



KAGRA
cryogenic underground
Gravitational Wave Observatory

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For the the KAGRA collaboration

JGW-G1201273

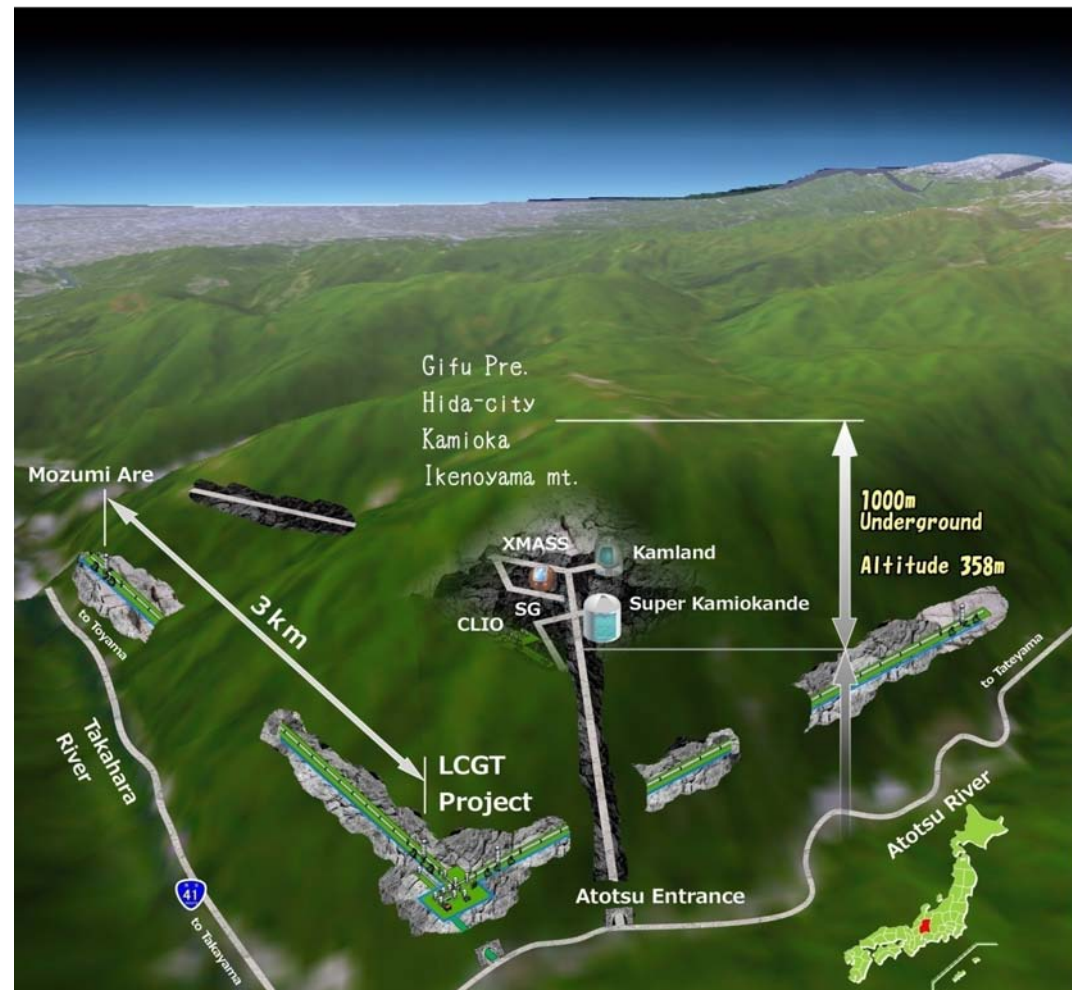
What is KAGRA

- A new **Gravitational Wave Observatory** under construction in the Kamioka mine in Japan
- Previously known as LCGT



