



BS and Mirrors for the LCGT

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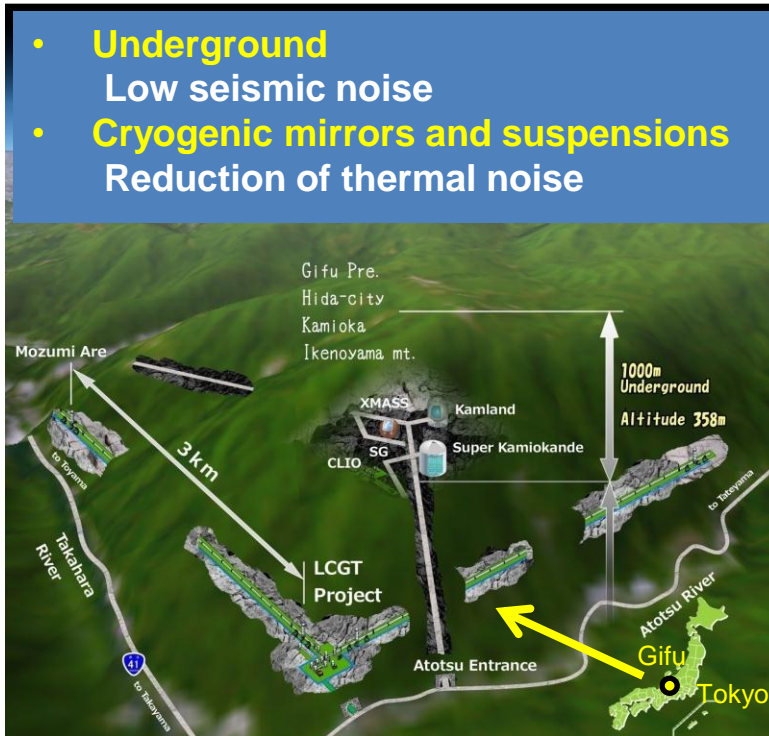
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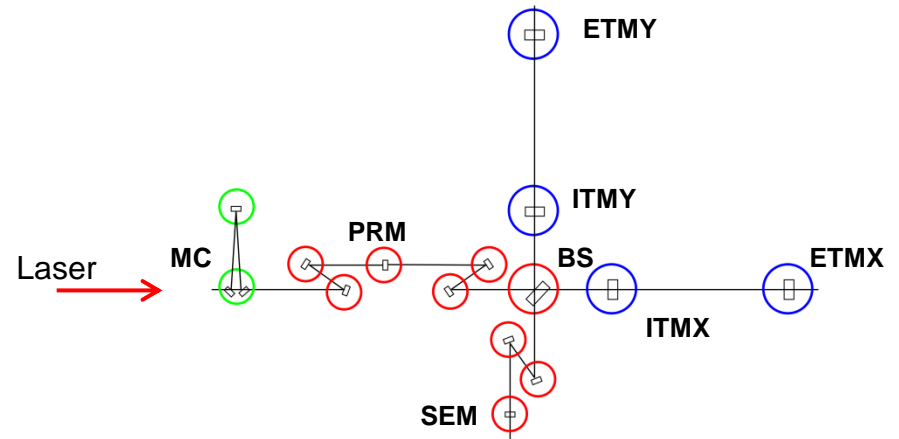
LCGT

- **Underground**
Low seismic noise
- **Cryogenic mirrors and suspensions**
Reduction of thermal noise



