14th Pisa Meeting on Advanced Detectors
May 27 - June 2, 2018 La Biodola, Isola d'Elba (Italy)

Outcome of the KLOE-2 experiment after the conclusion of the data-taking period

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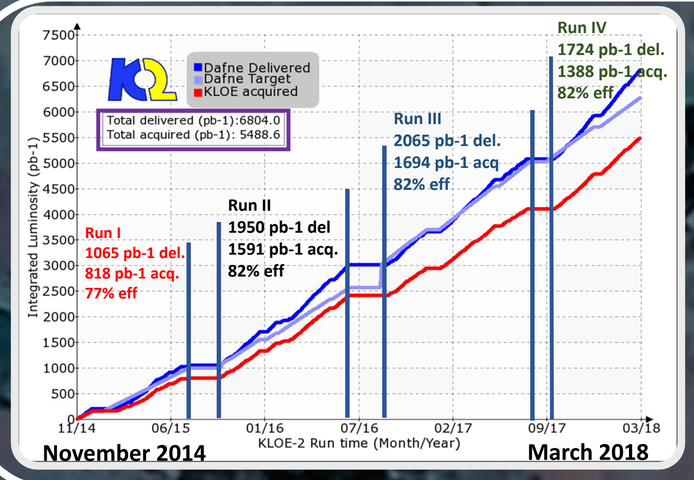
The KLOE-2 Experiment

The KLOE-2 experiment has concluded the data-taking at the $e^+ e^-$ DAΦNE phi-factory with more than 5 fb^{-1} of integrated luminosity collected. The physics program includes precise tests of fundamental discrete symmetries, the study of rare K and η decays, γγ fusion processes and search for new exotic particles. The new KLOE-2 detector shows good performance and their study is progressing to fully exploit their potentiality.

[Eur.Phys.J. C68 (2010) 619-681]



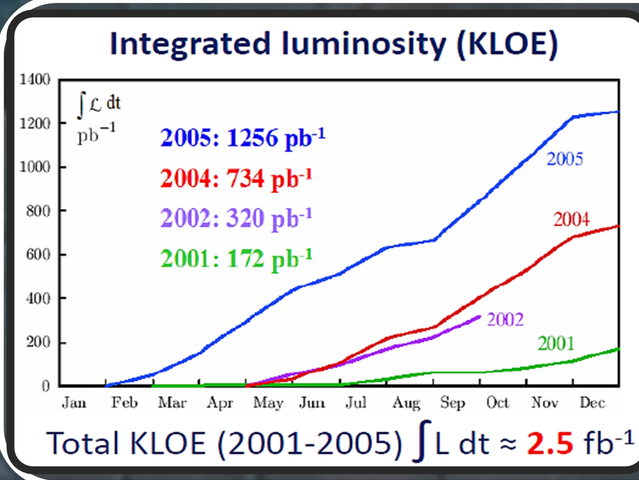
KLOE-2 data-taking
17 November 2014 - 30 March 2018

Total delivery: **6803** pb^{-1}

Total acquired: **5488** pb^{-1}

Max instantaneous luminosity:
$2.38 \times 10^{32} cm^{-2} s^{-1}$

Max hourly: 688.7 nb^{-1}
Max daily acquired: 11.9 pb^{-1}
Max weekly acquired: 70.0 pb^{-1}



KLOE and KLOE-2

$L_{int} \approx 8\ fb^{-1}$

2.4×10^{10} φ decays

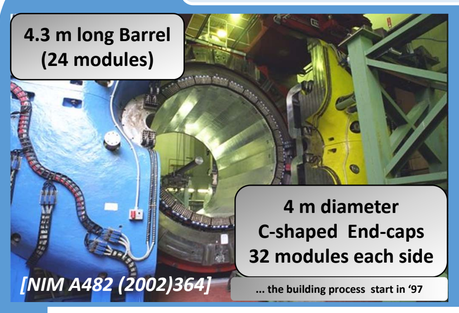
Worldwide

unique data sample

for typology and statistical relevance

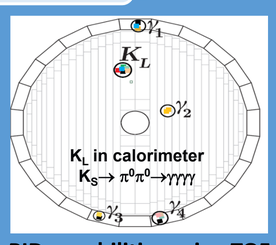
The KLOE-2: a multi-purpose detector optimized for K_L physics

Electromagnetic Calorimeter (EMC)



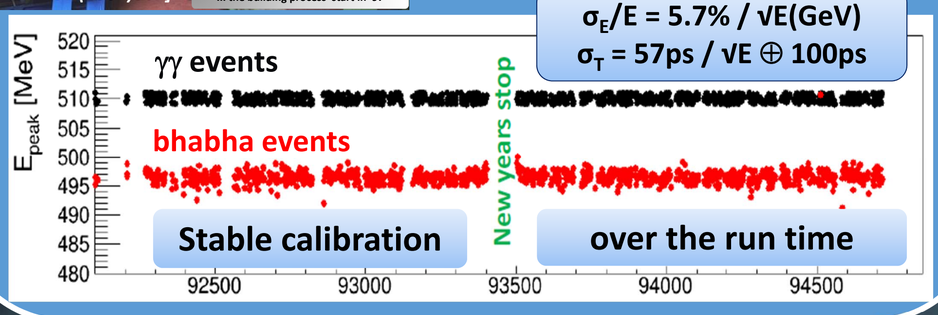
Pb - Scintilating fibers
98% solid angle coverage
$15X_0$ thickness

