



# Dual tunnel seismic isolation

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Discussion

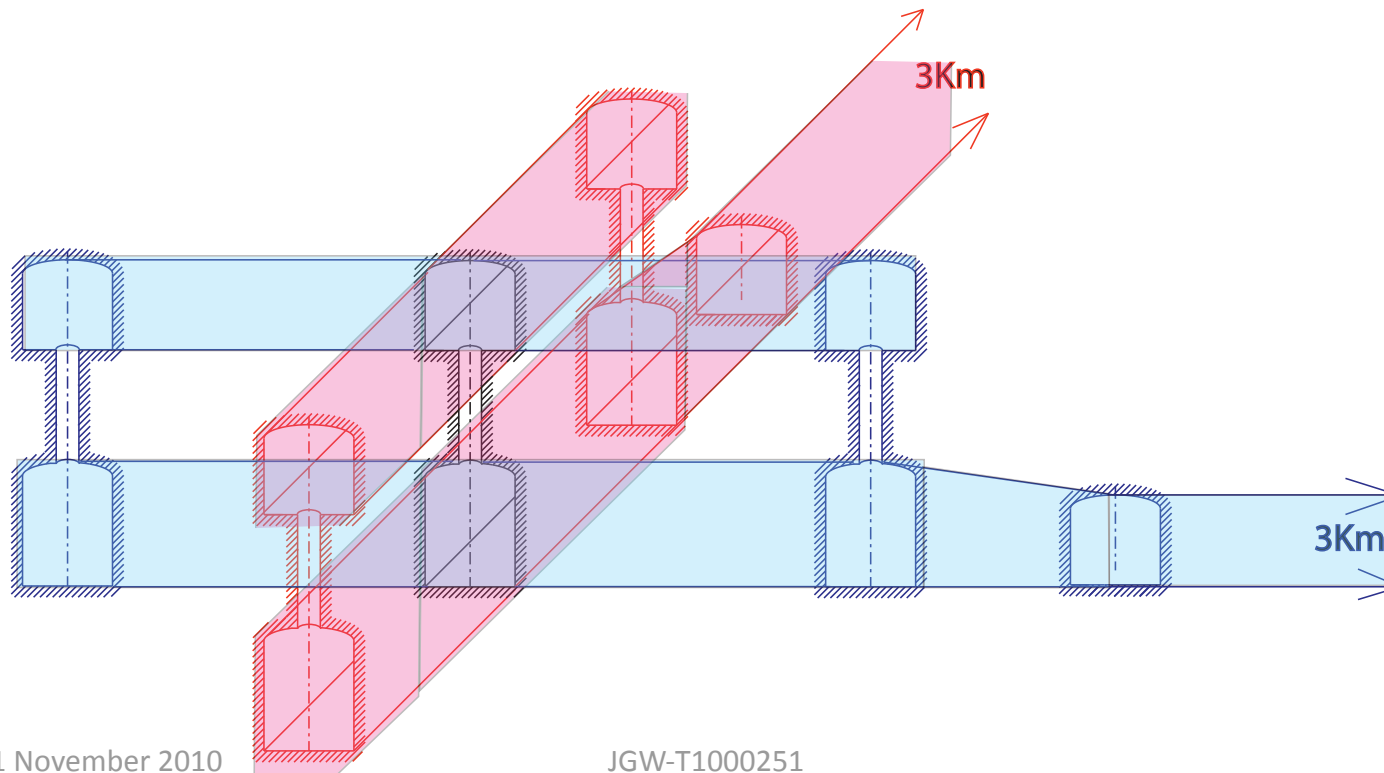
configuration with a dual tunnel geometry  
for improved seismic isolation

