Questions from reviewers

i) We'd like to hear more about the KAGRA commissioning plans. Who is in charge of the KAGRA commissioning efforts? Can you give us more details on the primary challenges facing the commissioning effort to prepare for the O3 run and your plans to address them?

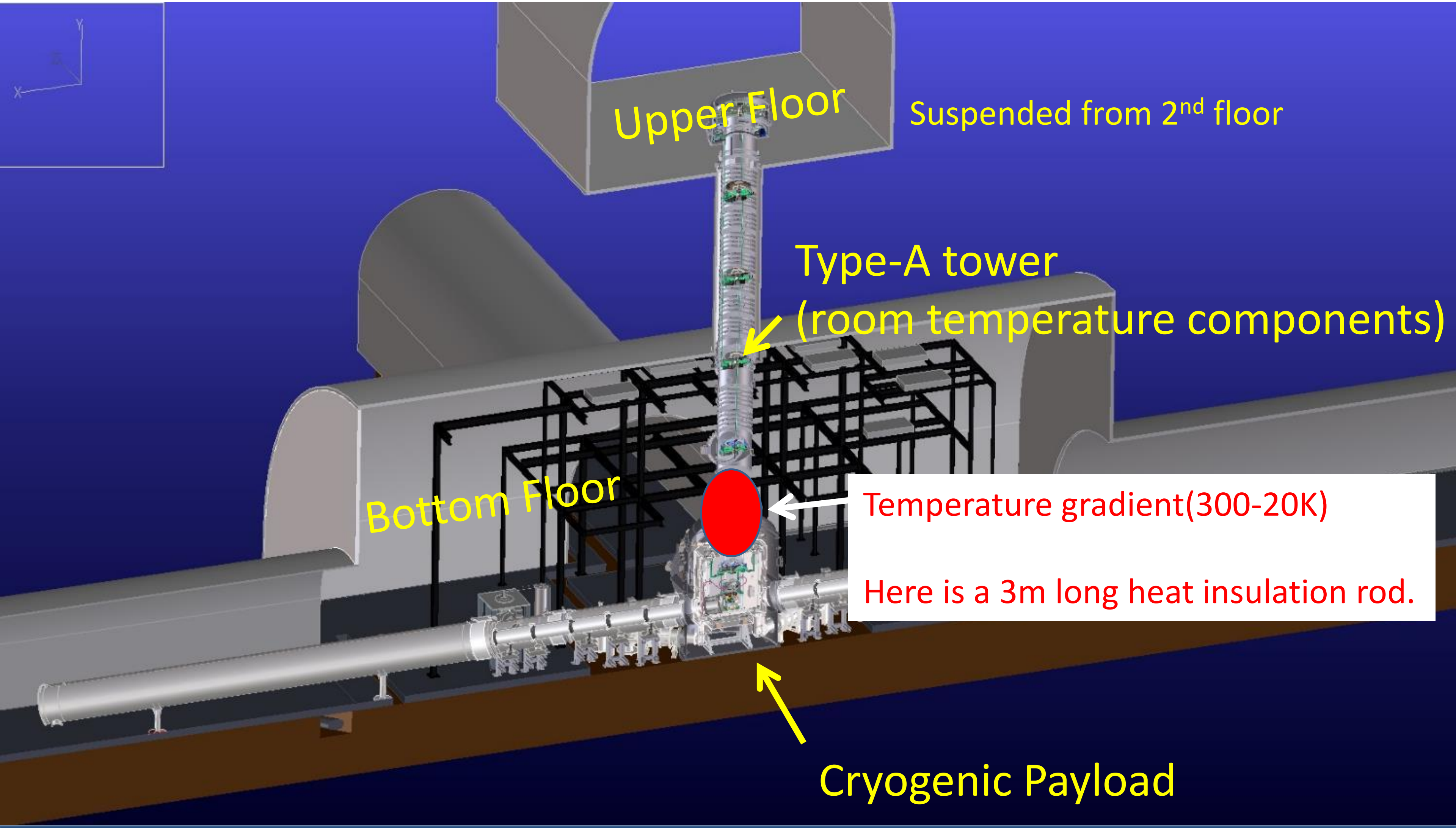
ii) Can you provide the committee with an updated version of the error box maps shown on slide 26 using expected sensitivities for O3 (LIGO 120 Mpc, Virgo 60 Mpc, KAGRA 25 Mpc)

