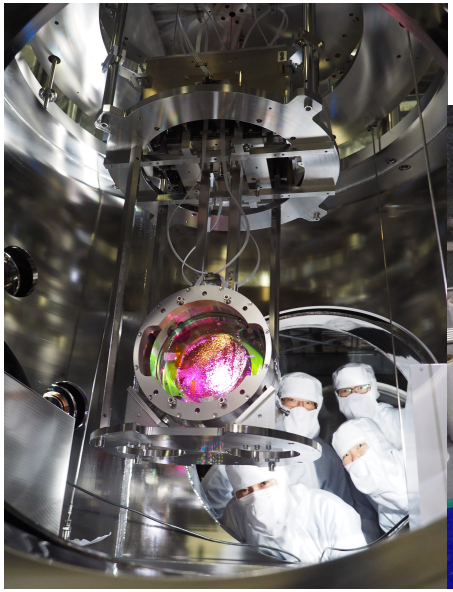
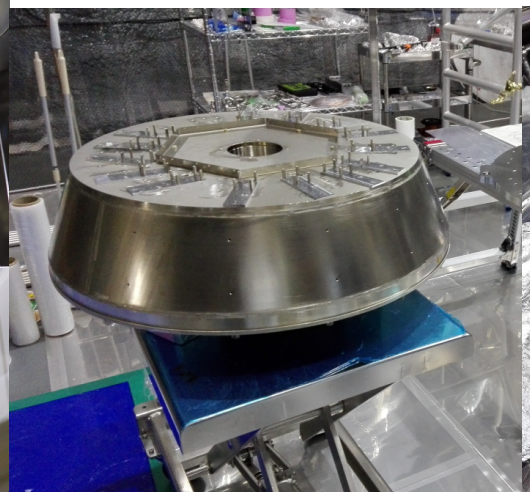
大型低温重力波望遠鏡 KAGRA の防振系

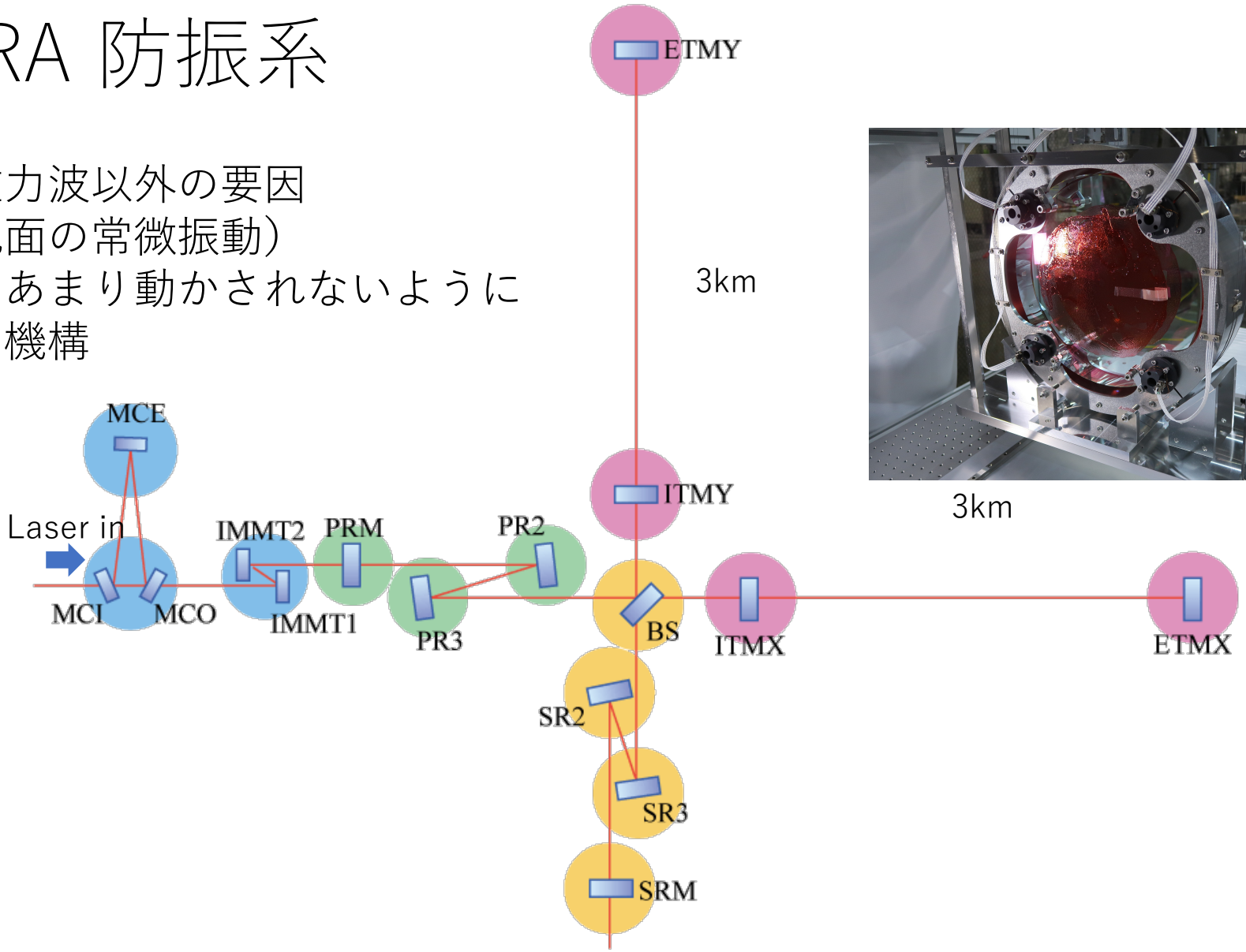
大石奈緒子（国立天文台）、KAGRA collaboration

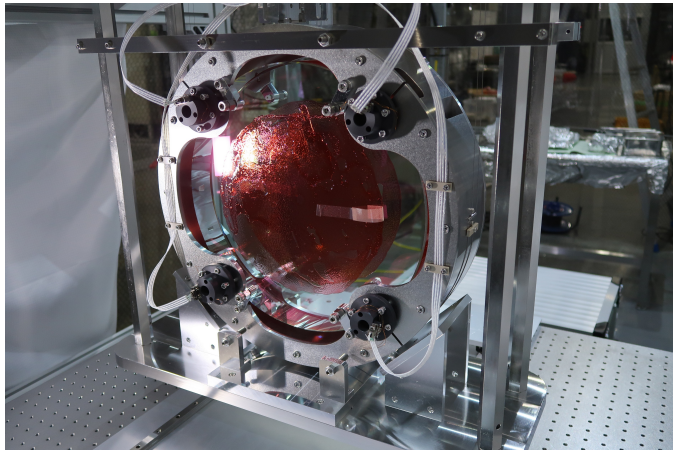





KAGRA 防振系

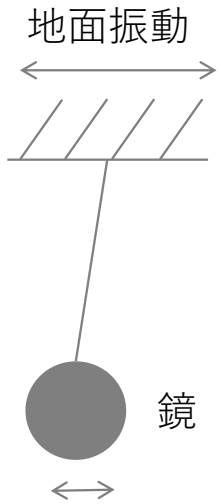
・鏡が重力波以外の要因
（主に地面の常微振動）
によってあまり動かされないように
支持する機構

