LCGT Schedule

Summary

Master schedule

- Being summarized as a default plan.
- There still are inconsistencies with subsystem plans.
- Uncertainties in excavation schedule.
  → Change in constrains??? No discussion yet.
  (iLCGT observation in Sept. 2014
  bLCGT observation in 2017.)

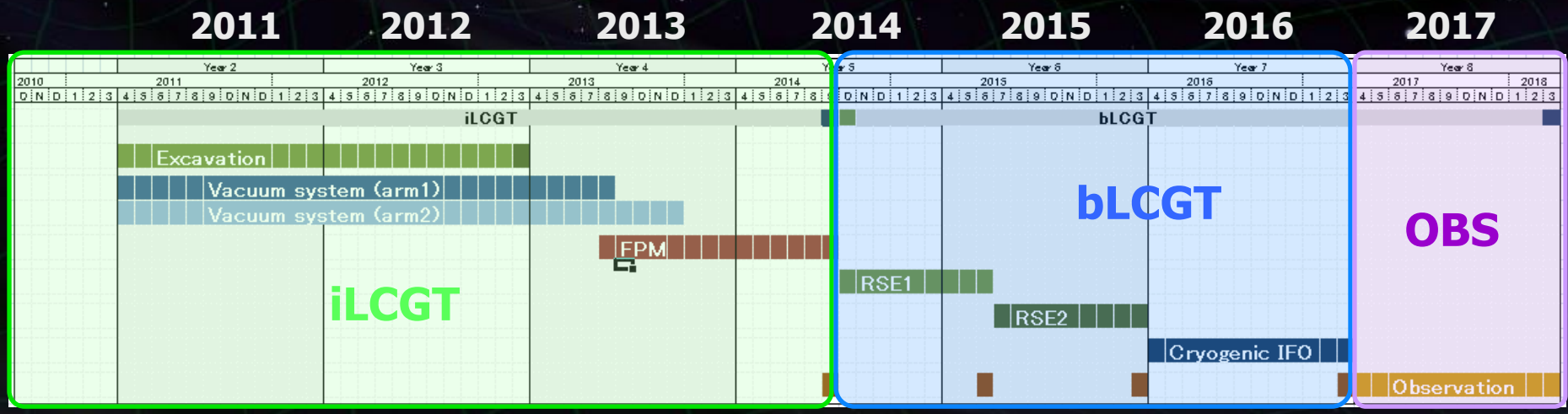
Next steps

- Subsystem bottom-up plan.
  → Interview to subsystems by SEO.
- Refine the schedule by iteration between
  the master schedule and subsystem bottom-up plans.

Master Schedule

- **iLCGT** : Stable operation with a large-scale IFO (2010.10 - 2014.9)
  - → 3km FPM interferometer at room temperature, with simplified vibration isolation system
  - ~1 month (TBD) observation run
- **bLCGT** : Operation with the final configuration (2014.10 – 2017.3)
  - → RSE, upgraded seismic isolator, cryogenic operation
- **OBS** : Long-term observation and detector tuning (2017.4 -)

