Special working group for KAGRA (LCGT) Roadmap

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On behalf of LCGT special working group

LCGT Face to Face meeting (Feb. 2 2012, Kashiwa, Chiba)

LCGT Roadmap Special working group

Roadmap special working group

- Special working group to make recommendation on the LCGT commissioning schedule.
- Open for all collaborators, nominally ~20 participants.
- Brainstorm-type meeting with free discussions.
- 20 meetings since Oct. 25, 2010.

Current Scope

To recommend the roadmap to realize LCGT.

Main topic In this talk ⇨

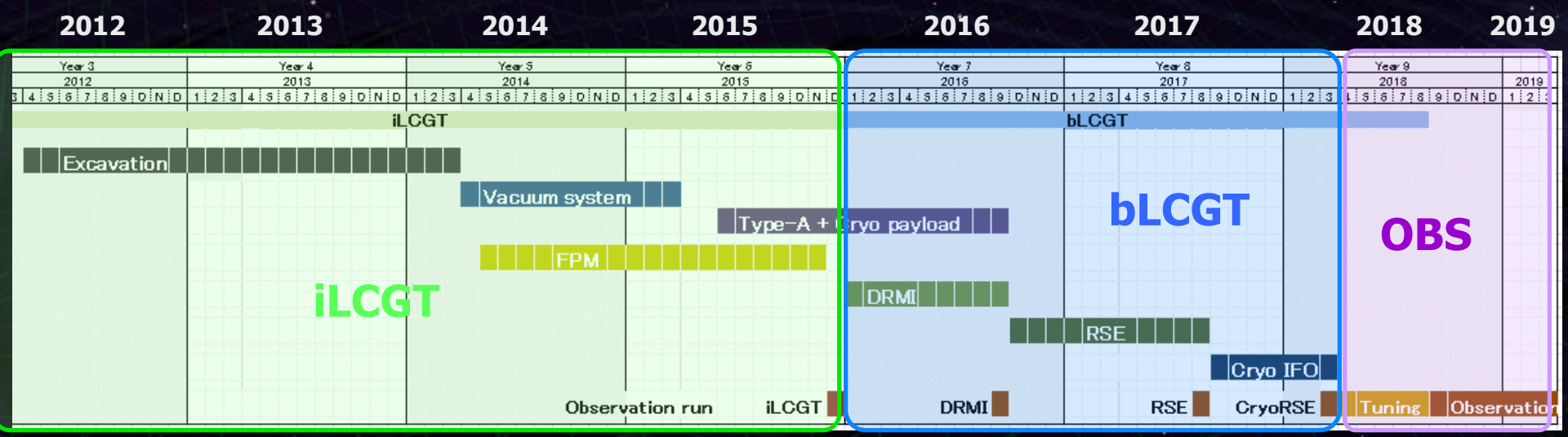
- Make a recommendation of the master schedule,
- Summarize subsystem bottom-up plans.
- Construct a progress evaluation system.
- Summarize information of risk factors during construction.

Master Schedule

Project Master Schedule

- We have updated the LCGT construction schedule.
  - Mainly because of delay in the excavation schedule.
    (or financial decision of the government)
- Good chance to refine the schedule.
  - Previous schedule was not a well-defined one.
    * Challenging and aggressive schedule.
    * Still have some inconsistencies between
      project master schedule and subsystem bottom-up plan.
  - We need better schedule management system.
    * Quantitative evaluation of project progress
      both in project management and sub-system development.
    * The status should be open for collaborators clearly.
  - Recommendation in the Last PAB:
    Progress evaluation system, sub-system bottom-up plan.

New Constraint on the master plan



Tunnel and Facility
(by the end of FY2013)

Vacuum system
by the end of FY2014

Start observation run
By the end of FY2017

* Completion the installation of the vacuum system is a strict constraint. Detailed schedule will be determined with iterations with subsystem bottom-up plans. However, Earlier start of observation run is preferable.

Timeline to decide the master plan

2011

Oct. Call for participation to the roadmap working group.

Nov. Collection of on bottom-up plans of subsystems.

Dec. 5 weekly meetings and
several small ones with a few subsystems.
Recommendation document on the master schedule.
Circulation to SEO and all the LCGT collaborators.

2012

Jan. Submission to EC (Executive Committee)
→ Approval with minor revision.
Decision announced to collaborators.
Feedback to subsystem bottom-up plans
→ Checked in the series of internal reviews.

Feb. Explanation in the face-to-face meeting (Now).