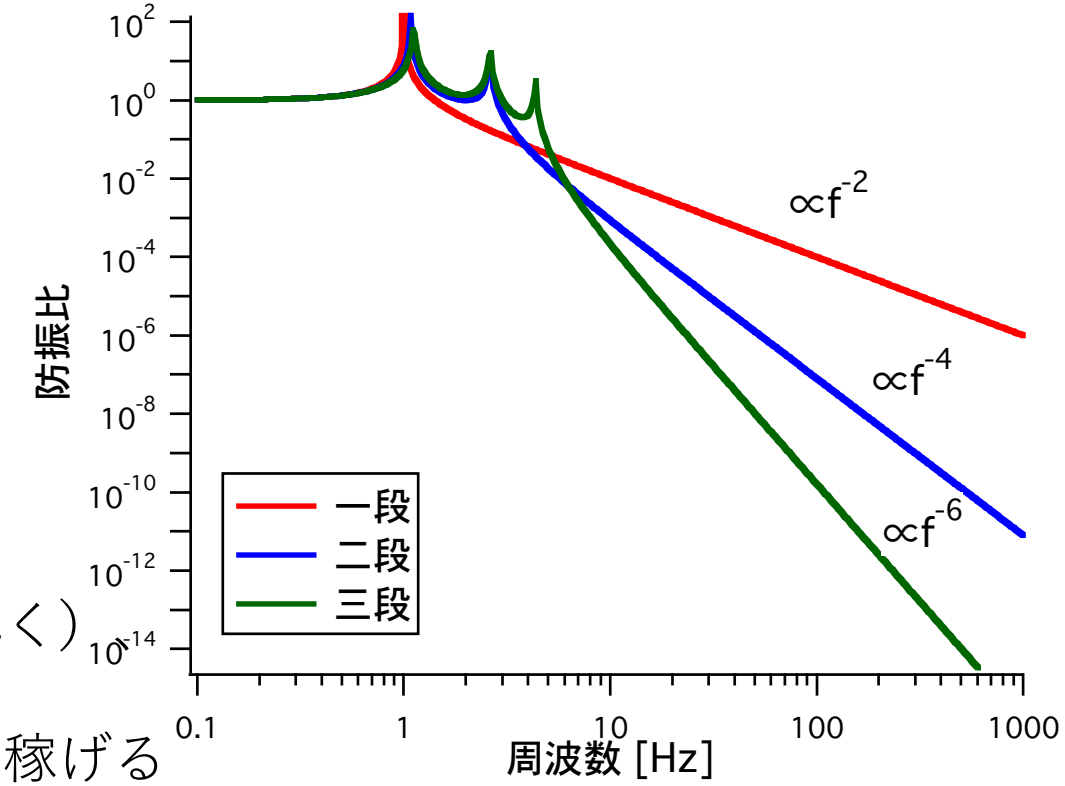




3km

振り子をつかった防振

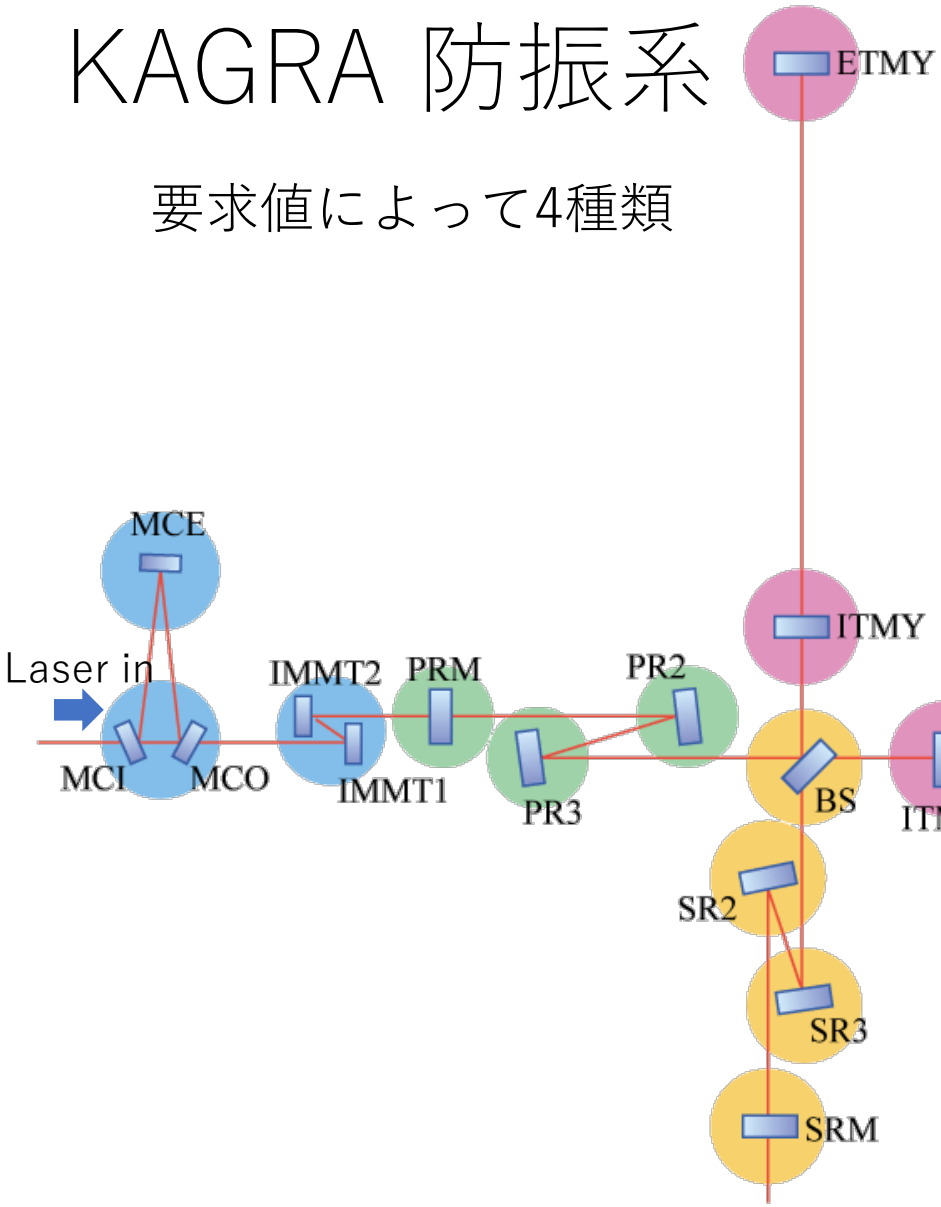




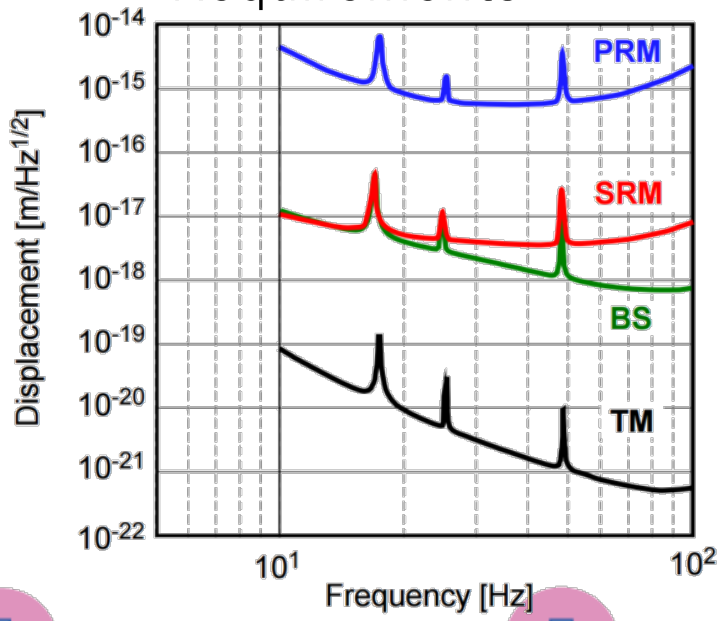
振り子を長く（〜共振周波数を低く）
段数を多くすれば
防振比（支点と鏡の動きの差）を稼げる