1st stage: **Room-temp. Operation**
→ **Silica TM (ITM and ETM)**

2nd stage: **Cryogenic Operation**
→ **Sapphire TM**

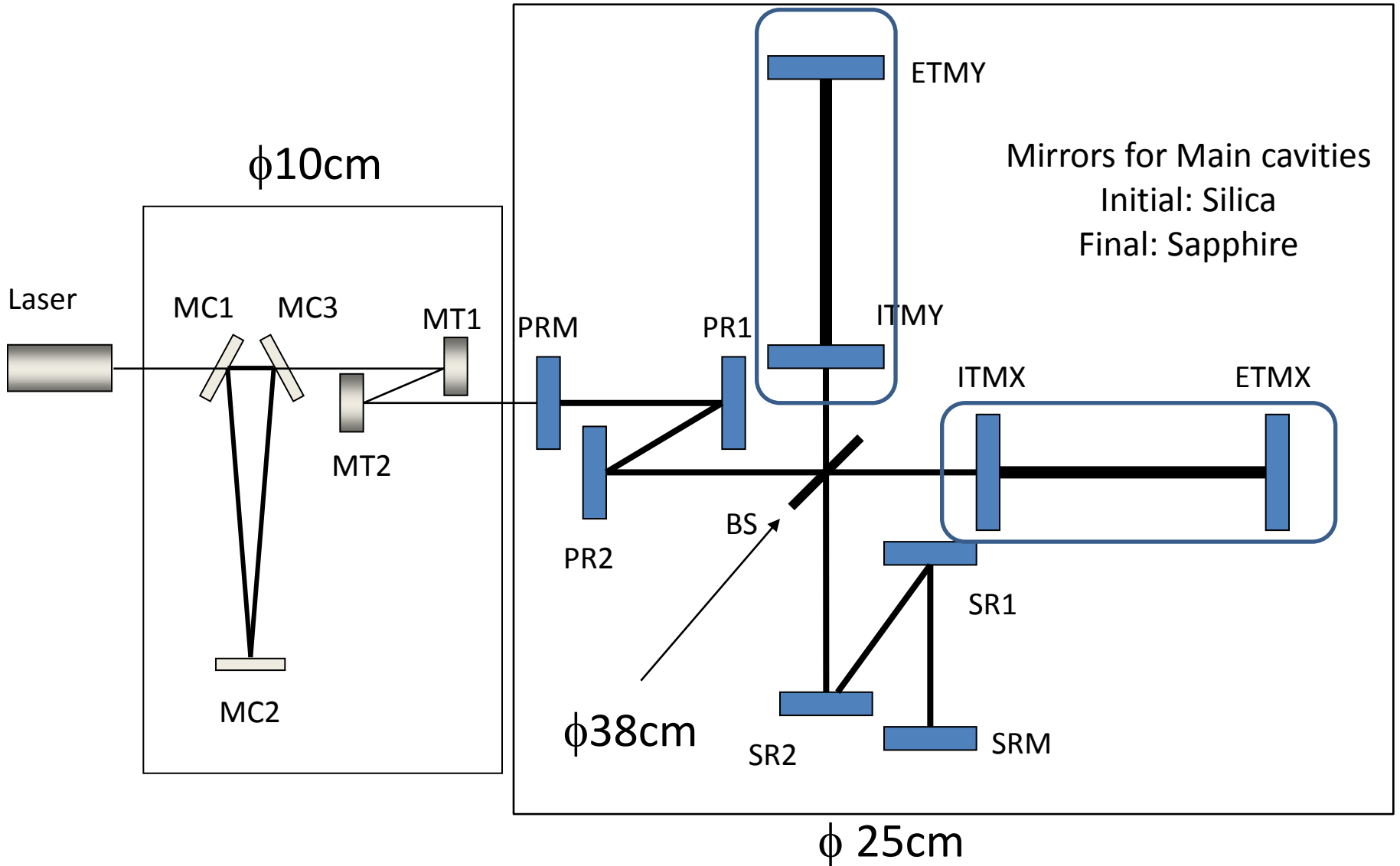


We would like to discuss possibility that CSIRO fabricates BS and possibly silica TMs

Overview of LCGT mirrors

- iLCGT
 - Room temperature
 - Silica mirrors
 - Modest laser power(<10W?)
 - Limited time for construction
- bLCGT
 - Cryogenic system
 - Sapphire mirrors
 - High power laser
 - Recycling system