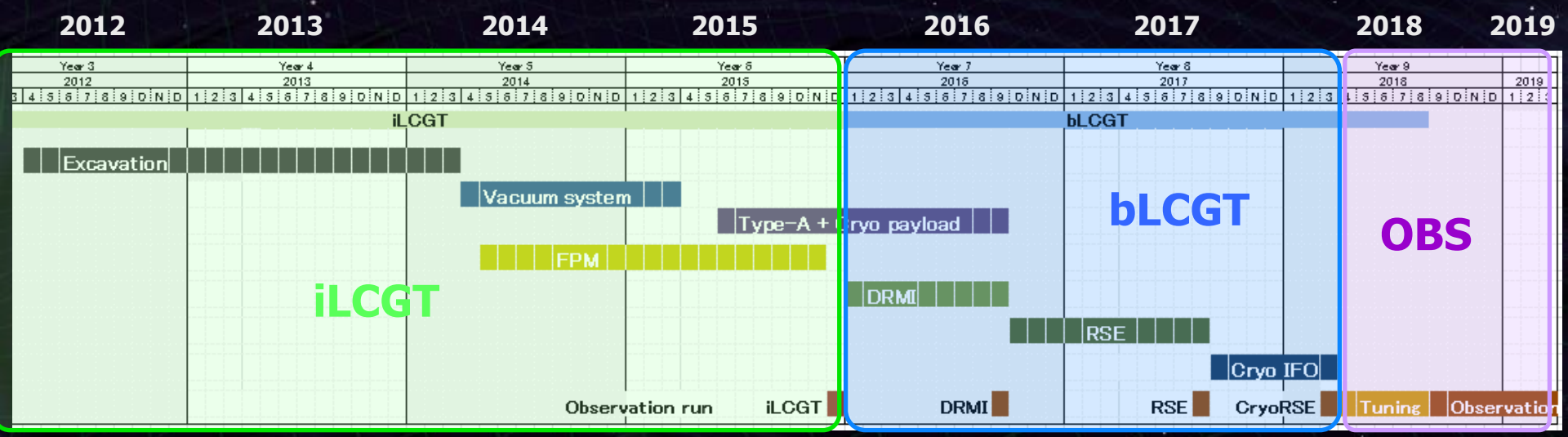
Commissioning Plan

- **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 ~35 m)
    for the room-temp. interferometer commissioning.
  - Step-by-step commissioning for the interferometer (FPM → DRMI → RSE)
  - Full test of the real VIS and cryogenic system at the end rooms.

New Constraint on the master plan



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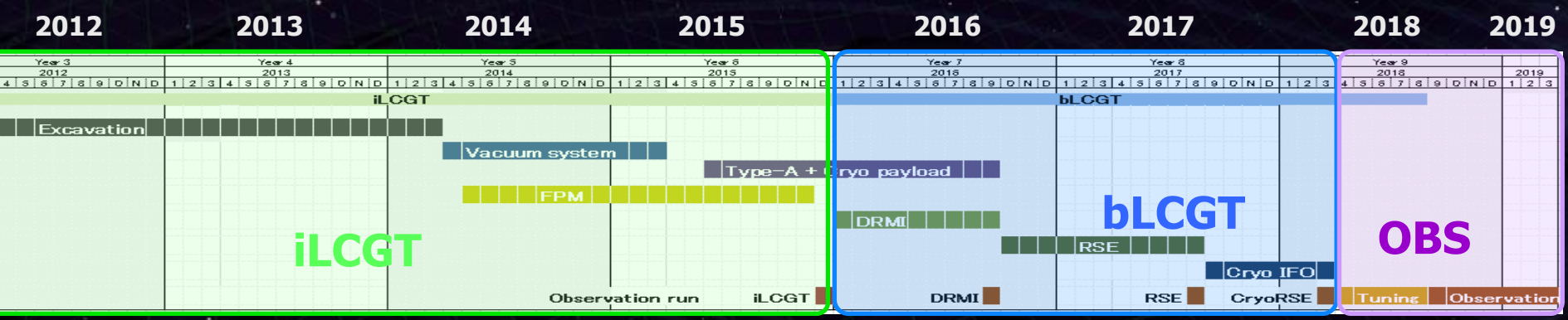
Major milestones of KAGRA



Tunnel and Facility (2014.3)

Vacuum (2015.3)

Type-A+Cryo (2016.9)

obs.

FPMI (2015.12)

obs.

DRMI (2016.9)

obs.

RSE (2017.8)

