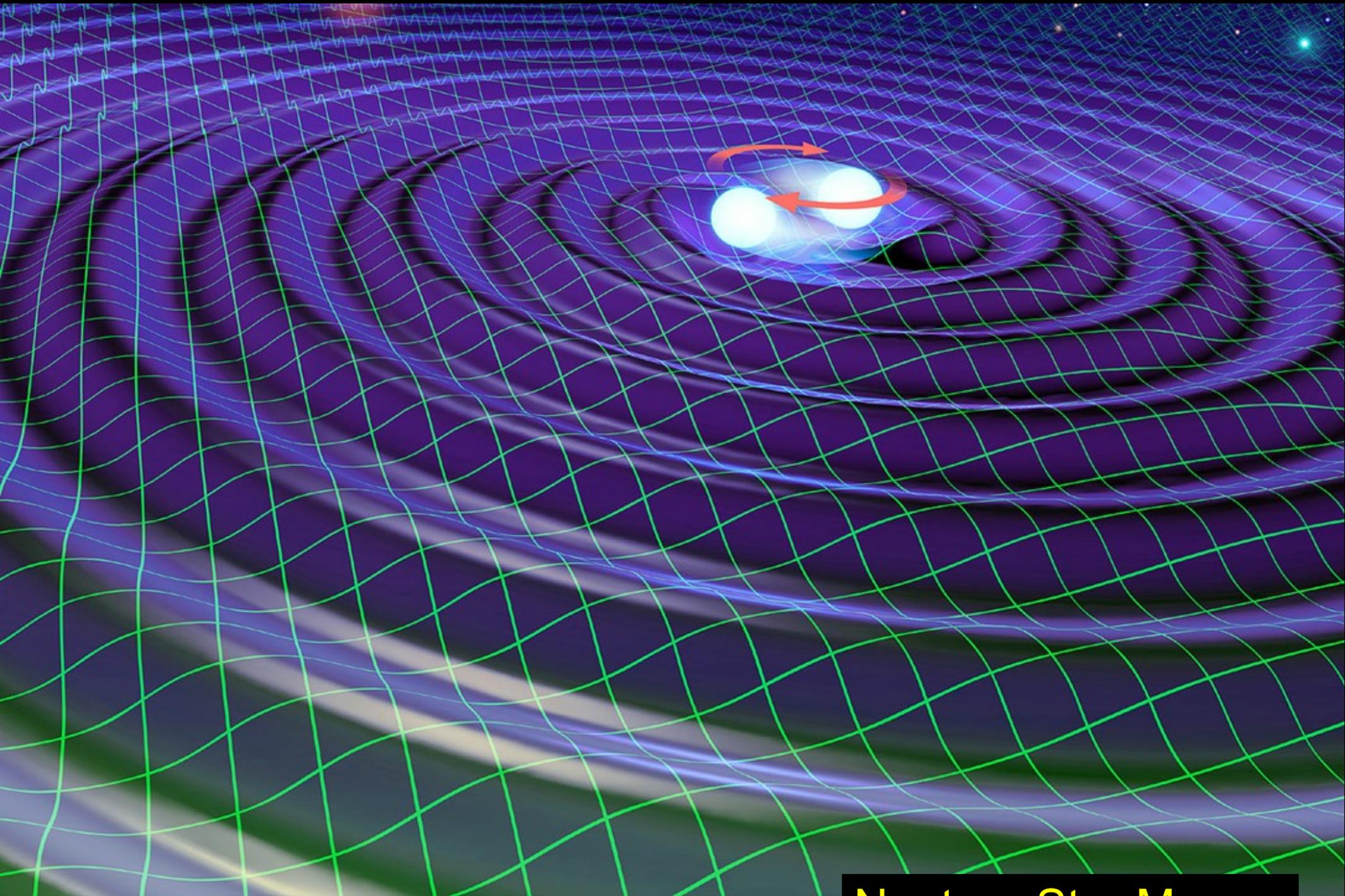


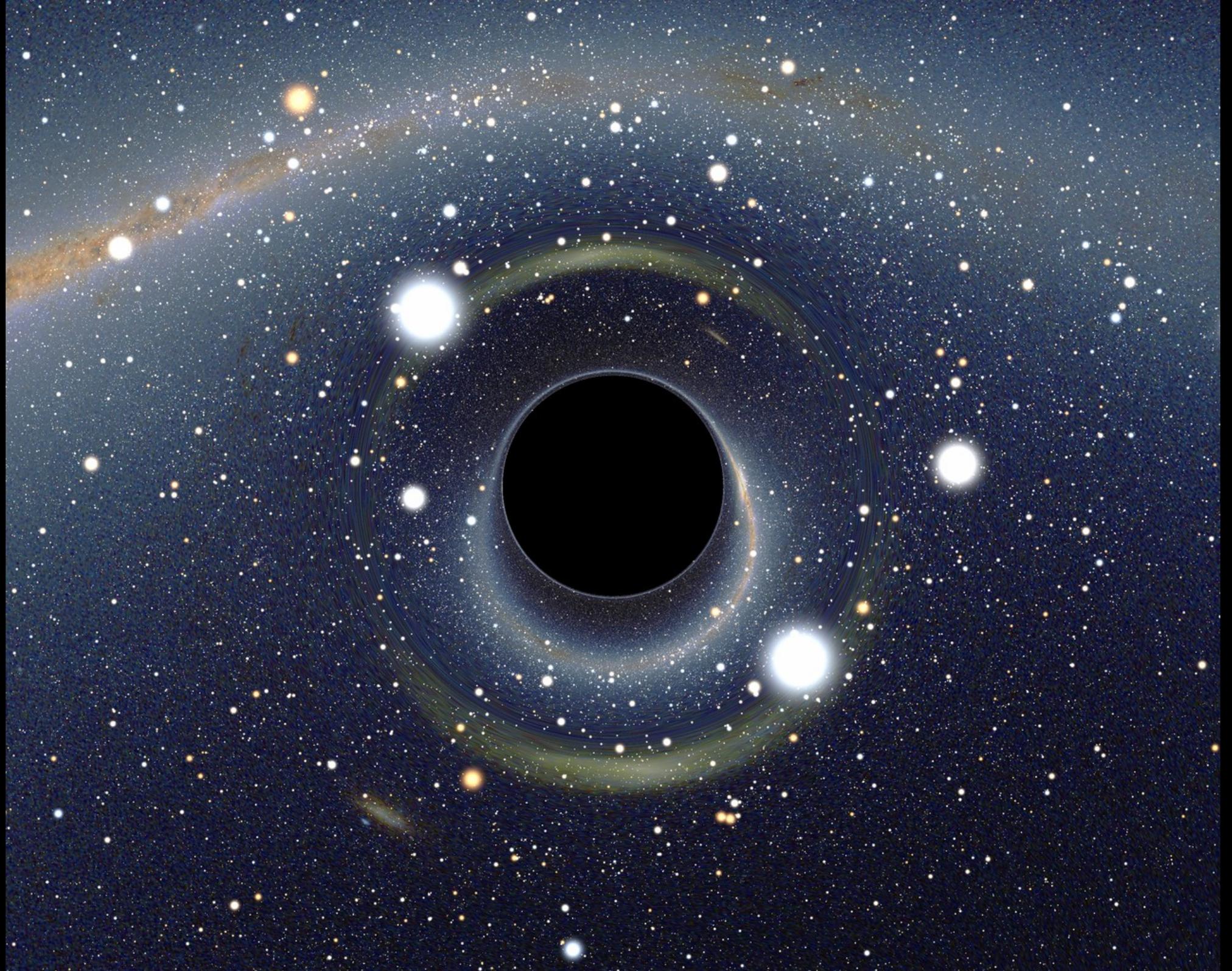
大型低温重力波望遠鏡 KAGRAプロジェクトの現状

2014/9/20@日本物理学会2014年秋季大会 in 佐賀大学
国立天文台・麻生洋一 for KAGRA Collaboration

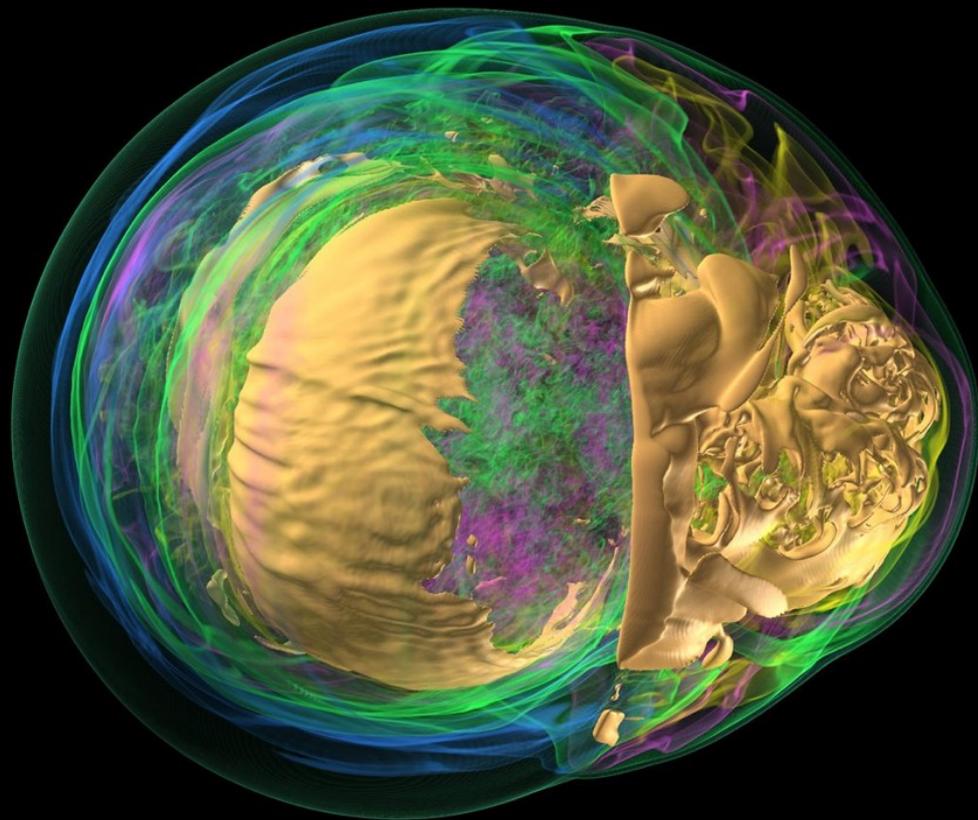
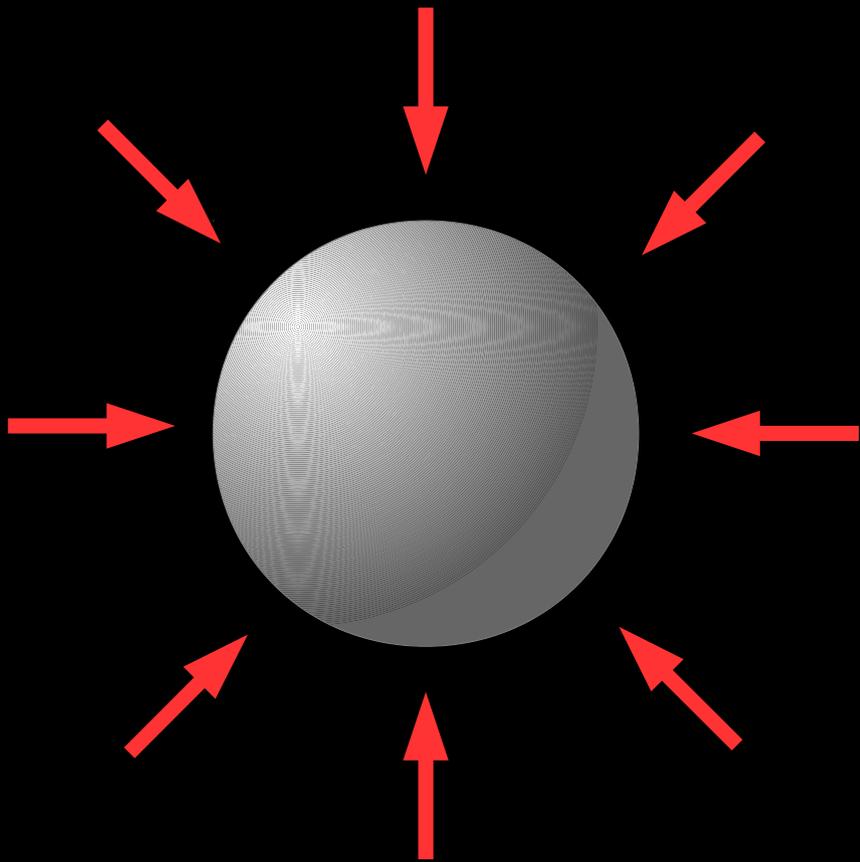
なぜKAGRAを建設するのか？

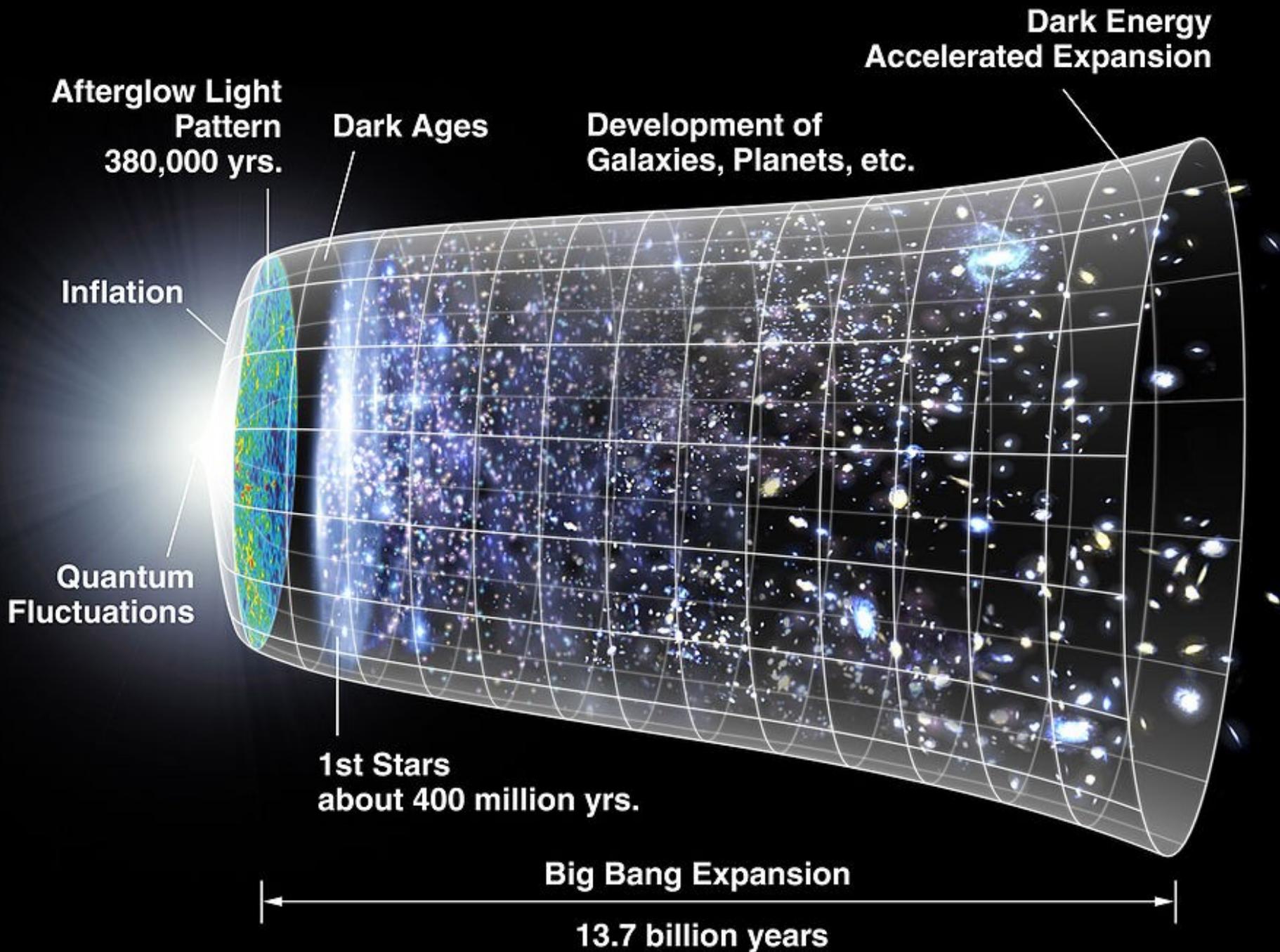


Neutron Star Merger

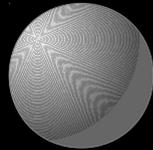
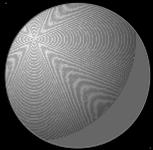