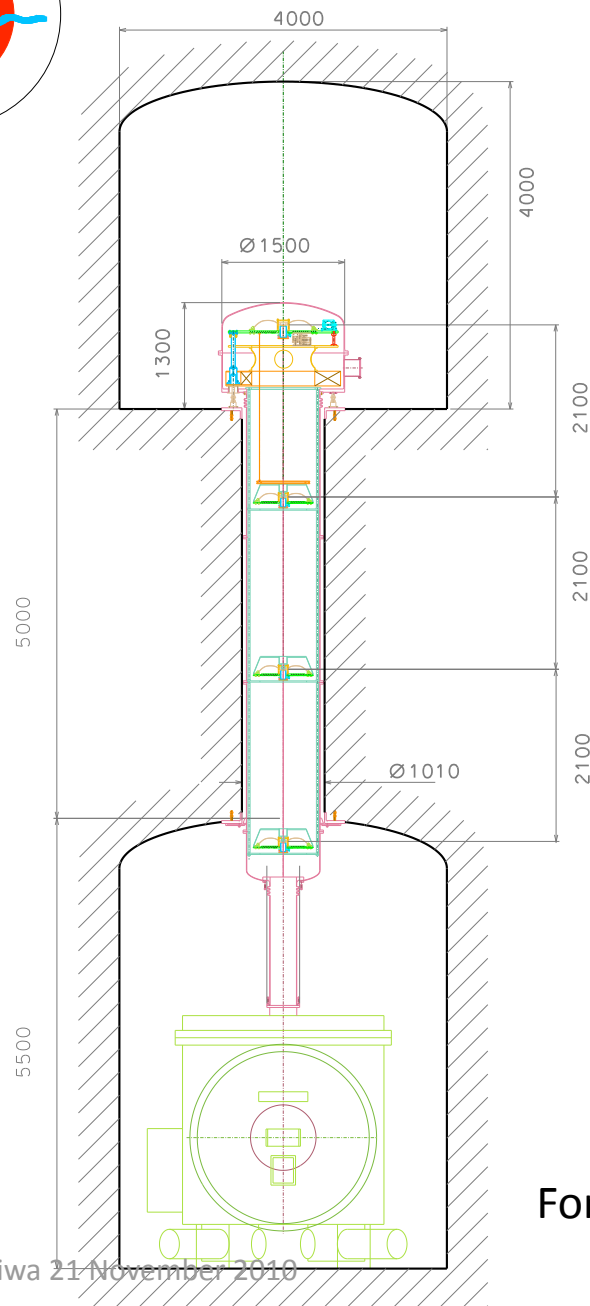
JGW-T1000251



# Dual tunnel - general description

- Eliminate the large experimental Hall
- Replace with two superimposed tunnels





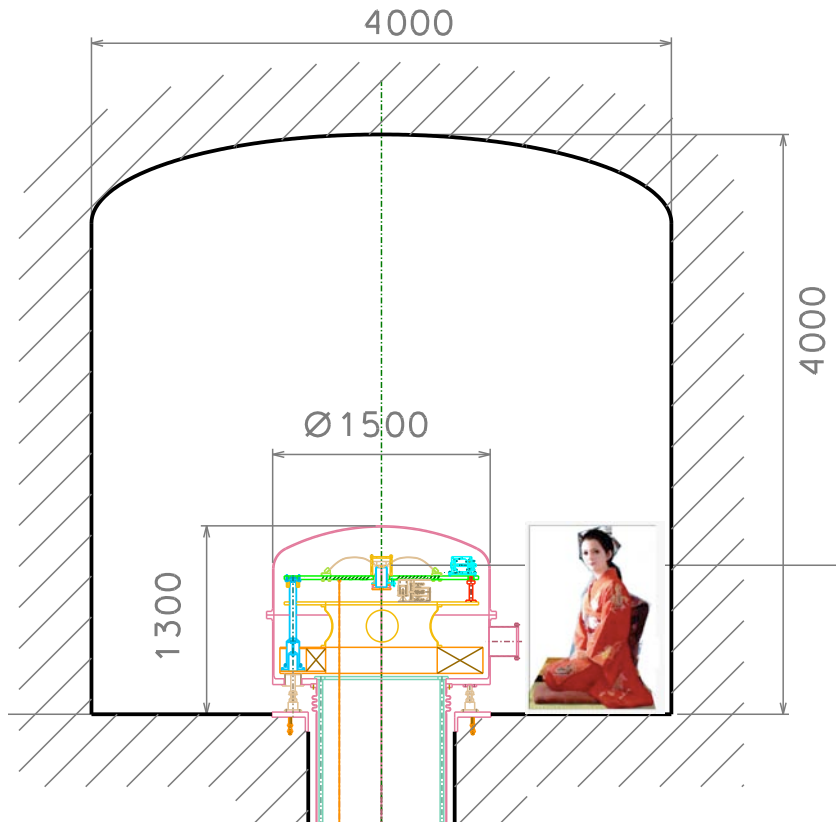
# Generalities

- 4m x 4m upper tunnel containing pre-attenuator
- 1 m diameter  $\geq 5$  m tall bore-hole with SAS chain
- 5.5 m tall containing main beam and cryostat

