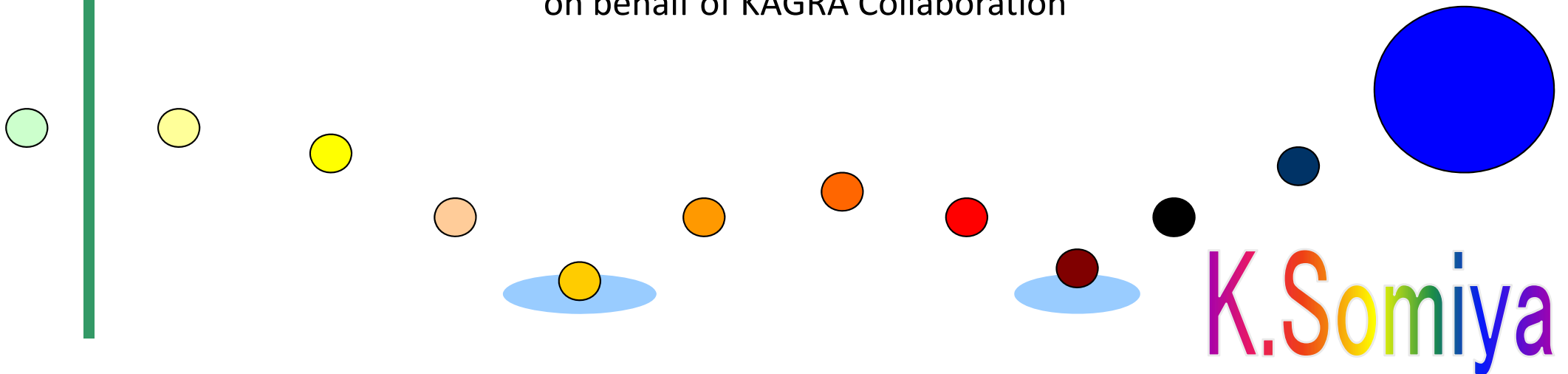


KAGRA status

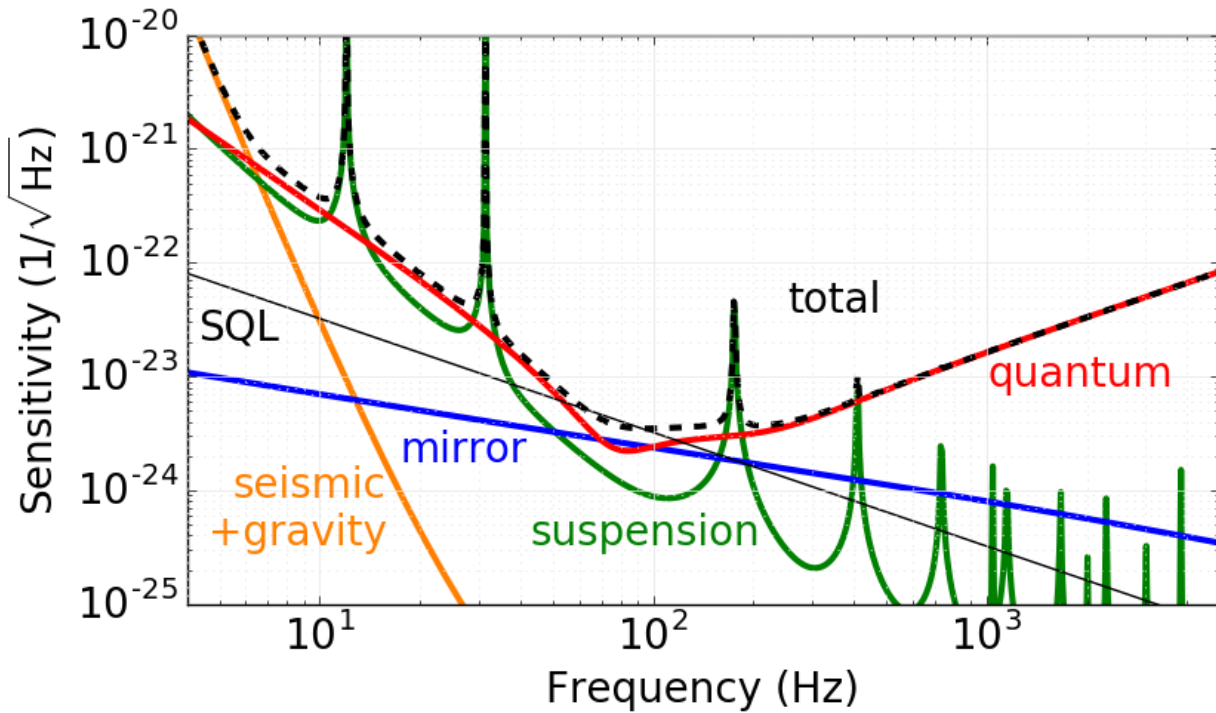
9th ET Symposium
Api. 2018

Kentaro Somiya (Tokyo Tech)
on behalf of KAGRA Collaboration



Contents

KAGRA is a 3km underground interferometer with cryogenic sapphire test masses.



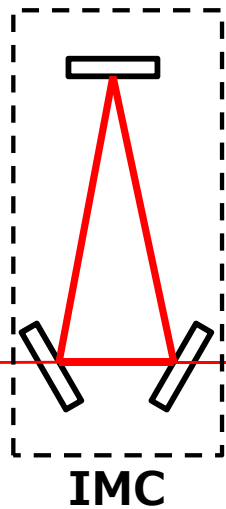
1. Installation status
2. Toward bKAGRA phase-1 (cryo-MI)
3. Observation plan
4. Toward KAGRA+

