

Current status of the 4m RSE

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Introduction

What Is 4mRSE

A broadband (tuned) power-recycled RSE interferometer, prototype of LCGT interferometer, built inside NAOJ's campus

The Goal

To demonstrate LCGT's control scheme to lock the RSE

Degrees of Freedom

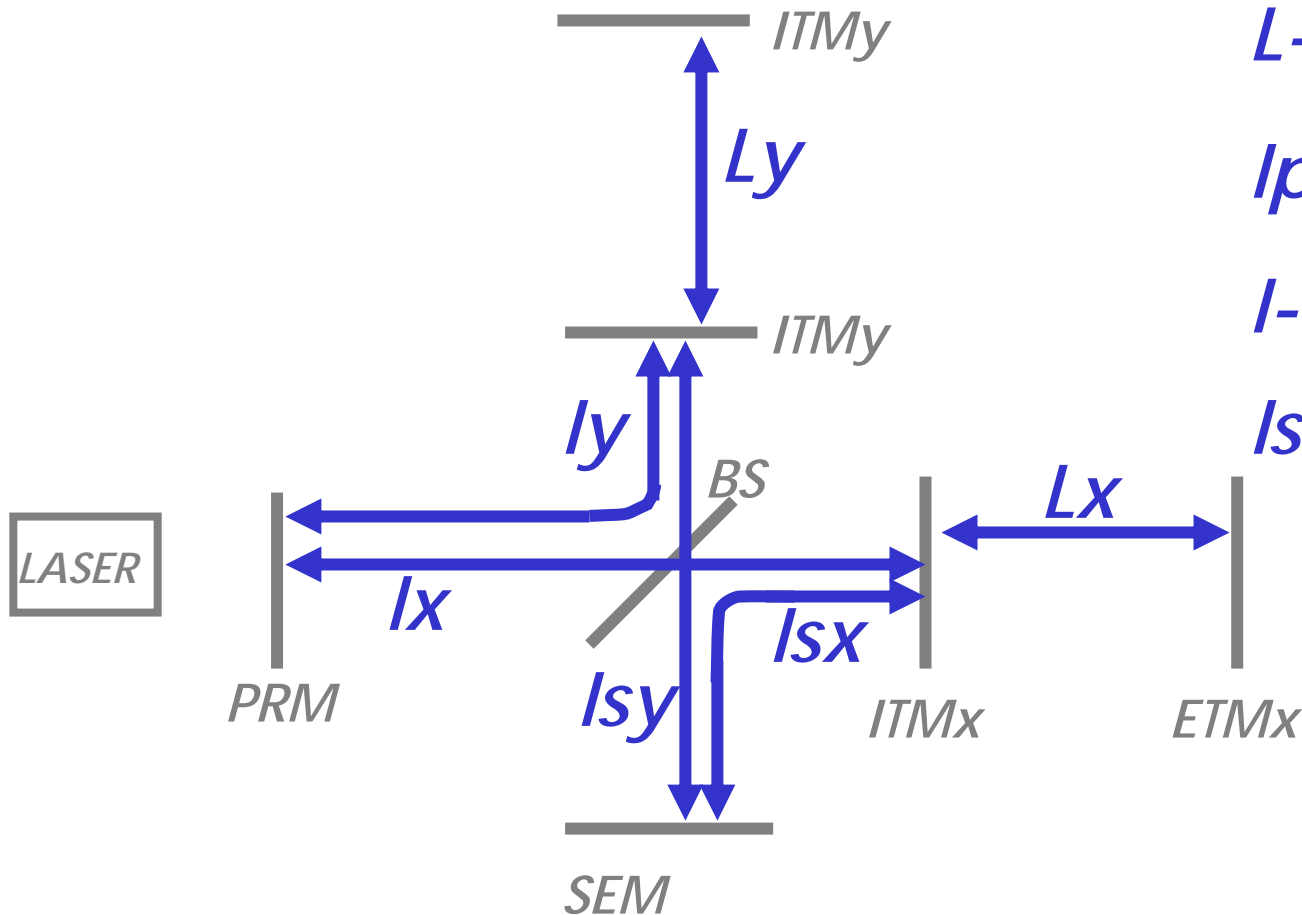
$$L_+ = (L_x + L_y) / 2$$

$$L_- = (L_x - L_y) / 2$$

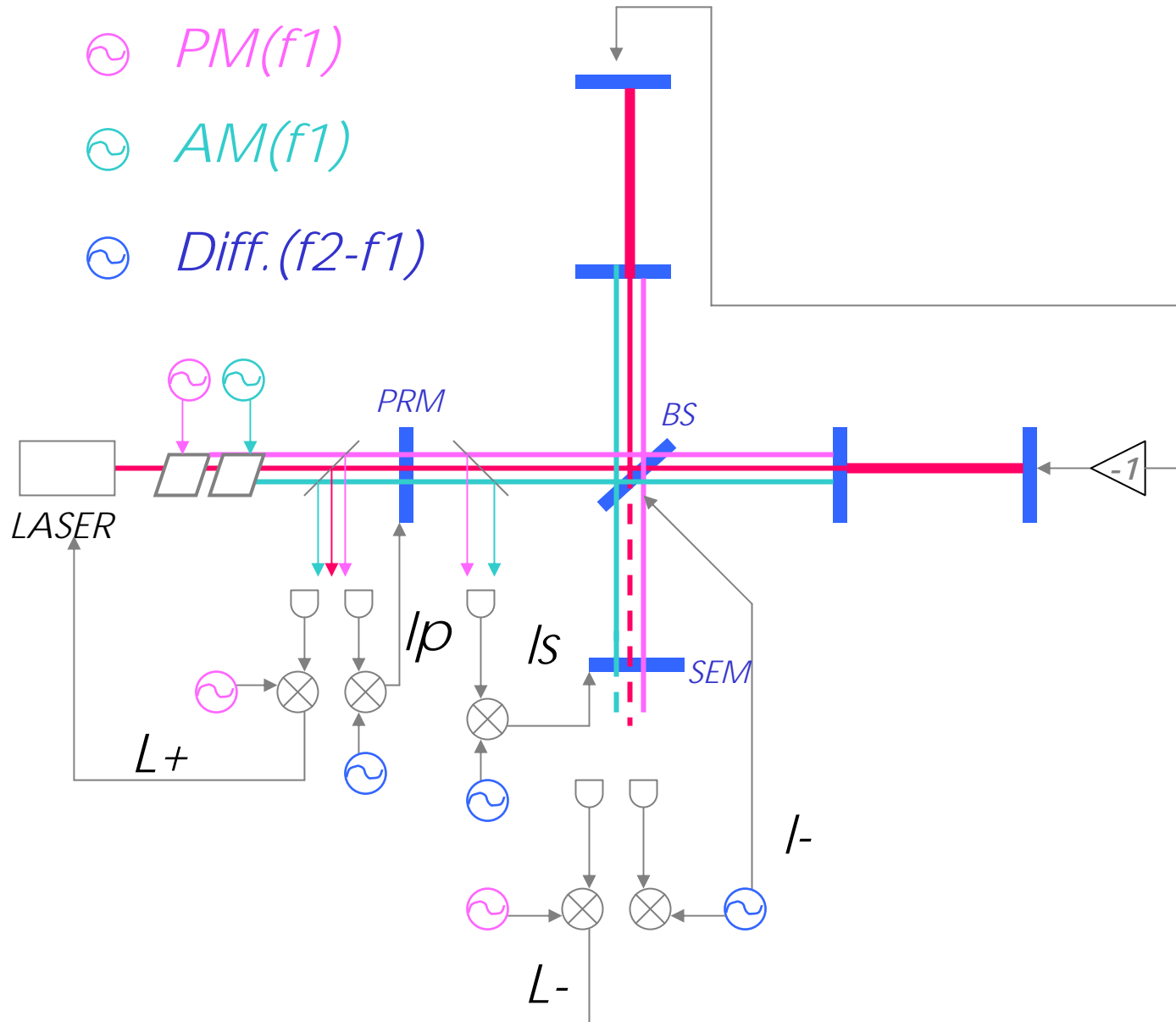
$$I_p = (I_x + I_y) / 2$$

$$I_- = (I_x - I_y) / 2$$

$$I_s = (I_{sx} + I_{sy}) / 2$$



Control Scheme

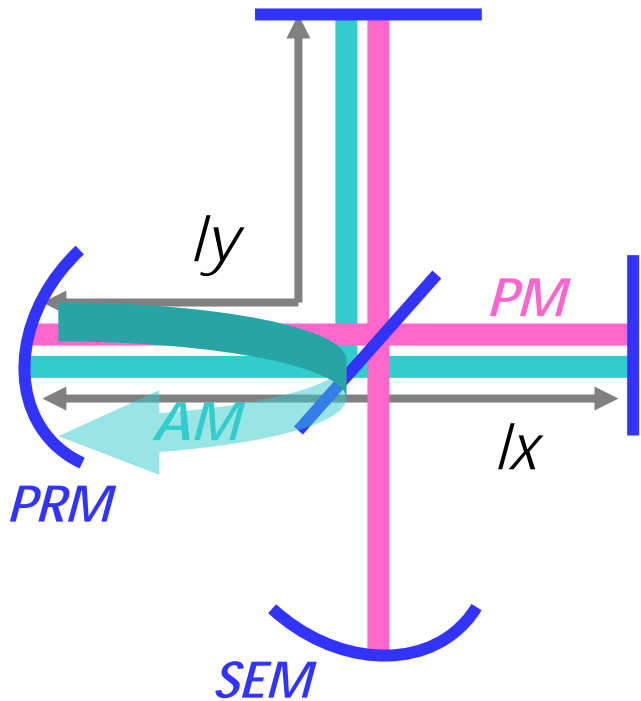


