

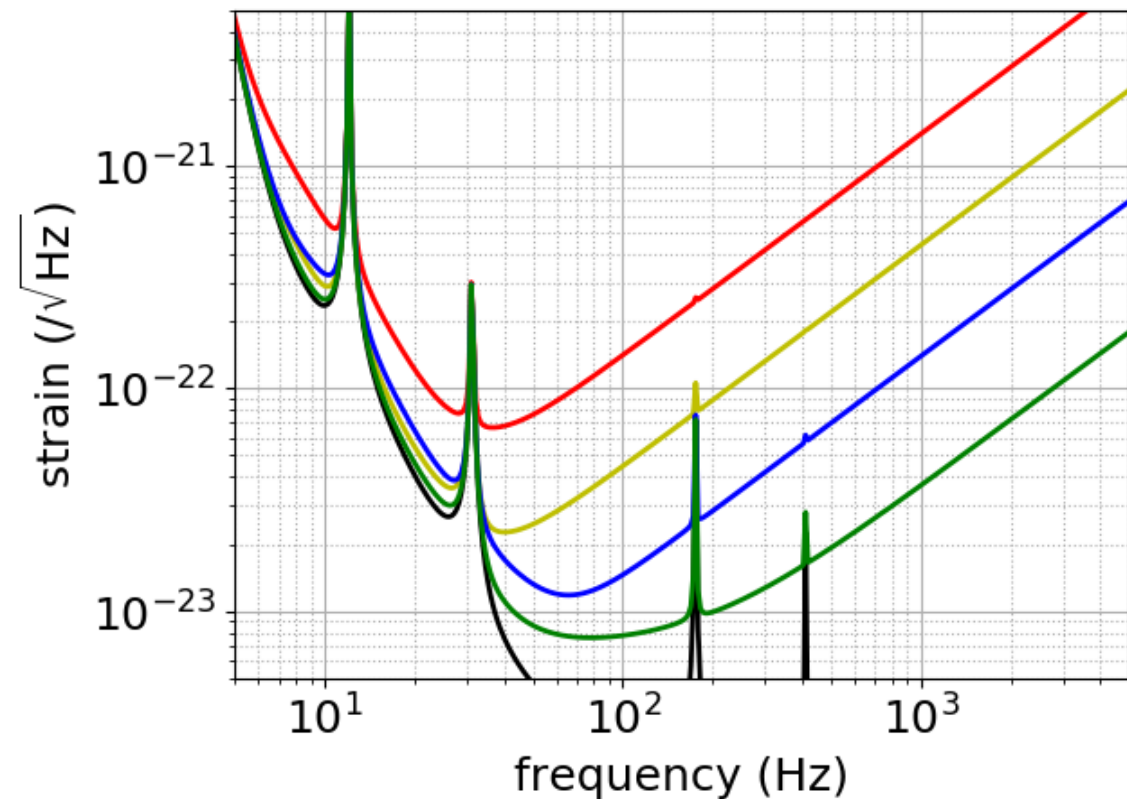
O3 Estimated Sensitivity for FPMI, PRFPMI and RSE

