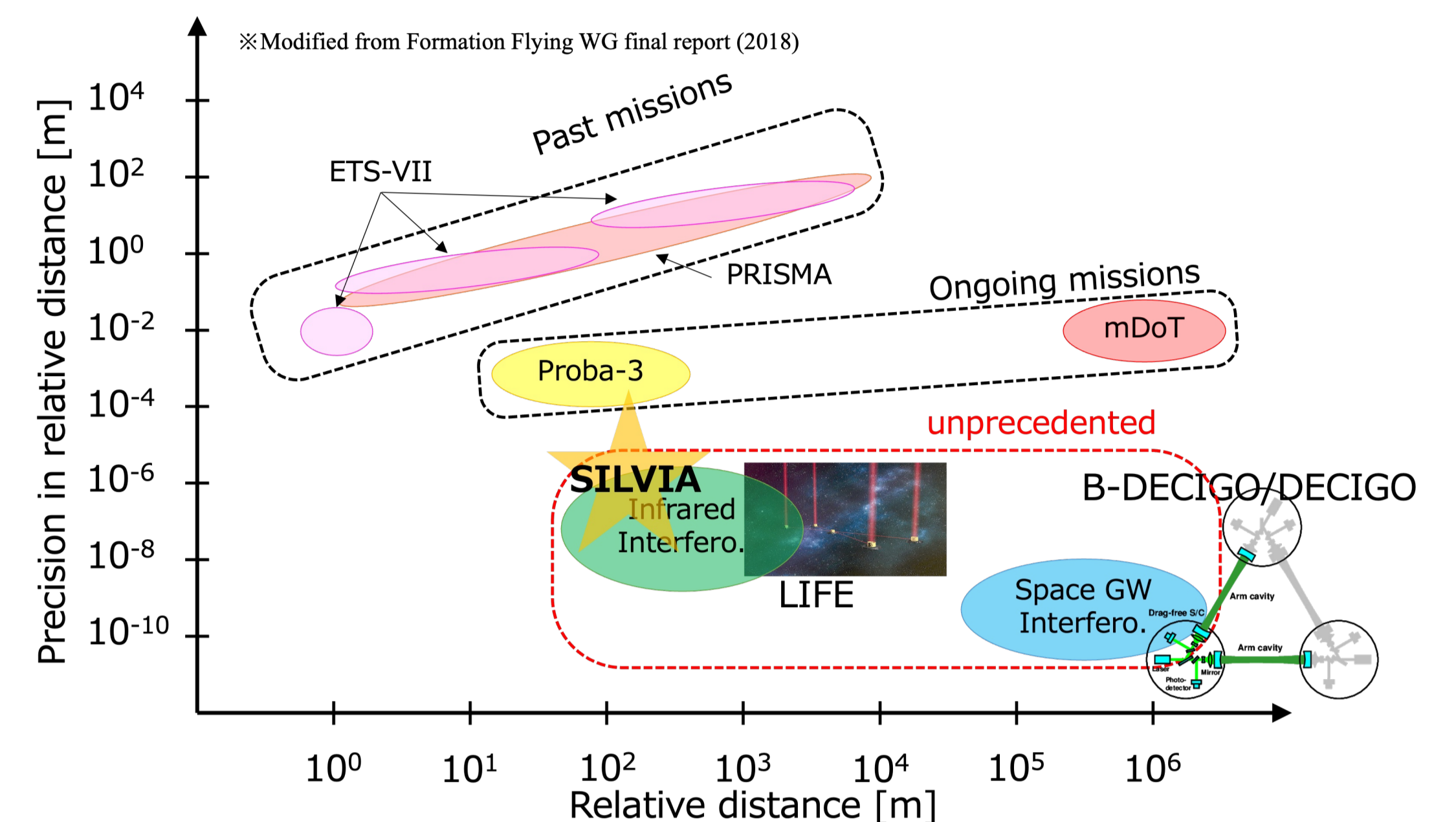
SILVIAのための衛星間レーザ干渉計の開発

Developing the Intersatellite Laser Interferometer for SILVIA

