

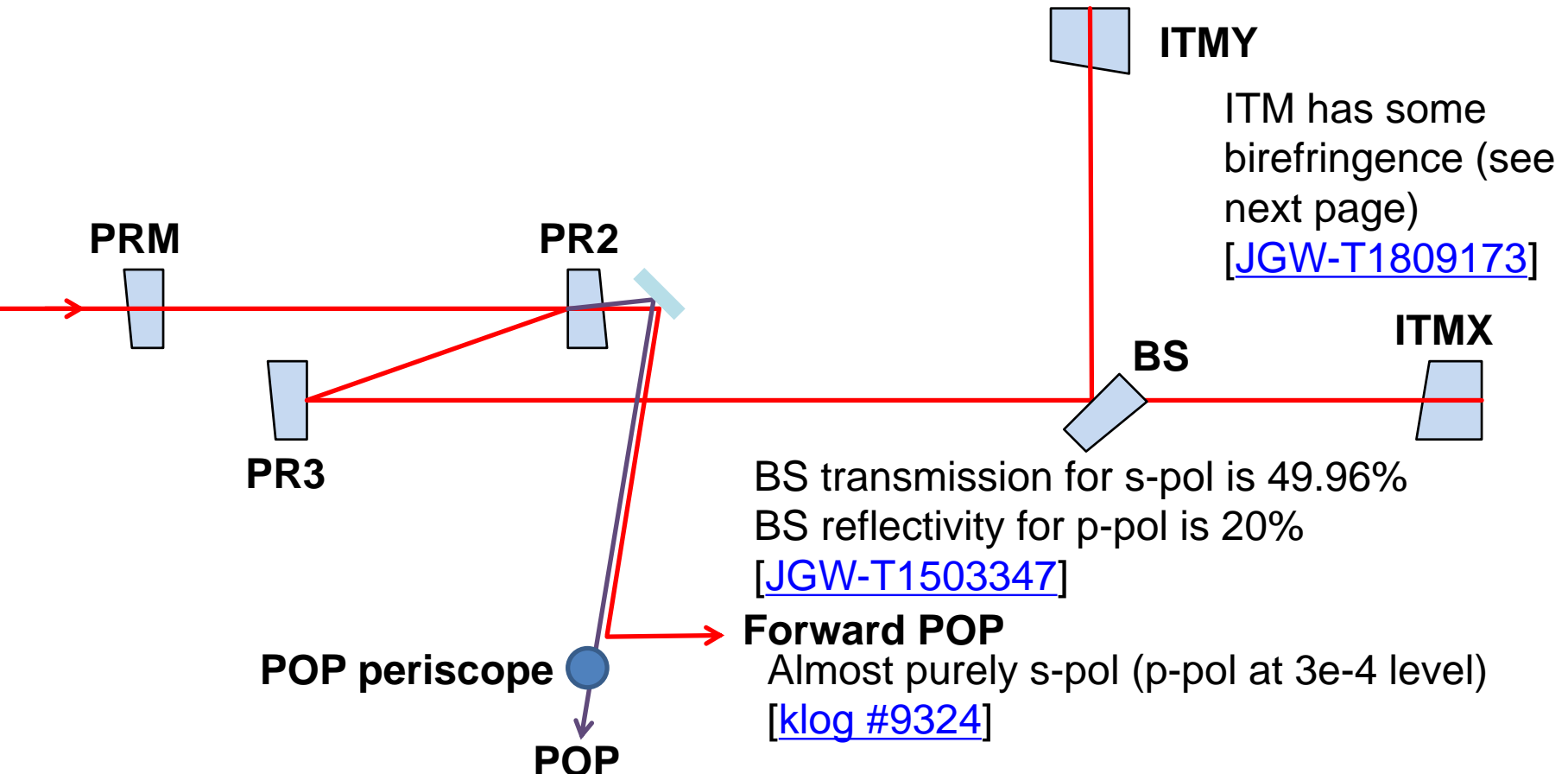
Discussion on Interferometer Configuration for O3 with Birefringent ITMs