Answer from KAGRA

- Temperature gradient (300-20K)
- Contamination of mirror surface by outgas
- Commissioning plan and responsible person
- Source localization accuracy with KAGRA at O3

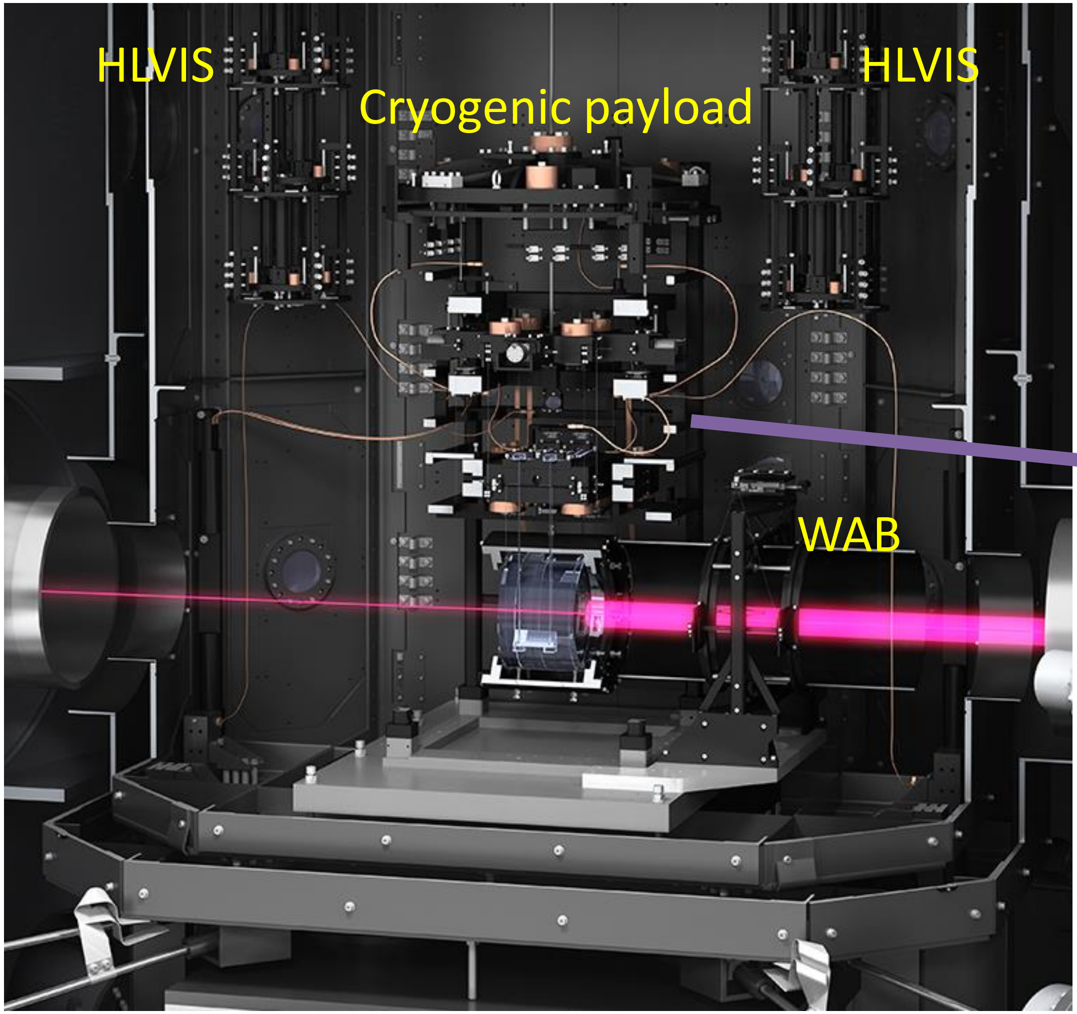
Temperature gradient (300K-20K)

