

1. Fiber induced frequency noises

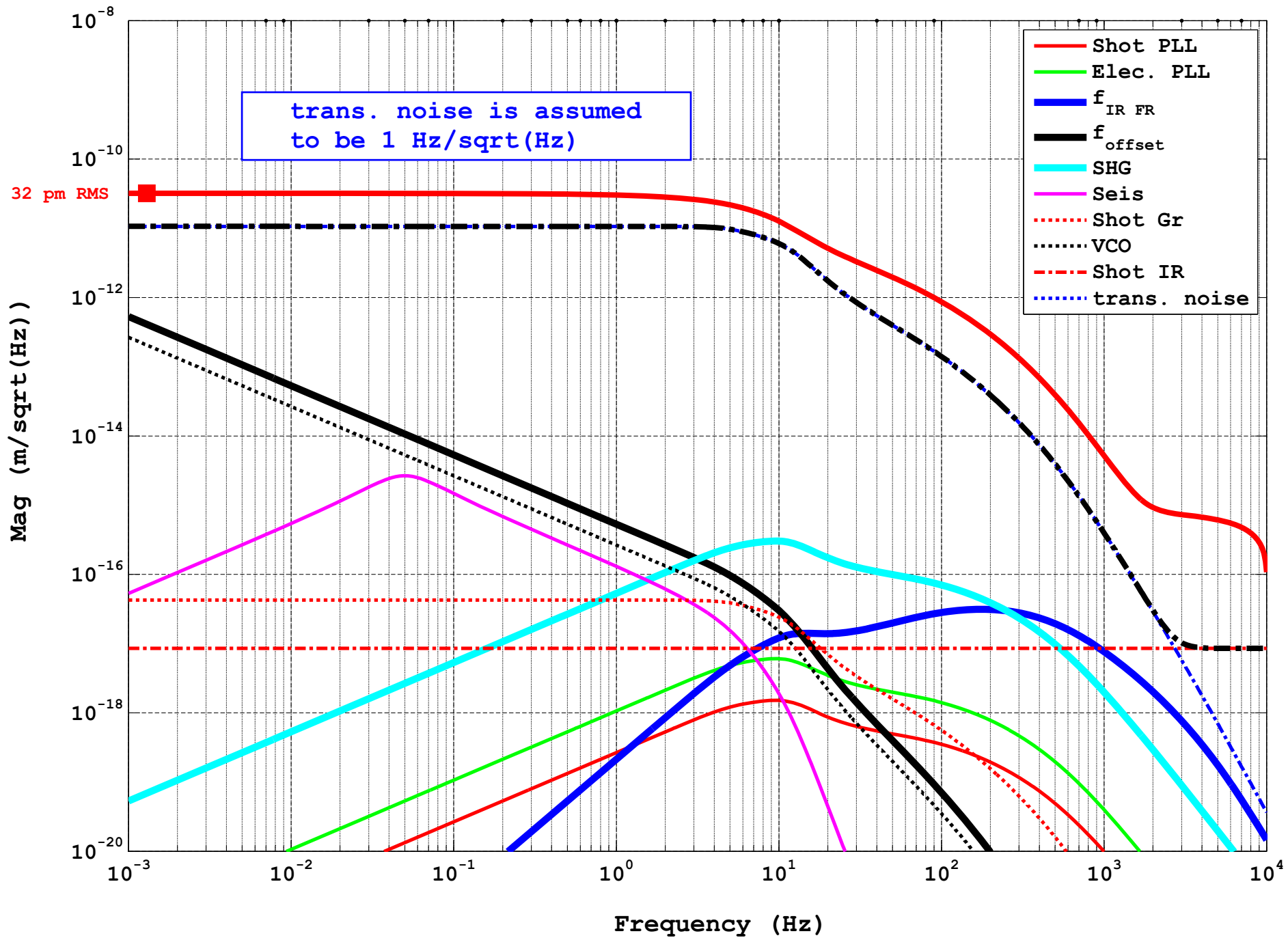
前回のおさらい

Green Lock に必要な周波数基準として、Pre-Stabilized Laser から optical fiber により Green 光源へ 1064 nm 光を送る。
この時生ずる frequency noise に対する要求値はざっと $1 \text{ Hz}/\sqrt{\text{Hz}}$ であった。