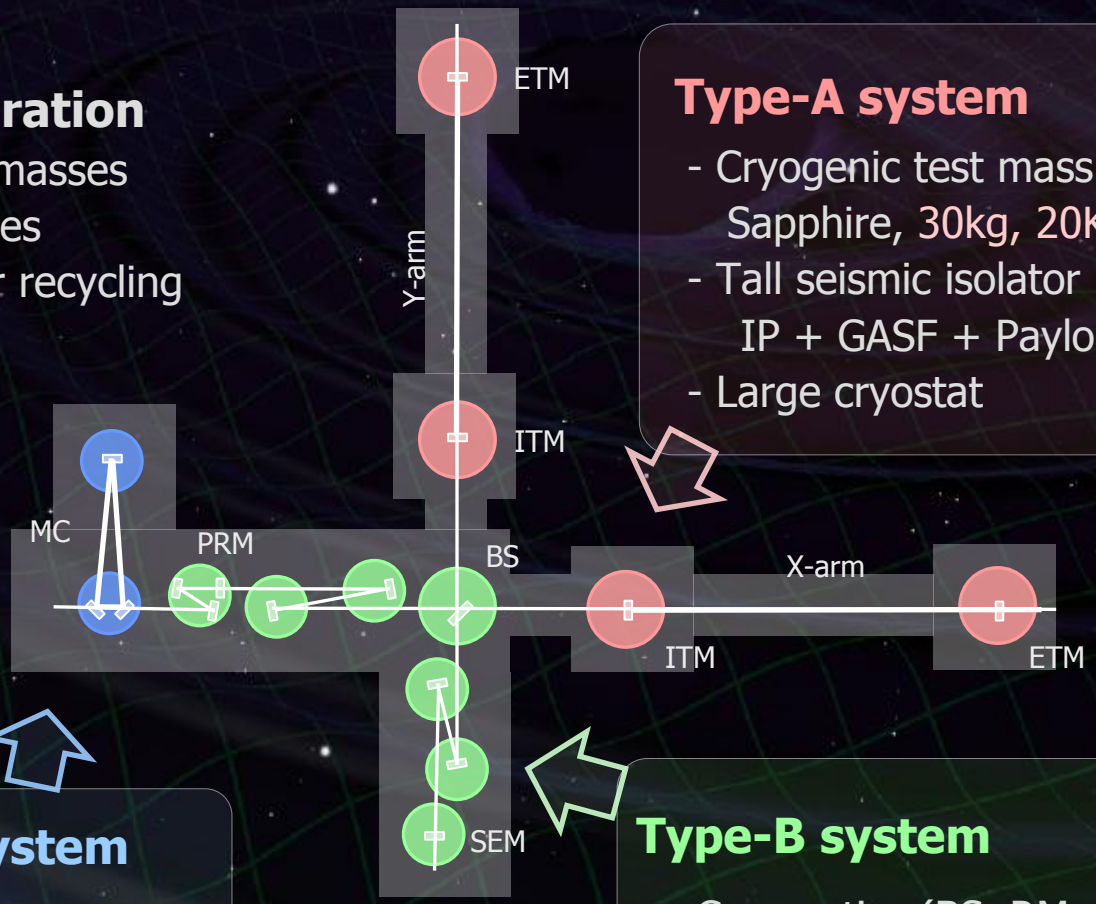
Delay in excavation start → schedule should be updated



bLCGT configuration

bLCGT configuration

- Cryogenic test masses
- 3 km arm cavities
- RSE with power recycling



Type-A system

- Cryogenic test mass
  Sapphire, 30kg, 20K
- Tall seismic isolator
  IP + GASF + Payload
- Large cryostat

Type-C system

- Mode cleaner
  Silica, 1kg, 290K
- Stack + Payload

Type-B system

- Core optics (BS, RM ,...)
  Silica, 10kg, 290K
- IP + GASF + Payload
- Stack for aux. optics

Commissioning Plan

- **LCGT schedule is extremely tight.**
  → We should reduce the amount of the on-site commissioning tasks.
  Intensive tests are required for each sub-system before installation.
  Avoid additional tasks only for intermediate steps.
  Basic policy 'Do not use LCGT as an R&D facility'.

