

KAGRA MIF Status Report

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(Almost) Done

- Main interferometer design
 - mirror specs (RoC, reflectivity, etc)
 - lengths, layout
 - signal extraction scheme, length/alignment control
- Noise requirements for IFO components
 - mirror displacement noise [VIS]
 - laser intensity/frequency noise [IOO, LAS]
 - modulation phase/amplitude noise [IOO]
 - scattered light [AOS]
 - beam jitter [IOO]
- MIF Design Document [JGW-T1200913](#)
- Y. Aso, Y. Michimura, K. Somiya *et al.*,
[PRD 88, 043007 \(2013\)](#)

Needs to be Done

- Initial alignment procedure
 - how do we put mirrors and point the beam
- Commissioning procedure
 - intermediate steps
 - lock acquisition (also for intermediate steps)
- Suspensions, laser, input optics, analog electronics, etc, which meet MIF requirements
 - we *always* have to check the requirement before production!! (ask me if MIF requirements are unclear)
 - don't forget about the range requirements also
- Output optics
- Calibration of GW signal

On Going

- Suspension controls design [Sekiguchi, Ono]
 - actuator noise: [JGW-T1503453](#), magnetic noise: [JGW-T1503469](#)
 - local damping (requirements?)
- PMC design [Nakano, UToyama]
 - plan: [JGW-G1503515](#)
 - check RF intensity noise, beam jitter
- RF modulation [Uehara, NiigataU, Somiya]
 - plan: [JGW-D1503189](#)
- Laser frequency stabilization servo design [Aso]
 - plan: [JGW-T1503330](#), [JGW-D1402908](#)
 - reference cavity: [JGW-T1503493](#)
- Laser intensity stabilization servo design [UToyama]
 - reference cavity: [JGW-D1503389](#)
- Output optics [Shiga, Akutsu]
 - around IMC: [JGW-D1503412](#)
- Arm length stabilization [Tatsumi, Arai]

Status Chart

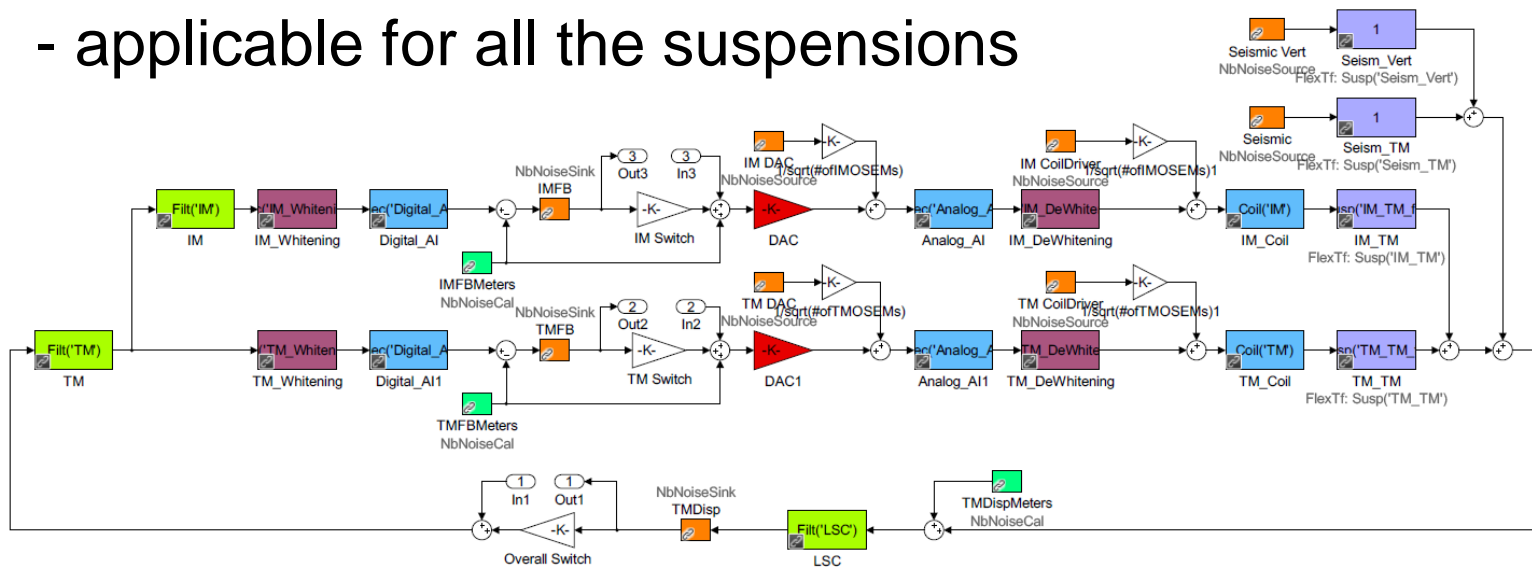
| | iK | bK | comments |
|------------|----|----|---|
| Laser | | | NPRO 2W for iK, 200W for bK. Developing 200W one. |
| PMC | | | Have to check if current design meet the requirement. |
| RefCav | | | FRC for iK, ULE for bK. Already made, but have to check the req. |
| EOM | | | High power EOM study on going. Testing start this year. |
| Periscopes | | | Newport 45. Have to check the requirement. |
| IFI | | | At Kamioka. High power testing is not fully done. |
| FSS | | | Servo model exists. Some circuits are in fabrication. |
| ISS | - | | No ISS for iK. Design study just started. |
| BRTs | | | TMS optical design study is almost done, but others are not. |
| Outputs | | | MCF/MCE tables are designed, but others are not. |
| OMC | - | | No OMC for iK. Designing and testing on going. |
| PDs | | | Boards are in fabrication. In-vac enclosures are not designed. |
| Circuits | | | Some are in fabrication, but many bK circuits are not designed. |
| Digital | | | RT models in development. |
| IMC sus | | | Placed, but mirrors are not suspended yet. |
| PR sus | | | Assembly on going. Mirrors are not delivered yet. |
| BS sus | | | No drawings for IM/TM stages. Mirror is not delivered yet. |
| SR sus | - | | No SRC for iK. Testing on going. |
| TM sus | | | In fabrication for iK. Designing cryogenic payload and mirror for bK. |

Red: (almost) no design
Orange: conceptual design
Yellow: development without detailed design / design and development at the same time
Green: in fabrication
Blue: almost ready
White: ready

iK: iKAGRA
 bK: bKAGRA

Highlights of Recent Activities

- Sapphire mirror inhomogeneity discussion with MIR
 - see [JGW-G1403015](#)
- List of analog electronics needed is made
 - see [wiki/KAGRA/Subgroups/MIF/AEL](#)
 - cables and electronics for IMC servo will be ready by June
- NoiseBudget model for suspension controls is made
 - see [JGW-T1503453](#)
 - applicable for all the suspensions



Results of Suspension Noise Model

| | Seismic | Magnetic | Actuator | Range | Comment |
|------------|---------|---------------------------|----------|---------|---|
| IMC | OK | no calc (should be OK) | OK (?) | BAD (?) | maybe actuator efficiency measurement was wrong by ~2 orders of magnitude (so, maybe the range is OK) |
| BS | OK | OK | OK | OK | |
| PRC | OK | OK | OK | OK | |
| SRC | OK | OK probably | BAD | OK | we should reduce the actuation efficiency |
| ITM ETM | OK | TBD | TBD | TBD | magnet selection on going |

- Note that magnetic noise from IM is not calculated yet