TG5:

Status of Infrastructure on Top of Vessel

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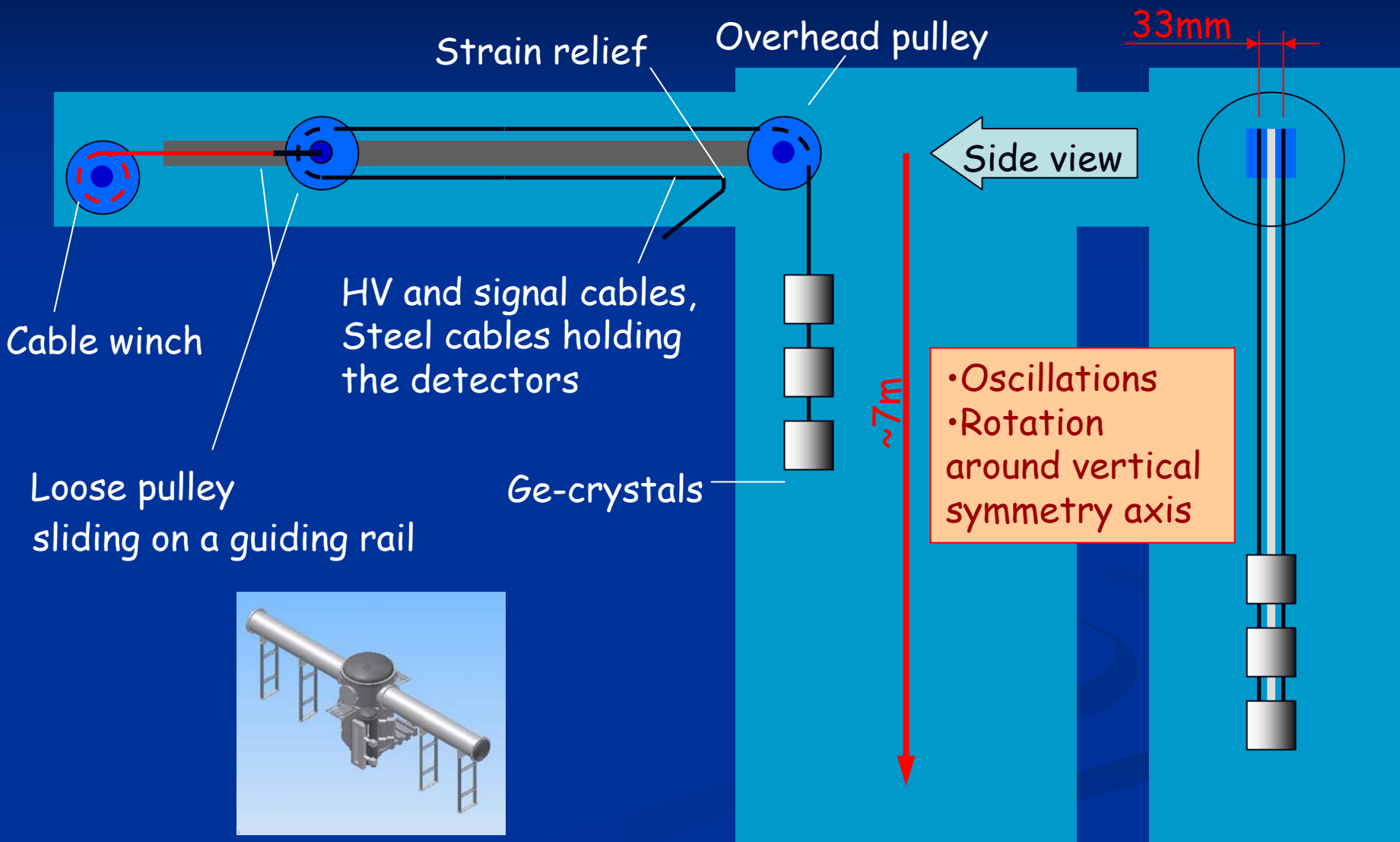
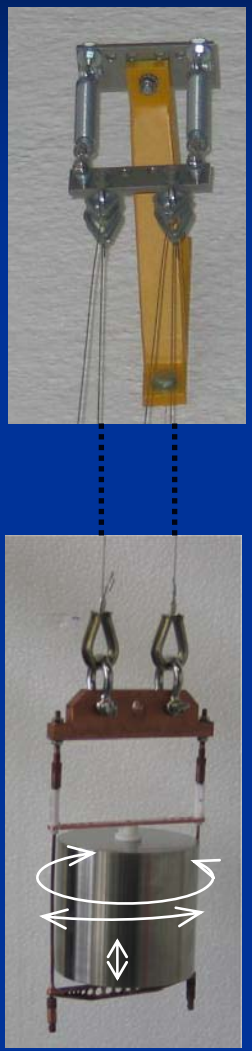
Overview