Where is KAGRA

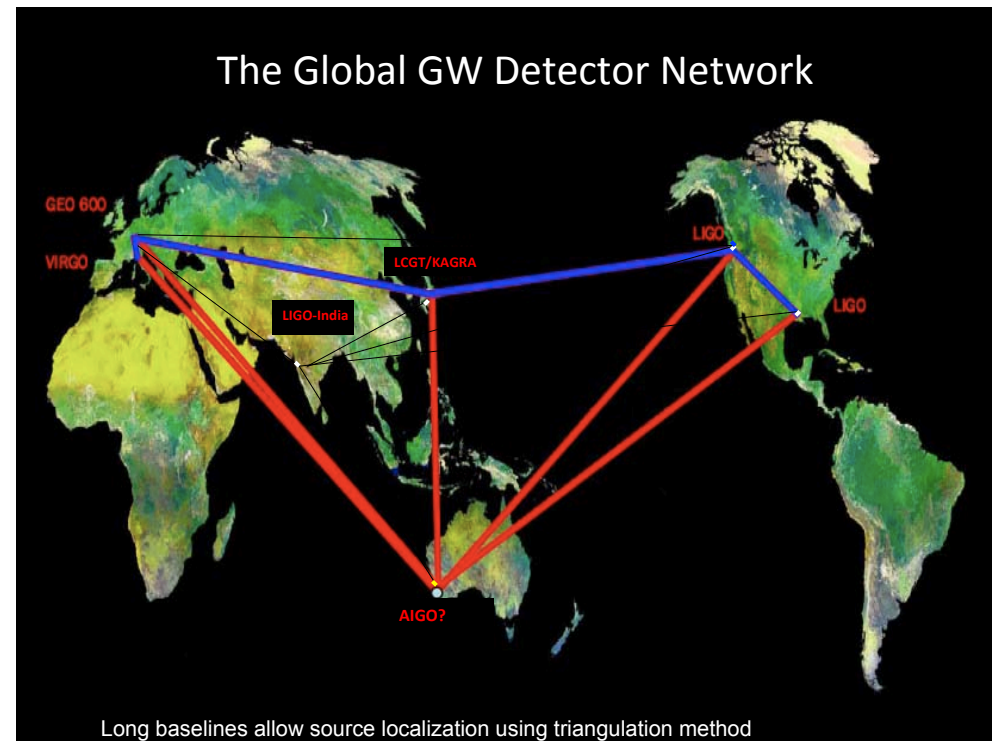
- Collocated with Kamiokande:
- Synergy
- Heritage of Astrophysical Observations
- Multimessenger physics





