Status of Muon Veto

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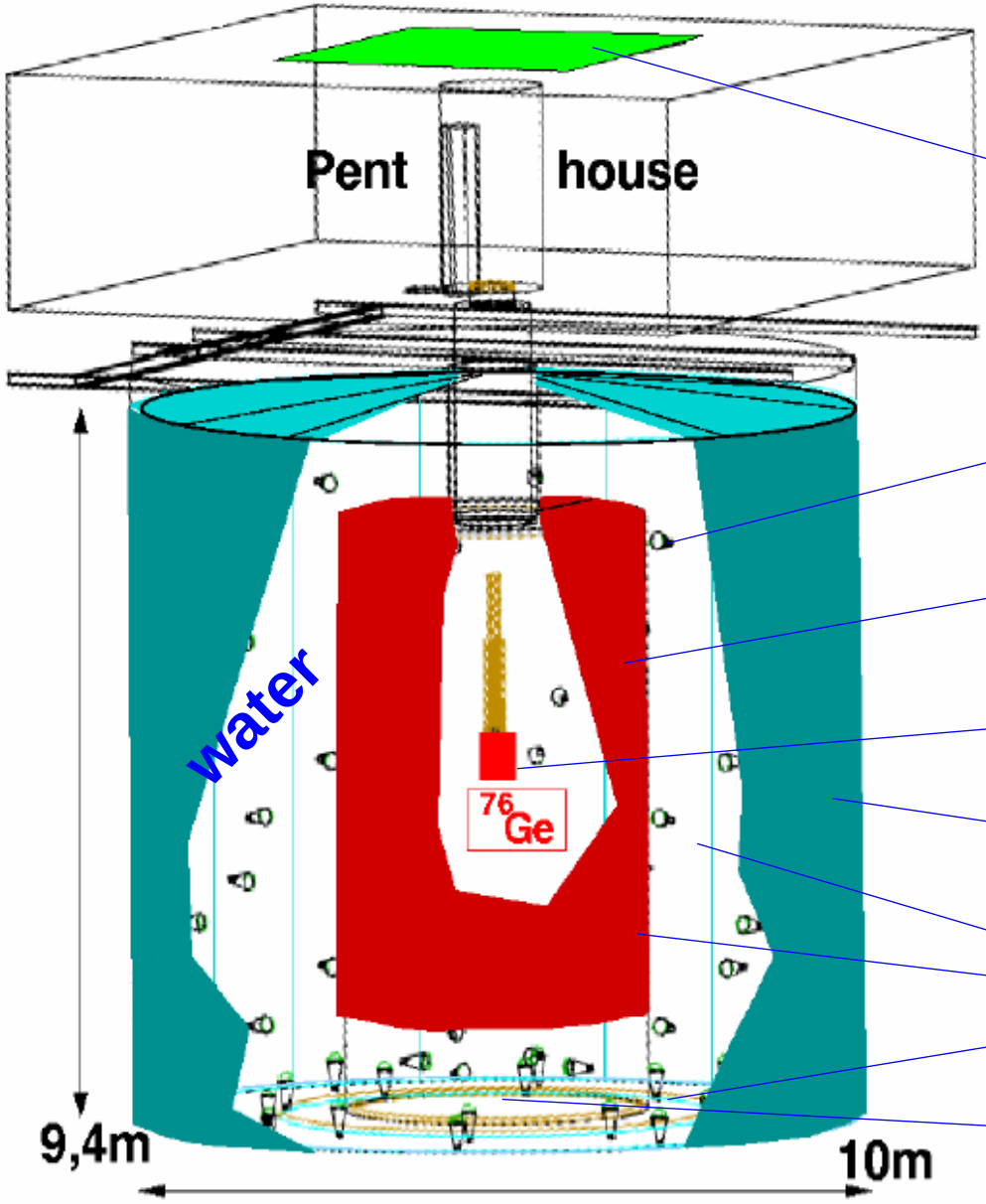
Muon Detector - Overview



