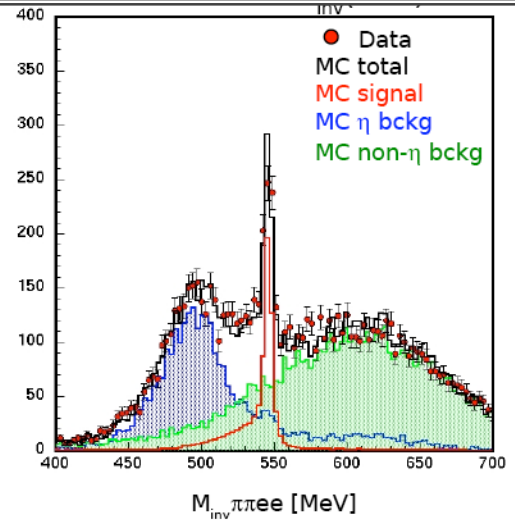
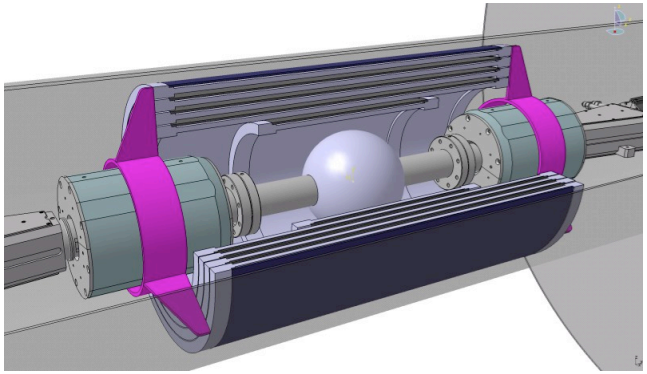
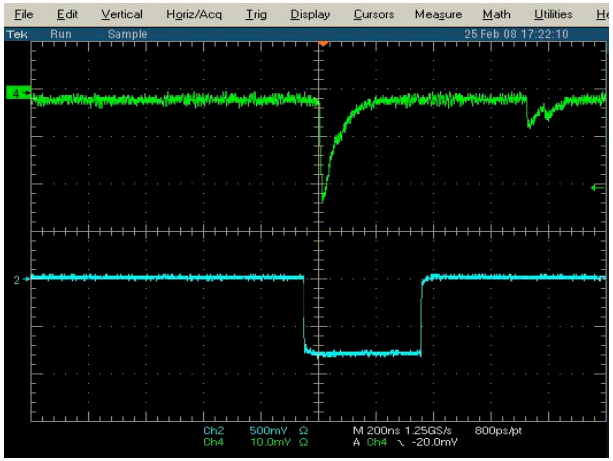
KLOE^2: motivations and preparation for a step-0







S. MISCETTI

Laboratori Nazionali di Frascati

7/4/2008 - CSN1 - Roma

Antefacts …

- ✓ New Crabbed-waist scheme of Dafne (Pantaleo's proposal) x 2006 pushed for L improvements between 3 to 10 with reasonable low cost and "fast delivery" times

- ✓ KLOE^2 reaction (9/07) -->

  Proposal of a two steps Roll-In (LNF-07/19(IR)

  - step-0 a.s.a.p after Siddharta run end 2008 (feb/march 2009) to get the first "flavour" of the machine and integrate >5 fb-1
  - step-1 @ end 2009 (march 2010) to make few months shutdown for installing the upgrades & keep running for a long data-taking campaign (25-50 fb-1).

- Indications from Pantaleo's of luminosity in Siddharta run are giving space to optimism. We propose to move fast to Step-0.

Motivations for Step-0

Apart from physics motivations there are "no-negligible" reasons to start with data taking as soon as possible + later shutdown and full upgrade:

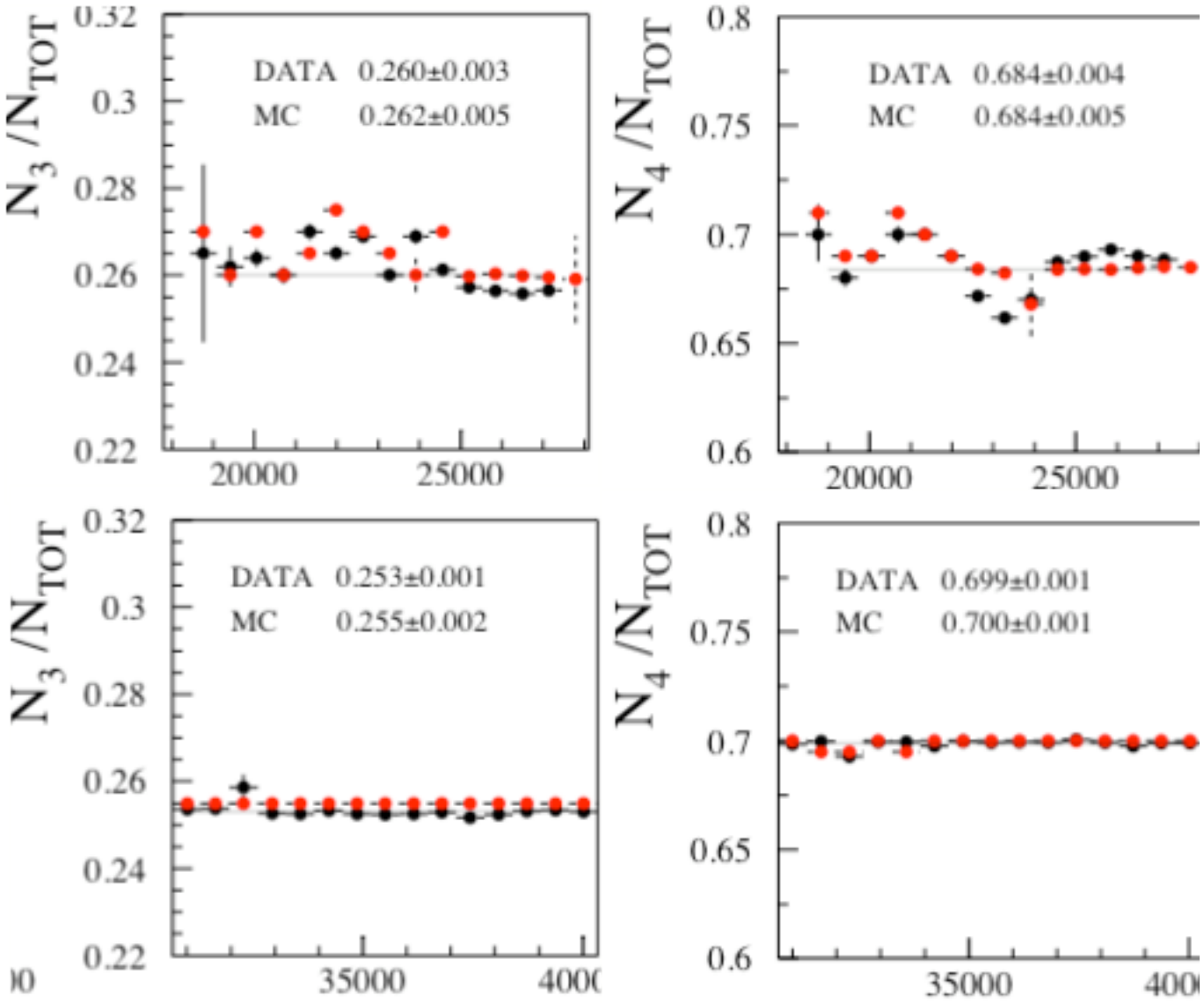
- **Daφne performances with KLOE B-field ON**
- **Machine background measurement and "its reduction"**
- **Moving toward an automatic data-taking to push efforts on Offline/Analysis.**
- **Improve L3 and calibration procedures**
- If working, dedicate a not-negligible data-taking period to special running conditions (0.5+0.5 fb-1, B=3kG, W=1000 MeV) to certify future choices with upgrades in place.

Past smoothing-run examples

Data/MC comparison of photon counting for Ks->2p0 after KL-crash tagging

2001-2002

2004-2005



Physics at KLOE^2

KLOE2 physics program seen as extention/completion of KLOE one

Valutation of performances is based on data and on "tuned" MC

- Discrete simmetries test (C,P,CP, CPT)
- Precise measurement of Vus and related ingredients
  (f.factors, extraction of f+(0) with CT …
  use of muon polarization to disentangle Scalar/Vector ff.?)
- Test of SM e NP models
  (Ke2 --> Susy, G(Km2) --> H+, Gckm --> Z' ..)
- QCD low energy tests + CHPT
- Scalar and Pseudoscalar meson physics
- gg physics

Today we concentrate only on few physics items which can be improved or can be reached also with > + 5 fb-1 "only"

Kaon sector rare searches ..

✓ Deviation from SM prediction of R = BR(Ke2/Km2) --> SUSY

- as shown by Mario we expect to reach 1% with KLOE @ 2.5 fb-1
- With step-0 we could aim to 0.5 %, almost comparable with P326 expectation reach.

