Modulation Frequency

f1 Candidates: 9MHz, 11.25MHz, 16.875MHz

	9MHz	11.25MHz	16.875MHz
Lprc	74.95m	73.28m	66.62m
Lsrc	74.95m	73.28m	66.62m
Las	6.66m	3.33m	3.33m
Lmc	33.3m	26.65m	26.65m
f3	13.5MHz(f2*3/10)	61.9MHz(f2*11/8)	56.3MHz (f2*10/8)
DDM freq.	22.5MHz, 31.5MHz	16.9MHz, 50.6MHz	11.25MHz, 39.4MHz

<u>Pros and Cons</u>

- Loop noise 11.25MHz < 16.875MHz < 9MHz (worse < better)
- 9MHz needs a bit longer MC (33m not 27m)
- 9MHz has a longer asymmetry (6.6m compared to 3.3m)
- 11.25MHz is incompatible with 3rd harmonics demodulation
- 9MHz and 16.875MHz have larger SRCL non-linearity

3rd Harmonics Demodulation

- Beat between 2*f1 and f1
- Useful for lock acquisition.
- Substitutes for NRS. No MZ, no AM necessary -> simple.

Unfortunately, all the f1 candidates cannot use this method in the usual sense, because 2*f1 resonates in the PRC-SRC.
(f1 frequencies tested: 9MHz, 11.25MHz, 13.5MHz, 16.875MHz, 19.3MHz)

Actually, 3rd harmonics demodulation produces some signal due to difference in the response of 2*f1 and f1.
However, strong interference from the carrier is present (carrier-3*f1 beat).

9MHz

Sensing Matrix [W/m]

	DARM	CARM	MICH	PRC	SRC
POP_1Thl	2.9e+01	5.4e+03	2.9e+03	6.5e+03	5.1e+03
REFL_2Thl	1.3e+03	2.2e+05	5.5e+03	5.4e+05	1.3e+02
REFL_1ThQ	6.9e+04	1.3e+07	3.7e+05	2.9e+05	2.7e+05
REFL_1Thl	7.1e+04	1.3e+07	1.8e+05	8.6e+05	4.6e+05

16.875MHz

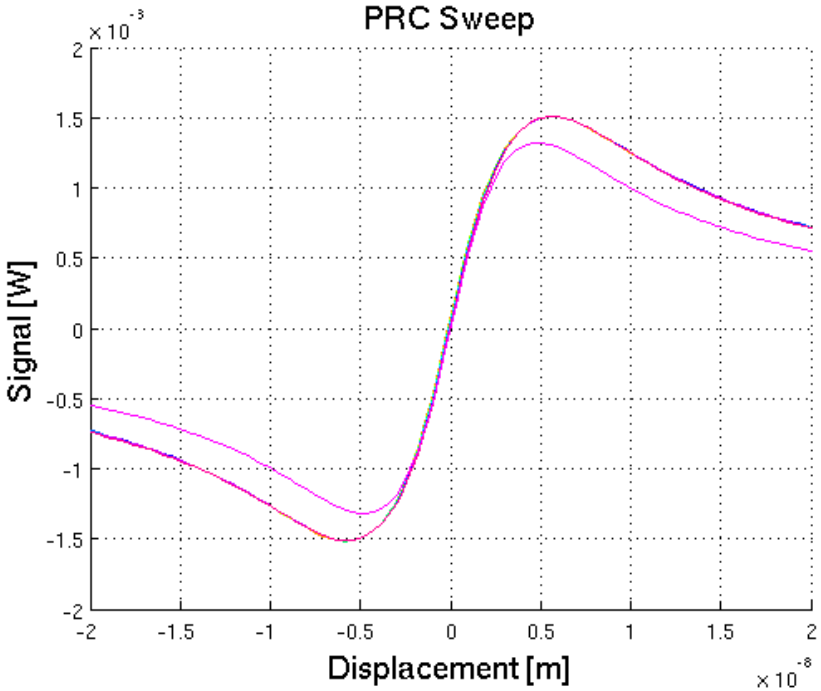
Sensing Matrix [W/m]

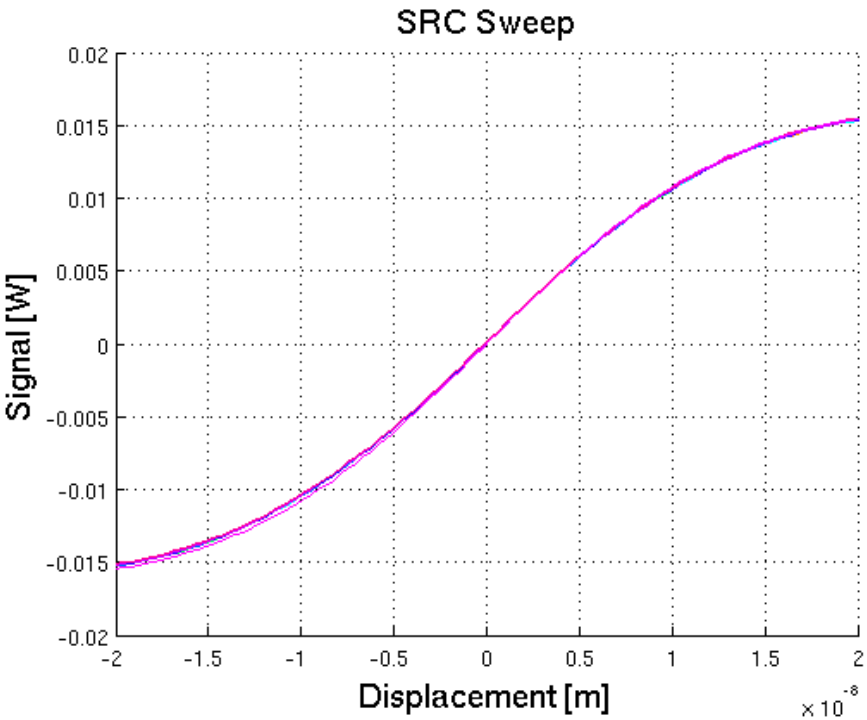
	DARM	CARM	MICH	PRC	SRC
POP_1Thl	1.0e+01	3.3e+02	2.5e+03	8.9e+03	2.4e+02
REFL_2Thl	7.5e+02	6.9e+04	5.5e+03	5.4e+05	1.5e+02
REFL_1ThQ	5.3e+04	9.6e+06	3.0e+05	1.6e+05	4.5e+02
REFL_1Thl	2.4e+04	4.4e+06	1.0e+05	2.2e+06	1.3e+06