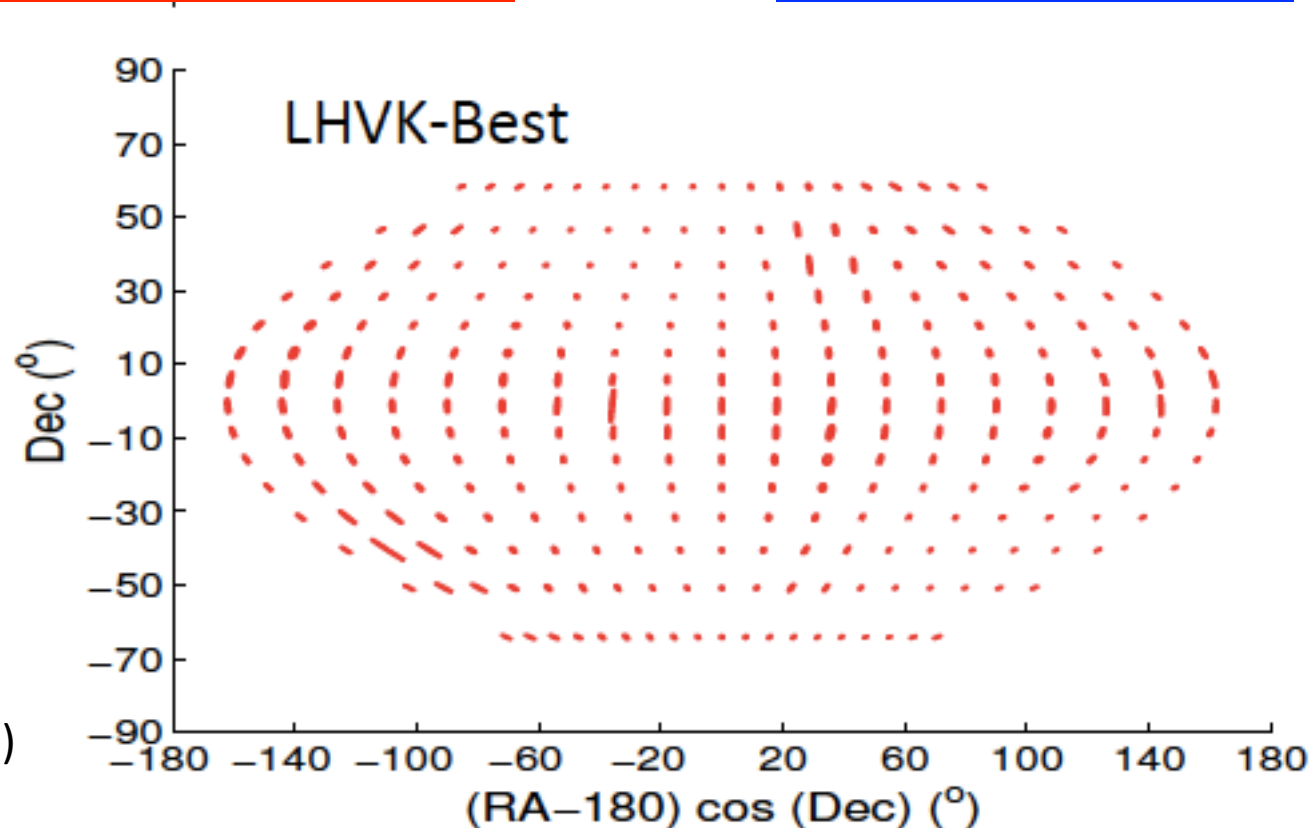
Next member of the international gravitational wave detection network

- KAGRA will join:
Virgo, GEO, LIGO
and all **future**
GW Observatories



GW detection network

- KAGRA will greatly improve the network's detection efficiency and pointing ability

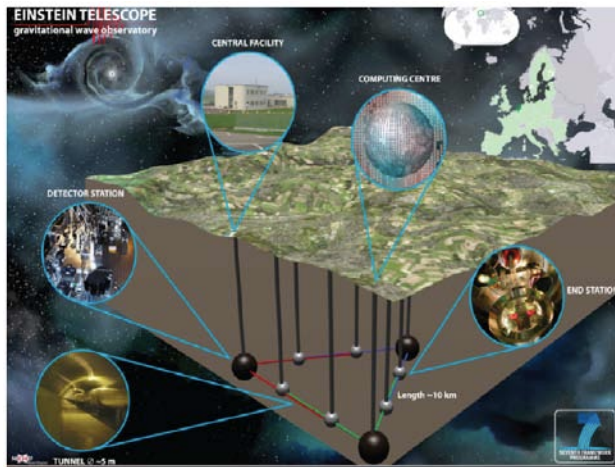


(Linqing Wen)

