Recycling KLOE: an ecofriendly possibility

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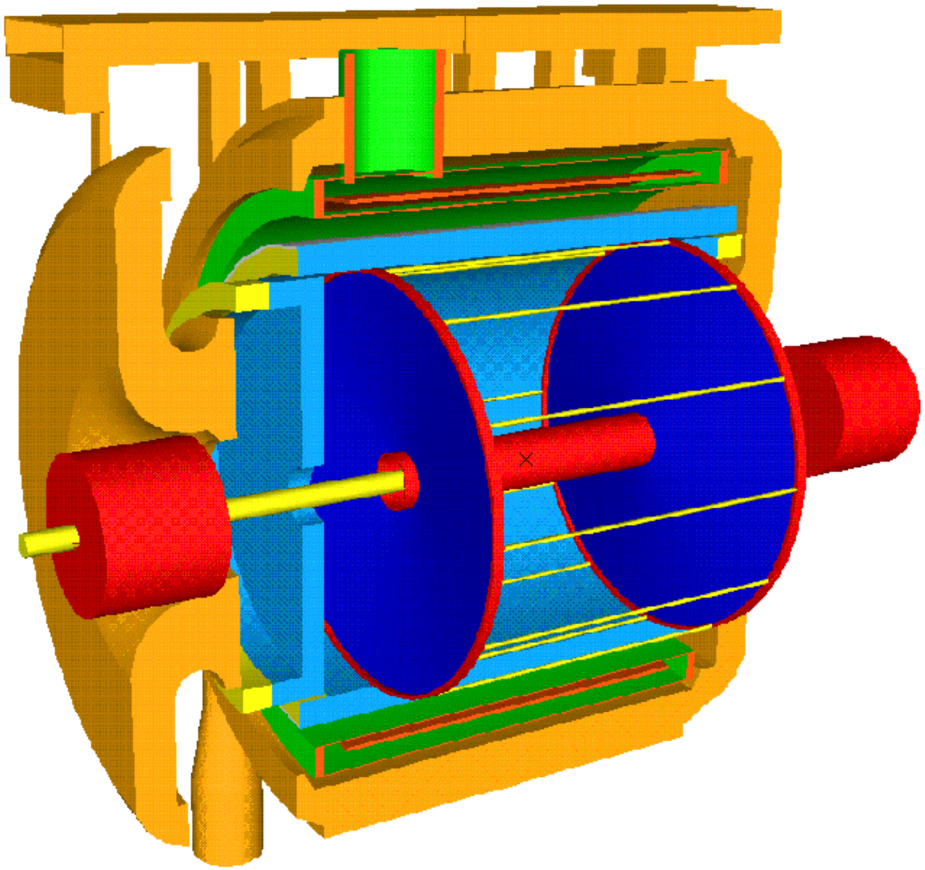
The KLOE experiment



Be beam pipe (0.5 mm thick)
Instrumented permanent magnet quadrupoles (32 PMT's)

Drift chamber (4 m ∅ × 3.3 m)
90% helium 10% isobutane
12582/52140 sense/total wires

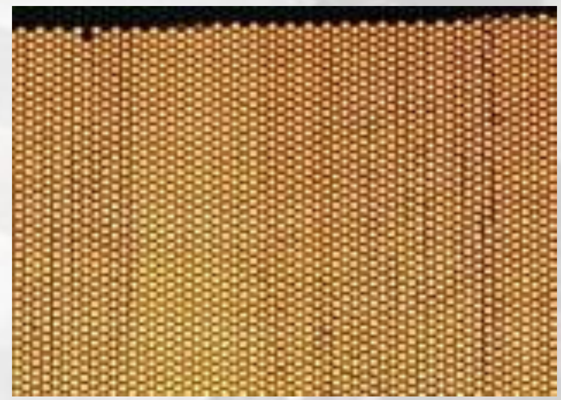
Electromagnetic calorimeter
Lead/scintillating fibers
4880 PMT's

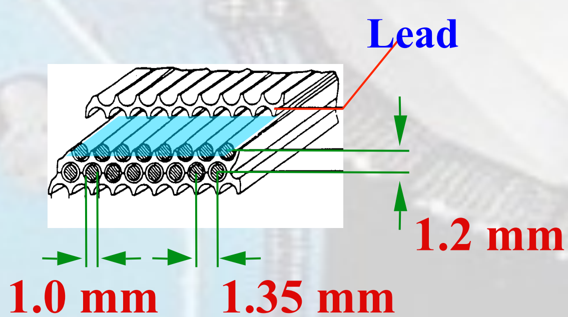
Superconducting coil (5 m bore)
$B = 0.6$ T ($\int B\, dl = 2.2$ T·m)