KAGRA 防振系

要求値によって4種類



Requirements

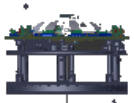


⇨Type-Bp

⇨Type-B

⇨Type-A

13.5m



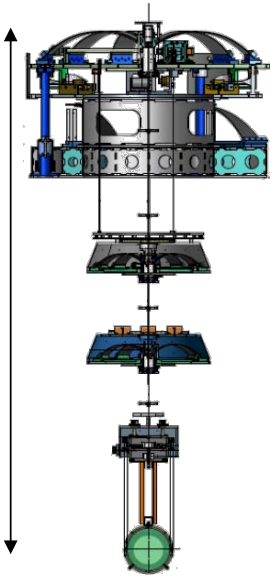
Type-A
4台





Type-B
4台

3.1m

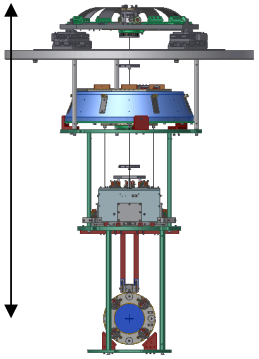


要求される性能によって異なる
4種類+αの防振系を制作

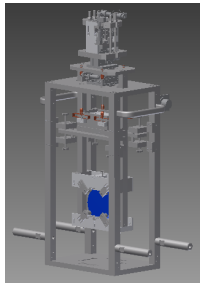


Type-Bp
3台

1.7m



Type-C
7台

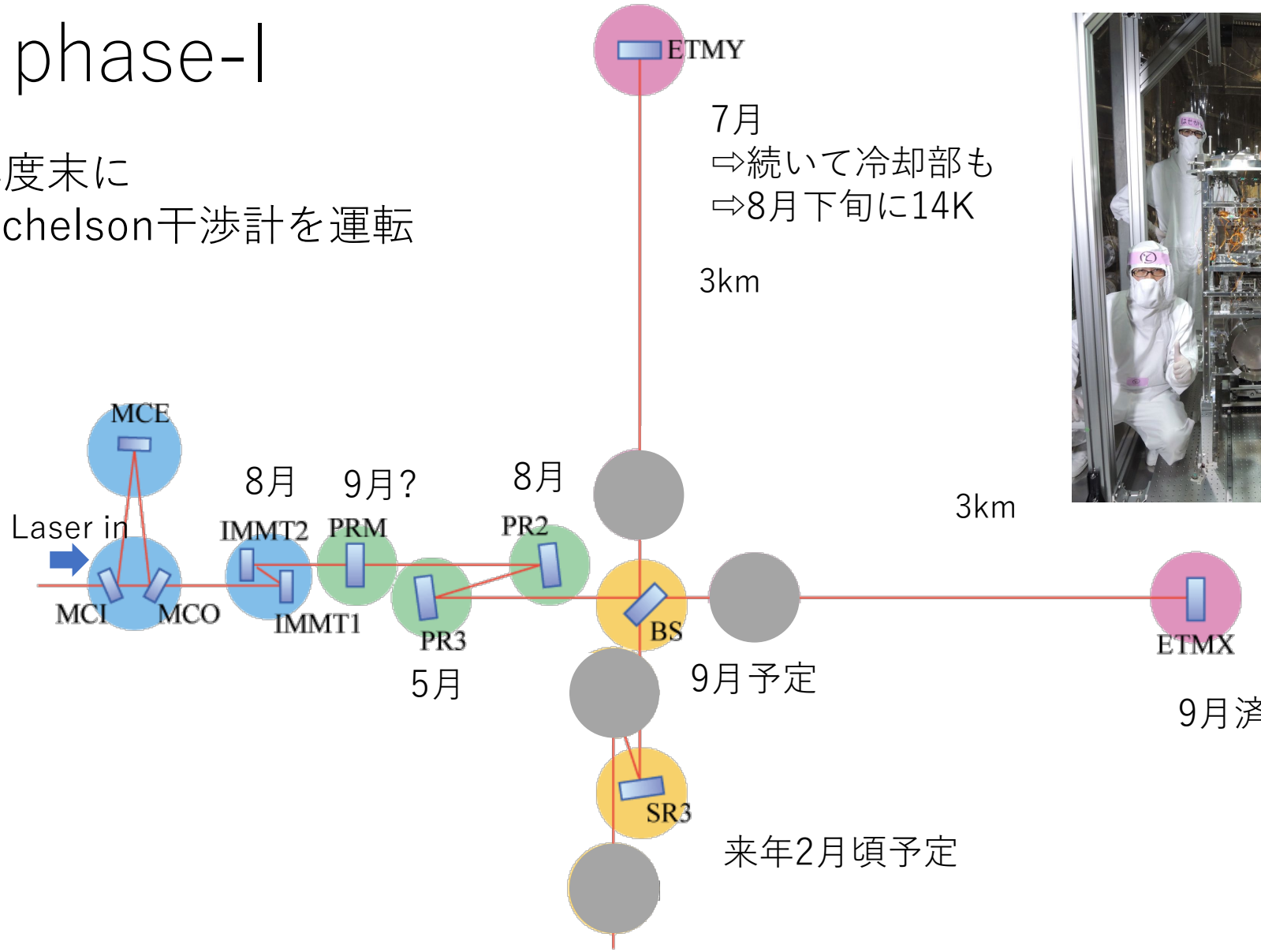