Core optics of LCGT

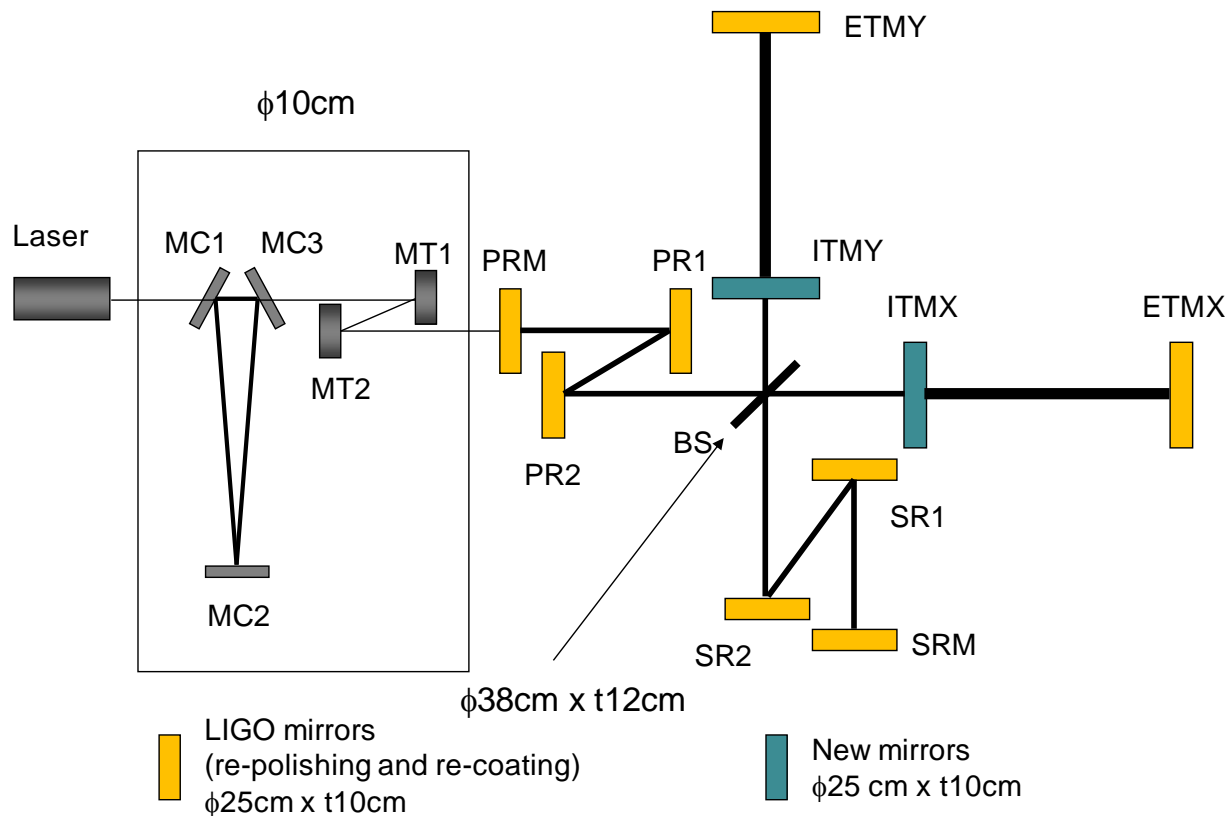


Requirements for iLCGT mirrors

- iLCGT
 - Room temperature
 - Silica mirrors
 - Modest laser power(<10W?)
 - Limited time for construction
 - Size of the mirrors for the main interferometer
 - 25cm in diameter 10cm in thickness
 - Most of them will be made from iLIGO mirrors

Current Plan

- For iLCGT, the size of the mirrors is chosen as that of iLIGO's mirror.
- BS and ITMs will be newly fabricated from Japanese Silica.
- We have obtained some of the iLIGO mirrors.