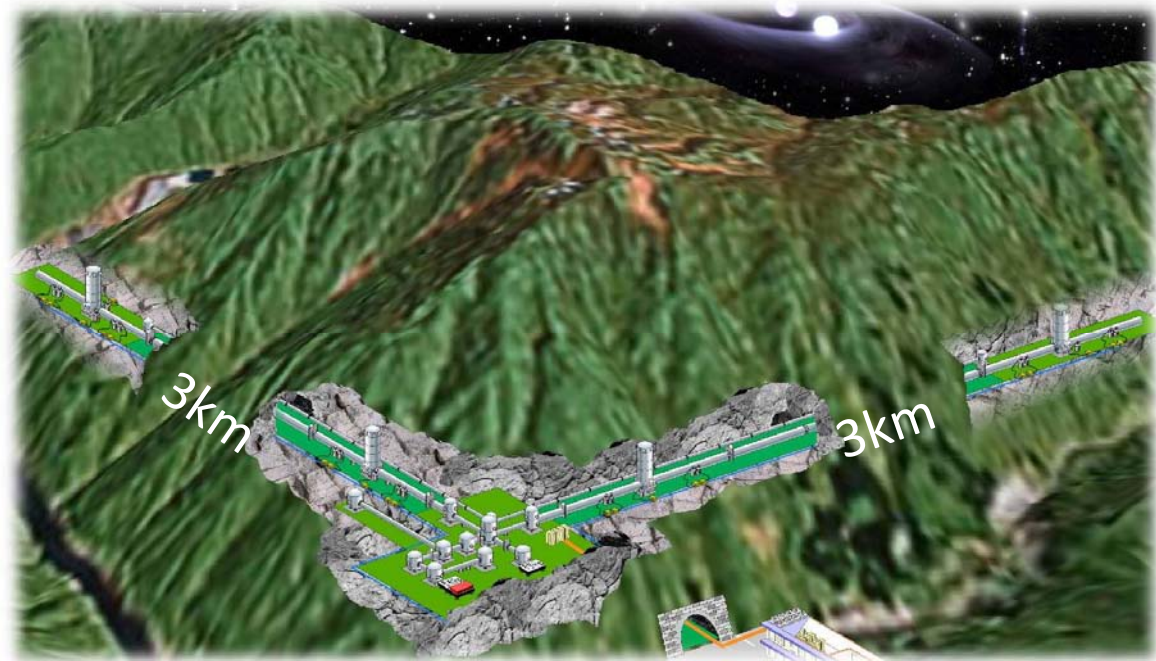
KAGRA

What is new in KAGRA

- The first cryogenic underground GW detector
- Precursor of the third gen. GW observatories
- Very similar to Virgo



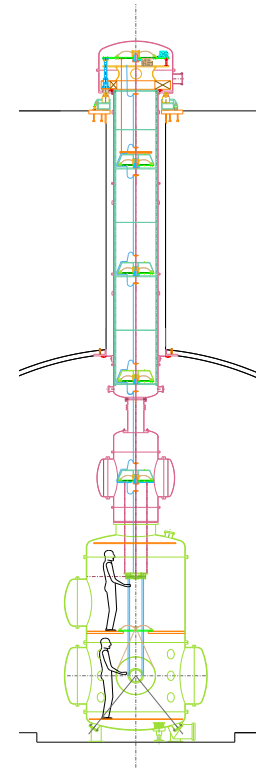
SIF-Napoli-9/21/12



KAGRA cryogenics

- A large cryostat
- Innovative pulse tube cooling techniques
- Seismic attenuation hanging from a overhead tunnel
- Innovative chiller noise isolation techniques

Yamamoto-Suzuki)



KAGRA *Status of construction: Tunnel excavation*

- The excavation was **started in May 2012**, and is scheduled to **finish at the end of March 2014**.