Installation status

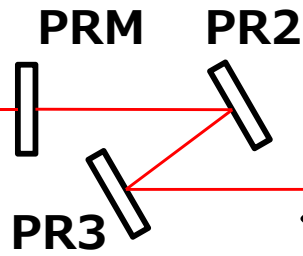
- IMC/IFI installed in 2015
- IMMTs installed in 2016

To be replaced
by 40W in 2018

2W laser

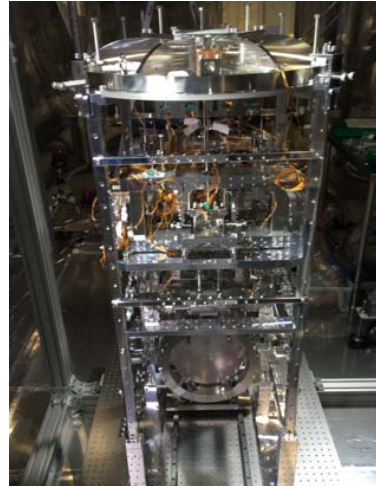
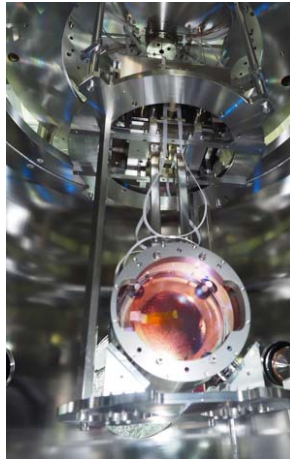


IFI



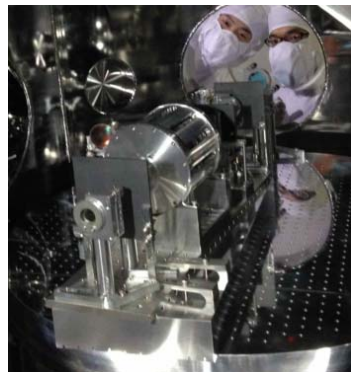
BS

ETMY



ETMX

- Type-A installed in 2017
- CRY payload installed at Yend in 2017 (w/spare TM) and at Xend in '18 Mar.



