

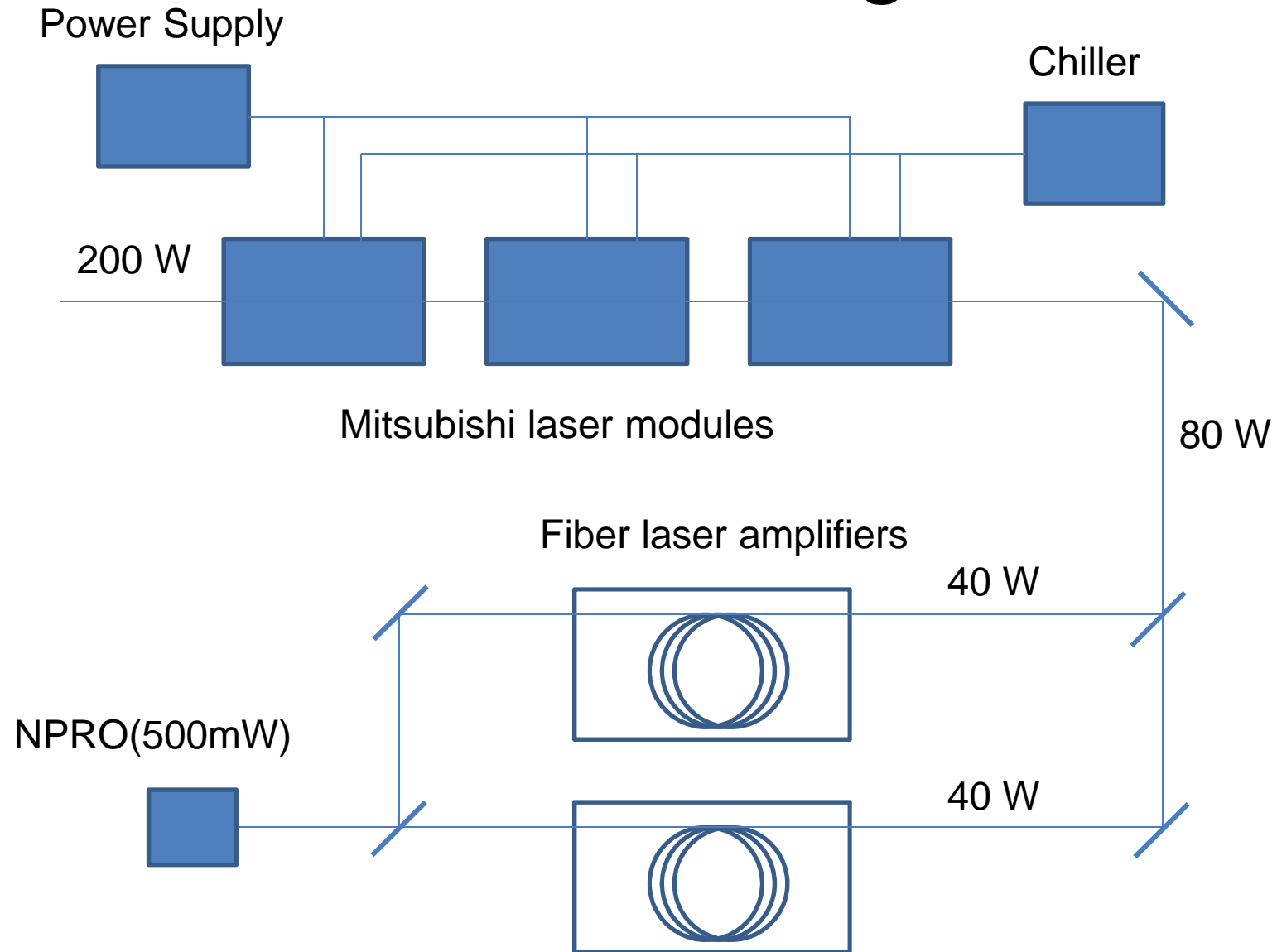
LCGT f2f Meeting Laser & Mirror

4 August, 2011