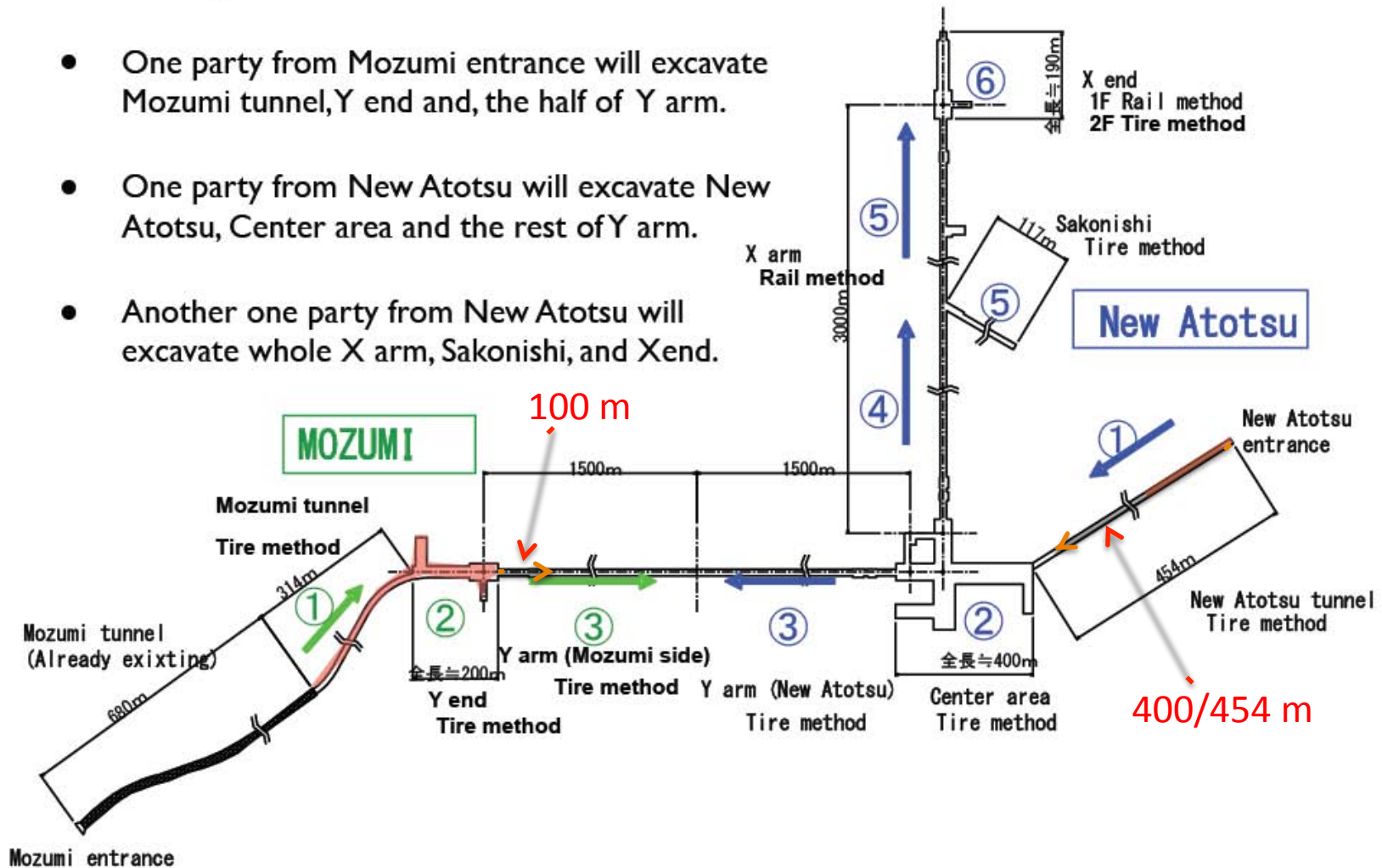


(Uchiama **JGW-G1201183**)



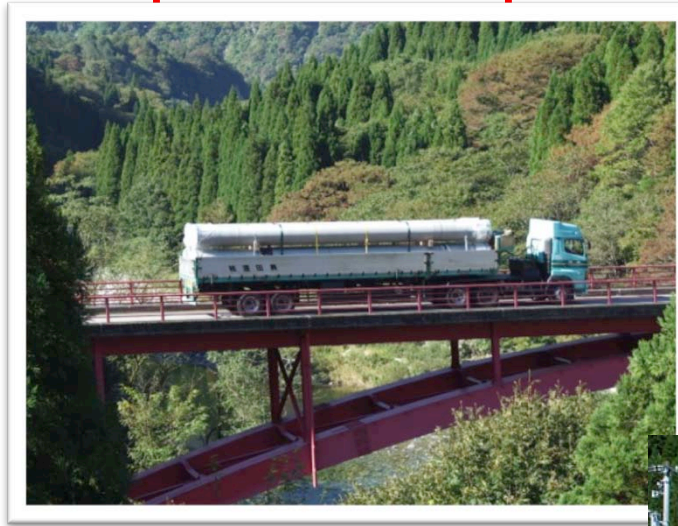
Status of construction: Tunnel excavation