この要求を満たせるか？

=> 回答 : $1 \text{ Hz}/\sqrt{\text{Hz}}$ 以下が達成できそうである。

Displacement noises at IR Error

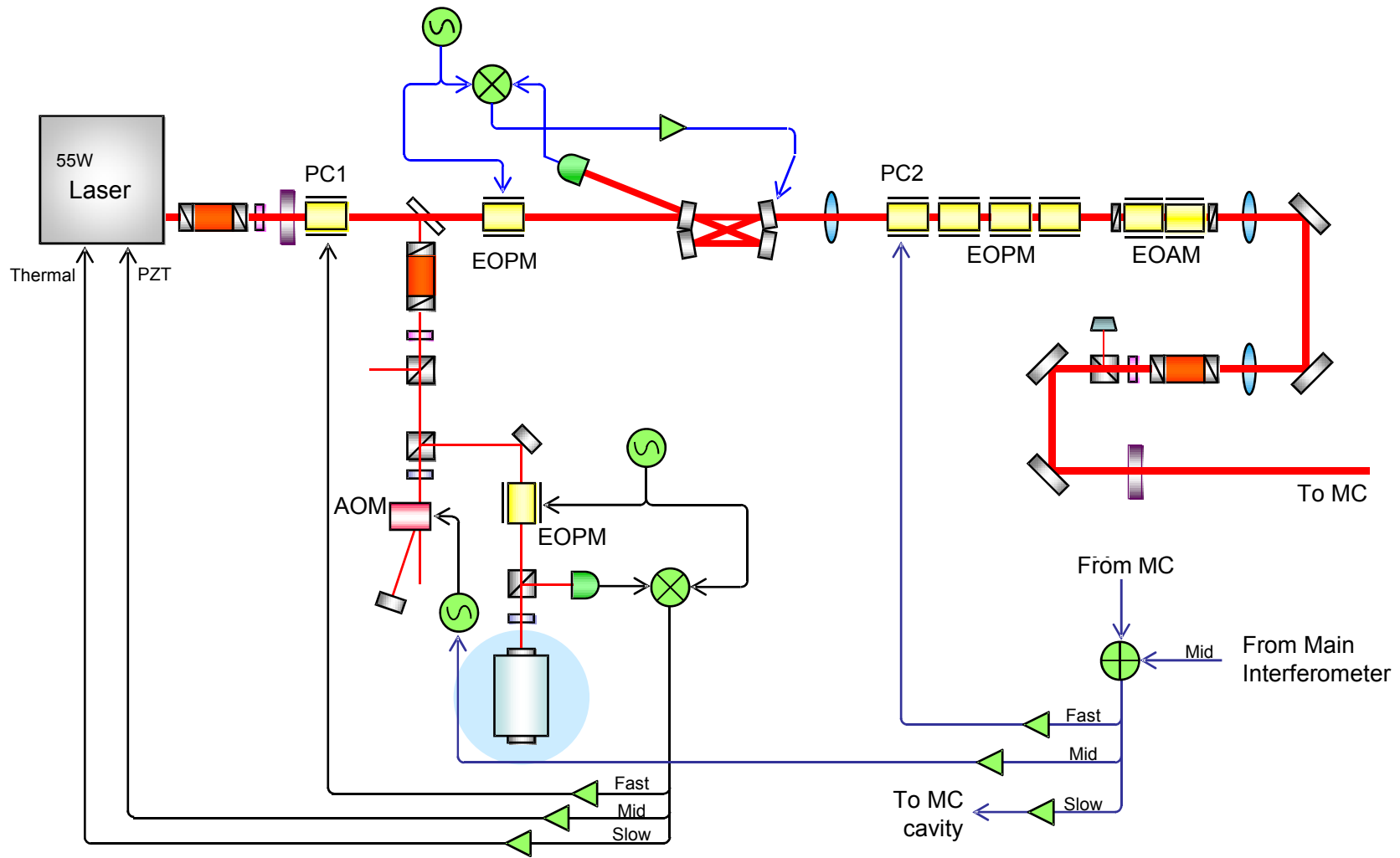


2. Servo topology of the Frequency Stabilization System

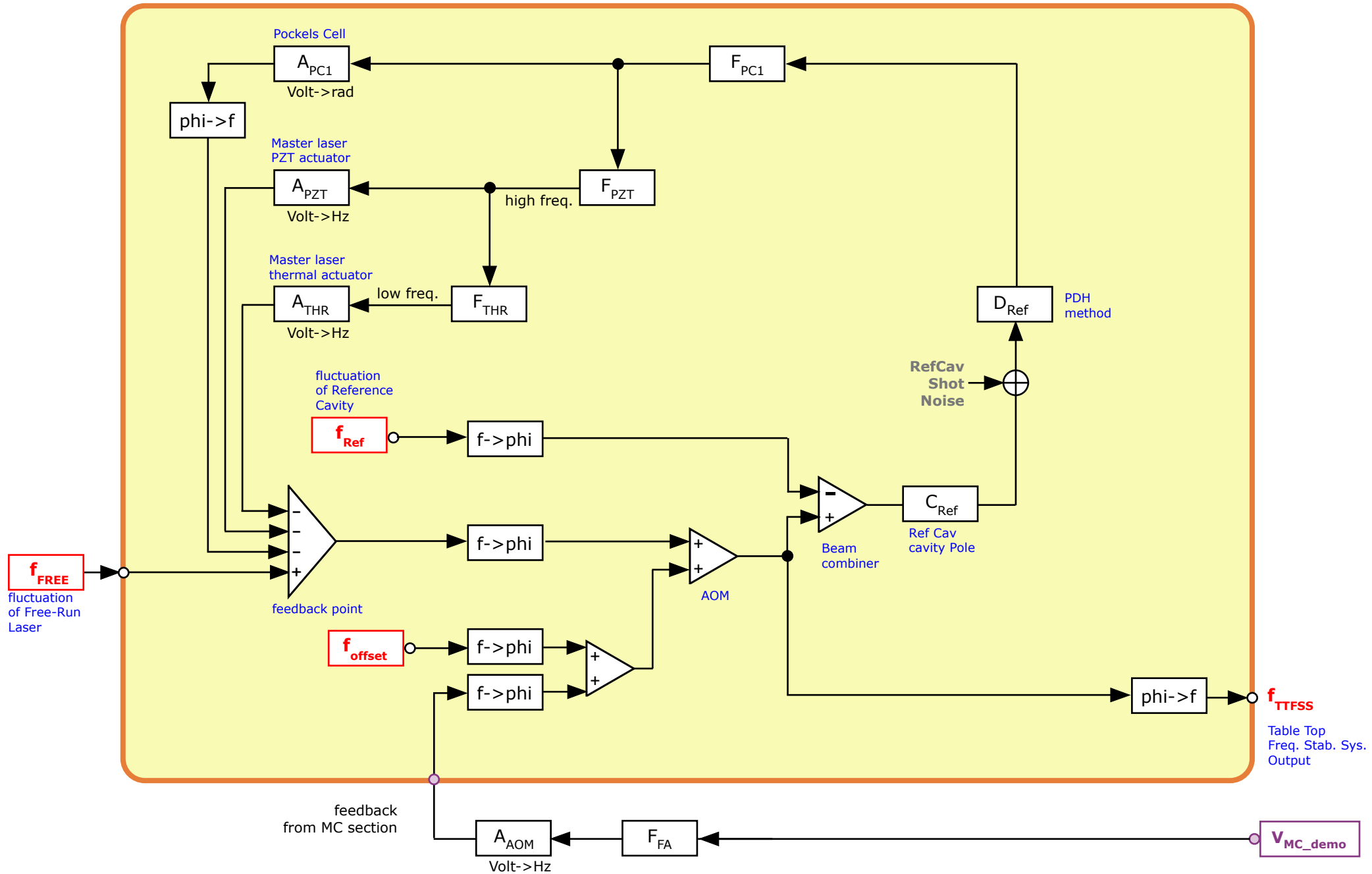