The KLOE calorimeter

Pb - scintillating fiber sampling calorimeter of the KLOE experiment at DAΦNE (LNF):

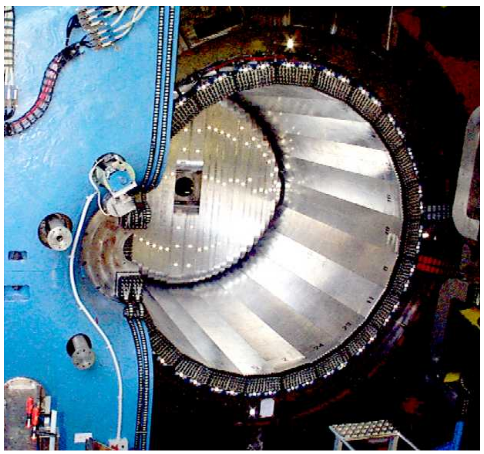
- **1 mm diameter sci.-fi. (Kuraray SCSF-81 and Pol.Hi.Tech 0046)**
  - **Core: polystyrene, ρ =1.050 g/cm^3, n=1.6, λ_{peak} ~ 460 nm**
- **0.5 mm groved lead foils**
- **Lead:Fiber:Glue volume ratio = 42:48:10**
- **X_0 = 1.6 cm ρ=5.3 g/cm^3**
- **Calorimeter thickness = 23 cm**
- **Total scintillator thickness ~ 10 cm**