plastic scintillator

photomultiplier

cryo tank (+3.wall)
-old design-

Ge crystals

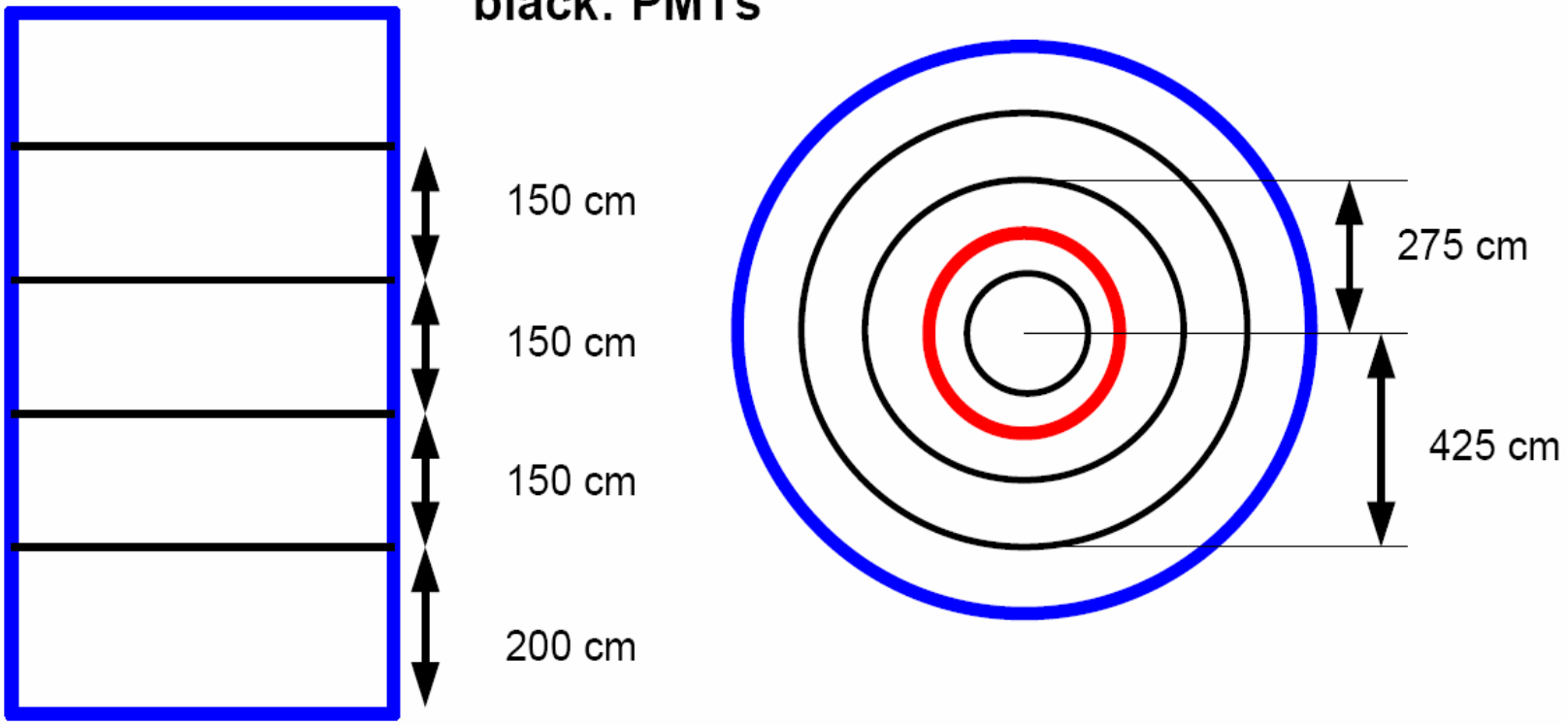
water tank

reflector VM2000

‚lower pillbox‘

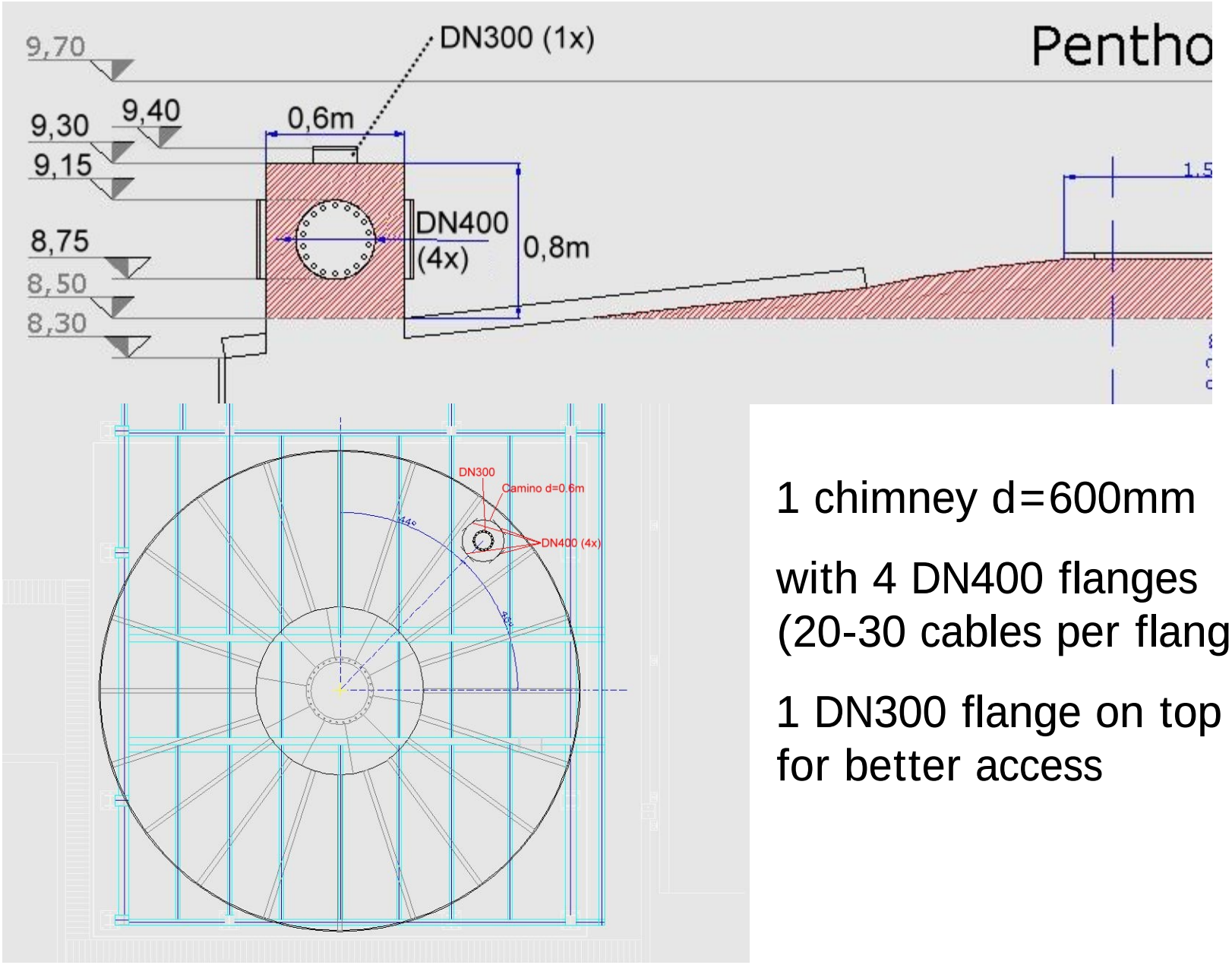
Muon Detector – PMT Distribution

red: Pillbox
blue: Watertank
black: PMTs



- 4 rings on the wall of the water tank -> each ring: 10 PMTs
- 2 rings on the bottom of the water tank -> inner ring: 8 PMTs
  -> outer ring: 12 PMTs
- 6 PMTs in the ‚Pillbox' below the cryostat

