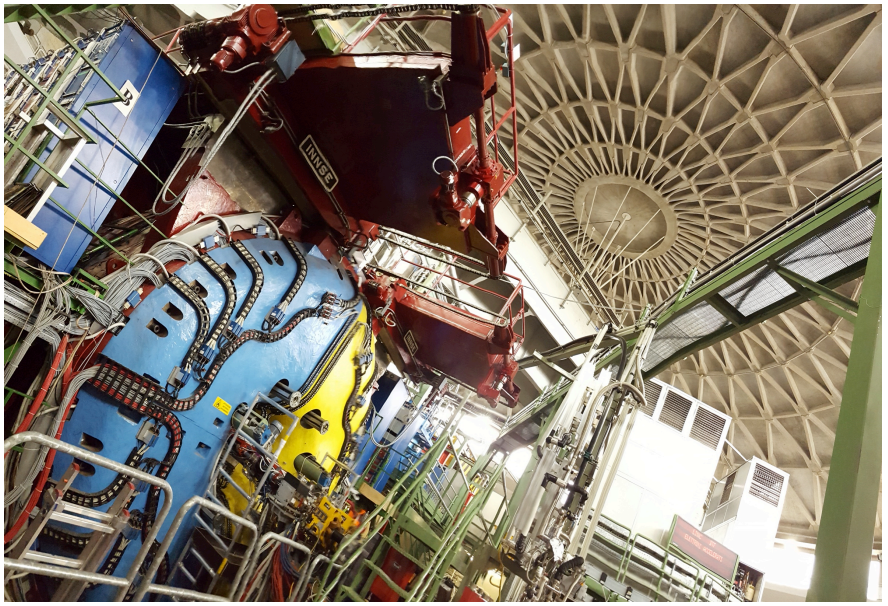
Status of KLOE-2

Antonio Di Domenico
Dipartimento di Fisica, Sapienza Università di Roma
and INFN sezione di Roma, Italy

on behalf of the KLOE-2 collaboration



LNF Scientific Committee meeting
Frascati, 21 November 2016

KLOE-2 Workshop on e^+e^- collision physics at 1 GeV

KLOE-2 Workshop on e+e- collision physics at 1 GeV

26-28 October 2016 *INFN - Laboratori Nazionali di Frascati, Italy*
Europe/Rome timezone

Overview
Registration
Registration Form
Timetable
List of registrants
Accommodation
Internet access
Poster
Social events

✉ Support

The Workshop will be devoted to a thoroughly discussion of the KLOE-2 Physics program at DAPHNE, and more in general about topics related to e+e- Physics at 1 GeV c.m energy:

- CP and T violation, CPT and QM tests
- K_S decays, eta decays and chiral lagrangians
- Phi decays, light hadron spectroscopy and transition form factors
- gamma-gamma Physics
- Dark force searches
- Hadronic contribution to the anomalous magnetic moment of the muon
- Low energy kaon interactions
- Future machines and new detectors

A special session on Friday 28th will be devoted to new proposals for the measurement of the hadronic contribution to the muon g-2.

The Conference will consist of plenary sessions held at the LNF Bruno Touschek Auditorium Hall, with invited talks.

The proceedings of the Conference will be published.

Invited speakers:
Patrik Adlarson (Mainz)
Giovanni Amelino-Camelia (Rome)
Michele Arzano (Rome)
Jose Bernabeu (Valencia)
Catalina Curceanu (Frascati)
Giancarlo D'ambrosio (Naples)
Achim Denig (Mainz)
Simon Eidelmann (Novosibirsk)
Shuangshi Fang (Beijing)
Paola Gianotti (Frascati)
Beatrix Hiesmayr (Vienna)
Fred Jegerlener (Berlin)
Karol Kampf (Prague)
Marc Knecht (Marseille)
Bastian Kubis (Bonn)
Leonard Lesniak (Krakow)
Stefan Leupold (Uppsala)
Guido Martinelli (Rome)
Nick Mavromatos (London)
Catia Milardi (Frascati)
Emilie Passemar (Indiana)
Paride Paradisi (Padua)
Massimiliano Procura (CERN)
Christoph Redmer (Mainz)
Olga Shekhovtsova (Krakow)
Eugeny Solodov (Novosibirsk)
Natalia Toro (SLAC/Perimeter)
Sean Tulin (York)