✓ Push limits on Ks -> 3p0 below 10-8

✓ Improve error on Ks -> p+p-p0

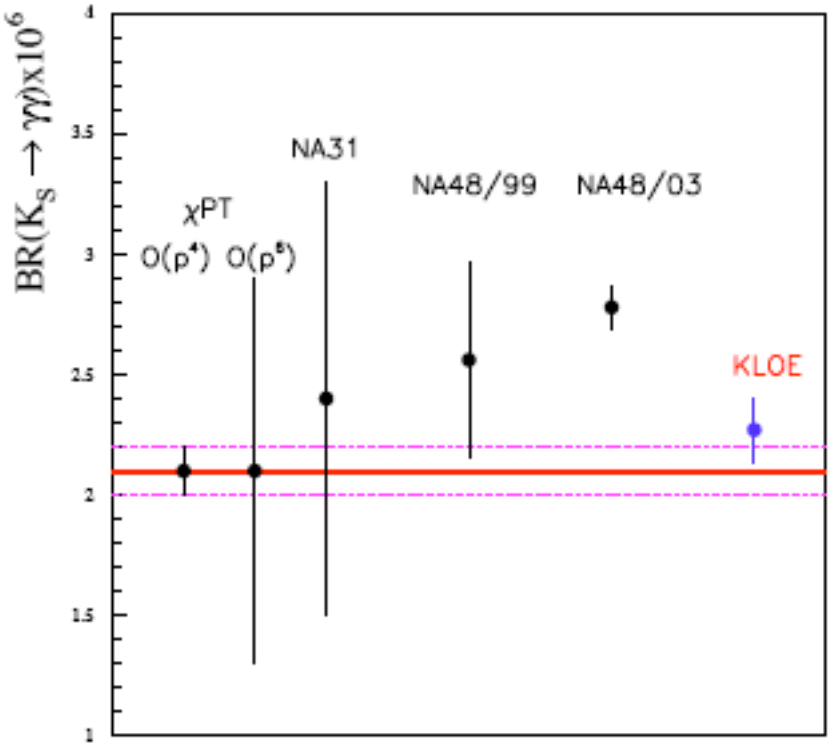
Assuming	Error on BR @ 5 fb^{-1} (%)	Error on BR @ 20 fb^{-1} (%)
No further effort made to reduce background	~ 40%	~ 20%
Further efforts completely remove background	~ 30%	~ 12%

Search for $K_S \rightarrow \gamma\gamma$

- 3 σ discrepancy of BR(Ks->gg) from KLOE to NA48
- Our measurement indicates perfect agreement with CHPT O(p4)

- Even releasing the cut on QCAL used to reduce the BKG of a factor 3 .. We expect a $\approx$ 4.5% measurement of the BR with + 5 fb-1

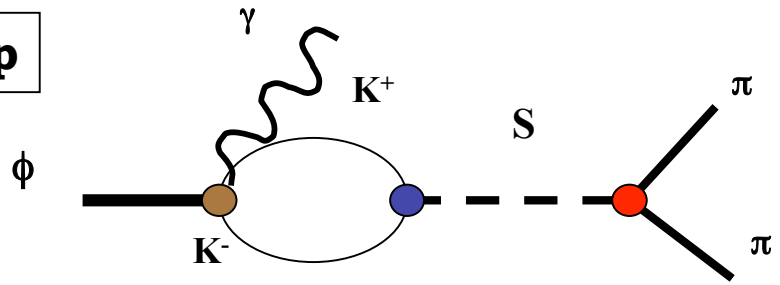
- 1-2 % measurement error expected with larger statistics + upgraded QCAL



Light scalars (f_0/a_0) in ϕ radiative decays

- Contributions $\phi \to S\gamma$, with **$S=f_0(980)/\ \sigma(500)/a_0(980)$** searched for in $\pi\pi\gamma$, $\eta\pi\gamma$
- Both **BR($\phi \to S\gamma$) and scalar mass spectra are sensitive to scalar structure**

Kaon Loop

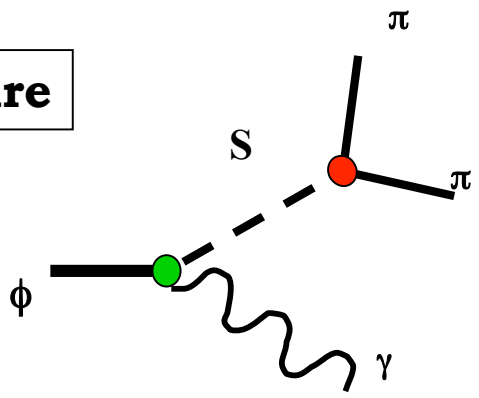


Fit params:
M_S, $g_{S\pi\pi}$, g_{SKK}

[N.N.Achasov, V.N.Ivanchenko, NPB315 (1989) 465]
[N.N.Achasov, V.V.Gubin, PRD 56 (1997) 4084]

new/improved $f_0+\sigma$:
PRD 73 (2006) 054029

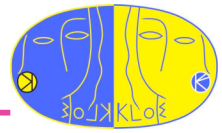
No Structure



Fit params:
M_S, g_{fSg}, $g_{S\pi\pi}$, g_{SKK},
continuum (polynomial)

JHEP 605 (2006) 49

$f_0(980)$ fit comparison ($\pi^+\pi^-\gamma$,$\pi^0\pi^0\gamma$)



Kaon Loop

No Structure

Parameter	$\pi^+\pi^-\gamma$	$\pi^0\pi^0\gamma$	$\pi^0\pi^0\gamma$ updates
m_{f_0} (MeV)	$980 \div 987$	$976.8 \pm 0.3_{\text{fit}}\ ^{+0.9}_{-0.6}\ _{\text{sys}} + 10.1_{\text{th}}$	$984.7 \pm 1.9_{\text{th}}$
$g_{f_0K^+K^-}$ (GeV)	$5.0 \div 6.3$	$3.76 \pm 0.04_{\text{fit}}\ ^{+0.15}_{-0.08}\ _{\text{sys}}\ ^{+1.16}_{-0.48}\ _{\text{th}}$	$3.97 \pm 0.43_{\text{th}}$
$g_{f_0\pi^+\pi^-}$ (GeV)	$3.0 \div 4.2$	$-1.43 \pm 0.01_{\text{fit}}\ ^{+0.01}_{-0.06}\ _{\text{sys}}\ ^{+0.03}_{-0.60}\ _{\text{th}}$	$-1.82 \pm 0.19_{\text{th}}$
$\frac{g^2_{f_0K^+K^-}}{g^2_{f_0\pi^+\pi^-}}$	$2.2 \div 2.8$	$6.9 \pm 0.1_{\text{fit}}\ ^{+0.2}_{-0.1}\ _{\text{sys}}\ ^{+0.3}_{-3.9}\ _{\text{th}}$	
$g_{f_0K^+K^-}$ (GeV)	$1.6 \div 2.3$	$0.40 \pm 0.04_{\text{fit}}\ ^{+0.62}_{-0.29}\ _{\text{sys}}$	
$g_{f_0\pi^+\pi^-}$ (GeV)	$0.9 \div 1.1$	$1.31 \pm 0.01_{\text{fit}}\ ^{+0.09}_{-0.03}\ _{\text{sys}}$	
$\frac{g^2_{f_0K^+K^-}}{g^2_{f_0\pi^+\pi^-}}$	$2.6 \div 4.4$	$0.09 \pm 0.02_{\text{fit}}\ ^{+0.44}_{-0.08}\ _{\text{sys}}$	
$g_{\phi f_0\gamma}$ (GeV^{-1})	$1.2 \div 2.0$	$2.61 \pm 0.02_{\text{fit}}\ ^{+0.31}_{-0.08}\ _{\text{sys}}$	

Search for $\phi \rightarrow (f_0/a_0)\gamma \rightarrow KK\gamma$

The $\phi \rightarrow [f_0(980)+a_0(980)]\gamma \rightarrow K^0K^0\gamma$ decay has never been observed

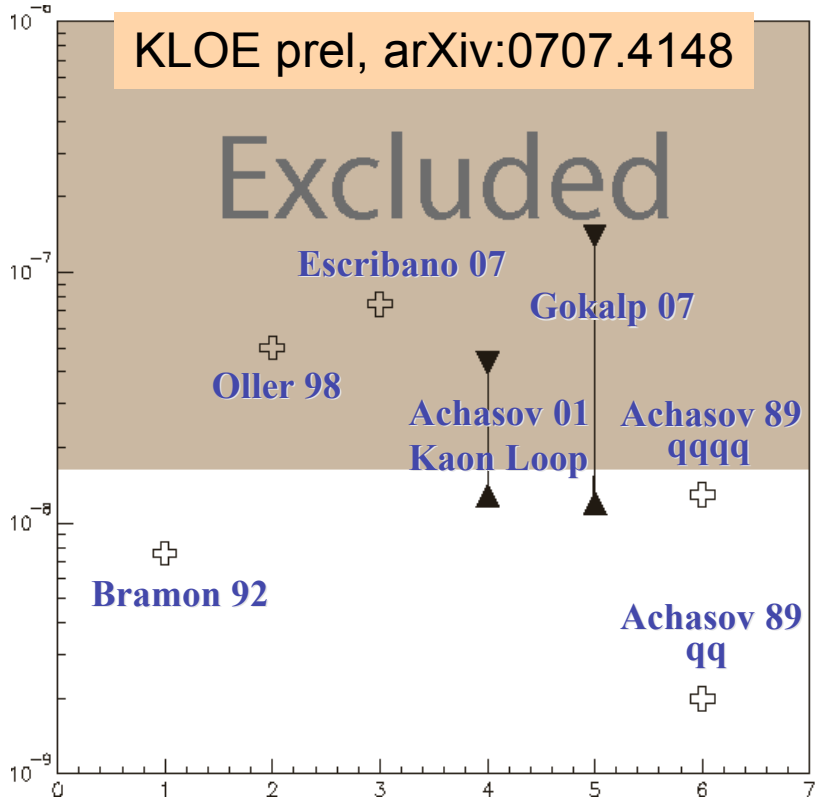
- ✓ Observation of this decay will constraint the gSkk coupling
- ✓ Signal search @KLOE in the clean topology $K_SK_S\gamma \rightarrow \pi^+\pi^-\pi^+\pi^-\gamma$

Preliminary/preliminary

- **2 events IN DATA**
- **NO events IN MC BACKGROUND**
- **improving effi and x2 MC**