Muon Detector – Cable Chimney

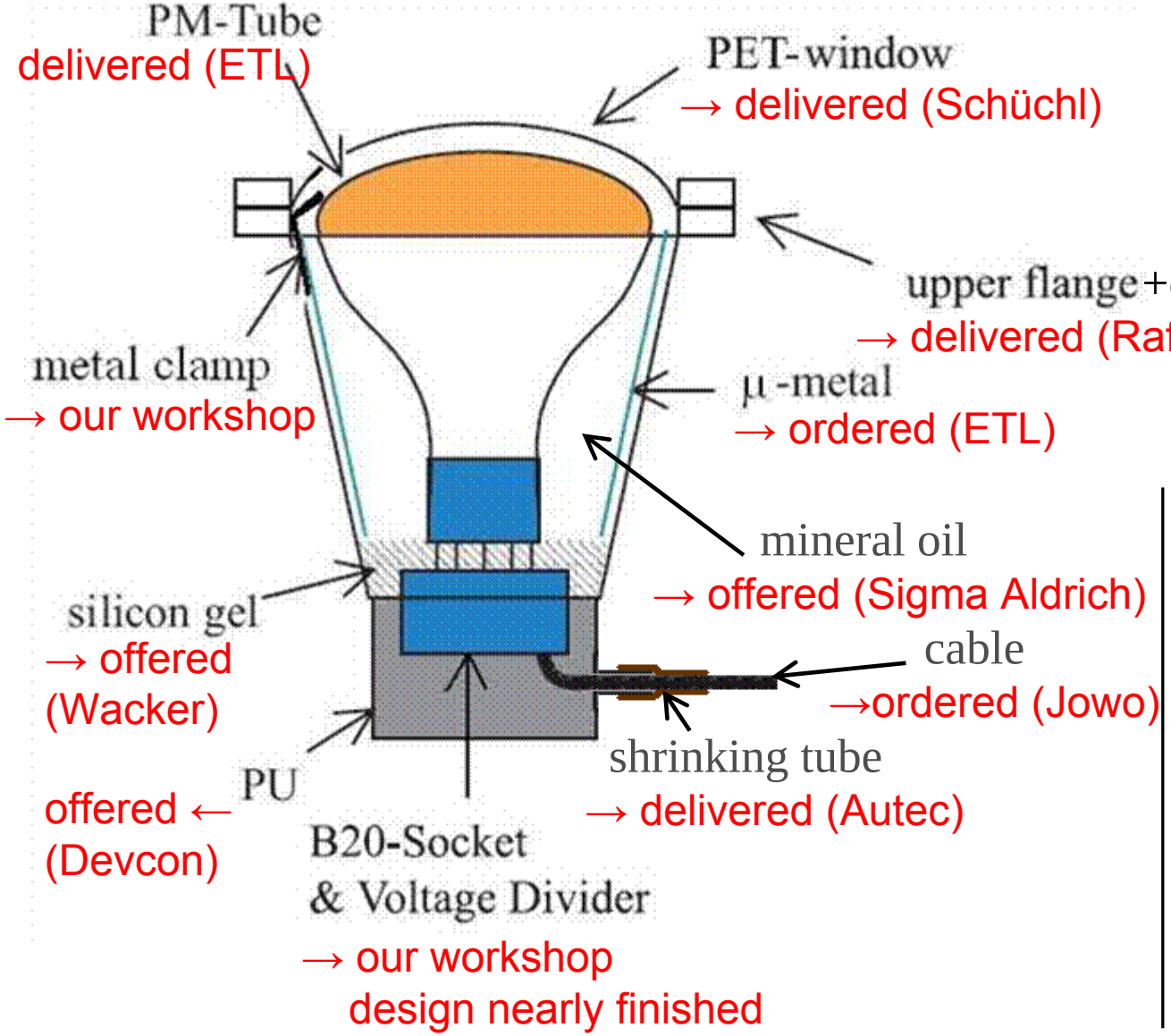


1 chimney d=600mm

with 4 DN400 flanges
(20-30 cables per flange)