Yutaro Enomoto, Yuta Michimura
Department of Physics, University of Tokyo

Conditions

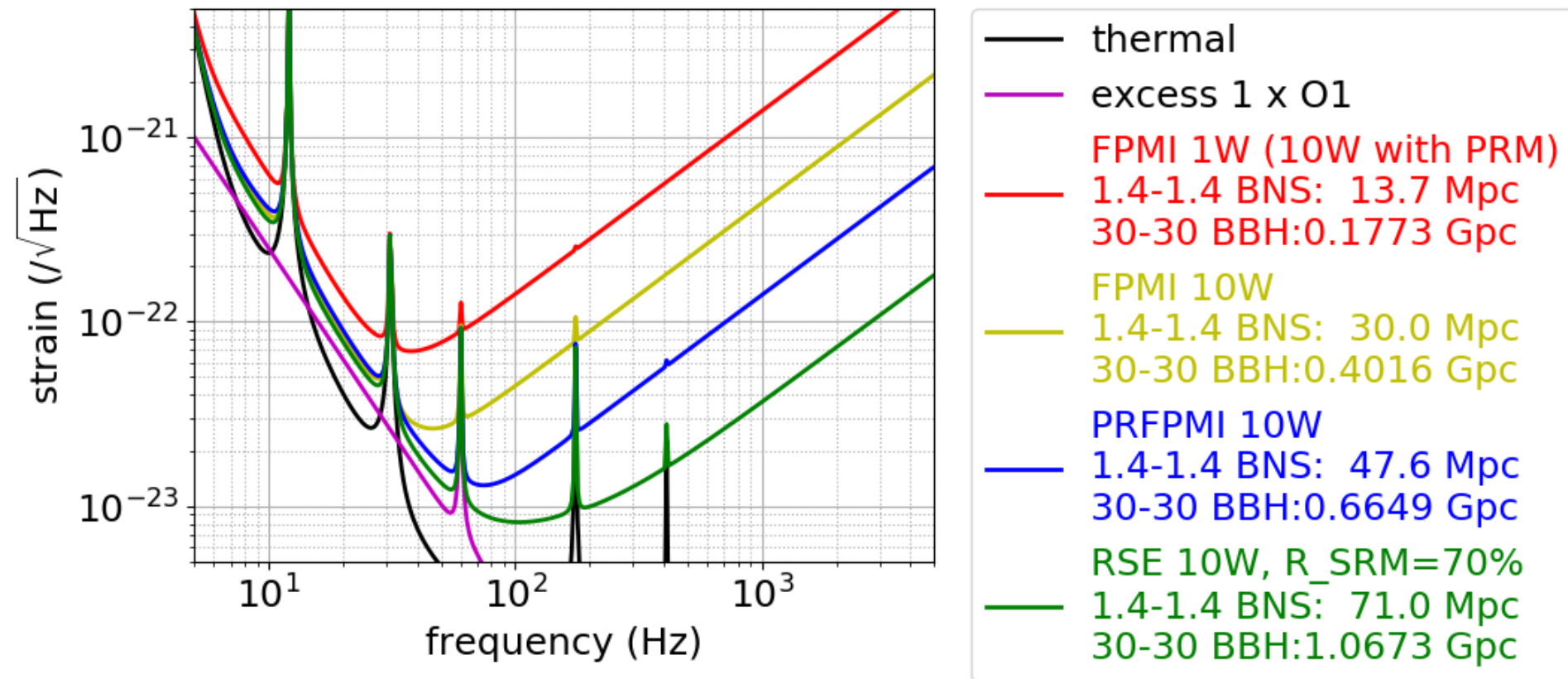
- 10W input
- Shot noise coupling with feedforward gain 100 included
- Four IFO configurations
 - **FPMI with tilted PRM** (equivalent to 1W input power)
 - **FPMI with blank PRM**
 - **PRFPMI** ($R_{\text{SRM}}=0\%$)
 - **RSE with $R_{\text{SRM}}=70\%$**
- Four excess noise models
 - No excess
 - aLIGO O1 level
 - 4x aLIGO O1 level (AdV O2 level)
 - 8x aLIGO O1 level