- Detector strings: tests & development
  - damping of oscillations, submersion procedure
  - rotation caused by cabling
  - cable-guiding chains, motors for lifting and lowering
  - realistic strings moved by motors
- Cabling
  - tests of HV cables
  - tests of HV feed through
- Clean room
  - status of tendering process
- Radon filter
  - gift of ICDO (Geneva)
- Conclusion

Reminder: String Pulley



Damping of Oscillations



- Small detector oscillations (<20^0, <10mm) should be damped fast enough (<10minutes)

- Steel dummy hanging at 5 meter long string
- Oscillation types being studied:
  - Pendulum, rotation, horizontal oscillation
- Oscillations were studied in air, H_2O ,LAr and LN_2

- Assuming exponential damping of oscillation:

→Damping constants τ of (rotation, pendulum):

~30…60min in air

~50…100sec in liquid

$$a(t) = a_0 \exp(-t/\tau)$$

→Horizontal oscillations even with τ~2sec

Small detector oscillations in liquid (a_0<20^0 or a_0<10mm)

→Wait 10 minutes. → Oscillation is over.

Submersion Procedure

- Submersion into cryo liquid studied with same test string
  Instead of lowering the string → lift up cryo liquid

- Submersion speed: slow enough to avoid violent boiling
  Maximal amplitudes of 10^0(rotation) and 9mm(pendulum)

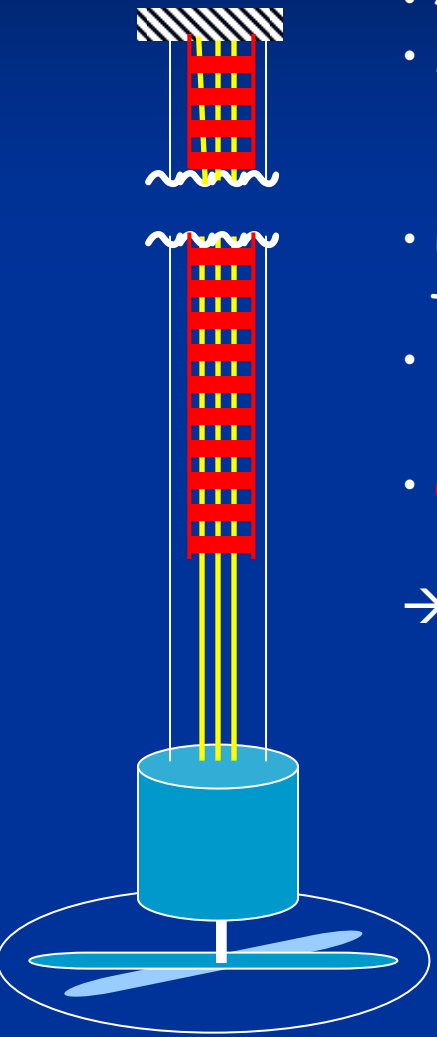
  →Minimal submersion time:
  20min/crystal (stainless steel)

  →Estimation for Germanium using the ratio of heat conductivities:
  5min/crystal (Germanium)

- Using two crystals/string:
  - Confirmation of previous results
  - Submerged lower crystal of string damps during submersion of upper crystal

(See GSTR-07-013 for oscillation and submersion tests)