Organising Committee:
Caterina Bloise (LNF)
Eryk Czerwinski (Krakow)
Erika De Lucia (LNF)
Antonio Di Domenico (Roma) - Chair
Paolo Gauzzi (Roma)
Simona Giovannella (LNF)
Enrico Graziani (Roma Tre)
Andrzej Kupsc (Uppsala)
Luca Trentadue (Parma)
Graziano Venanzoni (LNF)

KLOE-2 Workshop on e^+e^- collision physics at 1 GeV

The workshop has been without any doubt very successful, with the enthusiastic and interested participation of more than 60 people, including 28 invited speakers coming from all Europe, Russia, China, Canada and USA.
It has been an occasion for the collaboration to present and discuss the status of the experiment and its potentialities. New ideas came out and we will summarize all the interesting issues in a written form in the proceedings of the Workshop.

KLOE-2 Physics

KAON Physics:

- CPT and QM tests with kaon interferometry
- Direct T and CPT tests using entanglement
- CP violation and CPT test:
  $K_S \to 3\pi^0$
  direct measurement of Im(ε'/ε) (lattice calc. improved)
- CKM Vus:
  K_S semileptonic decays and A_S (also CP and CPT test)
  $K\mu 3$ form factors
- χpT : $K_S \to \gamma\gamma$
- Search for rare K_S decays

Hadronic cross section

- Measurement of a_μ^{HLO} in the space-like region using Bhabha process
- ISR studies with 3π, 4π final states
- F_π with increased statistics

New proposal: running at $\sqrt{s}$ = 958 MeV

- Production of Non-Vector-Resonances (η') in e+e− annihilation (η' TFF)

Dark forces:

- Improve limits on:
  $U\gamma$ associate production
  $e^+e^- \to U\gamma \to \pi\pi\gamma, \mu\mu\gamma$
- Higgstrahlung
  $e^+e^- \to Uh' \to \mu^+\mu^-$ + miss. energy
- Leptophobic B boson search
  $\phi \to \eta B, B \to \pi^0\gamma, \eta \to \gamma\gamma$
  $\eta \to B\gamma, B \to \pi^0\gamma, \eta \to \pi^0\gamma\gamma$
- Search for U invisible decays

Light meson Physics:

- η decays, ω decays, TFF $\phi \to \eta e^+e^-$
- C,P,CP violation:
  improve limits on $\eta \to \gamma\gamma\gamma$, $\pi^+\pi^-$, $\pi^0\pi^0$, $\pi^0\pi^0\gamma$
- improve $\eta \to \pi^+\pi^-e^+e^-$
- χpT : $\eta \to \pi^0\gamma\gamma$
- Light scalar mesons: $\phi \to K_S K_S \gamma$
- $\gamma\gamma$ Physics: $\gamma\gamma \to \pi^0$ and π^0 TFF
- light-by-light scattering
- axion-like particles

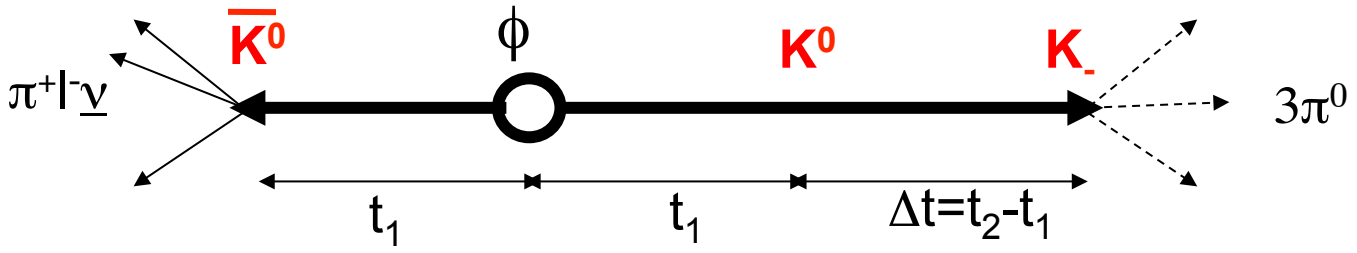
(new wrt K2 program EPJC (2010) 68, 619)

Direct test of T and CPT in neutral kaon transitions

- EPR correlations at a ϕ-factory can be exploited to study other transitions involving also orthogonal "CP states" K_+ and K_-

$$|i\rangle = \frac{1}{\sqrt{2}}\left[\left|K^0(\vec{p})\right\rangle\left|\overline{K}^0(-\vec{p})\right\rangle - \left|\overline{K}^0(\vec{p})\right\rangle\left|K^0(-\vec{p})\right\rangle\right]$$
$$= \frac{1}{\sqrt{2}}\left[\left|K_+(\vec{p})\right\rangle\left|K_-(-\vec{p})\right\rangle - \left|K_-(\vec{p})\right\rangle\left|K_+(-\vec{p})\right\rangle\right]$$