Experimental Parameters

- *Michelson Asymmetry*
- *Recycling Cavity Lengths*
- *Sideband Frequencies*
- *Other Parameters*

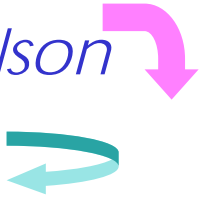
Michelson Asymmetry dl

$$dl = (l_y - l_x) = 3.5m$$



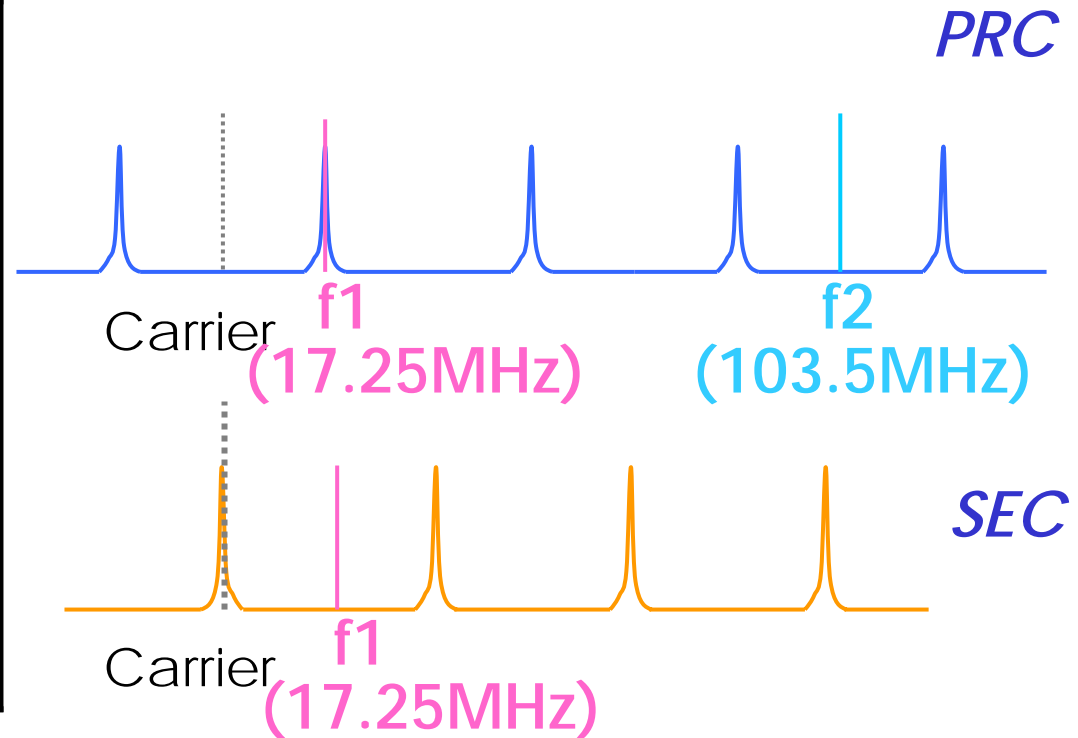
	dl / λ
$f_{PM} (17.25MHz)$	1/2
$f_{AM} (103.5MHz)$	3