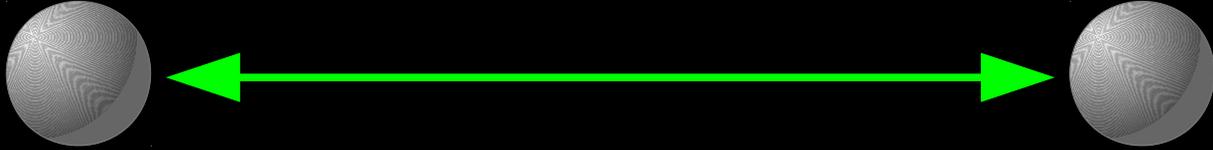
Core Collapse

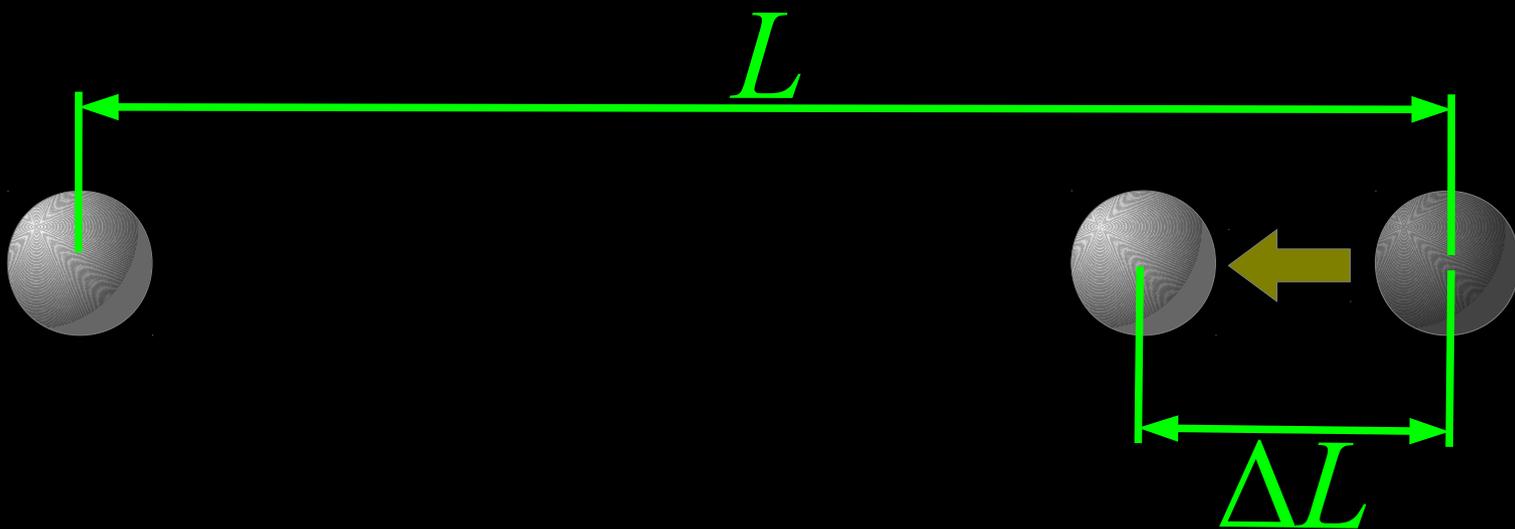




ではどうやって検出するのか？







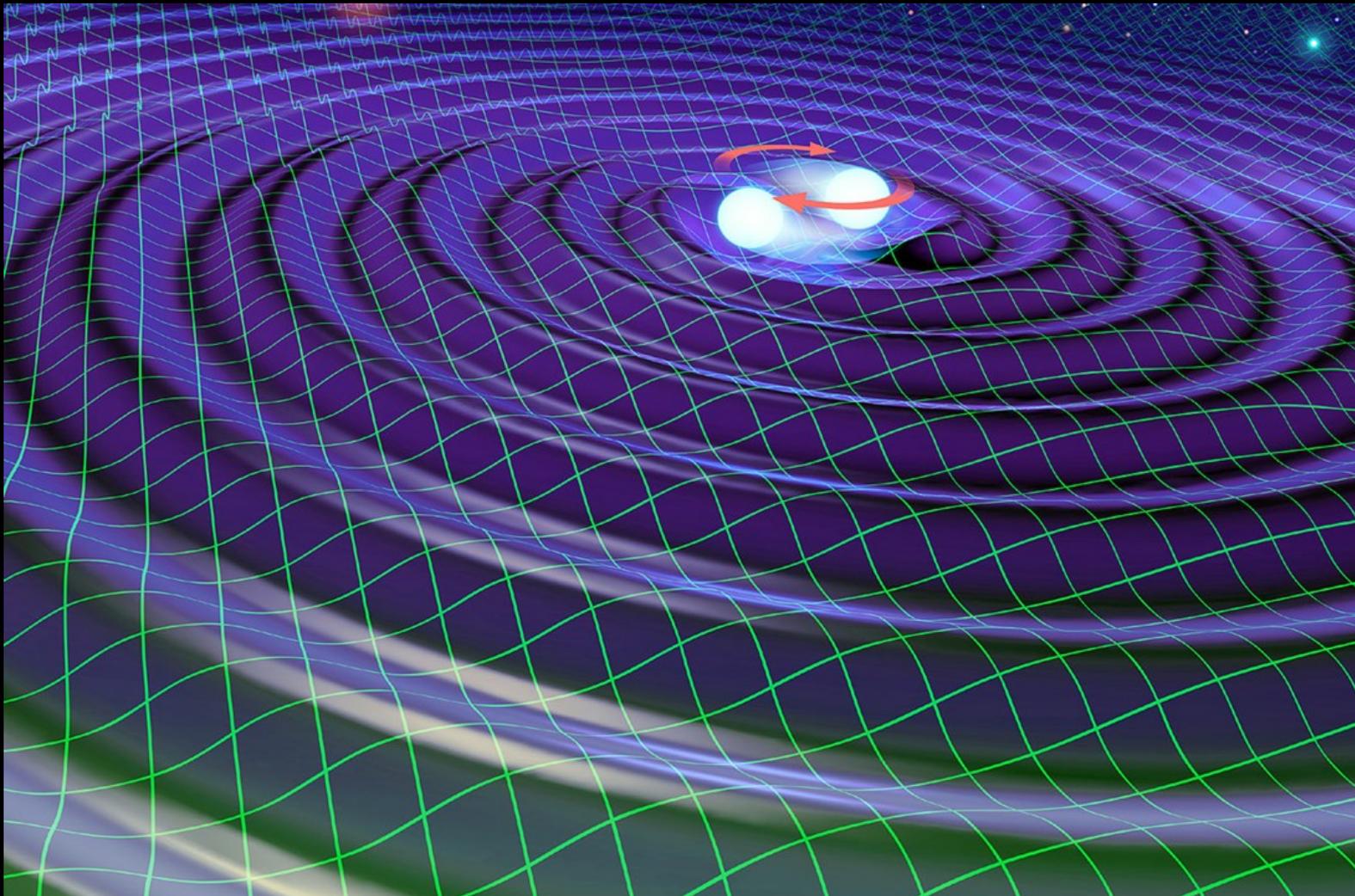
$$h = \frac{\Delta L}{L}$$

重力波振幅

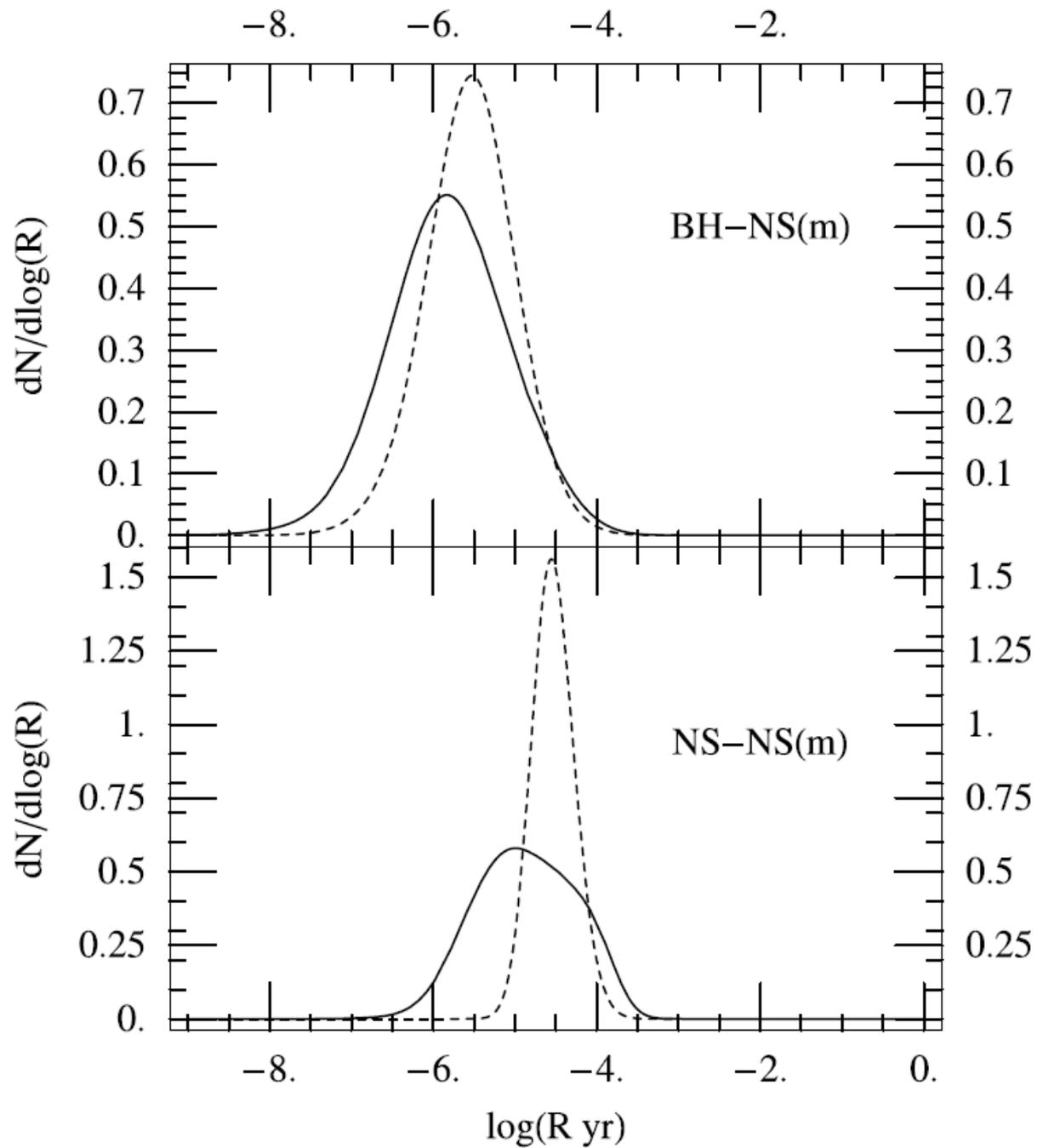
期待される h の大きさは？

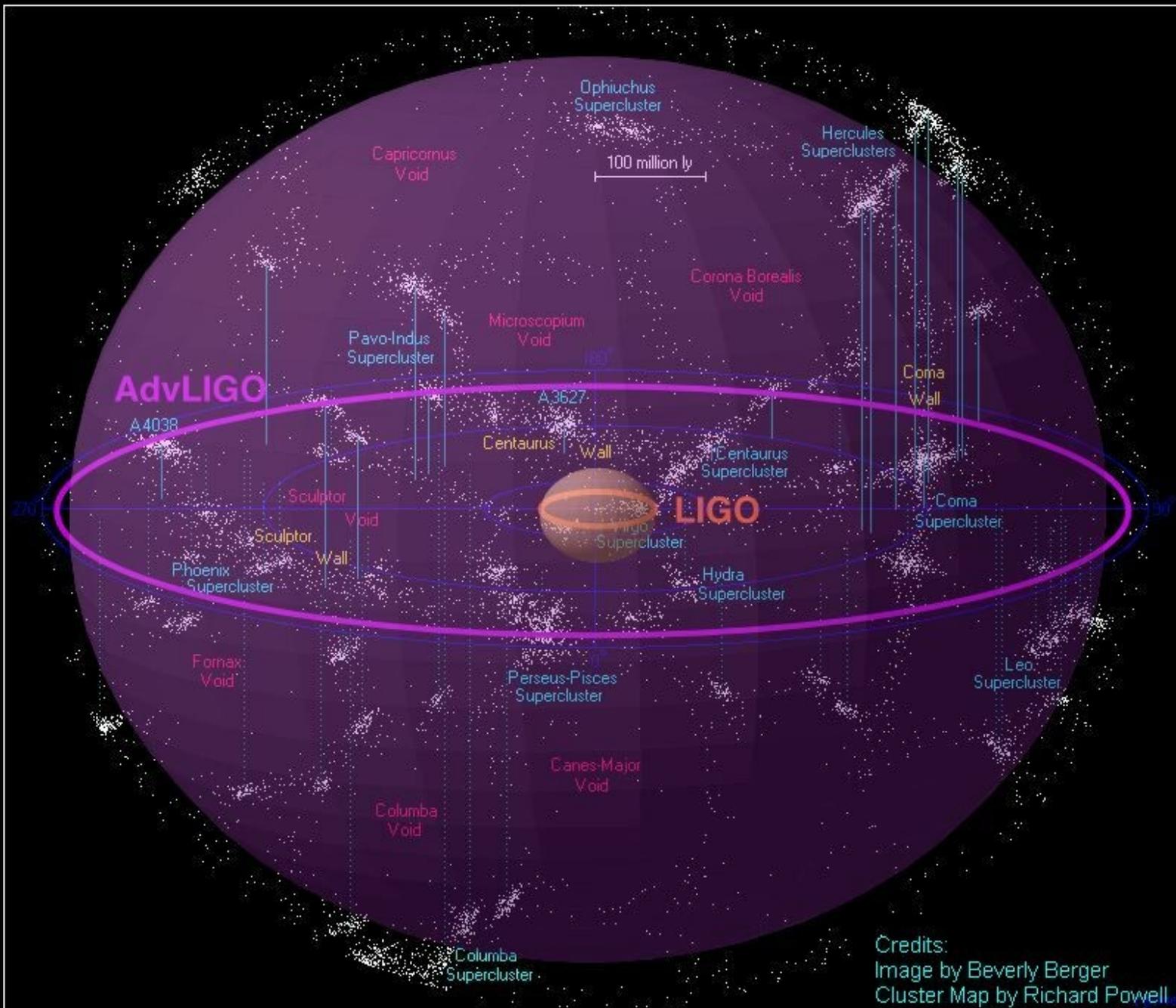
メインターゲット: 連星中性子星合体

最低1年間に1イベントは観測したい



1銀河当たり, 1万から10万年に一回





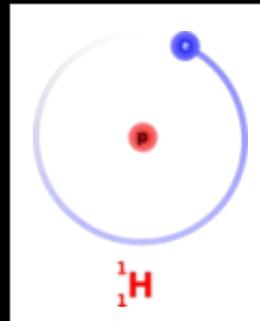
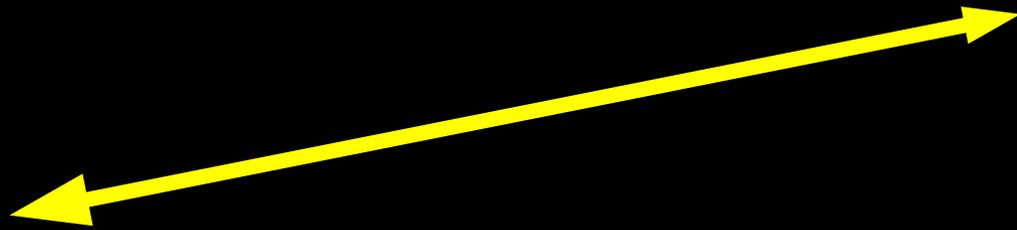
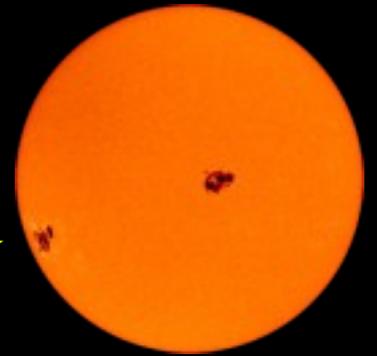
Credits:
 Image by Beverly Berger
 Cluster Map by Richard Powell