Sensitivity with No Excess Noise

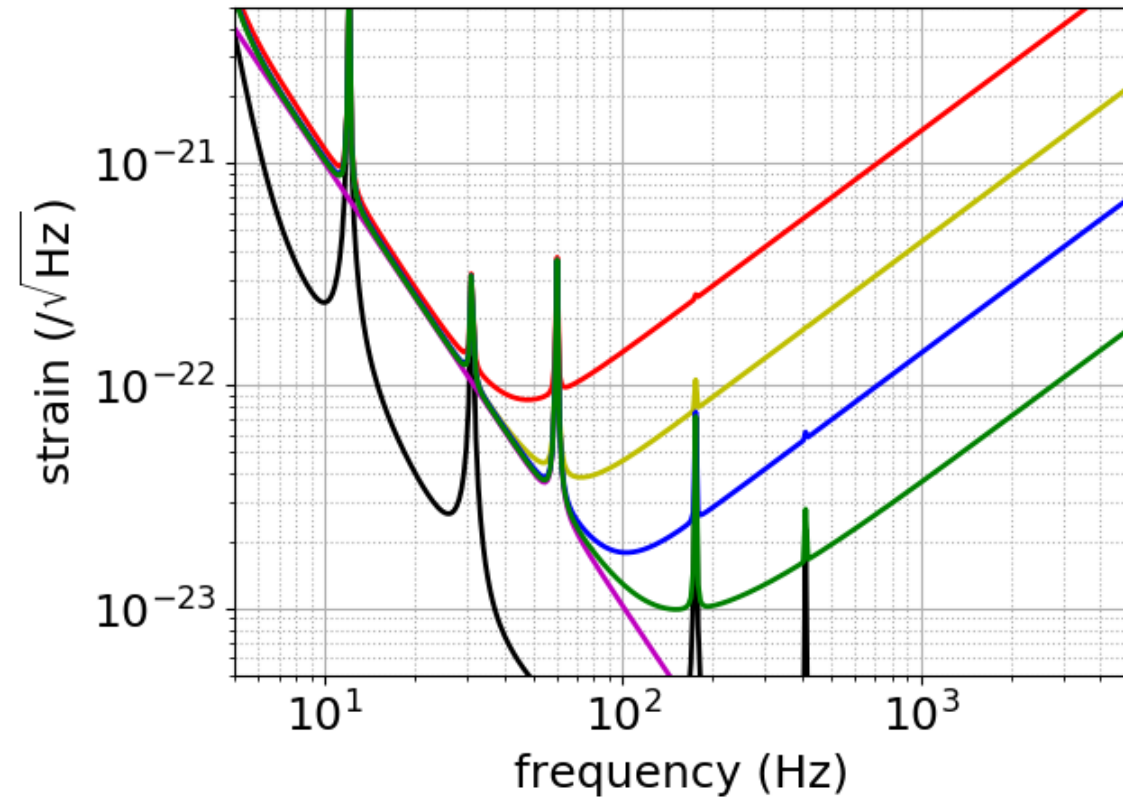


- thermal
- excess 0 x O1
- FPMI 1W (10W with PRM)**
- 1.4-1.4 BNS: 14.5 Mpc**
- 30-30 BBH: 0.1884 Gpc**
- FPMI 10W**
- 1.4-1.4 BNS: 36.7 Mpc**
- 30-30 BBH: 0.4970 Gpc**
- PRFPMI 10W**
- 1.4-1.4 BNS: 57.9 Mpc**
- 30-30 BBH: 0.8215 Gpc**
- RSE 10W, R_SRM=70%**
- 1.4-1.4 BNS: 93.4 Mpc**
- 30-30 BBH: 1.4323 Gpc**