- decay as filtering measurement
- entanglement -> preparation of state



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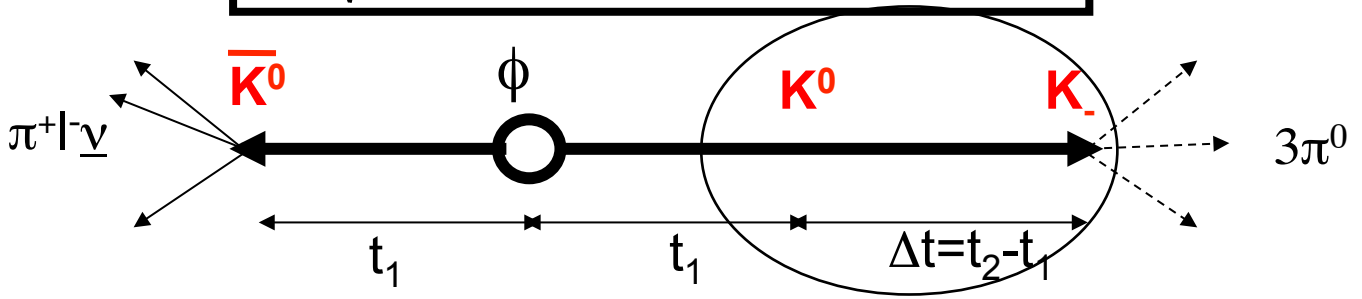

$K^0 \rightarrow K_-$ reference process

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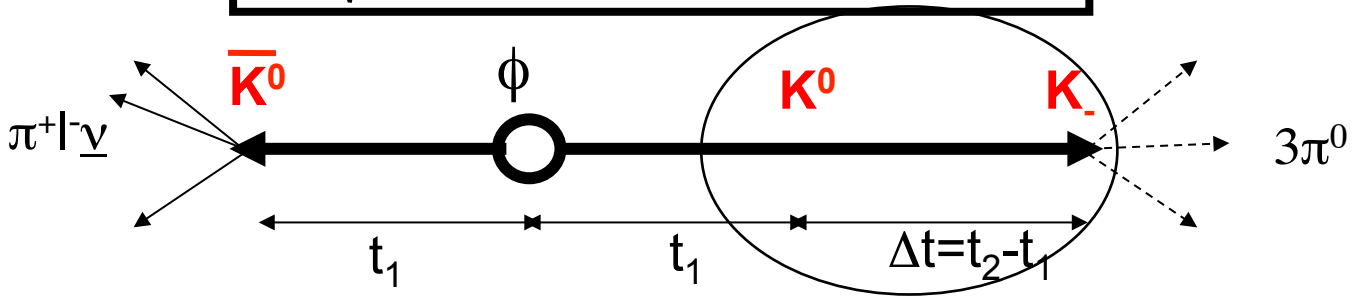

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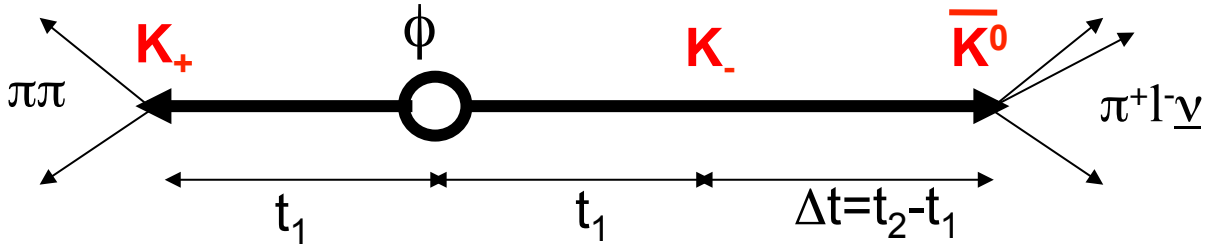