200Mpc

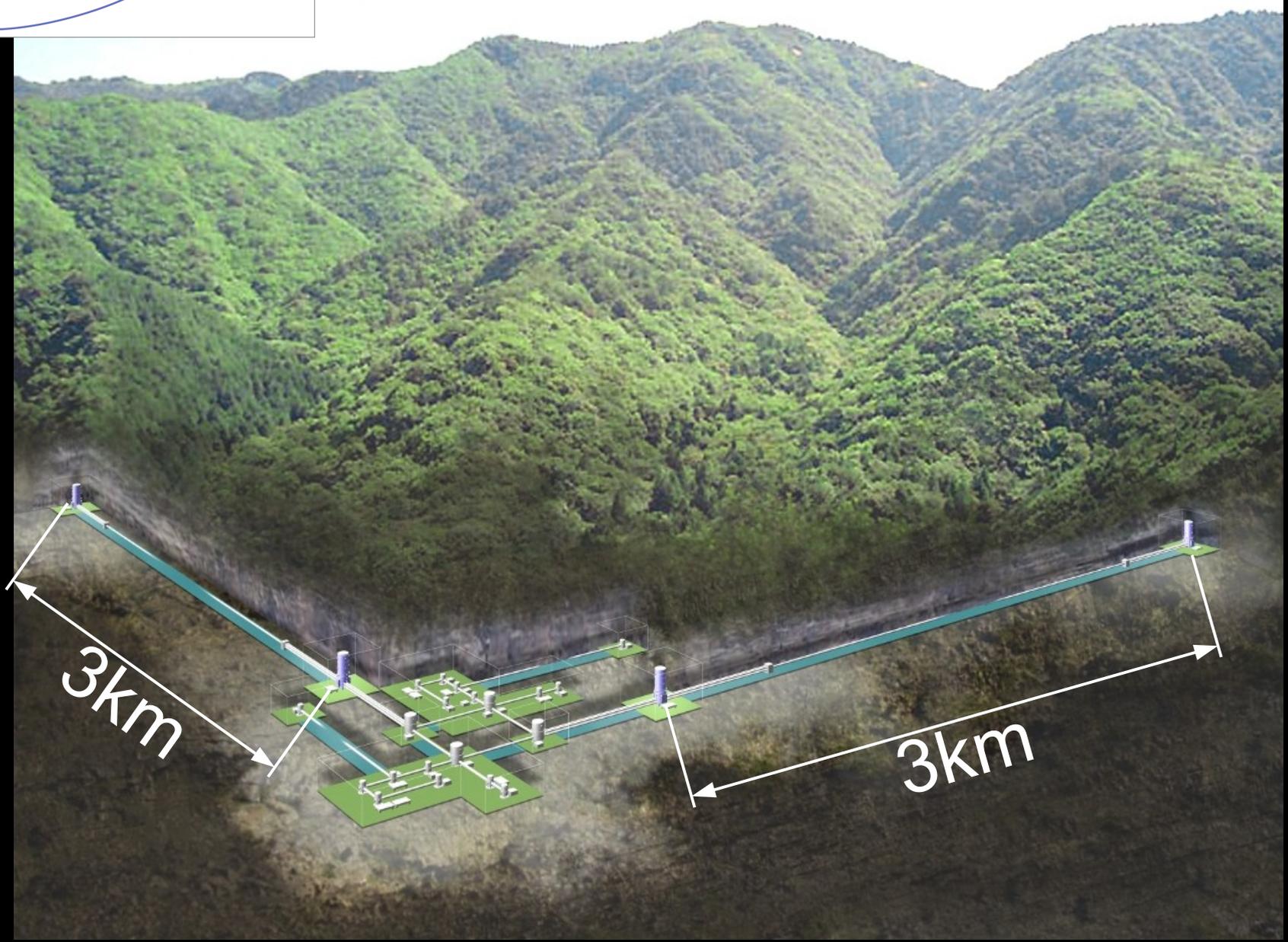
目標感度

$$h = 10^{-23} \sim 10^{-24}$$

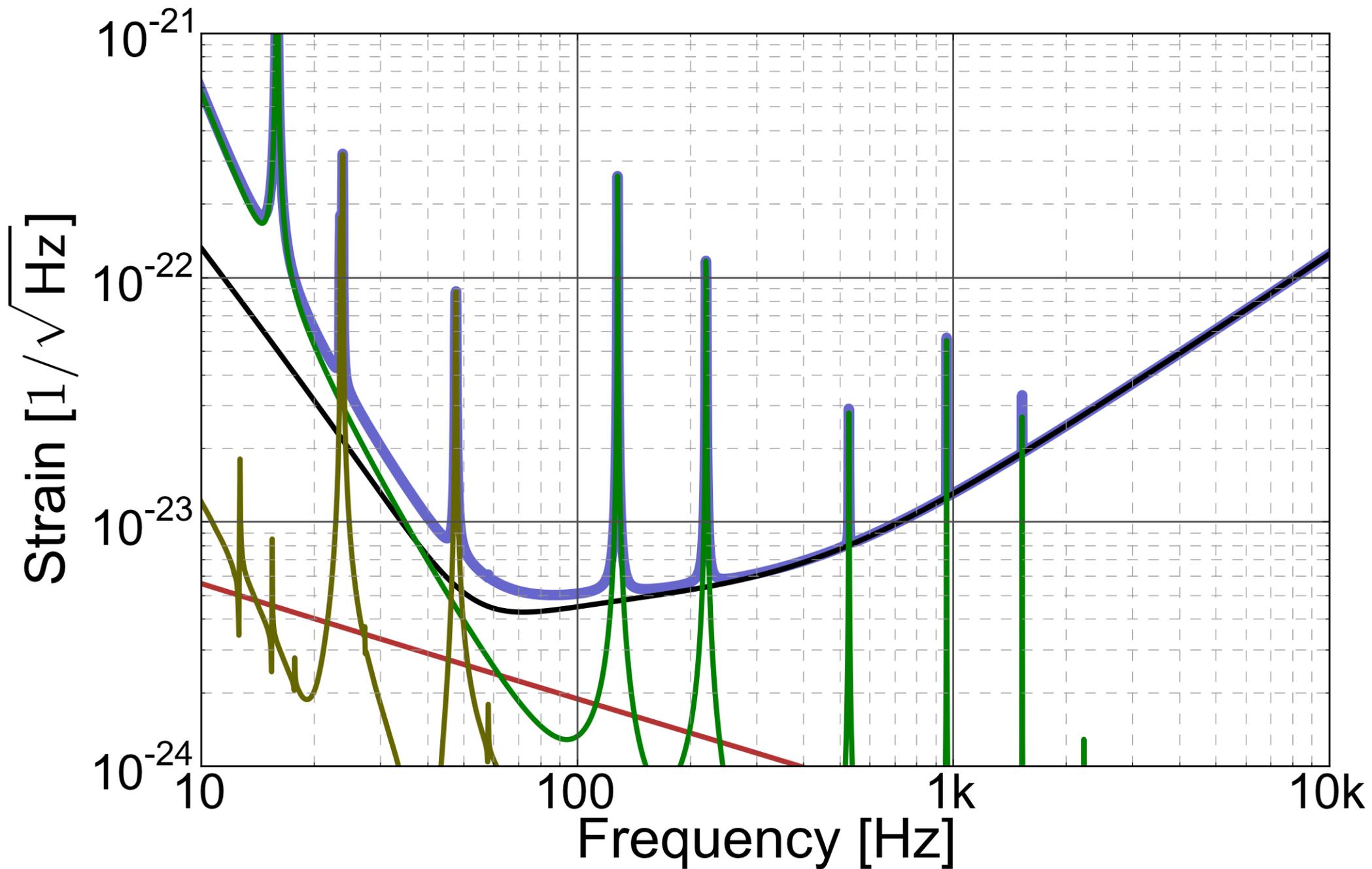
$$h = 10^{-24}$$



$$\times 1/1000$$

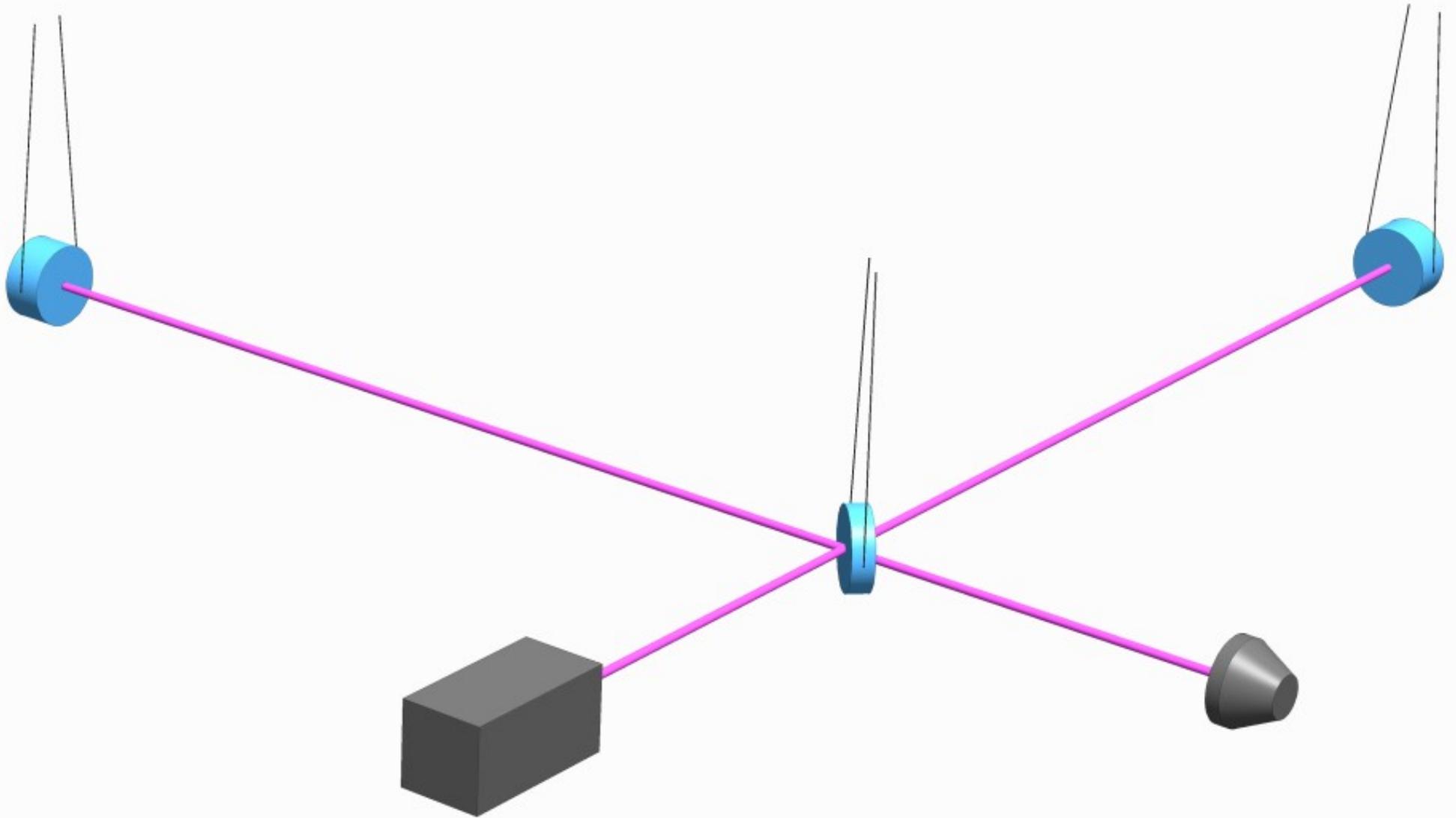


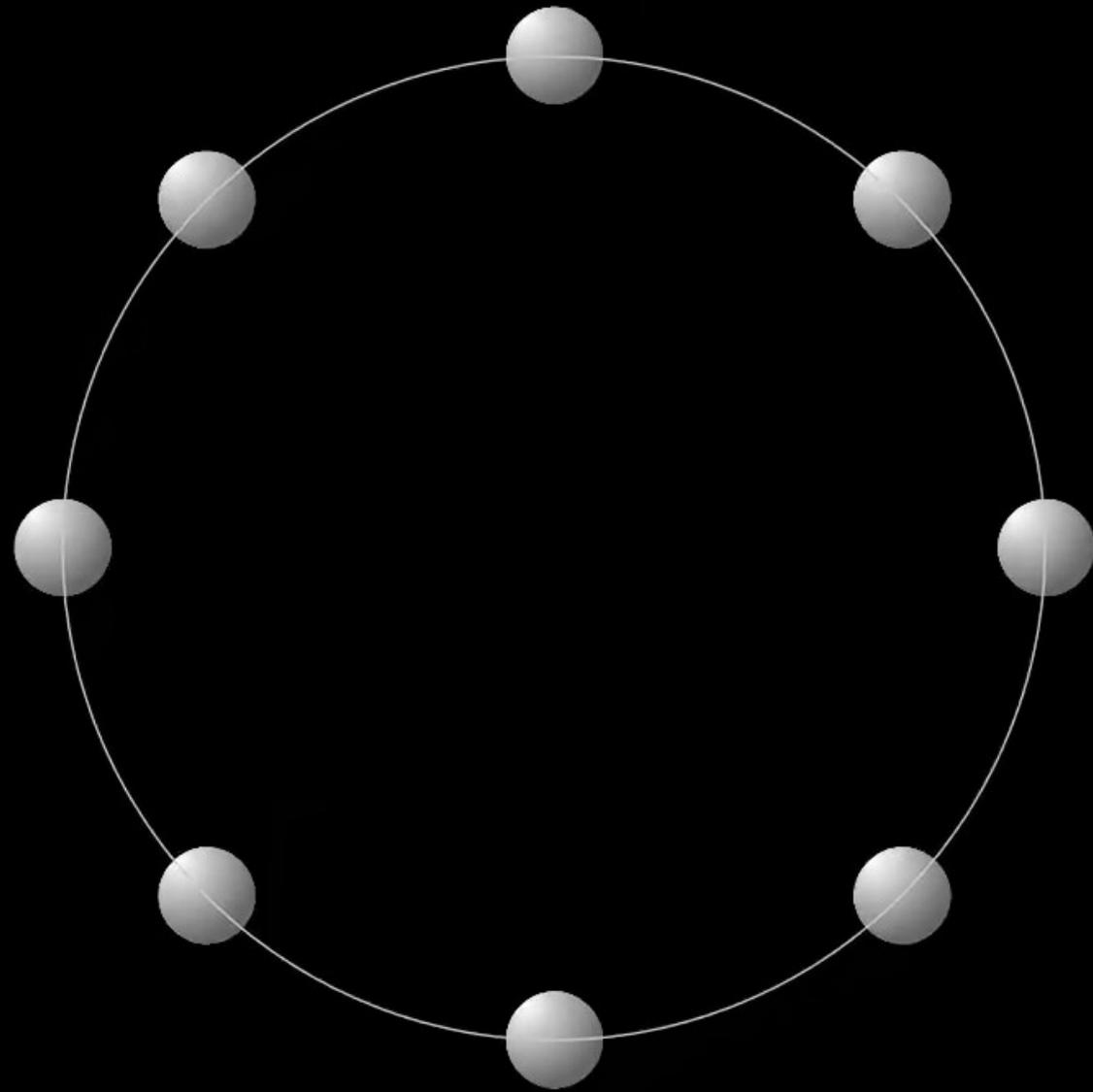
Target Sensitivity of KAGRA

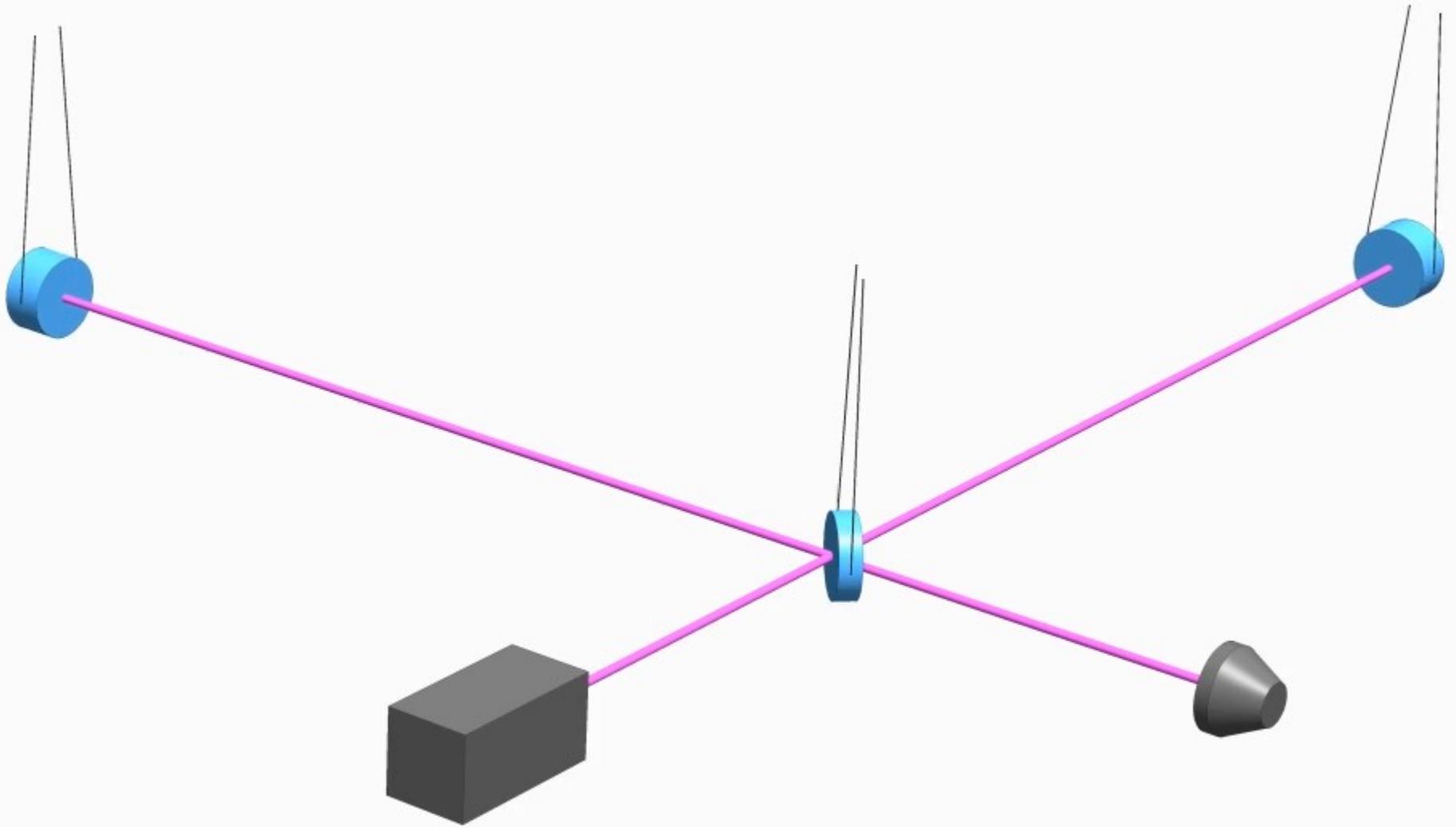


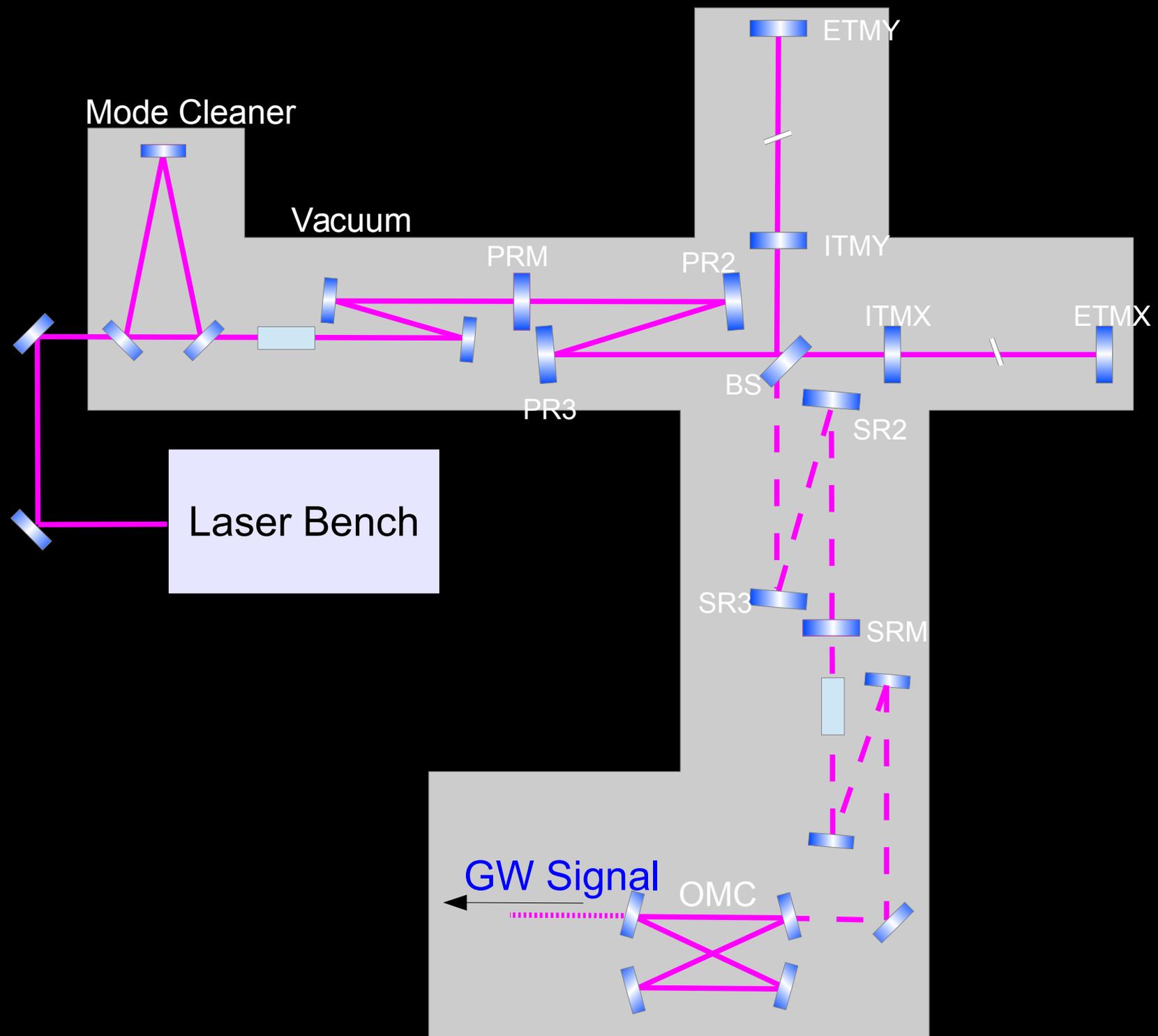
検出原理

Michelson Interferometer









KAGRA建設の現状

KAGRAの推進体制

- 中心機関: 宇宙線研, 国立天文台, KEK

KAGRA Collaboration

- 国内28機関, 国外36機関
- 国内155人, 国外76人



海外の重力波プロジェクトとの協力

- MoU with LIGO