Frequency Control Scheme

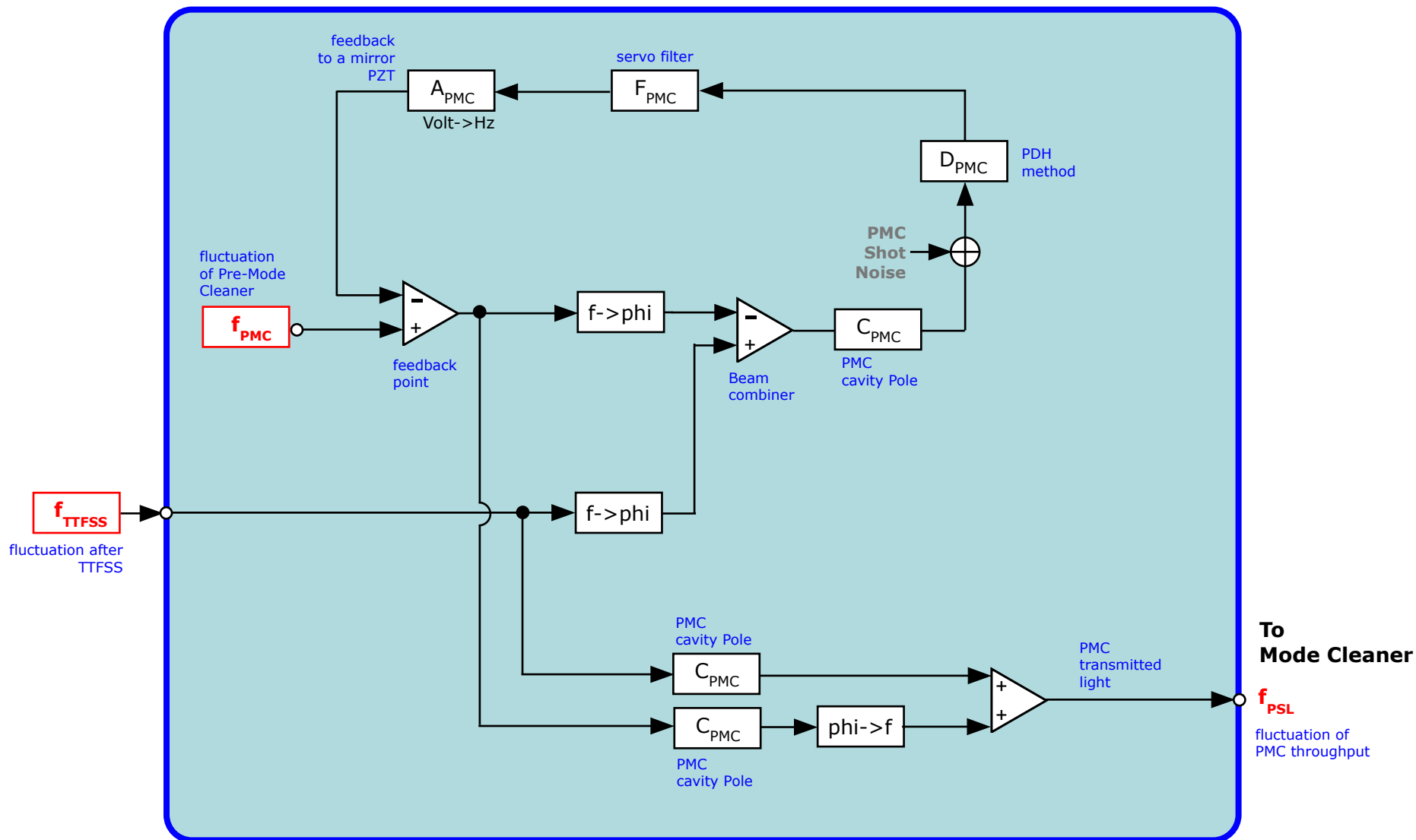
Fig.2-2-3-2



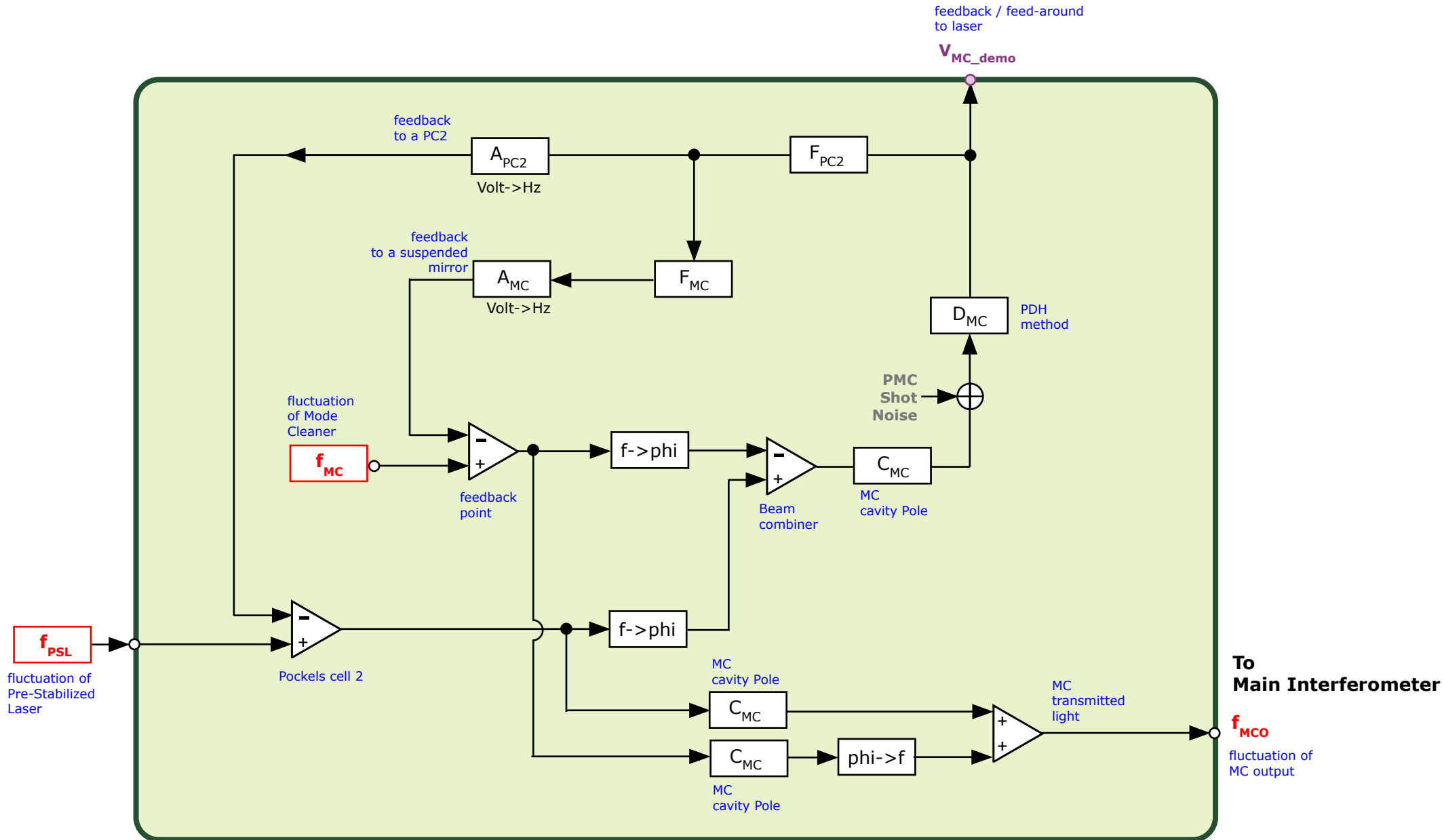
Reference Cavity section



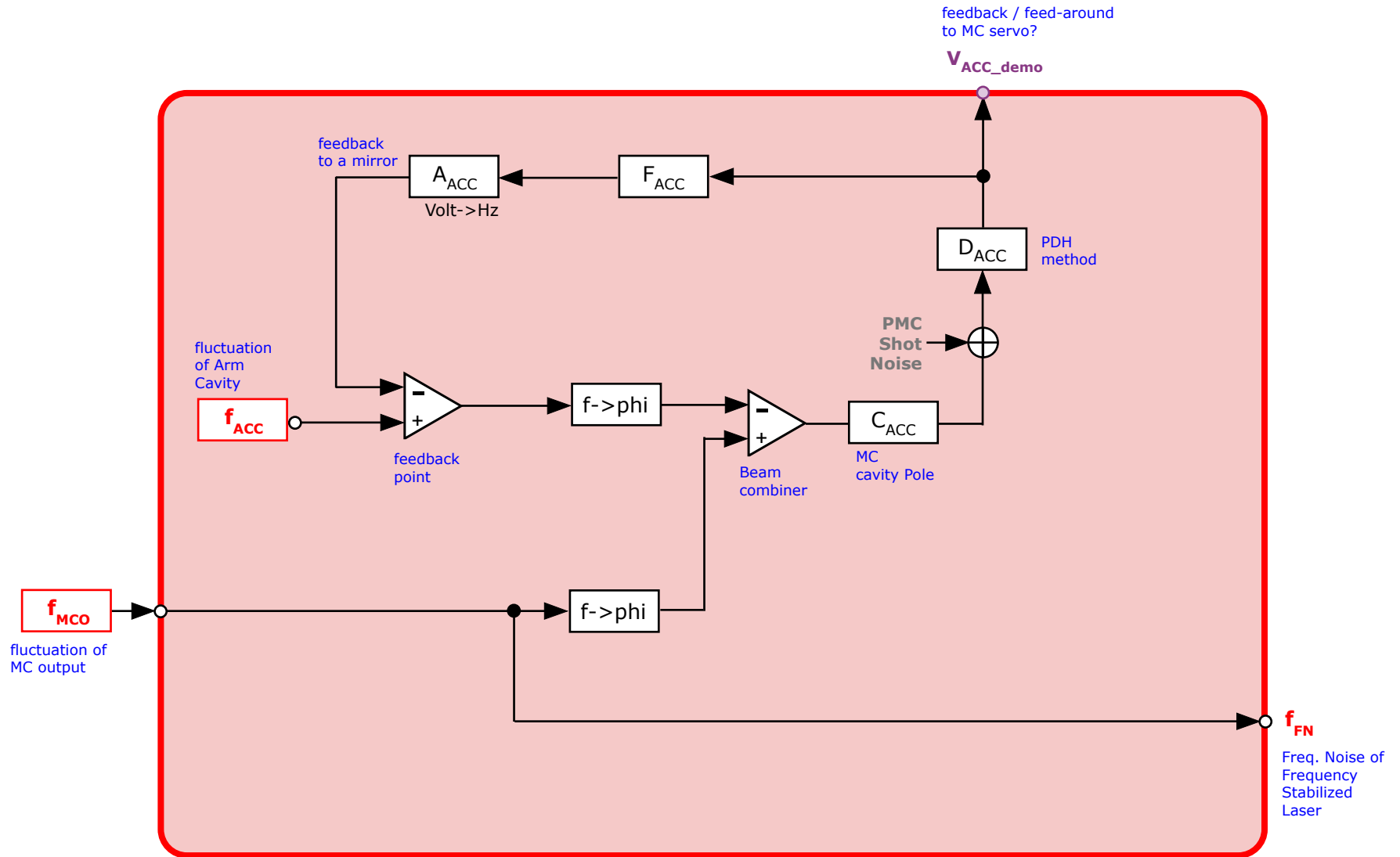
Pre Mode Cleaner section



Mode Cleaner section