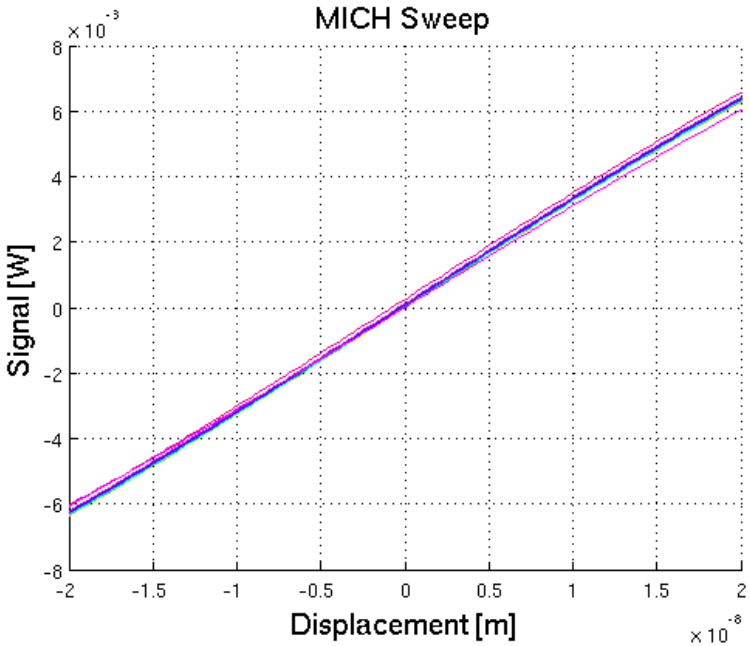
3rd Harmonics signal during lock acquisition