Rotation Caused by Cabling



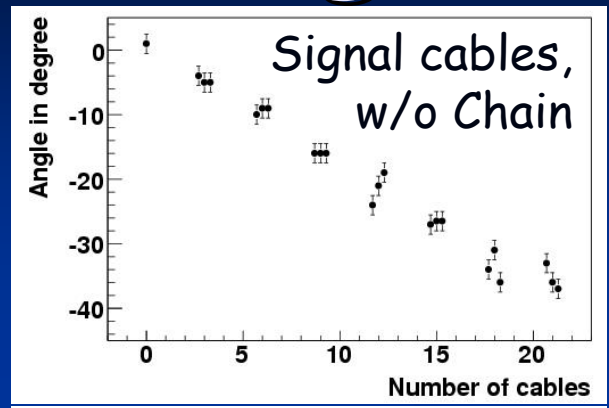
- 4.9meter long test string
- Angle measured with a pointer and a goniometer below string

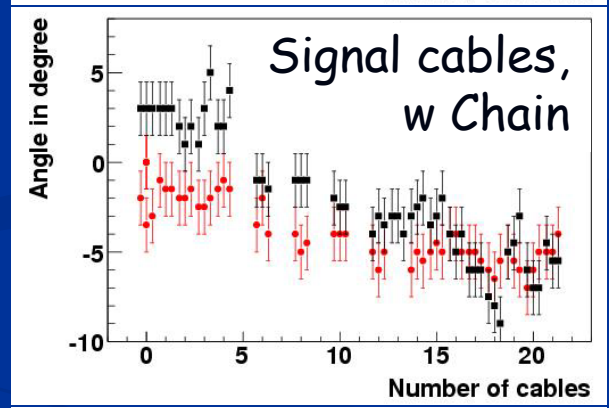
- Each electrical cable gives a little torque → $\alpha = \alpha$ (#cables) is linear
- 12 cables → 20^0

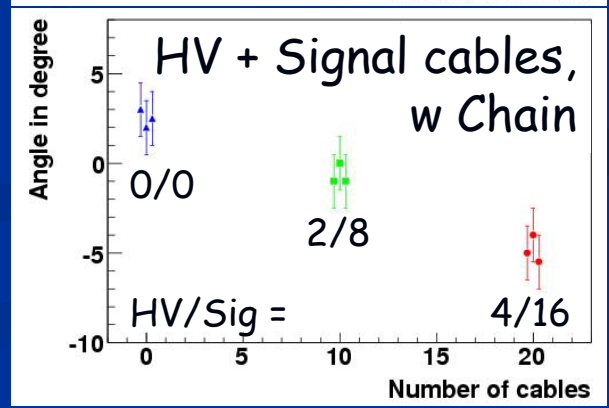
- Chain guiding the cables and reducing the rotation

→ still linear dependence α (#cables) but 12 cables → 5^0

- HV cable and signal cable for a phase-I-string → ~7^0



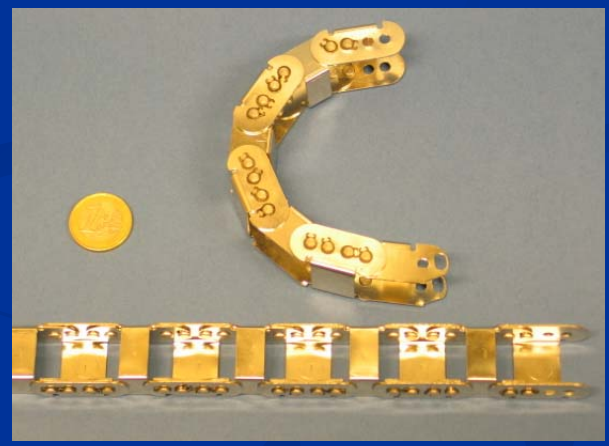




Cable Guiding Chains

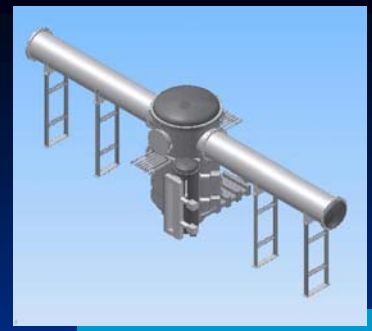
- Chains used till now:
  - made of Iglidur
  - similar geometry like final chain