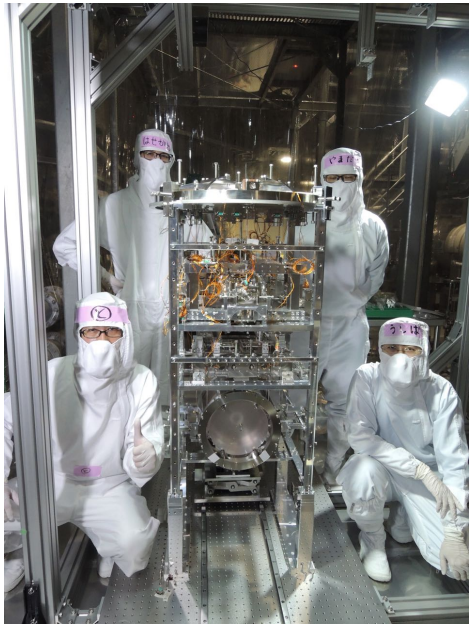


低温部はKEKの担当

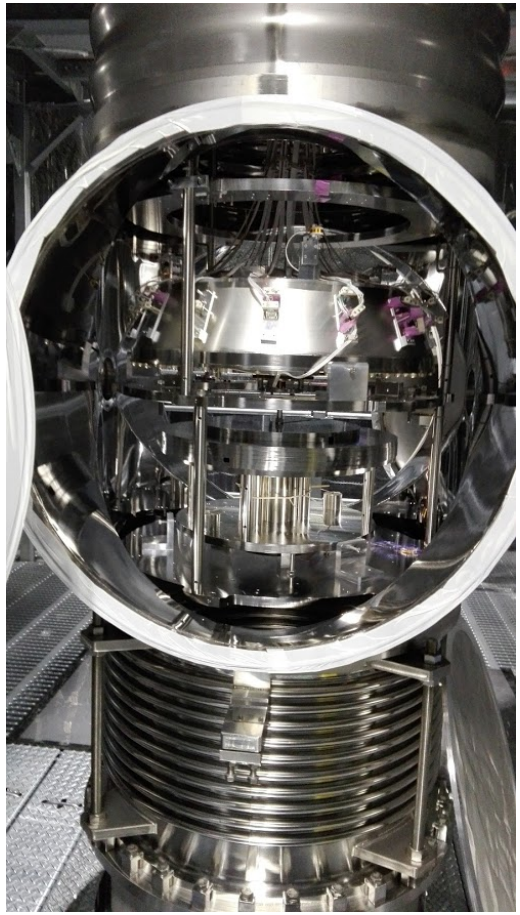
KAGRA phase-I

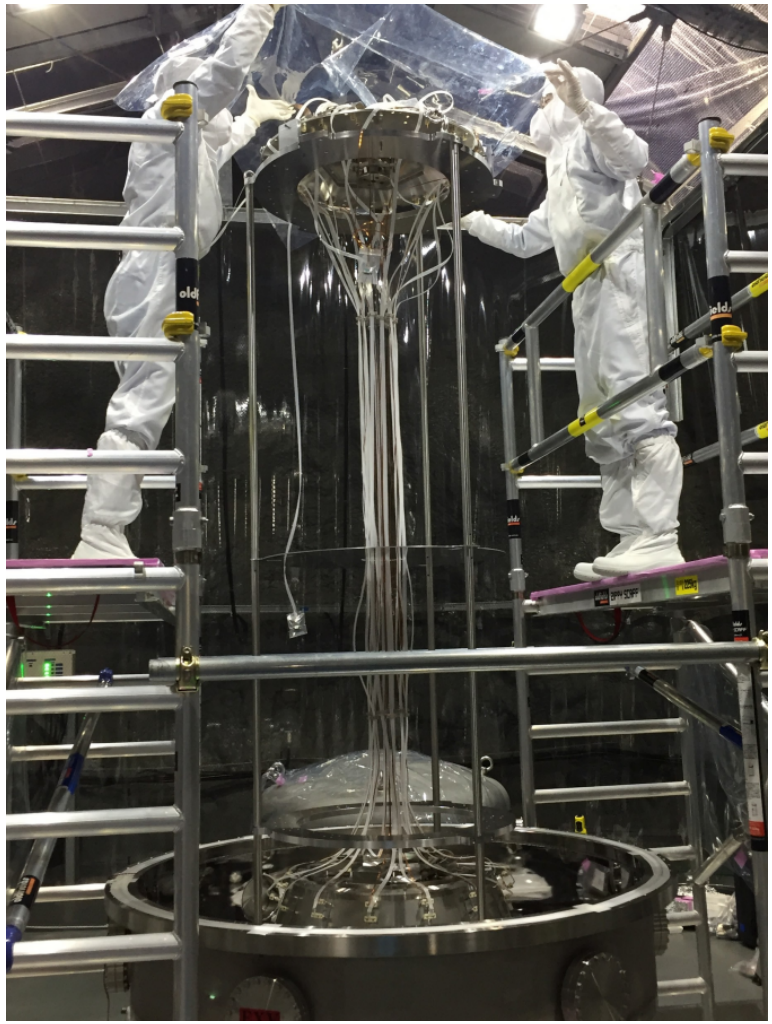
2017年度末に
低温Michelson干渉計を運転

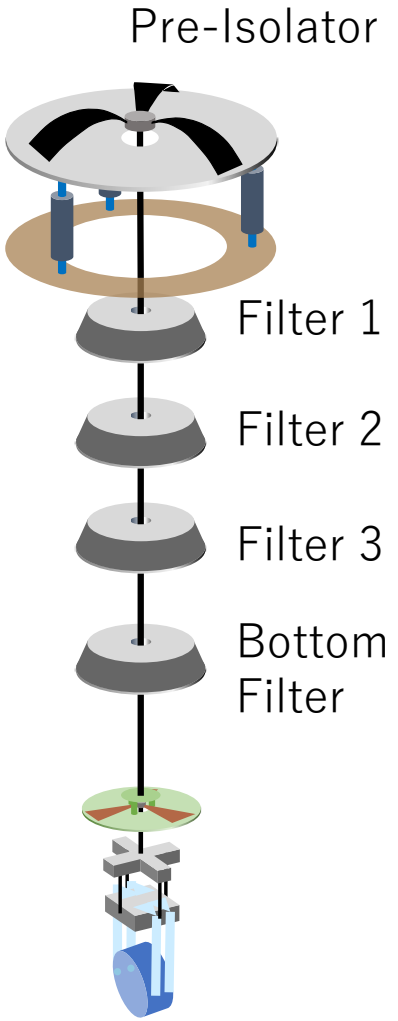




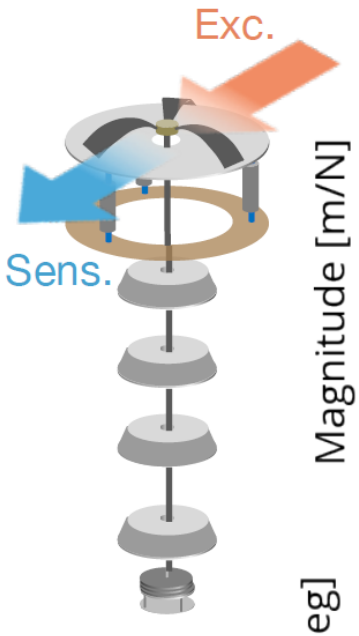
Type-A



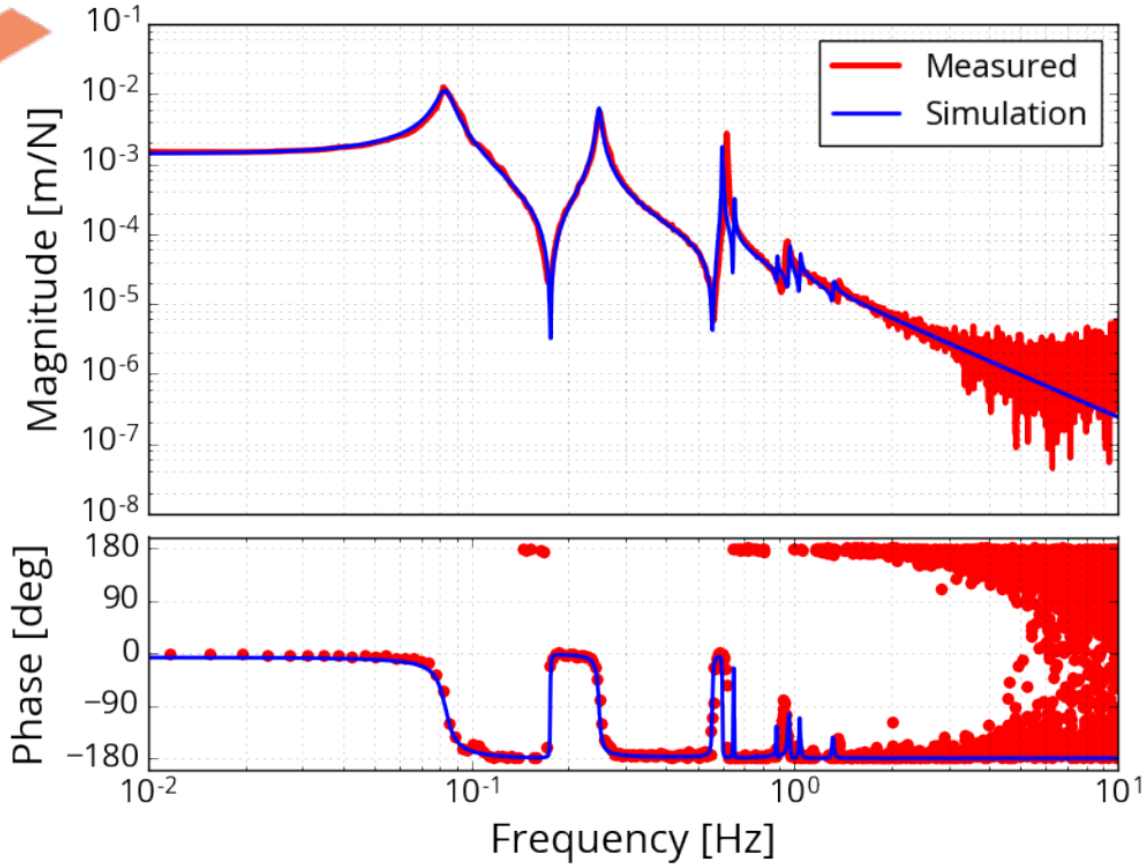




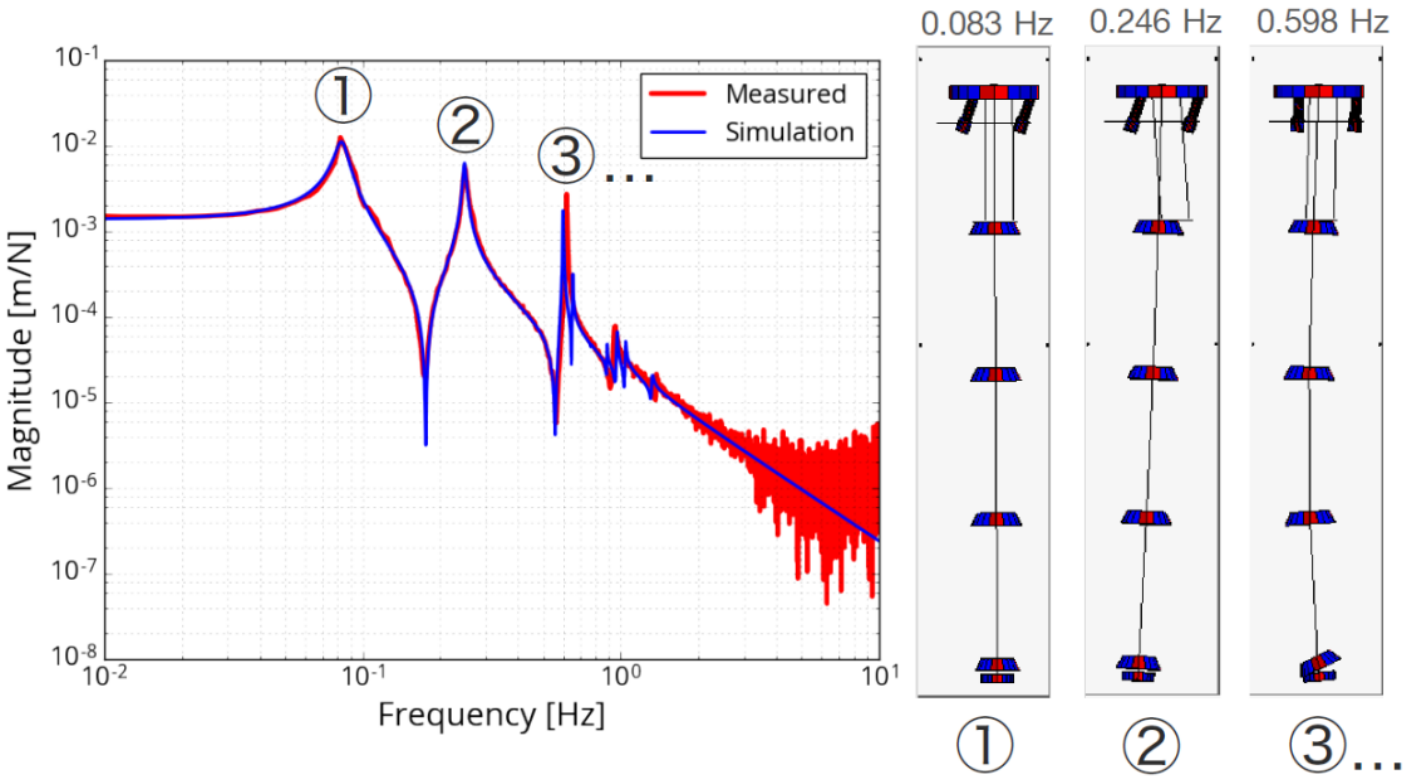