Arm Cavity Common section

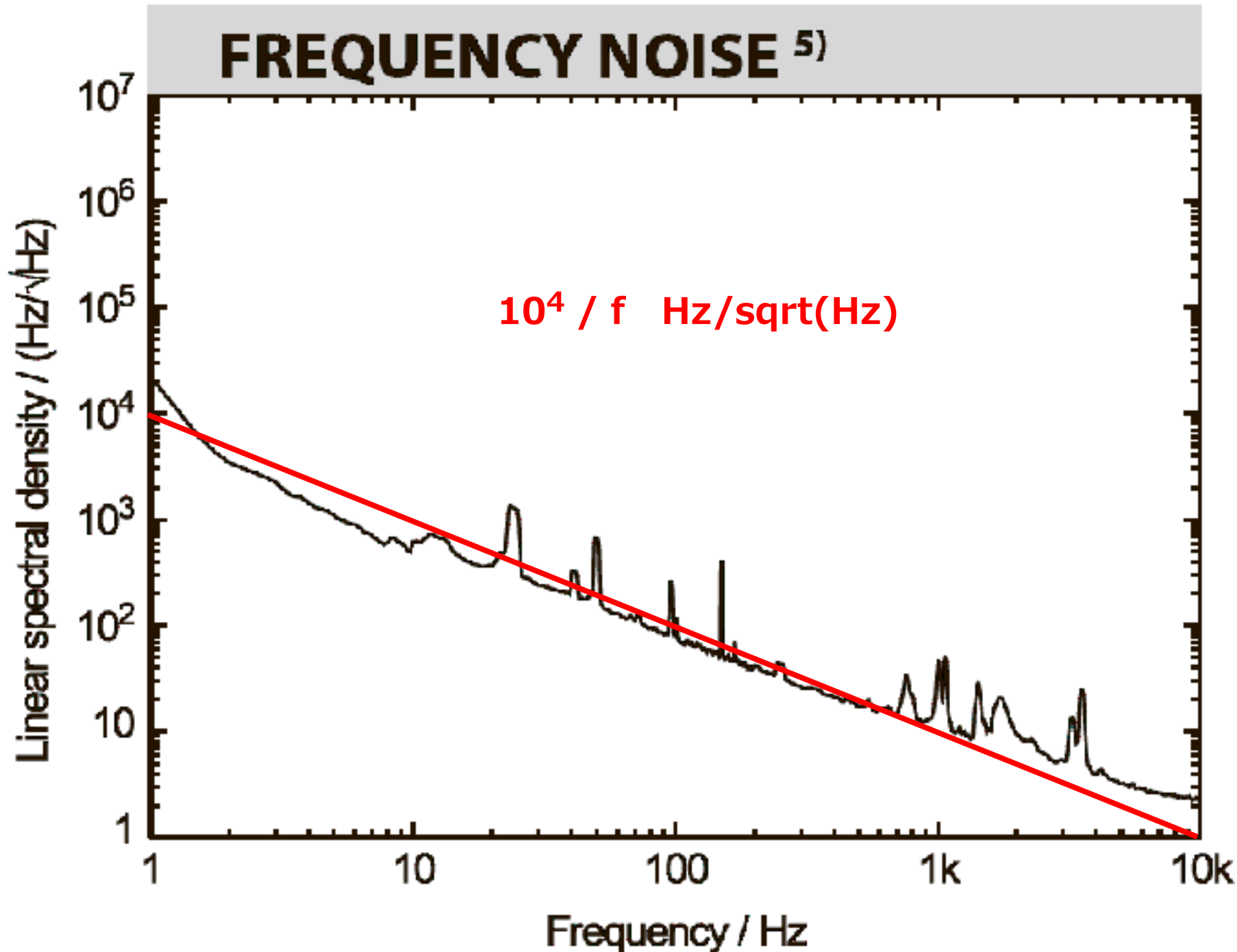


3. 各種の周波数雑音の推定／モデル化

Frequency noise modeling for servo designs

-- Laser source --

Master Laser : Innolight Mephisto



Ohmae's Doctor Thesis (p.58)