9-stage 13.5-m suspension for vibration isolation with a cryogenic mirror

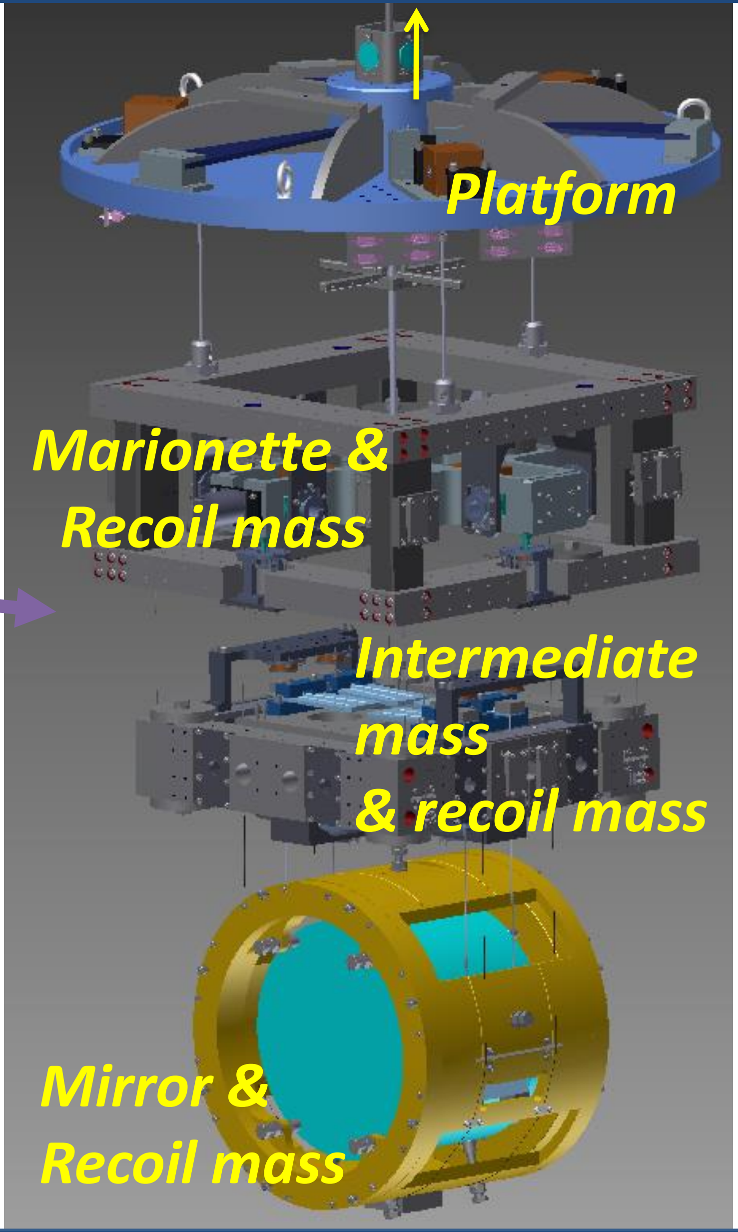


Contamination of mirror surface by outgas

Sapphire mirror is covered by cooled radiation shields and protected from outgas



(c) KAGRA Collaboration / Ray.Hori



Molecular adsorbed layer formation on cooled mirrors and its impacts on cryogenic gravitational wave telescopes