Measurement of transfer functions



$$\frac{x_{\mathrm{IP}}}{F_{x_{\mathrm{IP}}}}$$



Identified eigen mode



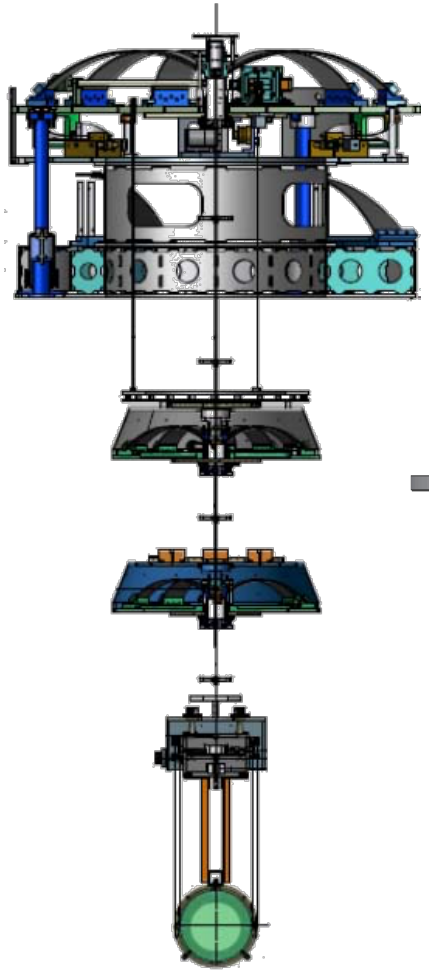
Type-B

- Team
  - Mark Barton (leader),
  - **Fabián Erasmo Peña Arellano (next talk),**
  - Enzo Nicolás Tapia San Martín,
  - 平田直篤
- Beam Splitter
  - July 2016-June 2017(Test)
  - July-Sep2017 (Real mirror)