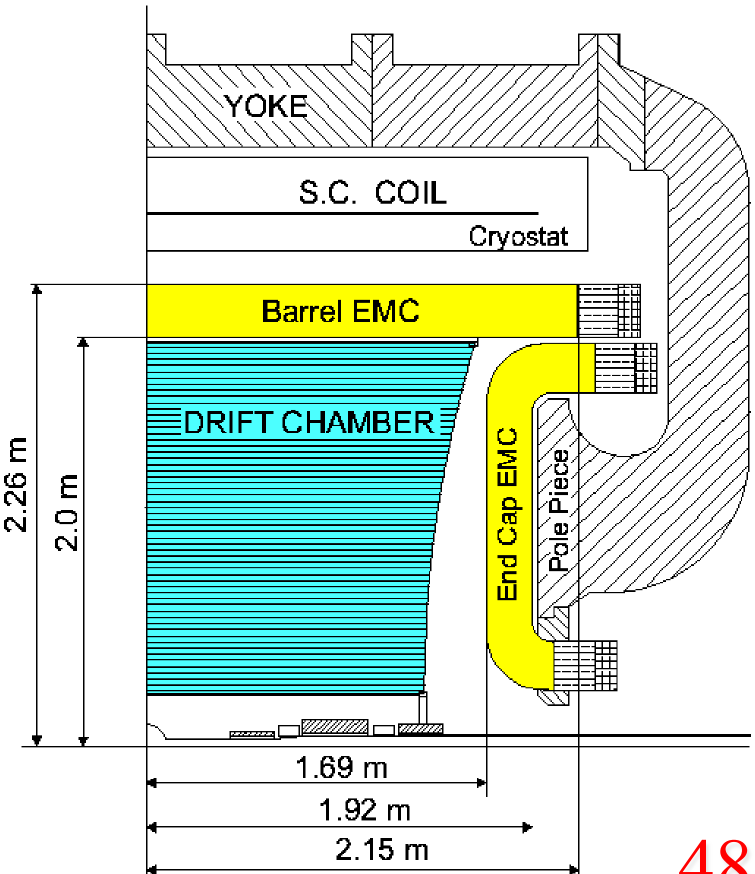




Electromagnetic calorimeter

24 barrel modules
60 cells (5 layers)
4.3m length

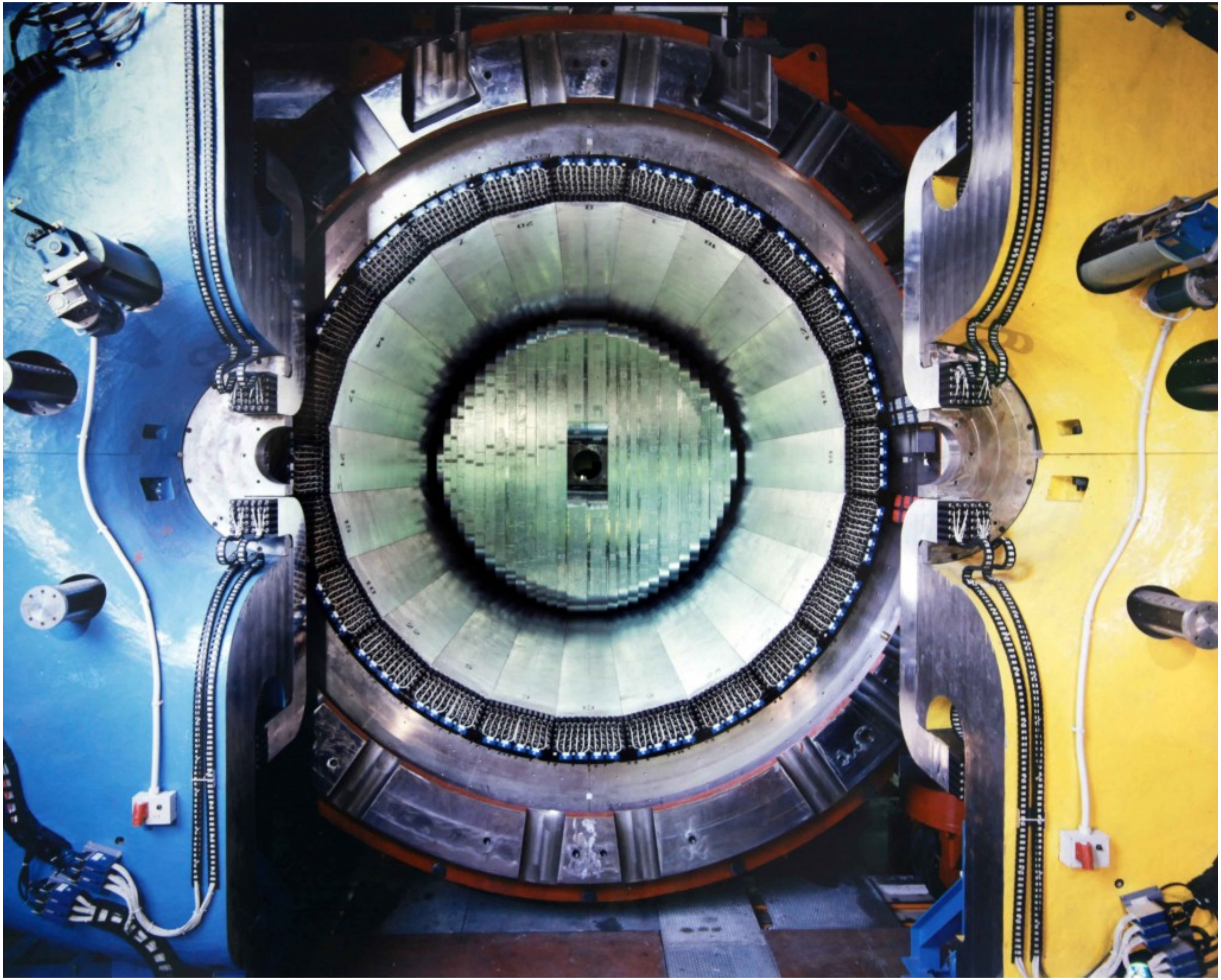


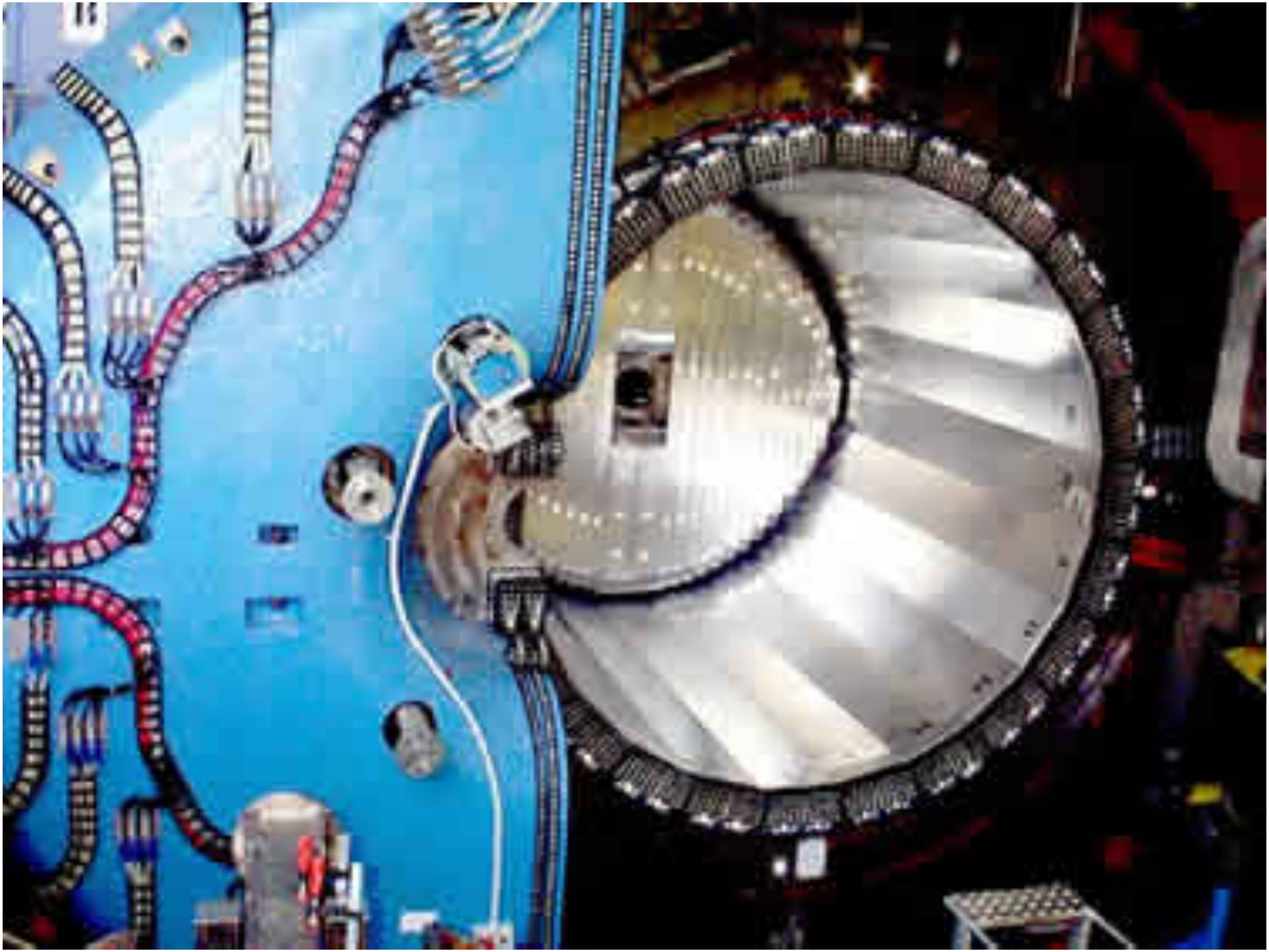


2 × 32 endcap modules
10/15/30 cells

2440 cells total

4880 channels

