

# **Present status of CUORE**

# CUORE set-up schedule and status

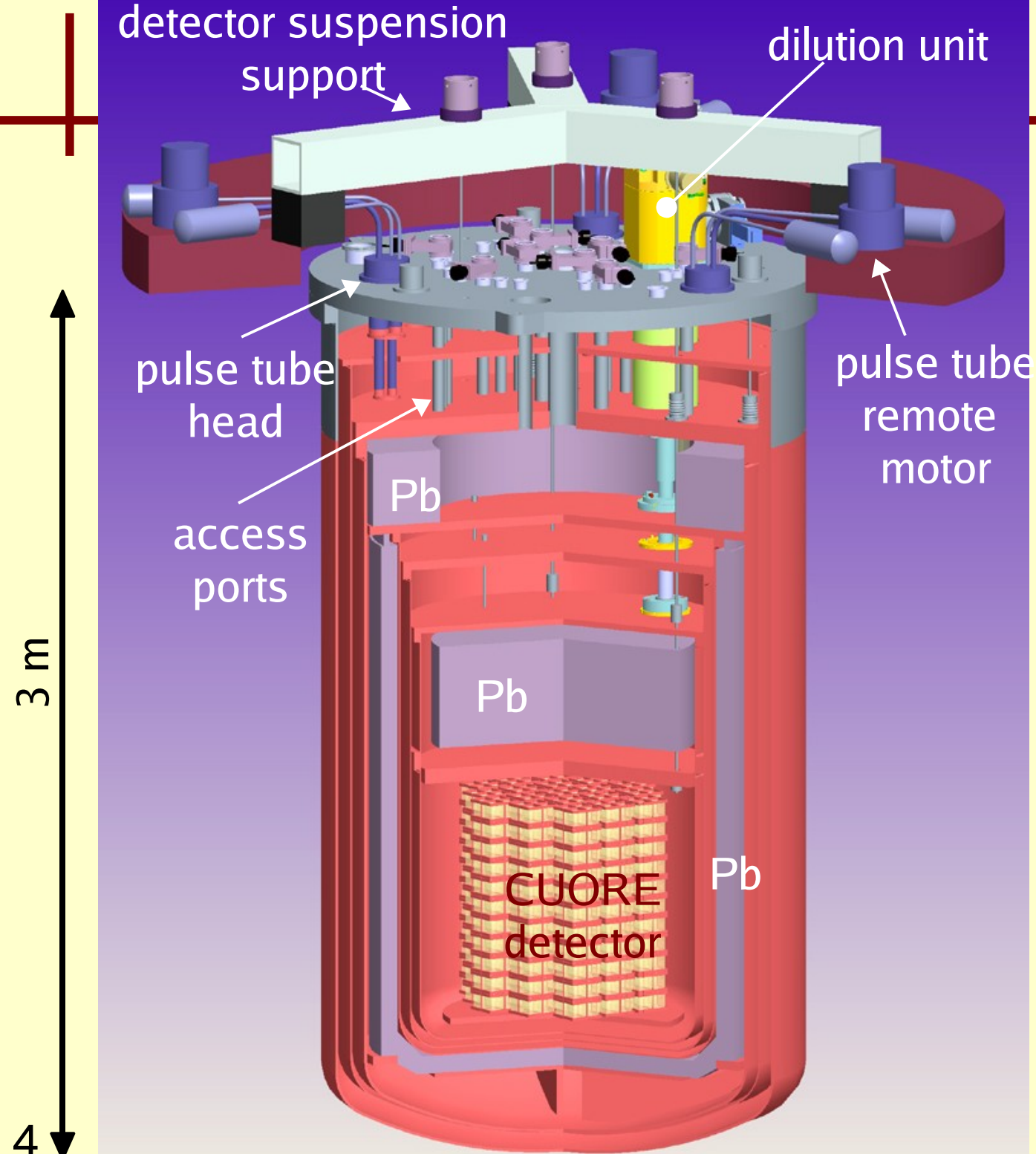
Hut	Q4 2008 (building now)
Utilities	Q1 2009 (starting tender)
External shielding	Q2 2009 (designed + order in progress)
Clean Room	Q2 2009 (design phase)
Dry Dilution Unit	Q4 2008 (ordered)
Cryostat	Q1 2009 (tender in progress)
Commissioning	2009
Suspensions	Q2 2009 (design and test phase)
Calibration system	Q2 2009 (design and test phase)
Wiring system	Q2 2009 (design and test phase)
Internal shields	Q4 2009 (design)

**Detector installation and testing 2010-2011**

**Start data taking 2012**

# CUORE Cryostat specifications

- **cryogen-free**
  - ▶ Pulse Tubes (with spares)
- **base temperature <10mK**
  - ▶ high cooling power custom Dilution Unit (DU) without 1K pot
- **dimensions**
  - ▶ external:  $\varnothing \leq 1687, h \leq 3100$
  - ▶ experimental space:  $\varnothing \geq 900, h \geq 1385$
- **low radioactivity experimental space**
  - ▶ strict material selection
    - only selected pure copper
    - other selected materials only in small amounts (SS, TiAlSn...)
  - ▶ large cold lead shielding close to detector
  - ▶ small amount of Multi Layer Insulation (MLI)
- **heavy load support**
  - ▶ detector: total mass about 1 ton
  - ▶ lead shielding: total mass about 10 ton
- **low mechanical vibration input on detector**
  - ▶ independent detector suspension



# CUORE Cryostat

# CUORE Cryostat: cold shieldings

OVC

40K shield

IVC (~4K)

Still (~0.7K)