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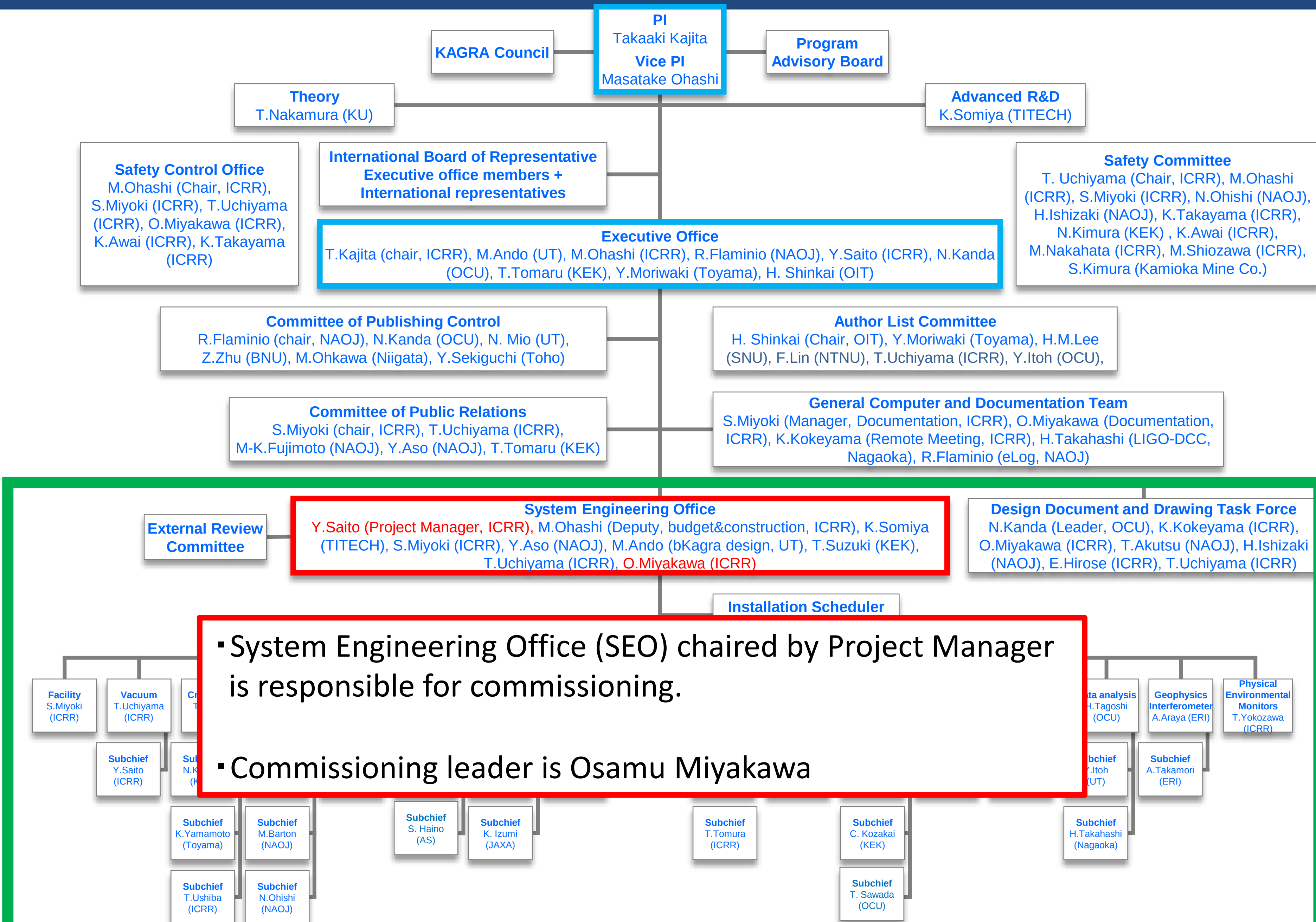
Cryogenic mirrors have been introduced to the KAGRA gravitational wave telescope in Japan and are also planned to be used in next-generation gravitational wave telescopes to further improve their sensitivity. Molecular gases inside vacuum chambers adhere to cold mirror surfaces because they lose their kinetic energy when they hit cryogenic surfaces. Finally, a number of adsorbed molecules form an adlayer, which will grow with time. The growing adlayer functions as an optical coating and changes the properties of the underly … n to maximi … ivity. To char … , and the fine … t the molecular adlayer was formed on a cold mirror and caused an oscillation in the finesse. The real and imaginary parts of the refractive index of the adlayer were 1.26 ± 0.073 and $2.2 \times 10^{-7} \pm 1.3 \times 10^{-7}$, respectively. These are considered to be those of H_2O molecules. The formation rate of the molecular adlayer was 27 ± 1.9 nm/day. In this paper, we describe theoretical and experimental studies of the formation of a molecular adlayer on cryogenic mirrors. Furthermore, the effects of a molecular adlayer on the quantum noise and the input heat to the test mass are also discussed.

We still have some problems.

We will be able to solve the problems in this year.