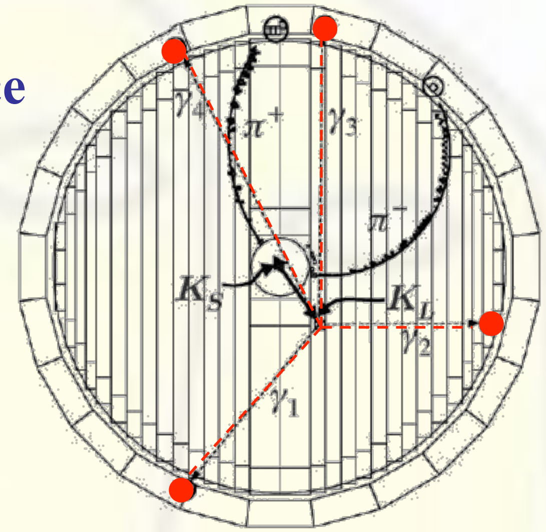




The KLOE calorimeter

KLOnE
KLOe Neutron Efficiency

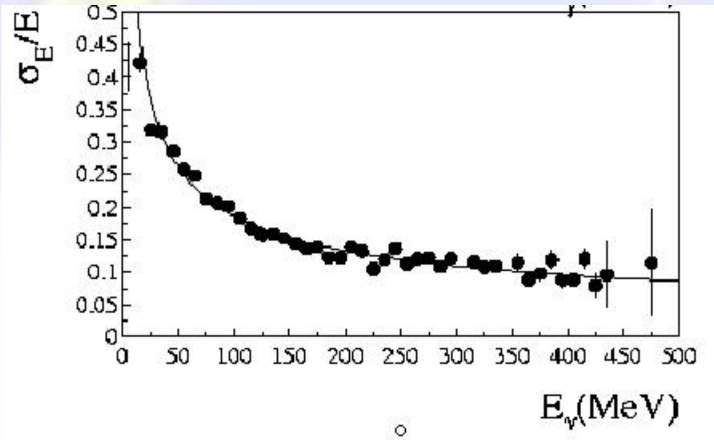
- **Operated from 1999 to now with good performance and high efficiency for electron and photon detection, and also good capability of $\pi/\mu/e$ separation**