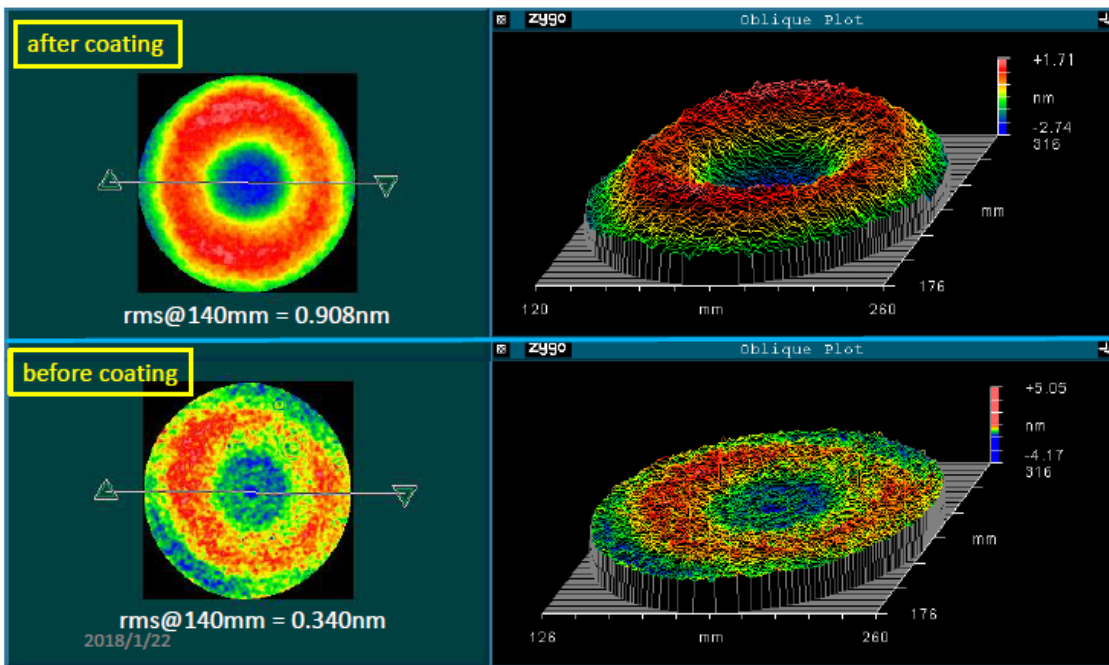
- PRMs intalled in 2017 (Type-Bp suspension)
- BS installed in 2017 (Type-B suspension)



- Yend in vac '18/Jan
- ETMY cooled '18 Feb (currently T=18K)
- Center in vac '18/Mar
- Xend in vac '18/Apr

Sapphire mirrors

[Hirose, Jan '18]

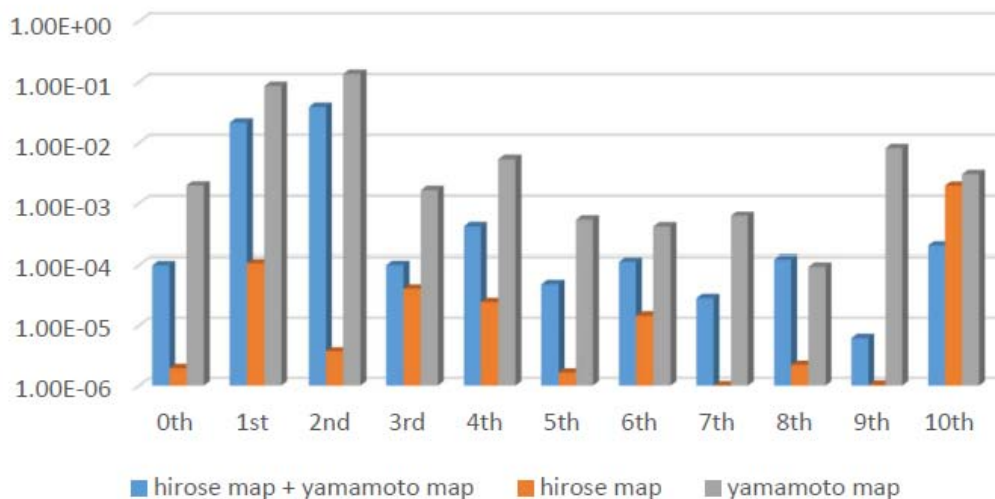


- Coated ETMs were measured in '18 Jan.