- Three parties will enter from two entrances.
- One party from Mozumi entrance will excavate Mozumi tunnel, Y end and, the half of Y arm.
- One party from New Atotsu will excavate New Atotsu, Center area and the rest of Y arm.
- Another one party from New Atotsu will excavate whole X arm, Sakonishi, and Xend.



KAGRA *Status of construction:* *Vacuum pipes*

- More than **70% of the pipes** (total 6km) are **produced processed and delivered to Kamioka.**

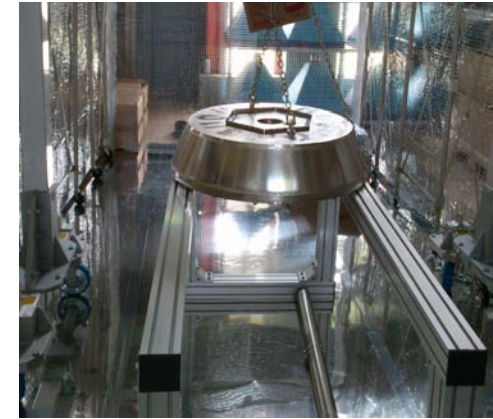


(Saito JGW-G1200988)



KAGRA *Status of construction: Seismic Attenuation*

- All prototypes built & under test
 - Including warm suspensions
- Standard filters delivered from Italy and stored in clean cond.
- Pre-isolators under construction
- Balance of parts to be built within 2013-2015 budget



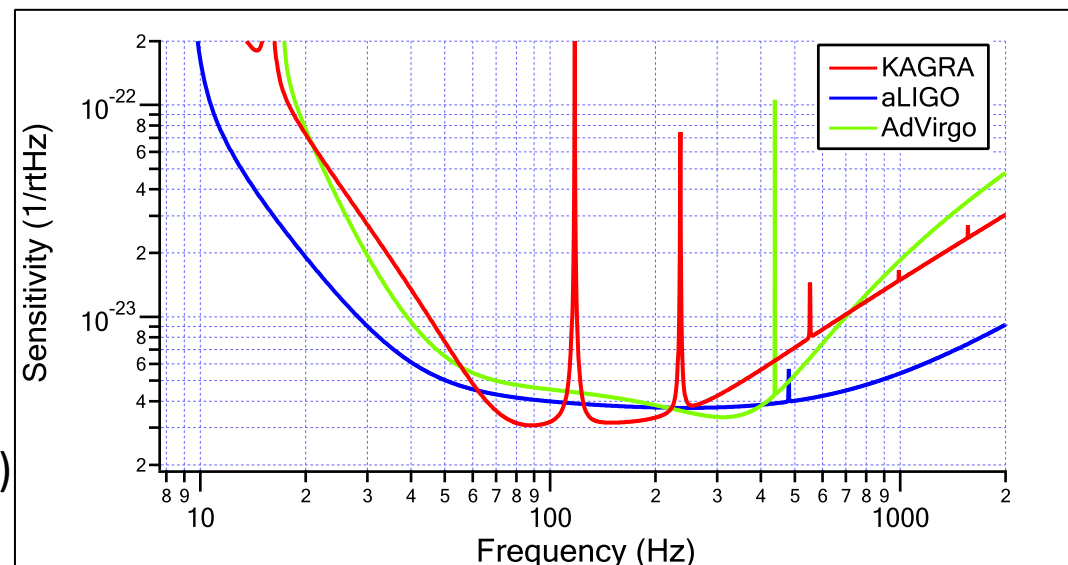
(Takahashi JGW-G1201207)