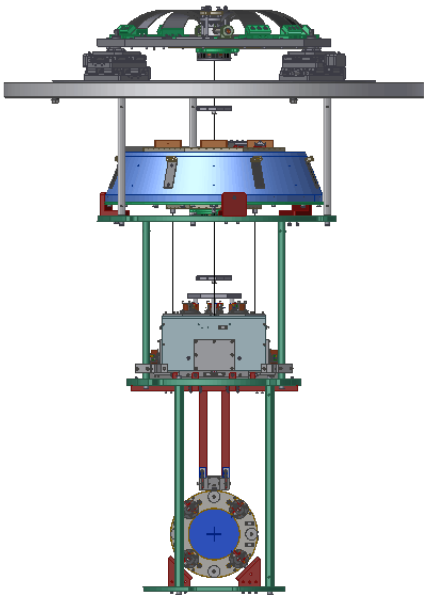
Type-Bp

Type-B



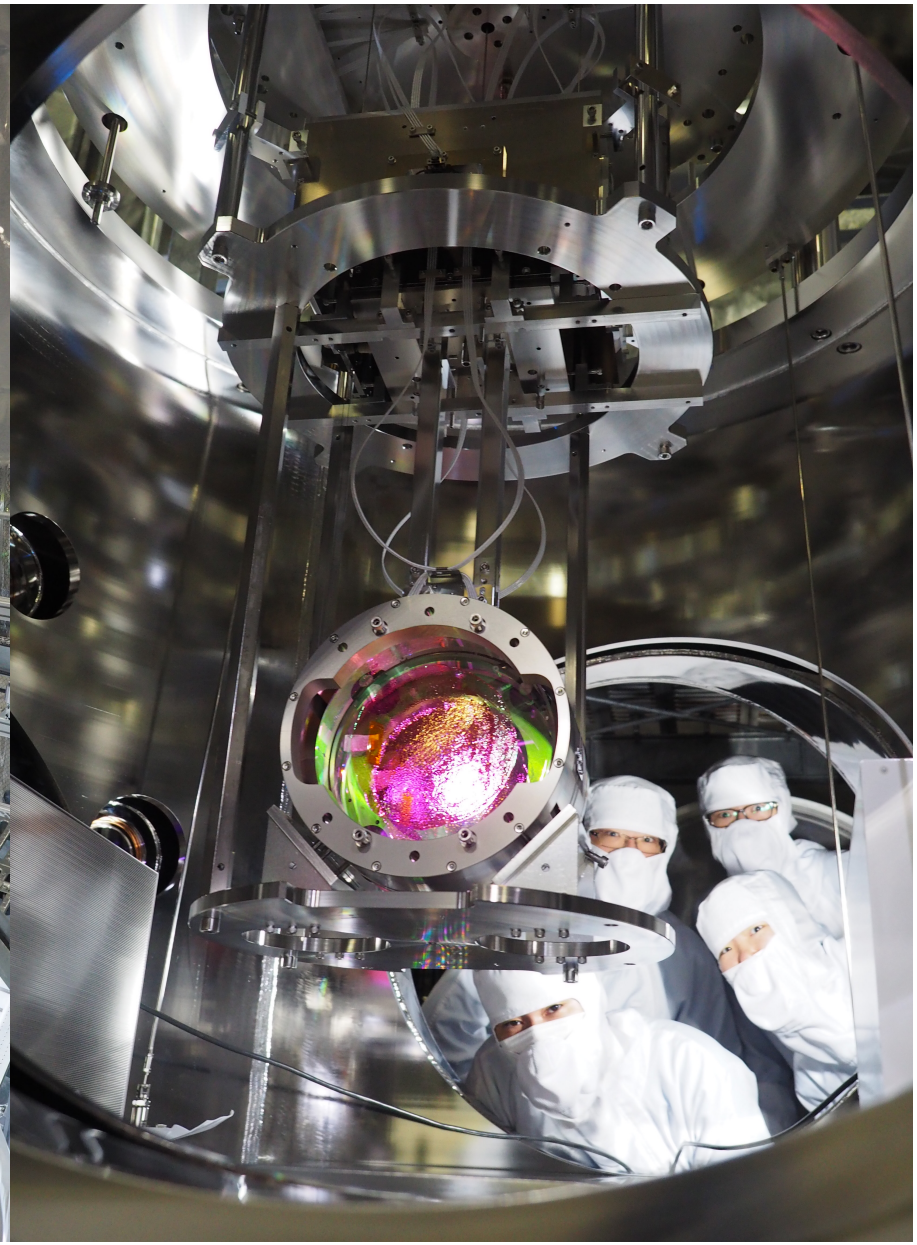
Pre-Isolatorがない

Type-Bp