	spec	meas. (ETMX)	meas. (ETMY)
ROC	1900m	1908m	1906m
figure	0.5nm	0.9nm	0.9nm
roughness	0.16nm	0.08nm	0.07nm
Absorption	<1ppm	<0.5ppm	<0.5ppm
scattering	<10ppm	~11ppm	~11ppm

[Somiya, Feb '18]

AS power (W)



- ETMX was delivered to Toyama Univ and HCBed. It was delivered to KAGRA and suspended in '18 Mar.
- ITMX was delivered in '18 Mar
- ITMY is to be delivered in '18 Aug

Toward bKAGRA phase-1

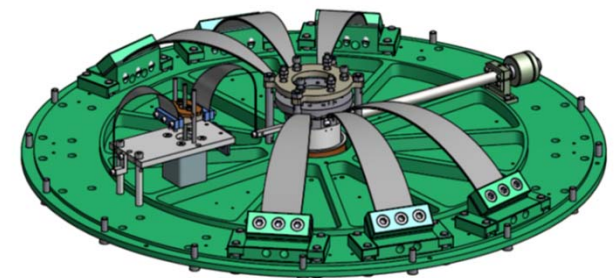
[plan as of Apr 16]

	4/23	4/24	4/25	4/26	4/27	4/28	4/29	4/30	5/1	5/6
Day (9:00-17:00)	OLG measurements	Type-A Yend TRF	BS TRF	Type-A Xend TRF	Noise injection Center	Noise injection YEND	Schnupp Assymetry & IFO noise budget	Noise injection XEND	CRY Extra EXP. 1	CRY Extra EXP. 2
Night (17:00-9:00)	OLG measurements	Type-A Yend TRF	CW injection	Type-A Xend TRF	CBC injection	CBC injection	Schnupp Assymetry & IFO noise budget	OLG measurements	CRY Extra EXP. 1	CRY Extra EXP. 2
Parallel	Data transfer, Pipeline tests, GIF									

- Test run will start from Apr 28 (postponed)
- Only ETMY will be in cryogenic
- MICH error signal has been observed at REFL (RF)
- IMC is stably locked

Some issues to be solved (as of this Monday)