CARM offset: 2nm -> 0

16.875MHz



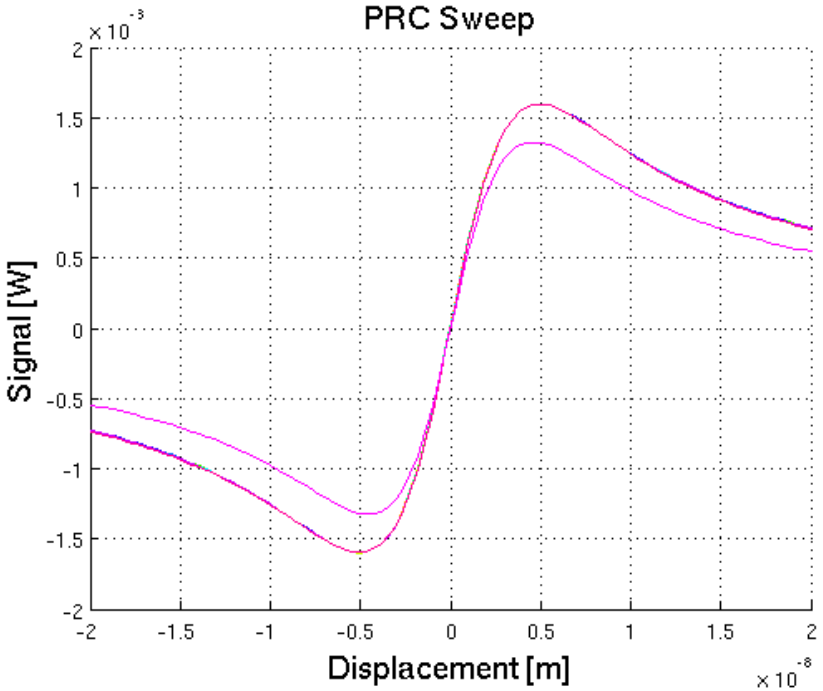


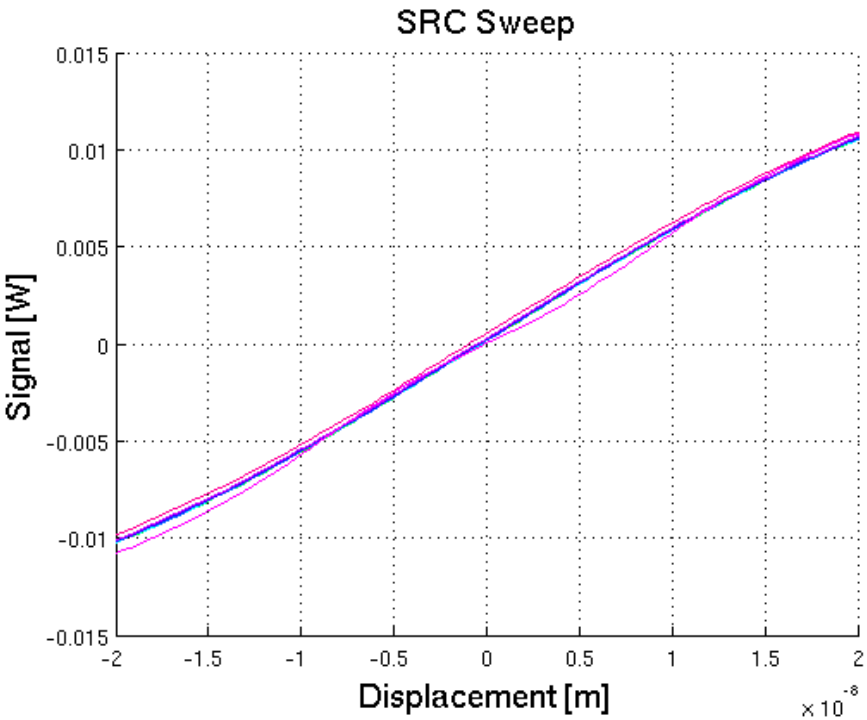


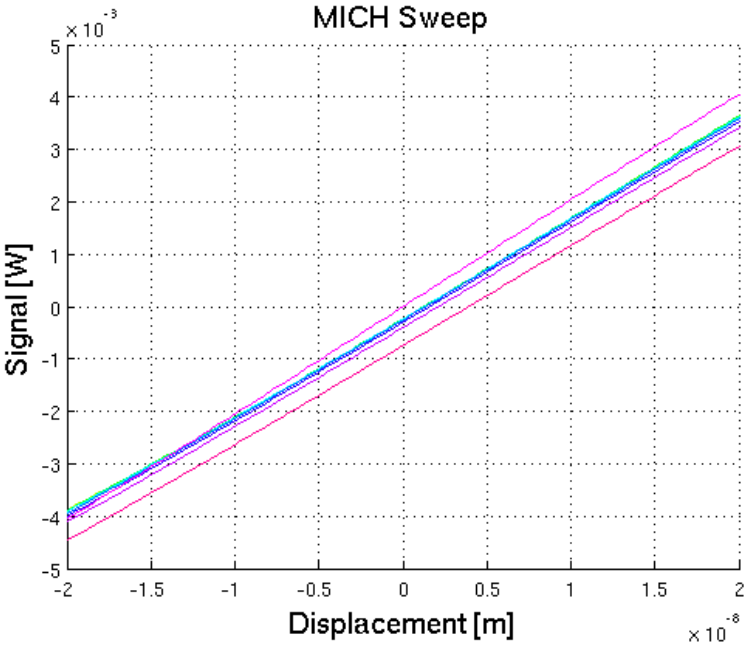
3rd Harmonics signal during lock acquisition