- Academic Exchange Agreement with EGO/Virgo



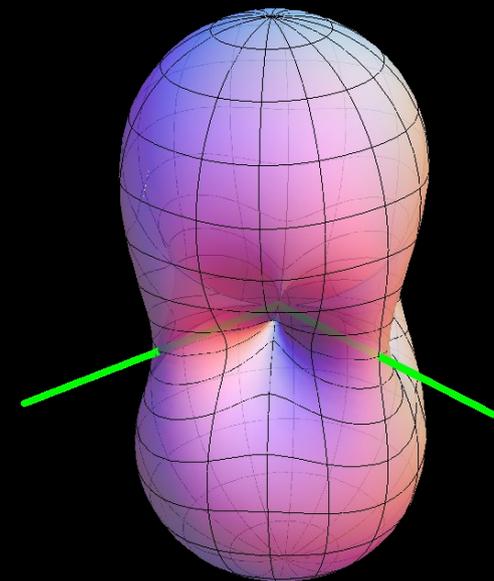
ELITES

日伊二国間
シンポジウム

日韓重力波ワークショップ



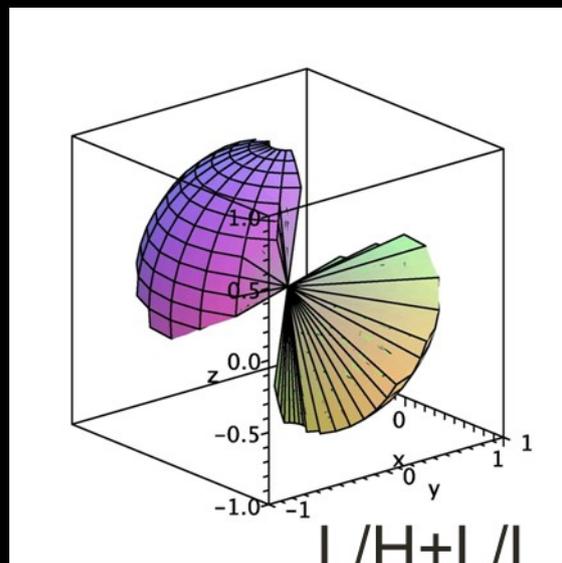
天球カバー率



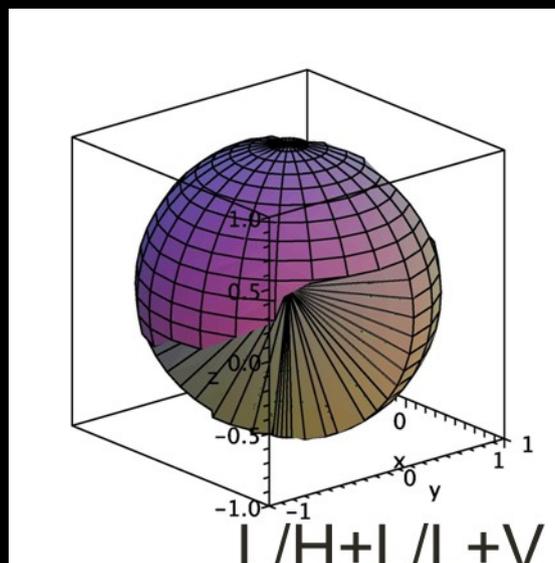
LIGO Only

LIGO+VIRGO

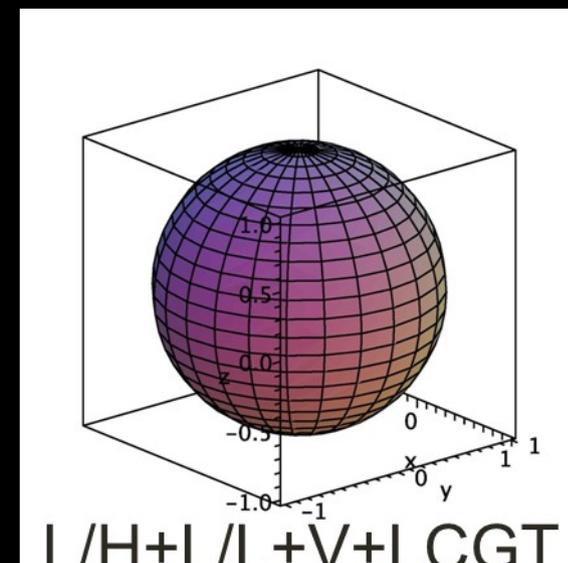
LIGO+VIRGO+KAGRA



33%

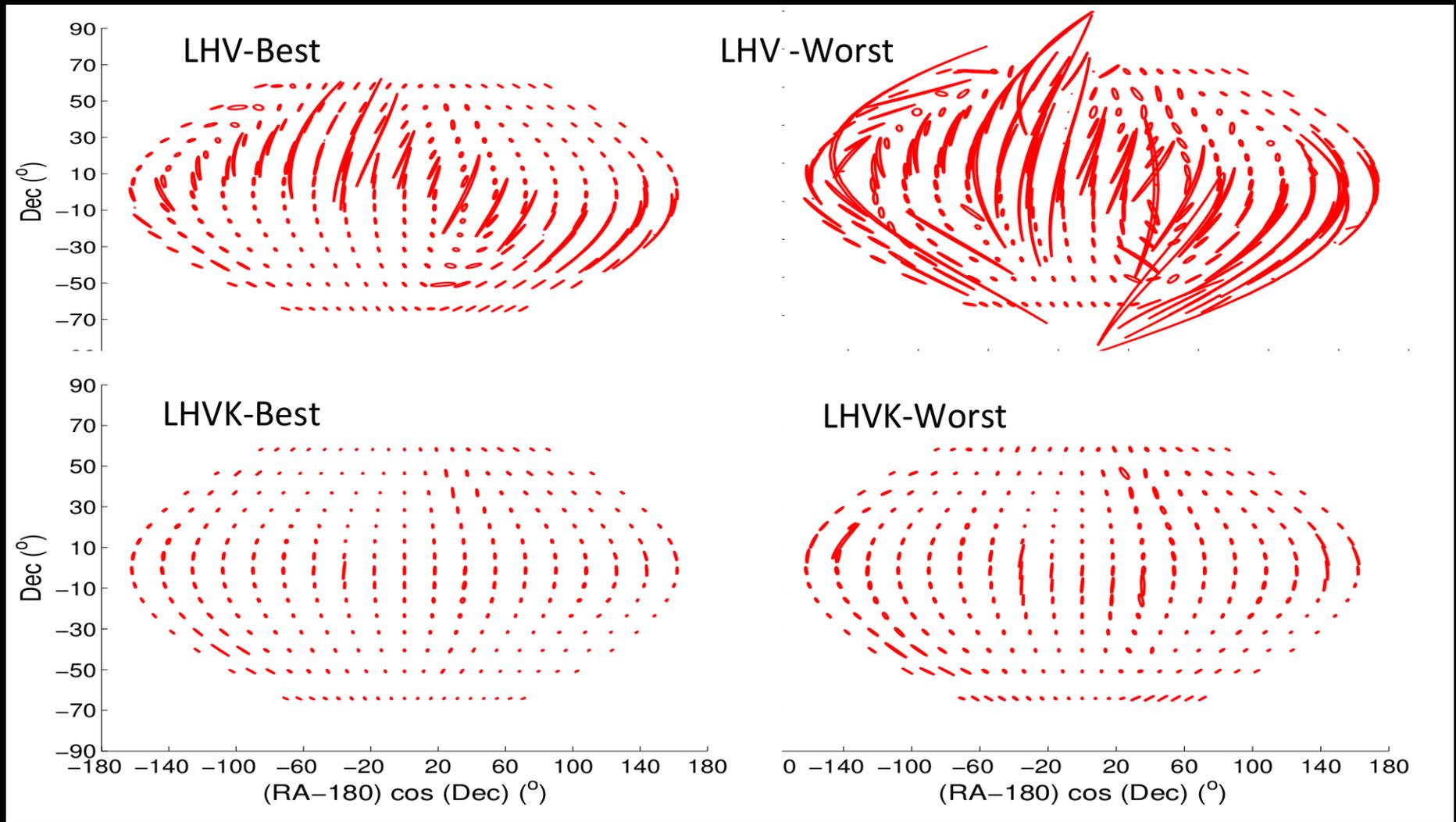


72%

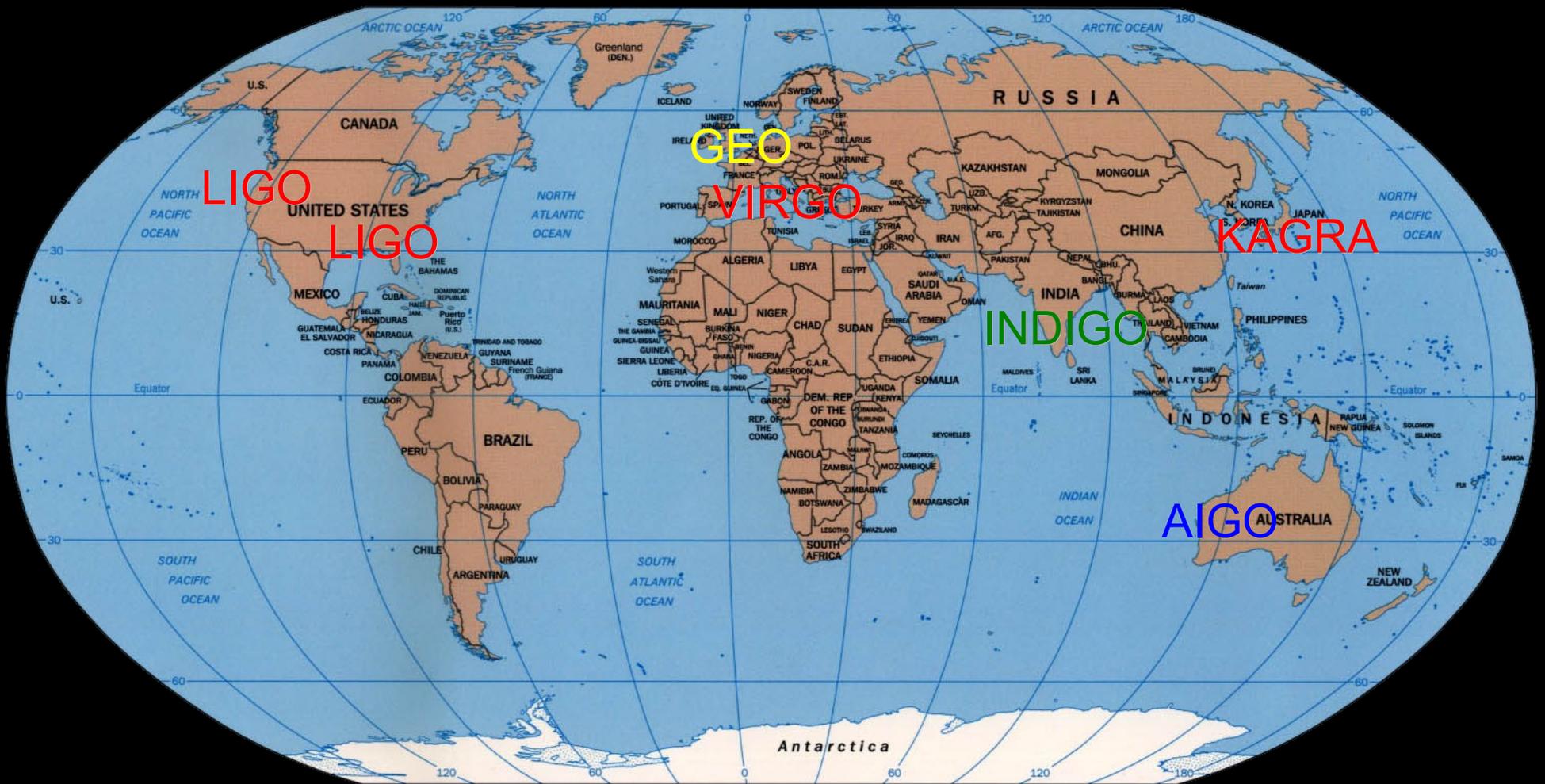


100%

重力波源の位置決定精度

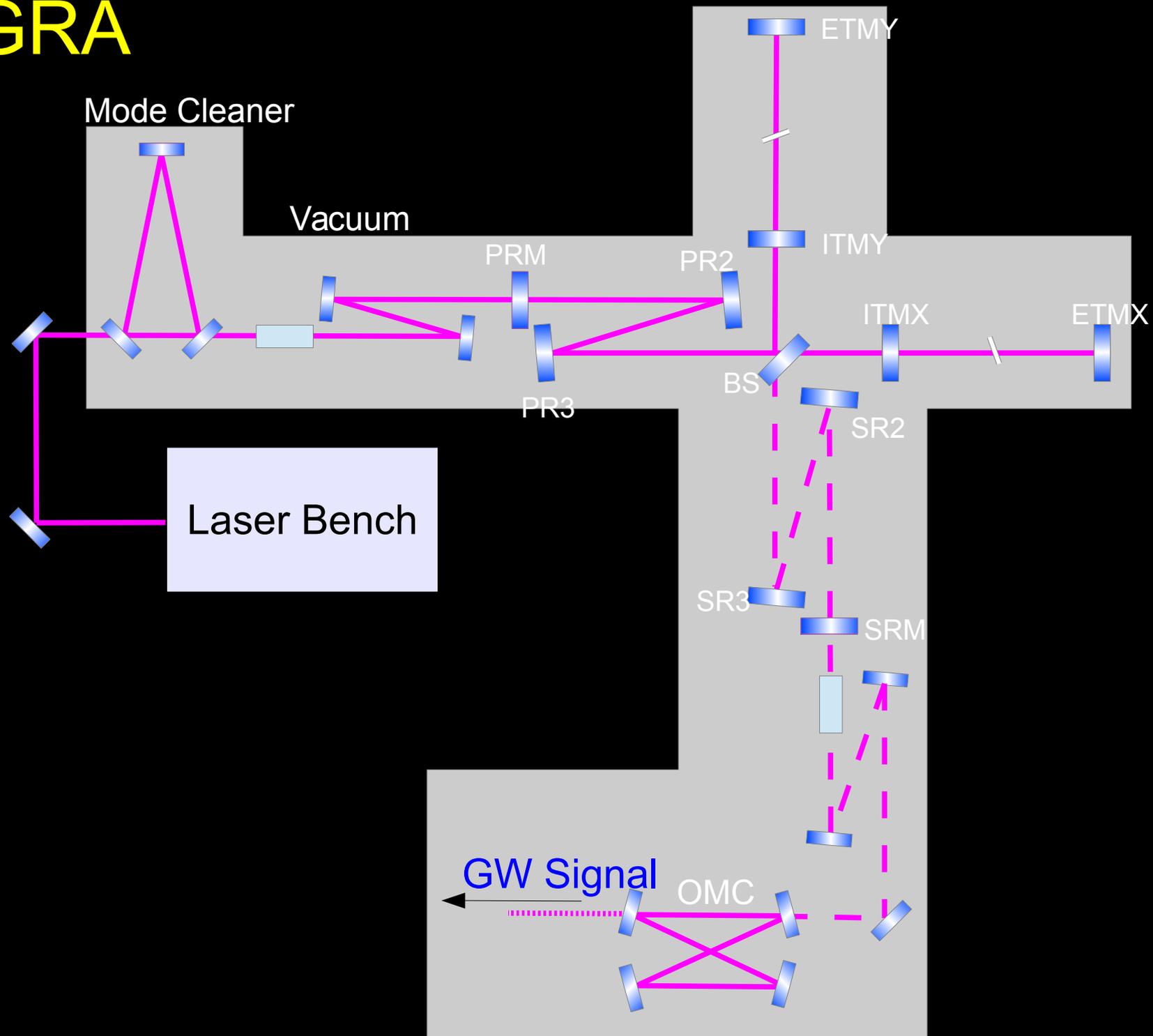


世界の大型重力波検出器計画

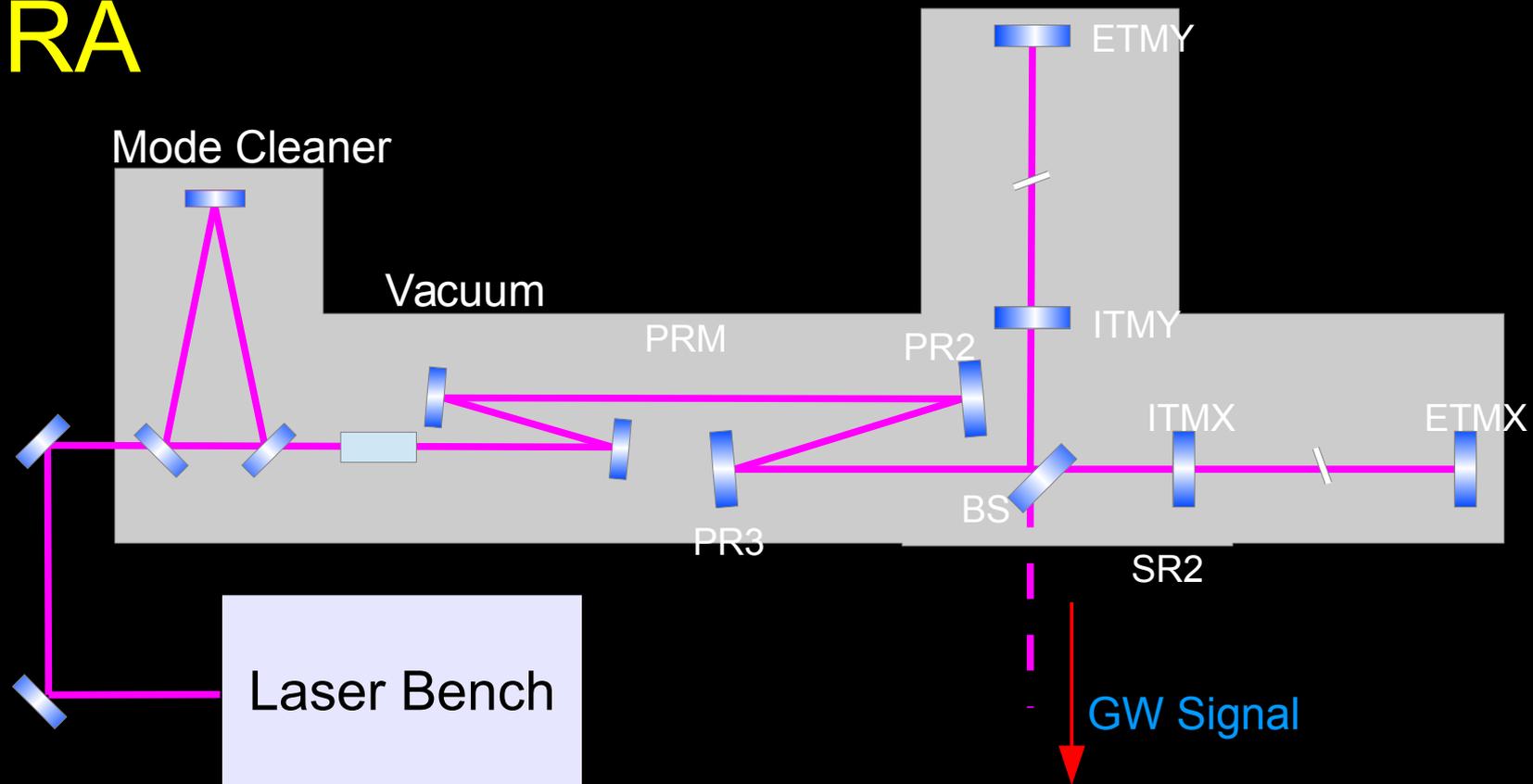


目標感度での観測開始: 2017 - 2018付近

bKAGRA

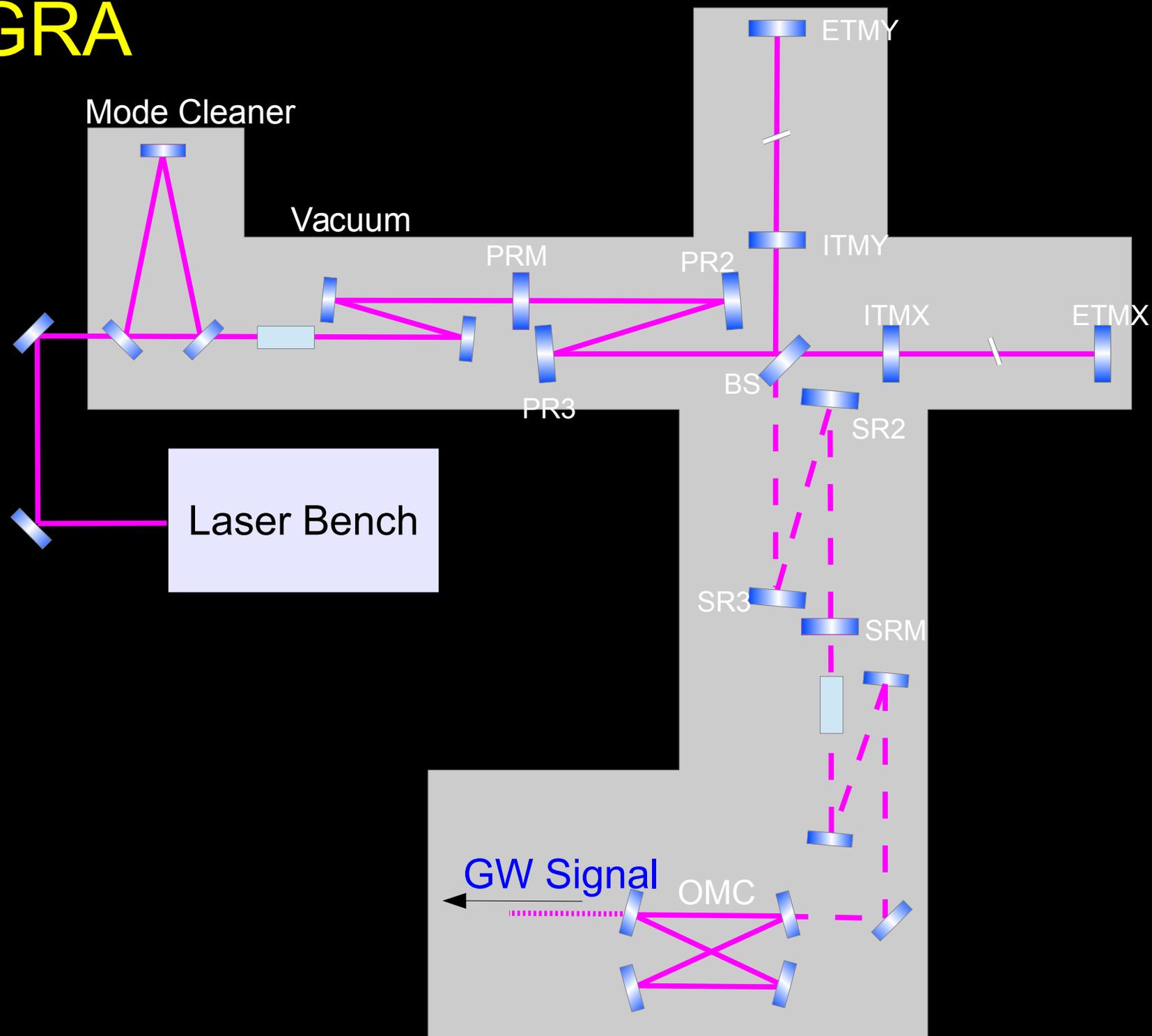