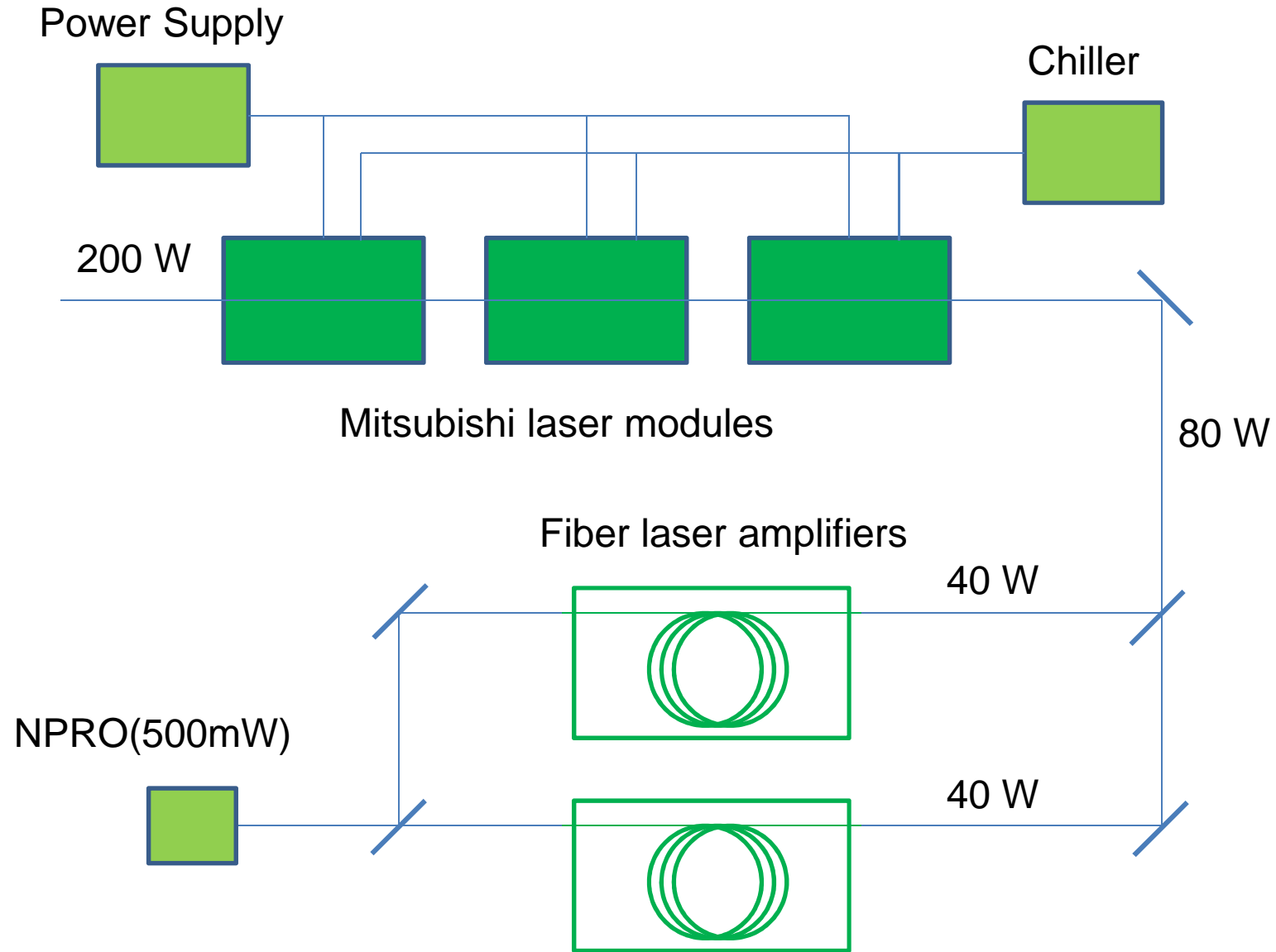
Norikatsu Mio
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Laser