Sensitivity with O1 Excess Noise

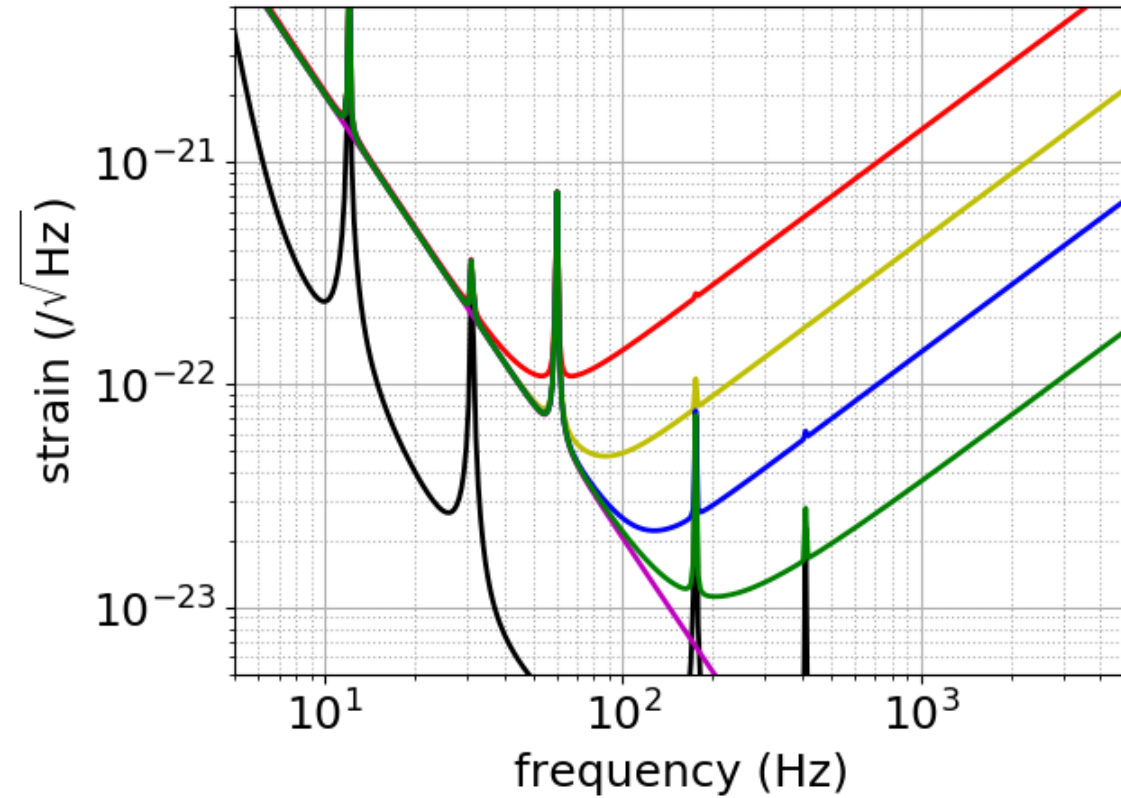


Sensitivity with x4 O1 Excess Noise



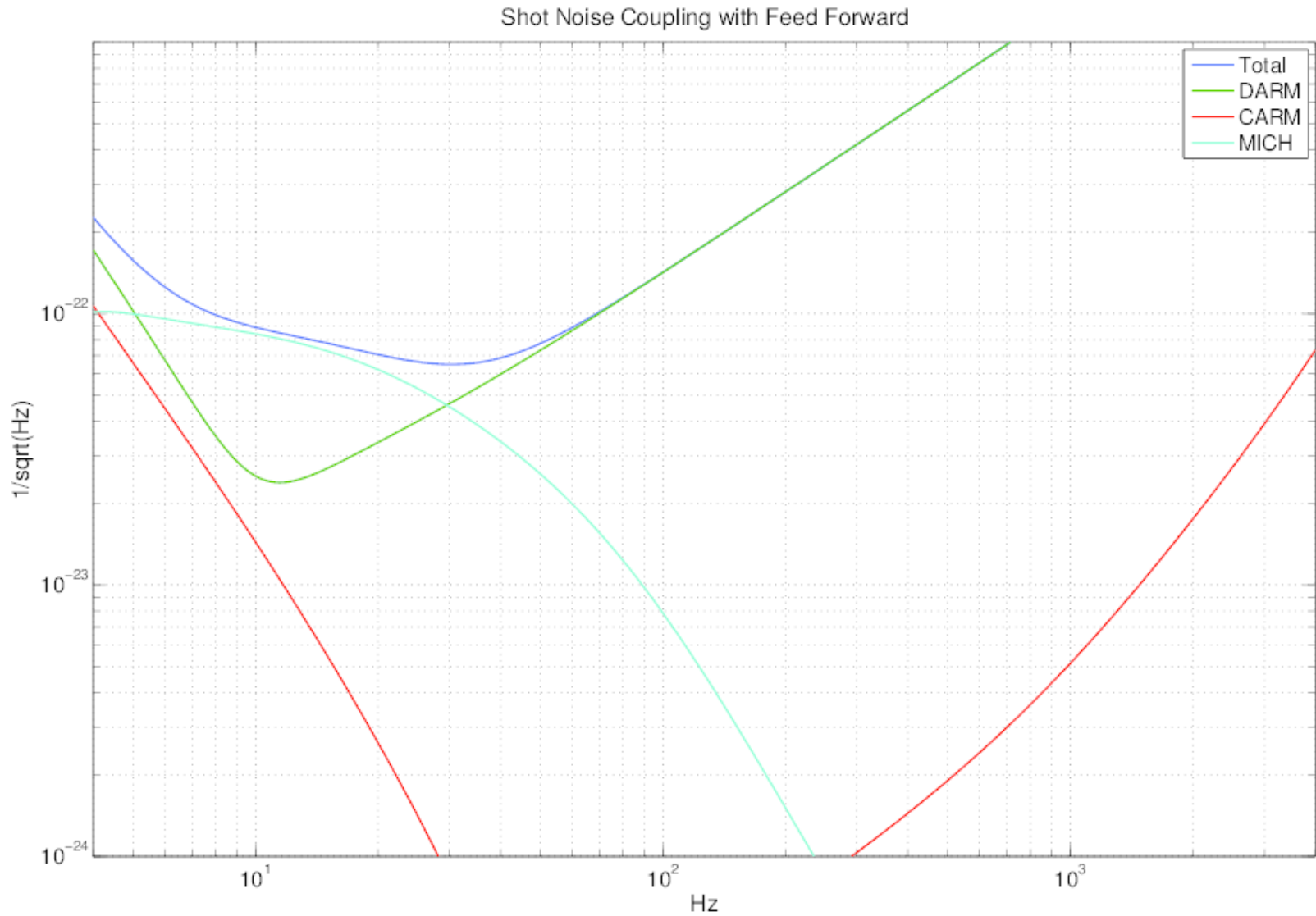
- thermal
- excess 4 x O1
- FPMI 1W (10W with PRM)**
 1.4-1.4 BNS: 9.4 Mpc
 30-30 BBH: 0.1216 Gpc
- FPMI 10W**
 1.4-1.4 BNS: 16.3 Mpc
 30-30 BBH: 0.2137 Gpc
- PRFPMI 10W**
 1.4-1.4 BNS: 27.1 Mpc
 30-30 BBH: 0.3737 Gpc
- RSE 10W, R_SRM=70%**
 1.4-1.4 BNS: 41.6 Mpc
 30-30 BBH: 0.6219 Gpc