For more detailed discussion, please see JGW-T1000249



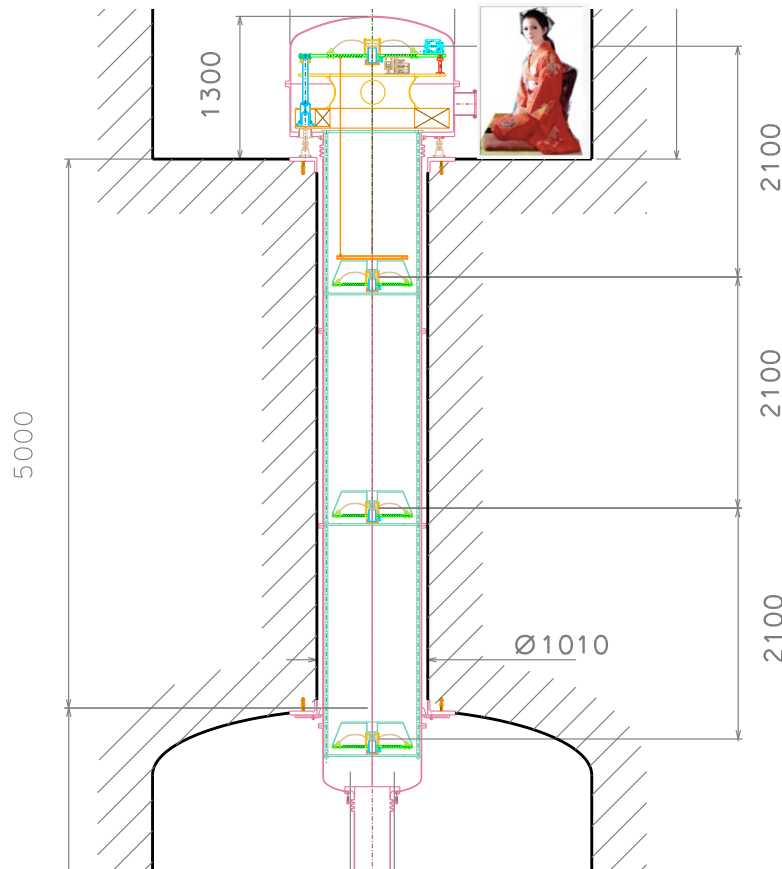
# Physical advantages



- Pre-isolator footed on solid rock
- Inverted Pendulum table short
  - Found shall size = better performance
- Easy of access for pre-isolator tuning



# Physical advantages

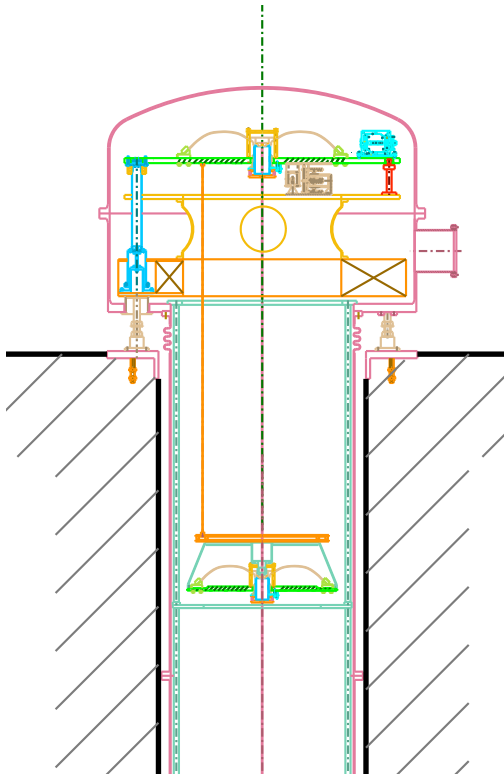


- Naturally longer pendulum length between filters
- Lower frequency performance
- Opens door to possible physics from lower underground