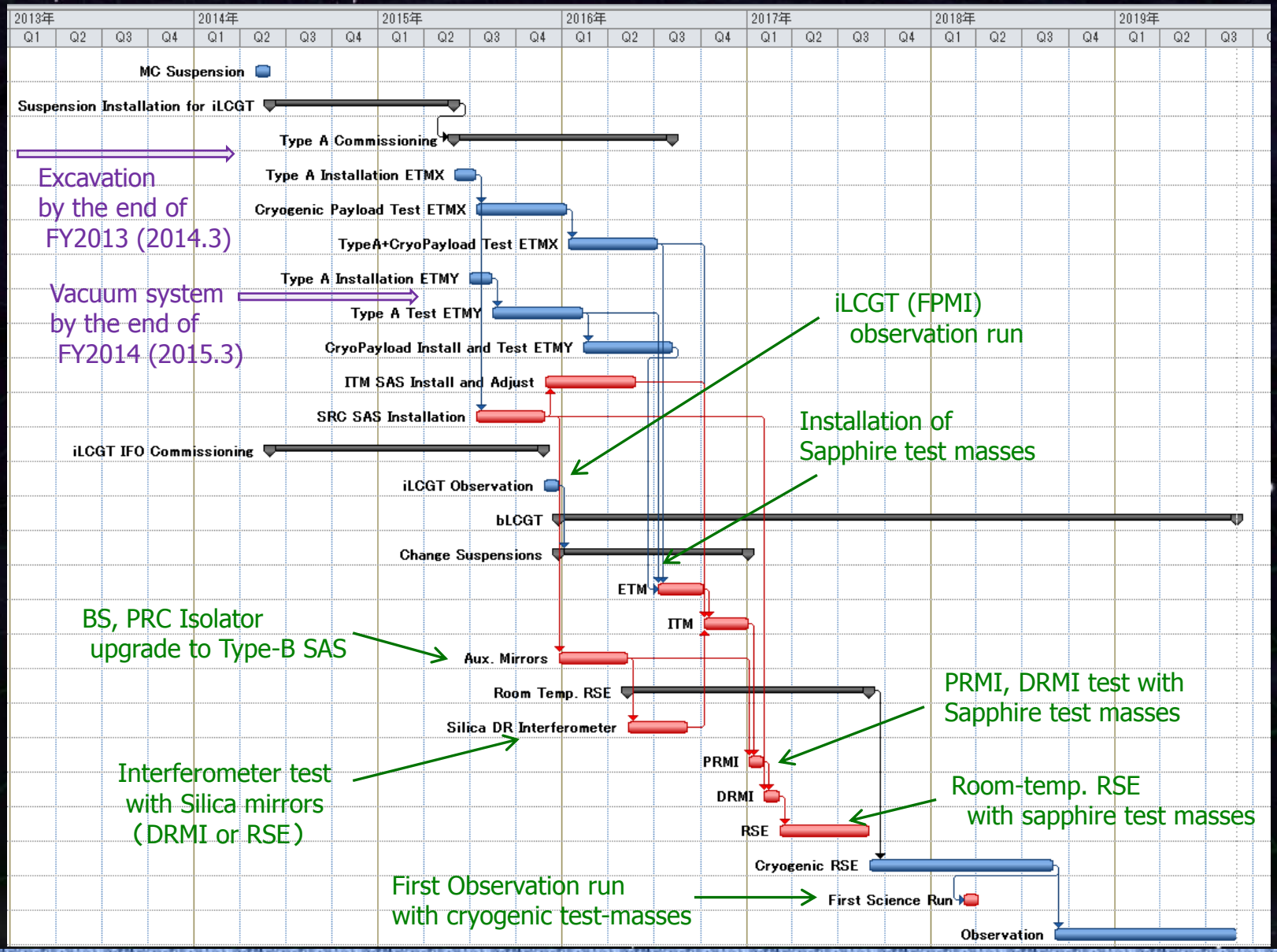
Tuning and observation

First Science run

Sapphire test mass (2016.3)

installation

Cryo RSE (2018.3)