三尾研 100W Laser

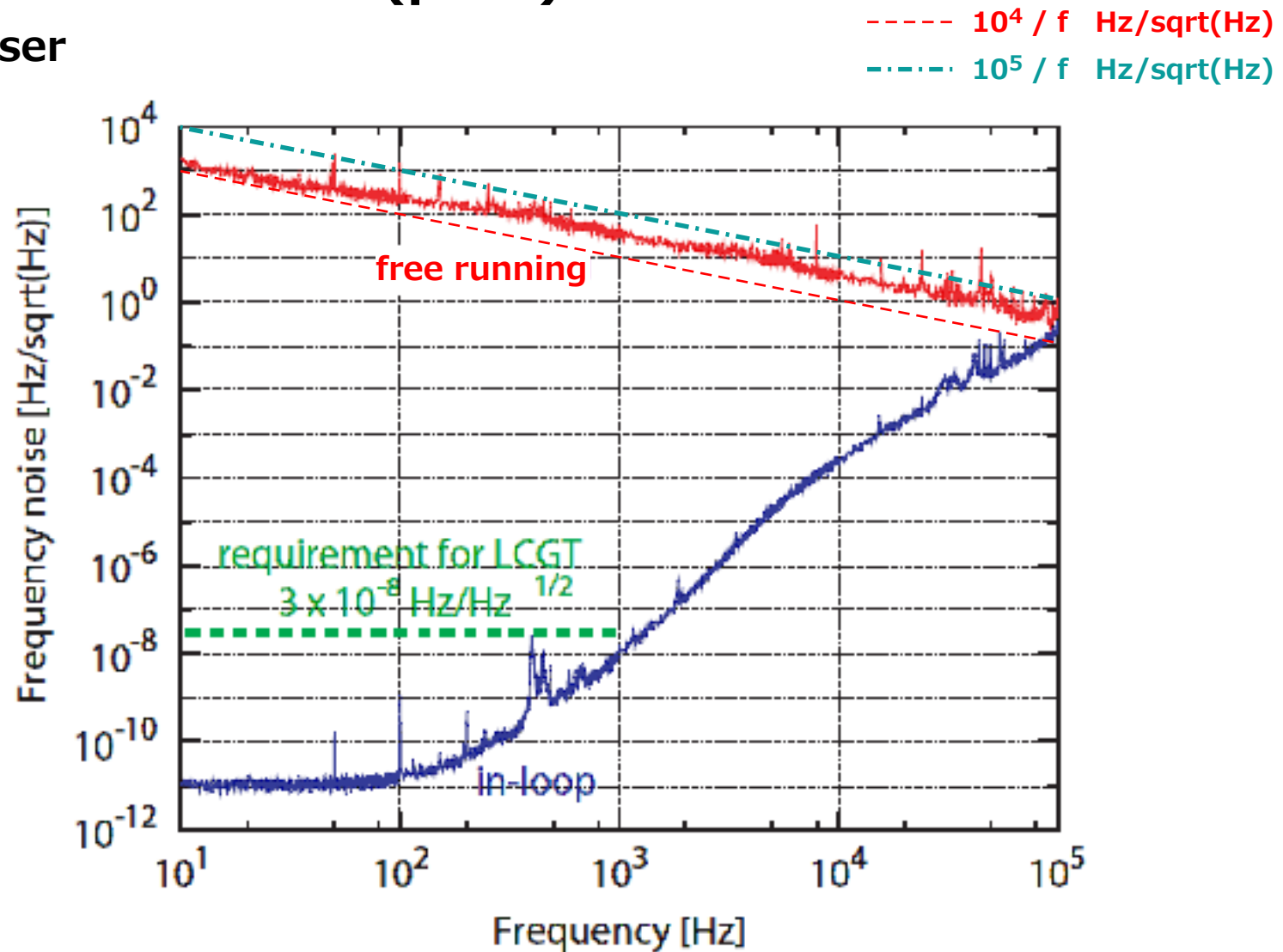


Figure 3.18: Measured frequency noise spectra of free-running injection-locked laser and laser stabilized relative to a reference cavity obtained by an in-loop measurement (final state).