Future improvements:
Look also to $K^+K^-\gamma$, $K_LK_L\gamma$

The possible reach for KLOE^2
Step-0 is up to 10-20 events



η rare decays: $\eta \rightarrow \pi^+\pi^- e^+e^-$

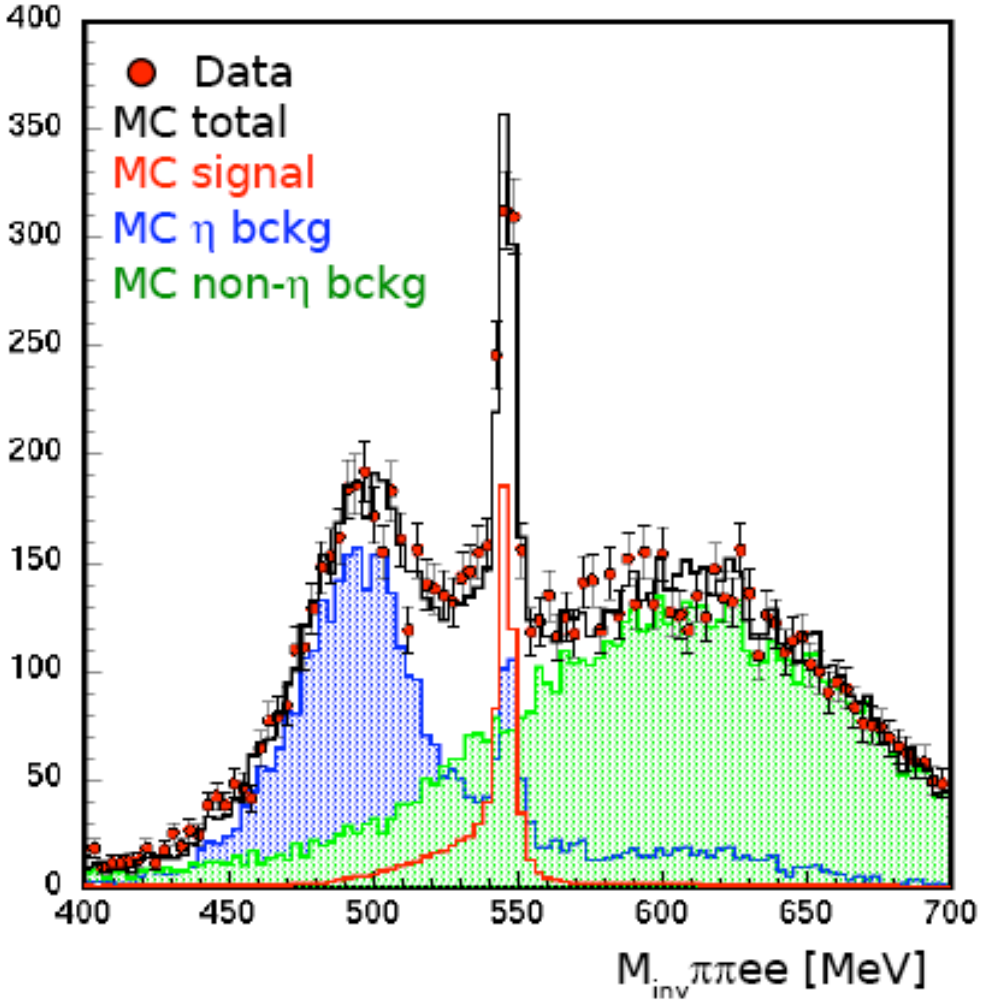
- The angular asymmetry between the decay planes of pions and electron pairs in this process can be due to "unconventional CPV" mechanism (4 quark operator).

- SM ($A_{CP} < 10^{-4}$), NP (A_{CP} up to 2%)

- World sample of this decay == 16 events

The possible reach for KLOE^2
Step-0 is 5000-10000 events
i.e. BR at 1.5 % and
δ(Acp) @ similar level!

Test unconventional CP mechanism



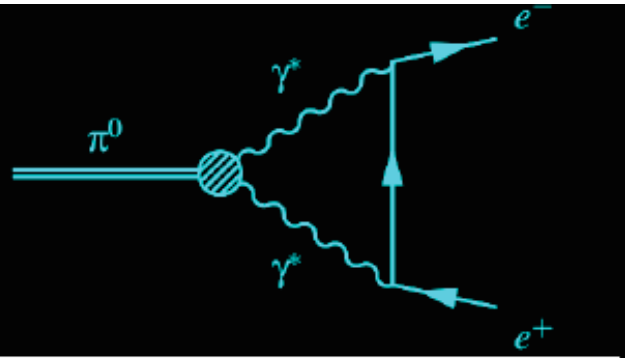
Looking for BSM processes

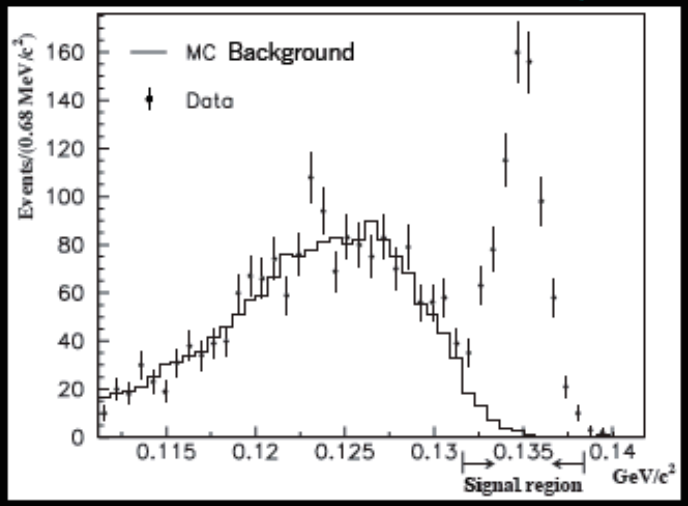
In the last years there have been two puzzling measurements that can be related to BSM processes which could be studied at the ϕ factory

(1) KTeV measurement of π^0 --> e+e-

(2) HyperCP observation of 3 events at Mμμ=214 MeV.

- Helicity suppressed decay; proceeds via loop at lowest order
- Probe of $\pi^0\gamma^*\gamma^*$ coupling
- KTeV result published: *Phys. Rev.* D**75** 012004 (2007)
  - $B(\pi^0 \to e^+e^-, x>0.95) = (6.44 \pm 0.25 \pm 0.22) \times 10^{-8}$





Looking for π^0-->e+e- events

KTEV result
vs theory

- New calculation predicts rate: Dorokhov and Ivanov, Phys Rev **D75** 114007 (2007)
  - Prediction is $(5.25 \pm 0.08) \times 10^{-8}$ for $x > 0.95$
  - This is 3σ below our result
- Kahn, Schmitt, and Tait (arXiv:0712.0007 [hep-ph]): MeV-scale dark matter could explain the excess…

Direct search of $\pi^0 \rightarrow$ e+e- at KLOE^2 on 4 possible final states:

$\phi \rightarrow \pi^+\pi^-\pi^0$, $K^+ \rightarrow \pi^+\pi^0$, $K_S \rightarrow 2\,\pi^0$, $K_L \rightarrow 3\pi^0$

by cross-section + tag efficiency + eff_ana conservatively set to 30%

- With 8 fb-1 we could select 250 events, dBR/BR = 6%

X-check of discrepancy of BR($\pi^0 \rightarrow$ e+e-) w SM can be done by accurate measurement of $\eta \rightarrow \mu\mu$. BR(PDG) = 5.7 (0.7) 10-6

- Dark matter expectation --> 3.5x10-5
- SM expectation --> 5.1(0.2) 10-5

With 7-8 fb-1 , 5-6 % error

Looking for HyperCP events

- **The HyperCP observation of 3 $\Sigma^+ \to p\mu^+\mu^-$ events with $M_{\mu\mu}$=214.3 ± 0.5 MeV motivated a long debate on its interpretation as BSM signal (light higgs, sgoldstino …)**

- On Arxiv:0714.1719v1, Mangano, Nason speculate on a possible interpretation of the neutral intermediate state p^0 as a light pseudoscalar higgs (a0) in NMSSM model.

- **Both Υ and ϕ radiative decays ($\Upsilon/\phi \to \gamma\ a^0$) can be used for searching this signal.** Background is pure QED processes. Mass Resolution is an issue, pi/e identification also.

$$\frac{B(V \to \gamma a^0)}{B(V \to e^+e^-)} = \frac{G_F\, m_Q^2}{\sqrt{2}\pi\alpha}\, g_d^2\, (1 - \frac{m_{a^0}^2}{m_V^2})\, F \sim 3.6 \times 10^{-4} \frac{m_Q^2}{\mathrm{GeV}^2} F g_d^2$$

Analysis of HyperCP data suggests g_d O(1)

Looking for HyperCP events

From $B(\phi \to \gamma a^0) = 2.8 \times 10^{-8} F g_d^2$ and $\sigma(\phi)$ they get:

$$N(\phi \to \gamma a^0 \to \gamma \mu^+ \mu^-) = 40\, g_d^2 \,.$$ @ 1 fb-1

- Assuming Mres of 0.5 (1) MeV
- Cos($\theta\gamma$) = 0.7 and 100 MeV cut

σ(QED) = 0.5 (1) pB

BKG/fb-1 = 500 (1000) ---> S/fb-1 = 40 g^2d

BKG/8 fb-1 = 4000 (8000) ---> S = 320 g^2d

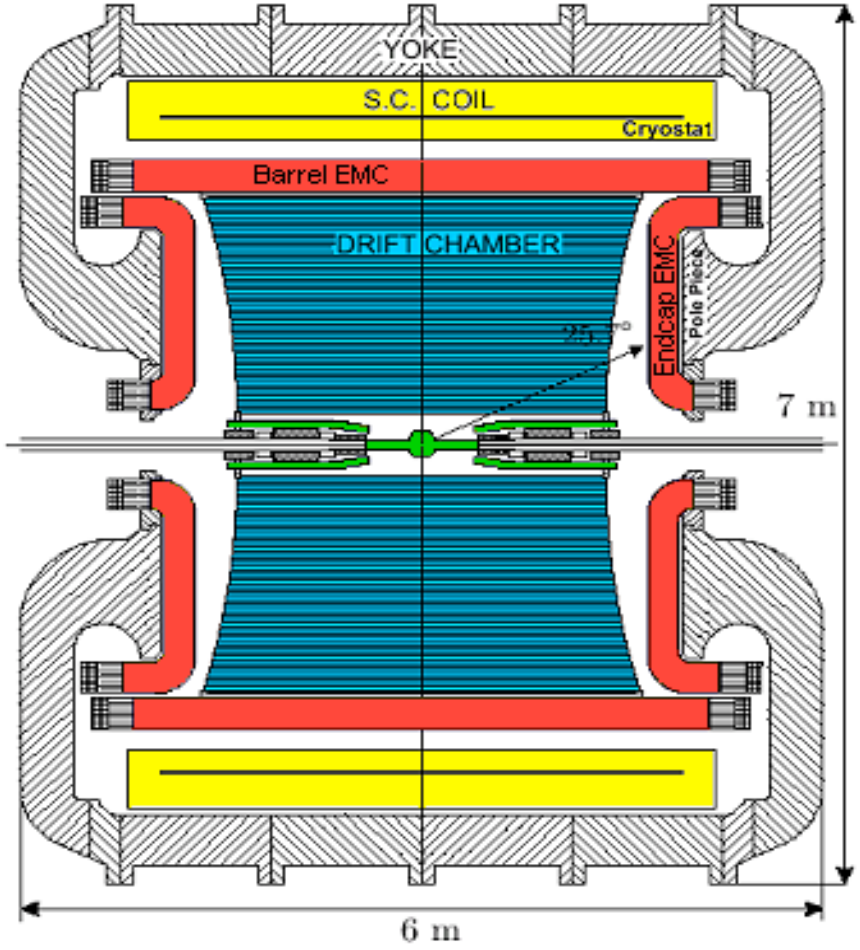
S/sqrt(BKG) = 1.8 (1.3) g^2d @ 1 fb-1

S/sqrt(BKG) = 5.0 (3.6) g^2d @ 8 fb-1

- Improvement on analysis strategy possible due to monoenergetic gamma
- Separation of $\pi\pi\gamma$ to be also taken into account (Mtrk, Likelihood)

Status of the KLOE$^{(1.5)}$ detector

We discuss the status of the key components of KLOE for the “step-0”
Few words on upgrade on the last slides -> More details on next meeting.