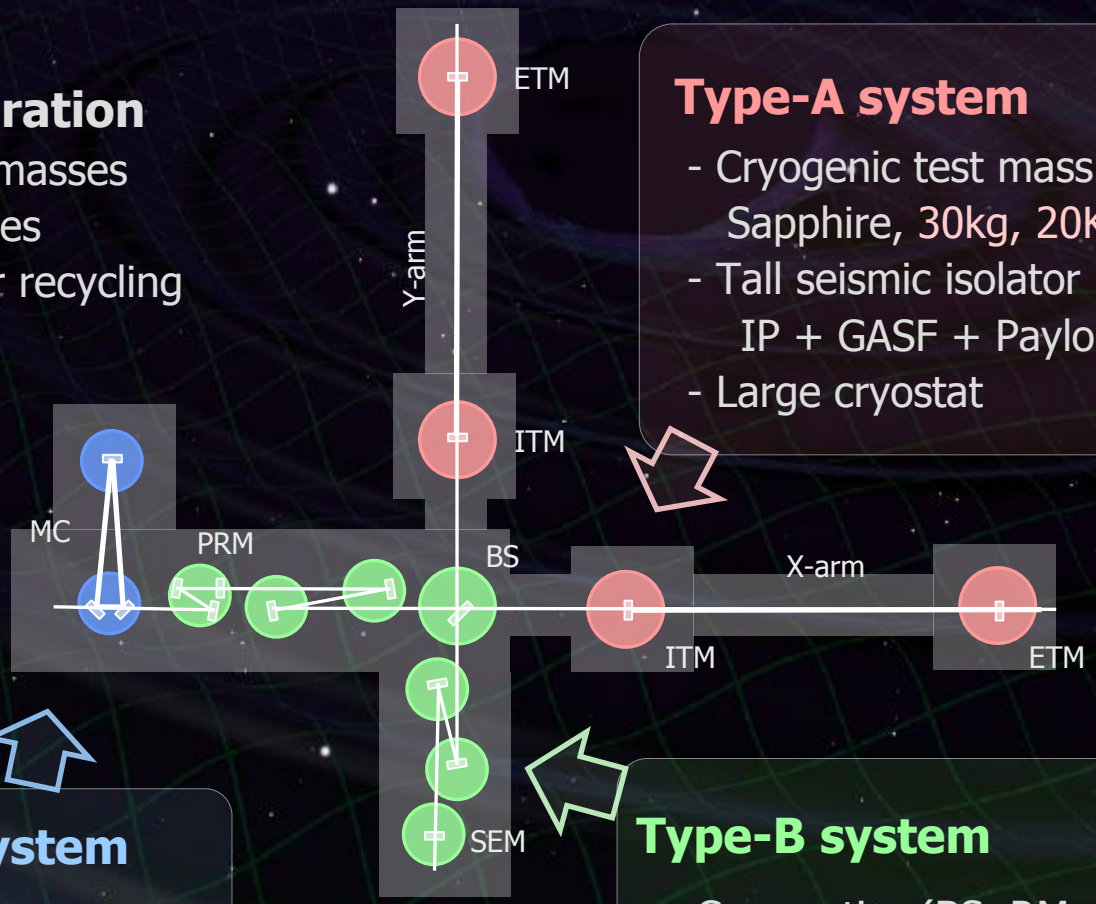

2013年
2014年
2015年
2016年
2017年
2018年
2019年
Q1 Q2 Q3 Q4
MC Suspension
Suspension Installation for iLCGT
Type A Commissioning
Excavation by the end of FY2013 (2014.3)
Type A Installation ETMX
Cryogenic Payload Test ETMX
TypeA+CryoPayload Test ETMX
Type A Installation ETMY
Vacuum system by the end of FY2014 (2015.3)
Type A Test ETMY
CryoPayload Install and Test ETMY
ITM SAS Install and Adjust
SRC SAS Installation
iLCGT IFO Commissioning
iLCGT (FPMI) observation run
iLCGT Observation
Installation of Sapphire test masses
bLCGT
Change Suspensions
ETM
ITM
BS, PRC Isolator upgrade to Type-B SAS
Aux. Mirrors
Room Temp. RSE
Silica DR Interferometer
PRMI, DRMI test with Sapphire test masses
PRMI
DRMI
Interferometer test with Silica mirrors (DRMI or RSE)
RSE
Room-temp. RSE with sapphire test masses
Cryogenic RSE
First Observation run with cryogenic test-masses
First Science Run
Observation

(Dec 26, 2011)

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

Vacuum systems (- 2015.3)

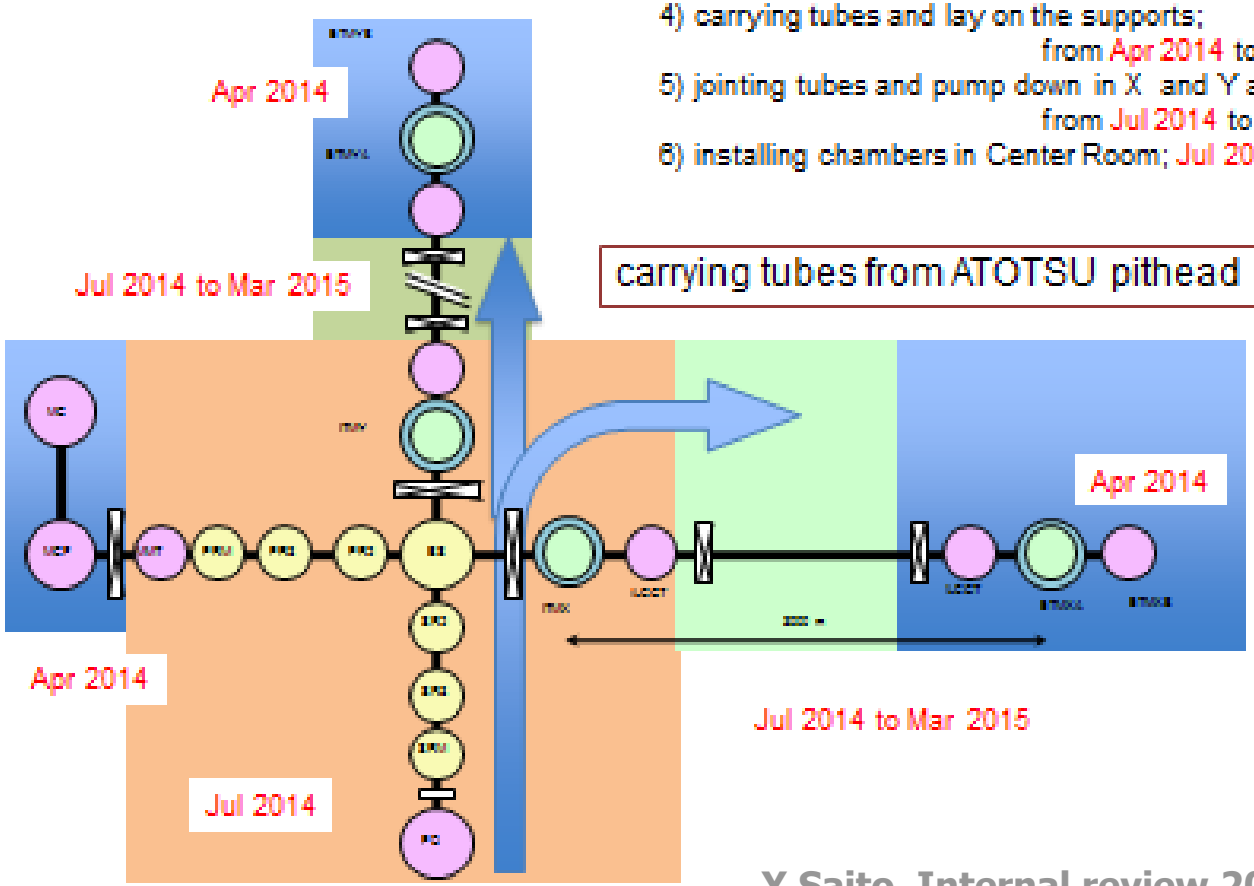
LCGT Vacuum System

120123 VAC (YS)

3. Schedule

expected schedule for installing (2)