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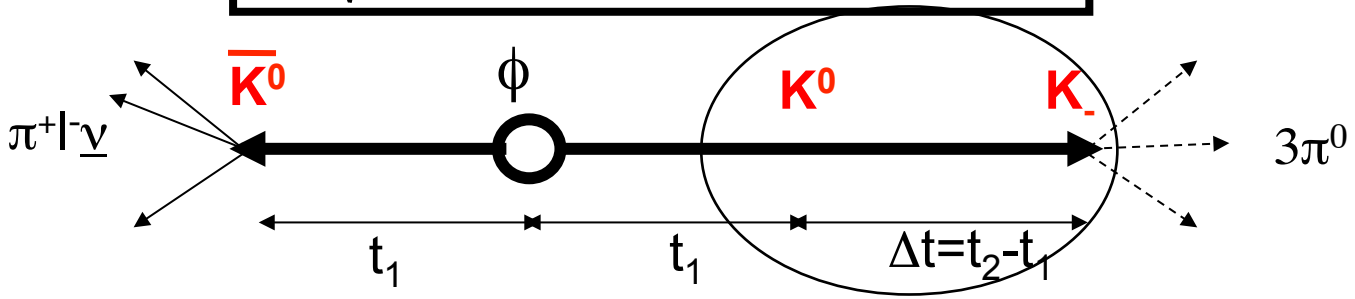
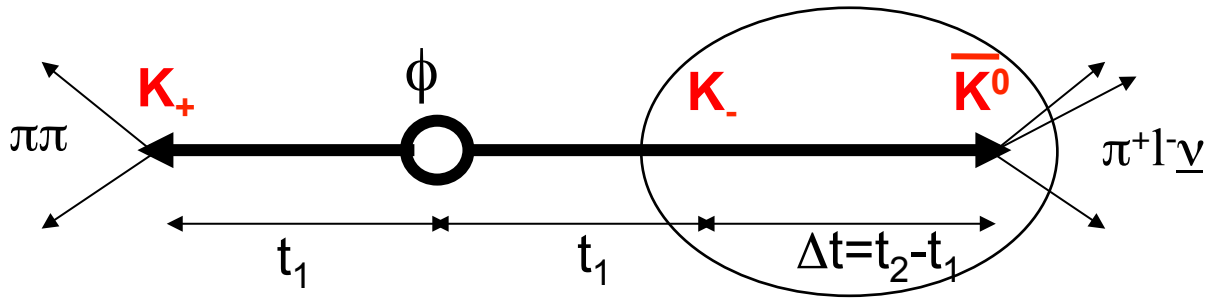


$K^0 \rightarrow K_-$ reference process

$K_- \rightarrow \overline{K}^0$ CPT-conjugated process



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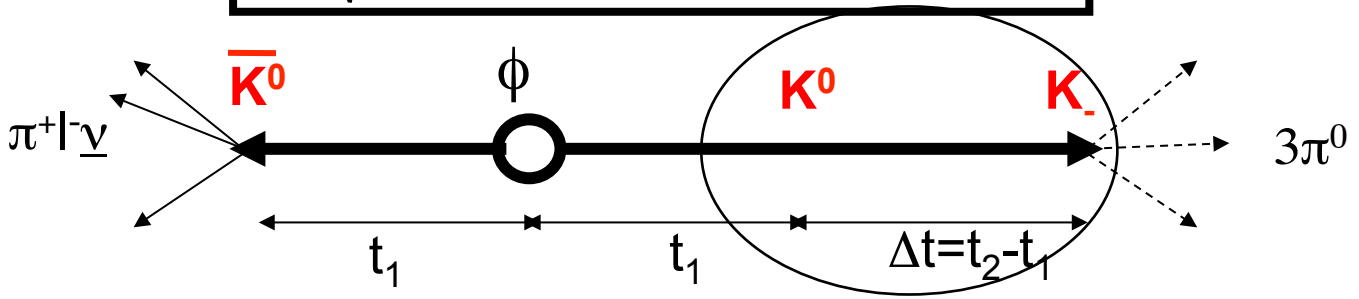
- decay as filtering measurement
- entanglement -> preparation of state