aLIGO prototype 200W Laser

LIGO-T0900649-v4

..... $10^5 / f$ Hz/sqrt(Hz)

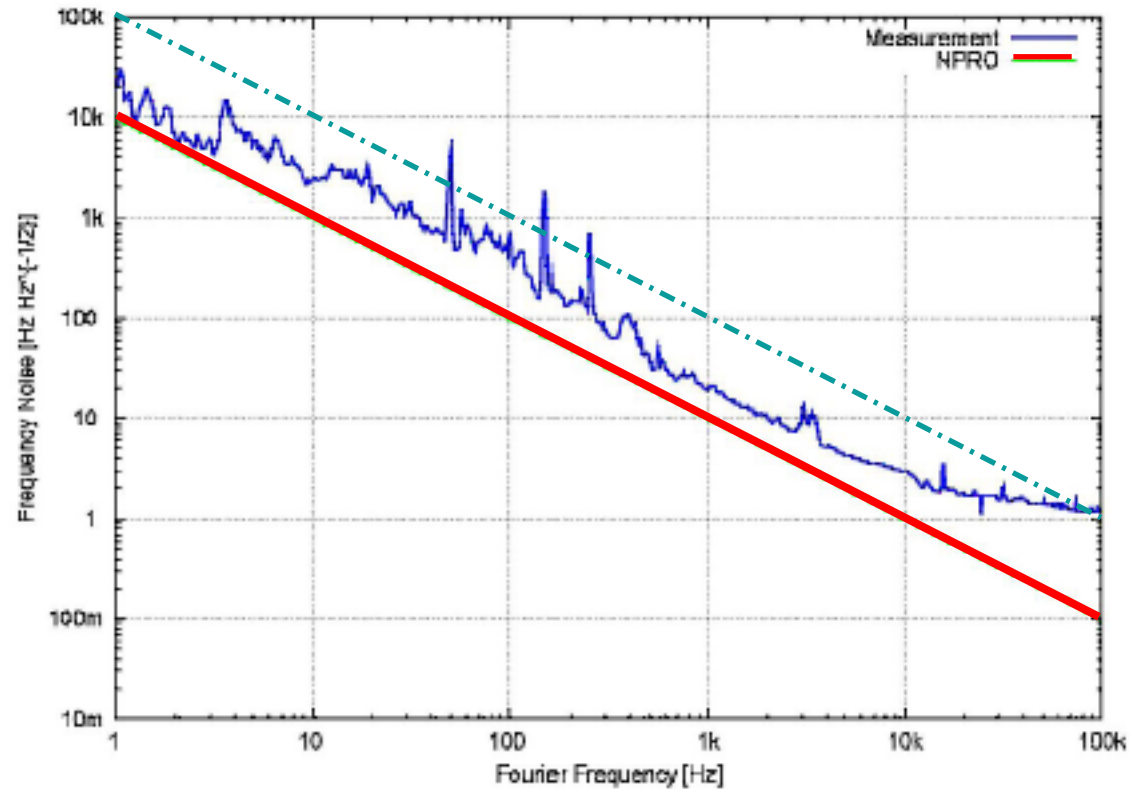


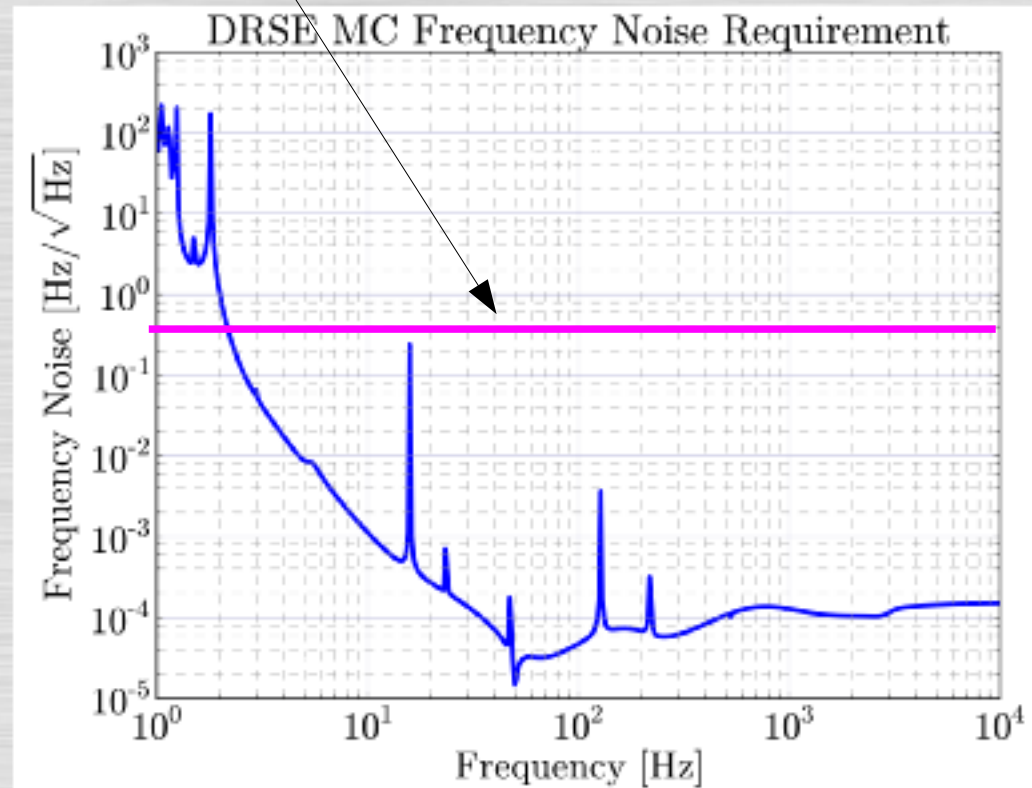
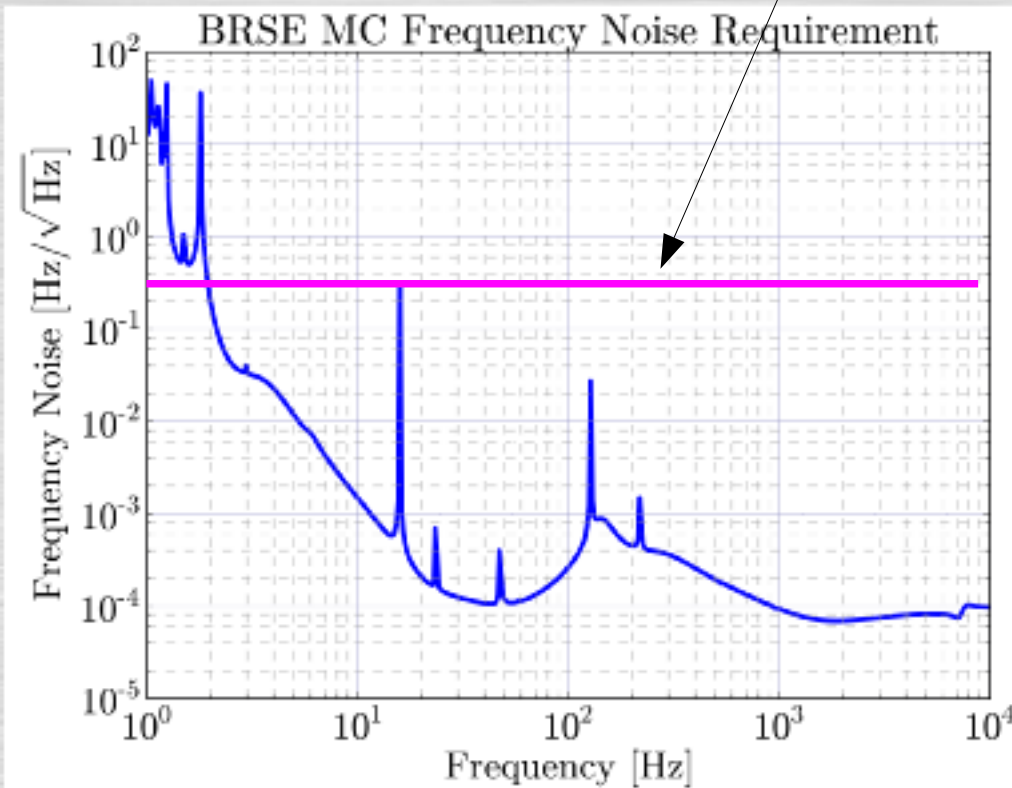
Figure 16 Measured free-running frequency noise of the 200-W oscillator. The frequency noise is about 5 dB above the noise estimate for the NPRO alone.