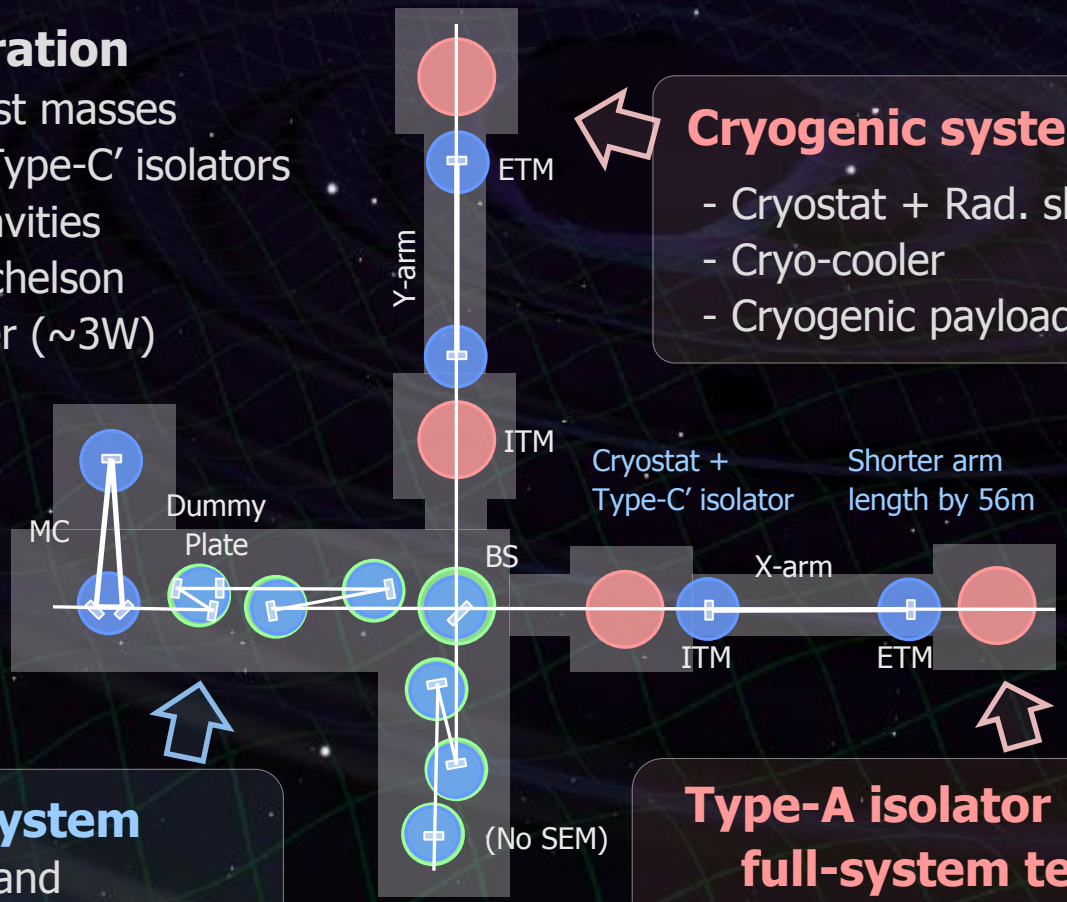
- **It is hard to test the full cryogenic test-mass system.**
  - Type-A isolator test requires a large facility and a quiet site.
  - Cryogenic system requires long test time
    for a cool-down and warm-up cycle.
  → Hard to avoid technical and schedule risks.

- **Roadmap to solve these concerns.**
  - Install ETMs in front of the original positions (by ~30 m)
    for the room-temp. interferometer commissioning.
  - Full test of the real VIS and cryogenic system at the end rooms.
  - 'Half-cryogenic' configuration step before the final bLCGT configuration.

iLCGT commissioning

iLCGT configuration

- Room-temp. test masses suspended by Type-C′ isolators
- 2.94 km arm cavities
- Fabry-Perot Michelson
- Low laser power (~3W)



Cryogenic system test

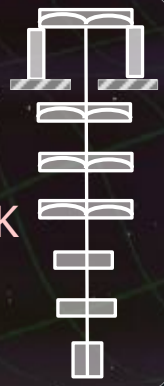
- Cryostat + Rad. shield duct
- Cryo-cooler
- Cryogenic payload (optional)

Type-C′ system

- Test mass and Core optics (BS, FM,..)
  Silica, 10kg, 290K
- Seismic isolator
  Stack + Type-B Payload