top lead ring  
T Still  
25 cm thick

lateral lead  
T IVC (or Still)  
6 cm thick

top cold lead  
T Cold Plate  
30 cm thick

detector

XYZ

detector  
suspension

cryostat bars  
Ti-6Al-4V

Cold Plate (~0.08K)  
Mixing Chamber

top cold lead  
suspension

top cryostat bars  
and lateral/top ring  
lead suspensions  
AISI 316LN

XYZ

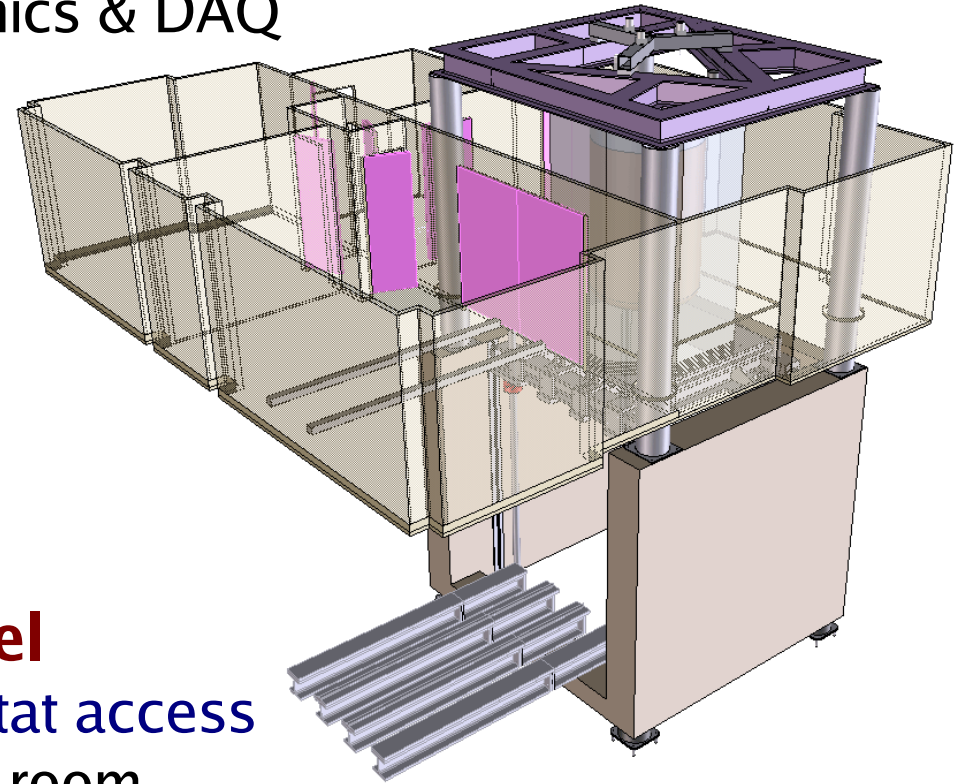
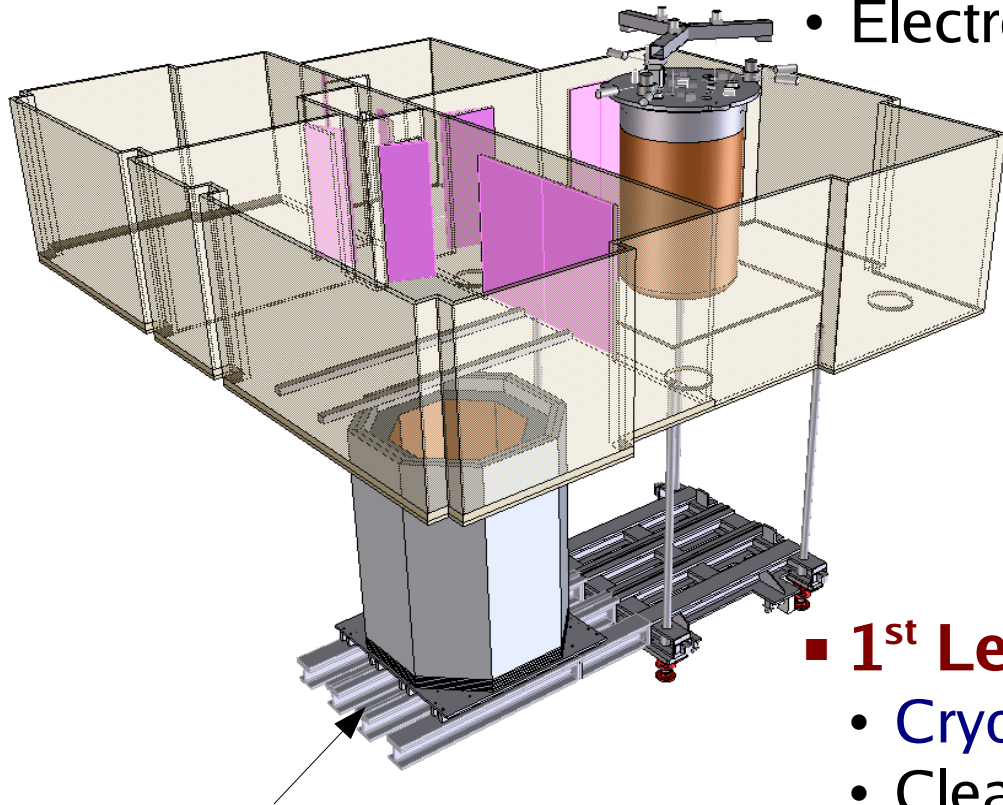
# CUORE Hut / 1