1) manufacturing 478 of tubes; from Apr 2011 to Mar 2013
2) manufacturing chambers; from Sep 2012 to Mar 2014
3) installing chambers in X and Y ends; Apr 2014
4) carrying tubes and lay on the supports; from Apr 2014 to Jun 2014
5) jointing tubes and pump down in X and Y arm from Jul 2014 to Mar 2015
6) installing chambers in Center Room; Jul 2014



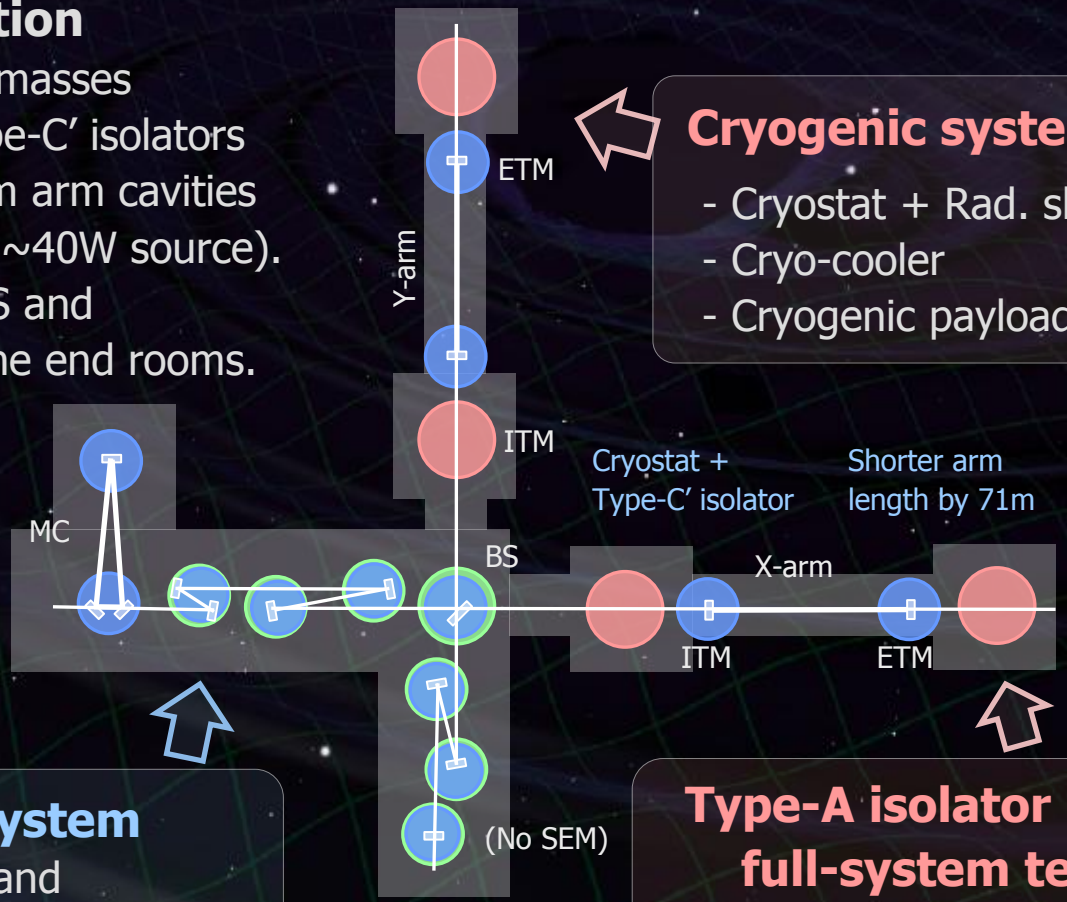
Y.Saito, Internal review 2012

22

iLCGT commissioning (- 2015.12)

iLCGT configuration

- Room-temp. test masses suspended by Type-C′ isolators
- FPMI with 2.93 km arm cavities
- Low laser power (~40W source).
- On-site test of VIS and Cryo-system at the end rooms.