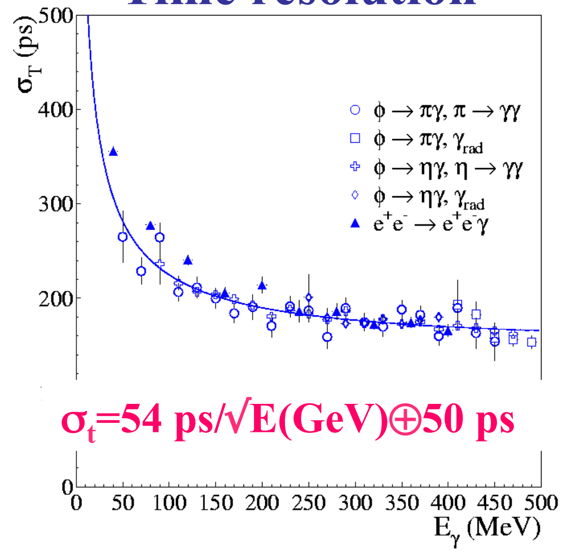
($\phi \to K_S K_L$; $K_S \to \pi^+\pi^-$; $K_L \to 2\pi^0$) → 4γ

Energy resolution:

$\sigma_E/E = 5.7\%/\sqrt{E(GeV)}$



Time resolution



$\sigma_t = 54\ \mathrm{ps}/\sqrt{E(GeV)} \oplus 50\ \mathrm{ps}$

(see KLOE Collaboration, NIM A482 (2002),364)