# CUORE Hut / 2

## ■ 2<sup>nd</sup> Level

- Top flange access
- Suspension access
- DU Gas Handling
- Electronics & DAQ



## ■ 1<sup>st</sup> Level

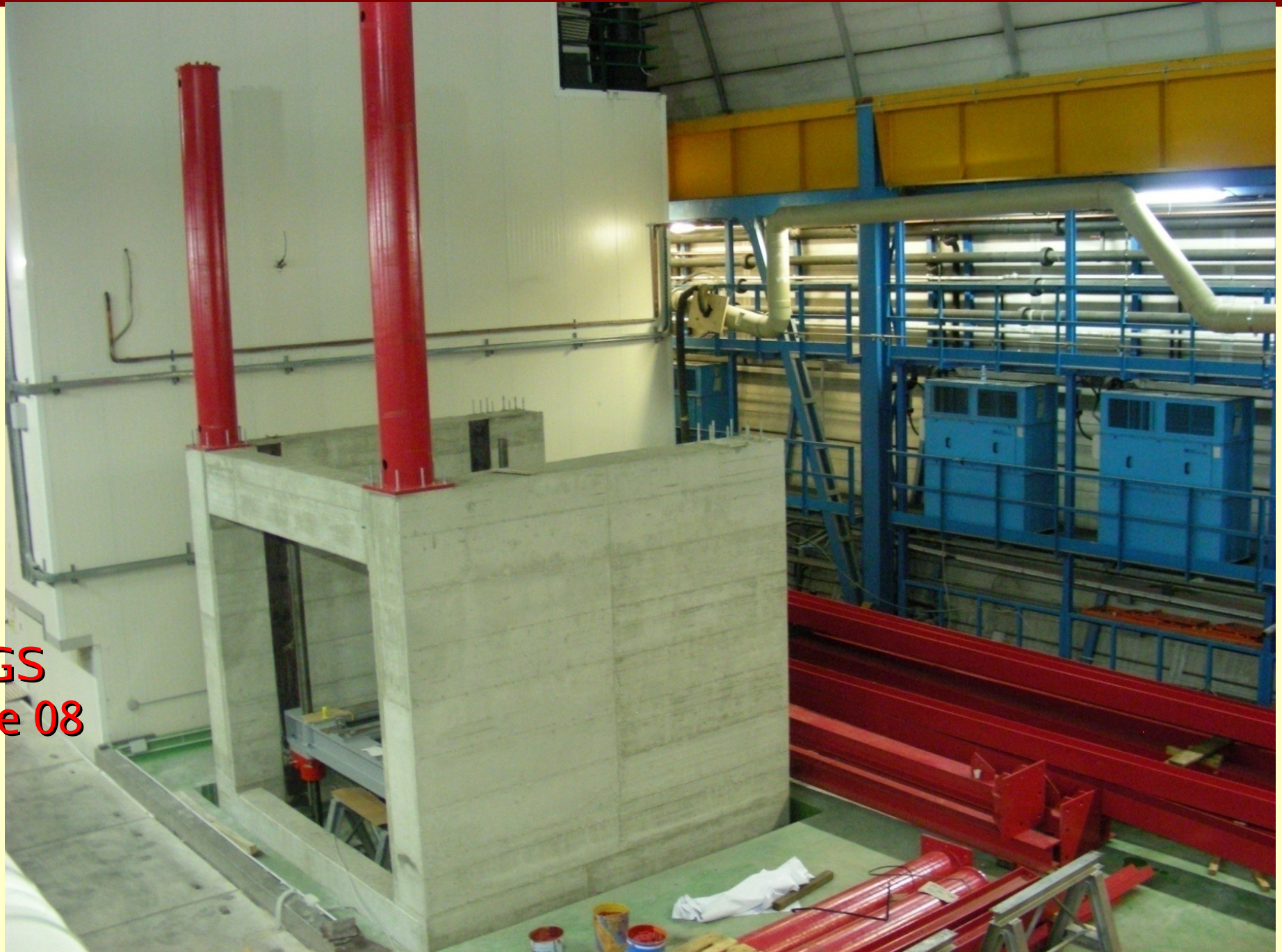
- Cryostat access
- Clean room

## ■ ground floor

- services (pumps,...)
- shields and screens storage