15000 Km fibers
4880 PMT
read-out channels
CAEN custom
HV, ADC, TDC



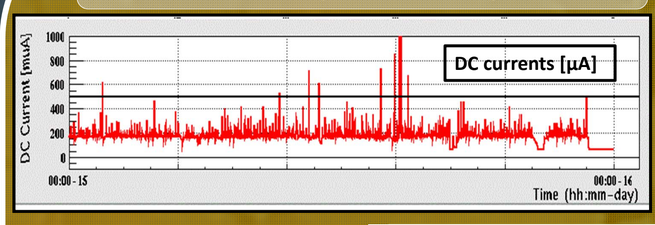
PID capabilities using TOF

$\sigma_E/E = 5.7\% / \sqrt{E(GeV)}$
$\sigma_T = 57ps / \sqrt{E} \oplus 100ps$



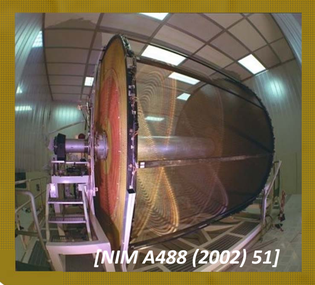
The Calorimeter System is composed by a 4π coverage Electromagnetic Calorimeter (EMC), among the best ones for energy and timing performance at low energies, low angle detectors (CCALT and QCALT) to increase geometrical acceptance and a lepton Tagging System to detect γγ collisions.

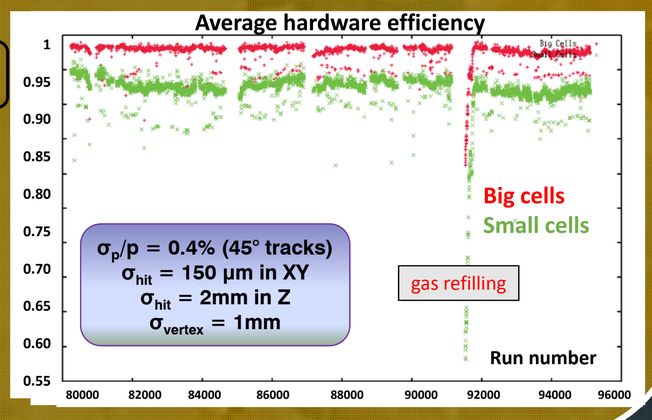
best tool for online feedback information (DC and IT currents) with DAΦNE to optimize the beam injection



4m diameter - 3.3m length
12582 sense wires
stereo geometry
low-mass gas mixture
Helium:Isobutane = 90:10

Drift Chamber (DC)



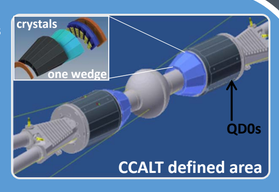


CCALT

Crystal CALorimeter with Timing

Each calorimeter has
48 LYSO crystals in 4 wedges
with 12 channels
read-out by SiPM

Better acceptance for low angle photons (21º→11º) and improve multi-γ detection in rare decays
$K_S \rightarrow 3\pi^0$, $K_S \rightarrow \gamma\gamma$

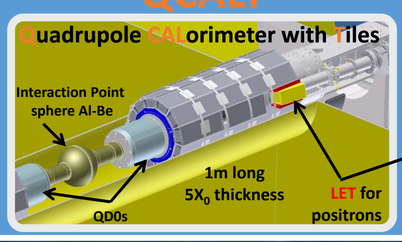


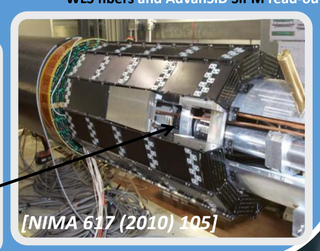
2 calorimeters made out of 12 side structures of scintillating tiles and Tungsten slabs with WLS fibers and AdvanSiD SiPM read-out