Cryogenic system test

- Cryostat + Rad. shield duct
- Cryo-cooler
- Cryogenic payload

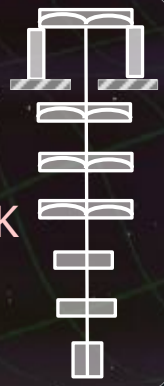
iLCGT obs. run
in Dec. 2015
~1 month

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

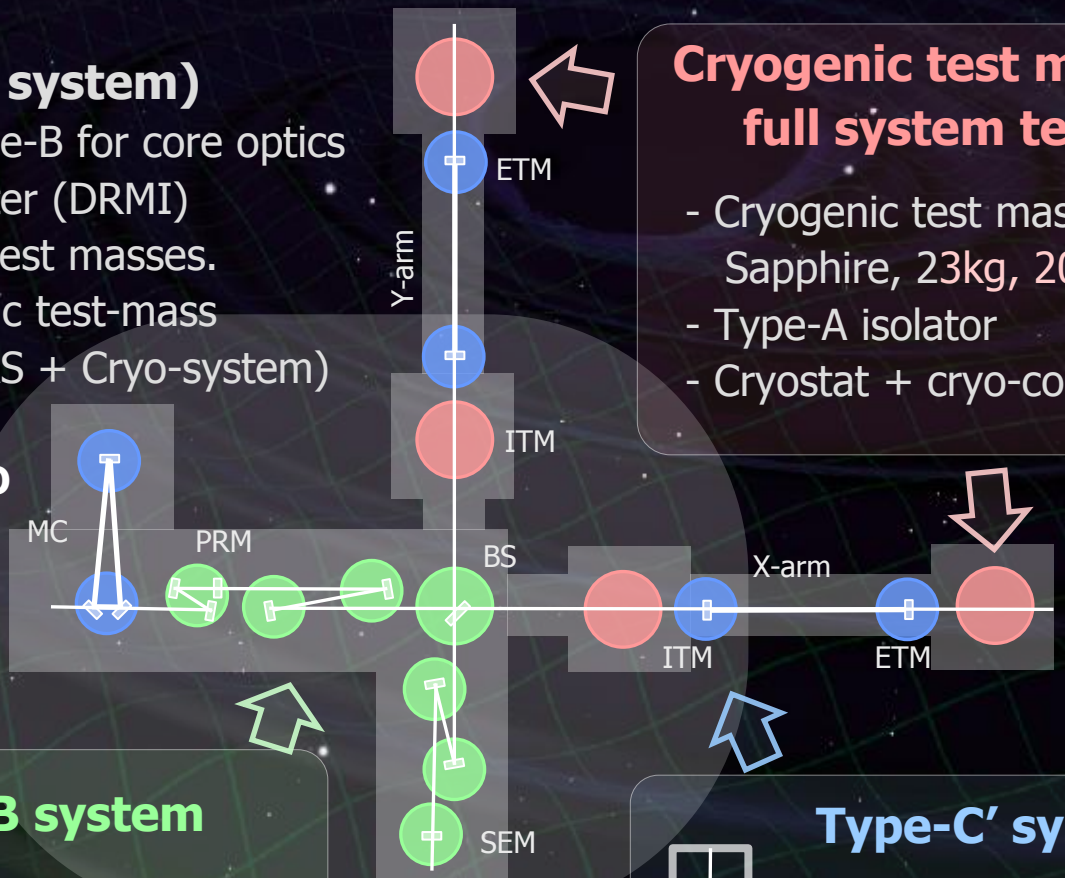
- Room-temp. test
  Sapphire (?), 23kg, 290K
- Tall seismic isolator
  IP + GASF + Payload



bLCGT commissioning 1 (- 2016.9)

bLCGT1
(DRMI, Cryo full system)

- VIS upgrade to Type-B for core optics
- Center interferometer (DRMI)
  with room-temp. test masses.
- Full test of cryogenic test-mass
  system (Type-A SAS + Cryo-system)



Cryogenic test mass full system test

- Cryogenic test mass
  Sapphire, 23kg, 20K
- Type-A isolator
- Cryostat + cryo-cooler