20 tons external lead shielding

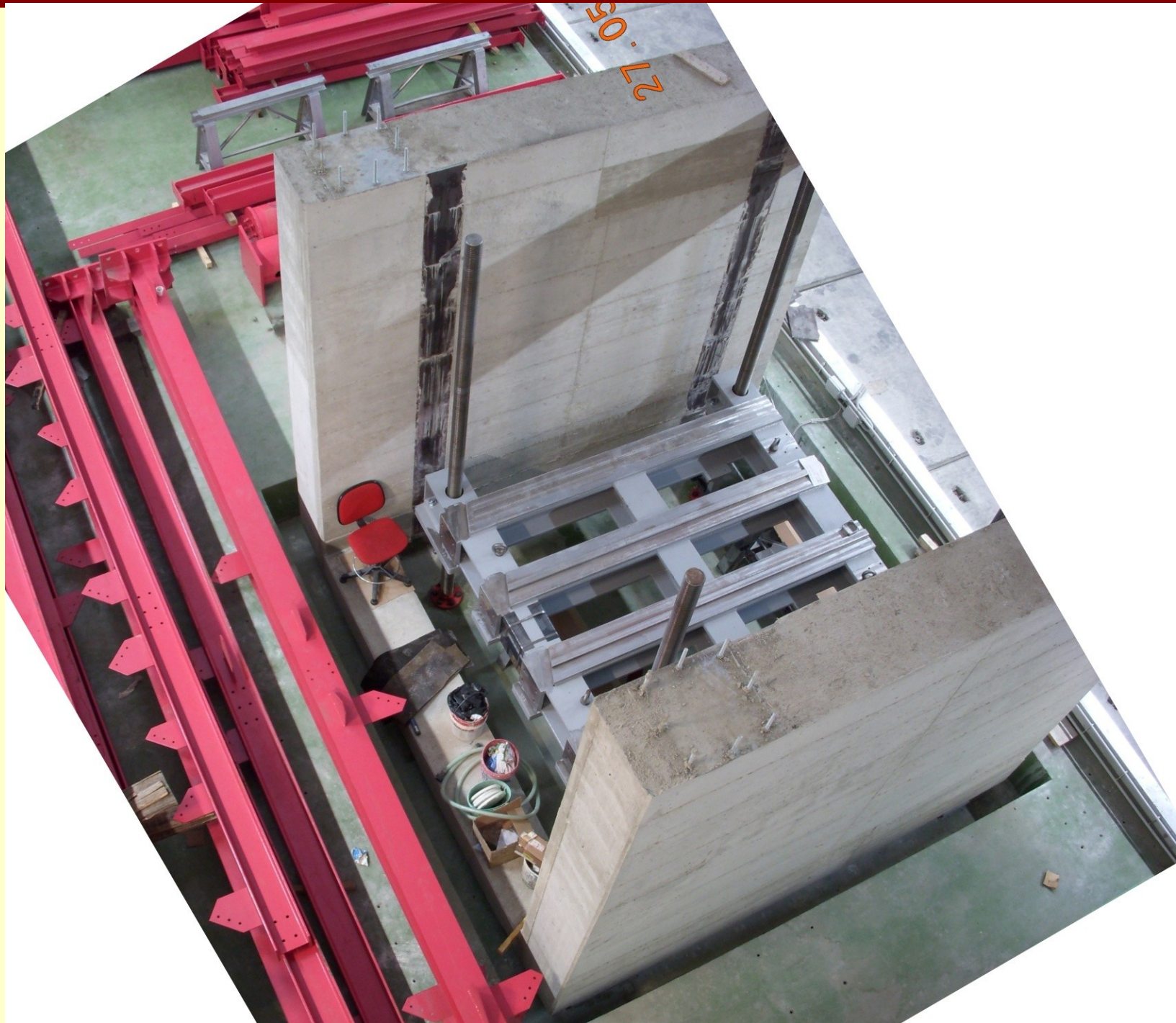
# CUORE Hut present status / 1



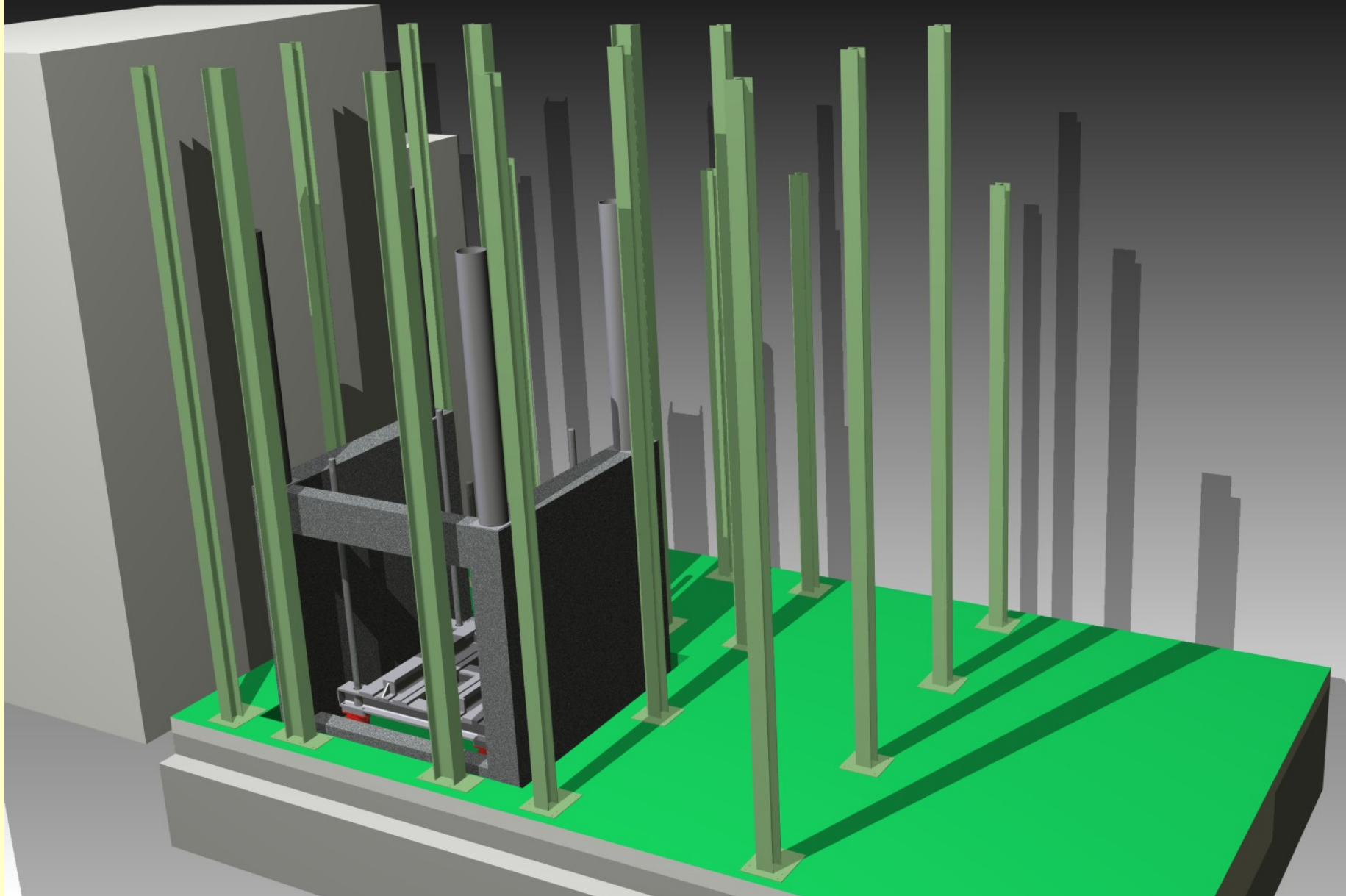
LNGS  
June 08



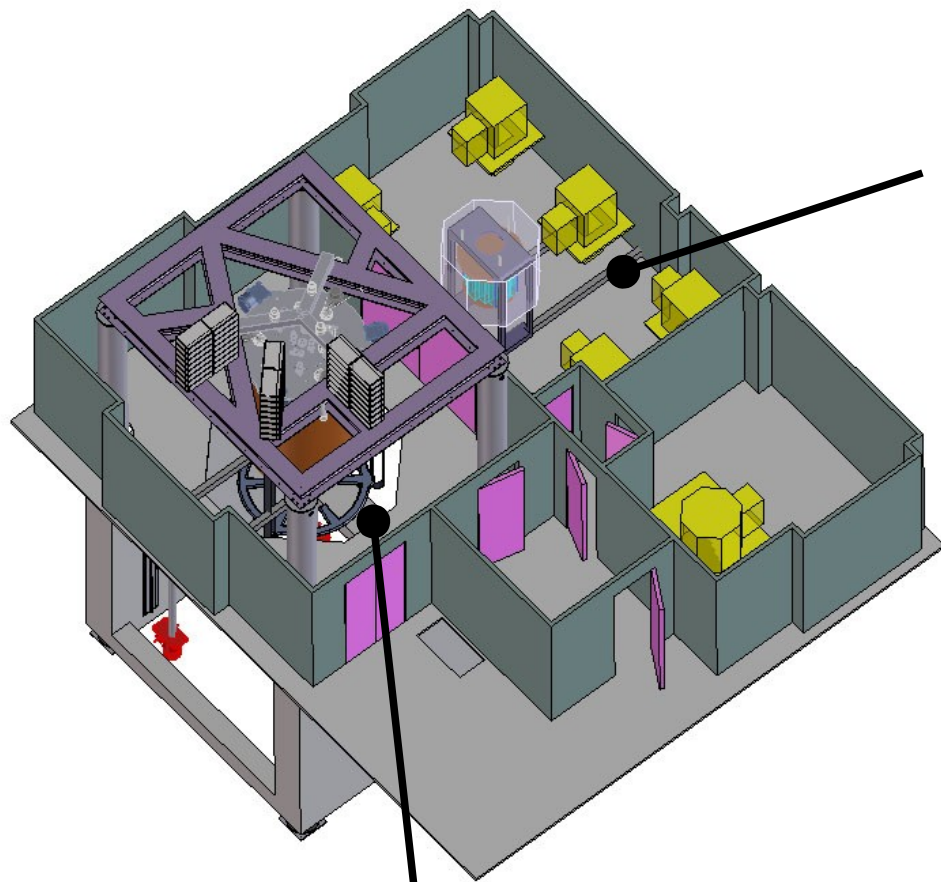
# CUORE Hut present status / 2



# CUORE Hut present status (last week...)



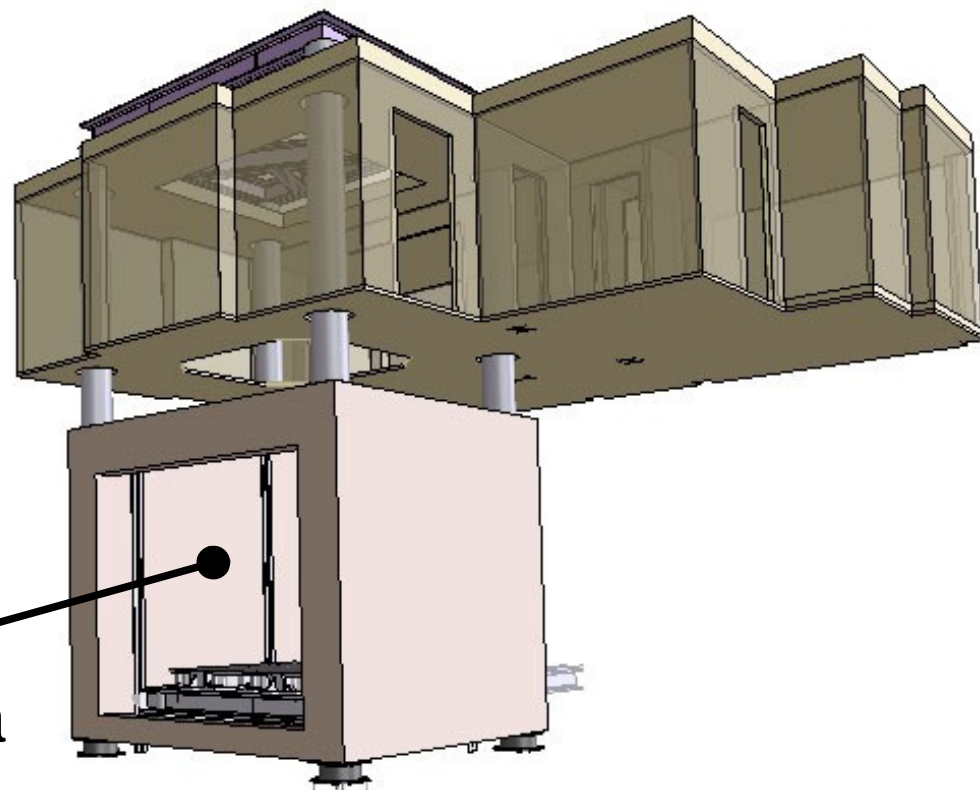