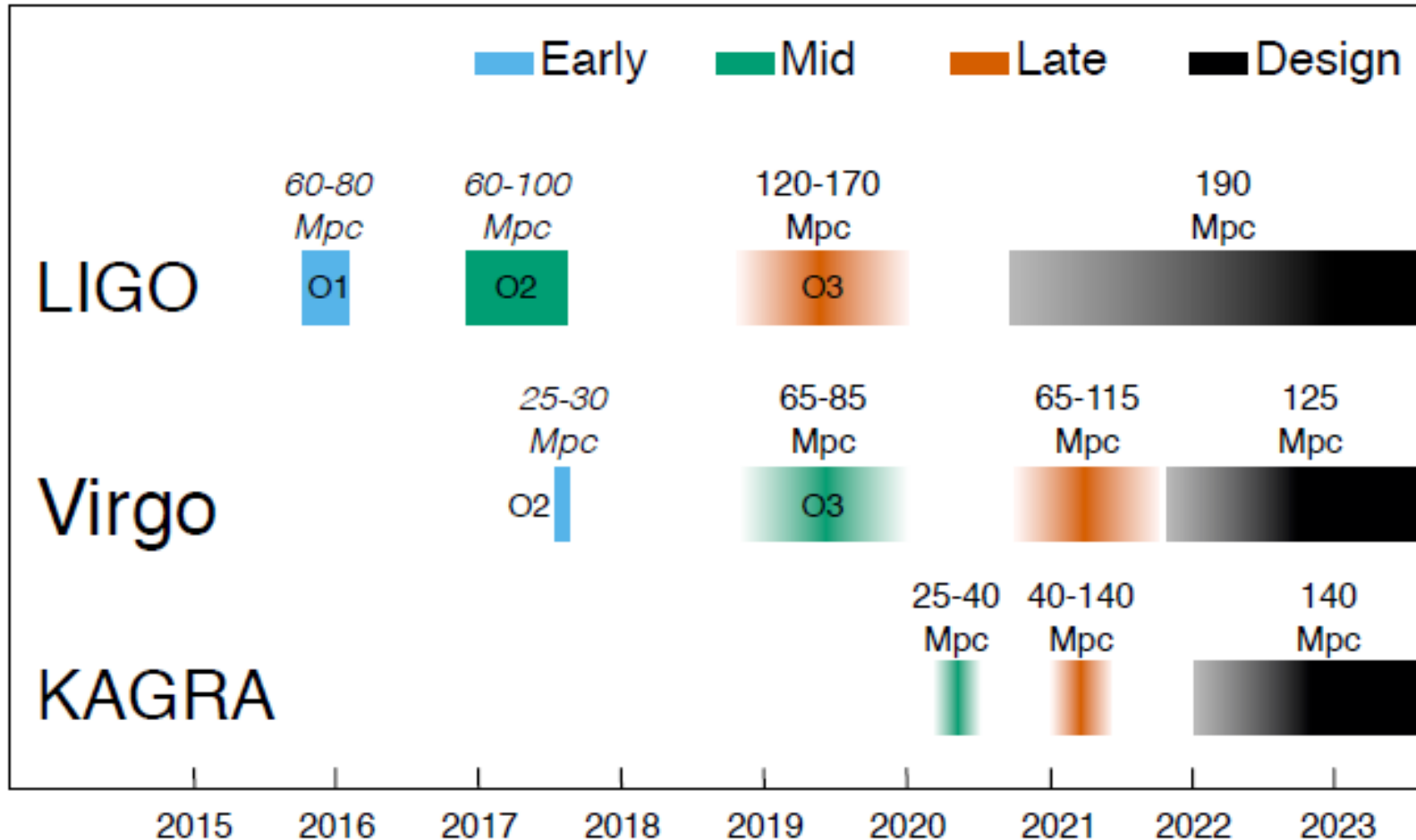
- A leak was found in the ETMX chamber (200Pa) (Vac level at the central area is $4e-5$ Pa)
- ETMY Yaw RMS is as large as 3urad (X is ok)
- ETMY F1/F2 seems to be touching to the keystone



Observation plan

[arxiv:1304:0670]

Original plan is to have the first observation in 2020.



KAGRA collaboration has agreed to somehow accelerate the schedule to join O3 in 2019.

Observation plan

Letter from KAGRA sent to LIGO and Virgo representatives.

“We extensively discussed and resolved to do our best to begin operation in late 2019, so that, if possible, KAGRA will run the detector at the same time of the LIGO-Virgo O3 run, and, if possible, to join the GW network.”



Professor Dave Reitze
LIGO Laboratory
Caltech, Pasadena, CA, 91125, USA

Professor David Shoemaker
LIGO Laboratory
MIT, Cambridge, MA 02139, USA

Professor Stavros Katsanevas
European Gravitational Observatory (EGO)
I-50021 Cascina, Pisa, Italy