- Final chain:
  - made of stainless steel (preliminary screening result: material is clean enough)
  - electro-polished surface
  - ends one meter above crystal

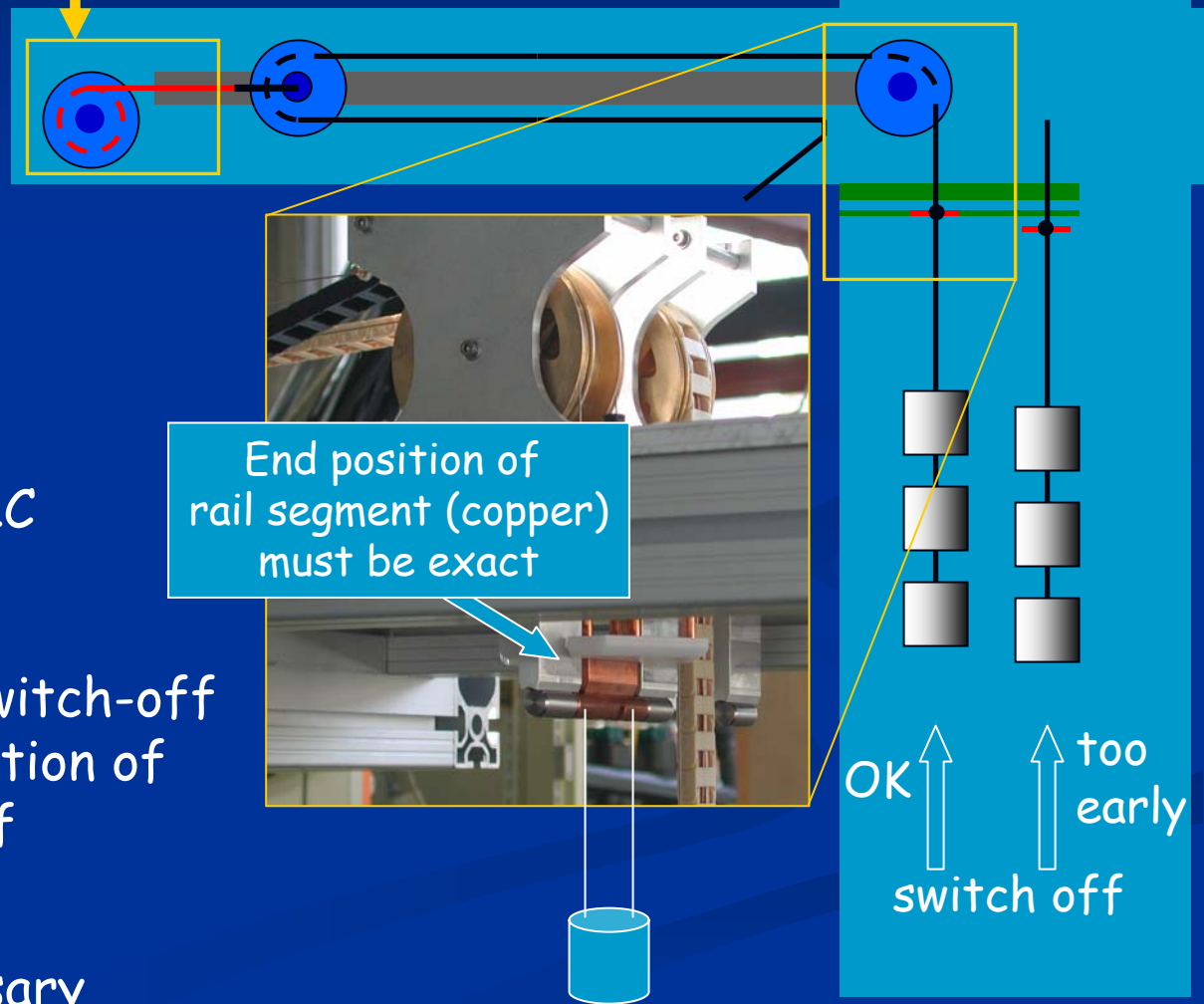


  - 10 chains are ordered
  - delivery of two chains till end of November

Motors



top view



- 20 Motors are ordered
- gear reduction (1:1000)