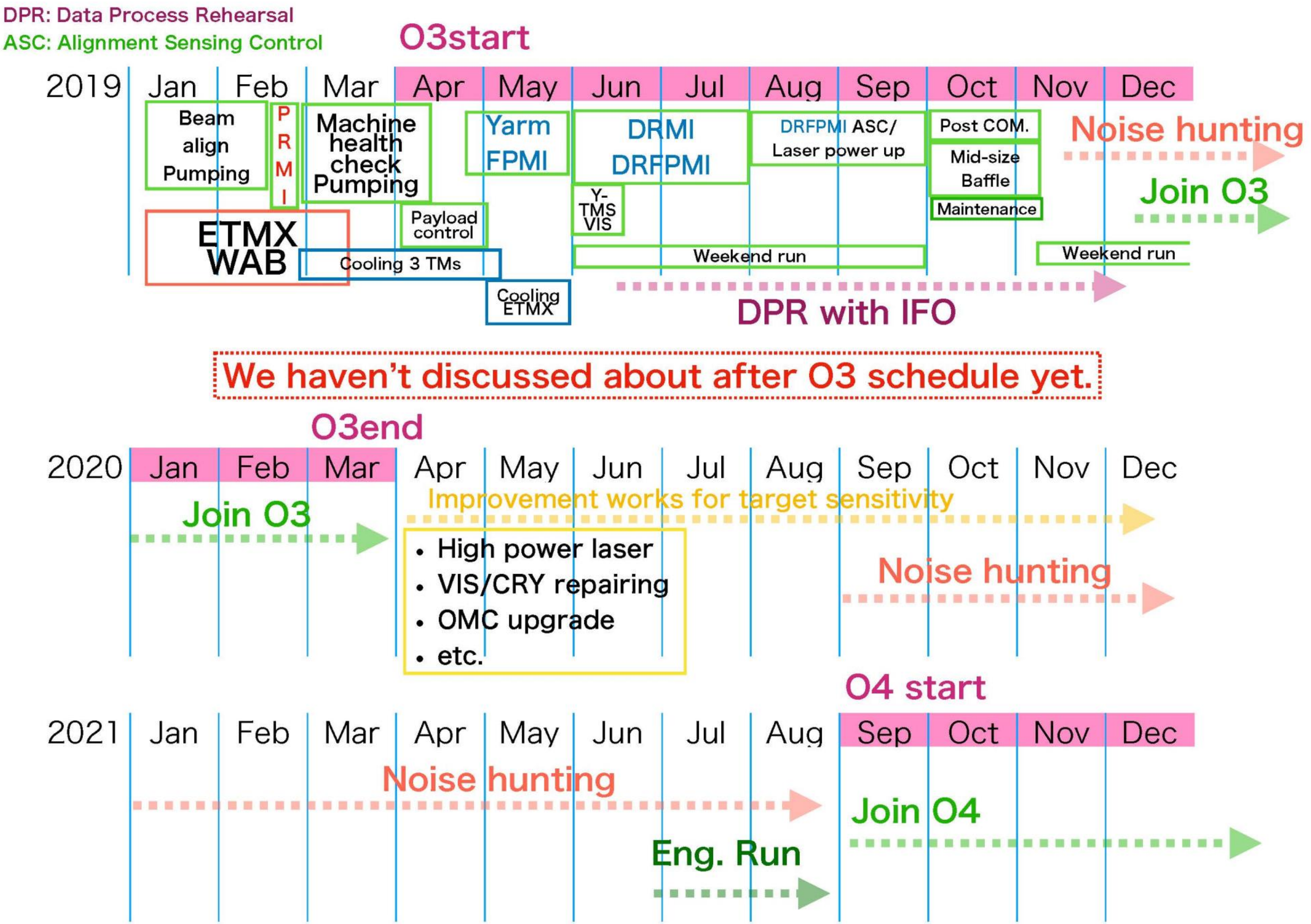
DOI: 10.1103/PhysRevD.99.022003

KAGRA structure for construction and operation



- System Engineering Office (SEO) chaired by Project Manager is responsible for commissioning.
- Commissioning leader is Osamu Miyakawa

KAGRA schedule



Prospects for KAGRA's contribution in O3

Reports at LIGO-Virgo meeting
LIGO-Virgo Joint Run Planning Committee, Oct. 11, 2018, (Tagoshi) JGW-G1809082, LIGO-G1802015
LIGO-Virgo Joint Run Planning Committee, May 6, 2019, focusing on KAGRA (Miyoki et al.)

This is now discussed jointly with LIGO and Virgo.

- LVC-KAGRA task force (make a report by the end of June 2019)

Yoshio Saito (KAGRA - Project manager, Chair on KAGRA side)
Hideyuki Tagoshi (KAGRA - Data analysis)
Takahiro Yamamoto (KAGRA - Calibration)
Osamu Miyakawa (KAGRA - Commissioning)
Hisaaki Shinkai (KAGRA - KSC (MoU))
Steve Fairhurst (LSC)
Patricia Schmidt (LSC)
Leo Singer (LSC)
Marie Anne Bizouard (Virgo)
Helios Vocca (Virgo)

- Updating "Observing Senario Paper"

"Prospects for Observing and Localizing Gravitational-Wave Transients with Advanced LIGO, Advanced Virgo and KAGRA"
Living Reviews in Relativity, 21, 3, (2018)