Beam Splitter

Substrate	Silica	AGC(Asahi Glass Corporation), AQ2
Diameter	38cm	
Thickness	8cm	
Wedge (S2 side)	0.383° ($\pm 0.008^\circ$)	
Incident angle	45.15° ($\pm 0.05^\circ$)	
Transmission @ 1064nm	50% ($\pm 1\%$)	
Transmission @ 532nm	> 0.9	
S1	S-state Beam Splitter	
ROC	Flat (> 100km)	as flat as possible
Astigmatism Z22	8nm	
LSF(<1mm ⁻¹) @ r < 100mm	2nm	
LSF(<1mm ⁻¹) @ r < 170mm	3nm	
HSF (Micro Roughness, >1mm ⁻¹)	0.3nm	
Loss @ 1064nm	< 100ppm	
Loss @ 532nm	< 1%	
S2	AR	
ROC	Flat (> 100km)	as flat as possible
LSF(<1mm ⁻¹) @ r < 100mm	2nm	
LSF(<1mm ⁻¹) @ r < 170mm	4nm	
HSF (Micro Roughness, >1mm ⁻¹)	0.5nm	
Reflectivity @ 1064nm	< 50ppm	
Reflectivity @ 532nm	< 5%	

ITM

Substrate	Silica	AGC(Asahi Glass Corporation), AQ2
Diameter	25cm	
Thickness	10cm	
Wedge (S2 side)	0.2° (±0.002°)	
Transmission @ 1064nm	0.004(+0.001/-0)	
Transmission @ 532nm	0.2(±0.1)	Transission of ITM must be larger than ETM @ 532nm
Transmission asymmetry @ 1064nm	< 0.01	2* (T1-T2)/(T1+T2) where T1, T2 are transmission of ITMX, ITMY
Transmission asymmetry @ 532nm	No requirement	
S1	HR	
ROC	1.68km(±0.008km)	0.5% error
Astigmatism Z22	3nm	
LSF(<1mm-1) @ r < 70mm	0.5nm	
LSF(<1mm-1) @ r > 70mm	2nm	
HSF (Micro Roughness, >1mm-1)	0.16nm	
Loss @ 1064nm	< 45ppm	
Loss @ 532nm	< 1%	
S2	AR	
ROC	Flat (> 100km)	as flat as possible
LSF(<1mm-1) @ r < 70mm	2nm	
LSF(<1mm-1) @ r > 70mm	4nm	
HSF (Micro Roughness, >1mm-1)	0.5nm	
Reflectivity @ 1064nm	200ppm (+100/-0ppm)	
Reflectivity @ 532nm	< 5%	as small as possible

ETM

Substrate	Silica	ETMs used in initial LIGO (@LLO)
Diameter	25cm	
Thickness	10cm	
Wedge (S2 side)	$0.2^\circ (\pm 0.002^\circ)$	
Transmission @ 1064nm	$5\text{ppm} < T < 10\text{ppm}$	
Transmission @ 532nm	$0.2(\pm 0.1)$	Transission of ITM must be larger than ETM @ 532nm
Transmission asymmetry @ 1064nm	< 0.01	Best effort
Transmission asymmetry @ 532nm	No requirement	
S1	HR	
ROC	$1.87\text{km} (\pm 0.009\text{km})$	0.5% error
Astigmatism Z22	3nm	
LSF($<1\text{mm}^{-1}$) @ $r < 70\text{mm}$	0.5nm	
LSF($<1\text{mm}^{-1}$) @ $r > 70\text{mm}$	2nm	
HSF (Micro Roughness, $>1\text{mm}^{-1}$)	0.16nm	
Loss @ 1064nm	$< 45\text{ppm}$	
Loss @ 532nm	$< 1\%$	
S2	AR	
ROC	Flat ($> 100\text{km}$)	as flat as possible
LSF($<1\text{mm}^{-1}$) @ entire surface	40nm	
HSF (Micro Roughness, $>1\text{mm}^{-1}$)	2nm	
Reflectivity @ 1064nm	$200\text{ppm} (+100/-0\text{ppm})$	
Reflectivity @ 532nm	$< 5\%$	as small as possible

Schedule

- BS
 - Delivery: March, 2013
 - Contract: February or March, 2012 ?
 - Arm Mirrors
 - Delivery: March, 2014 (?)
 - Contract: some day in 2013 (?) or 2012??
- Formal budget will be funded by the end of FY2012 (March, 2013); the extension is maybe possible.

Things to be discussed

- Specification (both BS and TMs)
- Quotation (delivery date, cost etc)
- Contract
(representative in Japan, deposit etc)
- Any other items