Professor Jo van den Brand
Nikhef,
Science Park, 1098 XG Amsterdam, Netherlands

Feb. 8, 2019

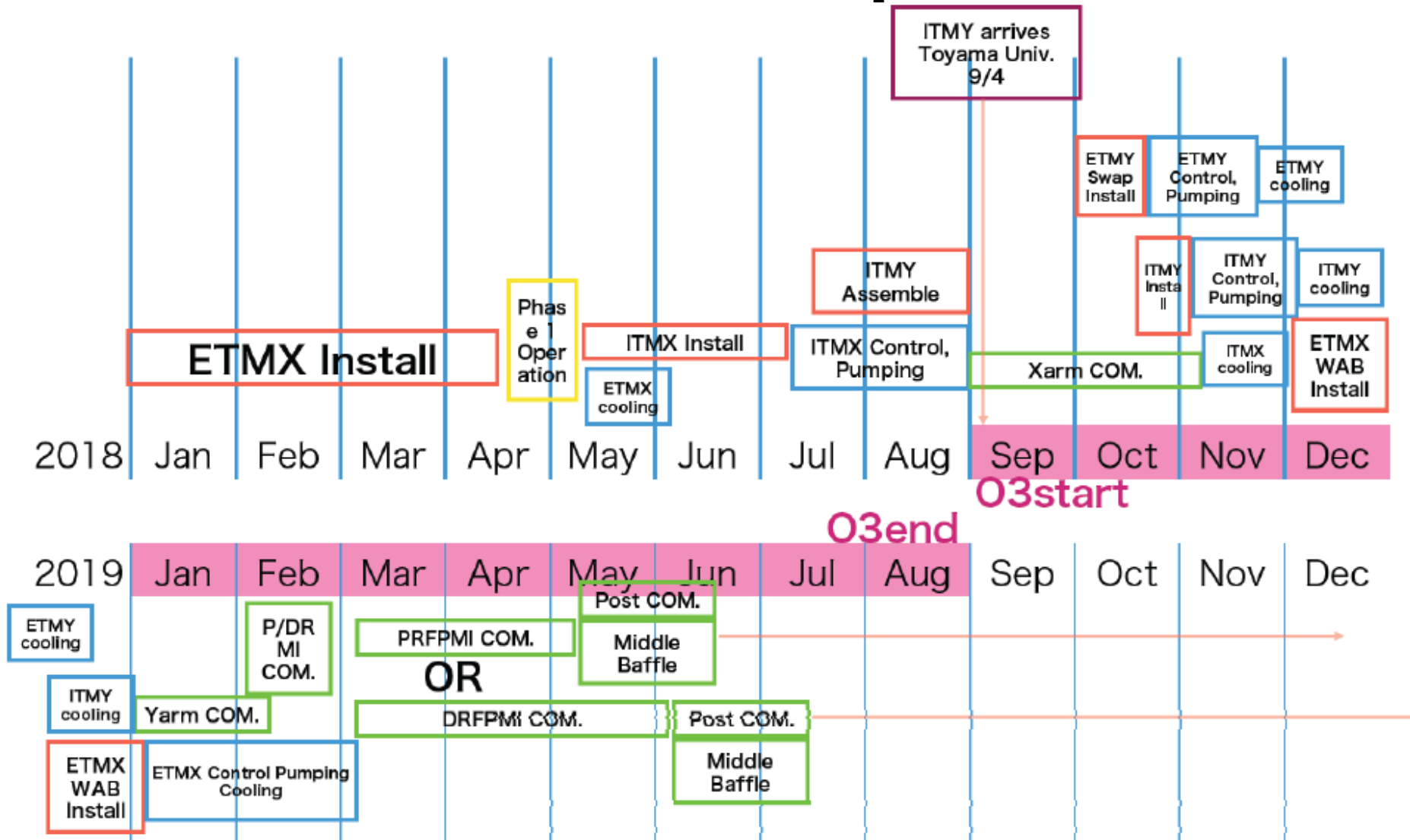
Dear Dave, David, Stavros and Jo,

Once again, we, the KAGRA collaboration, congratulate you for the observations of gravitational-wave signals from mergers of blackhole binaries and a neutron-star binary, and, of course, for the Nobel Prize in Physics in 2017.

The successful observations of GW signals in the summer of 2017 strongly suggested to us that KAGRA should join the global GW network as soon as possible. Therefore, at the December 2017 KAGRA Face-to-Face meeting, we extensively discussed and resolved to do our best to begin operation in late 2019, so that, if possible, KAGRA will run the detector at the same time of the LIGO-Virgo O3 run, and, if possible, to join the GW network. Since the December meeting, the KAGRA Systems Engineering Office (SEO) team has been studying if this is feasible.