1 DN300 flange on top
for better access

PMT - Encapsulation Design & Status



Master Bond
→ partially delivered

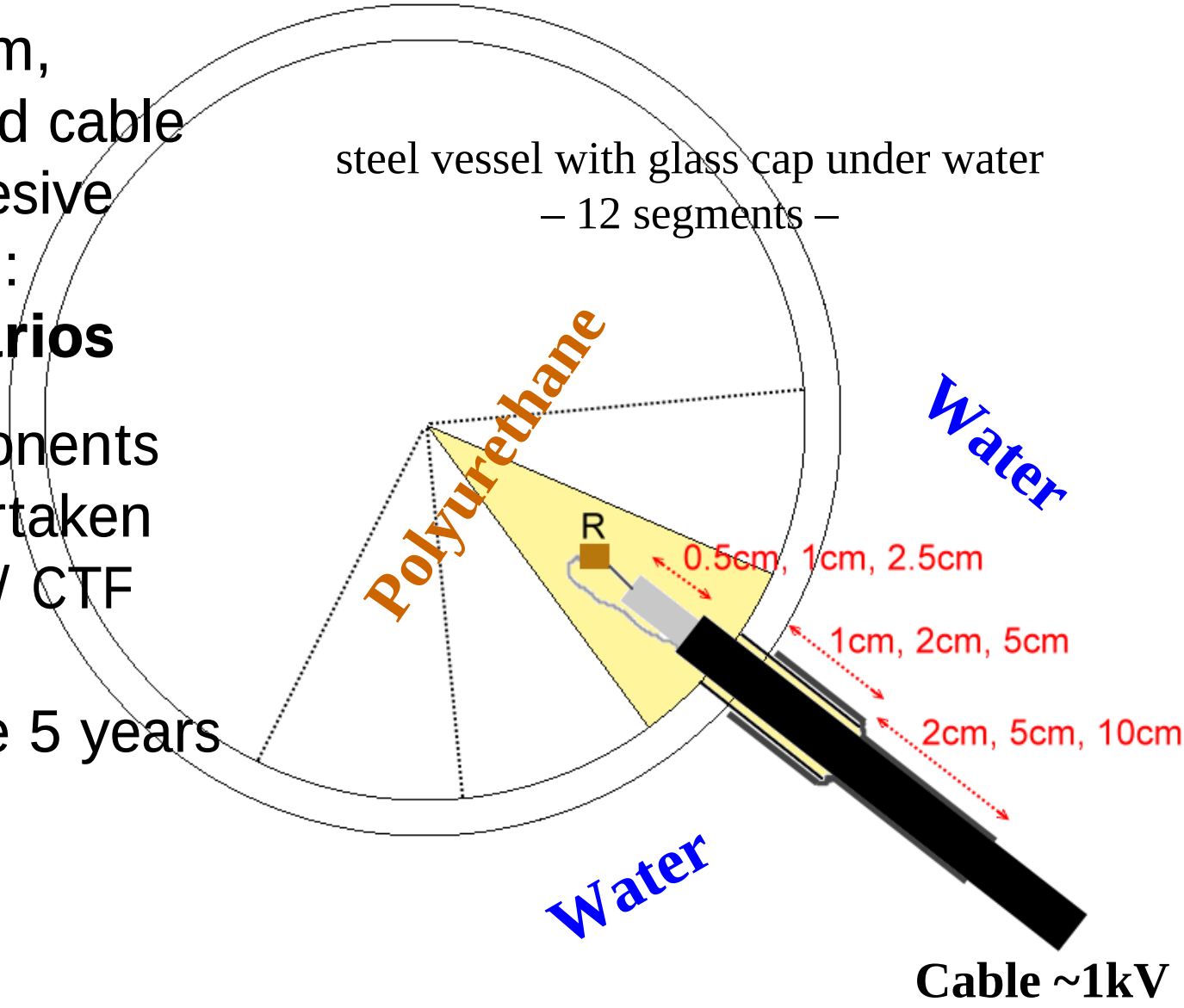
VM 2000 foil
→ offered

Plastic scint. panels
→ JINR Dubna

PMT Encapsulation – Tests

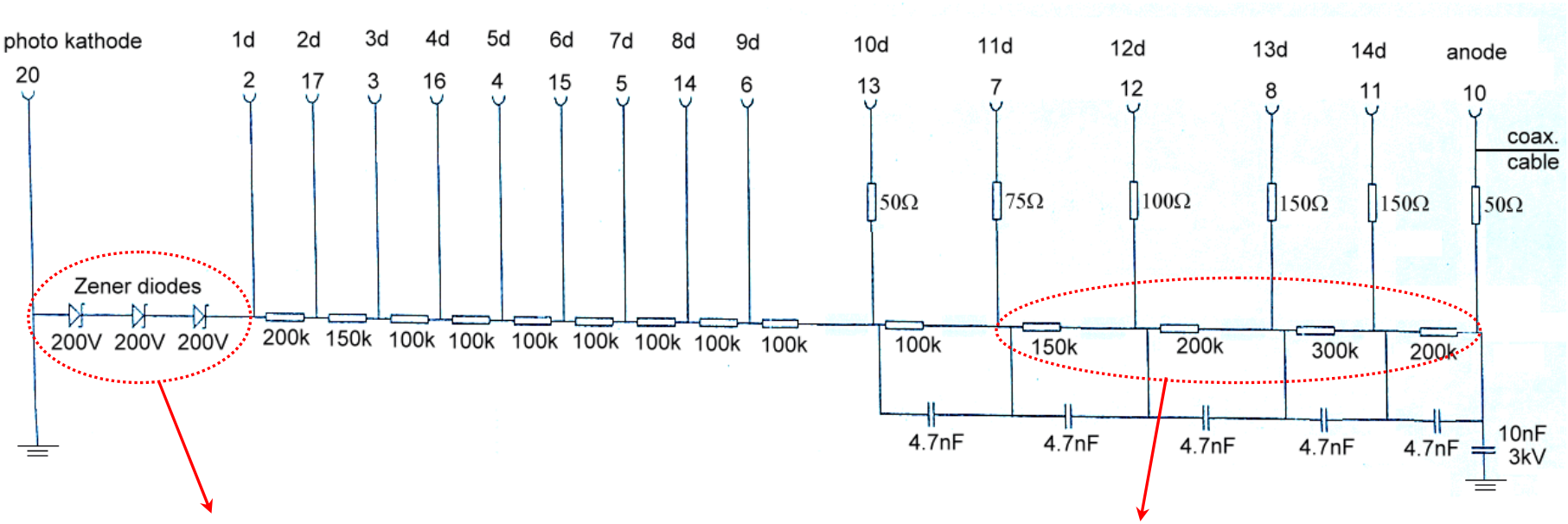
Test critical item,
i.e. the modified cable sealing by adhesive shrinking tubes:
12 diff. scenarios