Sensitivity with x8 O1 Excess Noise

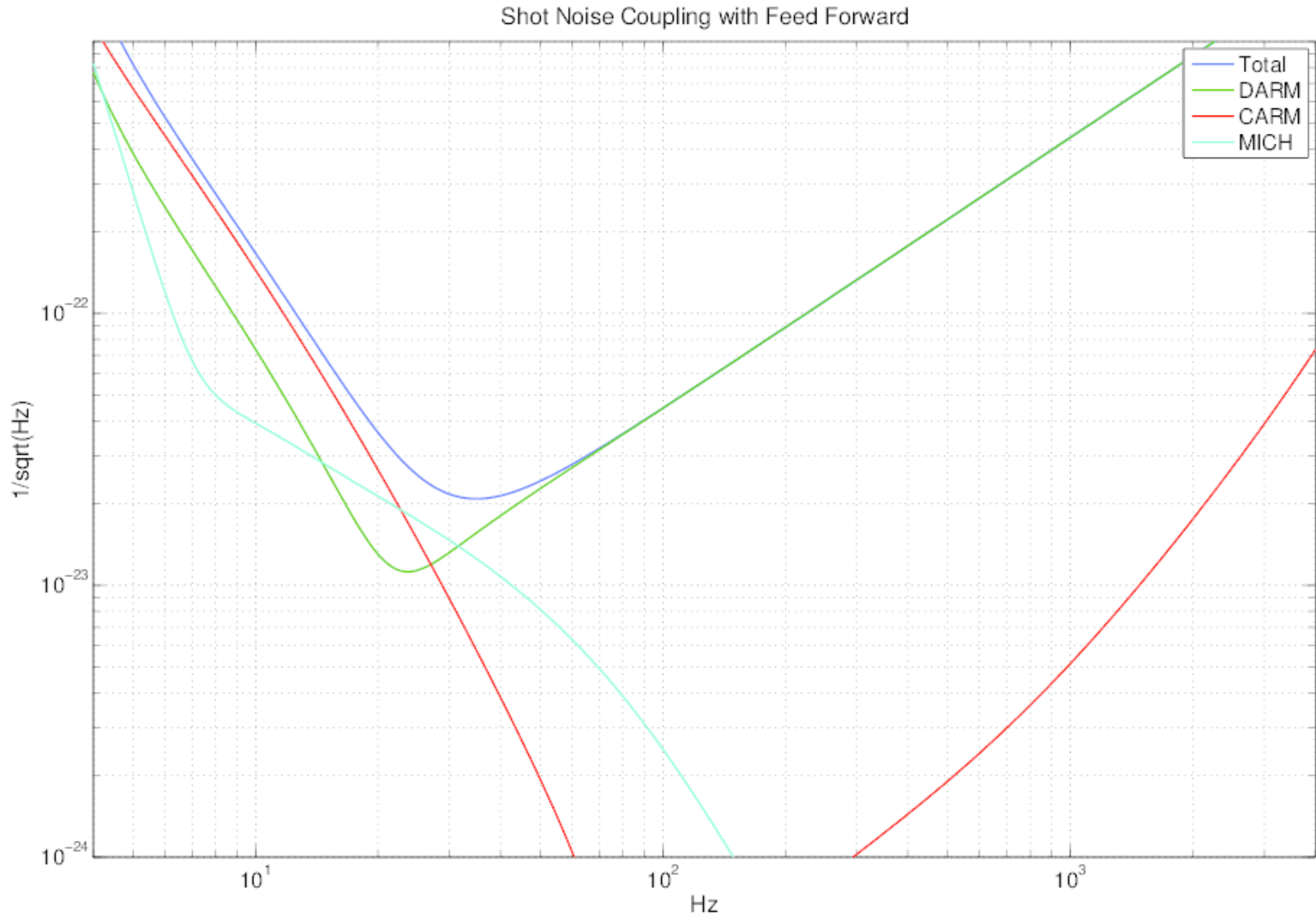


- thermal
- excess 8 x O1
- FPMI 1W (10W with PRM)
- 1.4-1.4 BNS: 6.7 Mpc
- 30-30 BBH: 0.0859 Gpc
- FPMI 10W
- 1.4-1.4 BNS: 11.2 Mpc
- 30-30 BBH: 0.1477 Gpc
- PRFPMI 10W
- 1.4-1.4 BNS: 19.0 Mpc
- 30-30 BBH: 0.2637 Gpc
- RSE 10W, R_SRM=70%
- 1.4-1.4 BNS: 30.2 Mpc
- 30-30 BBH: 0.4572 Gpc