# CUORE clean room



detector assembly area

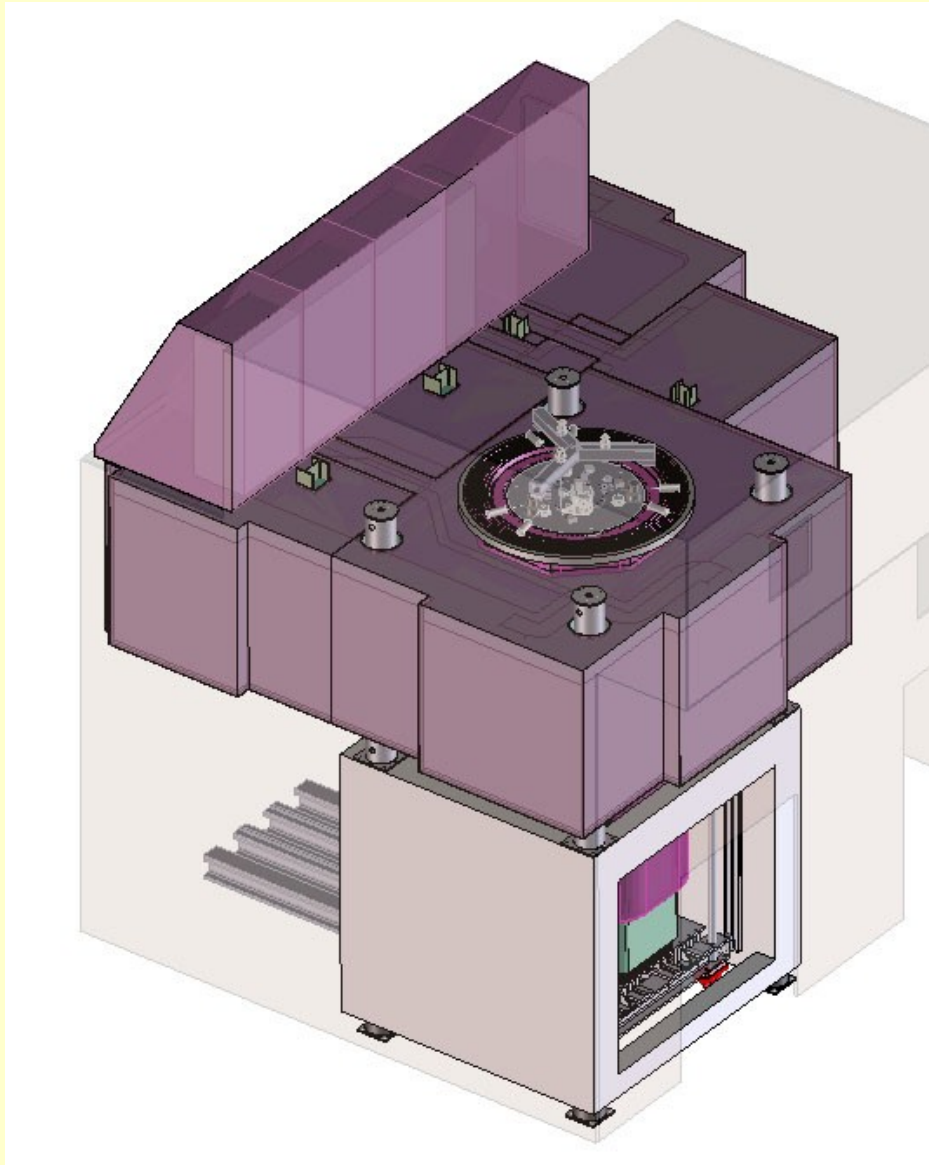
cryostat working area

outer lead shield and  
cryostat vessels storage area

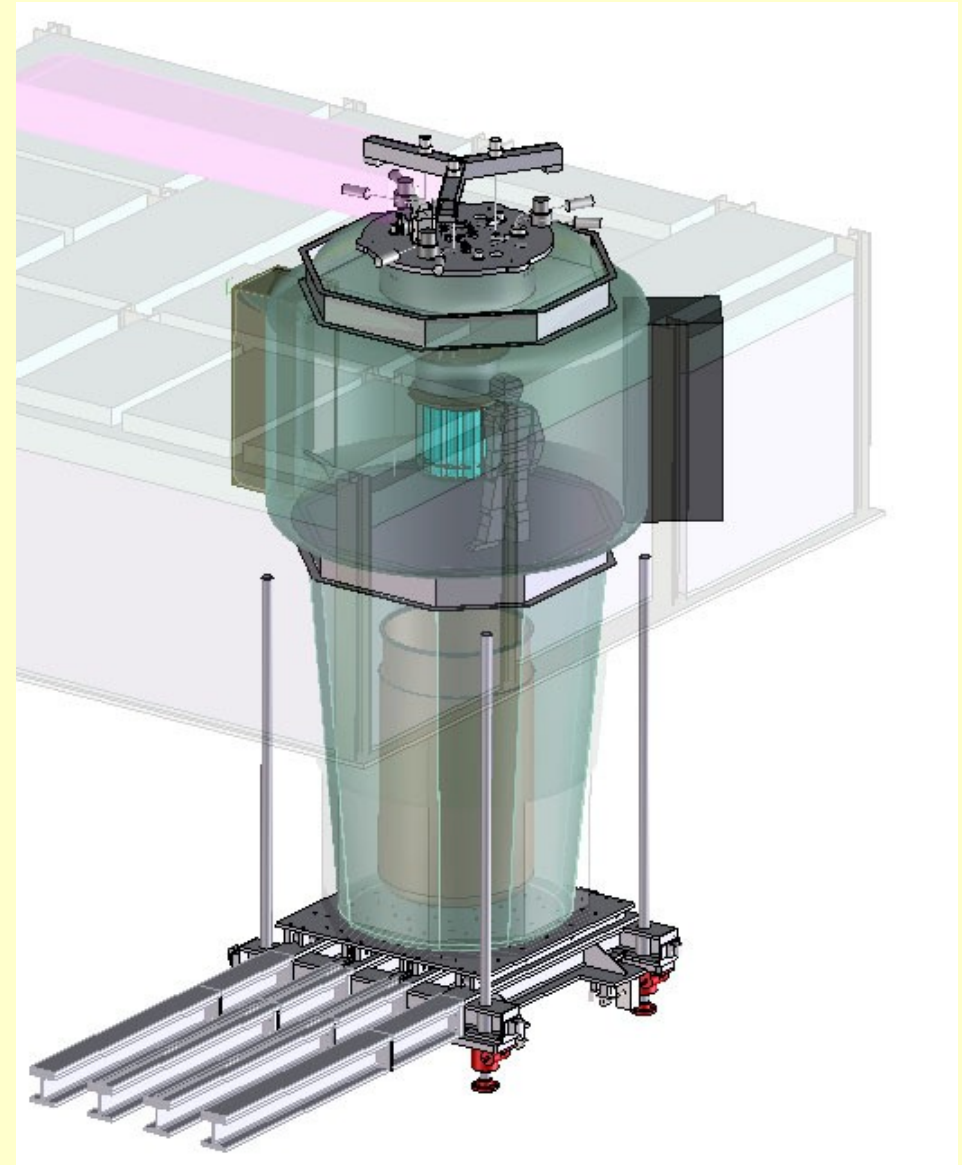


# CUORE: possible anti-radon measures

sealed radon box  
with radon-free air