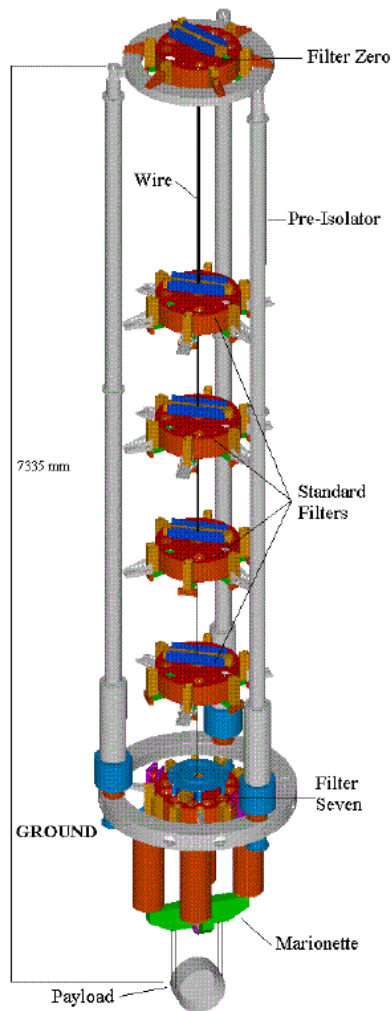
KAGRA's sensitivity

- KAGRA builds upon the experience of the initial observatories
- It is a second generation GW detector
- Designed for sensitivity to binary neutron inspiral within a radius in excess of 200 mega-parsecs
- Expected to record several event per year
- Builds on Virgo's and LIGO's experience

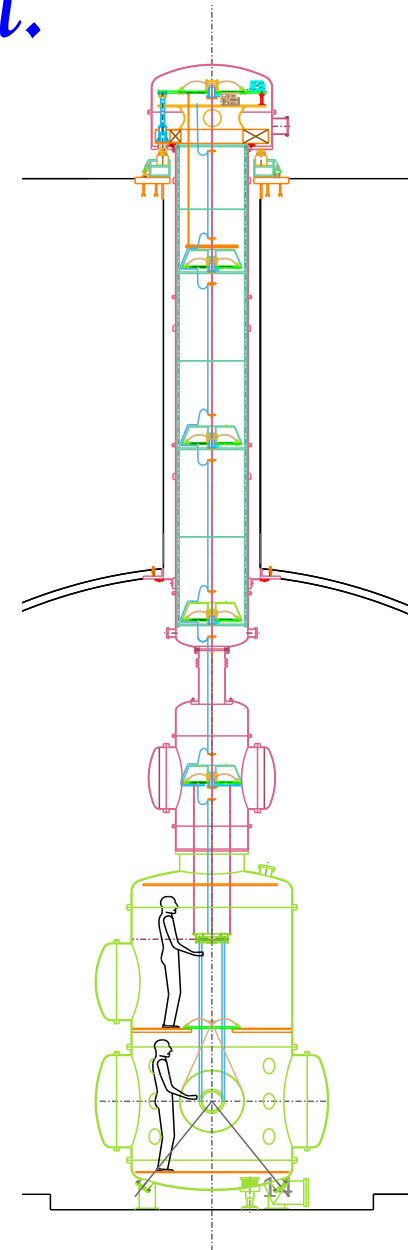
(Somiya)



The Italian contribution:



- KAGRA is the natural evolution of Virgo
- Inheriting the same seismic isolation scheme
- Opening the way of third generation GW detectors like the Einstein telescope





Italian designed and built Seismic Attenuation System

- A modern, simplified and advanced version of the Virgo Superattenuators
- Roughly twice the per-filter attenuation performance