Shot Noise Coupling **FPMI 1W**

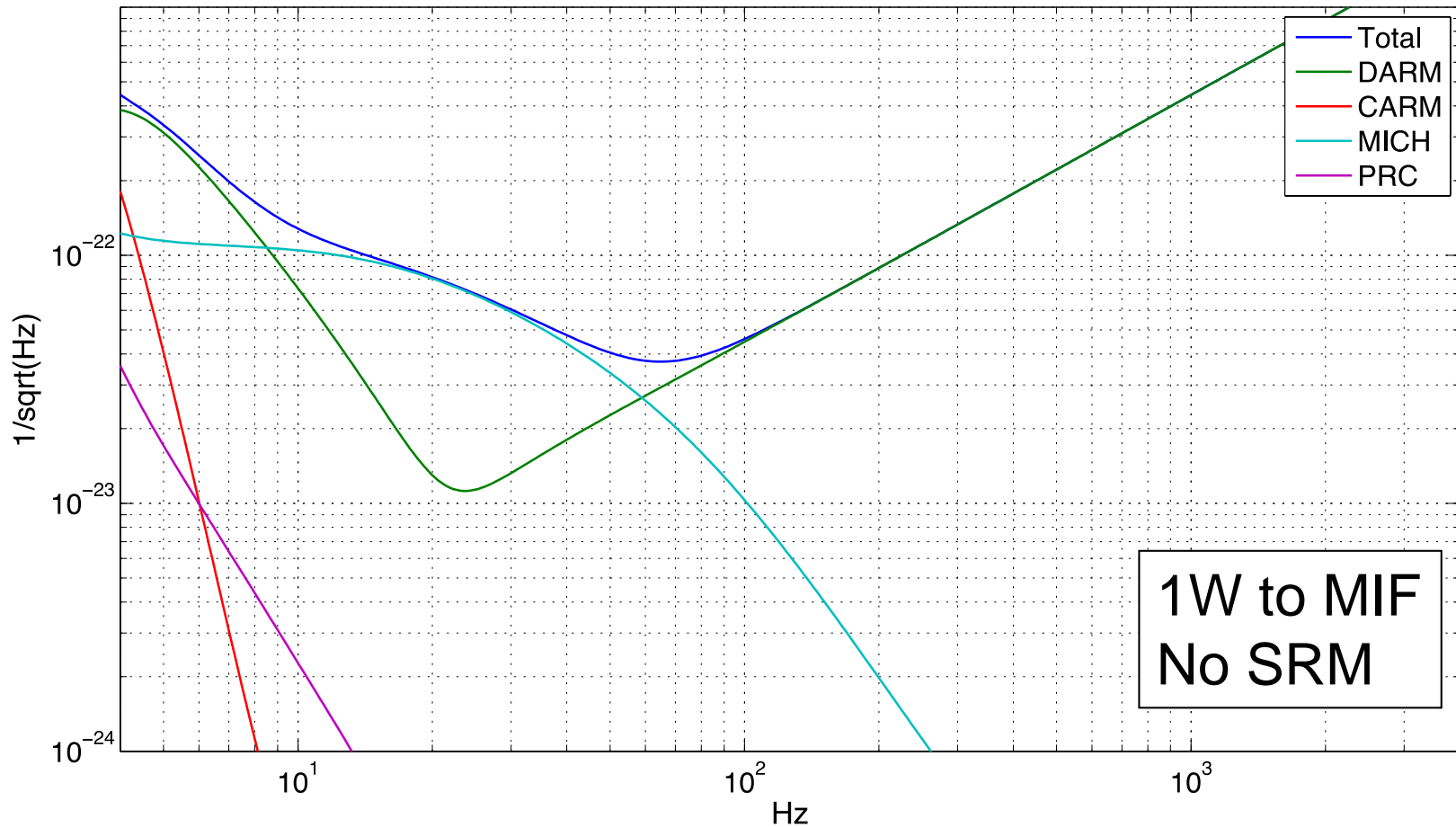


Shot Noise Coupling **FPMI 10W**



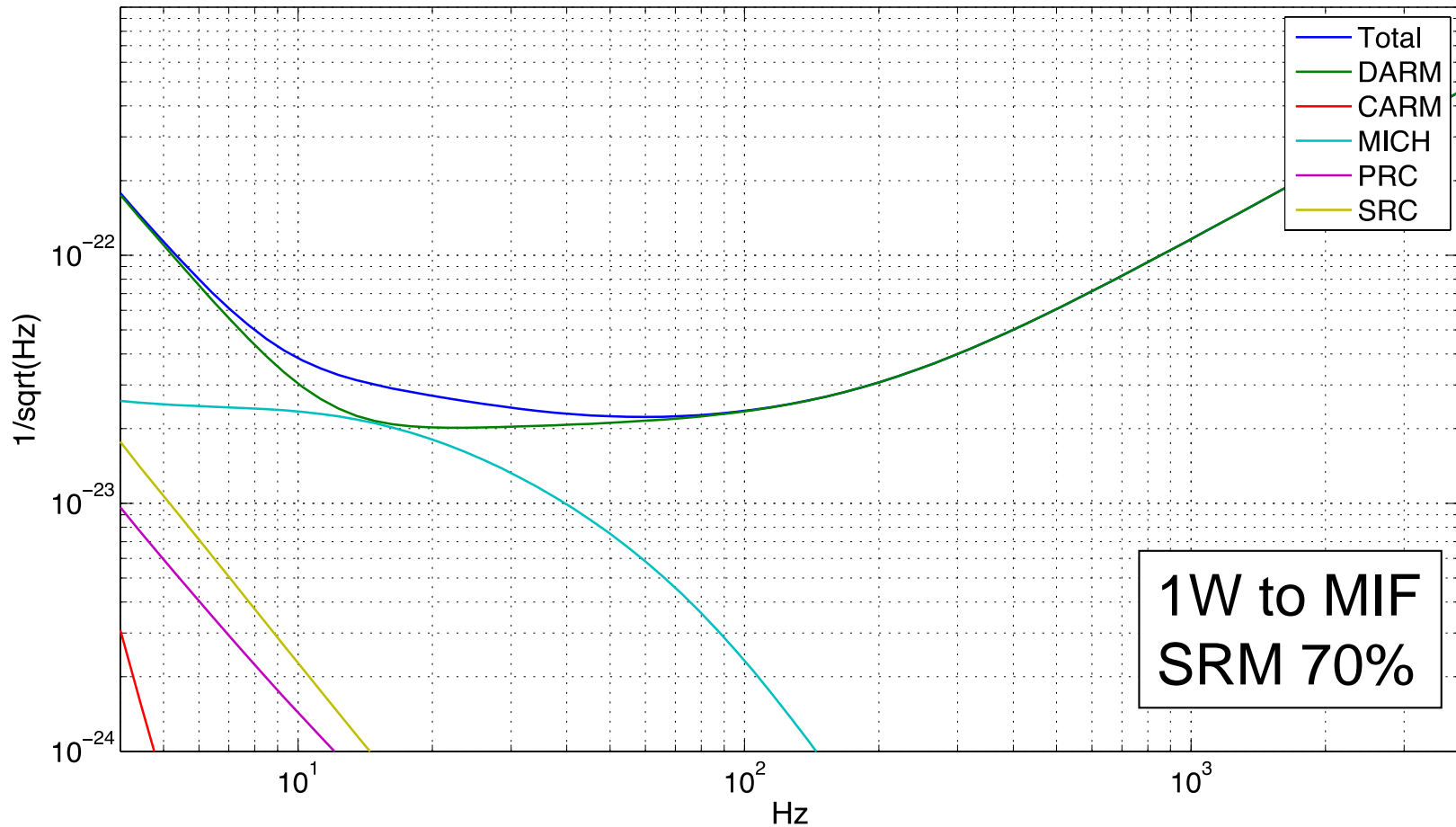