All other components have been overtaken from Borexino / CTF design
– working since 5 years



PMT Base – Development

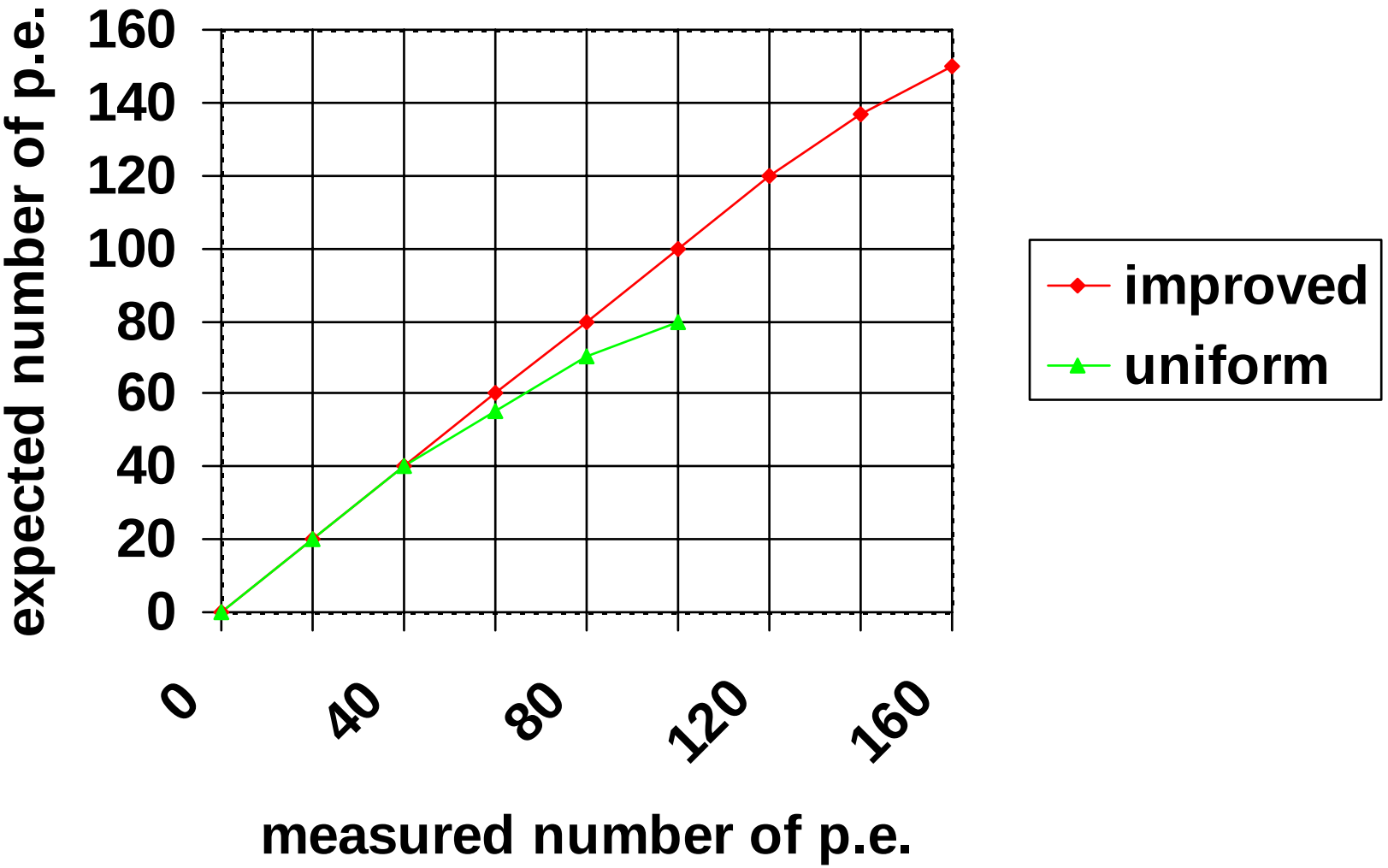
- Ground design from ETL for 9350KB
- Improved design (Bayarto Lubsandorzhiev):