PM transmit through Michelson
AM reflect from Michelson



Recycling Cavity Lengths

	Length
<i>Power Recycling Cavity</i>	4.34 m
<i>Signal Extraction Cavity</i>	4.34 m

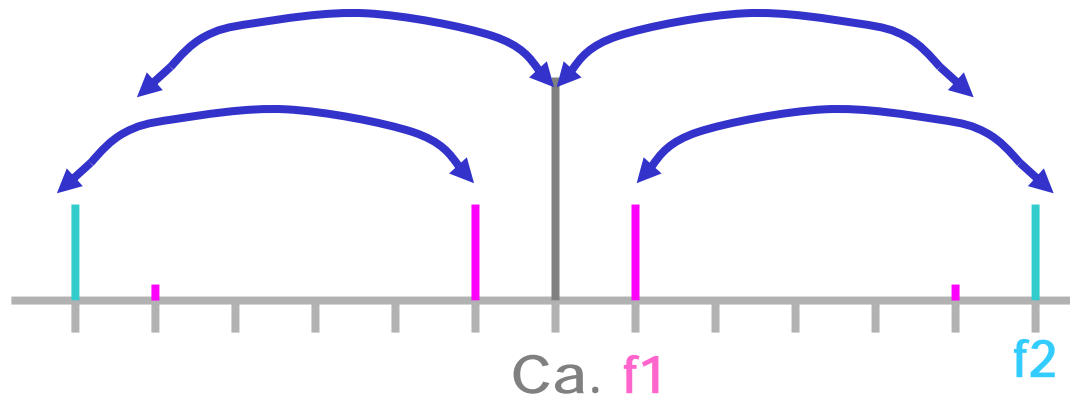


Transmission curves of *PRC* and *SEC*

Sideband Frequencies

