

How to be a superhero in interferometric gravitational wave detection



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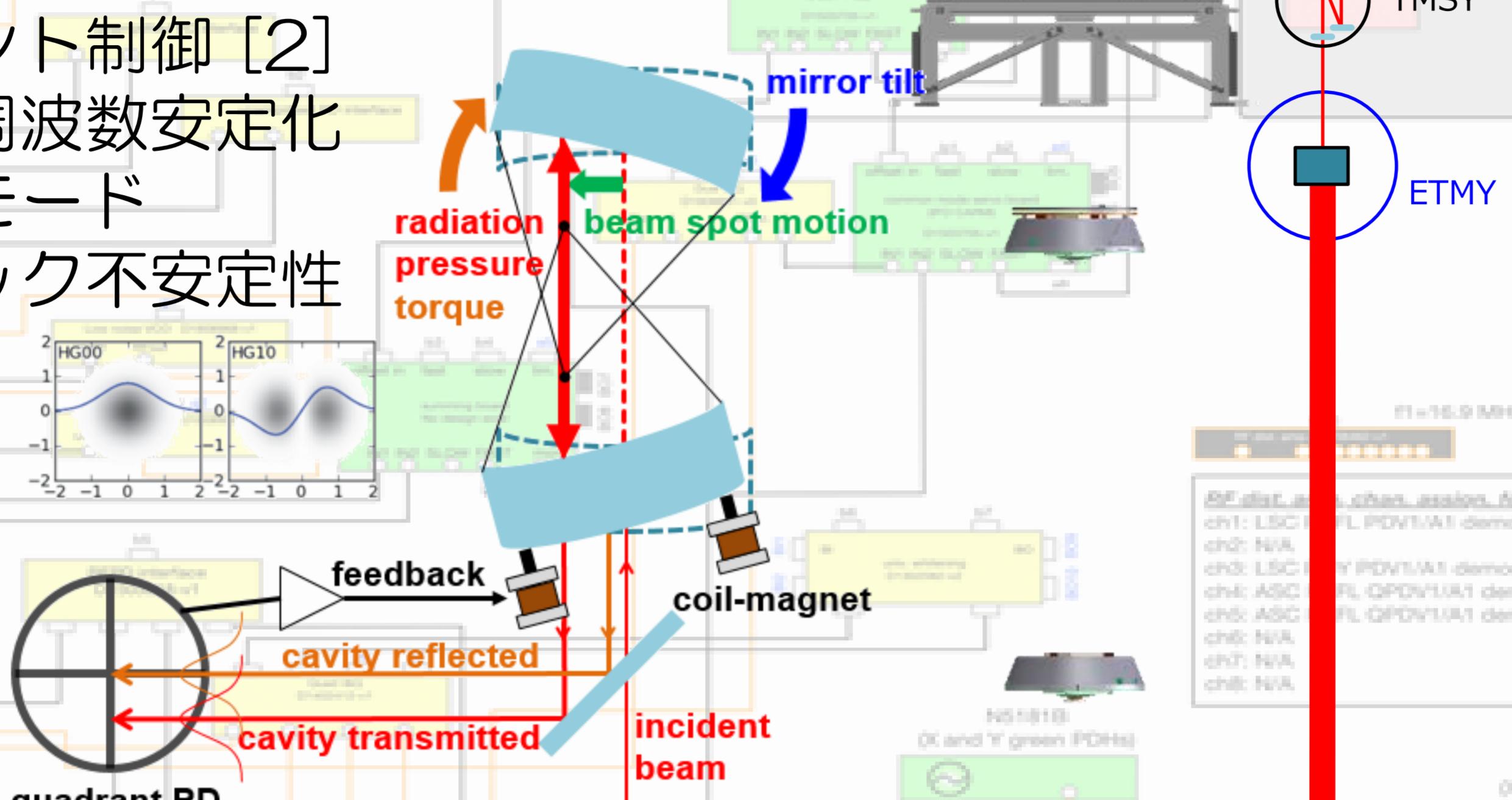
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干渉計モデリング Interferometer modeling