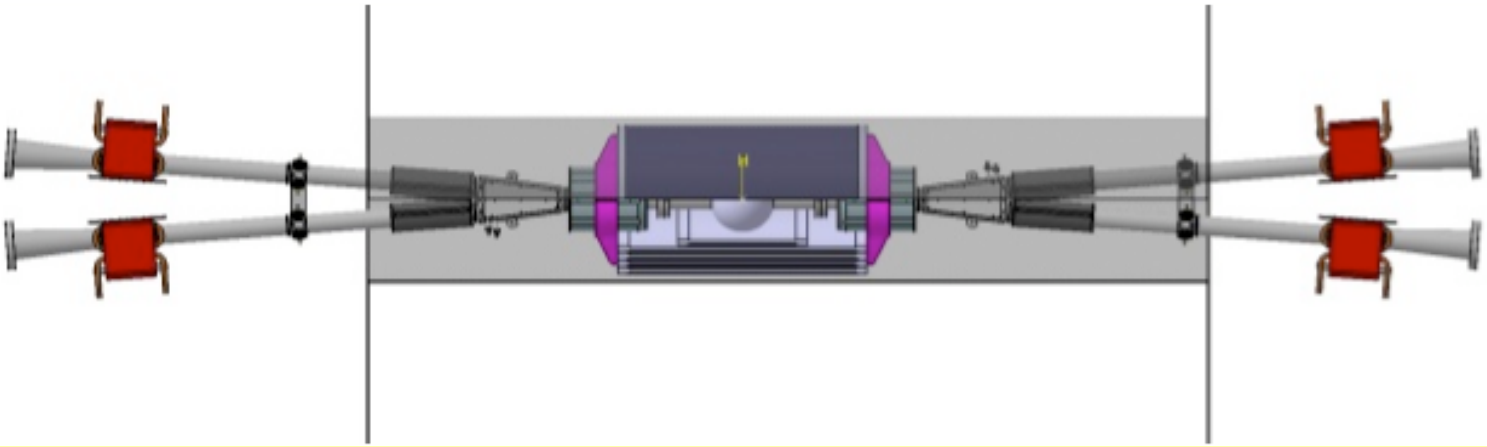


- **Be beam pipe** (to be modified !)
- **Drift chamber** (4 m ∅ × 3.3 m, CF frame))
- **Electromagnetic calorimeter**
- **Superconducting coil** (B = 0.52 T)

UPGRADES:

- DAQ/computing
- EMC readout
- IT + QCAL around beam pipe
- γγ-tagger

Beam pipe for KLOE^2



The new optics implies a substantial change of the interagion region in KLOE:

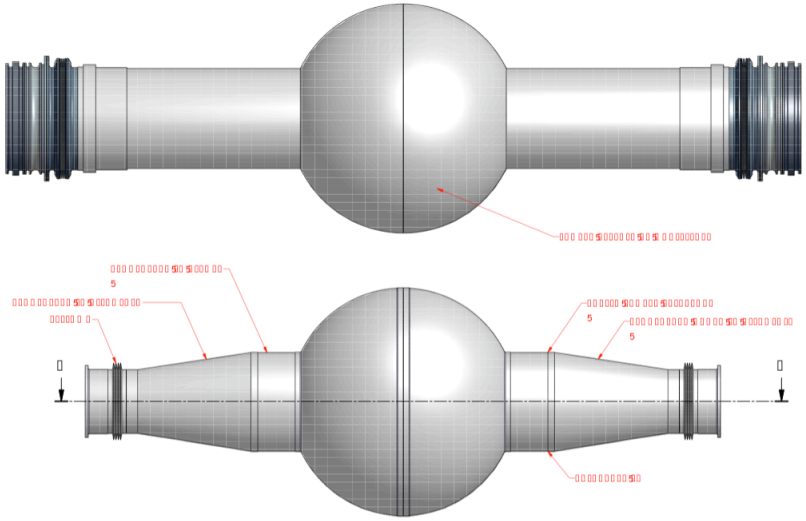
- Focusing quads much closer to IP (from 50 cm --> 25-30 cm)
- The two beams will be separated inside KLOE w two beam pipes/side

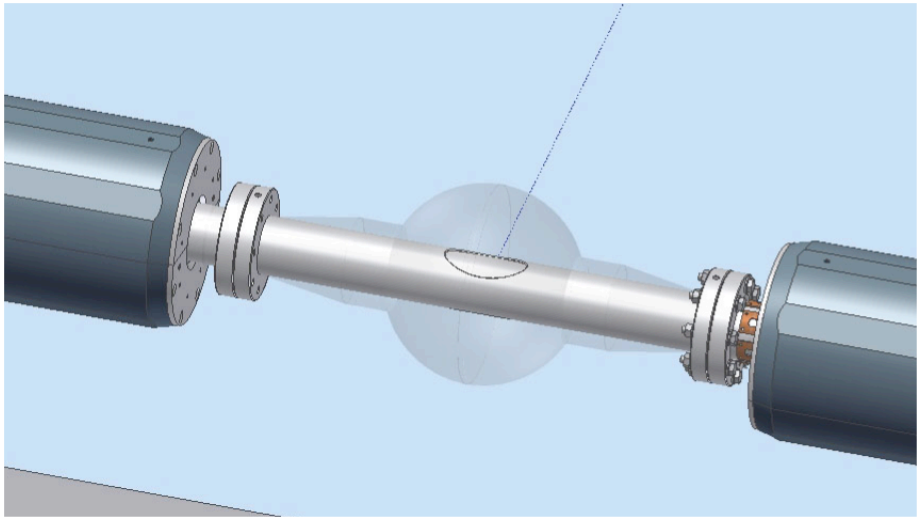
We have started discussion with AD to study in details the operation of insertion + detector opening with the new beam pipe.

At the moment, no relevant changes seems to be required to KLOE

Beam pipe for step-0

existing beam pipe (Albmet)





Pipe for step-0 (no detectors on it) principles: **Use existing stuff + fast delivery time**
Preliminary drawings exist (Albmet Spherical + Aluminum transition region vs cilinder)

Two options: (A) all done in Italy, (B) electron beam welding in USA (Brush Wellman)

A) - Cut existing pipe + Test of electron beam welding with “old” beam pipe
- if OK ---> Full assembly in Italy (exp. completion time Nov 2008)

B) - Cut existing pipe + other pieces of transition region in Italy,
- welding/assembly in USA (exp completion time, Feb 2009)

Overall view of the detector

KLOE status:

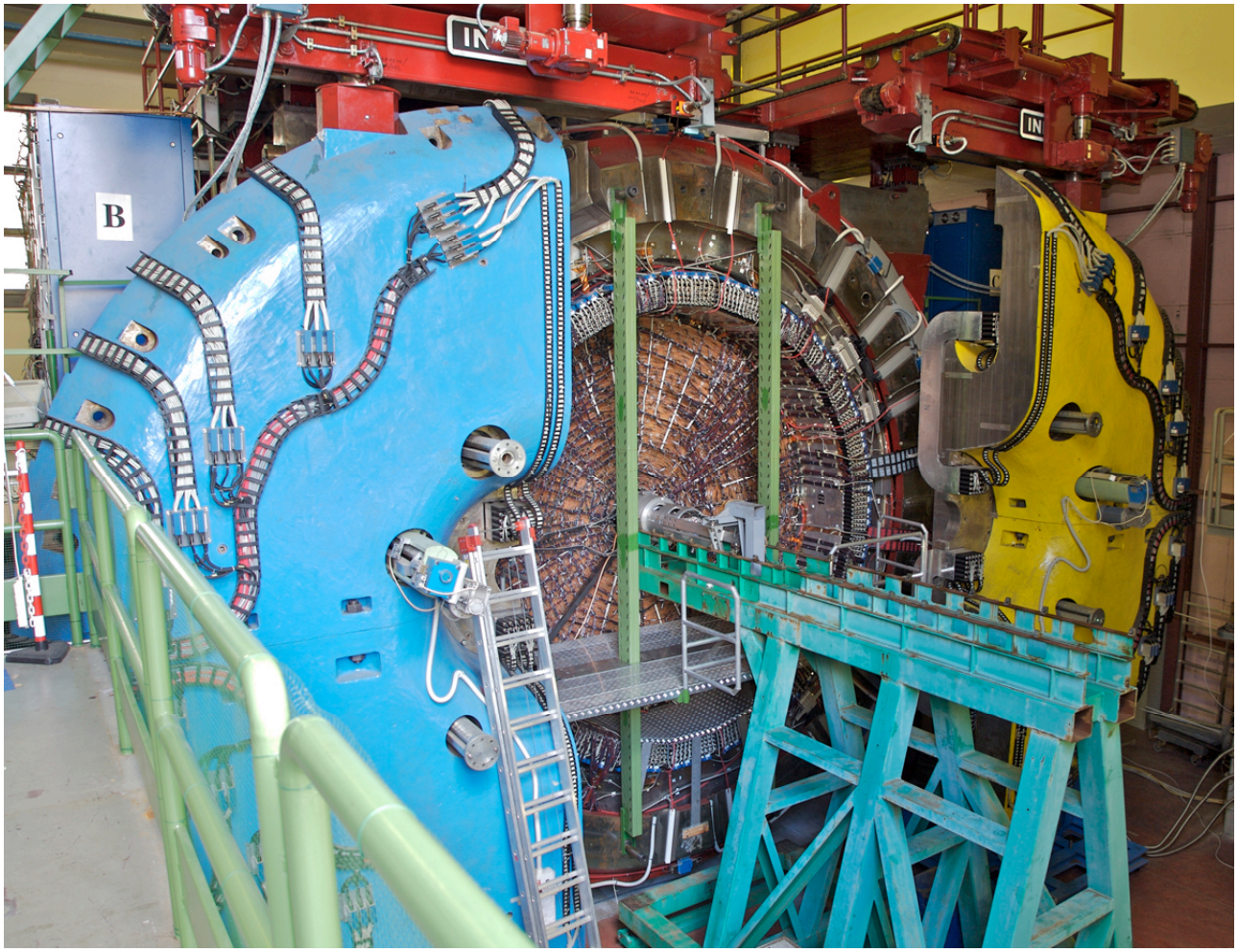
- EndCaps opened

- Beam-pipe extraction tools almost completed

- Electronics cooling OK

- FEE EMC on

- DAQ L2 ON



EMC Calorimeter status

After opening we have turned ON the EMC and related DAQ chains for few days to give a quick&dirty look at the detector status