When $n = 6$

*4th order of the f_1
sidebands...small enough*



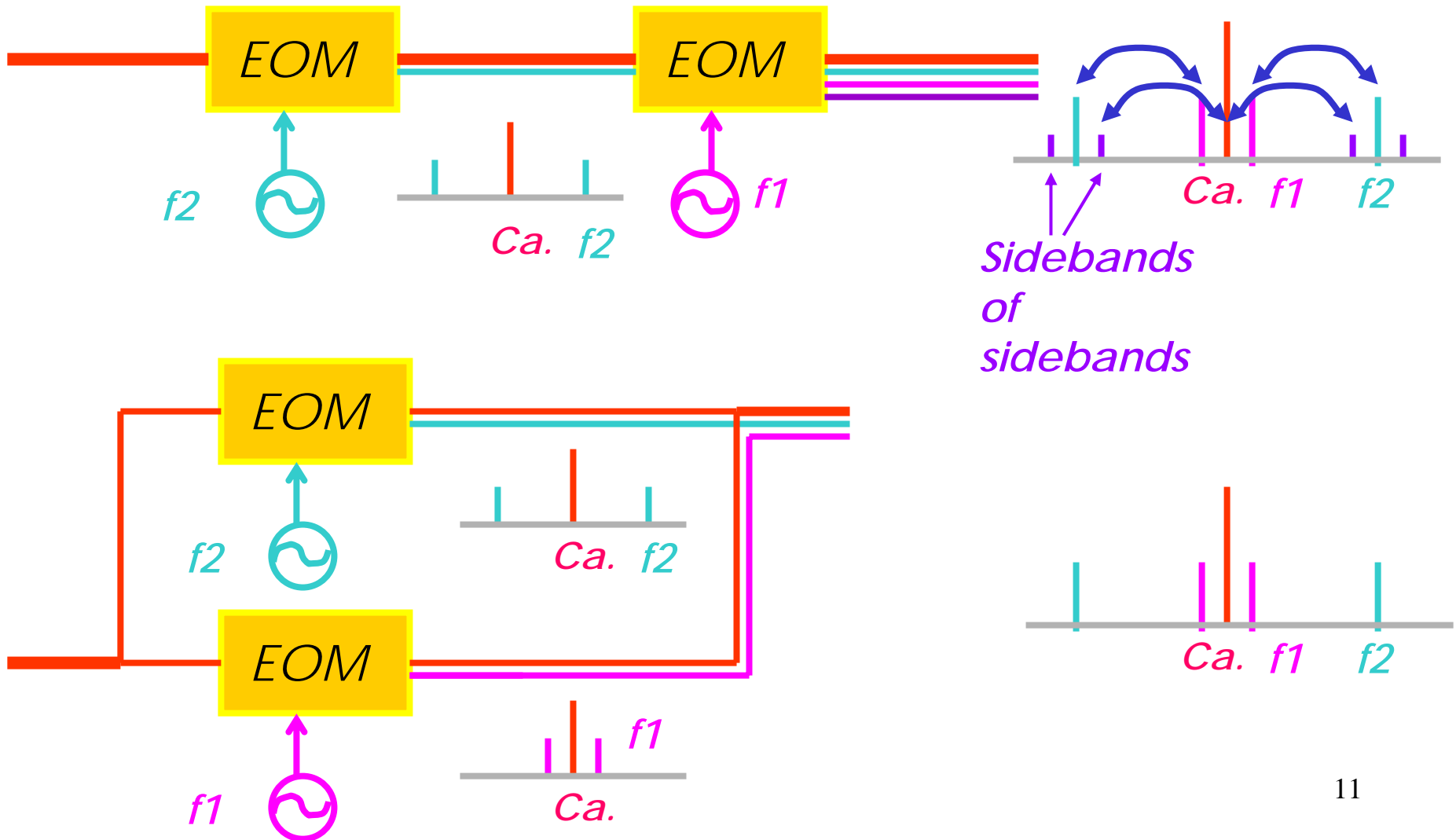
Clear beat signal between f_1 & f_2

Other Parameters

<i>Arm finesse</i>	<i>122</i>
<i>Power recycling gain</i>	<i>15</i>
<i>Arm length</i>	<i>4.05m</i>