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The Situation

- ITM reflection has some p-pol, while forward beam is almost purely s-pol



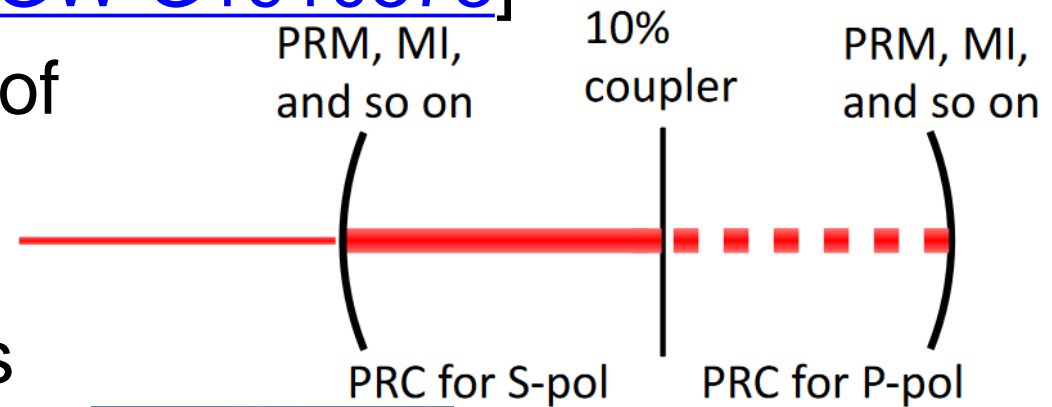
9.4 % p-pol from ITMX single bounce

4.6 % p-pol from ITMY single bounce [[klog #9314](#)]

The Situation

- Amount of p-pol generated with ITM single bounce seems to be explainable with inhomogeneous birefringence [[JGW-G19010369](#)]
- Loss as DRMI will be dependent on interference conditions for p-pol, and this is not controlled → sloshing issue [[JGW-G1910373](#)]

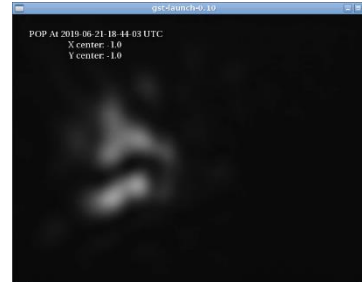
- Amount and phase of p-pol generated is dependent on beam spot positions