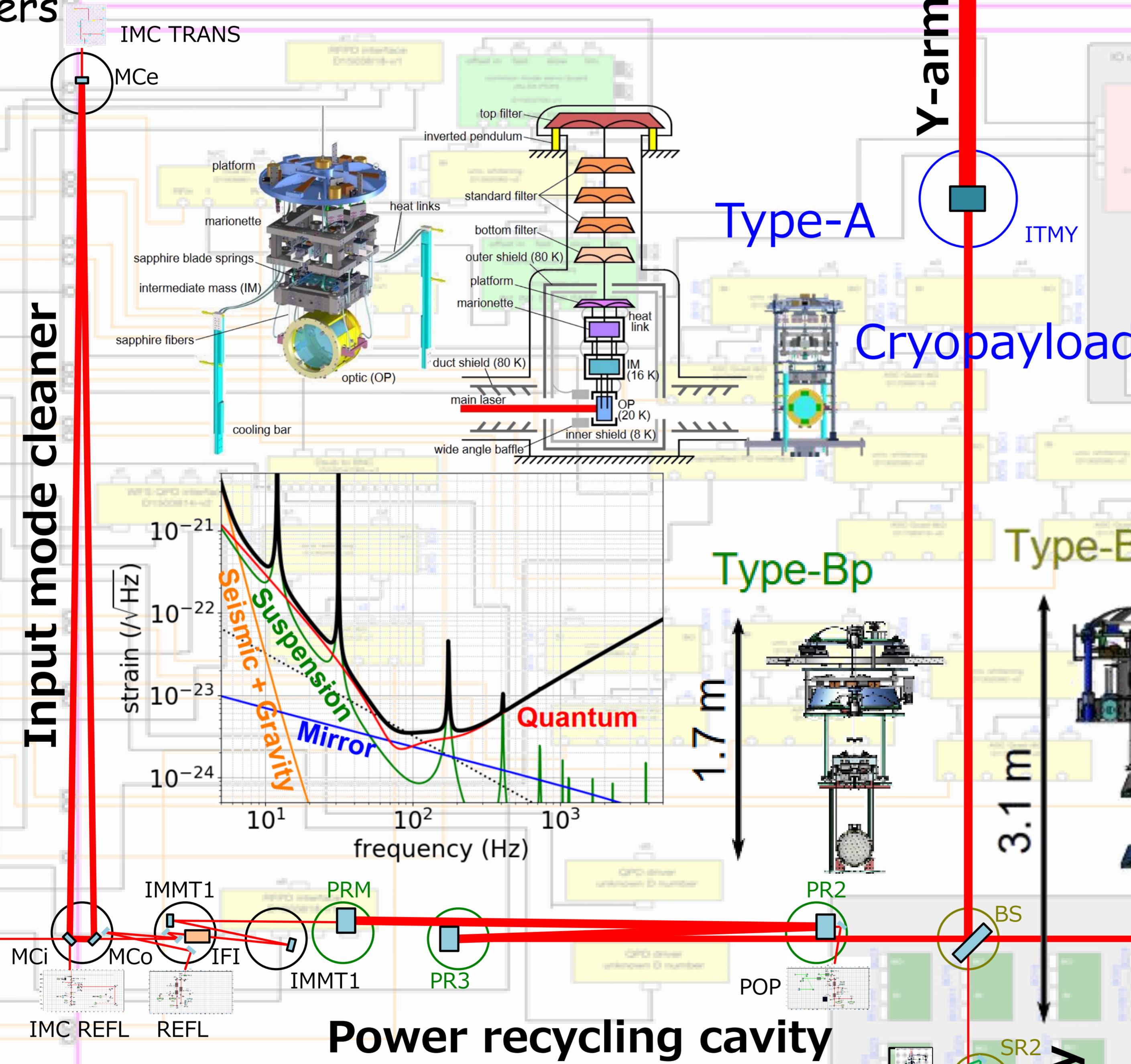
- ロックアクイジション
- 鏡のアライメント制御 [2]
- レーザー強度・周波数安定化
- 干渉計内の高次モード
- 鏡のパラメトリック不安定性