CARM offset: 2nm -> 0

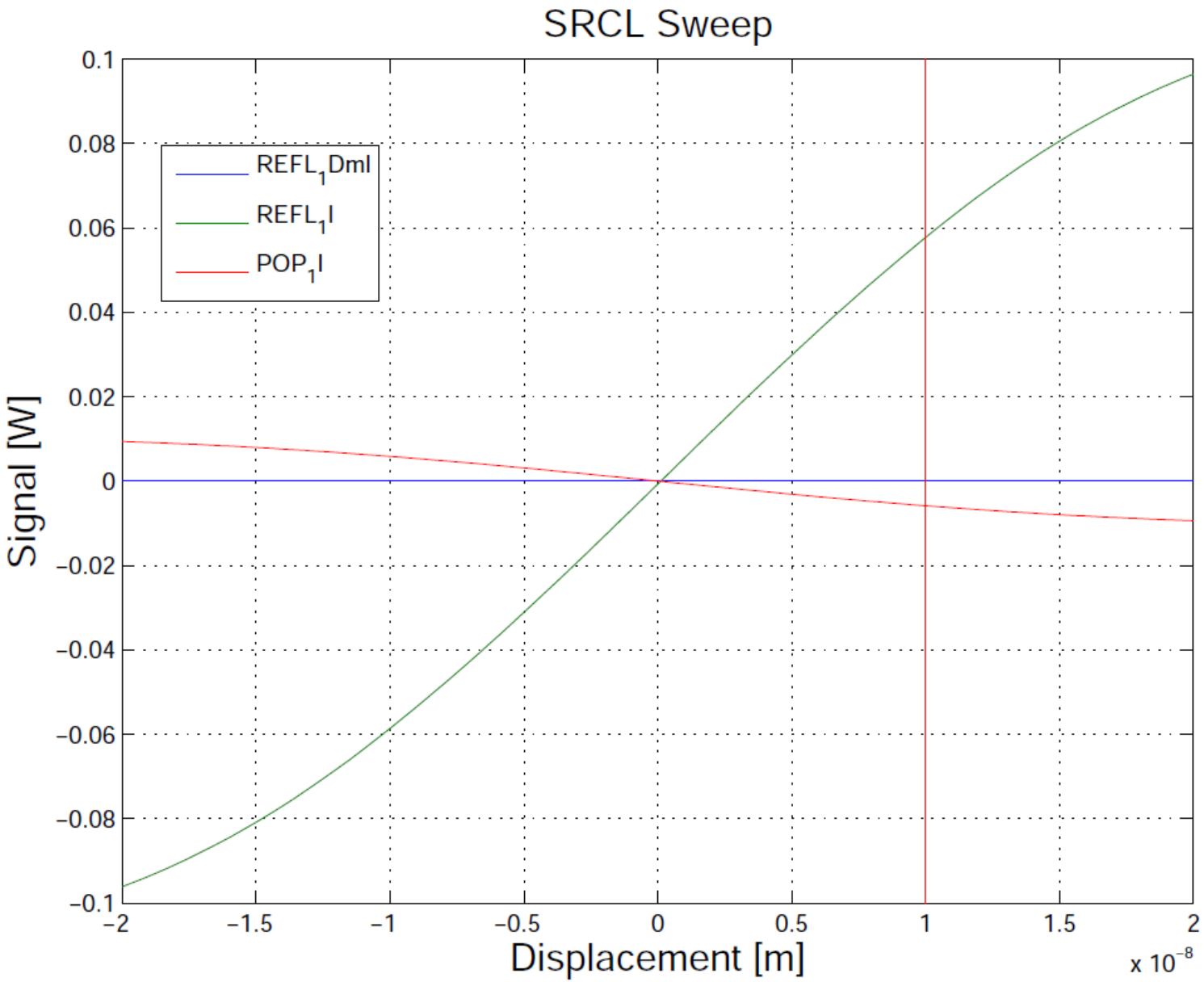
9MHz



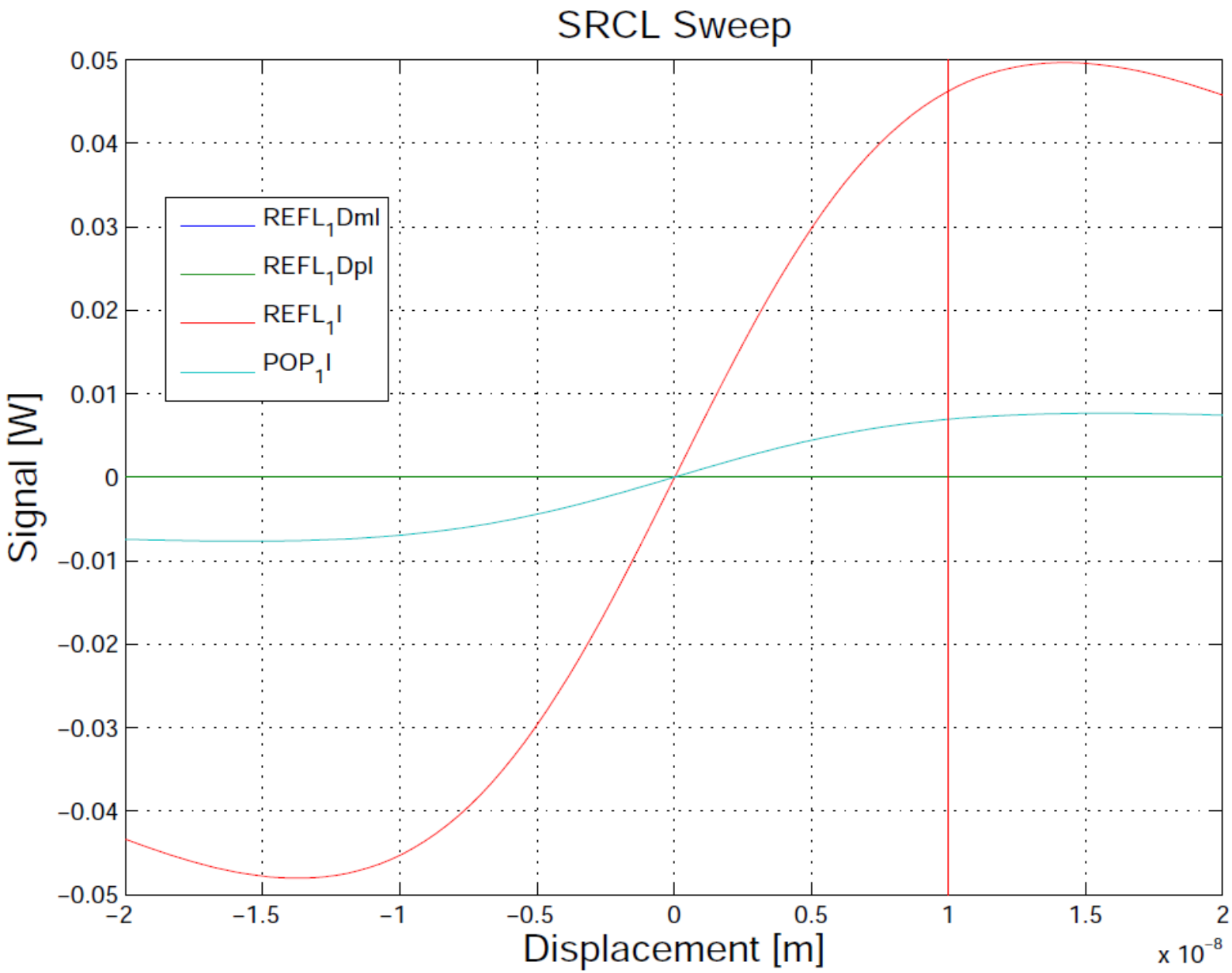




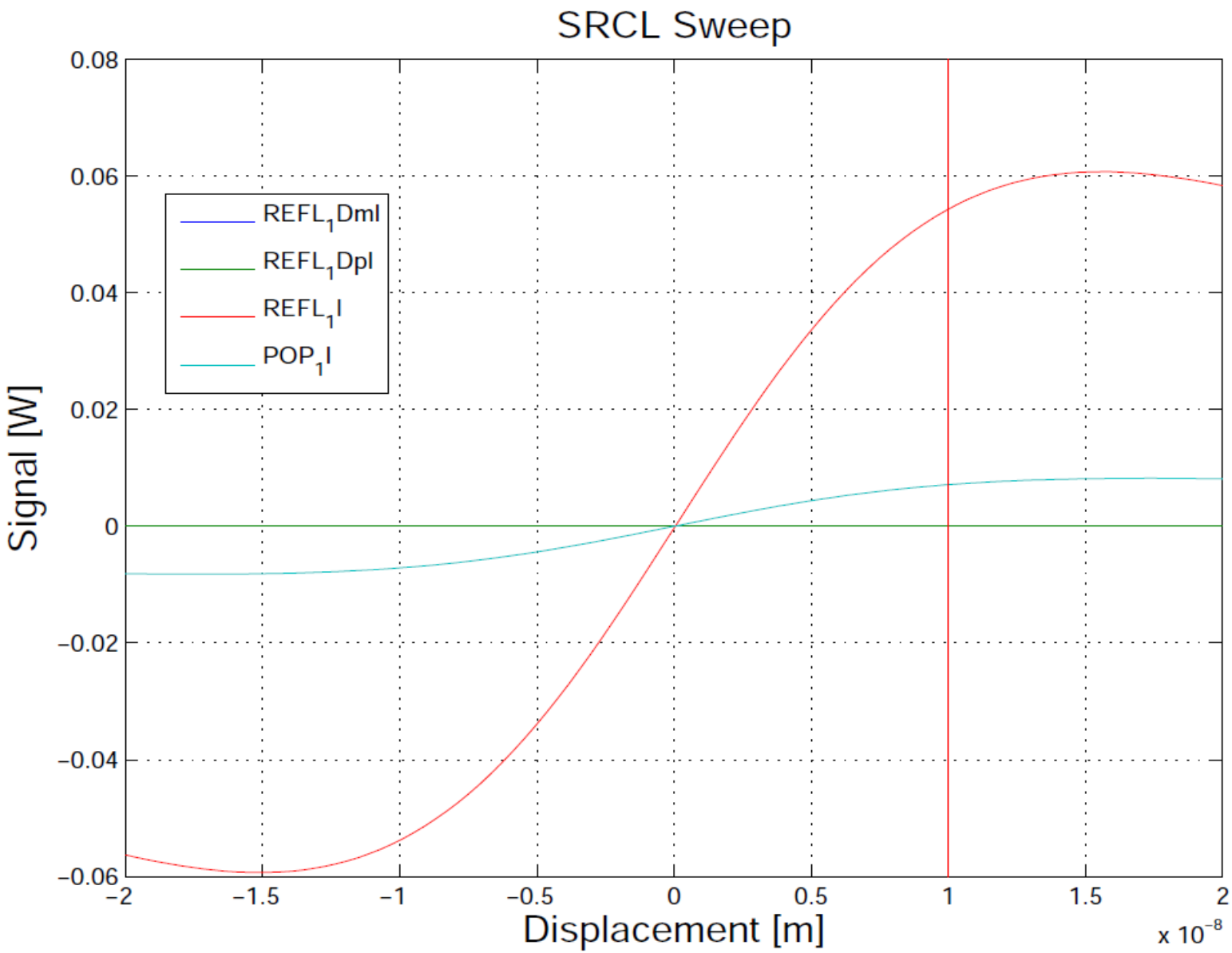
f1=11.25MHz


SRCL Sweep
REFL1Dml
REFL1I
POP1I
Signal [W]
Displacement [m]
x 10-8
0.1
0.08
0.06
0.04
0.02
0
−0.02