Type-A isolator full-system test

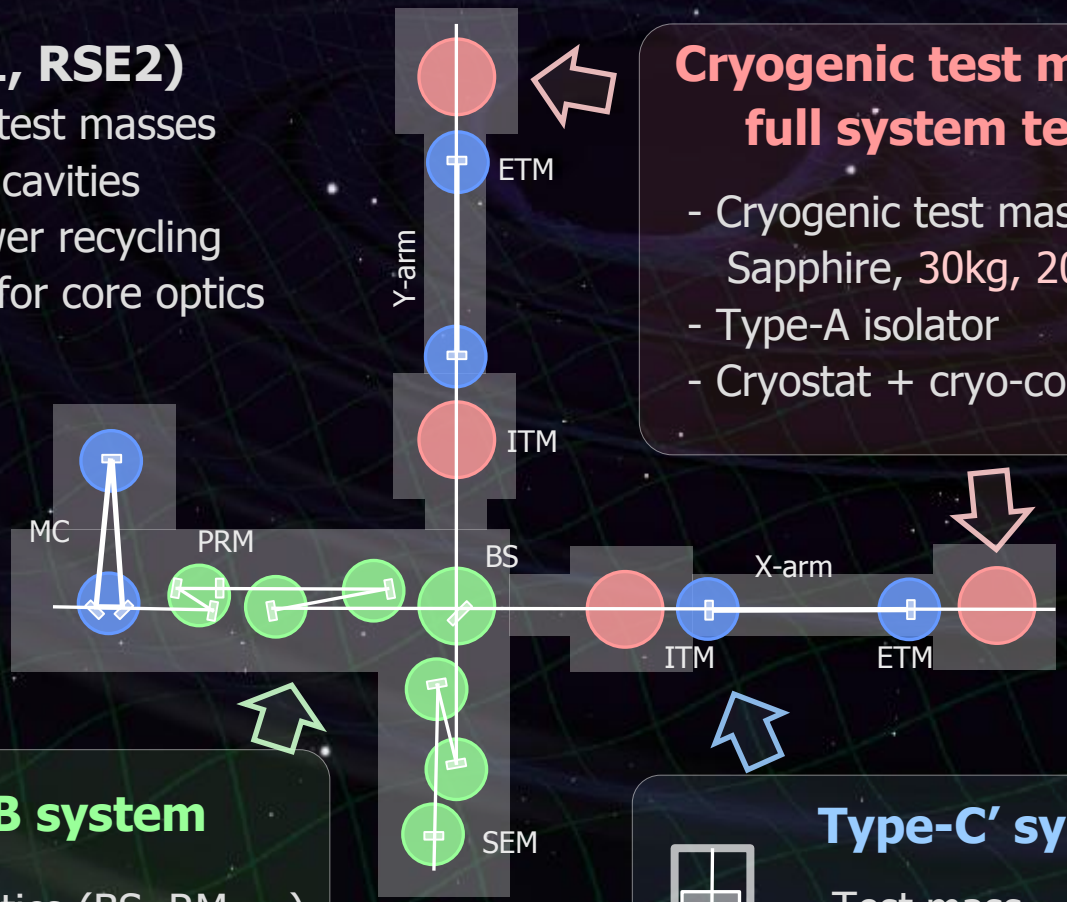
- Room-temp. test
  Sapphire (?), 30kg, 290K
- Tall seismic isolator
  IP + GASF + Payload



bLCGT commissioning (1)

bLCGT (RSE1, RSE2)

- Room-temp. test masses
- 2.97 km arm cavities
- RSE with power recycling
- VIS upgrade for core optics



Cryogenic test mass full system test

- Cryogenic test mass
  Sapphire, 30kg, 20K
- Type-A isolator
- Cryostat + cryo-cooler