Newtonian Noise



# Controls advantages

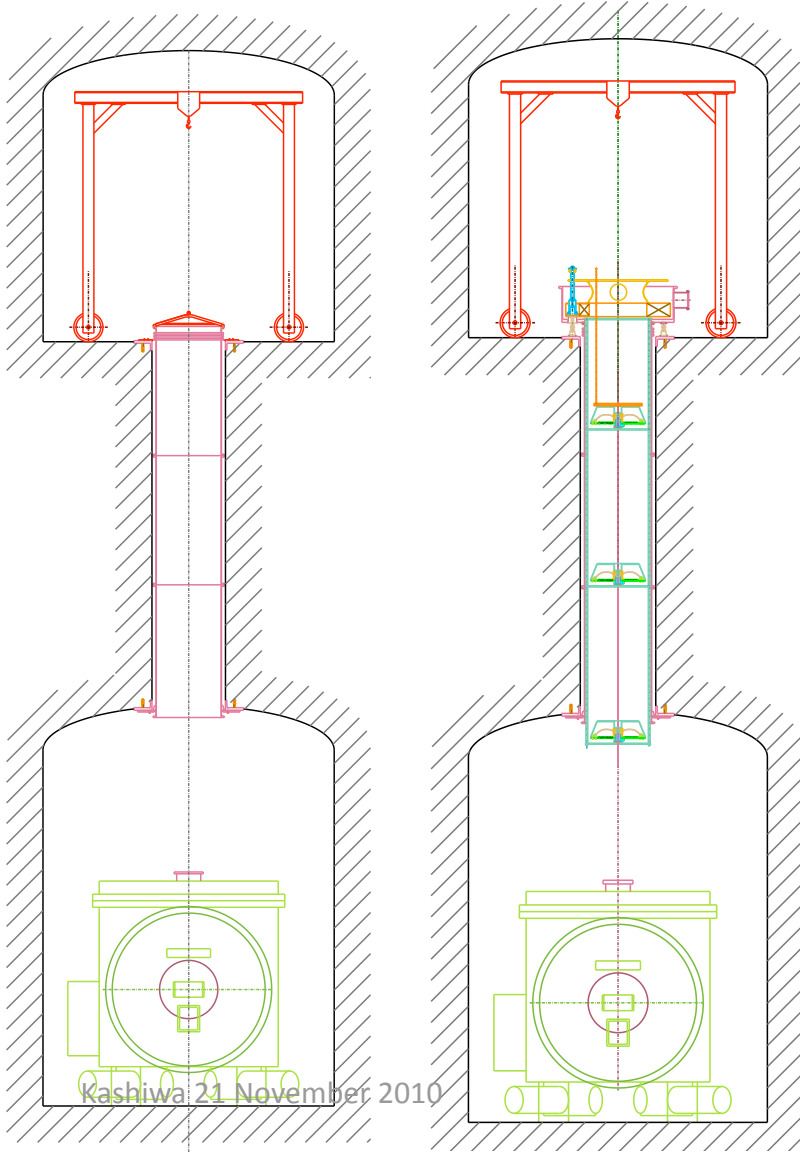


- 3 standard filters instead of 2
- Reserve in attenuation power
- Additional filter allows Eddy current damping
- Effective chain mode damping
- easier and more reliable Interferometer locking



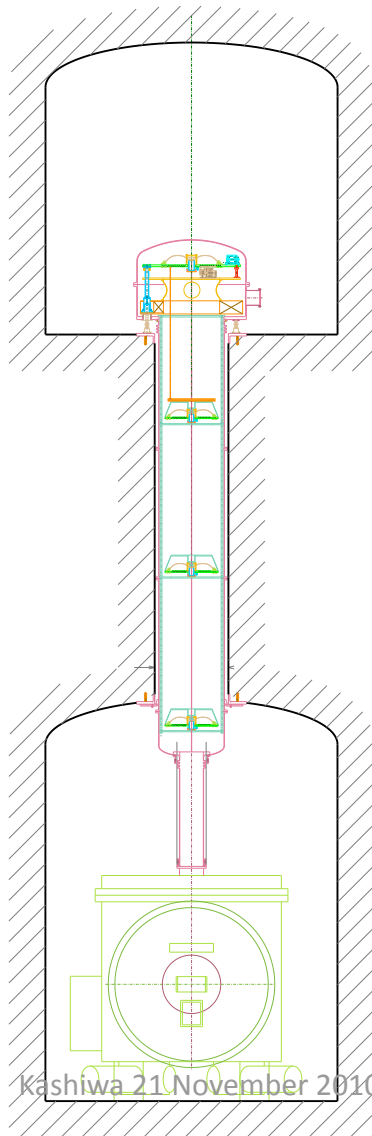
# Technical advantages

- Ease of installation
- No need of large, expensive rigid structures





# Technical advantages

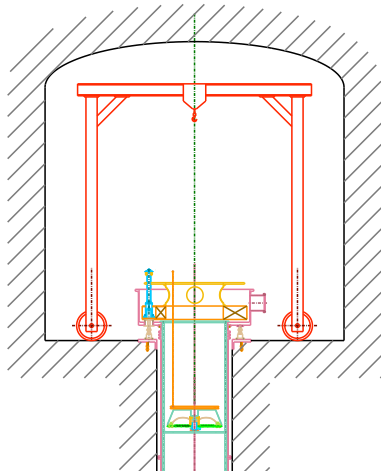


- Safer installation procedures
- Large separation between suspension point and main tunnel, cryogenics, . . .
  - Longer path for noise transmission
- Ease of payload/cryostat replacement





# Economical advantages



- Much smaller and cheaper vacuum structure
- Much lighter crane requirements



# Mining advantages

- **Smaller dug out volume**
  - Less stability problems
  - Less lining thickness
- **Tunnel-like structures**
  - No need of larger machineries to make large halls
-



# Disadvantages

- Need new bore-holes to re-position any optical element
- Need to know where to locate all mirrors !
- Re-boring alone ~M¥
- Need ~ 75 m (15% slope) of 4m x 4m tunnel ramp to connect floors



# Dual tunnel

- More stable pre-isolator footing
- Keep door open for exclusive physics
- At marginal or no additional cost