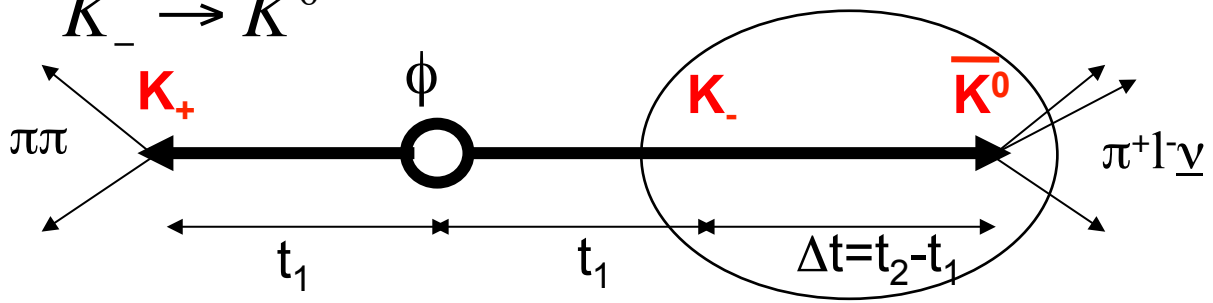


$K^0 \to K_-$ reference process

Note: CP and T conjugated process

$\overline{K}^0 \to K_-$ $\quad K_- \to K^0$

$K_- \to \overline{K}^0$ CPT-conjugated process



Direct test of T and CPT in neutral kaon transitions

Reference	T-conjug.	CP-conjug.	CPT-conjug.
$K^0 \to K_+$	$K_+ \to K^0$	$\bar{K}^0 \to K_+$	$K_+ \to \bar{K}^0$
$K^0 \to K_-$	$K_- \to K^0$	$\bar{K}^0 \to K_-$	$K_- \to \bar{K}^0$
$\bar{K}^0 \to K_+$	$K_+ \to \bar{K}^0$	$K^0 \to K_+$	$K_+ \to K^0$
$\bar{K}^0 \to K_-$	$K_- \to \bar{K}^0$	$K^0 \to K_-$	$K_- \to K^0$

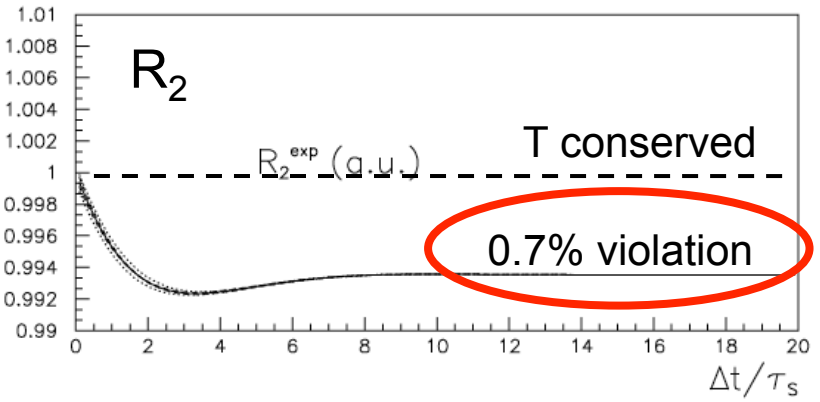
Unique direct CPT (and T) test with kaons very clean and model independent.

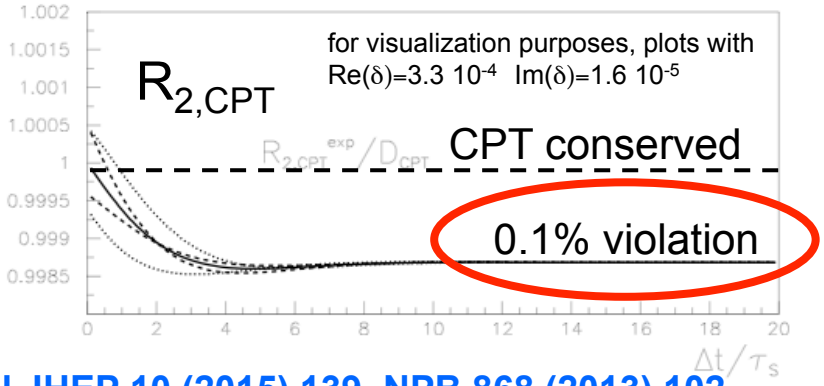
KLOE-2 can do a significant test with L≥5 fb^{-1}