Type-B system

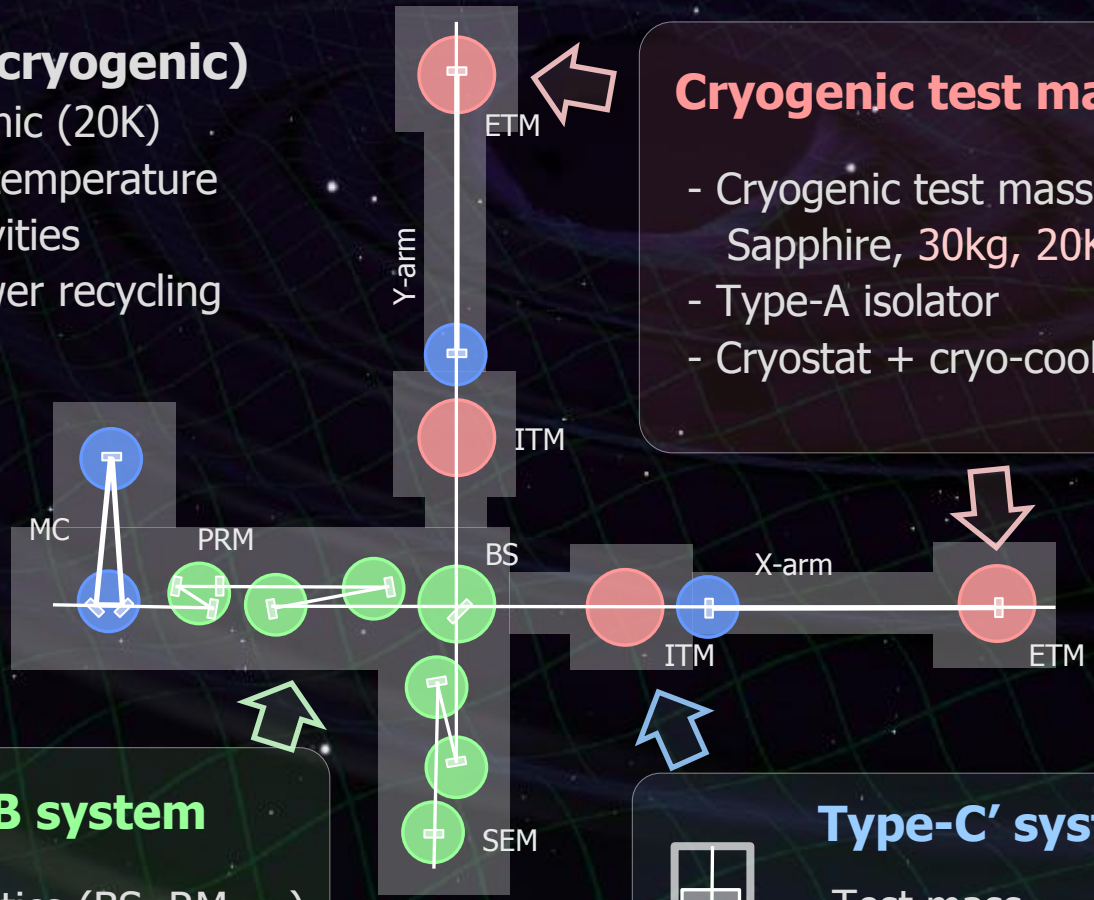
- Core optics (BS, RM ,...)
  Silica, 10kg, 290K
- IP + GASF + Payload
- Stack for aux. optics

Type-C' system

- Test mass
  Silica, 10kg, 290K
- Seismic isolator
  Stack + Type-B Payload

bLCGT commissioning (2)

bLCGT (Half cryogenic)
- ETM: Cryogenic (20K)
- ITM: Room temperature
- 3 km arm cavities
- RSE with power recycling



Cryogenic test mass

- Cryogenic test mass
  Sapphire, 30kg, 20K
- Type-A isolator
- Cryostat + cryo-cooler

Type-B system

- Core optics (BS, RM ,...)
  Silica, 10kg, 290K
- IP + GASF + Payload
- Stack for aux. optics