Frequency noise modeling for servo designs

-- Reference Cavity --

レーザー周波数雑音要求値

Reference Cavity 安定度



Frequency modeling of the reference cavity

LIGO-T0900649-v4

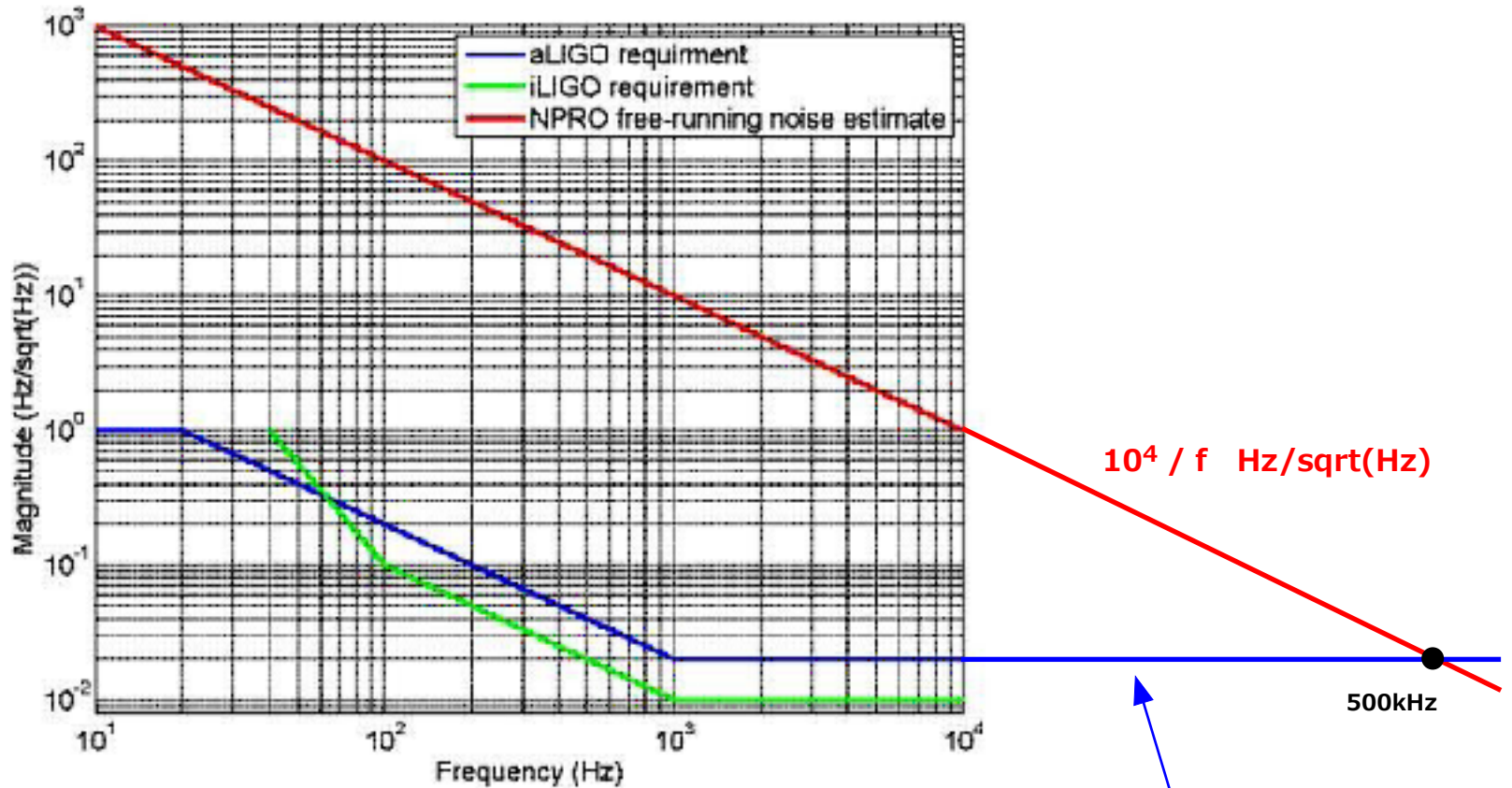


Figure 15. PSL free-running NPRO frequency noise estimate and *Advanced LIGO* and *Initial LIGO* frequency noise requirements.