Current design



Current Status



Light Green: Obtained

Green: Ordered

Laser

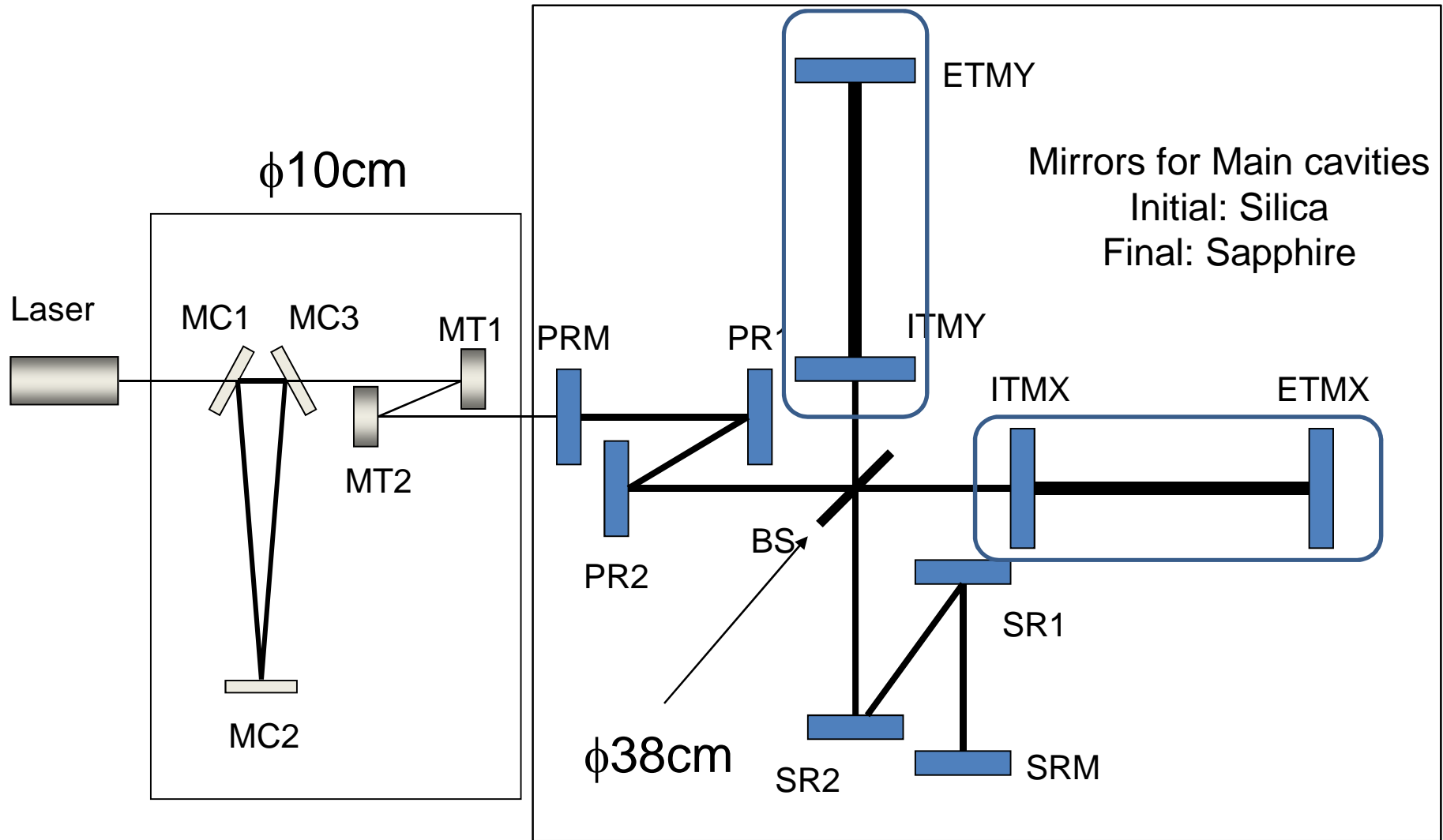
- Most of the main elements will be obtained by the end of this FY.
- Discussion will start with a company that will assemble the laser system using Mitsubishi modules and fiber amplifiers, soon.
- The first laser will be hopefully completed at the end of FY 2012 (March, 2013).
- Green lasers used for “GREEN-LOCK” will be prepared at the end of this FY; a commercial laser (Innolight PROMETHEUS) is the candidate.

Items to be tested

- Performance of the fiber amplifier
 - 10-W one is OK but 40-W one has not been tested.
- Performance of the coherent addition system
 - The fringe contrast, phase stability and so on.
- Performance of the laser module when used as an amplifier.
 - Optimization of the beam profile for obtaining the best amplification performance.
 - Polarization stability, noise level should be tested.
- Fix the specifications for the control system (interfaces to a PC and other systems)
 - Discussion about the assembling with a company is necessary.
- **The list has not been revised!**

Mirror

Mirror



Mirror

- Substrates(Silica, Sapphire)
- BS
- MC mirrors
- Polish & Coating & Measurement
- iLIGO Mirrors => Hirose
- Mirror evaluation => Hirose

Substrate (Silica)

- AGC AQ and AQ2 will be used.
- BS ($\phi 38\text{cm}$ x $t 12\text{cm}$, AQ2): obtained!
- MC ($\phi 10\text{cm}$ x $t 3\text{cm}$, AQ2 and AQ): obtained!
- Delivery was delayed owing to the earthquake because the factory of AGC is located in Koriyama (郡山).
- New substrates for ITMs ($\phi 25\text{cm}$ x $t 10\text{cm}$, AQ2) have been ordered.

Substrate (Sapphire)

- A-axis crystal ($\phi 25\text{cm}$ x $t15\text{cm}$) has been ordered.
- Max size of C-axis crystal is now $\phi 22\text{cm}$ x $t15\text{cm}$; this size is limited by the height of the boules.