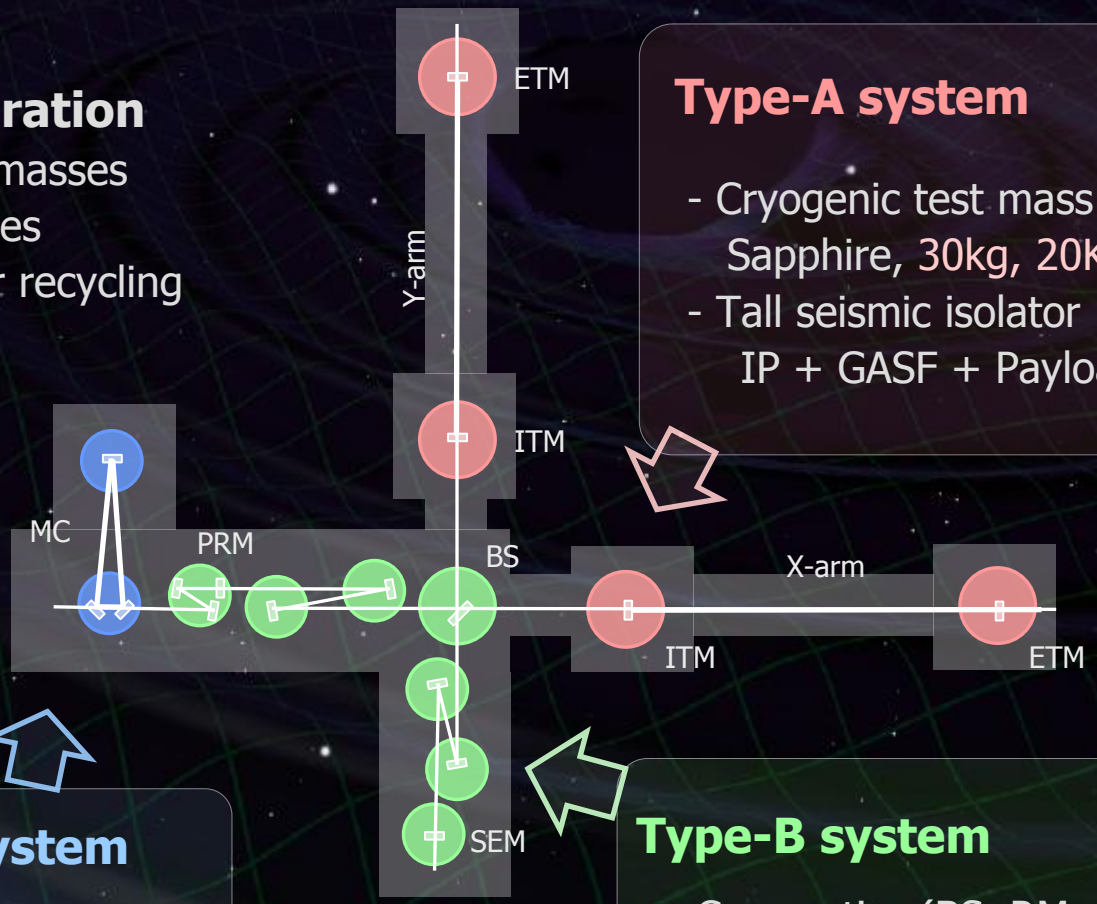
Type-C' system

- Test mass
  Silica, 10kg, 290K
- Seismic isolator
  Stack + Type-B Payload

bLCGT configuration

bLCGT configuration

- Cryogenic test masses
- 3 km arm cavities
- RSE with power recycling



Type-A system

- Cryogenic test mass
  Sapphire, 30kg, 20K
- Tall seismic isolator
  IP + GASF + Payload