- Lock acquisition
- Alignment sensing and controls [2]
- Laser intensity and frequency stabilization
- Higher order modes in the interferometer
- Parametric instability of the mirrors

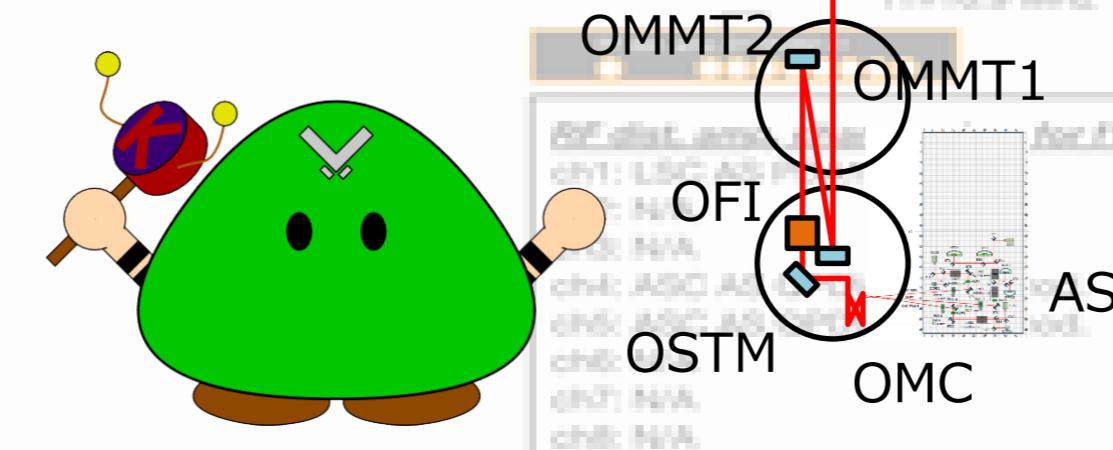
その他もろもろの重要な開発項目 Miscellaneous but important

- Cover and beam tubes for optical tables
- In-vac PDs and QPDs, in-vac optics, beam dumps
- Upgraded OMC
- Beam shutters