From ITMX

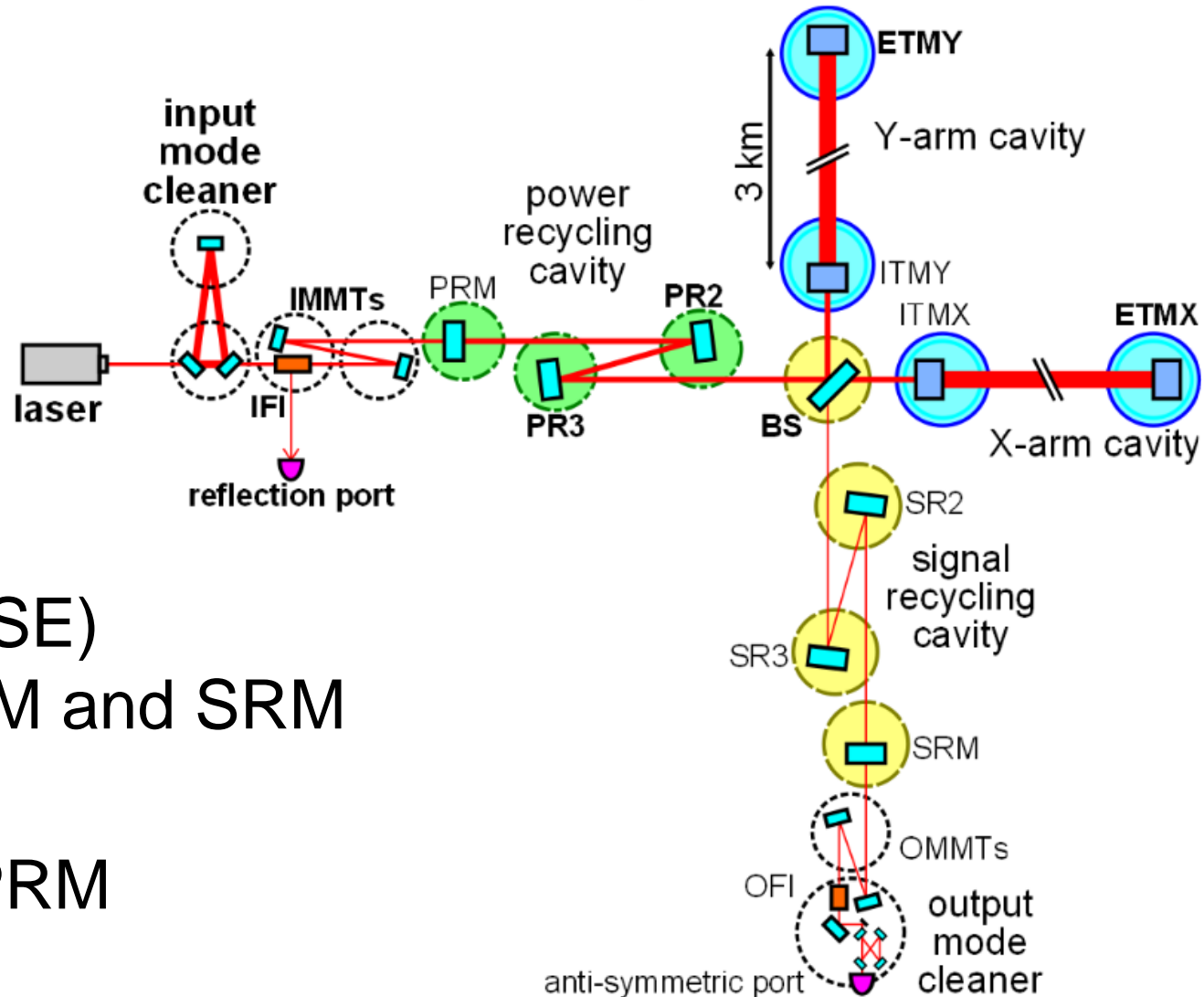


From ITMY



Options for the Configurations

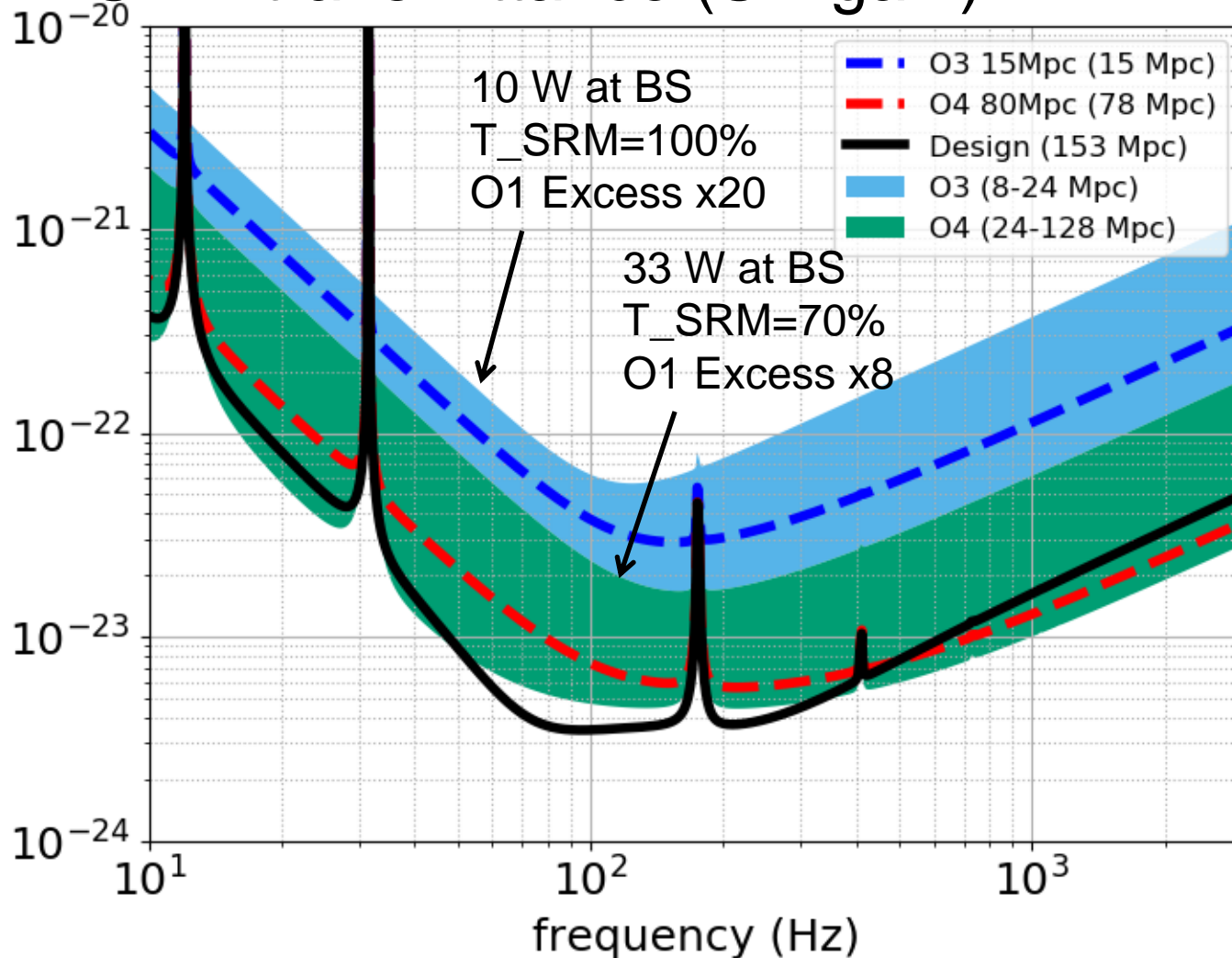
- Maximum PRM input:
~20 W



- DRFPMI (RSE)
 - Keep PRM and SRM
- SRFPMI
 - Pull out PRM
- FPMI
 - Pull out PRM and SRM (replace with blank)