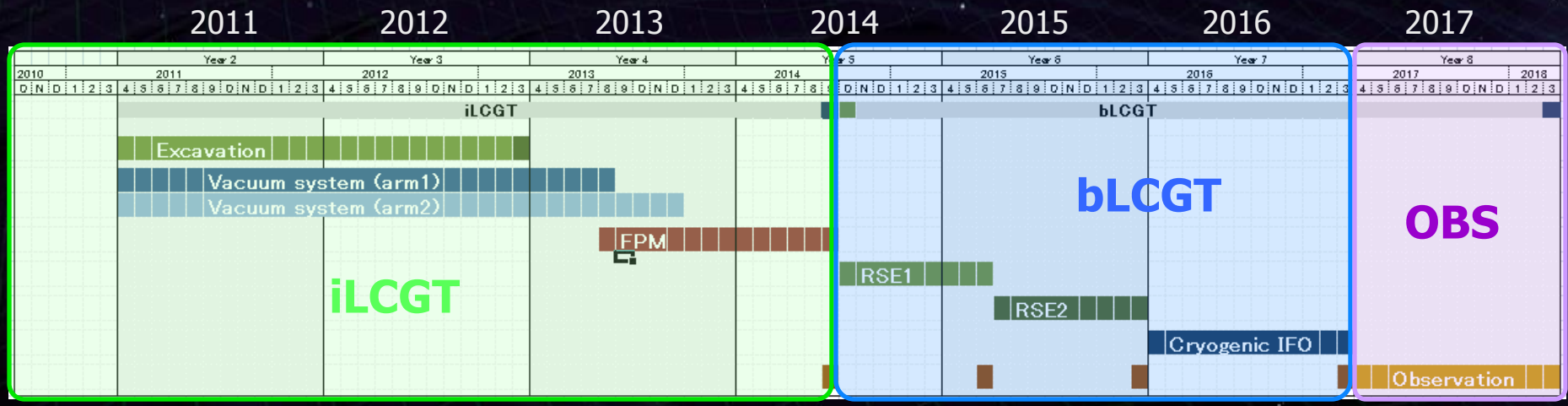
Type-C system

- Mode cleaner
  Silica, 1kg, 290K
- Stack + Payload

Type-B system

- Core optics (BS, RM ,...)
  Silica, 10kg, 290K
- IP + GASF + Payload
- Stack for aux. optics

Master Schedule



Type-A,B,C system development →

System construction and test →

Type-C' installation and shakedown →

Type-A, B installation and shakedown →

Room-temperature IFO commissioning →

Half-cryogenic operation →

Full-cryogenic operation →

Observation and tuning →

Type-A,B construction and test →

Cryostat + Cryo-payload Prototype test →

Cryogenic full system installation and shakedown

Observation runs

- **Step-by-step commissioning plan**
  - → Observation or engineering run is planed at each step.
    - Test of full detector system including a data-processing.
    - Detector characterization on long-term stability.
    - Development of data-analysis pipelines.

Observable range for NS binary inspiral

Fundamental noise limit
Not 'target sensitivities'

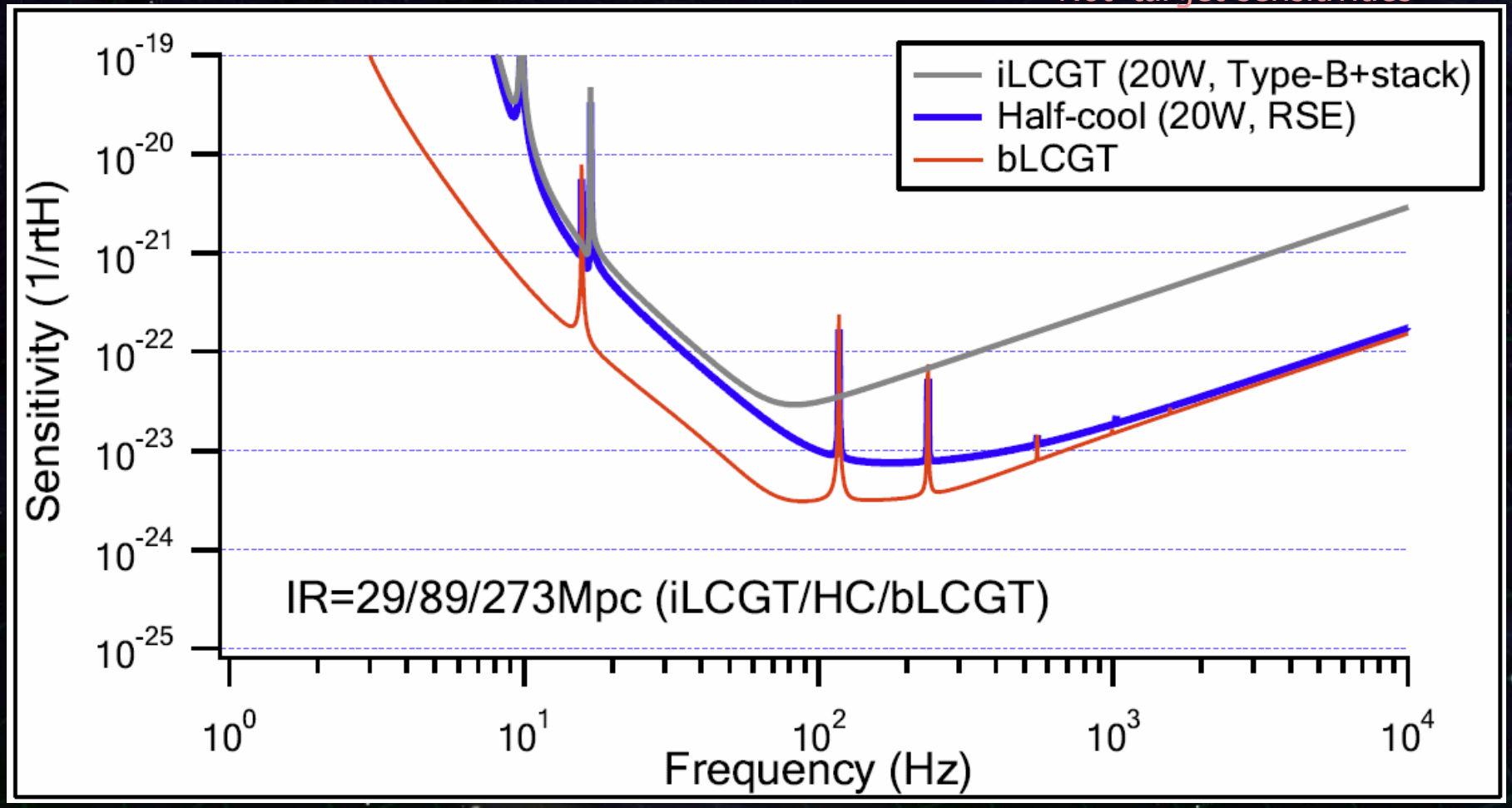
iLCGT	29 Mpc	FPM, Low power, 10kg Silica, Temp: 300K
Half cryogenic	89 Mpc	RSE, Low power, 10kg Silica, Temp: 20K + 300K
Final bLCGT	273 Mpc	RSE, High power, 30kg Sapphire, Temp: 20K