iKAGRA



常温干涉計

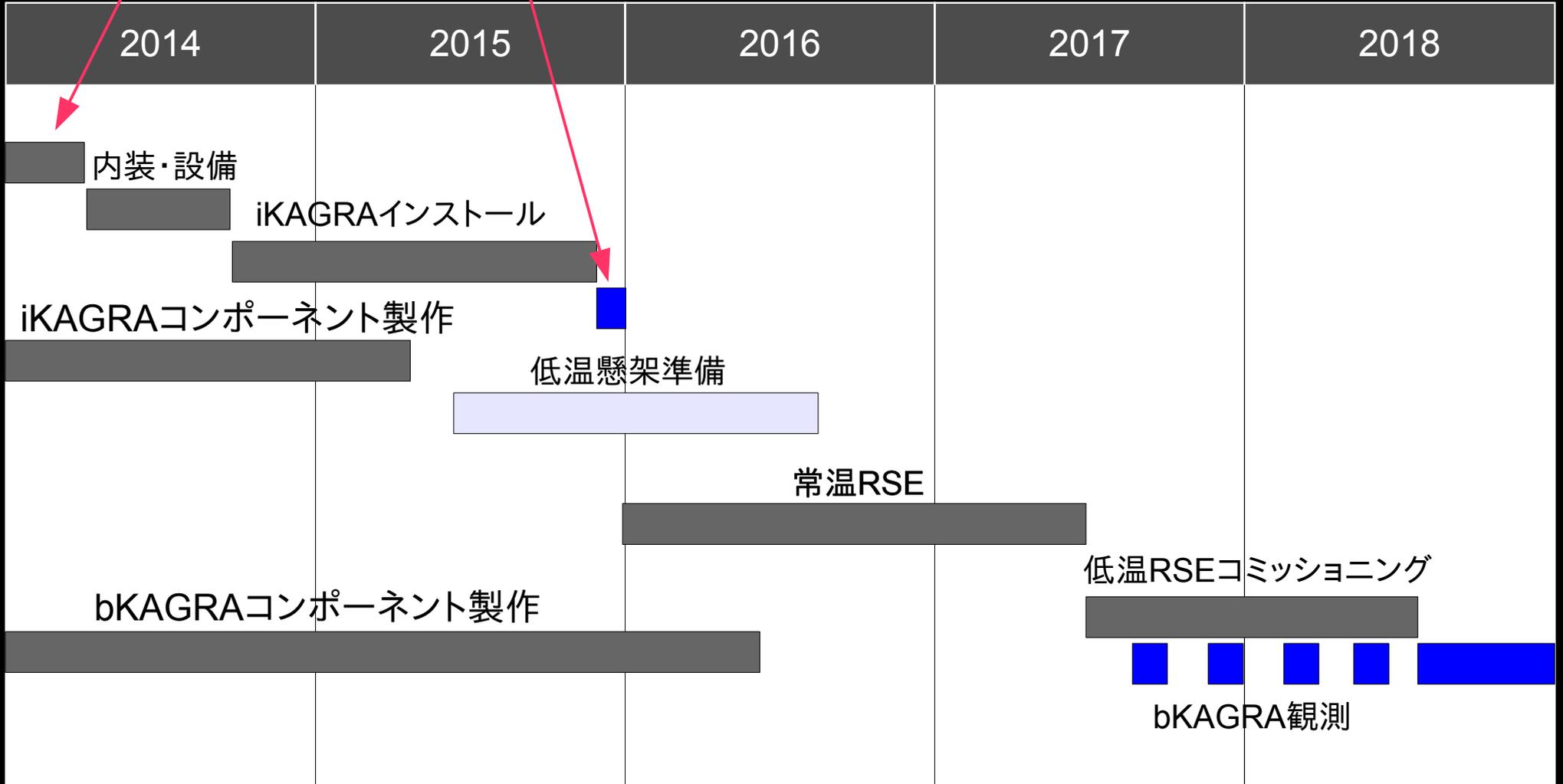
bKAGRA



スケジュール

トンネル掘削

iKAGRA観測



Location of Center (BS)

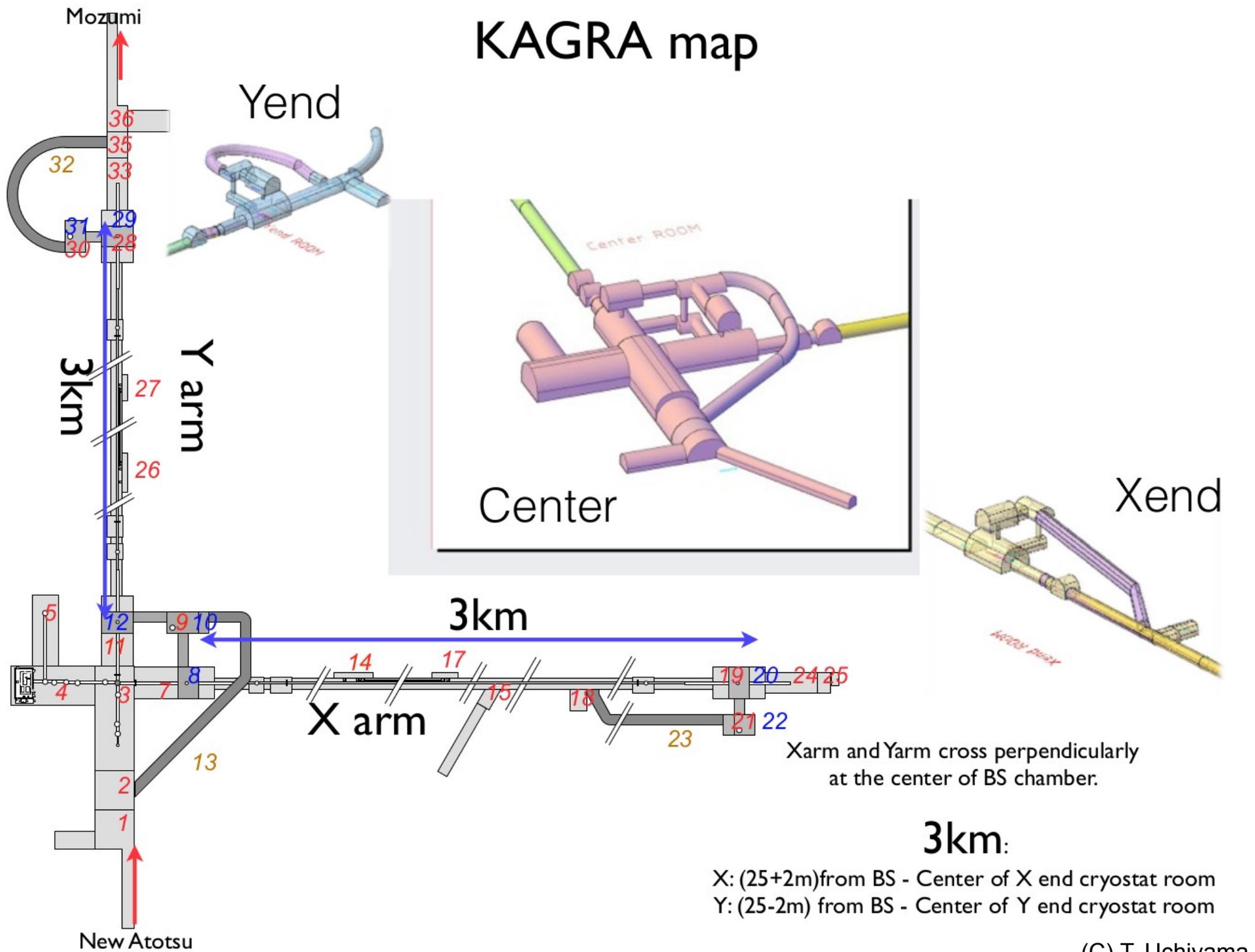
- latitude: 36.41°N , longitude: 137.31° .
- Y arm direction: 28.31 deg. from the North.
- Height from the sea level : about 372m.
- 2 entrances for the experiment room.
- Center, Xend, Yend are inside more than 200m from the surface of the mountain.
- Tunnel floor is tilted by $1/300$ for natural water drainage.
- Height of the Xend: 382.095m.
- Height of the Yend: 362.928m.