Sensitivity

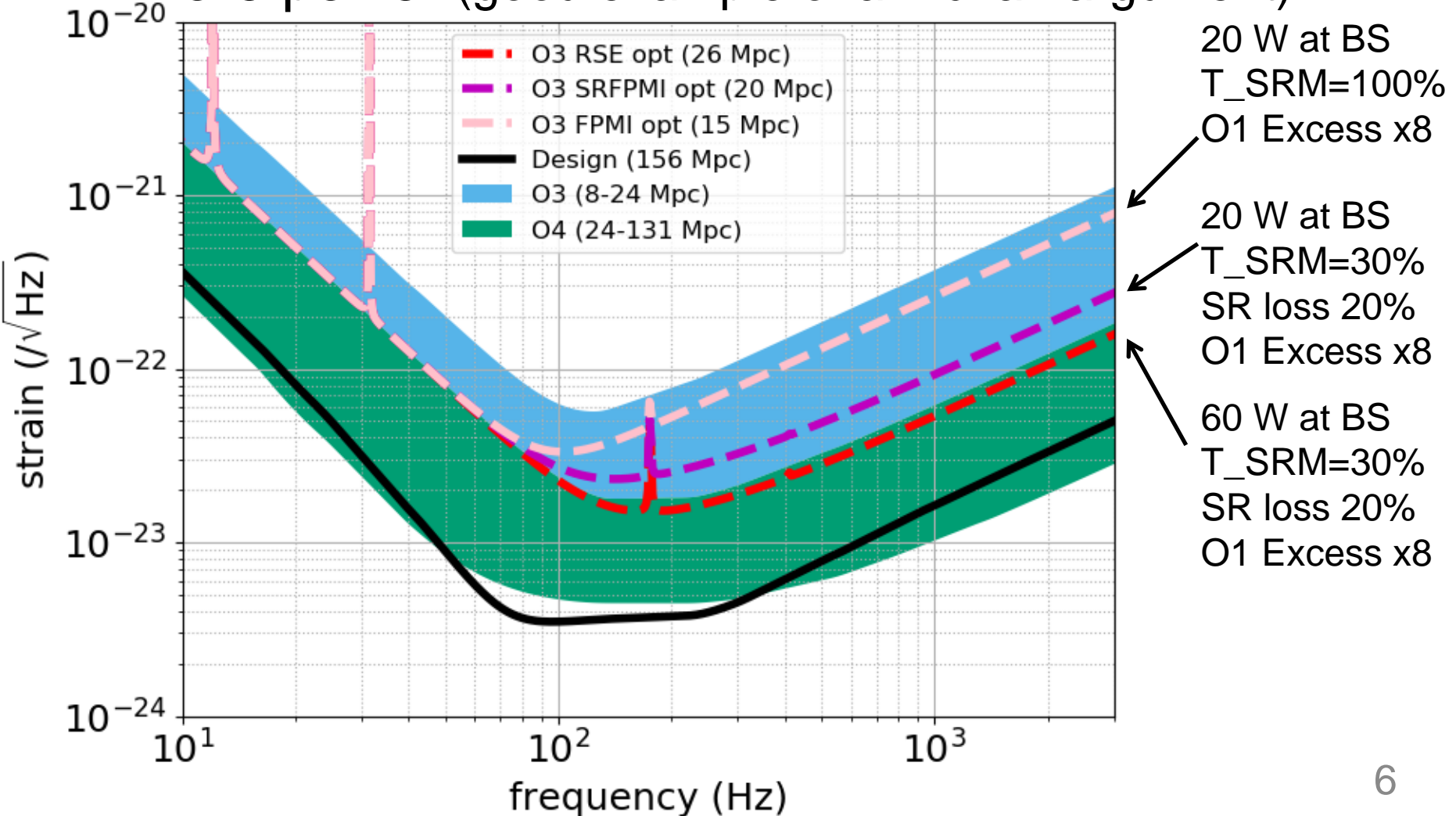
- Sensitivity is determined with power at BS and SRM transmittance (SR gain)



[JGW-T1809078](#)

Sensitivity

- In principle, we still have some margin if we can put more power (good example of armchair argument)



DRFPMI

- Are there mirrors for replacing ITMs?
 - Sapphire?
 - Fused silica?
- How to control the loss?
 - Fix the beam positions on ITMs
 - Rough estimate gives ~ 0.1 μm PRX length change for p-pol per ITMX 1 μrad (~ 10 nrad should be possible with proper WFS)
 - Somehow do something with arm transmission?
- ASC possible with distorted beams?

SRFPMI

- Increasing PRM input power by x3 sounds easier than locking PRC with PR gain ~ 3
- Frequency/Intensity noise coupling will be x10 higher at high frequencies
- How to keep PR mode-matching?
 - Fixed 2-inch blank mirror? (scattering...)
 - Tune IMMT positions?

FPMI

- Narrow bandwidth due to no signal extraction
- Frequency/Intensity noise coupling will be x10 higher at high frequencies
- How to keep PR and SR mode-matching?
 - 2-inch blank mirror for SRM
 - Tune IMMT positions?