Response from CSI at the beginning of 2011

– Current Max size of

- C-axis mirror: $\phi 20\text{cm}$ x $t15\text{cm}$
- A-Plane mirror: $\phi 25\text{cm}$ x $t15\text{cm}$

“With time we feel can develop larger C-axis sapphire slabs to achieve your goal of 25cm x 15cm sapphire mirrors with our HEM growth process.”

Absorption is still unclear; new small samples are being AR-coated. We need further days for obtaining the information (improved or not).

BS

- BS (ϕ 38cm x t12cm, AQ2): obtained!
- Its fabrication (Polish and Coating) will be done by CSIRO in Australia; CSIRO can do it after January or February in 2012.
- We have not obtained the quotation.
- CSIRO asked whether the thickness of 12 cm is really needed; the thickness was determined to make the mass of BS 30 kg that is the same as the OLD sapphire mirror.
- To obtain large aperture, thinner is better.

- The thickness of BS should be changed to 8cm.

MC Mirrors Spec Sheet

input & output mirror					
	Number	2			
	Material	Silica	AGC AQ2		
	Diameter	100 mm			
	Thickness	30 mm			
S1(HR)					
	Curvature Radius	Flat			
	Wedge	None			
	Surface figure	$\lambda / 20$			
	Clear Aperture	90 %			
	SurfaceRoughness	0.5 nm	Central part within 3cm		
S2(AR)					
	Curvature Radius	flat			
	Wedge	2.5 deg			
	Tolerance of Wedge	± 0.1 deg			
	Surface figure	$\lambda / 20$			
	Clear Aperture	90 %			
end mirror					
	Number	1			
	Material	Silica	AGC AQ		
	Diameter	100 mm			
	Thickness	30 mm			
S1(HR)					
	Curvature Radius	40.0 m			
	Tolerance of CR	± 0.2 m			
	Surface figure	$\lambda / 20$			
	Clear Aperture	90 %			
	SurfaceRoughness	0.5 nm	Central part within 3cm		
S2(AR)					
	Curvature Radius	flat			
	Wedge	2.5 deg			
	Tolerance of Wedge	± 0.1 deg			
	Surface figure	$\lambda / 20$			
	Clear Aperture	90 %			

Specifications of MC mirrors have been fixed by Telada-san.

MC mirror

- We have asked to make the quotation to a few companies.
- “ $R=40\text{m} \pm 0.2\text{m}$ ” is one problem; to determine the absolute value of R is not so easy.
- Same problem may appear when PR3 will be fabricated. => Special care is necessary.

Polish & Coating & Measurement

- Discussion with members of AIST-NMIJ has started; a mirror used in LISM ($R=30$ m) will be sent to NMIJ to evaluate the absolute of its curvature radius.
- Memorandum for the collaboration about the polishing with Riken group has fixed.
- Test facilities for optical absorption and optical scattering are being developed.
- We are still looking for the facilities for polishing and coating.

By Hirose

Importing LIGO mirrors

1. Very first BRT is about to leave Hanford site, and two more will be shipped.

[Thanks to Terry Santini and Keita Kawabe at LHO!](#)

2. As for large optics (ITM, ETM, etc), we requested 11 mirrors, and are waiting for their response.

[Quote: David Shoemaker's email on July 22](#)

[“Eiichi, thanks; Gari and I will work through this and get back to you soon. David”](#)

Serial No	Location	ROC(km)
ETM01	WA4K-X	7.26
ETM02	WA4K-Y	7.32
4ITM05	WA4K-X	13.9
4ITM06	WA4K-Y	13.6
ETM03	Metrology Lab	7.17
SPETM01	OTF Lab	8.87-Unc
SPETM02	OTF Lab	9.06-Unc
SPETM03	WA2K-Y	8.21
SPETM04	Metrology Lab	8.38-Unc
SPETM06	WA2K-X	8.36
SPETM08	OTF Lab	8.49-Unc

NOT CONFIRMED YET

Measuring things



<http://cweb.canon.jp/indtech/zygo/index.htm>

Items	@	references
Substrate ROC, roughness	AIST, ICRR	Takatsuji/Bitou/Kondo
absorption	Mio Lab	Watanabe
Coating scattering loss	ICRR	Moriwaki
Coating reflectivity	ICRR	Miyoki
coating mechanical Q	KEK	Yamamoto/Suzuki(KEK)
Coating research	NAOJ	Tatsmi/Ueda

These are all under way to make selections for polishing and coating.