- can be operated by a PLC in a CAN BUS

- well suited for motor switch-off exactly at upper end position of string (limit parameter of electrical current)

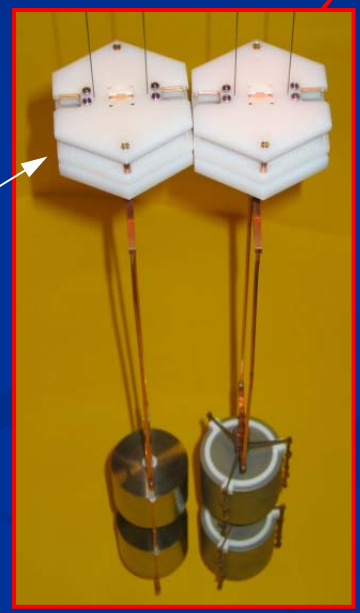
→ No limit switch necessary

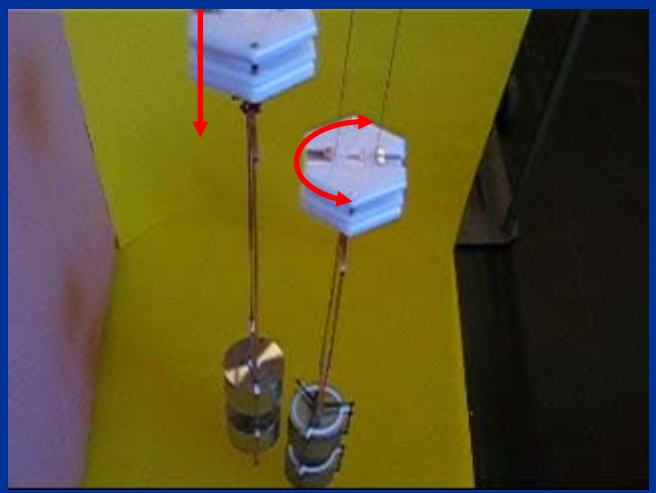
String Lowered into Array

- Array of two strings with nearly realistic geometry
- Only cabling is missing,
  test chains instead of final steel chains

→Check lifting and lowering of one string beside another string

- Important: hexagonal plate on top of detector unit



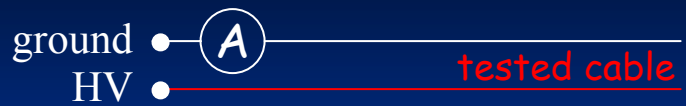


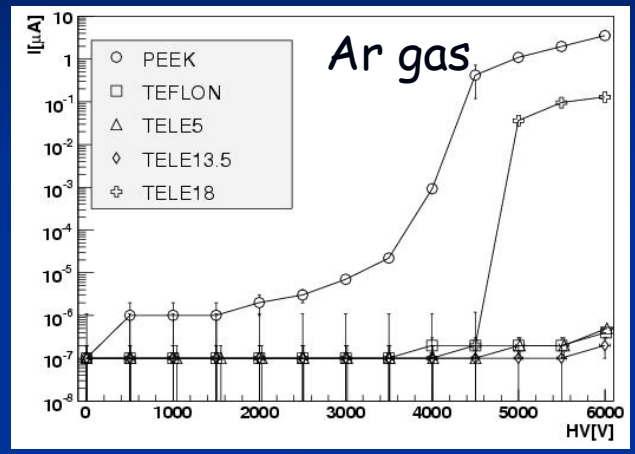
•Correct positioning in spite of rotating string

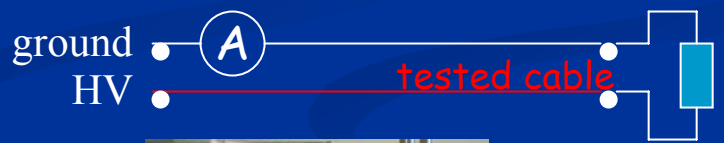
•Hexagonal plates:
→aligned angle position of strings in end position