- **Slow Control of LV, HV, DAQ crates working**
- **Most of the FEE electronics OK**
- **Few HV crates add problems in being turned ON due to fan crates failure ---> CLEANING Needed**
- **L2 CPU's were working and R_C was acquiring data with a cosmic trigger**
- L3 streams running
- Monitoring failing due to a missing comunication with the magnet PC (expect B-field to be ON)

EMC Calorimeter: back 2 cosmics

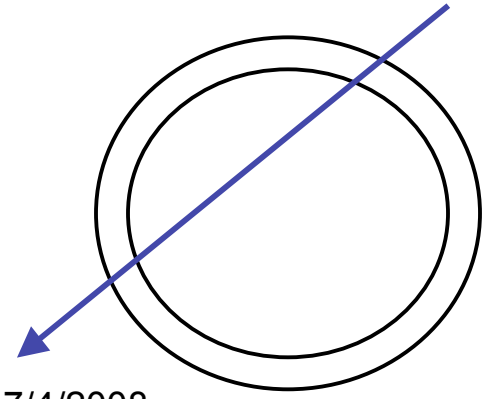
The first 10k events acquired by L3 for cosmics streams

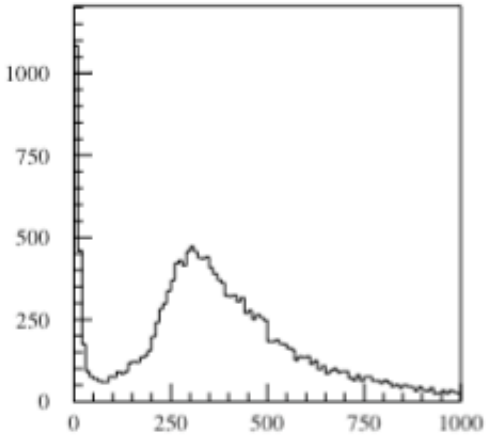
(1) MIP peak

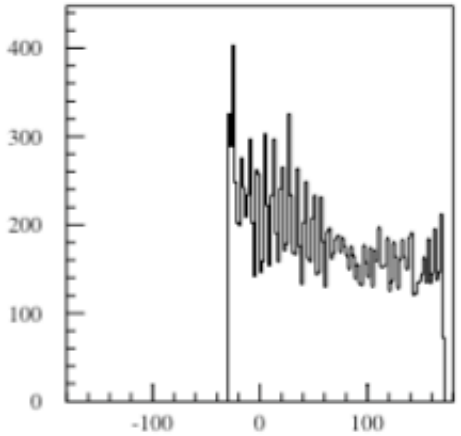
(2) φ distribution (holes due to bad HV crates)

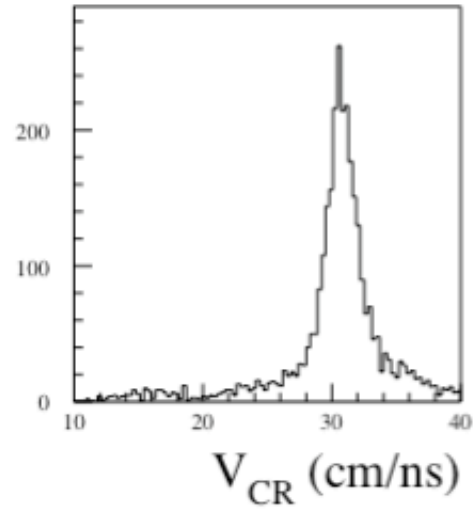
(3) Vcr=DR/DT

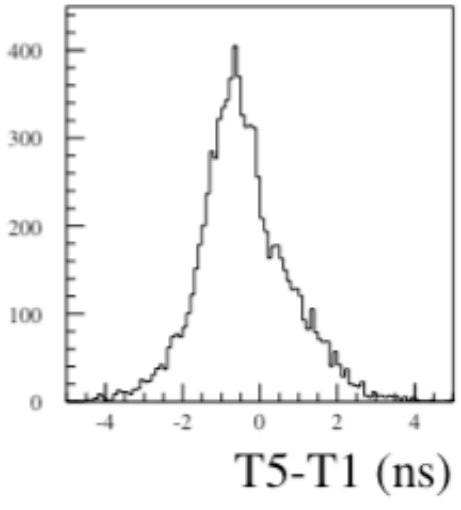
(4) T1-T5 inside the cluster











Drift Chamber & Gas System

DC still kept with HV OFF. Continuous flushing of Nitrogen.

- **First Technical Board to be held on April**
  - Survey of Dead FEE Channels (preamp+HV+ADS) with Pulsing
  - Discussion on tracking with 3 kGauss
  - Plans for finding gas-leaks & flushing of He-IsoButhane end of the year (IsoButhane cost x 1.6 vs 2005 !)

- **Re-organization of Gas System**

  Keep basic functionality while refurbishing the system:
  - new PC
  - new boards for reading IsoButhane
  - simpler/more documented interface

- **Re-allocation of external GAS storage racks**
  - safety + easy to reach/transport

FEE status (1)

FEE in overall good shape

-> needs production of spares + refurbishing of a "cannibilized" Test Stand

EMC electronics

- No concerns on the first electronic stages (amp,SDS,CCC,l.p.s.)
  To guarantee mantainance we are purchasing the obsolete components needed
- HV system needs cleaning of crates (fan) -> planned for April + followed by counting of malfunctioning boards + standard CAEN repair
- Repair of ADC/TDC spares programmed -> new Test Stand

Trigger electronics

- Missing/small number of spares for Pizza, Torta and other not so "eatable" boards such as Trigger supervisor and Trigger distributor.

Construction of new boards planned.
Critical time issue for T.Supervisor only (BARI)

FEE status (2)

DC electronics

- First FEE blocks of DC.
  Need to increase the number of spares for both ON detector (preamp) and OFF detector (ADS) boards.

Scheduled in October

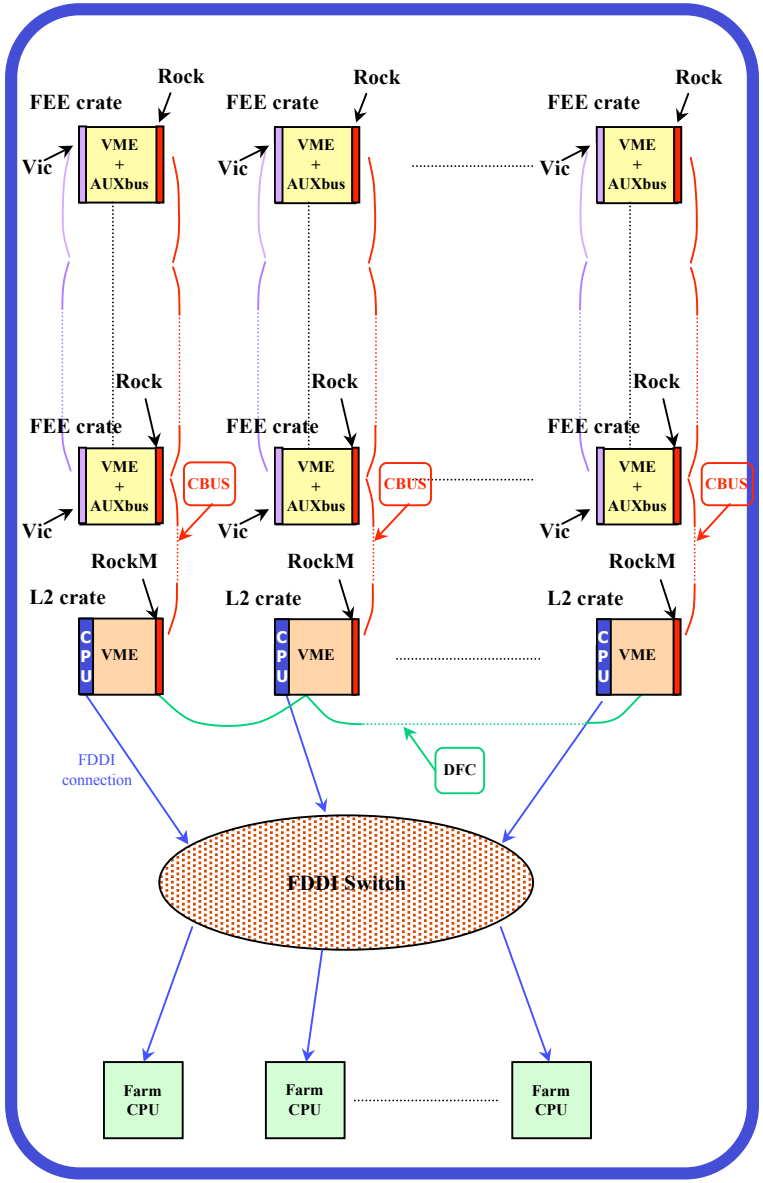
- DC TDC's: few spares existing.
  Need to produce a small sample of new boards.

- HV system. Only maintainance and standard repair

Electronics Test Stand

- First purchases for refurbishing done -> pulse generator
- VME crates (6U, 9U) being reallocated
- NIM-ECL, NIM-LVDS translators produced by LNF electronic department

DAQ readout chains



- 10 DAQ chains
  - Up to 50 Mbyte/s
- 2 levels concentrating scheme
  - ROCK + AUXbus at crate level
  - CPU + RockM + Cbus at chain level

  Link with ONLINE farm based on FDDI

  Obsolete by now!