Tilt: 1/300

★ Water drain point

KAGRA map





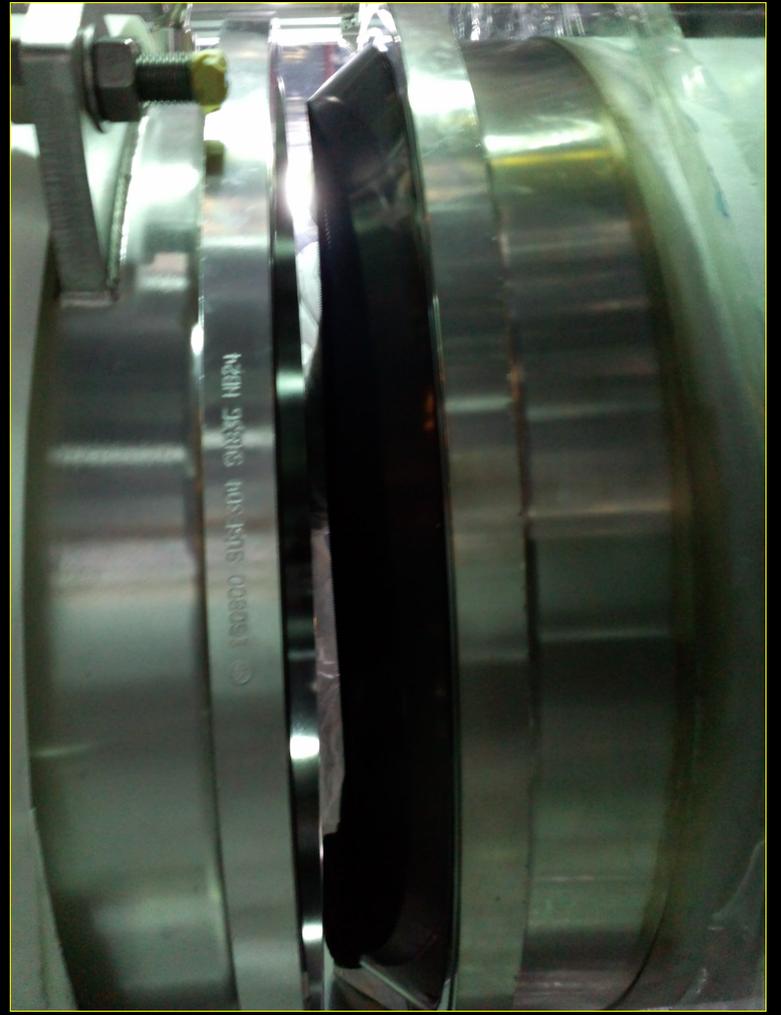
地上施設

2014年3月末竣工

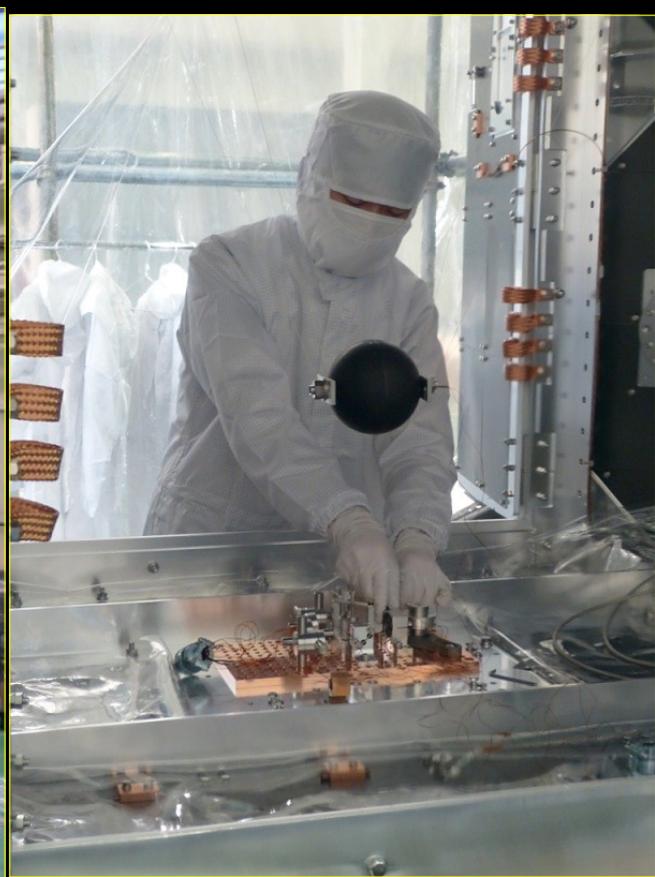
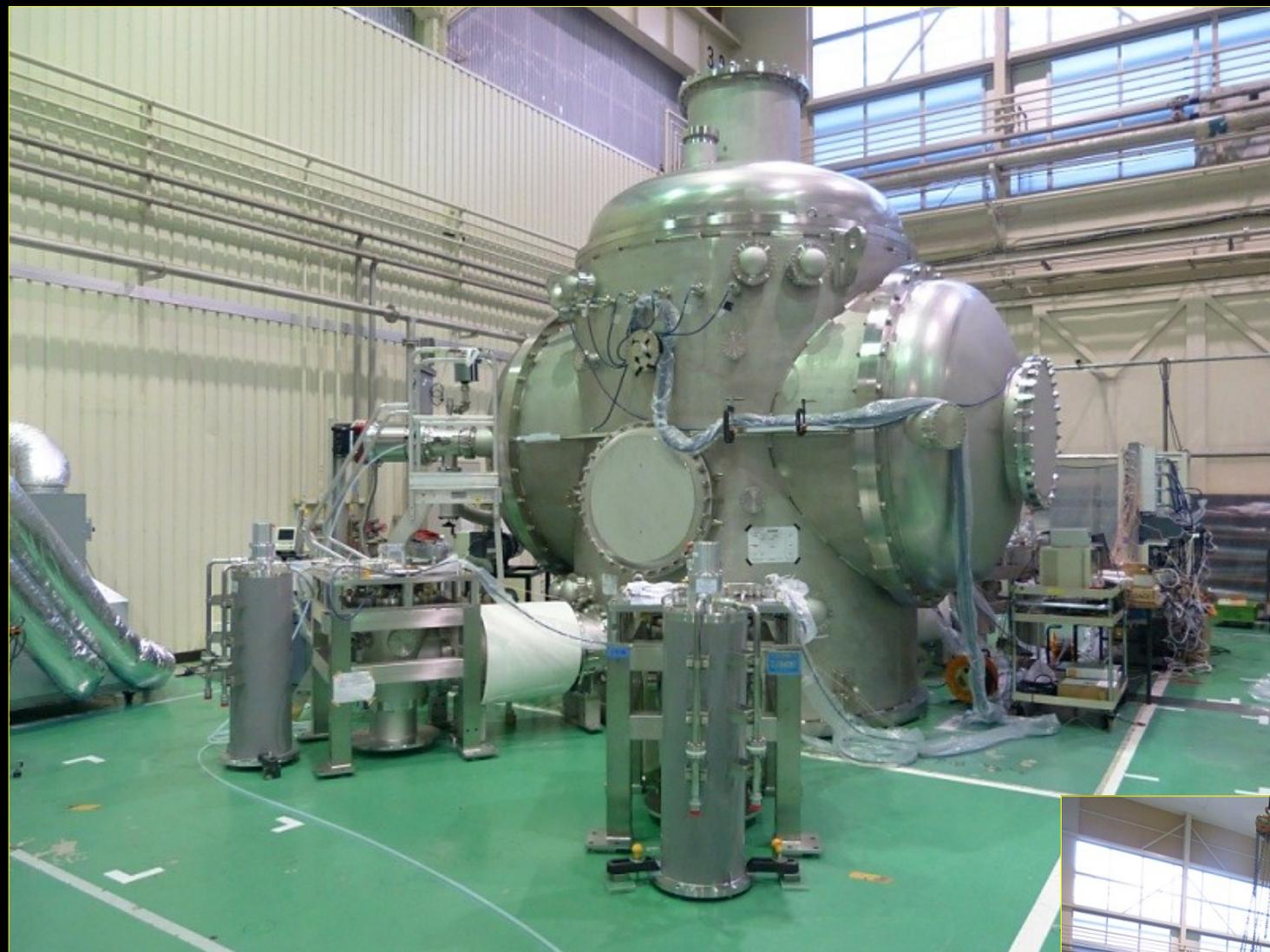


KAGRA office (since 2012, 140m²)

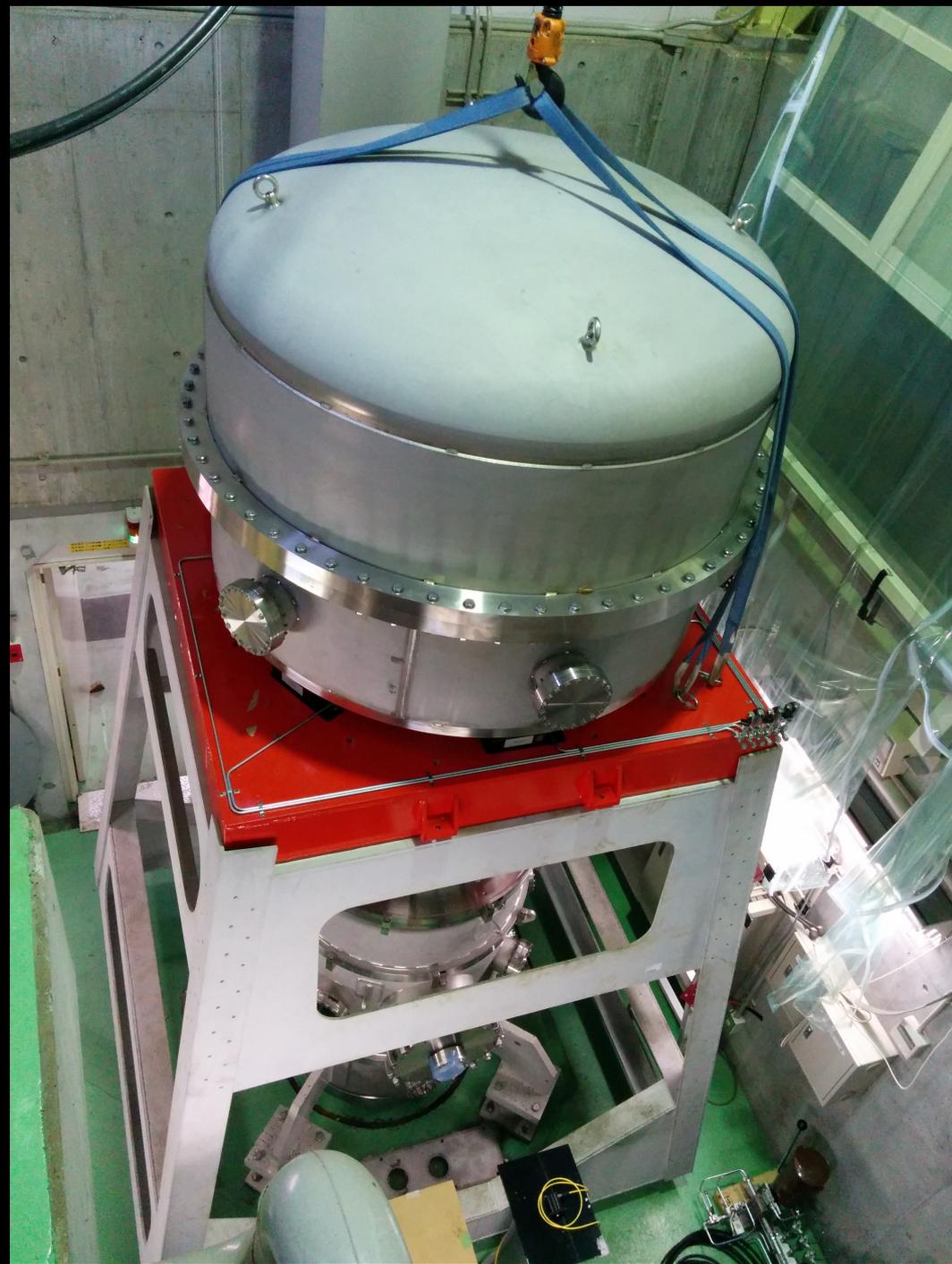
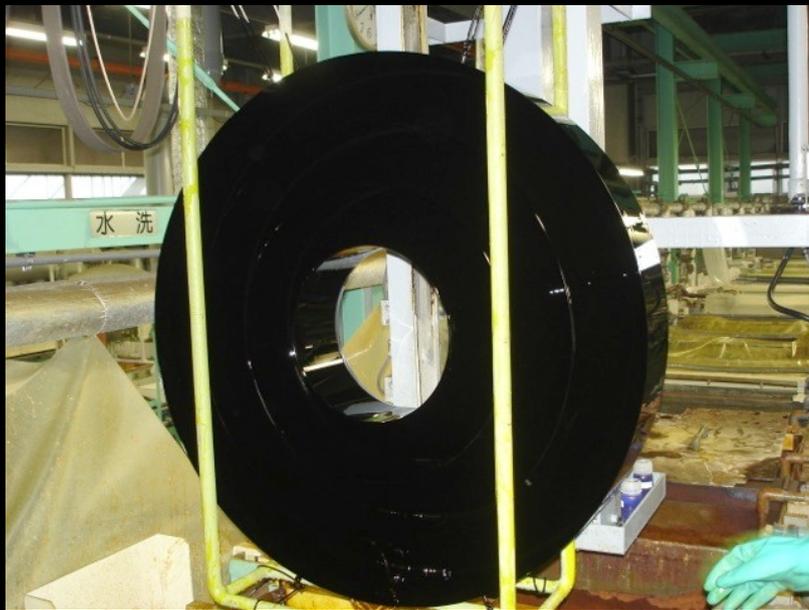




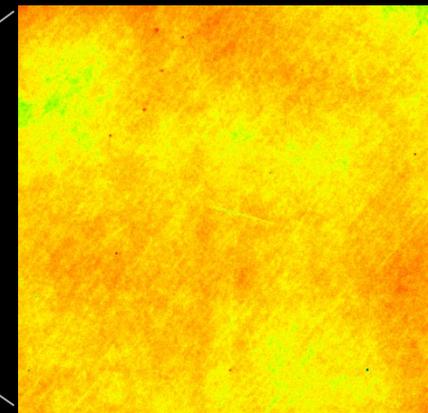
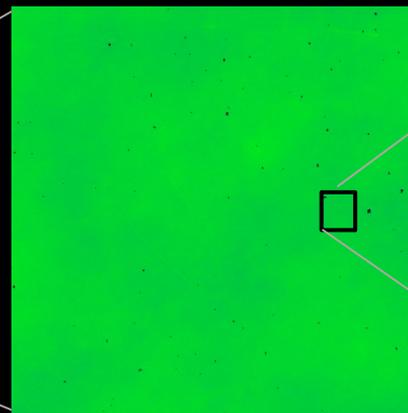
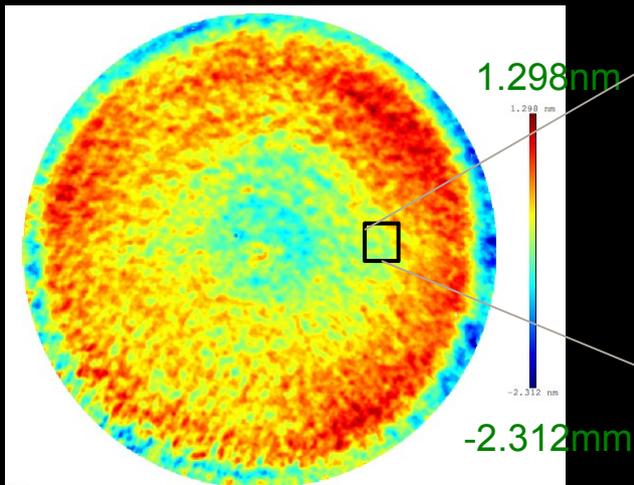
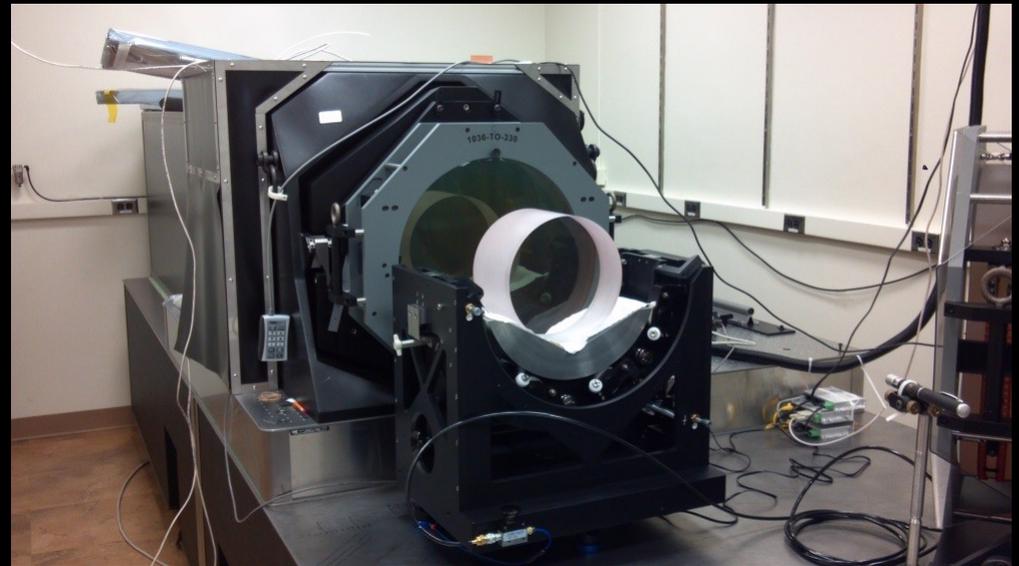