主干渉計サブグループ Main Interferometer subgroup

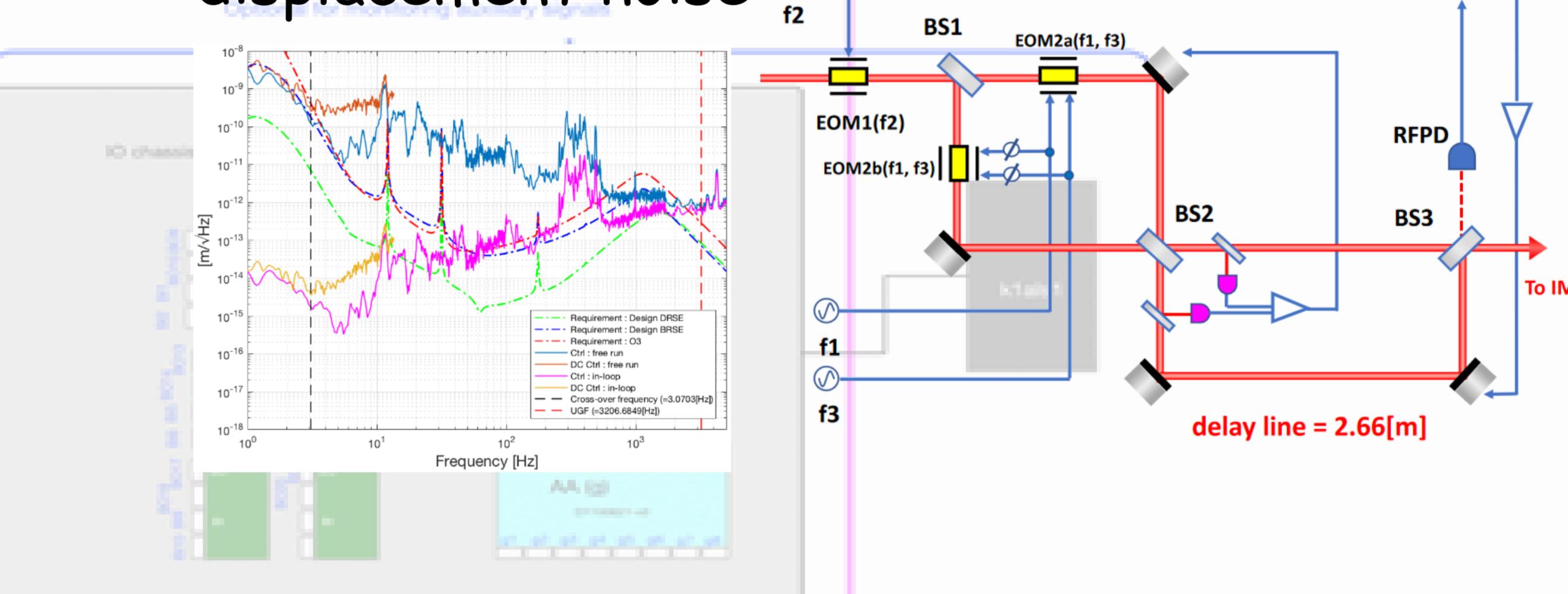
- レーザー干渉計を重力波検出器として用いるには、鏡の位置と姿勢の高精度な制御が必須
- MIFはレーザー干渉計とその制御系の設計・開発を行う
- 重力波検出器の端から端までを扱う
- To use an interferometer as a gravitational wave detector, positions and alignments of the mirrors must be finely tuned
- MIF group is responsible for the design and development of the KAGRA interferometer and its control system
- Requires wide and deep knowledge about the detector