Type-B system

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

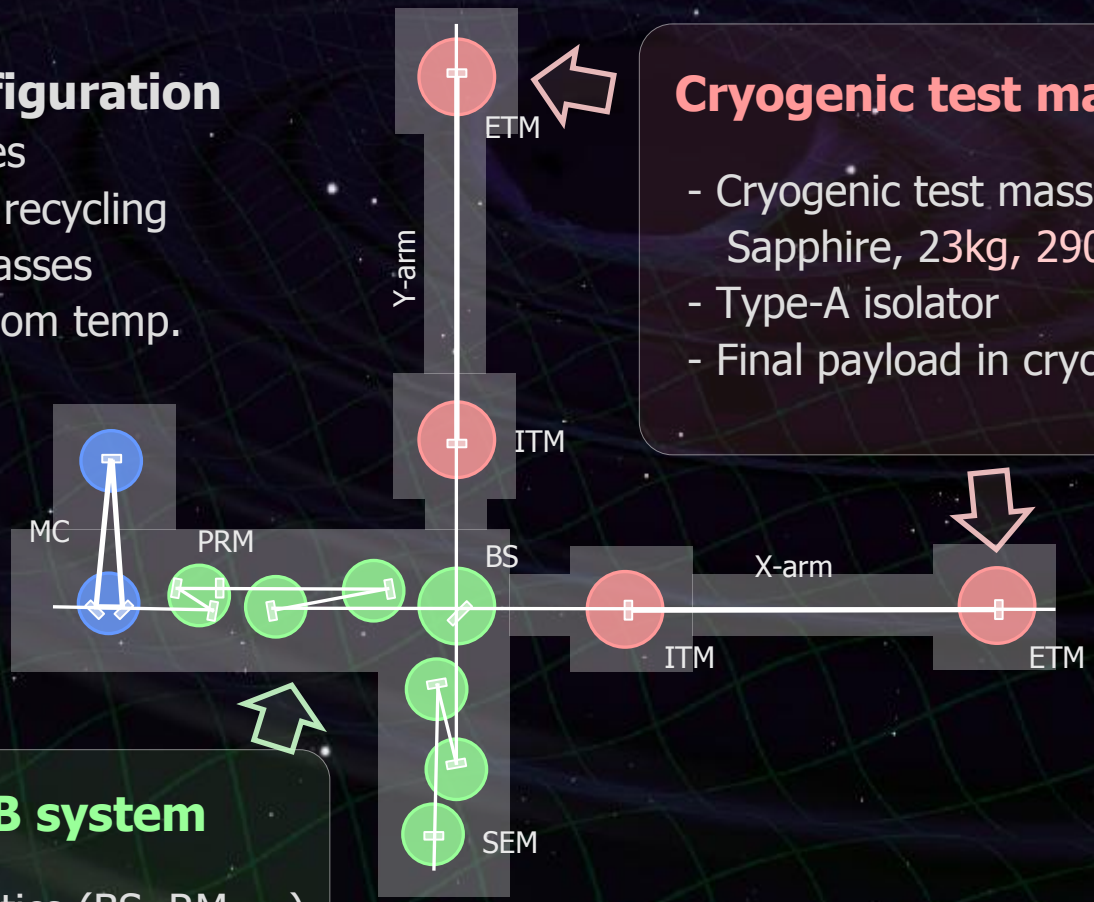
Type-C' system

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

bLCGT commissioning 2 (- 2017.8)

bLCGT full configuration

- 3 km arm cavities
- RSE with power recycling
- Sapphire test masses
  operated at room temp.



Cryogenic test mass

- Cryogenic test mass
  Sapphire, 23kg, 290K
- Type-A isolator
- Final payload in cryostat

Type-B system

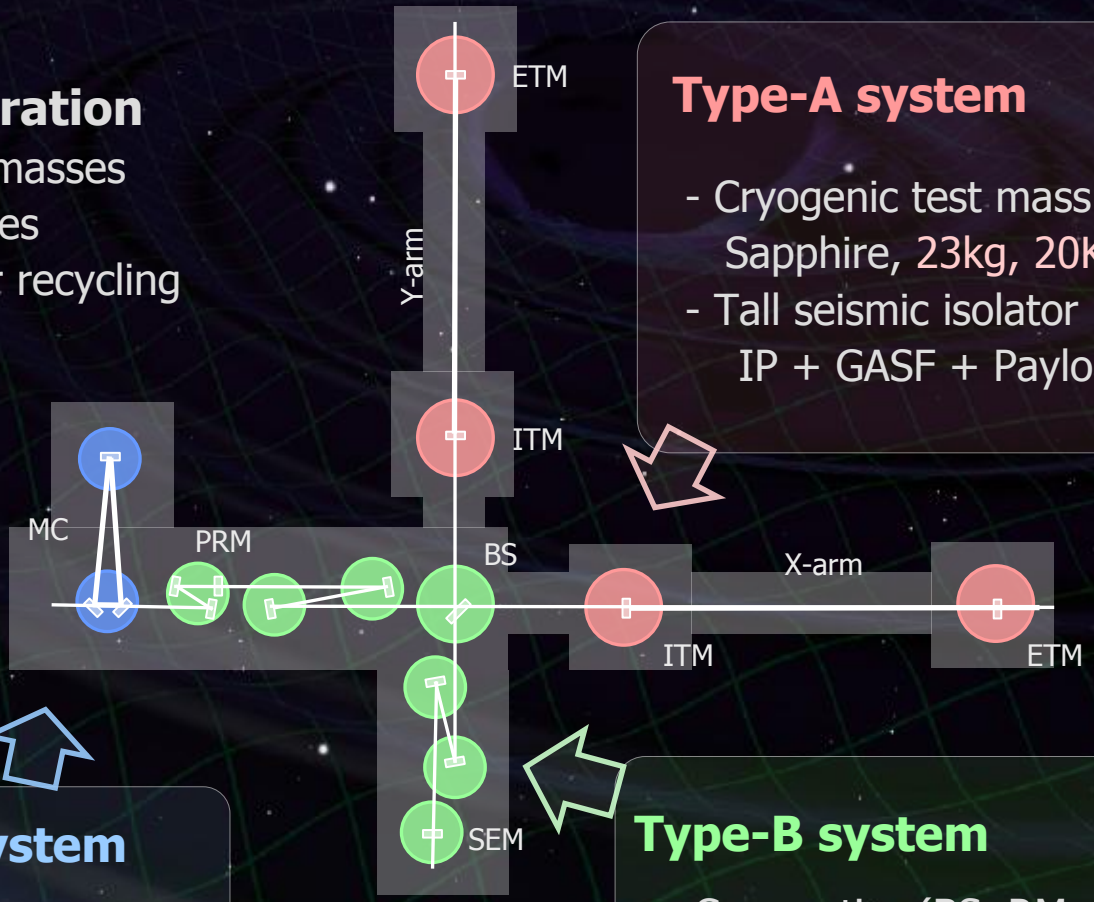
- Core optics (BS, RM ,...)
  Silica, 10kg, 290K
- IP + GASF + Payload
- Stack for aux. optics