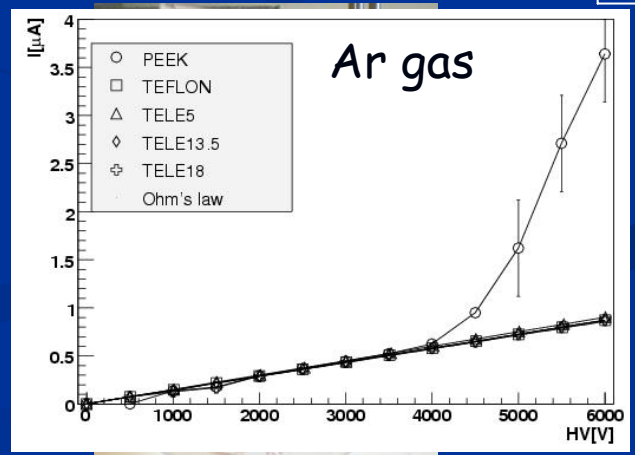
HV Cables

- Break through in Argon gas: 0.8kV/mm (Air: 4kV/mm)
- Set of 5 cables tested
- 1.test: - put HV to open cable
  - Does cable hold the HV ?
  Or is any current seen in neighboring ground (shield of tested cable, or extra cable)?
- 2.test: - Check Ohm's law in circuit with a Giga-Ohm resistor
  - Gives I=I(U) a line?
  Or are there leakage currents?
- Tests were performed in air and in Ar gas
- two HV cables from Teledyne passed all tests
→thinner one (Ø=0.64mm) also mechanically suitable









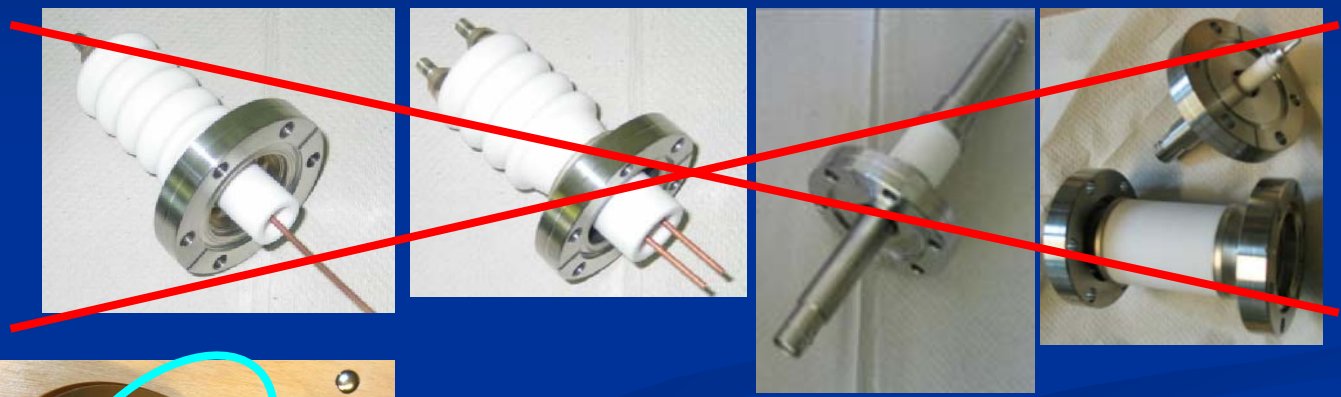
Cable Feed Through

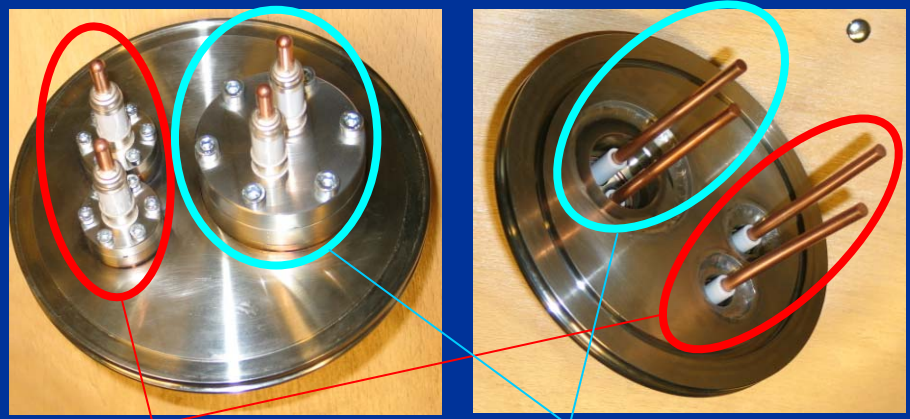
HV feed through:

- Break through in Argon gas: 0.8kV/mm (Air: 4kV/mm)

→ Feed through needs a lot of space, 5mm for 6kV

- Many commercial feed-through were tested but only one was working.