Shot Noise Coupling PRFPMI

Shot Noise Coupling with Feed Forward

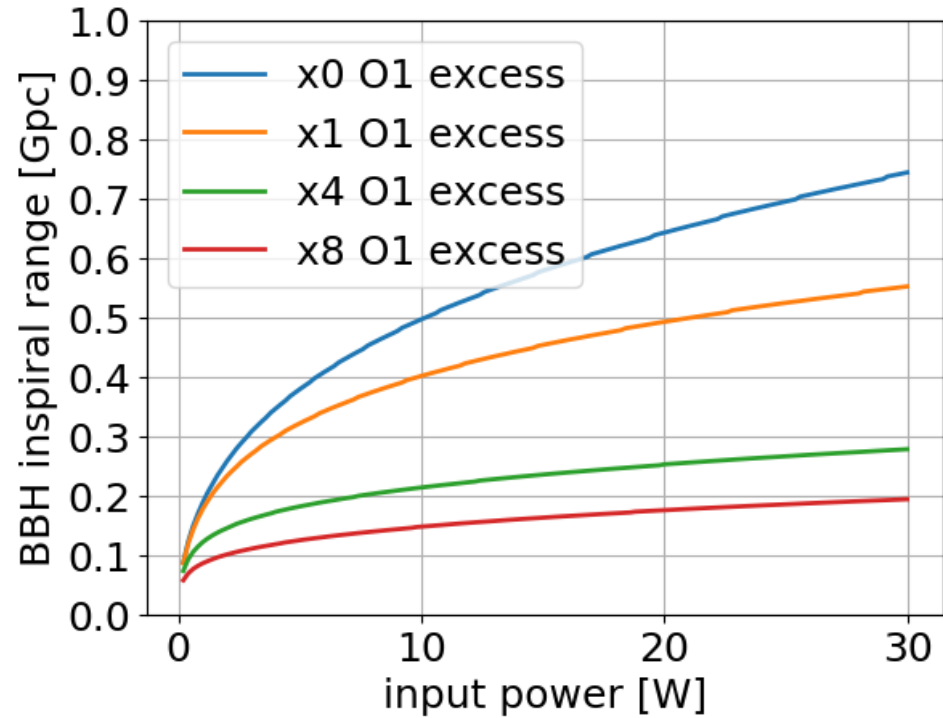
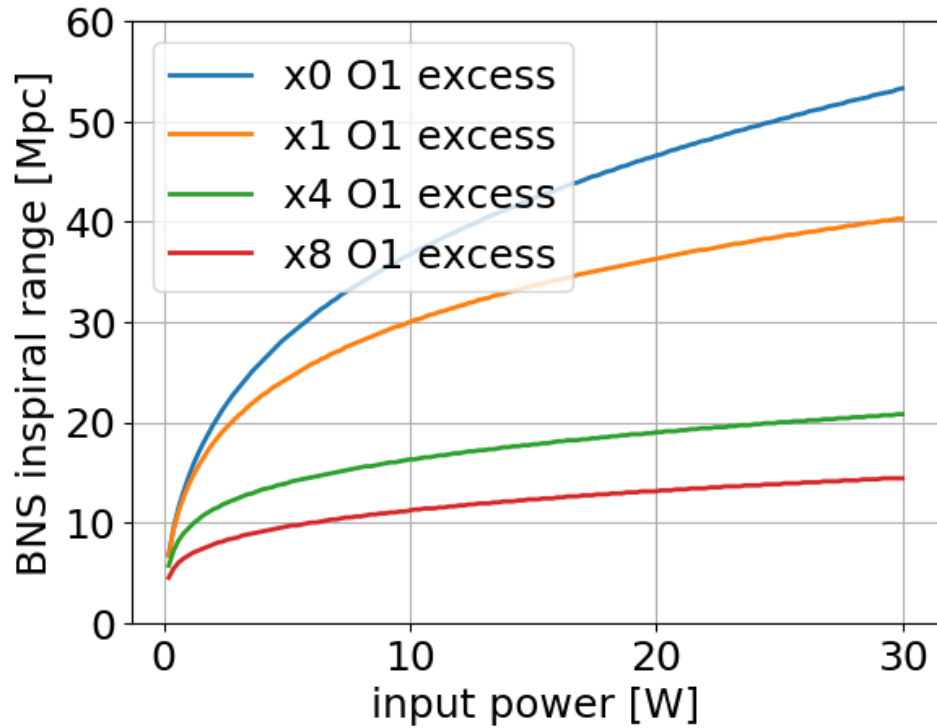