EMC mass reconstruction

$\phi \rightarrow \pi^+\pi^-\pi^0$

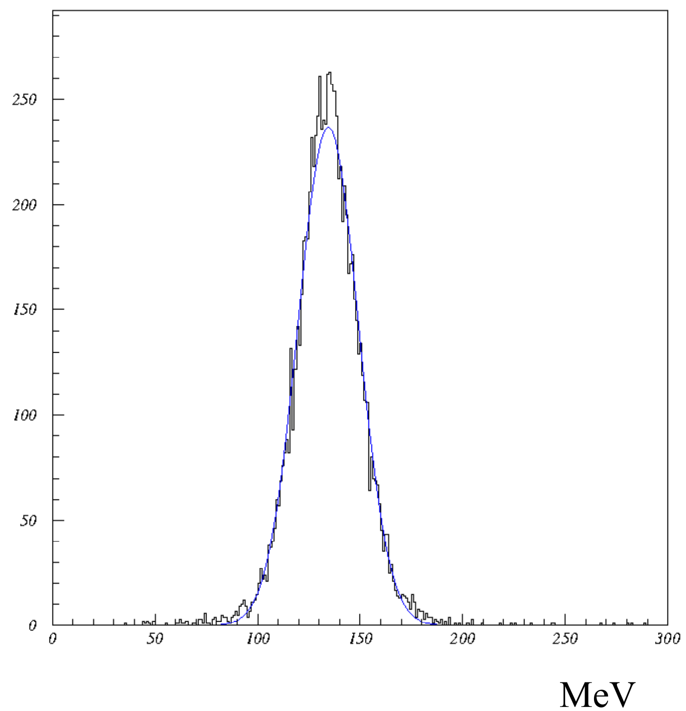
$M(\pi^0 \rightarrow \gamma\gamma)$

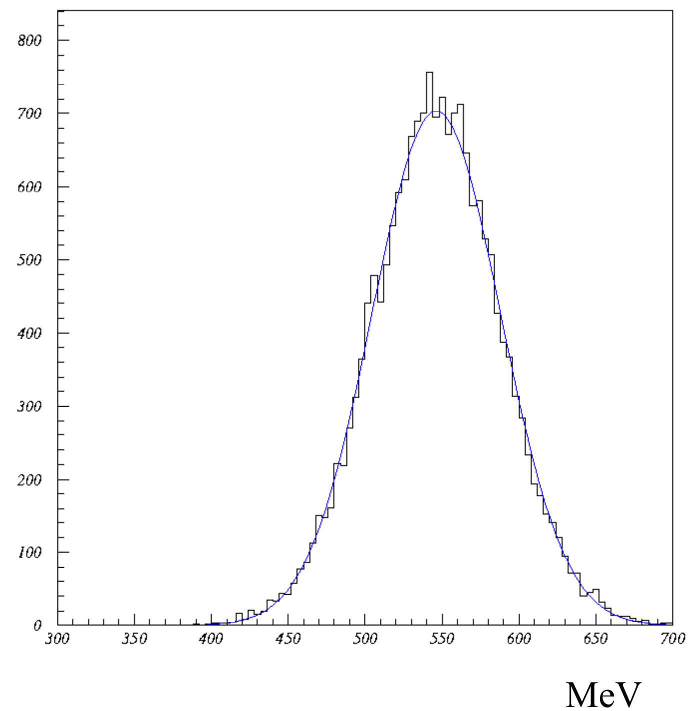
$M = 134.5$ MeV
$\sigma_M = 14.7$ MeV

$\phi \rightarrow \eta\gamma$

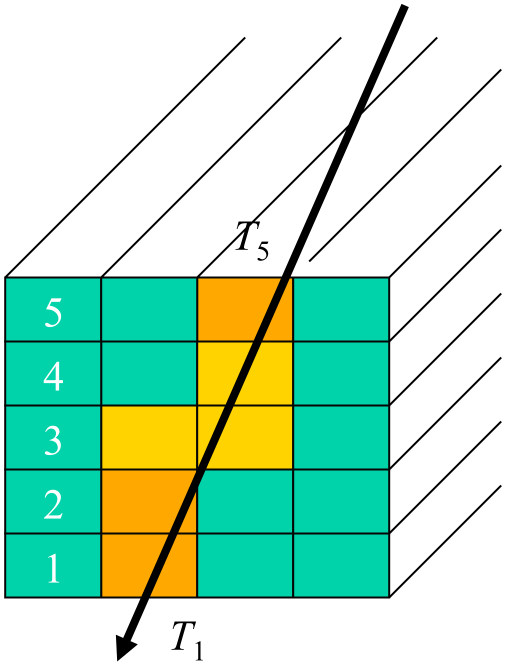
$M(\eta \rightarrow \gamma\gamma)$

$M = 546.3$ MeV
$\sigma_M = 41.8$ MeV



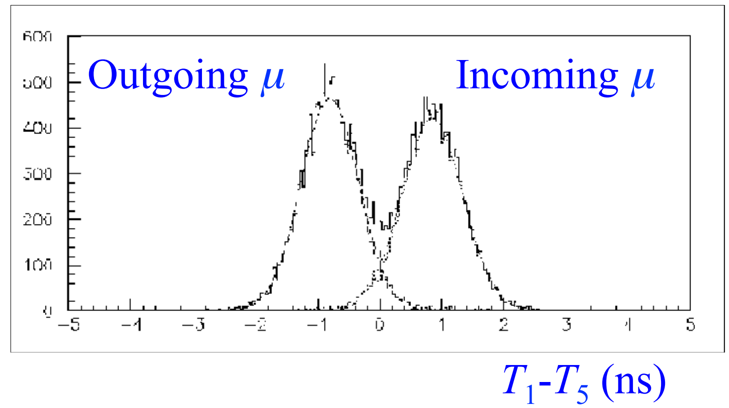


EMC time-of-flight measurement



T_1-T_5 distribution can distinguish incoming/outgoing μ' s

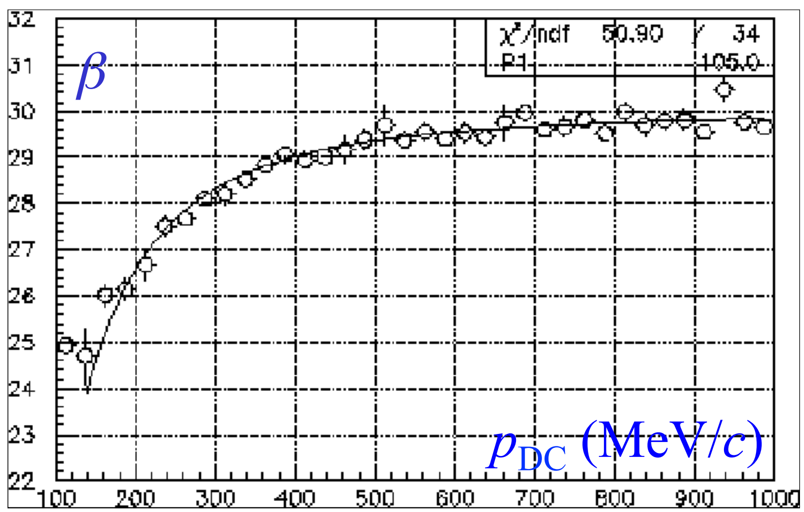
Used to reject cosmic rays



μ mass from TOF

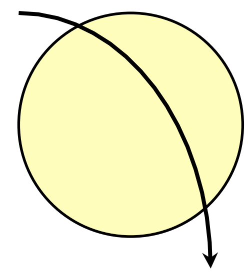