Mach-Zehnder

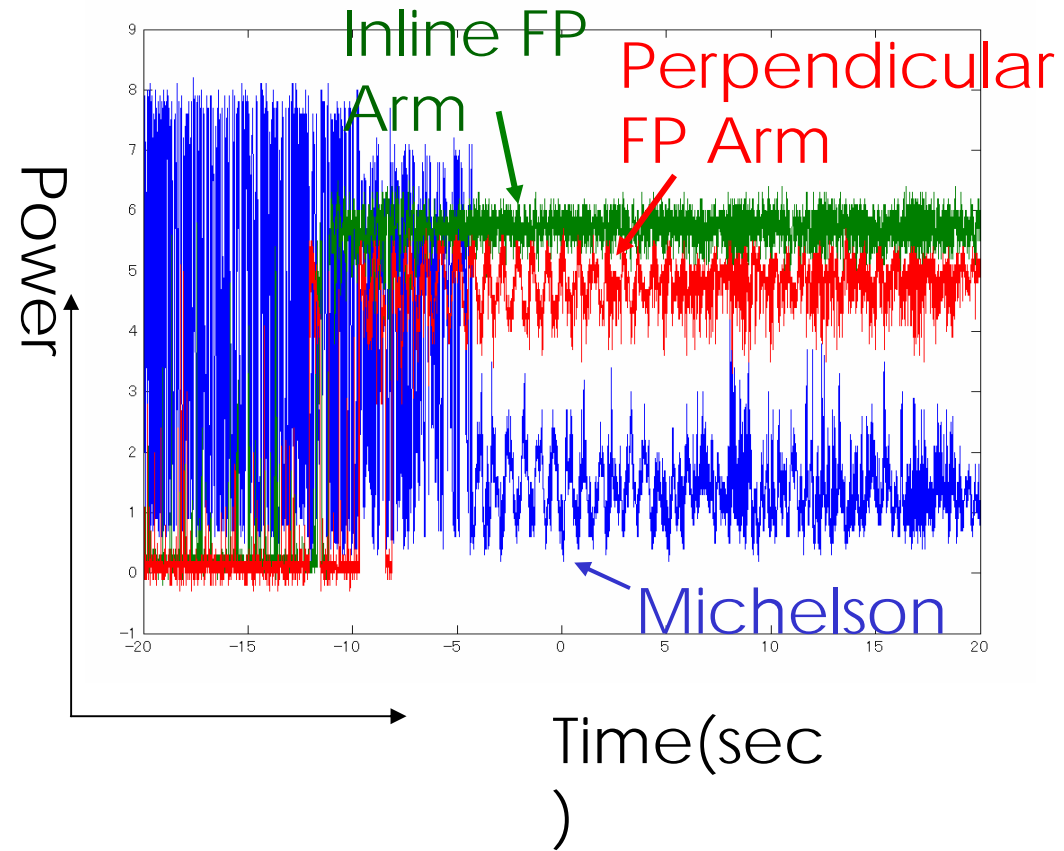
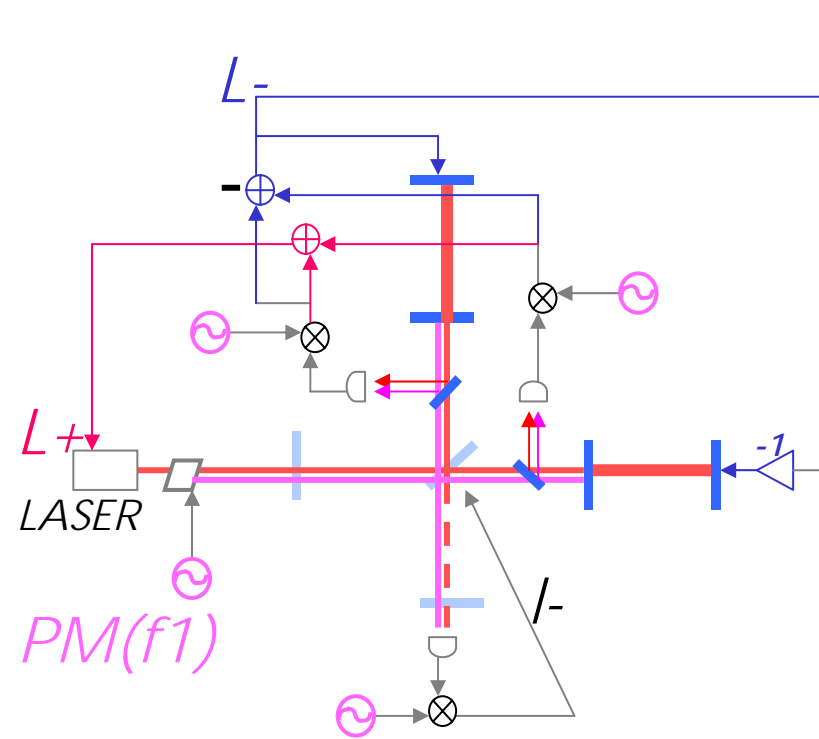
To avoid SBs of SBs



Current Status

- *FPMI Locked(single demodulation)*
- *Redesign of a Suspension System*
- *MZ Lock (w/o AM EOM in)*
- *Ready for Double Demodulation*