soft enclosure  
with radon-free air



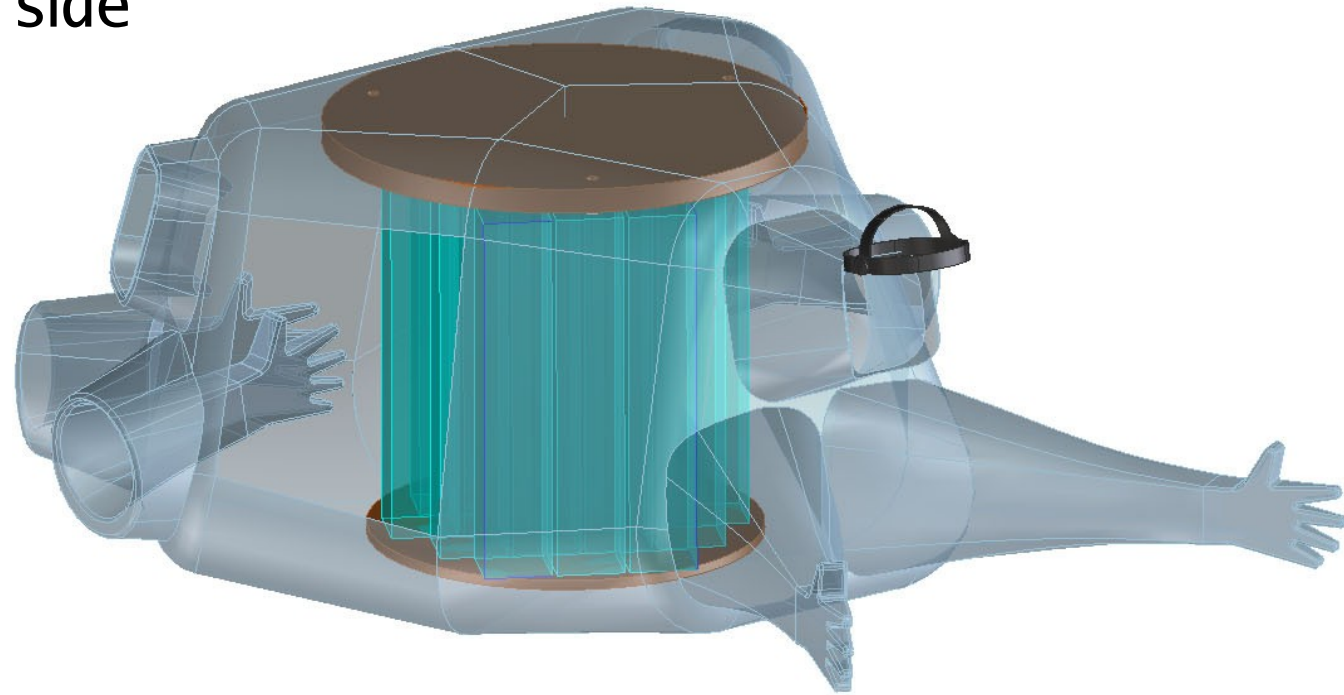
# CUORE: possible anti-radon measures

glove enclosures flushed with nitrogen

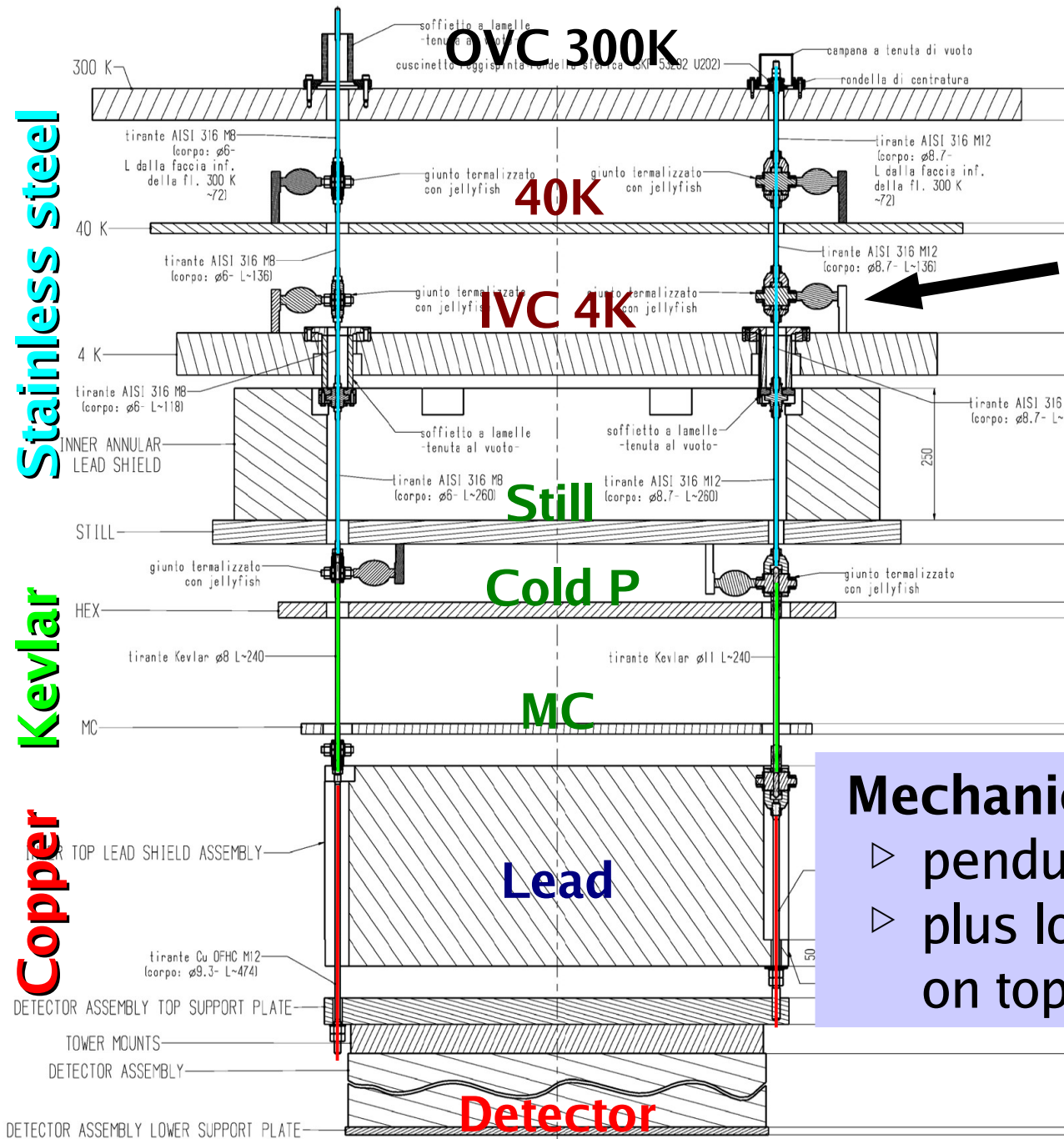
top



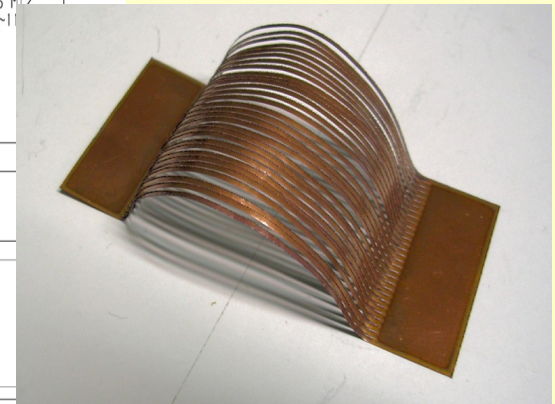
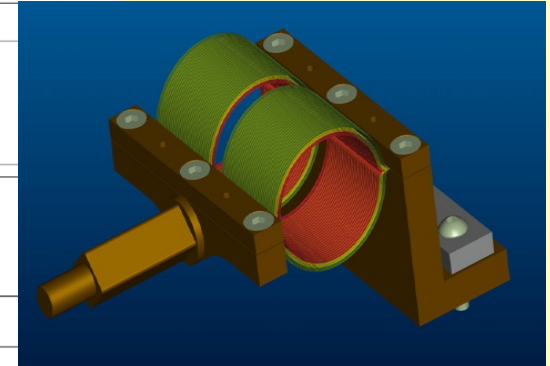
side



