LASER INTERFEROMETER GRAVITATIONAL WAVE OBSERVATORY

LIGO Laboratory / LIGO Scientific Collaboration

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Report on Gingin Advisory Committee Meeting of June 28, 2010

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LIGO Science Collaboration

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In attendance: Committee – Gregg Harry, Bill Kells, Stefan Gossler, Muzammil Arain (muted)

Gingin – David Blair, Chunnong Zhao, Jean-Charles Dumas, Ju Li, Jackie Davidson

Administrative notes: Garilynn Billingsley has tendered her resignation from the Committee. Aidan Brooks has jointed the Committee. Gregg Harry has stepped down as chair of the Committee but will remain a member. Stefan Gossler has agreed to take over as chair of the Committee. A suggestion was made by the Gingin team that recruiting a Committee member from the Glasgow gravity wave group would be valuable.

The Gingin team lead the committee through slides, G1000655-v1.

Specific topics and committee observations:

1. Further collection of seismic data at Gingin.

Jean-Charles Dumas has been gathering further seismic data at the Gingin site, and has found higher vertical noise than expected. This is believed to be connected to a building slab not being well connected to the ground, and thus acting like a diaphragm and giving resonant enhancement at low frequencies. This excess vertical noise is better on the "yellow floor" compared to the "blue floor", which are on different slabs. The yellow floor is the one where most of the Gingin instruments are sitting. No excess in vertical noise is seen away from the building. There is some suspicion that the fans in the HEPA filters may be contributing to this excess noise, but no evidence that wind is a cause. Wind does increase the overall seismic noise by up to an order of magnitude, but the excess vertical noise is seen regardless of wind conditions.

The committee supports continuing work on understanding the seismic environment and specifically on getting a better model of the behavior of the building slabs.

2. Change in springs in east arm seismic isolation.

Work is continuing on replacing the vertical isolation in the east arm because the previous isolation system was seen to have unacceptable creep. All springs in the input chamber that supports the east arm ITM have been changed. A decision was made to not replace the springs in the end chamber at this time, as the ITM change should allow enough improvement that any creep will be within the control margin of the cavity. This will be carefully observed, and the ETM springs replaced if necessary. The cavity is ready for lock tests, which will begin in the next few weeks. Ultimately the laser will be locked to a reference cavity, but this will likely be after a change in the ETM springs.

The committee supports this approach of proceeding with cavity tests in the near future, but planning for replacement of the ETM springs at some point.

3. Adelaide high power laser

The Adelaide high power laser is not installed, but there is currently a plan for an August installation. There are concerns that installation dates have slipped before, but a relatively hard limit is approaching. This is when Dave Hoskins is planning to leave Adelaide, October of 2010.

There has been significant progress in upgrading the laser room at Gingin, including improving the HEPA filter system for better cleanliness, temperature and humidity control, and vibration levels as well as a design for a safety system that is being prepared and installed. The laser itself has shown around 40 W in tests at Adelaide.

The committee suggests that both the Gingin team and the Adelaide group make installing the laser at Gingin a priority over the next few months.

4. Three mode interaction as thermal noise transducer in south arm

The Gingin team is doing experiments using the three mode interaction between acoustic and optical cavity modes as a transducer to see thermal noise excitation of mirror resonances. It is estimated that this technique can achieve a sensitivity of 10^{-17} m/√Hz, and it has been demonstrated on a mode near 180 kHz with a Q of 10^6.

The committee feels this is an interesting experiment, and encourages the Gingin team to continue to explore this effect. However, we feel it should not be allowed to interfere with progress being made on higher priority projects. The committee also suggests discussions with Slawek Gras at MIT, who is making dampers to reduce the Q of high frequency test mass modes as a way of dealing with parametric instability. These dampers could be used at Gingin to alter mode Q's to study their effect on modal thermal noise.

5.New test masses for east arm

New test masses made of fused silica are in hand at Gingin. It had been hoped they could be installed in the east arm, but amount of work needed to get the seismic isolation working had been underestimated, so the silica mirrors are not currently installed. Once the NPRO laser can be locked to the east arm cavity and the low frequency residual motion of the seismic isolation can be reduced, the silica mirrors will be installed. The current schedule has this planned for September-October 2010.

6. Local readout interferometer in south arm

Planning is beginning for measuring the transfer function between the south arm ETM and ITM when light in the cavity between them creates an optical spring. This would allow for study of ways to beat the standard quantum limit proposed by Yanbei Chen and collaborators. Current thinking is to start with a simple HeNe laser interrogating the ITM position locally, independent of the cavity and correlating it with a drive signal applied to the ETM.

The committee supports this level of effort on this interesting and potentially useful phenomenon. Once more detailed plans are in place including ideas on scheduling, the committee will consider the value of this research relative to other uses of Gingin and make a recommendation about relative priorities.