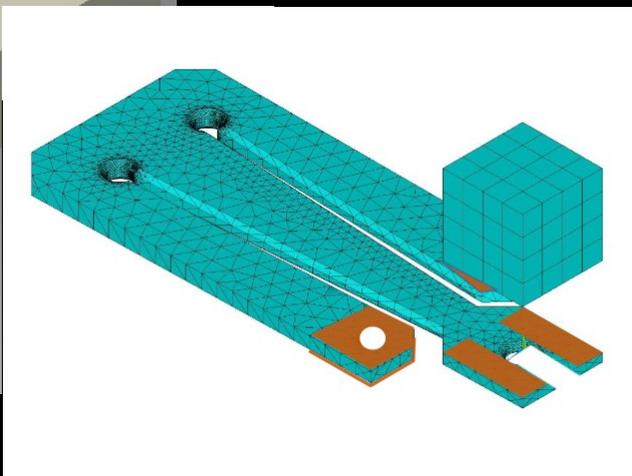
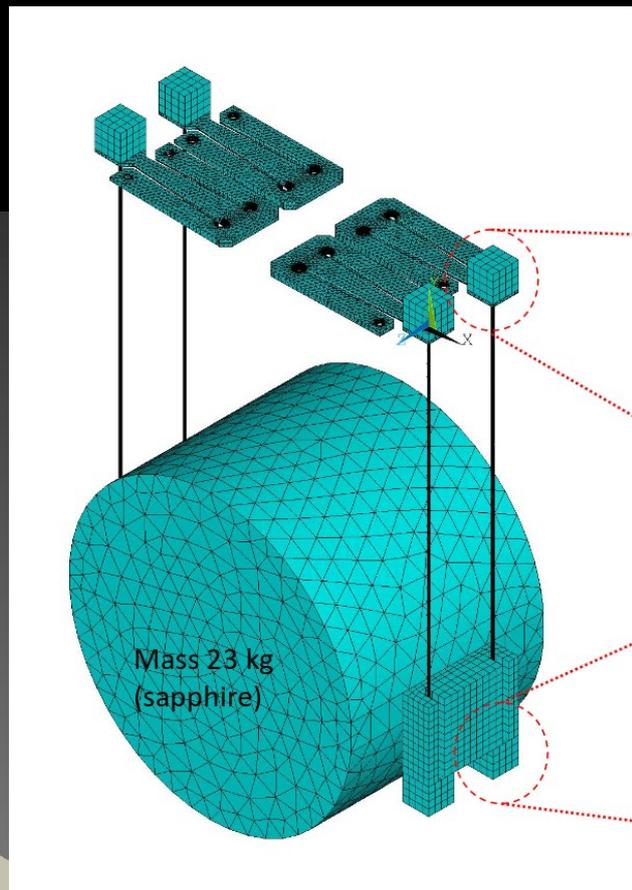
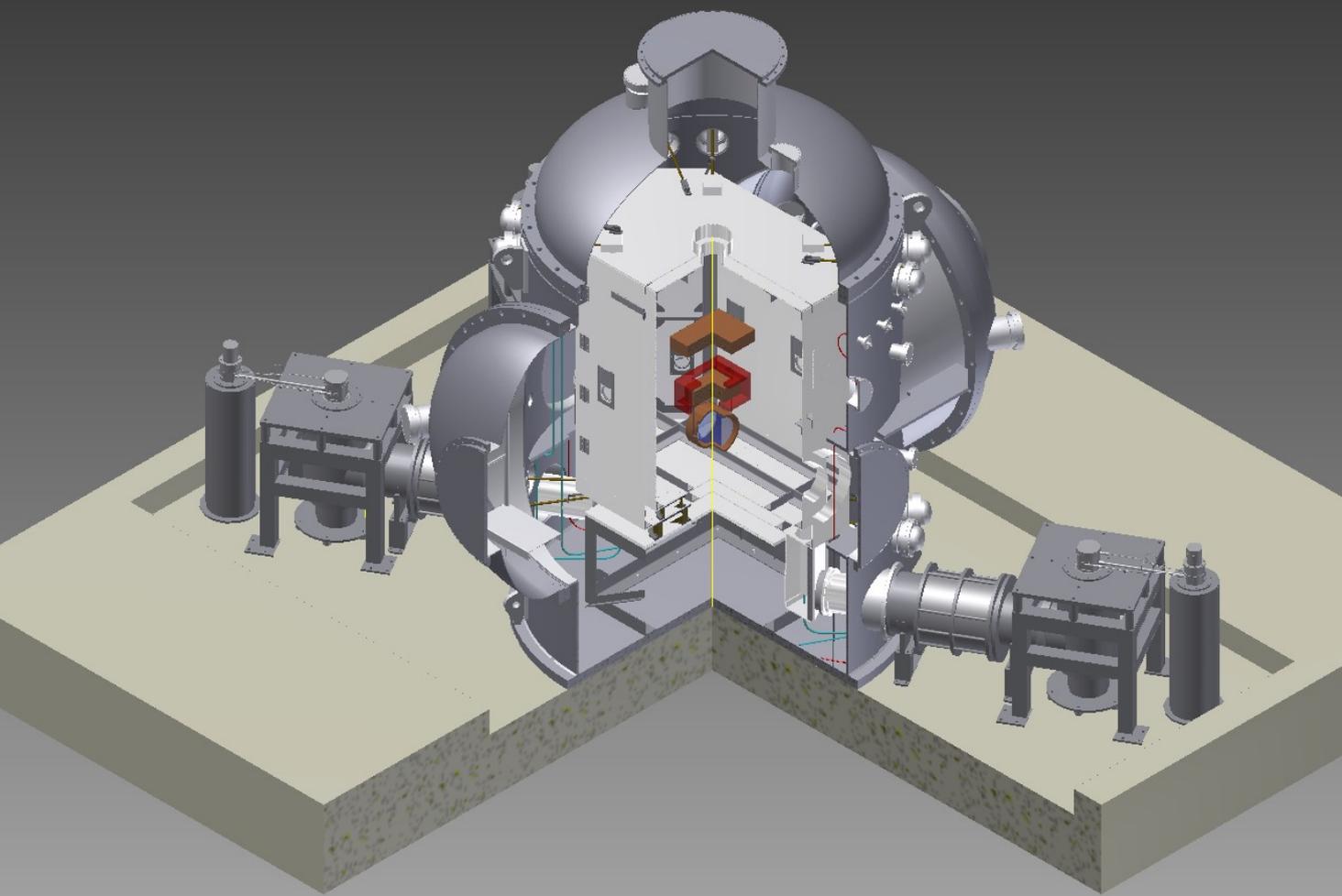
クライオスタット試験@東芝



サファイア鏡の研磨試験



低温ペイロード



S. Koike

R. Kumar

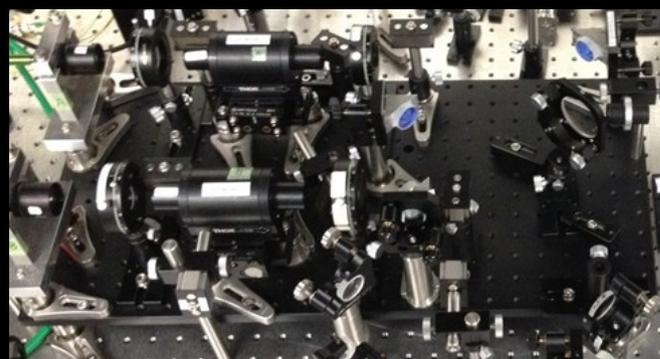
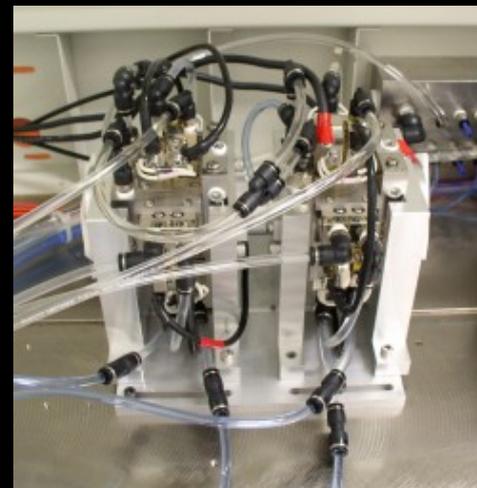
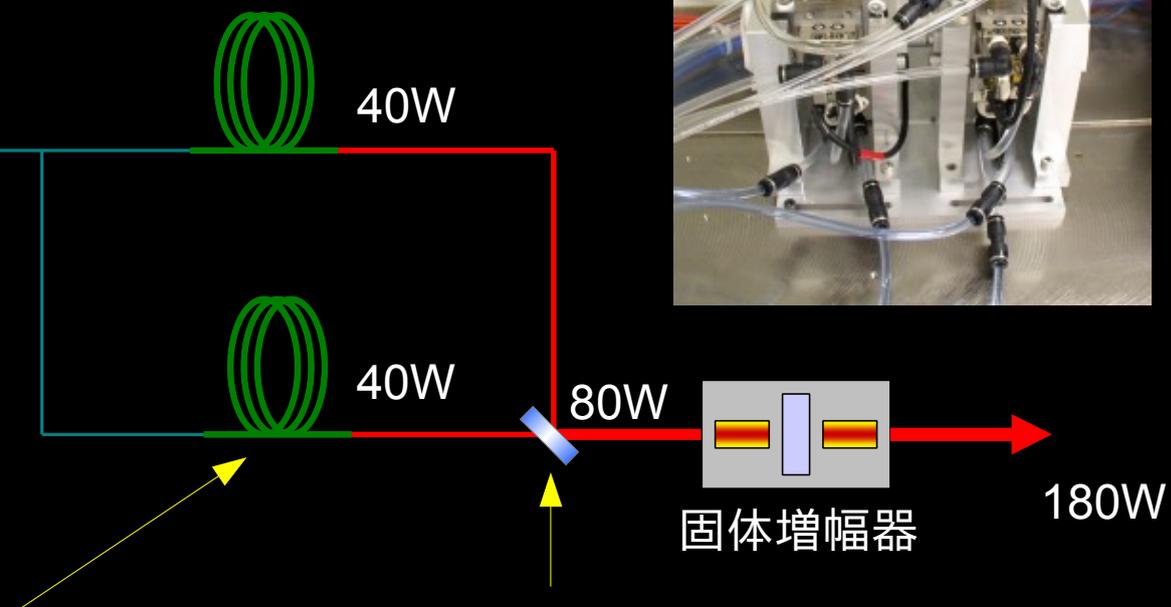
180W レーザー