(Source at optimal direction, Threshold : SNR 8)

- **Tight schedule**
  - First priority is to operate LCGT with the final configuration.
  - Refrain from spending too much time for the intermediate runs.

Sensitivity

Fundamental noise limit
Not 'target sensitivities'



By K.Somiya

Issues (1/2)

Update of the 'master schedule' is necessary

- There is an uncertainties in the excavation schedule.
- No sufficient iterations with sub-system bottom-up plans

Issues (2/2)

Mirror and mode-matching issues

- **Different arm length and mirrors between iLCGT and bLCGT**
  - iLCGT: Flat-7km silica mirror. Longer PRC by 26.6m
  - bLCGT: 1.6km-1.9km sapphire mirror.
  - Mode mismatching in iLCGT and bLCGT
    → Require replacement of recycling and folding mirrors in the bLCGT stage.
- **Auxiliary optics for ITM**
- **Beam from ITM-AR surface**.

Backup Options

(1) Place ITM at original place in iLCGT with room-temp. tank

- Use Type-C' isolator in this configuration.
- Replace to cryostat in bLCGT stage.

(2) Place ITM in cryostat in iLCGT

- Use Fixed type-B payload.
- Replace to Type-A isolator in the full-cryogenic stage.

Subsystem bottom-up plan

External review for subsystems (Feb. 28th – March 4th)

Each subsystem should have prepared review document

Subsystem schedule was reviewed

Will require update

'GUIDELINES FOR THE EXTERNAL REVIEW ON THE LCGT PROJECT'
By I.Nakatani, et al. (Jan. 28, 2011)

1. Design for bLCGT
   - 1-1. Definition of Subsystem
   - 1-2. Requirements
   - 1-3. Interface
   - 1-4. Preliminary Design
   - 1-5. Schedule
   - 1-6. Prototype Test Plan
   - 1-7. First Article Test Plan
   - 1-8. Installation/Adjustment Procedure
   - 1-9. Risk Management

2. Design for iLCGT
   - 2-1. Definition of Subsystem
   - .....

Subsystem Risk Management

Assessment of risk factors by each subsystem

- Potential risk factors
- Probability
- Seriousness
- Backup plans

Summarize serious risk factors

→ • Share the risk factors (or importance) by all collaborators.

• Can be a basic information for distribution of resources

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