Fit to β vs p_{DC} gives

$m_\mu = 105$ MeV/c^2



$\beta = L/\Delta T$

L from DC

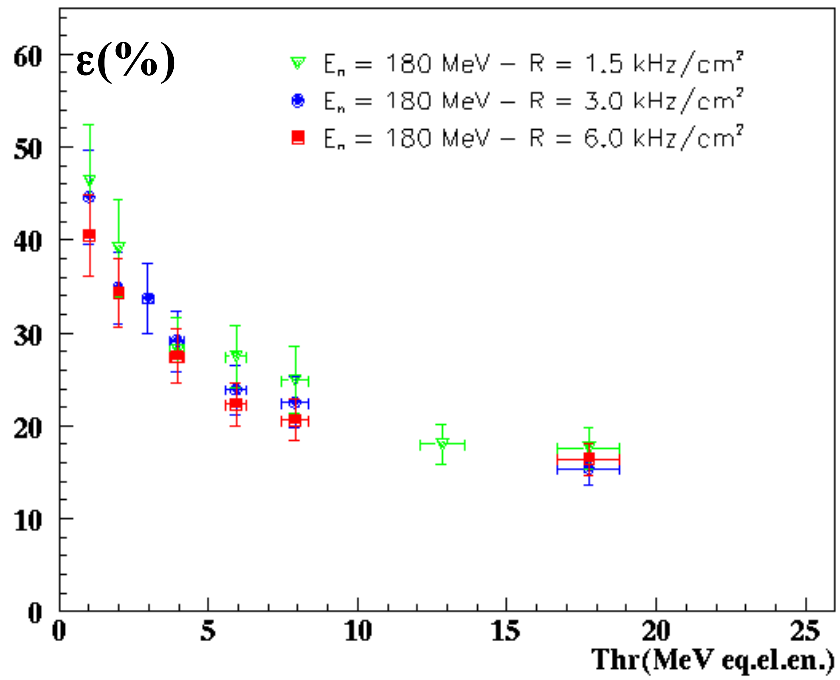


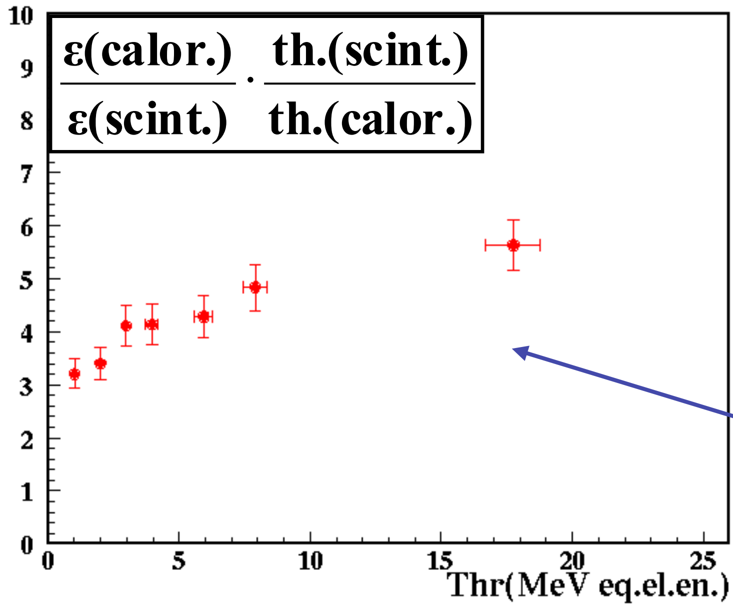
Calorimeter efficiency for neutrons

KLOnE
KLOe Neutron Efficiency

- E_{peak} = 180 MeV
- Stable for different run conditions

- Very high efficiency w.r.t. the naive expectation (~ 10% @ 2 MeV thr.)



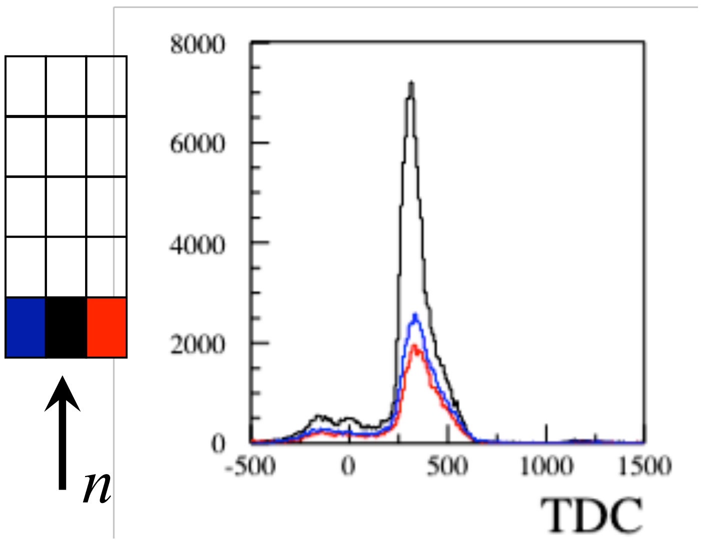


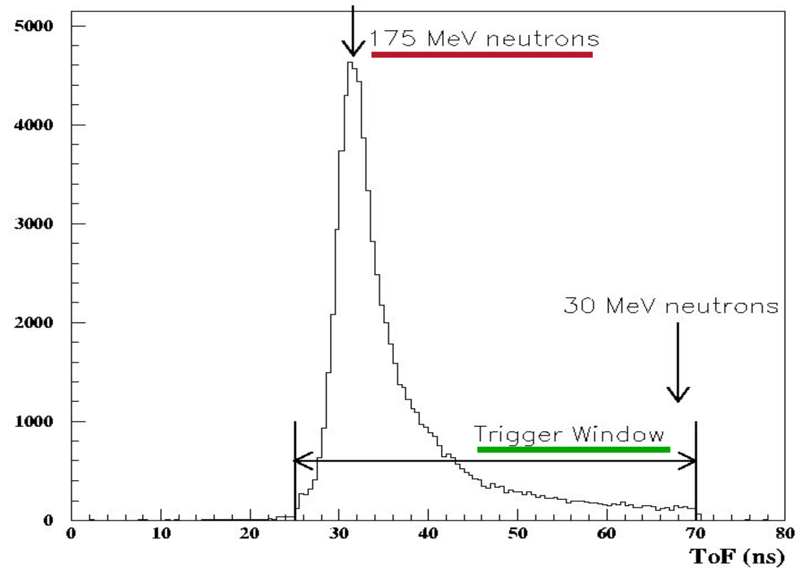
Comparison with our scintillator normalized to the same active material thickness

Energy spectrum from TOF

KLOnE
KLOe Neutron Efficiency

- Energy spectrum can be reconstructed from TOF





- Rephasing is needed, since the trigger is phase locked with the RF (45 ns period)
- From TOF ⇒ β spectrum of the neutrons
- Assuming the neutron mass ⇒ kinetic energy spectrum

In summary

Italy has decided to contribute to the ND

- We are starting getting into the picture, by joining the ND working groups and digesting all the excellent work done so far
- We will study the possibility to recycle the components of KLOE (solenoid, em calorimeter)
- We underline the fact that KLOE has a large (13 m^3) empty magnetized volume, which can host the new detectors needed for the ND task.