We plan to have initial interferometer operation with 2 cryogenic mirrors in the spring of this year (2018). We expect the completion of the construction for the first physics run one year from now. Some commissioning work will begin even before the completion of

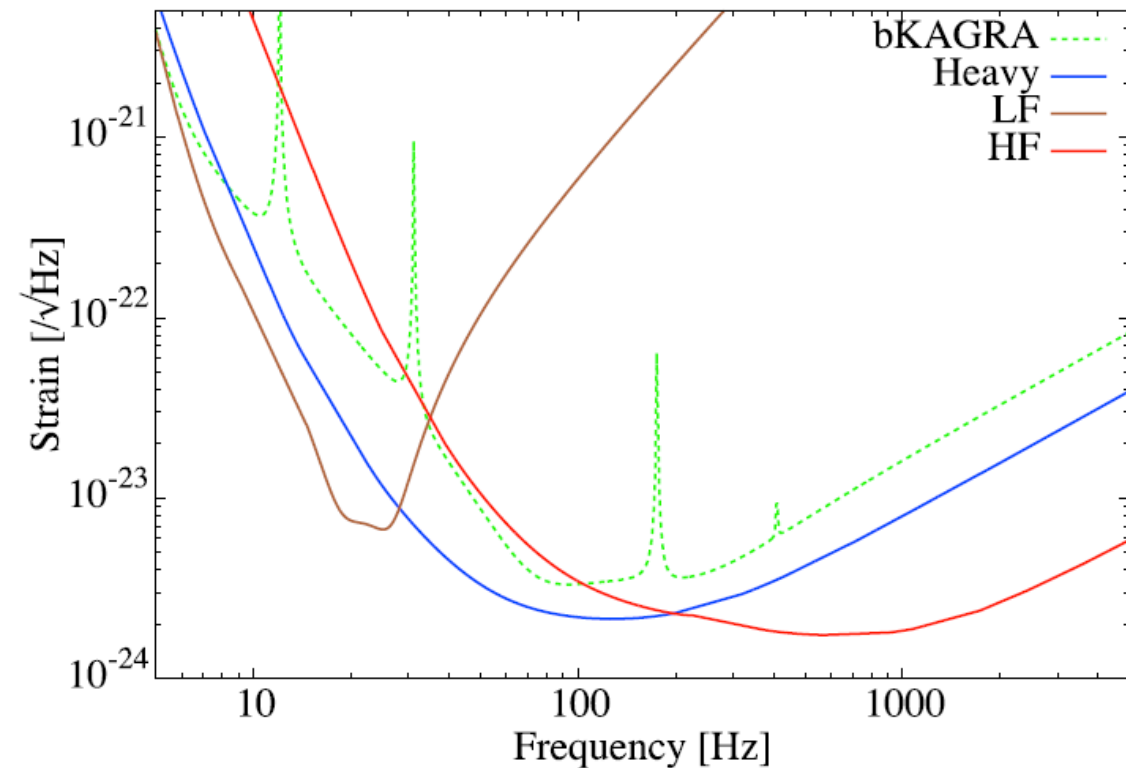
Observation plan



The IFO configuration is still undecided (RSE/PRFPMI/FPMI).
 Our estimated possible sensitivity is 40/20/10Mpc for BNS.

KAGRA+

Sensitivity curve candidates



About a year ago, we started discussing a possible upgrade of KAGRA, aiming at an observation in 2022~24.

We studied science case for 3 possible upgrades, and considered the feasibility of each sensitivity.