Source localization simulations for O3

Astrophysical population of BBH, BNS, NSBH

Black holes: BH mass 5-50Msun,
power law mass distribution with power law index α=-2.3
Spin aligned or anti-aligned

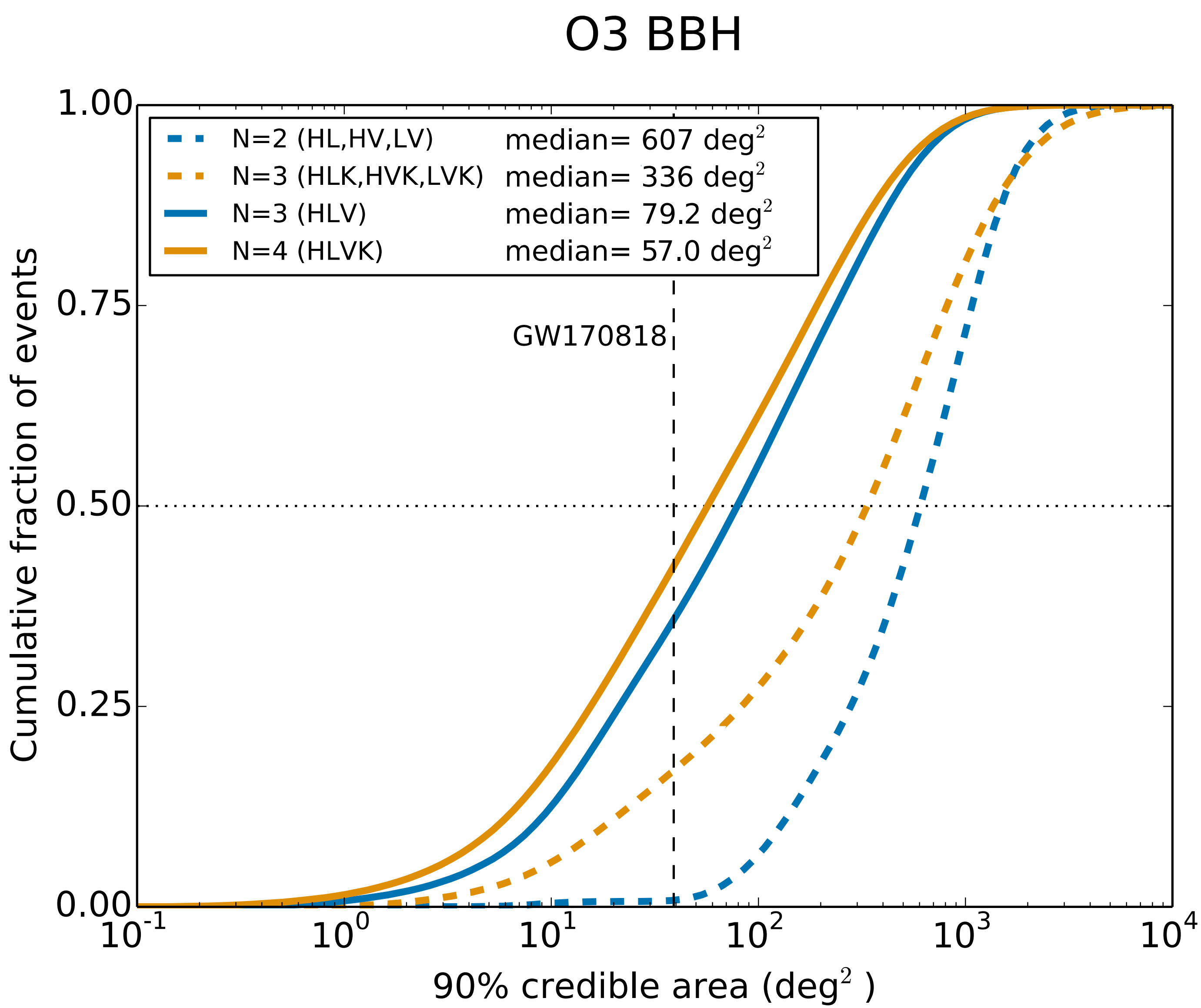
Neutron stars: NS mass: Gaussian distribution with mean = 1.33Msun
and standard deviation = 0.09 Msun.
Spin aligned or anti-aligned, with magnitude less than 0.05.

Consider only sources detected with SNR > 4 at at least two detectors, and network SNR > 12.