固体レーザーモジュール

Nd:YAG NPRO
400mW



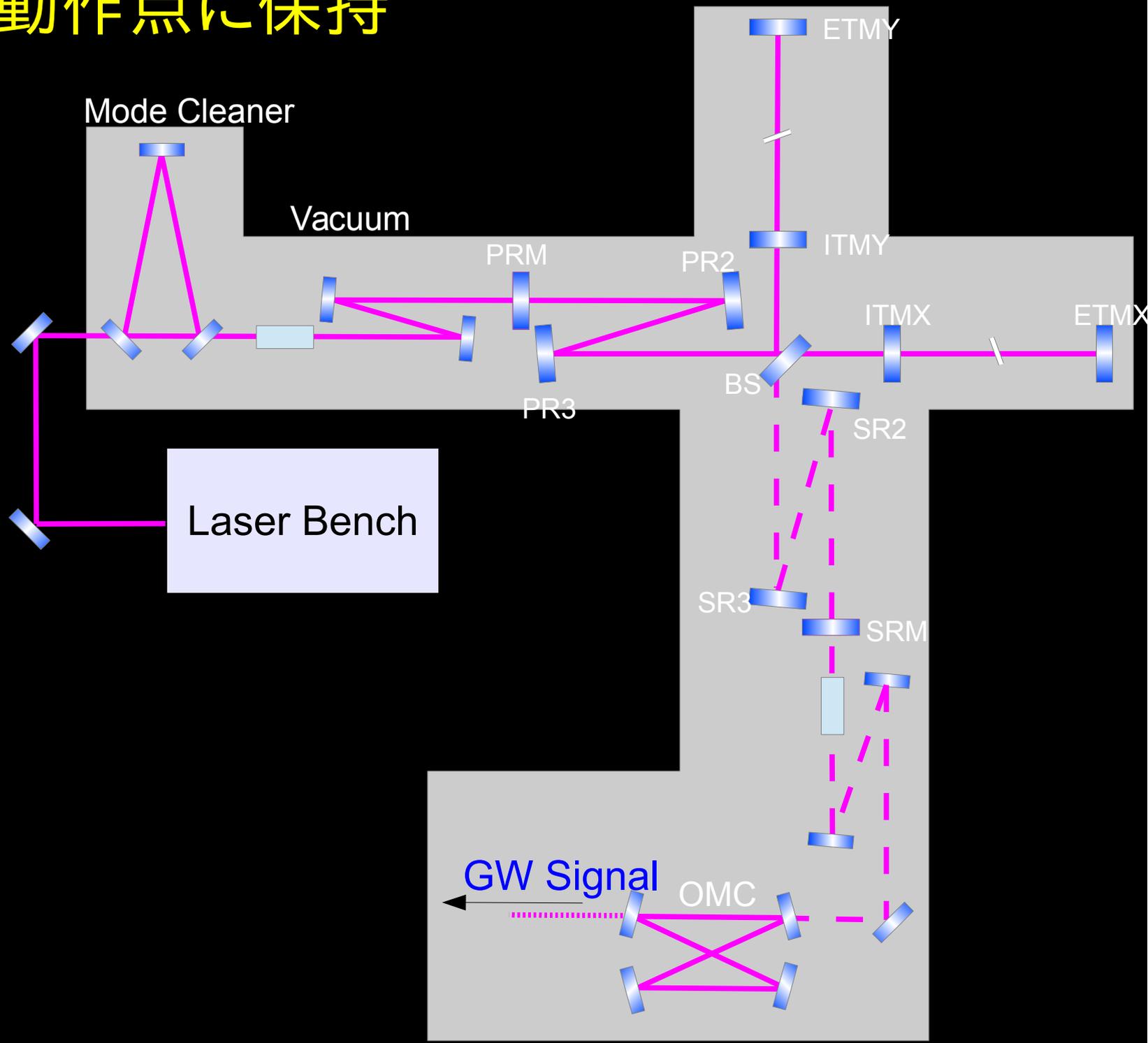
ファイバーレーザー増幅器



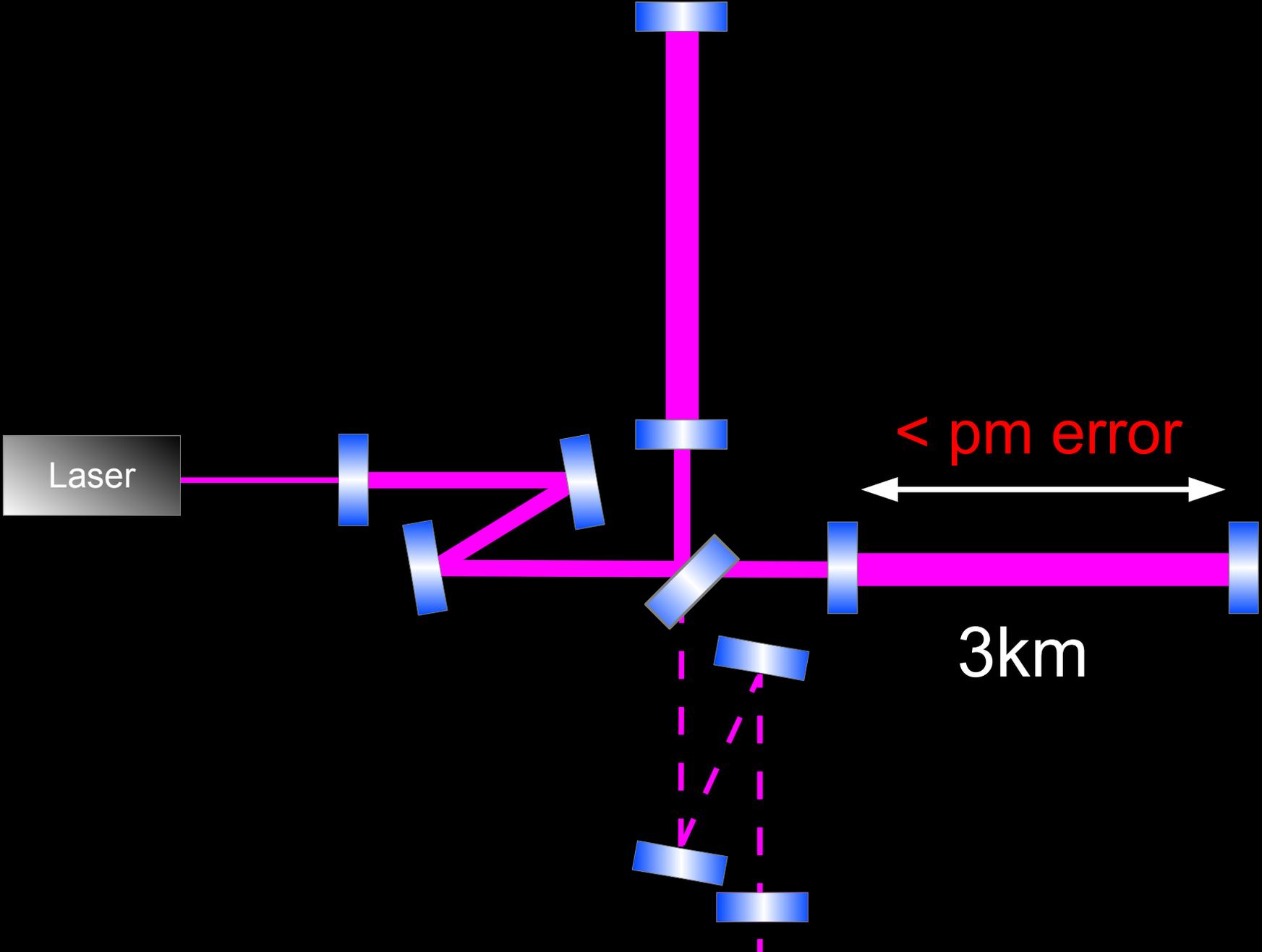
コヒーレント加算器

コミットショニング

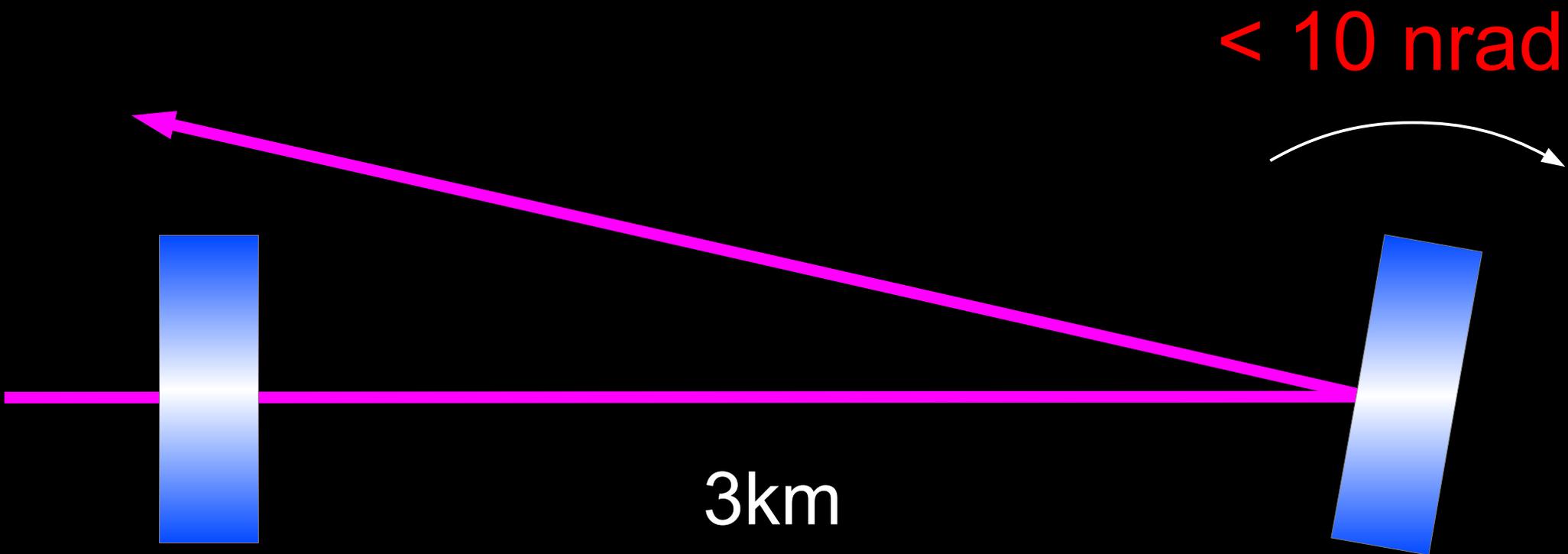
干渉計を動作点に保持



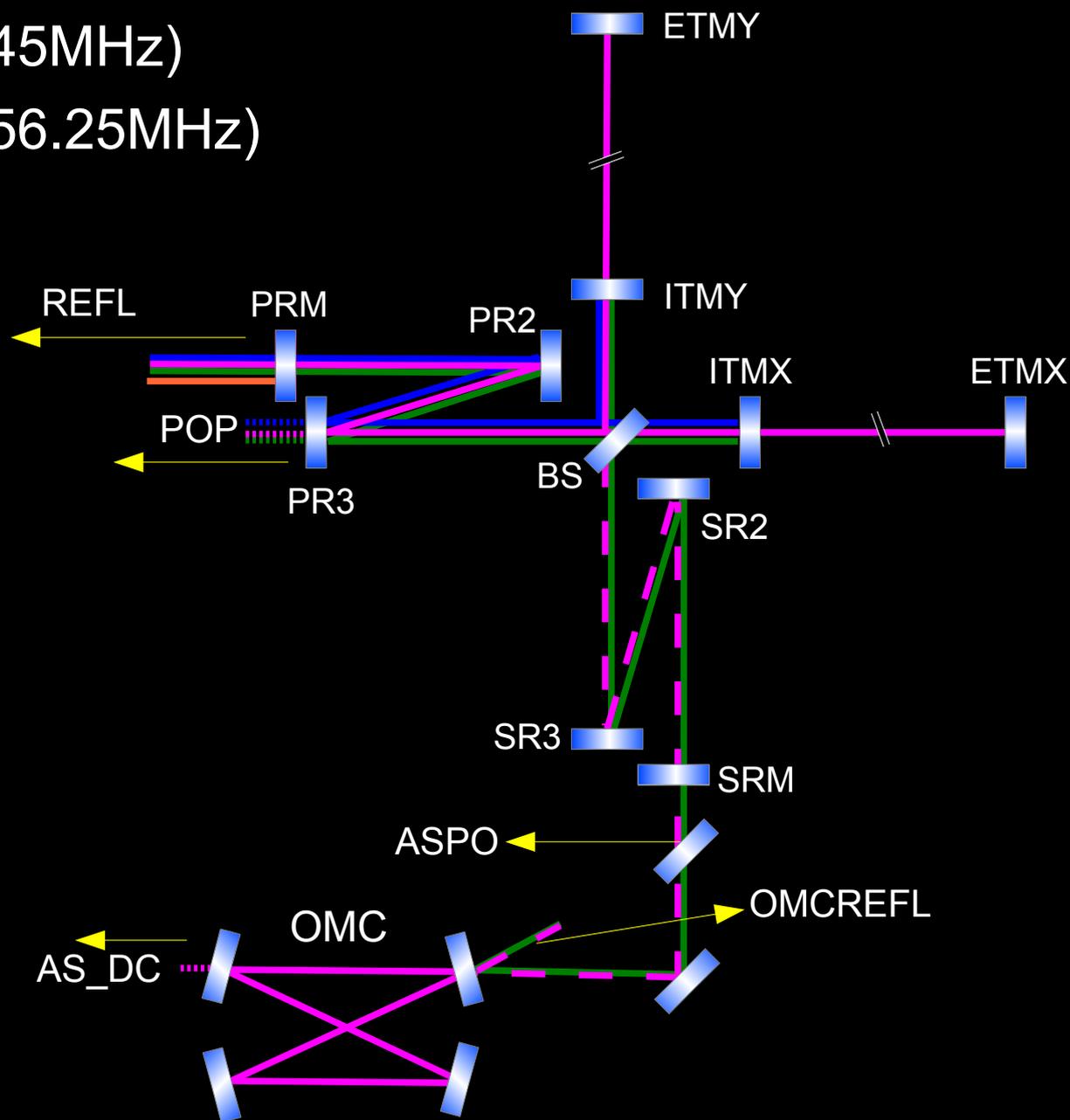
長さ制御



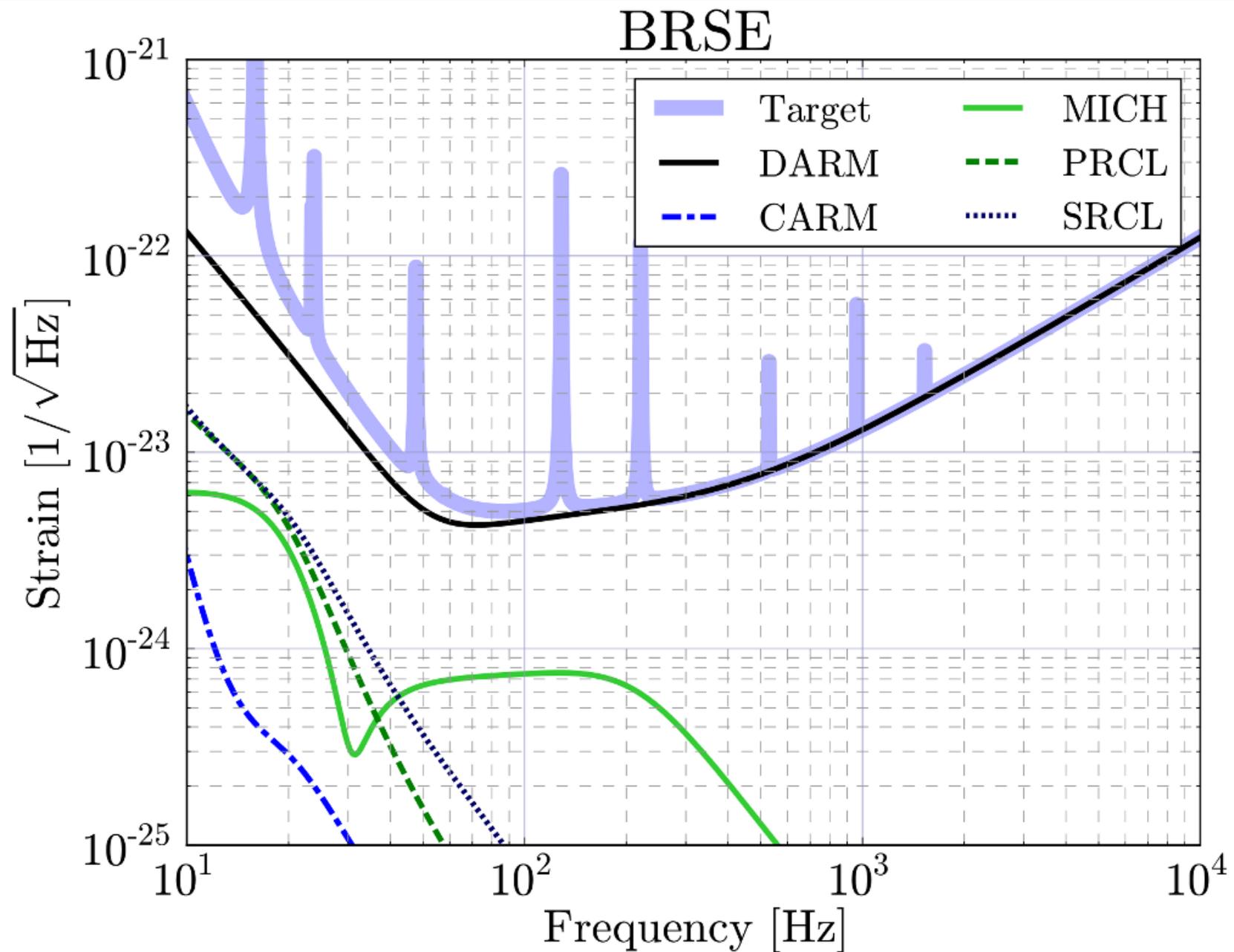
角度制御



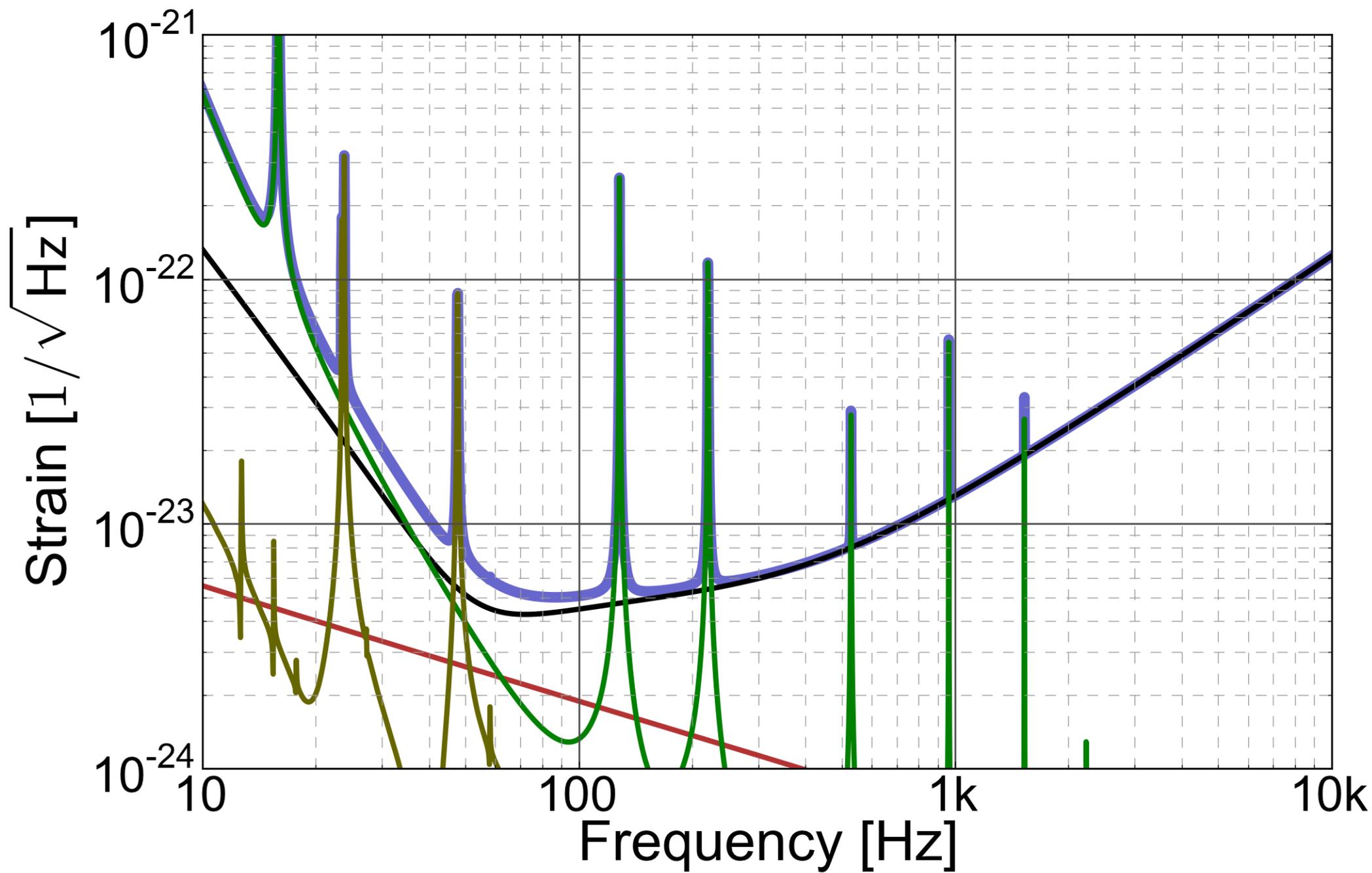
- Carrier
- f1 sideband (PM 16.875MHz)
- f2 sideband (PM 45MHz)
- f3 sideband (AM 56.25MHz)



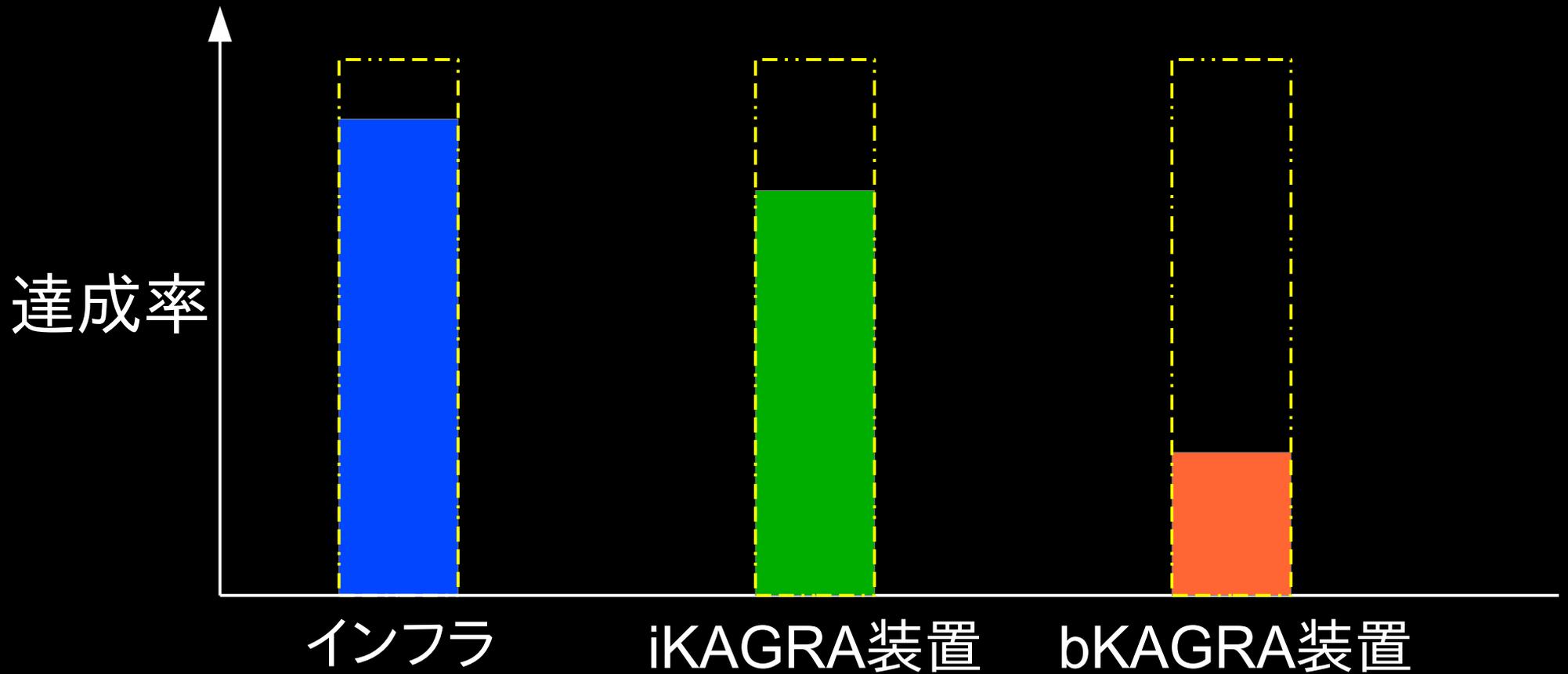
制御雑音の見積り



KAGRA目標感度



KAGRA建設進行状況



インストール開始!
コミッショニングはこれから