2 x CF 16 flanges

1 x CF 35 flange

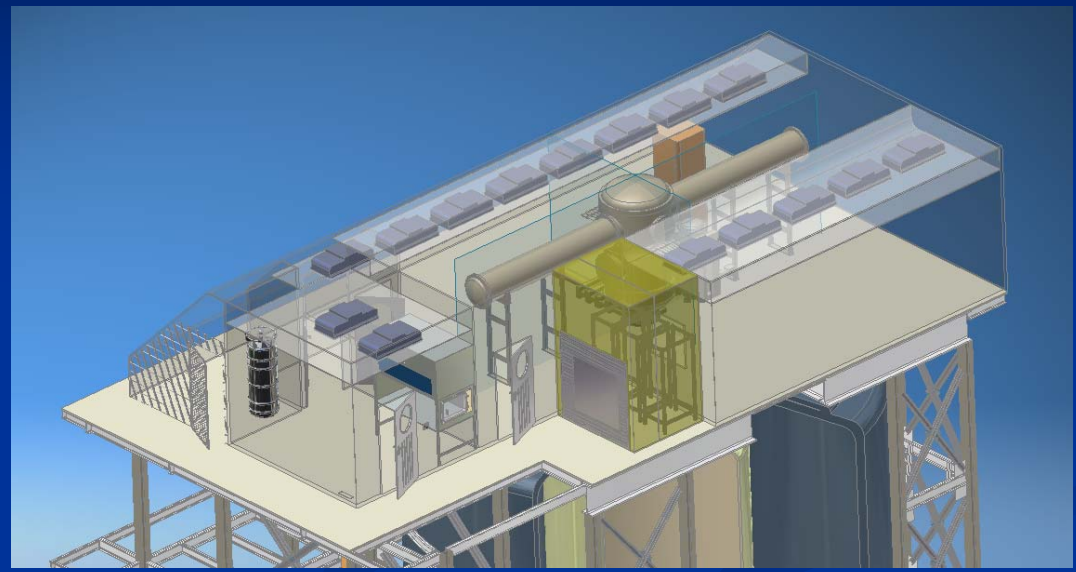
- one big flange mounted on a vessel to check two feed through systems.
- Vessel was first evacuated and than filled with Argon gas.
- HV was applied to the feed through

→ These are solutions for bringing HV into the GERDA system filled with Ar gas

Clean Room

- Tender is in progress.

- Rn tight version will not be built because it is to expensive.
  But: Rn reduction in direct environment of crystals is planned.



- Plan of Construction department of MPI:
  limited tendering after a public competition for participation
  (German: "beschränkte Ausschreibung nach öffentlichem Teilnahmewettbewerb")
- hopefully participants will visit LNGS still this year

Radon Filter

- Gift of ICDO (International Civil Defence Organization, Geneva) for MPI Munich:
  8 activated charcoal filters (total: 1.25tons)

- Filters:
  - were installed in nuclear bunkers in the eighties
  - protect against all kinds of chemical and biological warfare

- Planed application:
  - no general Rn reduction in clean room (no Rn tight walls)
  - provide Rn reduction in direct environment of crystals (crystal storage system, flow boxes for crystal handling)

Conclusion and Outlook

- Phase 1: use of cable guiding chain to suppress rotation

- String with nearly realistic geometry was lowered in direct neighborhood of another string
→ Hexagonal plates giving angle alignment of strings

- Several test were performed to have suitable HV-cables and HV feed through

- Clean room: tendering process in progress

- we got 8 Radon filters (total 1.25tons activated charcoal)
→ will probably be used in direct environment of crystals