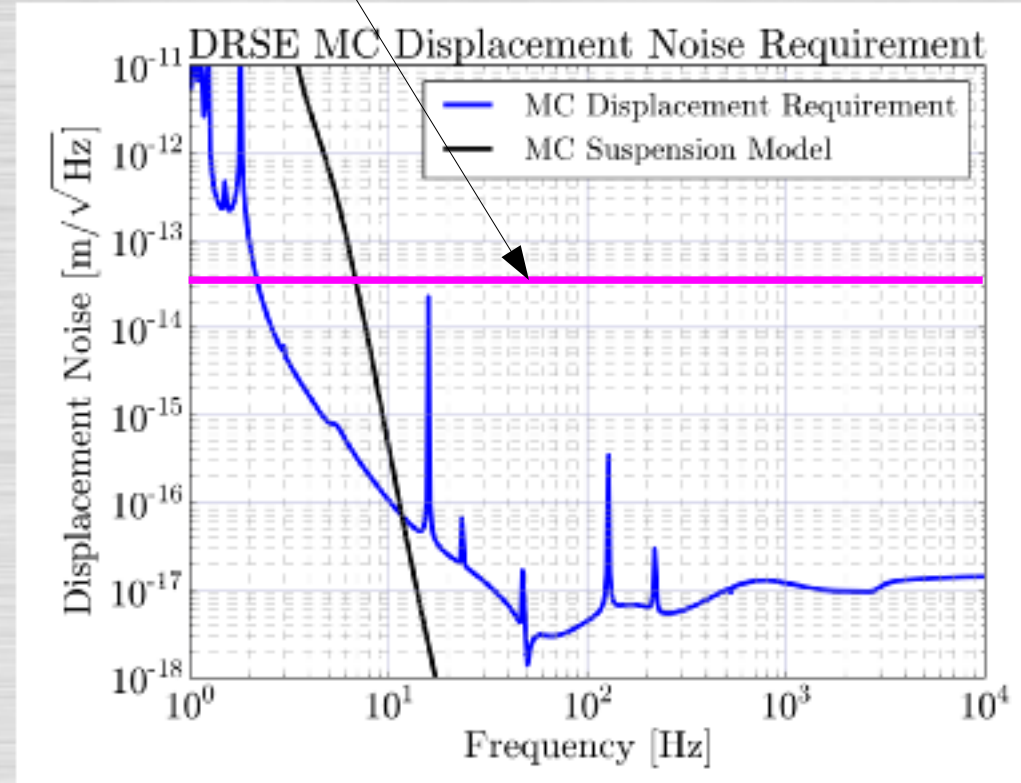
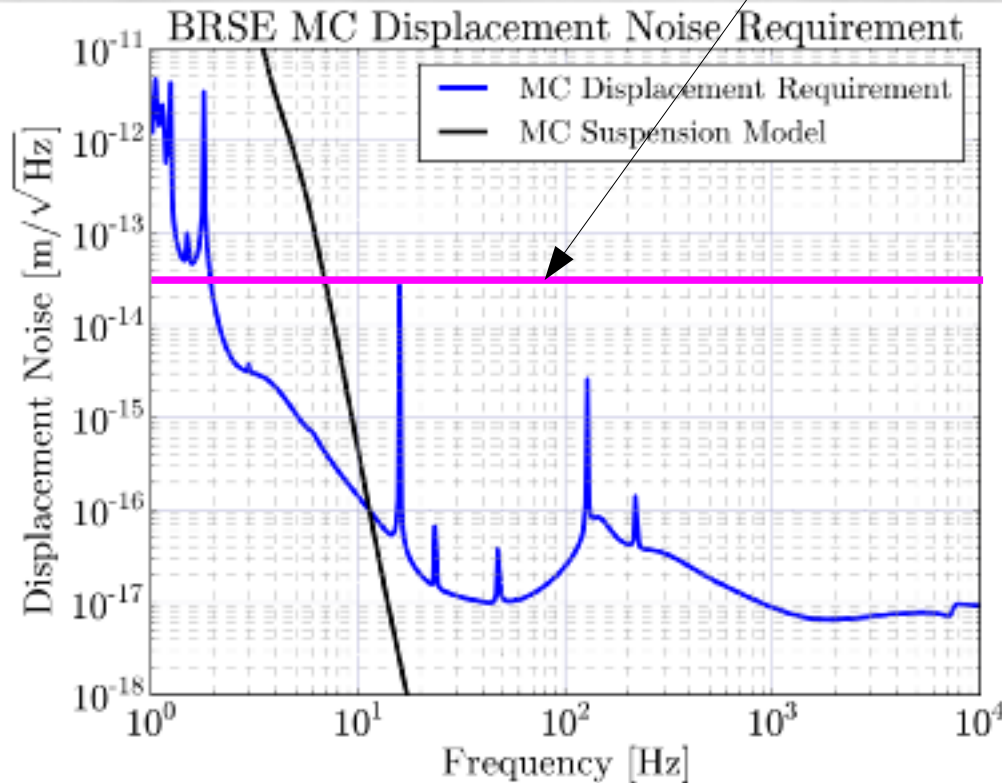
えいやつと
これを Reference Cavity の
目標値に設定。

Frequency noise modeling for servo designs

-- Mode Cleaner --

MC変位雑音に焼き直すと

Reference Cavity 安定度



2012年3月24日 日本物理学会春季大会

KAGRAの主干渉計設計II

麻生洋一