−0.04
−0.06
−0.08
−0.1
−2
−1.5
−1
−0.5
0
0.5
1
1.5
2

f1=9MHz

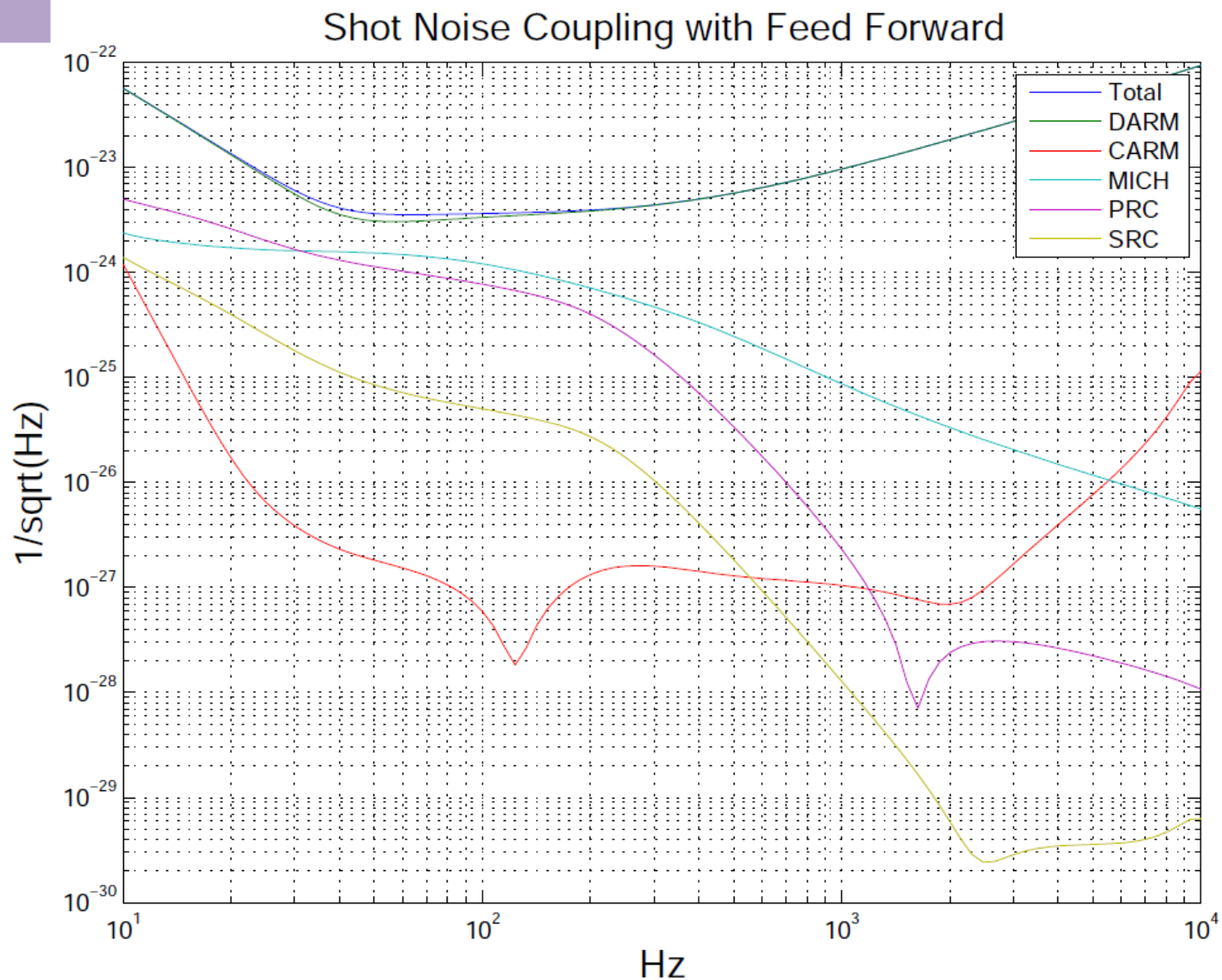

SRCL Sweep
REFL1Dml
REFL1Dpl
REFL1I
POP1I
Signal [W]
Displacement [m]
x 10-8
0.05
0.04
0.03
0.02
0.01
0
−0.01
−0.02
−0.03
−0.04
−0.05
−2
−1.5
−1
−0.5
0
0.5
1
1.5
2