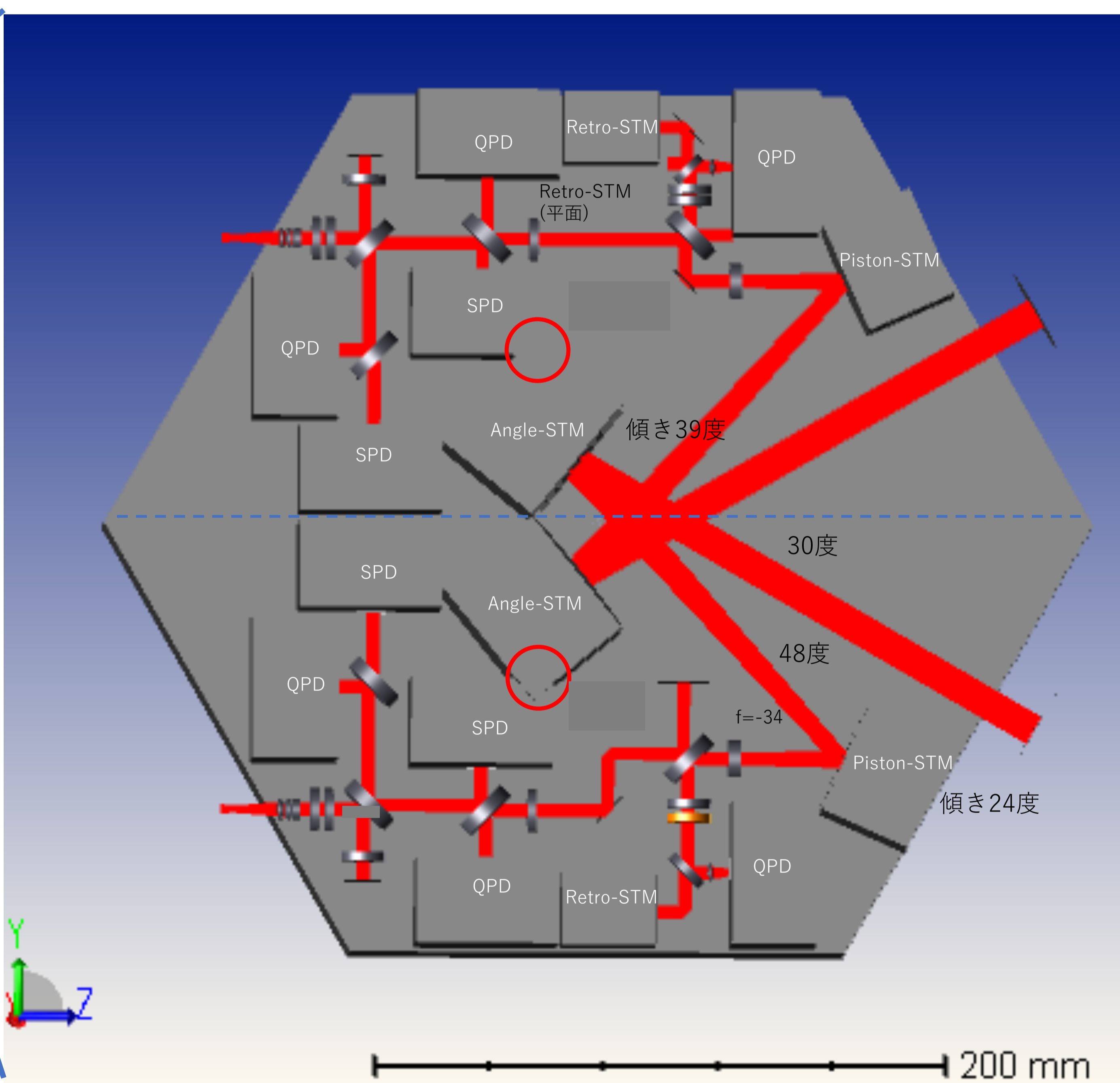
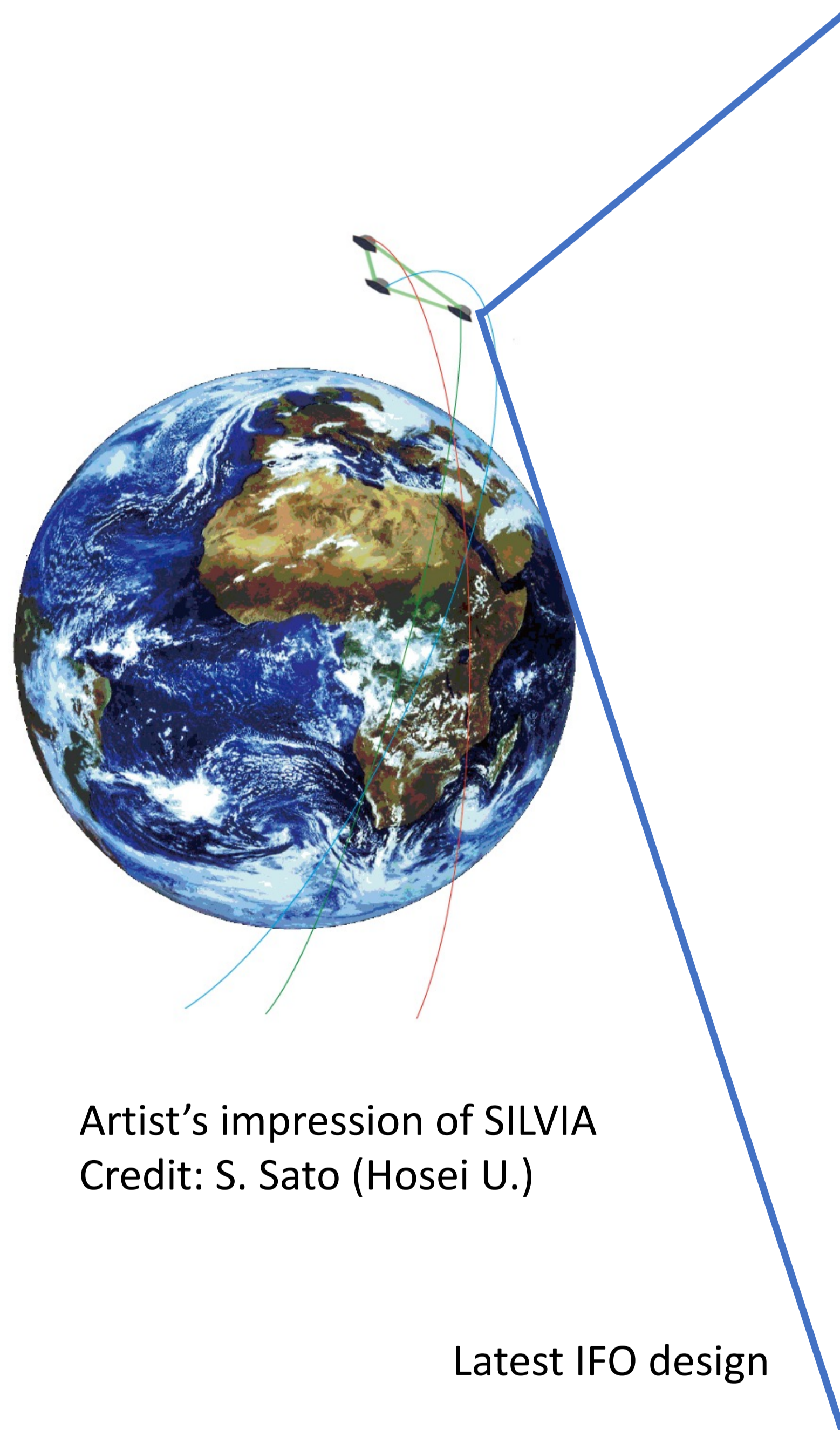
SILVIA = Space Interferometer Laboratory Voyaging towards Innovative Applications
 Kiwamu Izumi (JAXA) for the SILVIA pre-project candidate preparation team