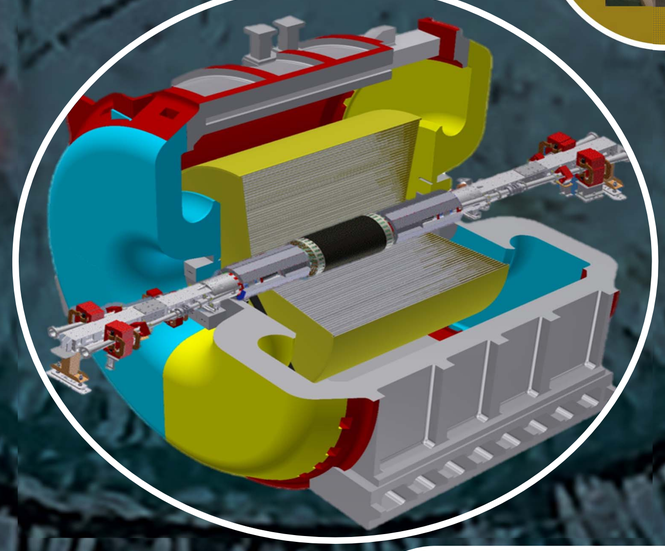
Complete hermeticity of the central detector and increase acceptance for photon coming from K_L neutral decay

QCALT

Quadrupole CALorimeter with Tiles







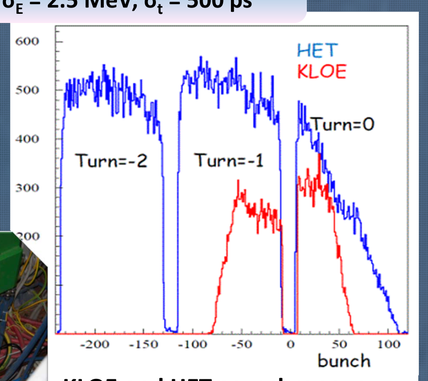
The Tracking System, immersed in a 0.52T solenoidal magnetic field, composed by one of the biggest Drift Chamber (DC) ever built and an Inner Tracker (IT) – a state-of-the-art cylindrical GEM detector – complete the apparatus.

Four tagging stations to identify
$e^+ e^- \rightarrow e^+ e^- \gamma^*\gamma^* \rightarrow e^+ e^- + X$ events

High Energy Tagger

2 stations ± 11m from IP
EJ-228 scintillator hodoscope
Hamamatsu PMT R9880U-110
Xilinx Virtex-5 FPGA

Energy = 400 ÷ 500 MeV
σ_E = 2.5 MeV; σ_t = 500 ps

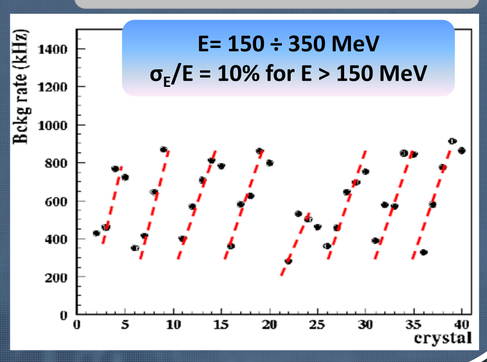


KLOE and HET asynchronous Data Acquisition overlap

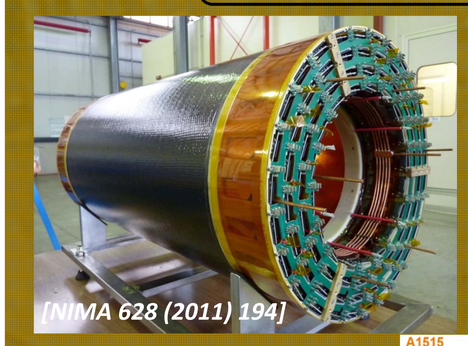
20 LYSO crystals in a matrix of 6x7.5x12 cm^3
SiPM read-out
2 station inside QCALT

Low Energy Tagger

E= 150 ÷ 350 MeV
σ_E/E = 10% for E > 150 MeV

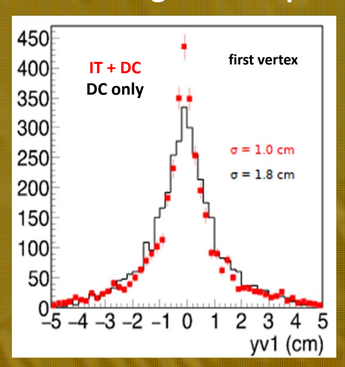


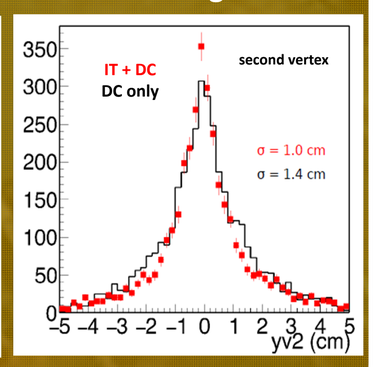
First cylindrical triple-GEM detector (IT)



700 mm active length
4 layers with radii between 130 and 205 mm
novel readout on XV strips / pads (GASTONE chip)
large acceptance for low-P_T tracks
water cooling and temperature monitoring

CAEN HV board (A1515) designed specifically for GEM detectors read-out currents with 0.1 nA resolution





Vertex reconstruction for $K_S K_L$ -> 4π processes
Both vertices exhibit same resolution with IT + DC