UPGRADE for higher L /long running

(1) New L2 CPU's --> from Digital to Motorola

Old CPU's out of maintainance

- Few CPU's under testing

  + 15 needed for Step-0

Delivery time 6 months

New L2 CPU's + Gigabit

(A) First 3 L2 MoTorola CPU'S under testing

- 1) 1 CPU in use on BhaBha (B^2M^2V) Luminometer
- 2) 1 CPU being tested for readout of SLOW control chains

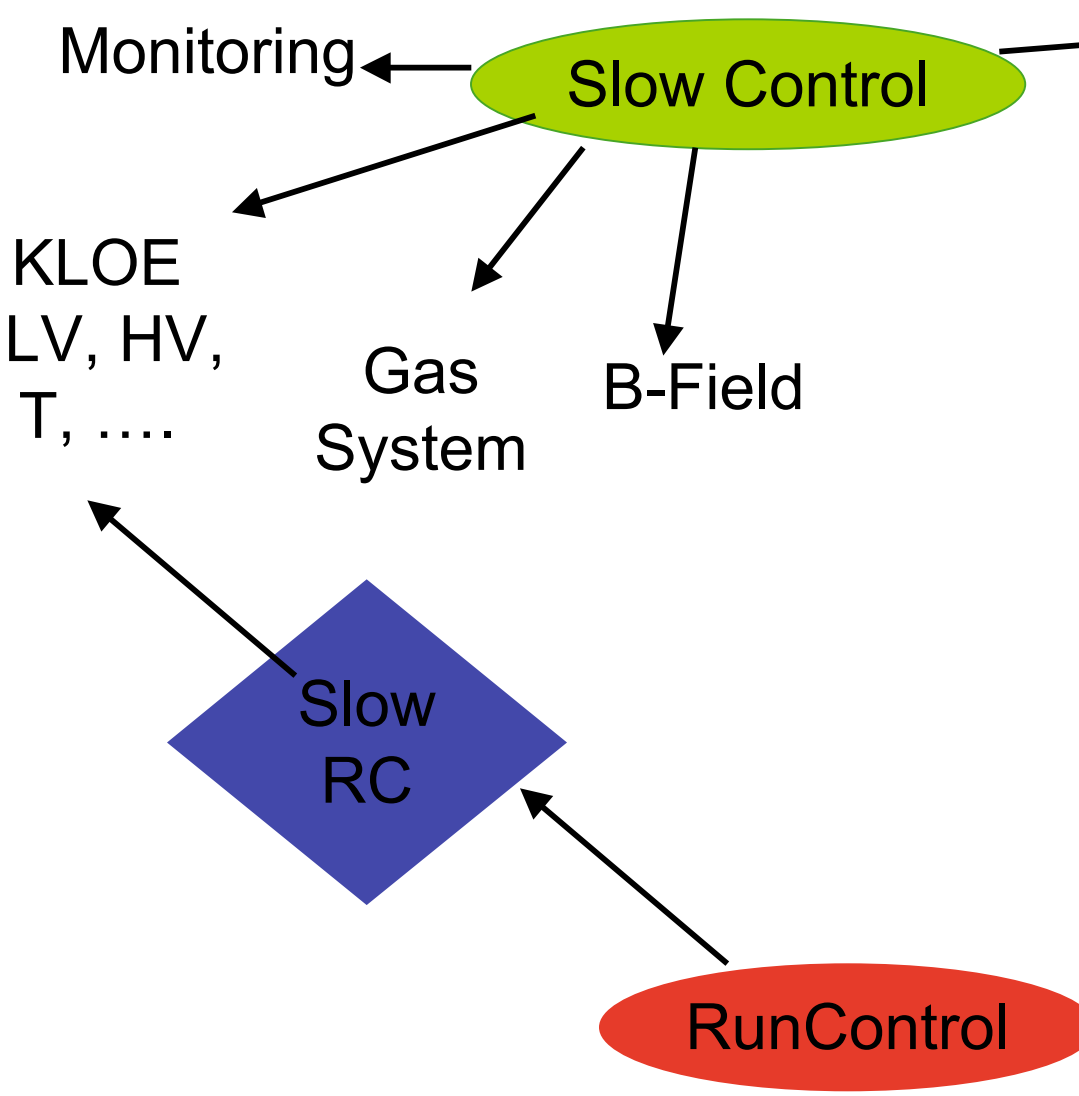
Test of booting the new CPU's from the new KLOESLOW (AIX) machine succesfull. KLOE sw environment almost installed.

(B) To transfer data to ONLINE farms need

- Copper Ethernet to Fibers

- Gigabit switch

Slow Control & AutoRunning



Slow Control Set/Reads
Values from detectors :
- write them on disk/DB
- Comunicate w RC
  via shared mem

Process to make automatic
Running in RC is under-way.

It is based on 4 conditions:
1) Busy DAQ
2) Problems LV,HV, Monitoring
3) fast reply 2 trips
4) L from Dafne

Online computing & storage

Existing DAQ acquisition farm:

5 SMP AIX machines at 330 MHz for:

- reading data from FDDI + Event Building.
- run the L3 system which provide events (CR,Bhabha,$\gamma\gamma$) for display and calibration stream both on disk/shared memory

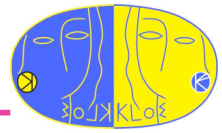
- 1 SMP AIX for monitoring
- 1 SMP AIX for calibration

Calibration of EMC (DC) grants a complete processing of L3 streams around 1 hour after end-of-run.

ONLINE DAtaStorage disks for:

- Keeping Calibration + Raw data samples
- Keeping Datarec output of OFFLINE processing in real-time
- Allow a few days buffer for continuous data taking

Online Computing KLOE^2



- ✓ **Replace the acquisition machines with faster ones.**

  e.g. 7 faster machines - 4 way at 2-3 GHz
  - Handle data-throughput +
  - Improve L3 (Kcrash stream)
  - Improve Calibration (e.g. single channel T0's in 1 hour)

- ✓ **Expand the DAS disks x 5 in the computing room**

Need to apply also an upgrade of the Tape Library to handle +5 fb^{-1}

- Constraint: Keep most of the hardware in KLOE computing building

Offline Computing & storage

- ✓ Overall CPU of KLOE Offline computing doubled on 2006 with the acquisition of 3 16 way SMT (x2) processors + two new data servers (2007) to handle data transfer

Today max reconstruction rate = 35 pb^{-1}/day

- ✓ **AIMING to 50 pb-1/day for 2009**

Warning: it could be necessary to upgrade UPS + water cooling

Data Storage

Library	slots	available cartridges	present capacity PB	*max with current technology PB*	***with next year technology PB***
#1	5200	5200	0.31	*3.64*	***5.20***
#2	3300	2000	0.60	*1.89*	***3.30***
total	8500		0.91	*5.53*	***8.50***

Reconstruction jobs since 9/07

To show reconstruction speed …
Let's check what has been done since last meeting w referees

- Duplicate MC04/05 $\phi \rightarrow all$ statistics
  (~1.7 fb^{-1}) ~100 days — OK, done

- Reprocessing of 2005 data with DBV<25:
  (1.1 fb^{-1}) ~80 days — OK, almost done

In order to make it we were forced to scratch
all MCRaw to free storage space

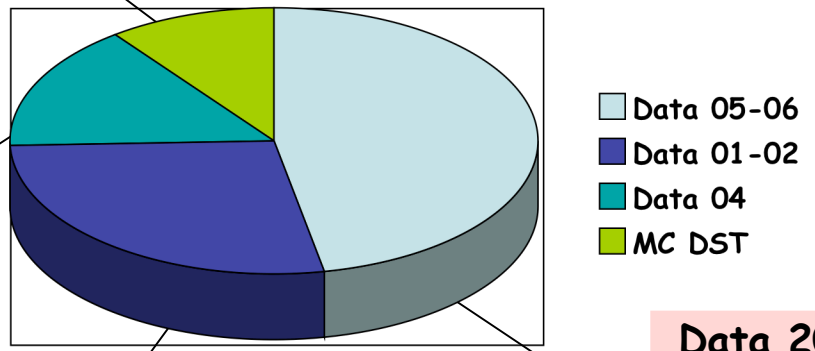
- Dst's holes — in progress
  Rad MC LSF = 5: ~10 days — " "
  Other specific MC production .. — " "
  (such as Bhabha for ke2)

Tape Storage Usage Status @ Mar 08

MC dst's (TB)	
2001/02	9
2004	16
2005	38
Total	63

Tot ~700 TB

MC (7+63) = 70 TB



Luminosity Tag=OK	(pb^{-1})
2001-02	440
2004	677
2005	1233
Scan+OP	282
Total	2632

Data 2004 (TB)	
RAW	54
Recon	35
DST	7
Total	96

Data 2001/02 (TB)	
RAW	101
Recon	60
DST data	8
Total	169

Data 2005/06 (TB)	
RAW	95
Recon	160
DST	36
Total	291

Tape storage for KLOE^2 (step-0)

- **Required increase of Tape Library storage capability**

  + 5 fb-1 == 0.9 PB

  - 175 gB/fb-1 (raw + rec + dst + MCdst x 2)
  - [other 200 gB/fb-1 (if whole Mcrec are kept)]

- **Proposed plan: Start upgrading Library #2**

  1) 6 mounting points --> 12 new mtp w higher writing density
     - 2100 existing cartridges @300 GB = 0.6 PB
     - Writing at higher density we obtain
       2100x (+200 GB) ---> +0.4 PB on old cartridges

  2) Add 500 cartridges of 1 TB ---> + 0.5 PB

Offline resources: Disk Space

Existing Storage on DISK

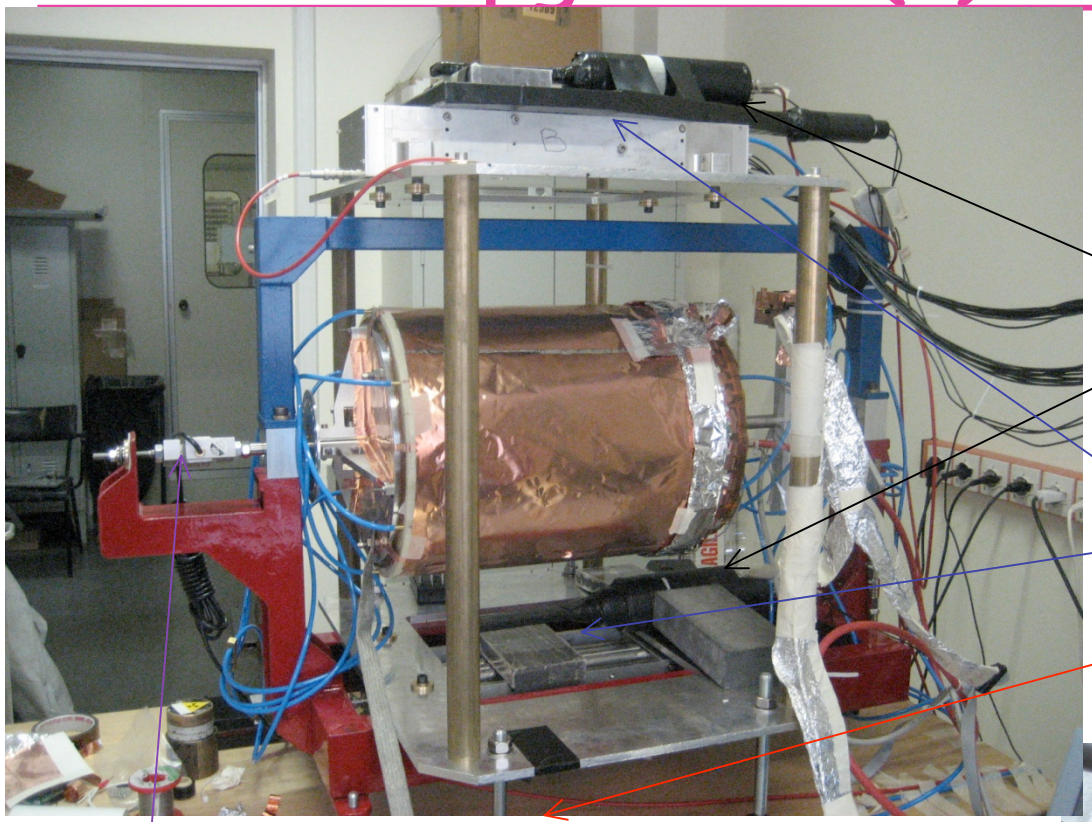
- 80 TB mostly dominated by staging of DST's
- 14 TB/fb-1 (data), 16 TB/fb-1 (MC)

Analysis jobs on Batch Queues use the "available" CPU's (left-over from Datarec) to run on DST's and produce slimmer Ntuples/Root Trees.