SILVIA aims to acquire the technologies necessary for spacecrafts flying in formation at an unprecedented precision of a micron or better in the relative distances [1] for future astronomical space missions. The formation-flying spacecrafts will allow for achieving the large-scale instruments which would not be feasible with a conventional single spacecraft. In particular, SILVIA will pave the way to future large-scale instruments such as the gravitational-wave observatory concept B-DECIGO [2], the infrared interferometer concept LIFE [3].

Goal of SILVIA is the in-orbit demonstration of key technologies including the inter-satellite laser interferometry, micro-Newton thrusters, control scheme cooperatively using satellite bus and science payload, and more.



Intersatellite Laser Interferometer or **ILO** in short, is one of the most critical subsystems. The conceptual design study is being carried out with NAOJ ATC and an industrial partner.

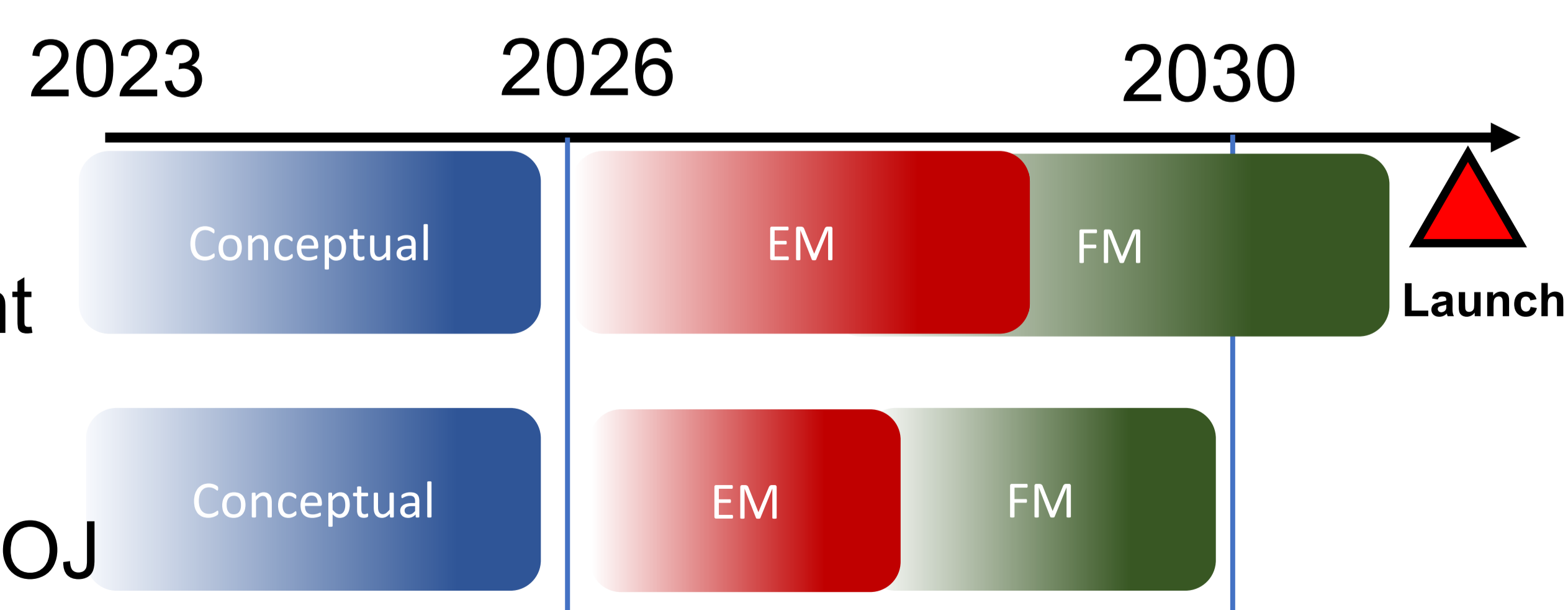
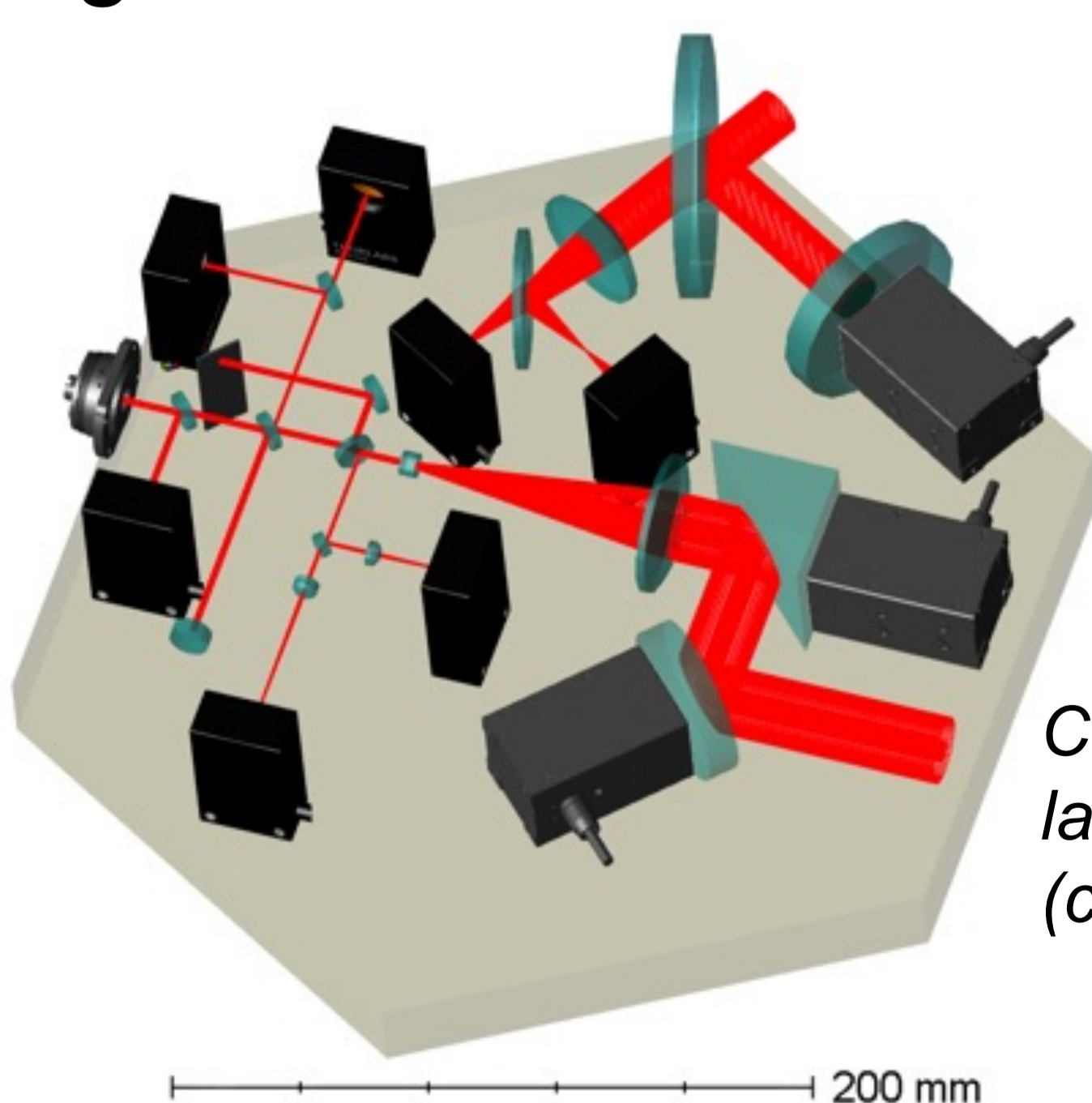