Cryogenic operation (- 2018.3)

bLCGT configuration

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

first science run
in Mar. 2018
~1 month



Type-A system

- Cryogenic test mass
  Sapphire, 23kg, 20K
- Tall seismic isolator
  IP + GASF + Payload

Type-C system

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

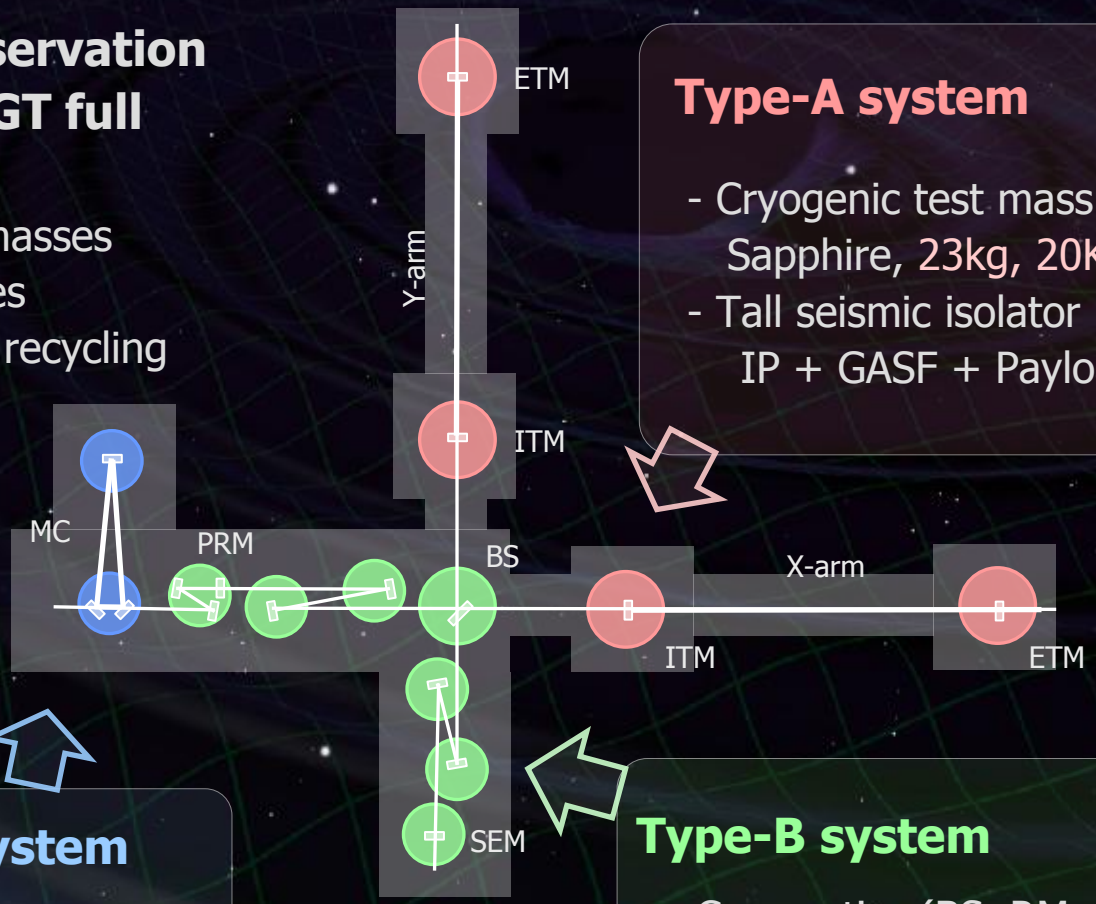
Type-B system

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

Tuning and observation (2018.4 -)

Tuning and observation run with bLCGT full configuration

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



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Type-C system

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Type-B system

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

- Subsystem
  - Bottom-up plans
  - Progress evaluation
  - Risk management

Subsystem Plans

- Subsystem bottom-up schedule
  - Detailed subsystem schedule
    (Development, Prototype test, Quality insurance, Installation,…)
  - Should be consistent with the project master plan.
  - Also include risk factors and back-up plans.

- Progress evaluation
  - Evaluated by a 'milestone scheme'
    * Set ~10 milestones for each subsystem
      (subset of subsystem bottom-up plan)
    * Status for the milestones -- checked in regular meetings.
  - The status will be open for all the collaborators.
  - System: Microsoft Project + Network access.

Current status/Next steps

- Internal reviews (~Jan. 2012)
  - Subsystem bottom-up plans with the newly decided master plan.
    → Consistencies with the master plan have been checked.
  - Basic information have been presented
    on the milestones, risks of each subsystem.

- Upcoming tasks (by the next PAB).
  - Summarize the bottom-up plans and milestones for the project management (scheduling and progress evaluation).
    ← Require a help of each subsystem.
  - Update and summarize the risk factors.
    ← Also need a help of all the collaborators.

Summary

Roadmap special working group

- Master schedule has been decided.
- Detailed tasks to be finished:
  - Subsystem bottom-up plans
  - Milestones and progress evaluation
  - Risk factors