Assumed sensitivity (BNS range)
LIGO 120Mpc, Virgo 60Mpc, KAGRA 25Mpc

Source localization

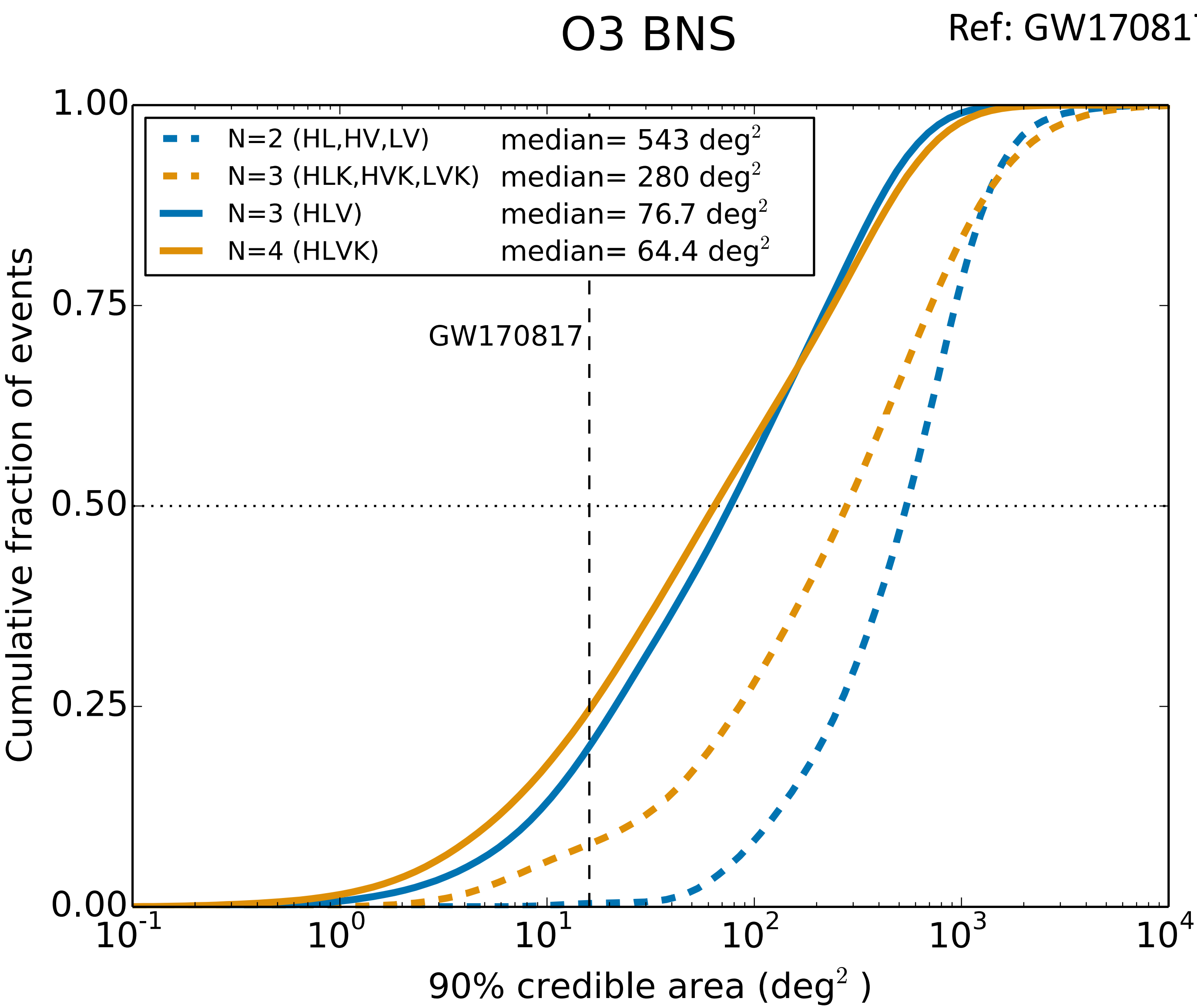
Assumed sensitivity (BNS range)
LIGO 120Mpc, Virgo 60Mpc, KAGRA 25Mpc



Source localization

Assumed sensitivity (BNS range)
LIGO 120Mpc, Virgo 60Mpc, KAGRA 25Mpc

Ref: GW170817: 28-31 deg^2



Source localization

Assumed sensitivity (BNS range)
LIGO 120Mpc, Virgo 60Mpc, KAGRA 25Mpc