Heavy: Upgrade of overall sensitivity using heavy sapphire

LF: Use thin long suspensions to improve low frequencies

HF: Inject high power laser, sacrificing the TM temperature

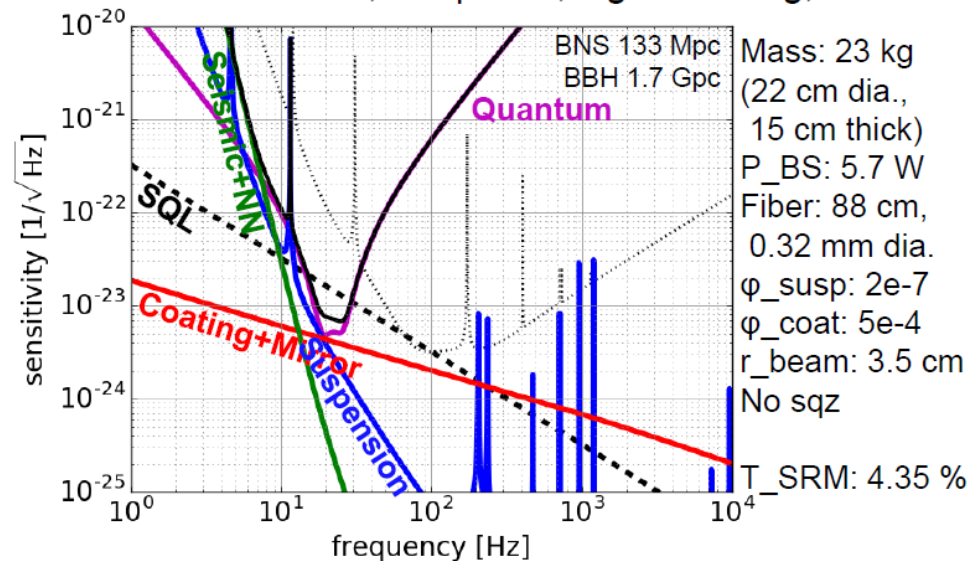
KAGRA+

[Nishizawa]

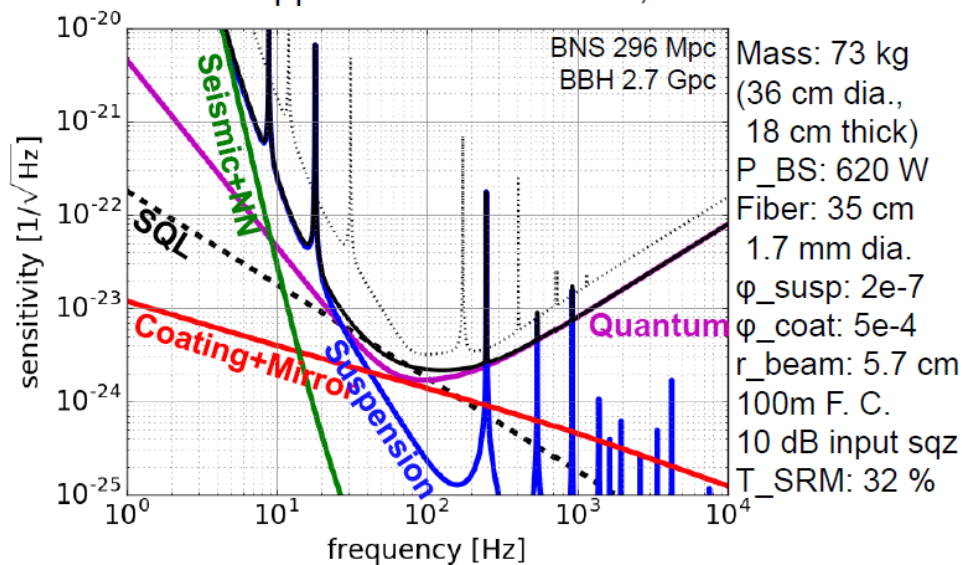
[Michimura]

	bKAGRA	LF	Heavy	HF
test of GR with BH ringdown	×	×	△	○
existence of IMBH from hierarchical growth	△	△	○	△
existence of stellar-mass BBH from popIII	×	×	×	×
sky localization for BBH (identifying host galaxy)	△	×	○	○
pulsar ellipticity	×	×	△	○
NS equation of state	×	×	△	○

- Same test mass, low power, high detuning, 20 K



- Heavier sapphire and heavier IM, 20 K



- Same test mass, high power, 24 K