Increases el. field E to suppress influence of magnetic field

Increases ΔV in last dynodes to improve linearity

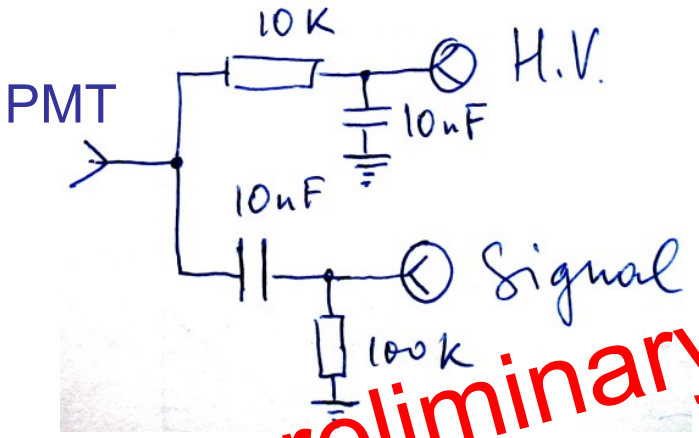
PMT Base – Linearity



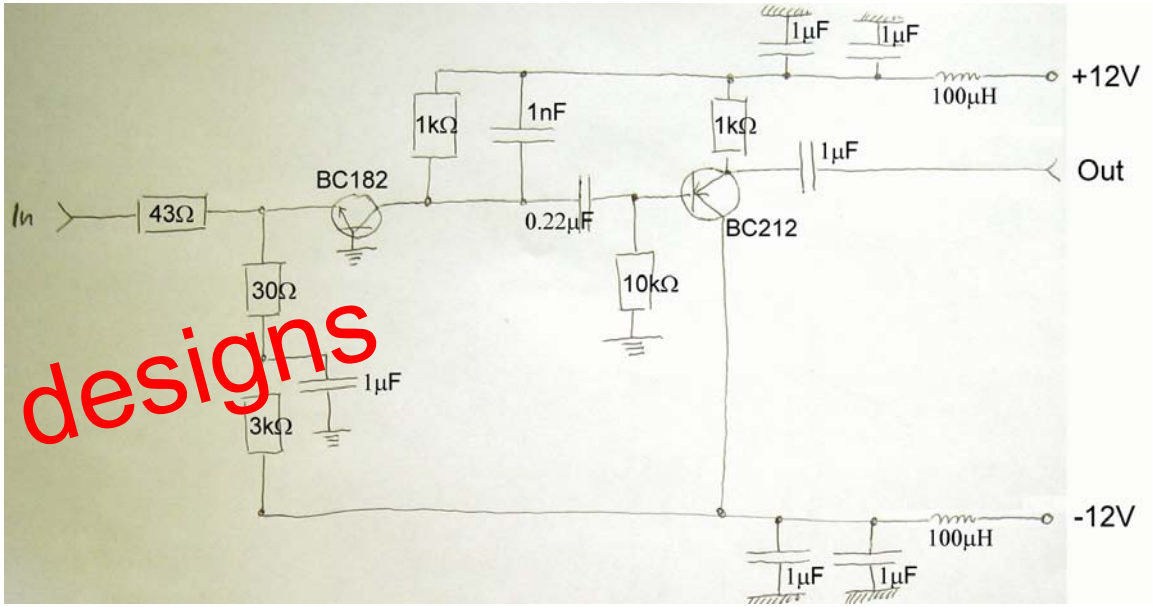
Signal Decoupling and Stretching

- Decoupling Station:
  Coax. cable from PMT → -High Voltage
  -Signal
- Active Stretching Unit:
  FADCs 100MHz (10ns)
  Signal rise time: Some ns → ~30ns
  Amplification integrated (±12V supply)