FPMI Locked

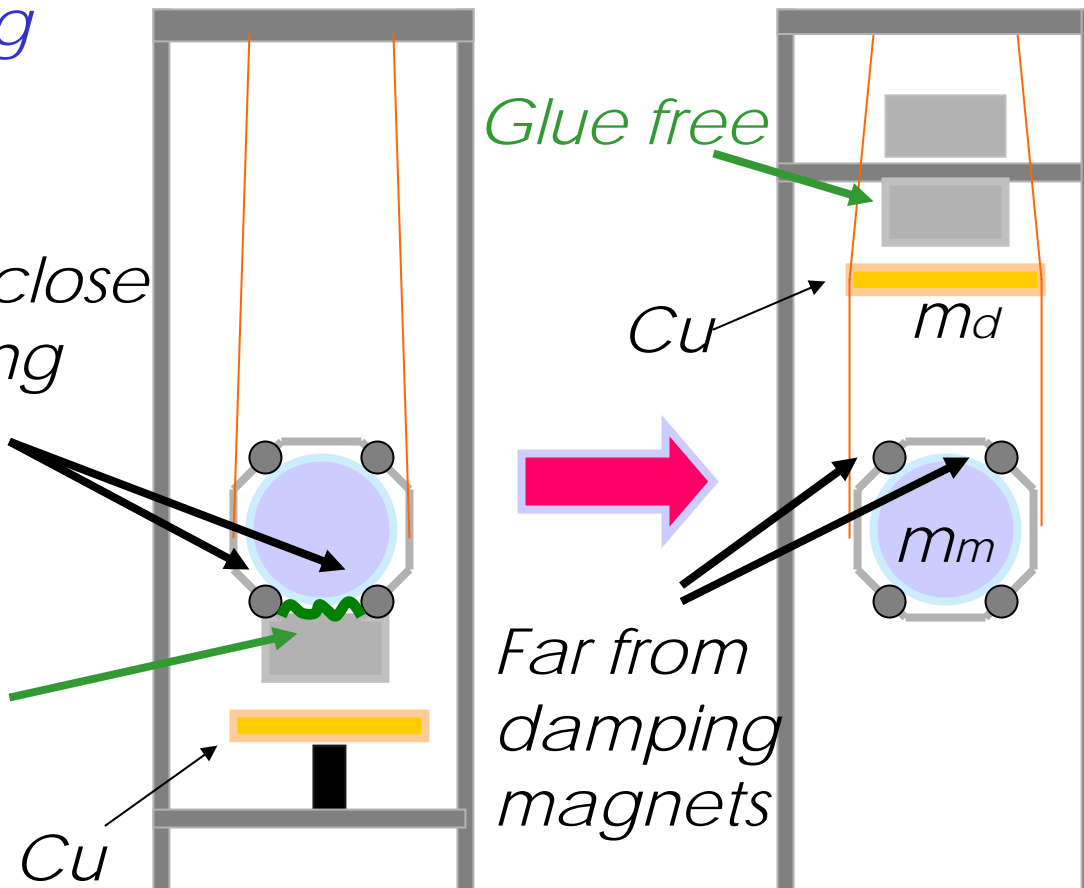


Redesign of a Suspension System

Uses Eddy Current Damping

Actuator magnets close to damping magnets


Damping magnets glued



$l_d = l_m$
 $m_d = m_m$
 Q of Pitch 15
 Q of Yaw 7

Coupling between Pitch and Yaw fixed

Schedule



<i>July</i>	<i>Lock Michelson on double demodulation</i>
<i>August</i>	<i>Lock Arms with L- from Dark Port</i>
<i>September</i>	<i>Put in Power Recycling Mirror</i>
<i>October</i>	<i>Lock PRFPMI</i>
<i>November</i>	<i>Put in Signal Extraction Mirror</i>
<i>December</i>	<i>Lock full RSE</i>
<i>2007</i>	<i>Noise characterization, Test Delocation Scheme</i>

Summary

Control Scheme

- *Single modulation and demodulation for FP arms*
- *Double modulation and demodulation for the central part of the IFO*

What Has Been Done

- *Have locked FPMI on single demodulation*
- *Redesigned the suspension system*
- *Mach-Zehnder locked*
- *Double Demodulation getting ready*