f1=16.875MHz


SRCL Sweep
REFL1Dml
REFL1Dpl
REFL1I
POP1I
Signal [W]
Displacement [m]
x 10^-8
0.08
0.06
0.04
0.02
0
−0.02
−0.04
−0.06
−2
−1.5
−1
−0.5
0
0.5
1
1.5
2

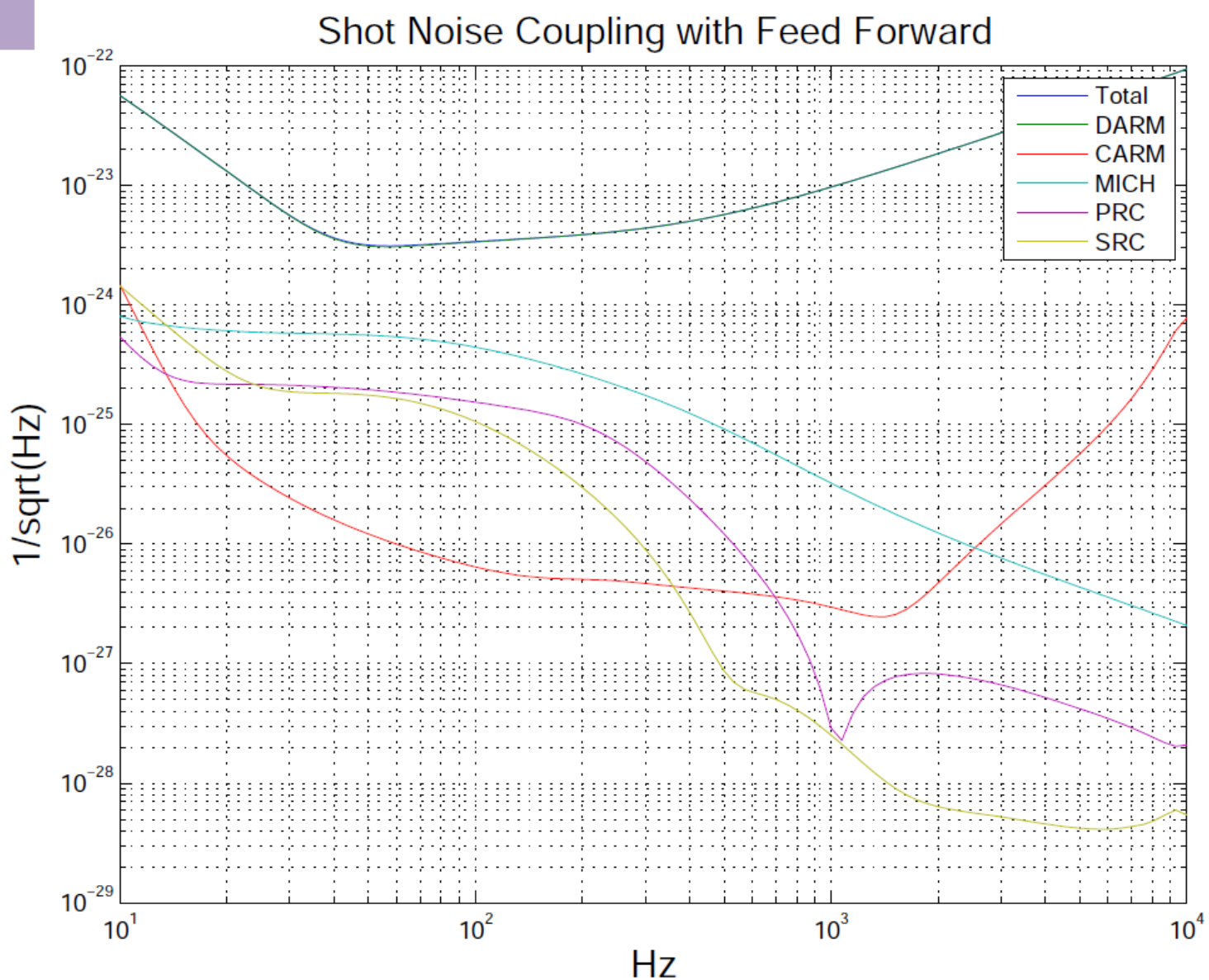
DARM: ASDC
CARM: REFL 1I
MICH: REFL 1Q
PRCL: POP 2I
SRCL: POP 1I

BRSE: f1=11.25MHz, Feed forward gain=100