# CUORE Detector and Lead shield suspensions



thermal links



Stainless steel

Kevlar

Copper

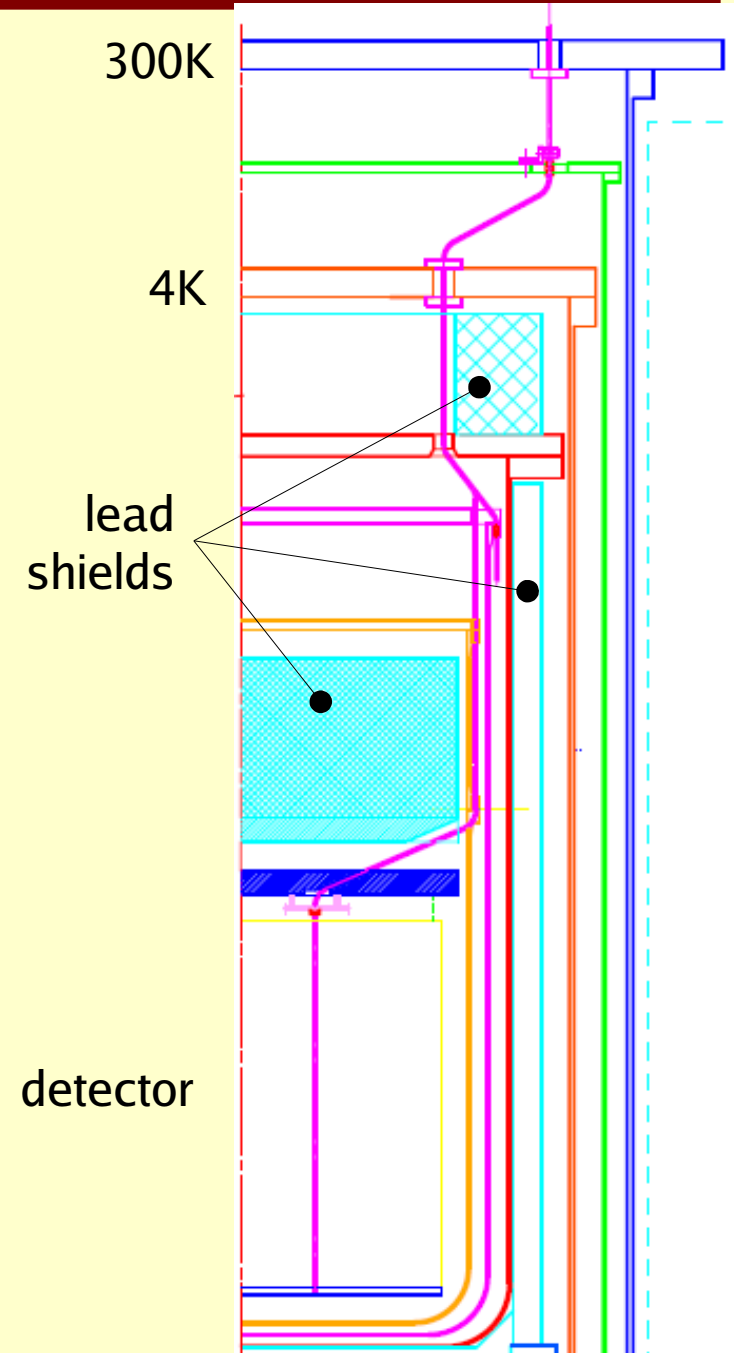
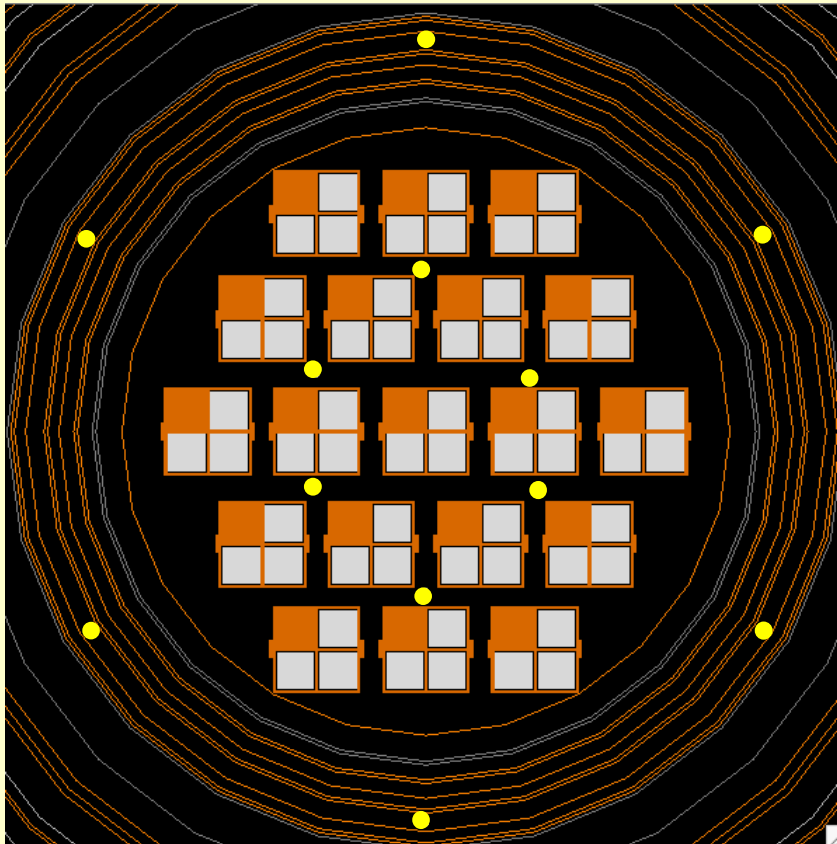


Mechanical vibration filter

- ▷ pendulum  $\sim 0.4$  Hz
- ▷ plus longitudinal filter on top

# CUORE Detector Calibration System / 1

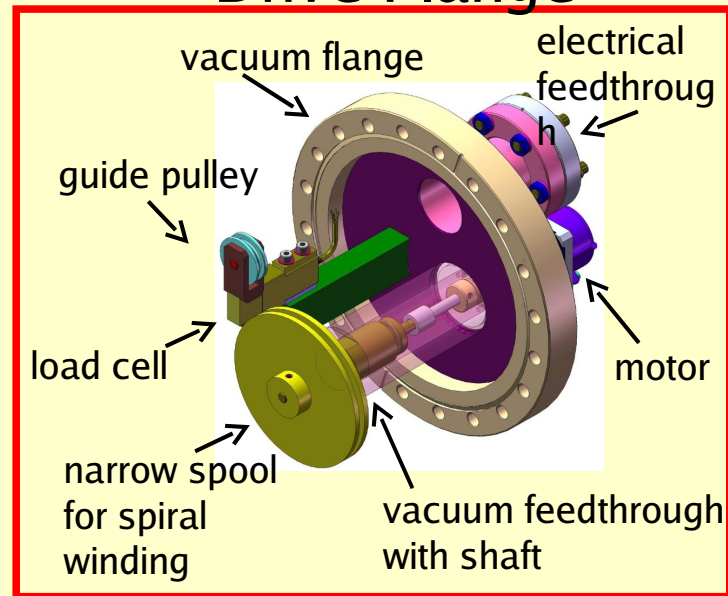
- 12 sources will be guided insided 12 tubes from 300K through the cryostat
- The source active wire contained in copper crimp tubes, crimped onto a Kevlar string and covered by PTFE heat shrink sleeves
- $^{232}\text{Th}$  or  $^{56}\text{Co}$



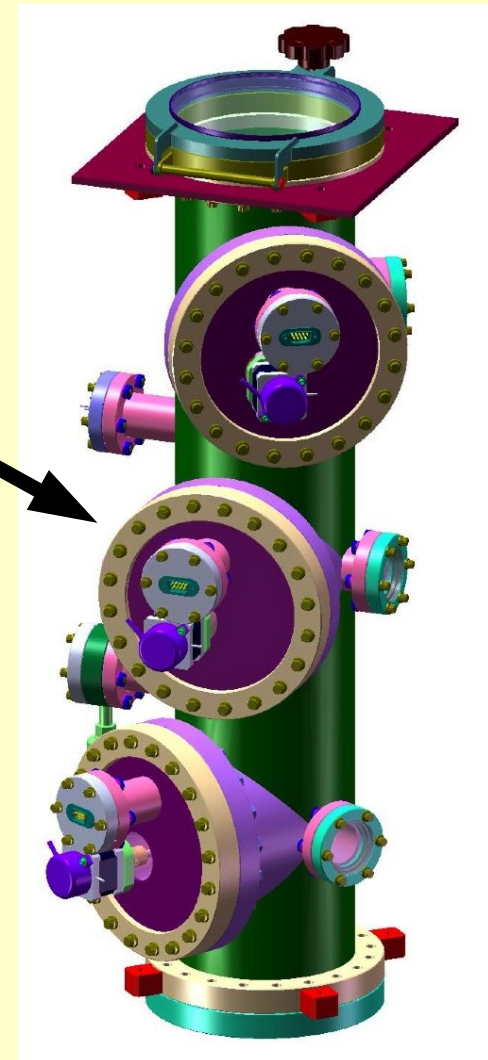
# CUORE Detector Calibration System / 2

- 3 power trains/spools per motion box
- 4 motion boxes for a total of 12 sources