Signal Decoupling and Stretching



preliminary designs



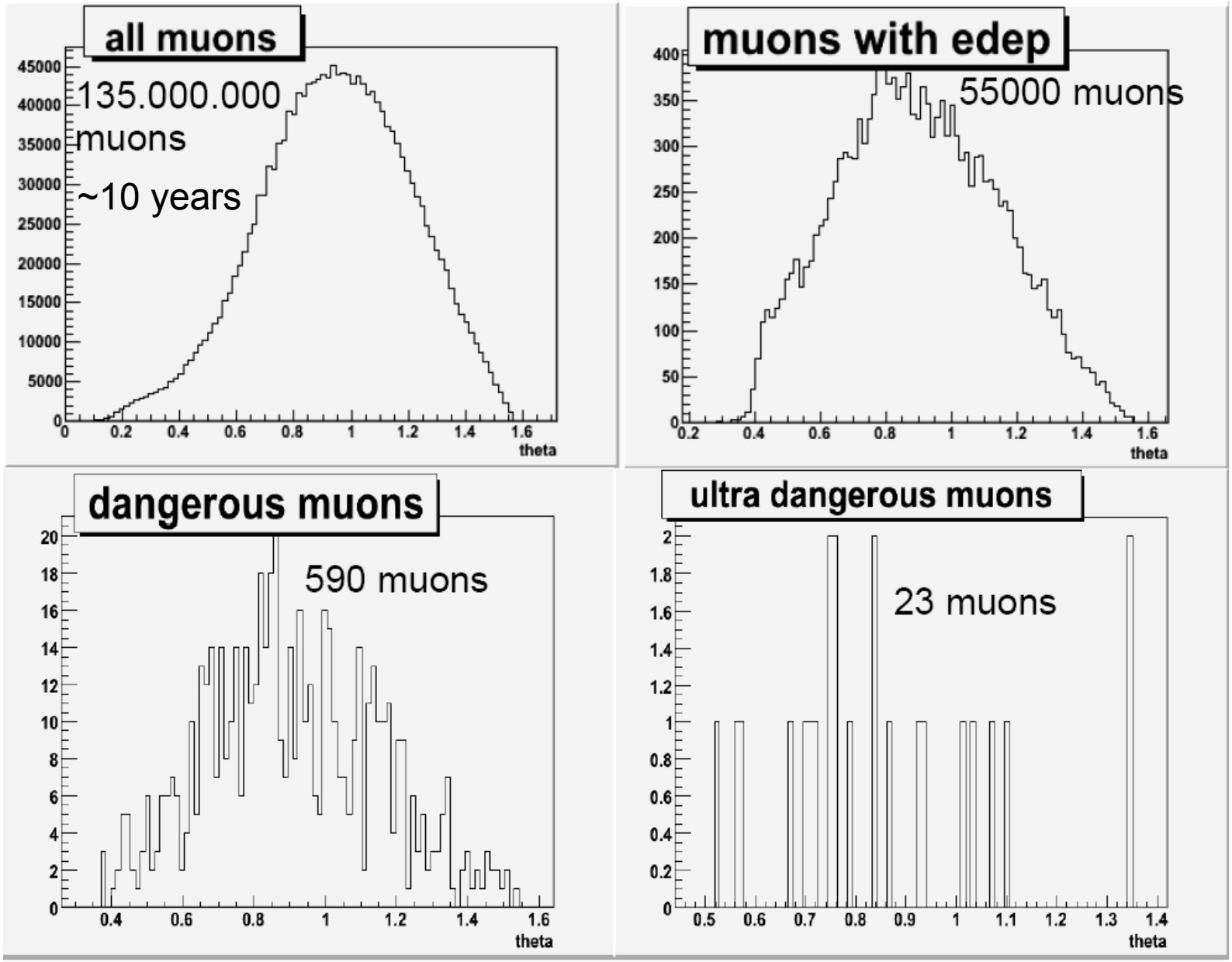
→ B. Lubsandorzhiev (INR Moscow)

- Intention: Combine both in one module
- Integrate as many PMT channels as possible in a NIM unit (→ 3 – 4 NIM units)
- Add additional output for external discriminator → hit pattern
- Production during winter (~3 months)

PMT Calibration – LEDs

- Developed ns light source based on powerful LED (0.5W) at 470nm
- Illuminates ~80 fibres (1 LED → all PMTs)
- Fibre: Acrylic
  Attenuation: 10^5 p.e./PMT after 30m (further attenuation needed)
- 3 LEDs tested (G-nor 8ns, LUMILED 10ns, CREE 12ns pulses)

Simulations – Muon distribution



→ Markus Knapp (Univ. Tübingen)

Muon Simulations - Summary

new MaGe steel cryostat	Data June 2006 - Gathered from $0.5 \cdot 10^8$ muos - Scaled up	Now - Gathered from $1.35 \cdot 10^8$ muons
all muons (~10y)	$1.35 \cdot 10^8$	$1.35 \cdot 10^8$
muons with E_{dep}	43200	55000
dangerous	594	590
ultra-dangerous	27	23

→ $\sim 2 \cdot 10^{-3}$ (kg keV y)$^{-1}$ of dangerous ext. muons

with 95% veto:
→ $\sim 10^{-4}$ (kg keV y)$^{-1}$

with anti-coincidence of Ge detectors:
→ $\sim 10^{-5}$ (kg keV y)$^{-1}$

Muon Veto – Schedule

- Encapsulation + Electronics tests under way
- Dez. 2006: Encapsulation of 1 PMT
- Jan./Feb. 2007: Tightness test (2 bar)
- Spring 2007: Encapsulation of all PMTs
- Sep. 2007: PMTs transport to LNGS

- We can meet the Gerda schedule -

- PMTs + VM2000 installation
- Electronics set-up + test