Italian designed and built Seismic Attenuation System

- **Designed and built by a collaboration of:**
 - University of Sannio,
 - Galli & Morelli in Lucca
 - Promec di G. Gennaro in Bientina



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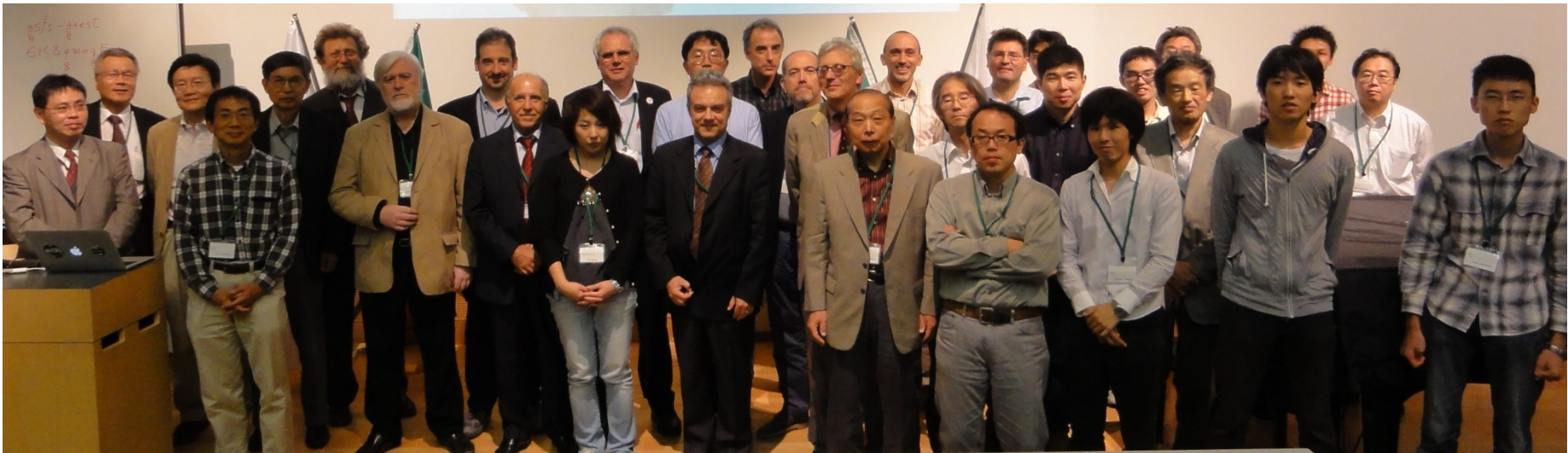
(DeSalvo
JGW-G1201259)

JGW-G1201273



Italian contribution

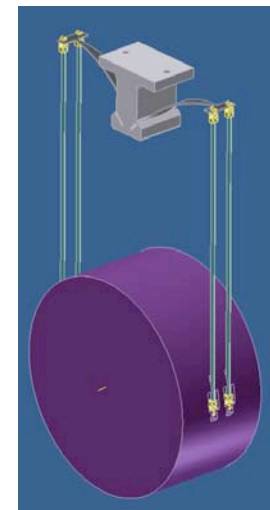
- Virgo, EGO, University of Roma, . . . also **provide a wealth of know-how and support**
- **Frequent exchanges of scientists**
- Italy-Japan workshop (4-5, October, 2011)



European collaboration

- The **Seismic Attenuation** is also developed in tight collaboration with NIKHEF Amsterdam and the Albert Einstein Institute in Hannover
 - Sharing many design and control features
- The cryogenic suspensions, mirrors and infrastructures are designed in collaboration with the European Community funded ELiTES exchange program

(DeSalvo JGW-G1201265)



Conclusions

- KAGRA will be the next Gravitational Wave Observatory to join the GW detection network
- It will have the first cryogenic detector
- It will be the first observatory located underground
- It enjoys support from the entire GW community
- It is built with very strong Italian and European contributions