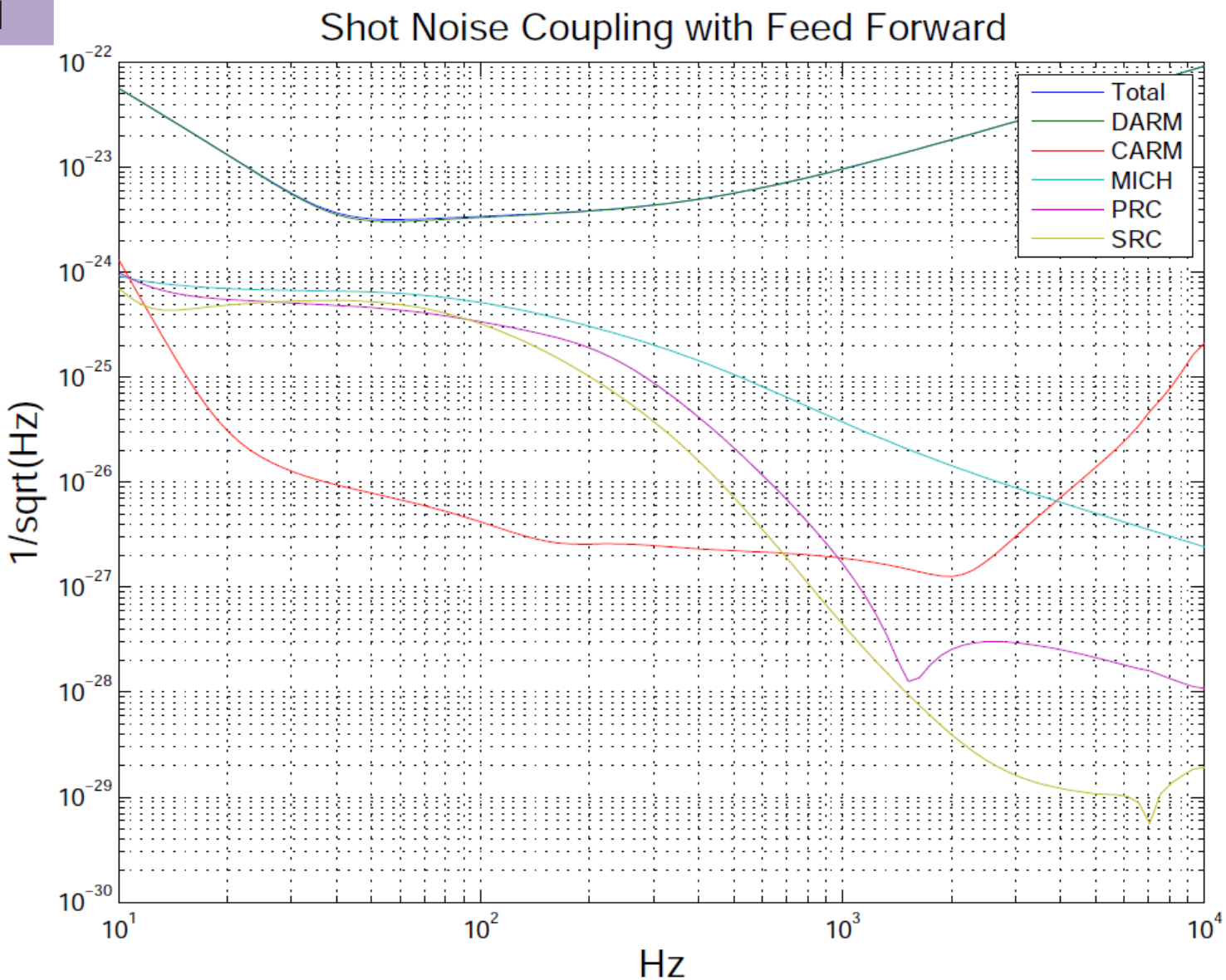
DARM: ASDC
CARM: REFL 1I
MICH: REFL 1Q
PRCL: POP 2I
SRCL: POP 1I

BRSE: f1=9MHz, Feed forward gain=100



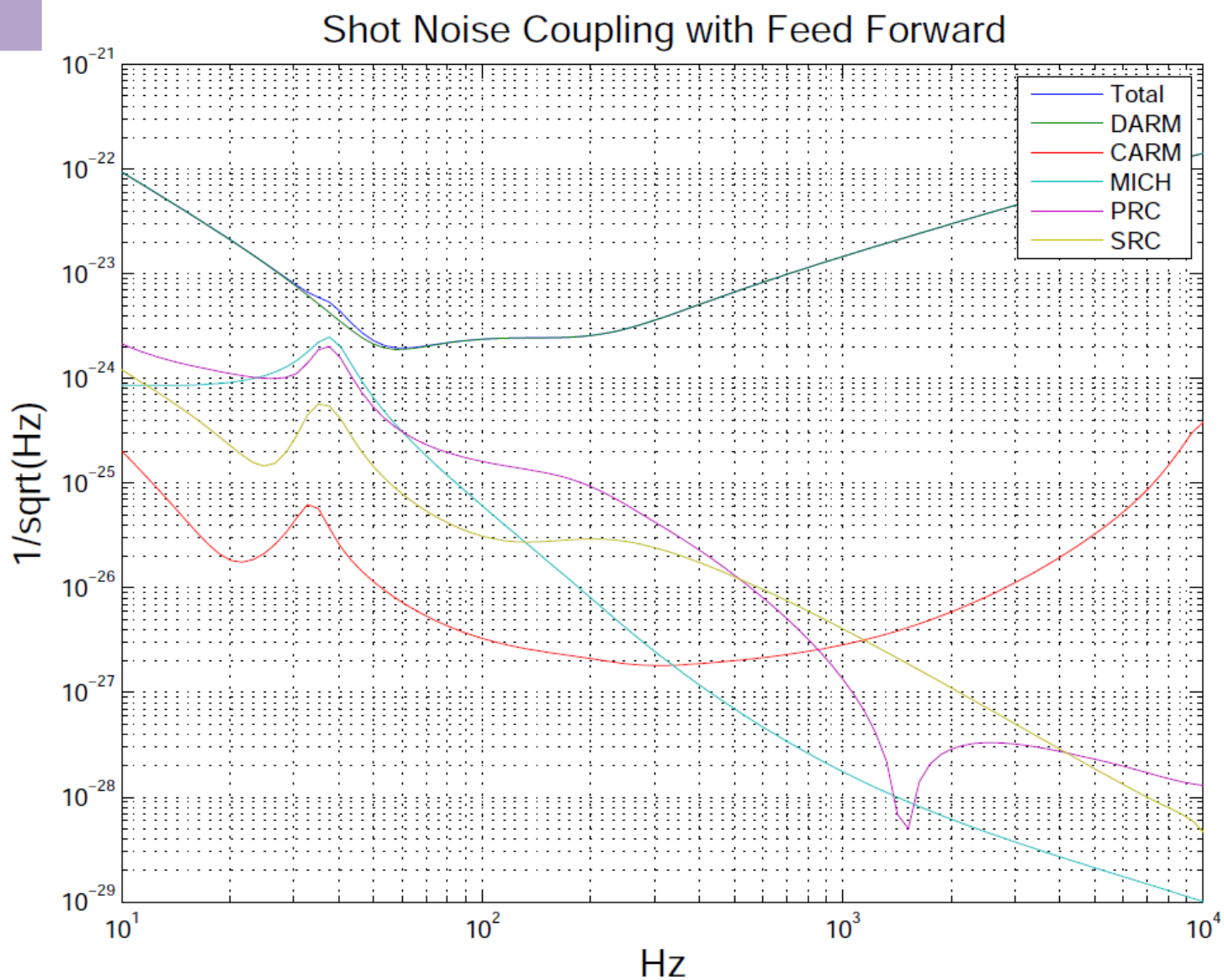
DARM: ASDC
CARM: REFL 1I
MICH: REFL 1Q
PRCL: POP 2I
SRCL: POP 1I

BRSE: f1=16.875MHz, Feed forward gain=100



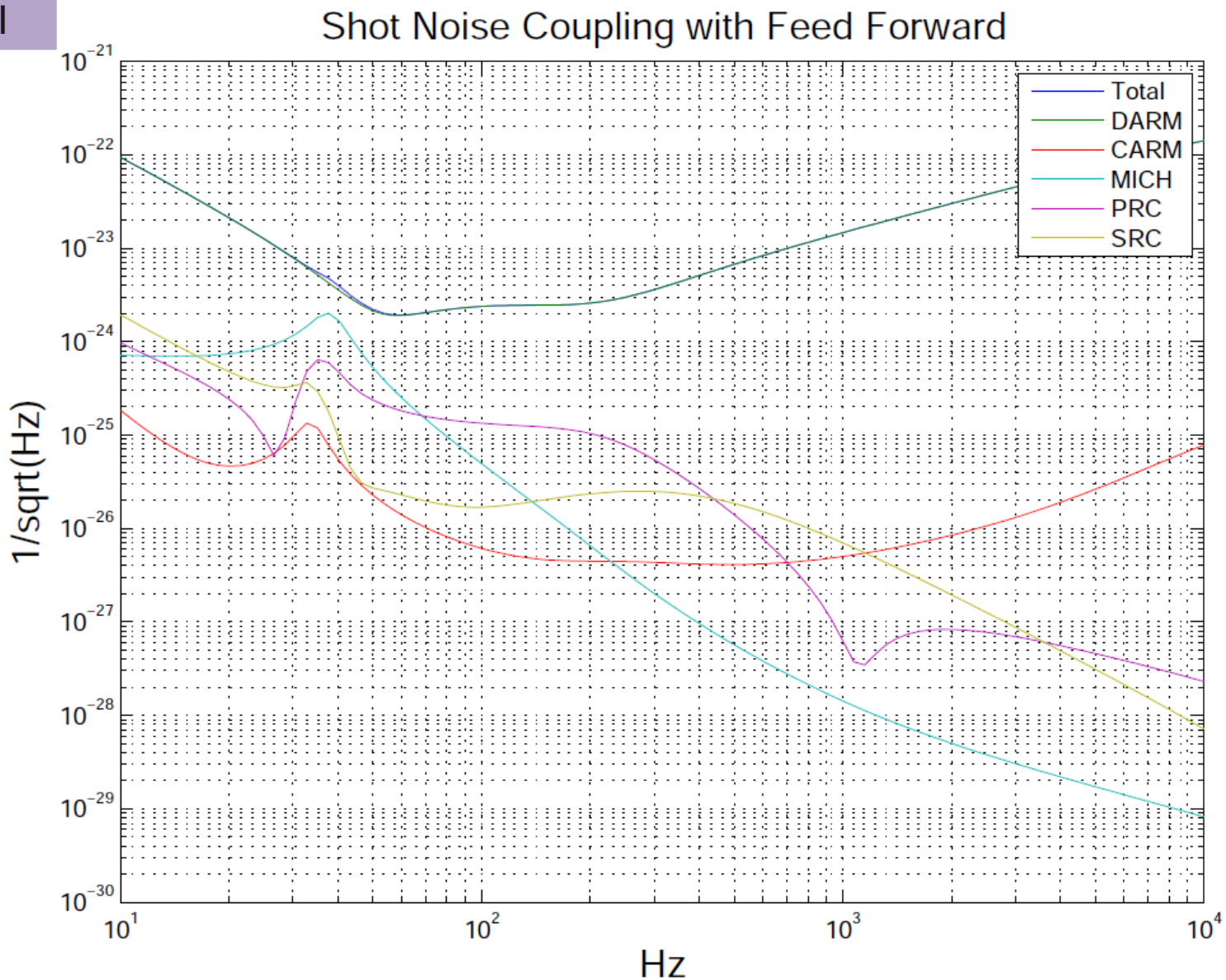
DARM: ASDC
CARM: REFL 1I
MICH: REFL 1Q
PRCL: POP 2I
SRCL: POP 1I

DRSE: f1=11.25MHz, Feed forward gain=100



DARM: ASDC
CARM: REFL 1I
MICH: REFL 1Q
PRCL: POP 2I
SRCL: POP 1I

DRSE: f1=9MHz, Feed forward gain=100



DARM: ASDC
CARM: REFL 1I
MICH: REFL 1Q
PRCL: POP 2I
SRCL: POP 1I

DRSE: f1=16.875MHz, Feed forward gain=100