Shot Noise Coupling RSE

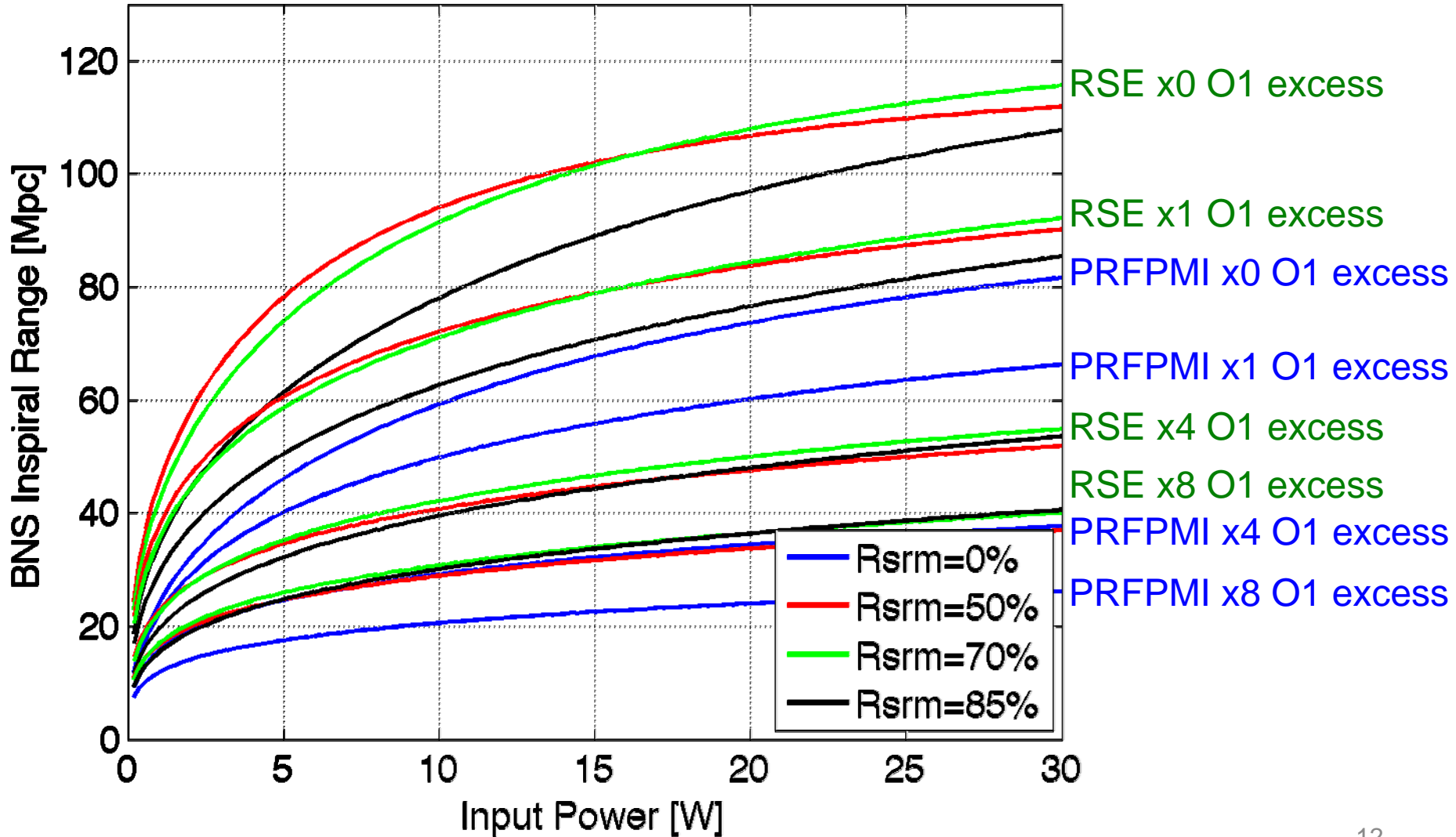
Shot Noise Coupling with Feed Forward



IR vs Power **FPMI**



IR vs Power PRPFMI/RSE



Necessity

⊙: Necessary for locking

○: Can be omitted with extra work

△: Can be omitted with sensitivity degradation

×: Not necessary

Sensitivity (10W, x4 O1 excess)	RSE (42 Mpc)	PRFPMI (27 Mpc)	FPMI (9.4 / 16 Mpc)
ALS (green lock)	⊙	○	×
f3 AM (MZI)	⊙	○	×
Extra locking simulation	×	⊙	×
SRC ASC	⊙	×	×
SRM	⊙	○ (Blank or move OMMT)	○ (Blank or move OMMT)
OMC	△	△	△
Comment	SRC ASC might be tough	f1 will be 1/10, no SRC mode cleaning	PRM: tilt or blank or move IMMT No PRC jitter attenuation