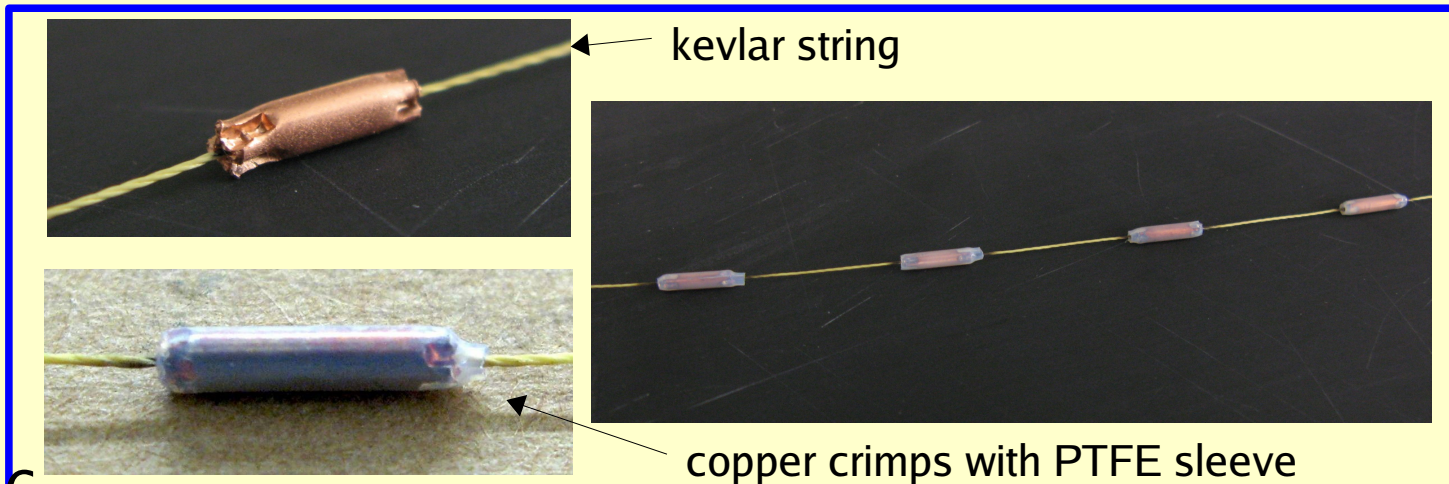
## Drive Flange



## Motion Box



## Source Carrier

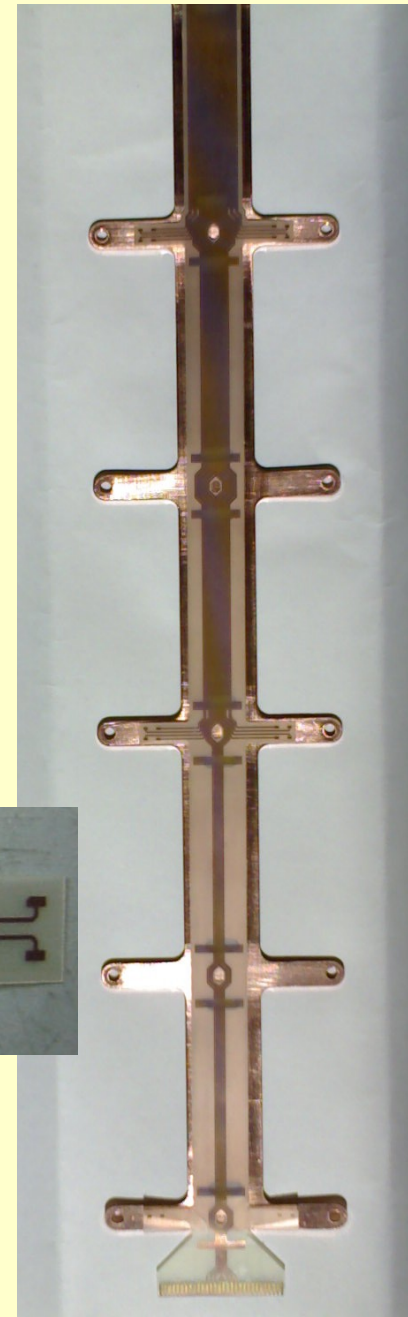
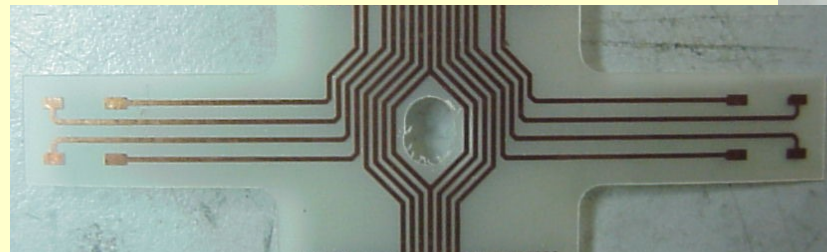
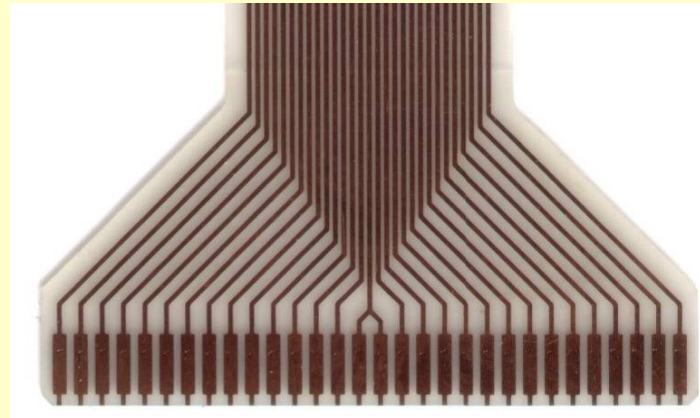
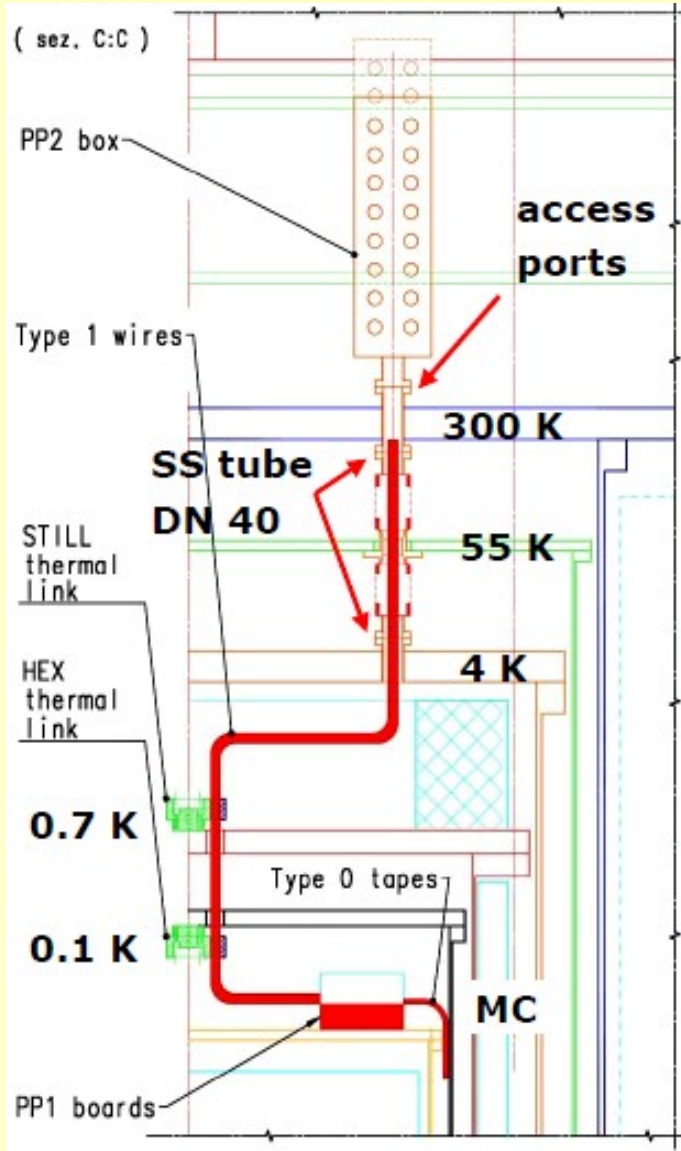




# CUORE Wiring system

2600 read-out wires

Mixing Chamber to Detector:  
copper on mylar ribbons



300K to Mixing Chamber:  
17 woven NbTi twisted pairs

# Conclusions

- Cryogenic detectors represent a well established technique, very competitive for neutrinoless double beta decay search
- CUORICINO is presently the most sensitive  $\beta\beta - 0\nu$  running experiment
- CUORICINO demonstrates the feasibility of CUORE, a next generation detector with high energy resolution and competitive background
- CUORE, presently being built at Gran Sasso Laboratory, will have the capability of exploring the inverse hierarchy mass region
- CUORE is planned to start data taking in 2012