Main Functions

- Angular scanning for outgoing beam
- Angular tracking for outgoing beam
- Detection and retroreflection of incoming beams
- Measurement of Doppler velocity
- Fringe lock of laser link

Laser Wavelength: 1,550 nm
 Interferometer: Bi-directional Michelson
 Sensing noise: 1 nm/Hz^{1/2} @ 0.1 Hz
 S/C separation distance: 100 m, nominal
 Angular actuation: Piezo actuated mirrors
 Length actuation: piezo-actuated mirror and laser frequency

Contribution of NAOJ ATC is the optical design of the ILO subsystem under ATC's joint research and development contract (共同研究開発) since FY2023. The ATC optics group plays a key role in interfacing between the SILVIA team and industrial partner.



References

- 1) T. Ito, *et al.*, "SILVIA: Ultra-precision formation flying demonstration for space-based interferometry," PASJ, psaf086
- 2) S. Kawamura, *et al.*, "Current status of space gravitational wave antenna DECIGO and B-DECIGO," Prog. Theor. Exp. Phys. 05A105 (2021)
- 3) S. P. Quanz, *et al.*, "Large Interferometer For Exoplanets (LIFE) I. Improved exoplanet detection yield estimates for a large mid-infrared space-interferometer mission," A&A 664, A21 (2022)