DST's storage on disk avoid too much load on Tape library.

For 2009 we ask a minimum increase of 40 TB + 1 disk controller

Upgrades (1) GEMS



Cosmic Rays Test Stand

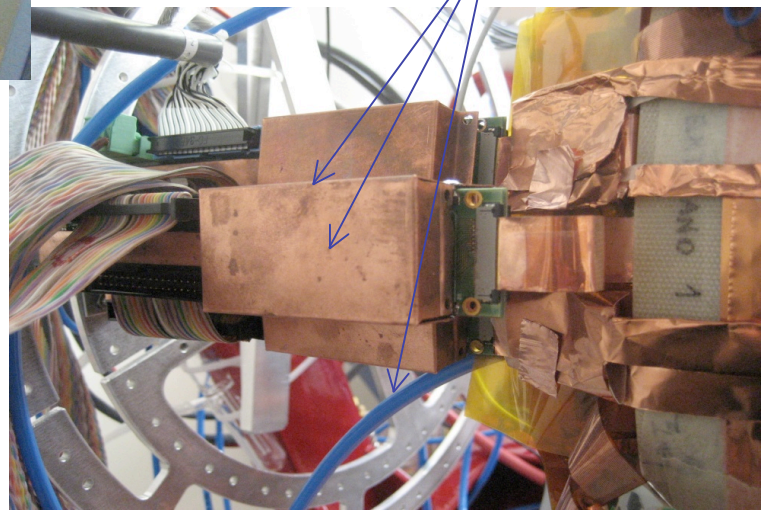
Scintillators for trigger

Streamer tubes for tracking

CGEM

3 FEE boards

Load cell for mechanical tensioning



The CGEM has been completely characterized with Xrays (gain, uniformity)
Now we are using a cosmic ray test stand to measure space resolution and efficiency of the overlap regions

Upgrades (2) : EMC readout w HQE PM's

- **R&D by Hamamatsu is in progress**

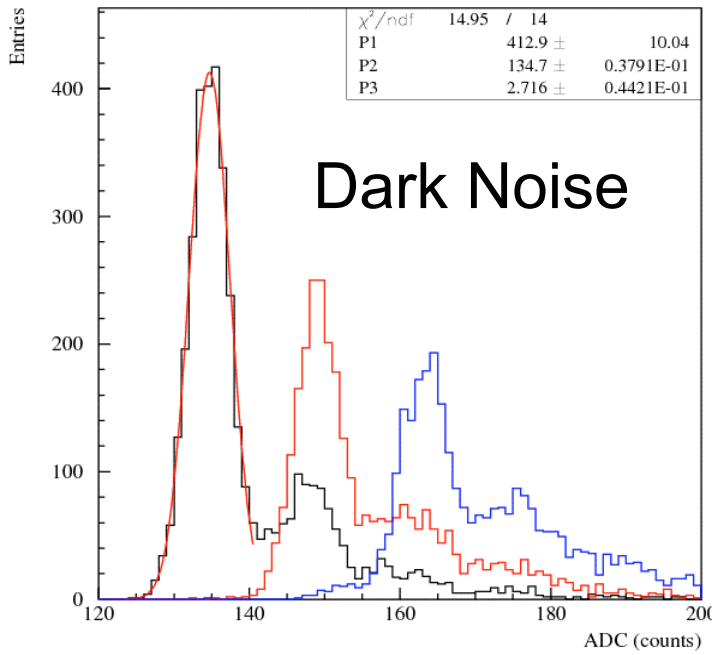
- **Several MC studies carried out to quantify benefits:**

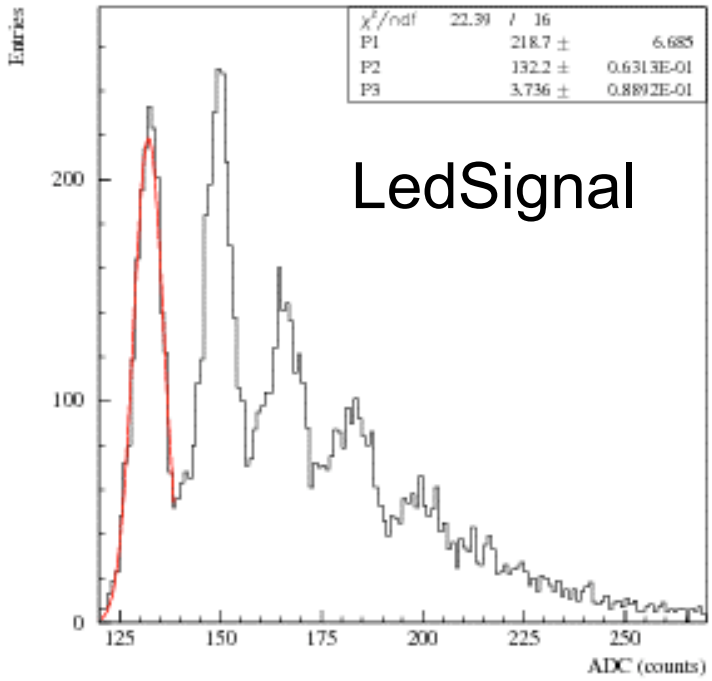
1. Impact on cluster splitting and merging probabilities
2. Impact on background rejection for Ks -> 3p0 search
3. Impact on low energy photon detection efficiency
4. Impact on PID for Ks pev, pmv decays
5. Impact on PID for Ke2/Km2 decays

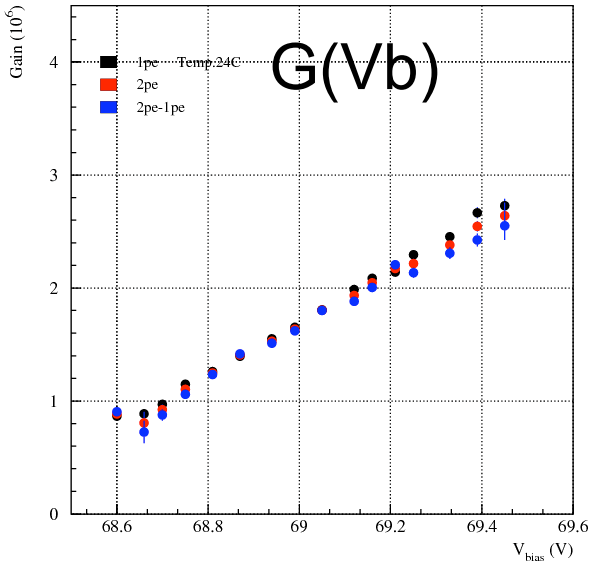
A meeting on all the above topics, including the high granularity studies and a review of the calorimeter situation has been held in Cracow, thanks to our Polish colleagues of the EMC wg.

Upgrades (3): CCALT + QCALT

- SIPM qualification done
  electronics under development
- Test of fibers + SIPM done
- First tile prototypes in progress
- First LYSO crystals received







Upgrades (4): γγ-tagger

- (1) Test of LET in the region after QD0 /before QF1S in the Siddharta IR is planned (silicon strips wait for cleaner running conditions).
- (2) Simulation of full optics under way to drive/ constraint detector positioning along the beam line and detector choices (granularity, readout …)
- If (1) & (2) are completed a full simulation of γγ-tagger could be done.
- Integration of part (or of all) of the tagger inside QCALT is under discussion.

Conclusions

- We propose two steps for running KLOE2 @ upgraded DAFNE :
  - Step-0 spring 2009 for 5-6 fb-1,
  - Step-1 > 1 year later with upgrads inserted for longer running

- **A lot of interesting physics items + a 1 year learning/smoothing running phase make this option actractive.**

- The detector is in good shape but at least three items seems to be decisive for running in time/smoothly:
  - **Bpipe, L2, Computing.**

- Although it seems to be easy, there is a lot to do if we want to run beginning 2009.