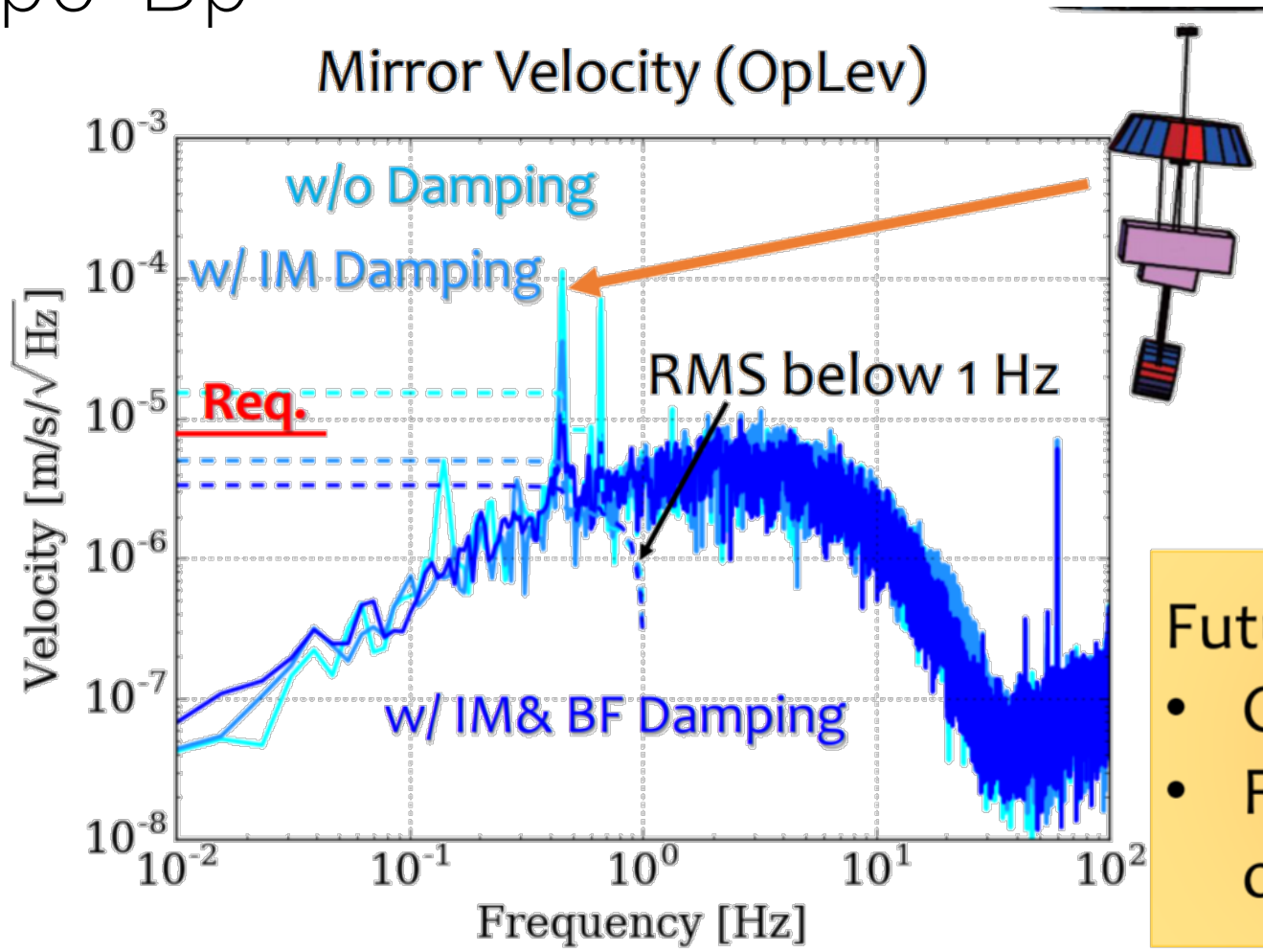


Type-Bp





Type-Bp



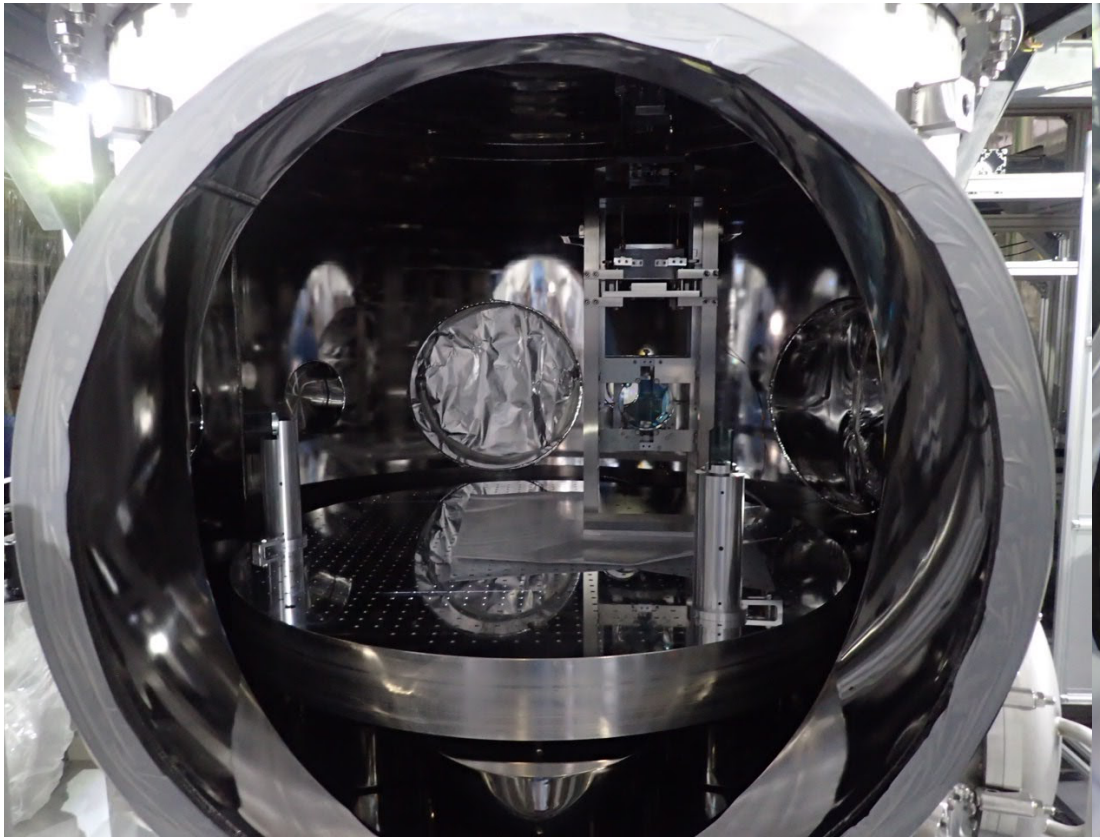
Properly damped!