Output mode cleaner

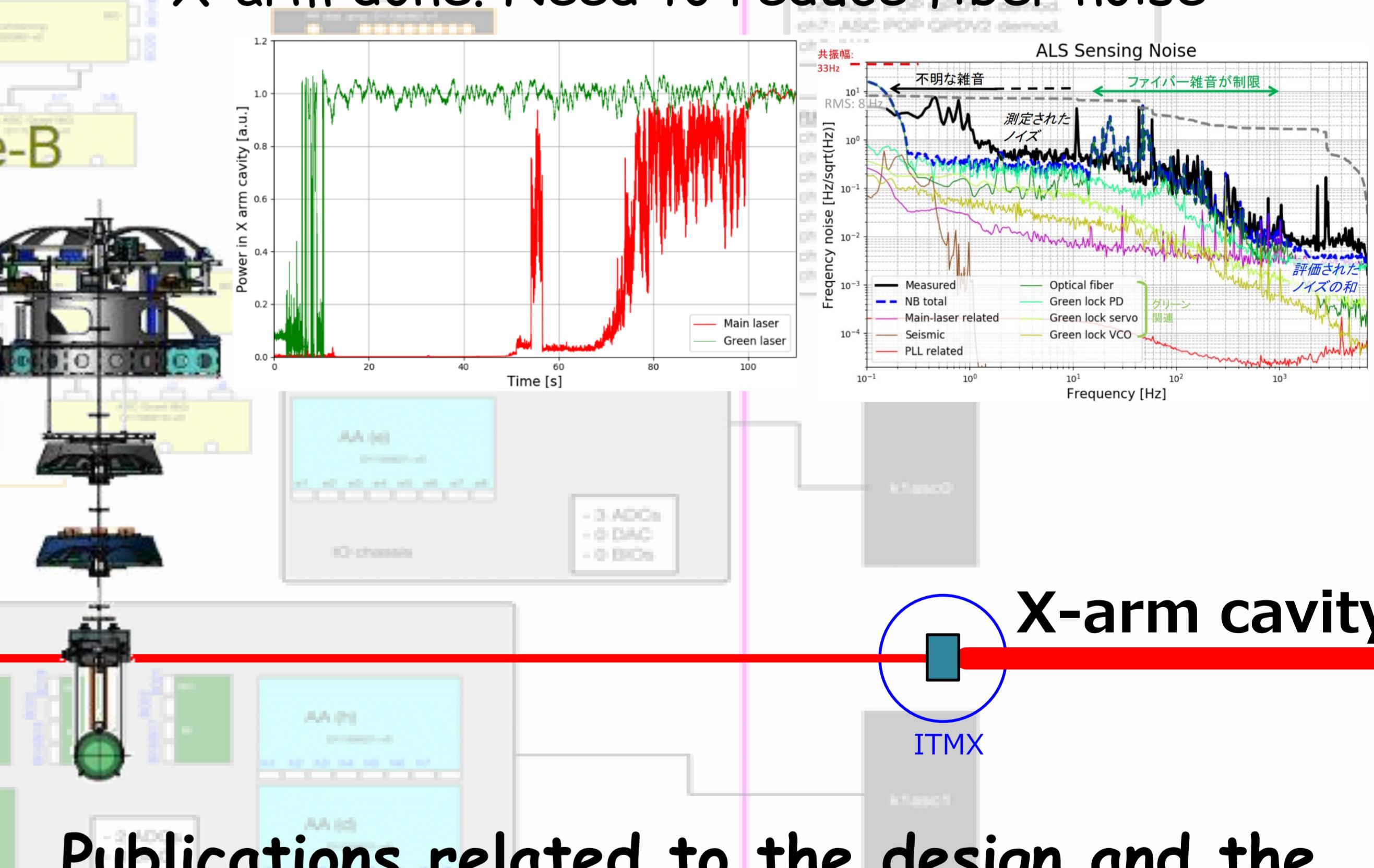
RF変調系の開発 RF modulation system

- KAGRAではシグナルリサイクリングの離調をするために、RF強度変調が必要 [3]
- マッハツェンダー干渉計を用いたRF強度変調系の開発が熱い
- 原理実証成功。変位雑音を減らす必要がある
- KAGRA requires RF AM due to detuning of signal recycling cavity [3]
- RF AM generation using Mach-Zehnder interferometer is very hot
- Demonstration done. Now we need to reduce displacement noise



腕長の安定化 Arm length stabilization system

- 倍波光を用いた補助制御で腕長を安定化
- aLIGOとは異なる手法
- X腕完了。ファイバ雑音の低減が必要
- Arm length stabilization using second harmonic beam
- Different approach compared with aLIGO
- X-arm done. Need to reduce fiber noise



Publications related to the design and the controls of the KAGRA interferometer

- [1] K. Somiya, CQG 29, 124007 (2012)
 - [2] Y. Aso+, PRD 88, 043007 (2013)
 - [3] S. Ueda+, CQG 31, 095003 (2014)
 - [4] A. Kumeta+, Optical Review 22, 149-152 (2015)
 - [5] K. Yano+, J Phys. Conf. Ser. 716, 012020 (2016)
 - [6] Y. Michimura+, CQG 34, 225001 (2017)
 - [7] K. Komori+, PRD 97, 102001 (2018)
 - [8] Y. Michimura+, PRD 97, 122003 (2018)
- and more to come !

修士論文も多数。下記を見よう !
<http://gwwiki.icrr.u-tokyo.ac.jp/JGWwiki/KAGRA/Publications>