- **Time has come to get decisions and compact again the team (Serriamo i ranghi + $$)**

CPU power

Nodes	Type	CPUs	B80 Equival.
fibm14-15,17-34	P3 375 MHz	80	80
fibm35-44	P4+ 1.45 GHz	40	96
fibm45-47 (Jan '06)	P5 1.5 GHz SMT	"96"	184
All			**360**

- KLOE CPU accounting is performed in B80 units

  1 "B80 CPU" = 1 P3 CPU installed in B80 server

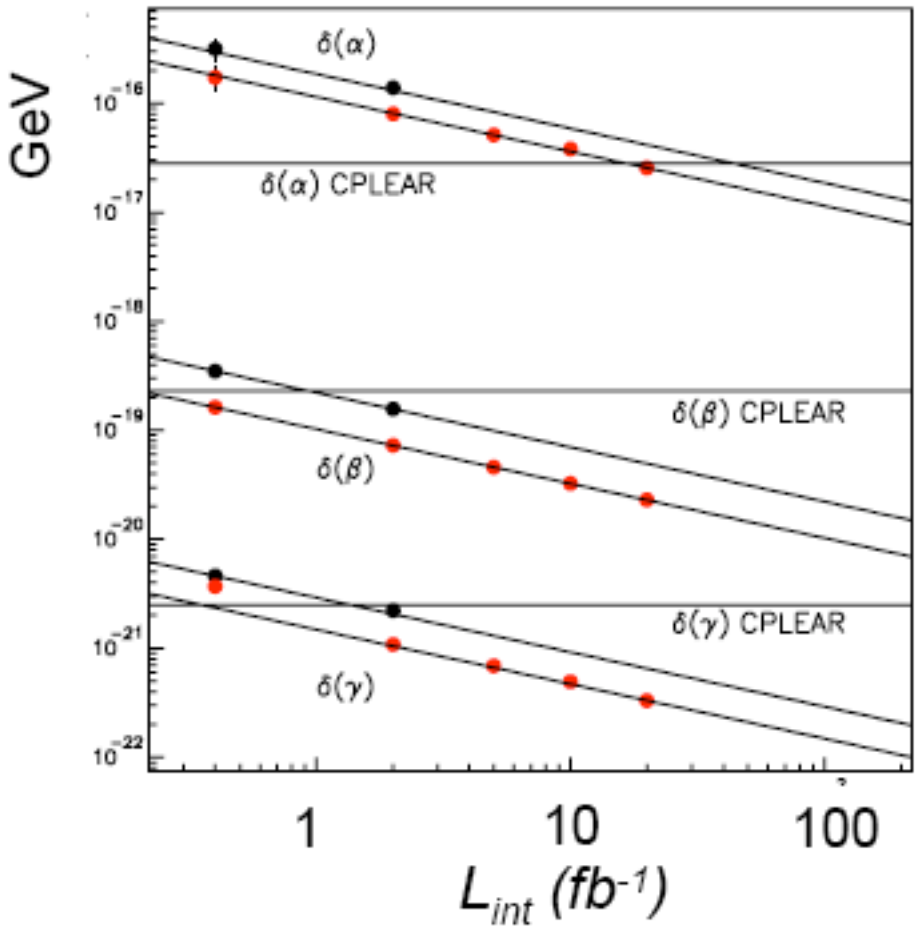
- 1SMT = Single Multi Thread is 16 ways x 2 = "32" CPU's

CPT : potenzialita' di KLOE-2

Come esempio prendiamo la misura dei parametri CPT violanti α, β e γ del modello Ellis, Hagelin, Nanopoulos e Srednicki

KLOE diviene competitivo su β e γ con pochi fb^{-1} ed anche su α con ≥ 20 fb^{-1}

L'inserimento di un detector di vertice (punti blu in figura) migliora i limiti raggiungibili di un fattore 2-3



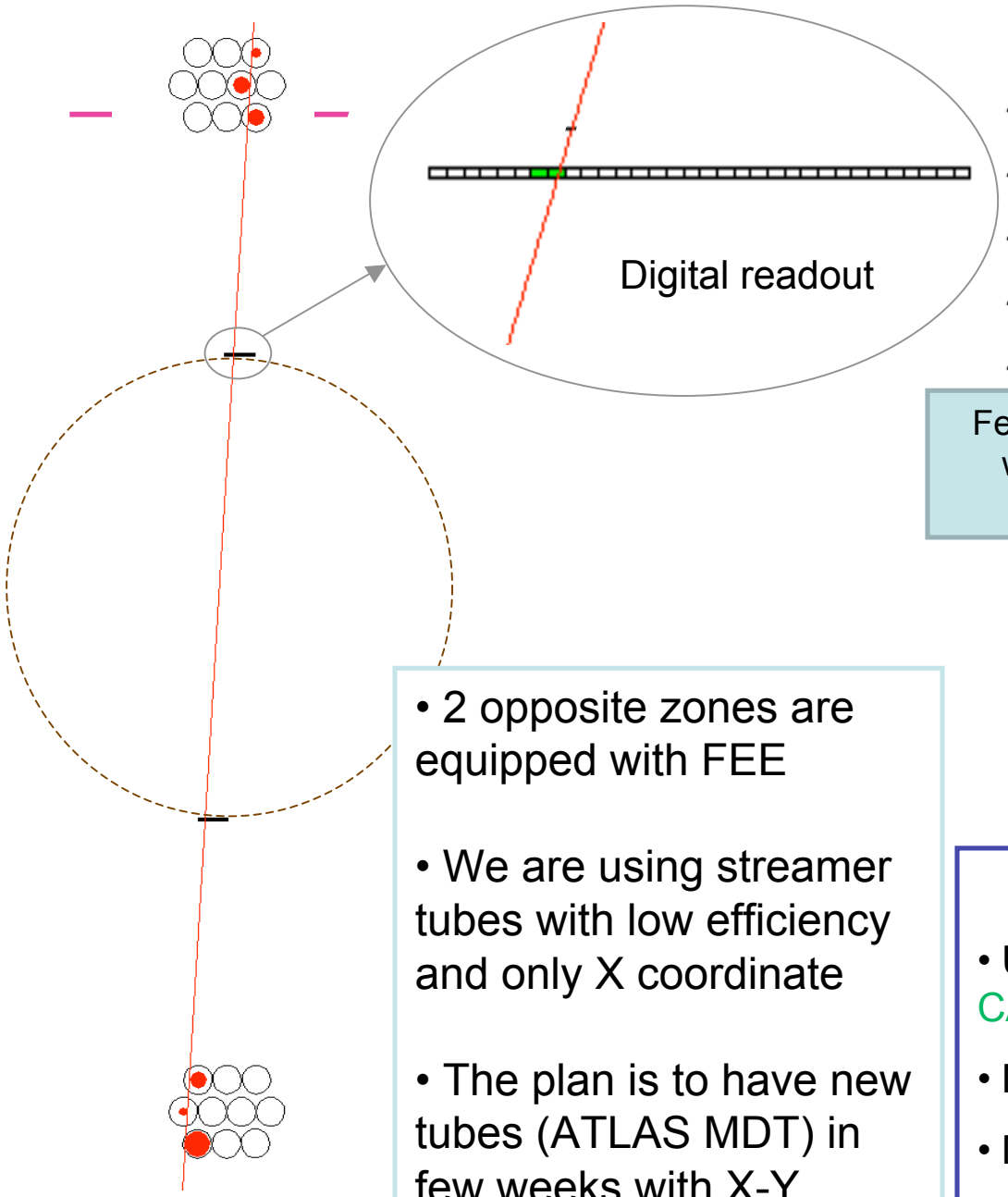
$K_S \to \pi^+\pi^-\pi^0$: un tipico testbench per la ChPT

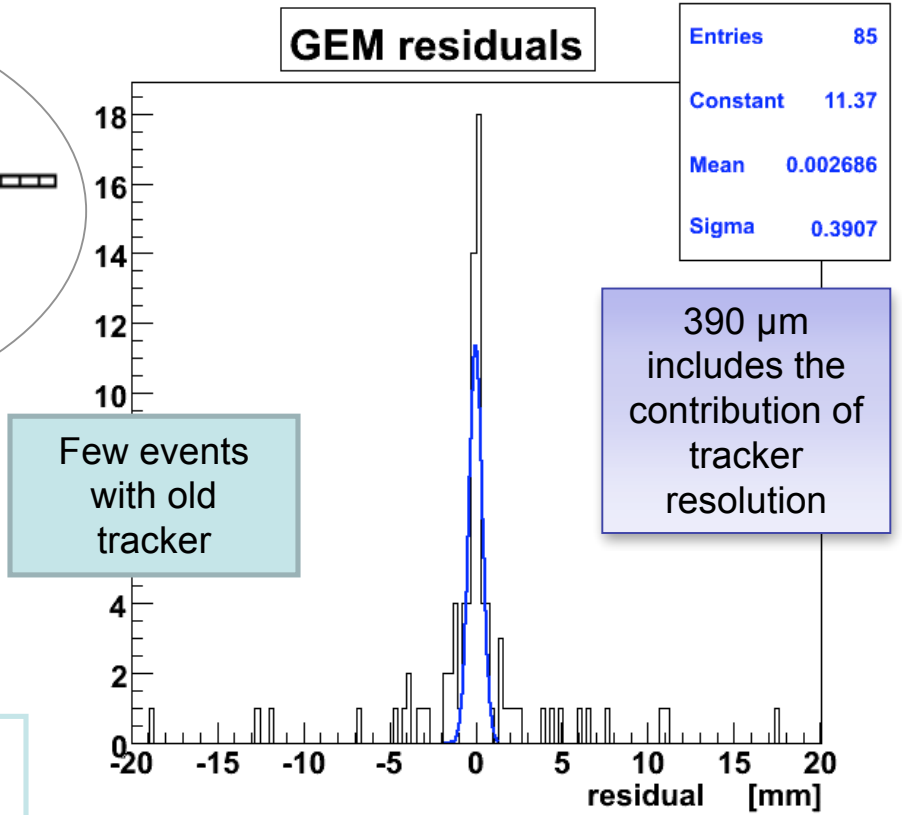
Predizione ChPT: $B(K_S \to \pi^+\pi^-\pi^0) = (2.4 \pm 0.7)\times10^{-7}$

L'attuale valore sperimentale $(3.3\ ^{+1.1}_{-0.9})\times10^{-7}$ deriva dalla media di tre misure ciascuna con precisione ~ 40%

Una analisi preliminare di KLOE ottiene ε_{sig} ~ 1.3%, S/B ~ 2

Assuming	Error on BR @ 5 fb^{-1} (%)	Error on BR @ 20 fb^{-1} (%)
No further effort made to reduce background	~ 40%	~ 20%
Further efforts completely remove background	~ 30%	~ 12%





Few events with old tracker

390 μm includes the contribution of tracker resolution

- 2 opposite zones are equipped with FEE
- We are using streamer tubes with low efficiency and only X coordinate
- The plan is to have new tubes (ATLAS MDT) in few weeks with X-Y readout

FEE schedule

- Until now: 32+32 channels with CARIOCA
- Now: **96+96** channels with CARIOCA
- Mid April: **128** channels with GASTONE
- End June: Testbeam at PS with both
- End 2008: first run for GASTONE 64ch

S.Miscetti@CSN1

Calorimeter upgrade: HQE PM option

Substitution of present KLOE fine-mesh R5946 PMs with the corresponding high quantum efficiency (HQE) version.
Substitution of a large fraction, or all 4880 PMs in the calorimeter (2880 in the barrel, 2000 in the end-caps)

Advantages:
- improvement of calorimeter performance
=> corresponding improvement and benefit in, e.g. :
  - clustering
  - efficiency for low energy photons
  - particle identification
  - kinematic fitting constraints
  - background rejection
- no mechanical modification needed
- minimum or no read-out electronics modification needed