Future work:

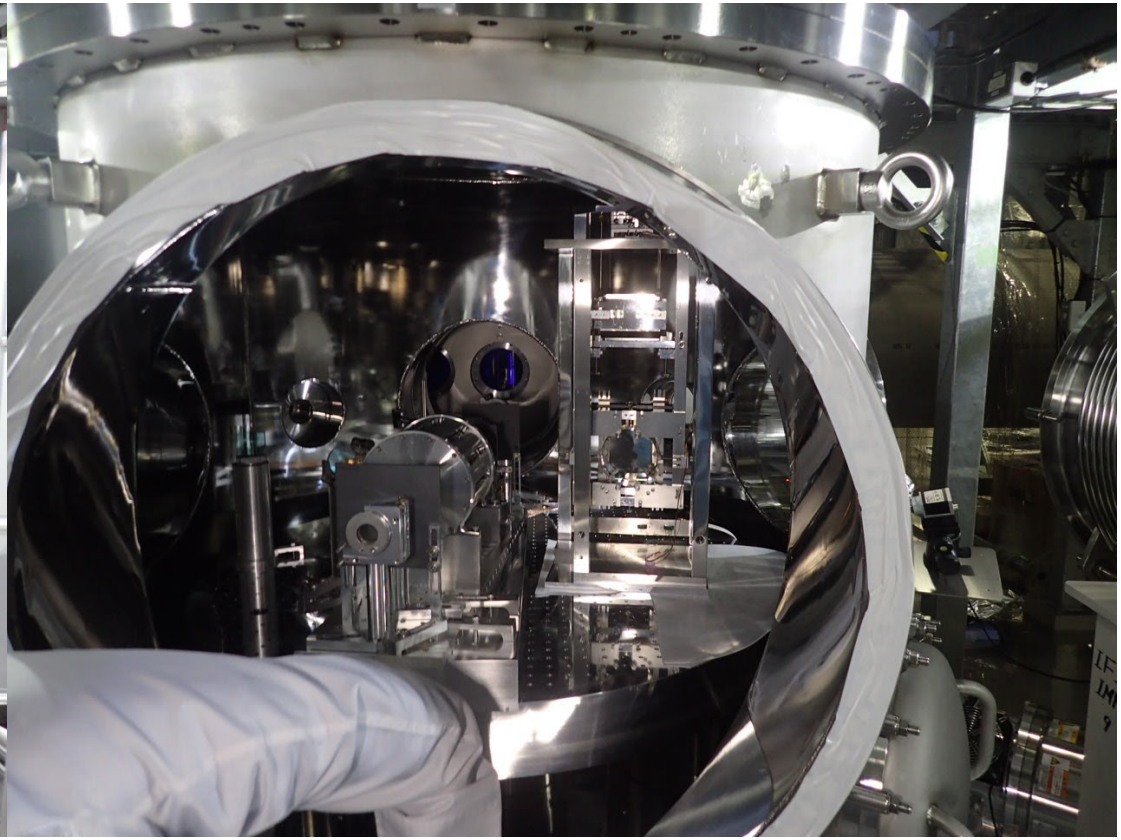
- Q measuremer
- Filter optimization

Type-C

IMMT1



IMMT2

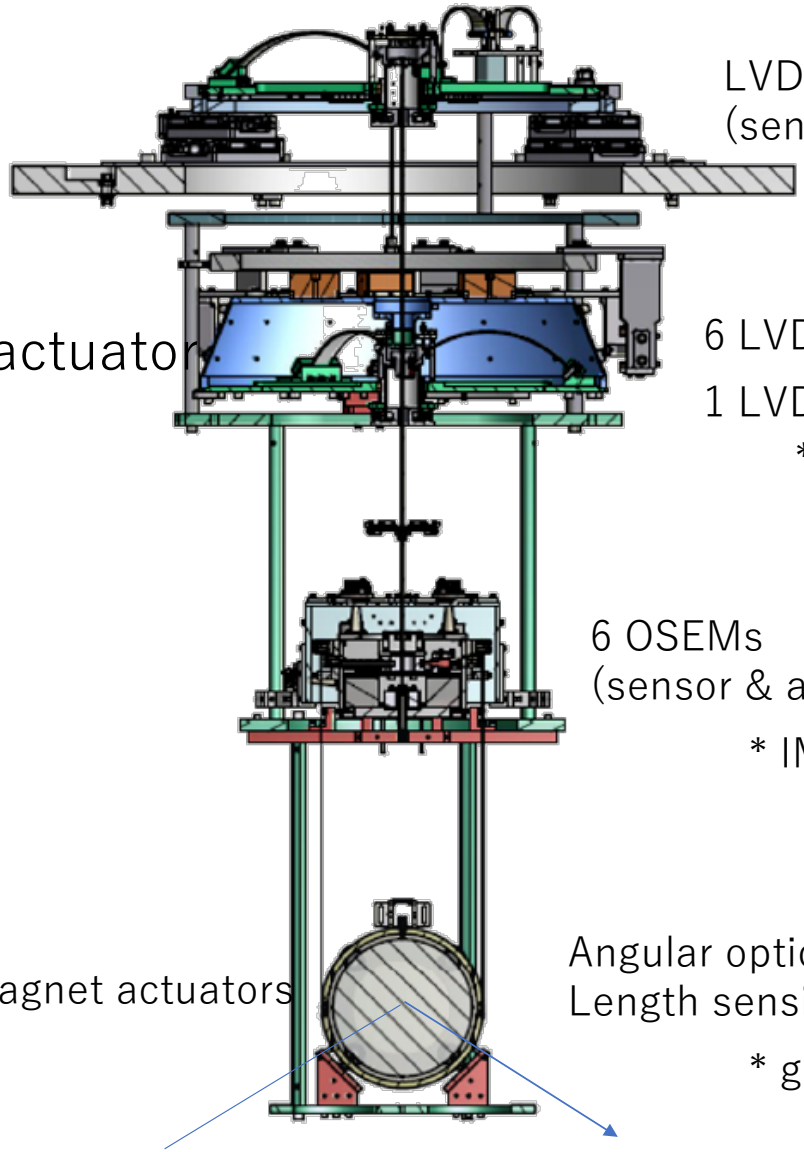


Summary

- KAGRAの防振系の進捗状況
  - Type-A：2/4台インストール済
  - Type-B：1/4台組み立て中（今月中にインストール予定）
  - Type-Bp：2/3台インストール済
  - Type-C: 5/7台インストール済
- 年度末の運転(phase-I: 低温マイケルソン)のために
  必要な防振系は、1台を除いて今月末には真空槽内に入る予定。
- 残りは来年度インストール予定。

Type-Bp

Active damping using
the local sensors and actuator
at each stage.



LVDT for GAS
(sensor & actuator unit)
* ground-suspension point

6 LVDTs * BF-BFRM

1 LVDT for GAS
* BF-suspension point

6 OSEMs
(sensor & actuator unit)
* IM-IRM

4 coil-magnet actuators

Angular optical lever (OpLev)
Length sensing optical lever
* ground-mirror