One can define the following ratios of probabilities:

$$
\begin{aligned}
R_1(\Delta t) &= P\left[K^0(0) \to K_+(\Delta t)\right] / P\left[K_+(0) \to K^0(\Delta t)\right] \\
R_2(\Delta t) &= P\left[K^0(0) \to K_-(\Delta t)\right] / P\left[K_-(0) \to K^0(\Delta t)\right] \\
R_3(\Delta t) &= P\left[\bar{K}^0(0) \to K_+(\Delta t)\right] / P\left[K_+(0) \to \bar{K}^0(\Delta t)\right] \\
R_4(\Delta t) &= P\left[\bar{K}^0(0) \to K_-(\Delta t)\right] / P\left[K_-(0) \to \bar{K}^0(\Delta t)\right]
\end{aligned}
$$

$$
\begin{aligned}
R_{1,\mathcal{CPT}}(\Delta t) &= P\left[K_+(0) \to \bar{K}^0(\Delta t)\right] / P\left[K^0(0) \to K_+(\Delta t)\right] \\
R_{2,\mathcal{CPT}}(\Delta t) &= P\left[K^0(0) \to K_-(\Delta t)\right] / P\left[K_-(0) \to \bar{K}^0(\Delta t)\right] \\
R_{3,\mathcal{CPT}}(\Delta t) &= P\left[K_+(0) \to K^0(\Delta t)\right] / P\left[\bar{K}^0(0) \to K_+(\Delta t)\right] \\
R_{4,\mathcal{CPT}}(\Delta t) &= P\left[\bar{K}^0(0) \to K_-(\Delta t)\right] / P\left[K_-(0) \to K^0(\Delta t)\right]
\end{aligned}
$$





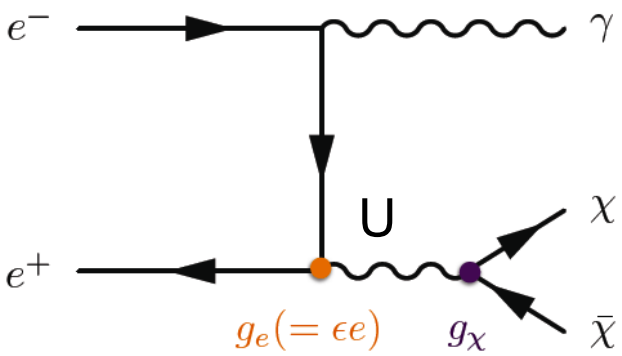
Any deviation from $R_{i,/CPT}$=1 constitutes a violation of T/CPT symmetry

J. Bernabeu, A.D.D., et al.JHEP 10 (2015) 139, NPB 868 (2013) 102

CPT and QM tests: prospects for KLOE-2

Param.	Present best published measurement	KLOE-2 (IT) L=5 fb^{-1} (stat.)	KLOE-2 (IT) L=10 fb^{-1} (stat.)
A_S	$(1.5 \pm 11) \times 10^{-3}$	$\pm 2.7 \times 10^{-3}$	$\pm 1.9 \times 10^{-3}$
ζ_{00}	$(0.1 \pm 1.0) \times 10^{-6}$	$\pm 0.26 \times 10^{-6}$	$\pm 0.18 \times 10^{-6}$
ζ_{SL}	$(0.3 \pm 1.9) \times 10^{-2}$	$\pm 0.49 \times 10^{-2}$	$\pm 0.35 \times 10^{-2}$
α	$(-0.5 \pm 2.8) \times 10^{-17}$ GeV	$\pm 5.0 \times 10^{-17}$ GeV	$\pm 3.5 \times 10^{-17}$ GeV
β	$(2.5 \pm 2.3) \times 10^{-19}$ GeV	$\pm 0.50 \times 10^{-19}$ GeV	$\pm 0.35 \times 10^{-19}$ GeV
γ	$(1.1 \pm 2.5) \times 10^{-21}$ GeV compl. pos. hyp. $(0.7 \pm 1.2) \times 10^{-21}$ GeV	$\pm 0.75 \times 10^{-21}$ GeV compl. pos. hyp. $\pm 0.33 \times 10^{-21}$ GeV	$\pm 0.53 \times 10^{-21}$ GeV compl. pos. hyp. $\pm 0.23 \times 10^{-21}$ GeV
$Re(\omega)$	$(-1.6 \pm 2.6) \times 10^{-4}$	$\pm 0.70 \times 10^{-4}$	$\pm 0.49 \times 10^{-4}$
$Im(\omega)$	$(-1.7 \pm 3.4) \times 10^{-4}$	$\pm 0.86 \times 10^{-4}$	$\pm 0.61 \times 10^{-4}$
Δa_0	$(-6.0 \pm 8.3) \times 10^{-18}$ GeV	$\pm 2.2 \times 10^{-18}$ GeV	$\pm 1.6 \times 10^{-18}$ GeV
Δa_Z	$(3.1 \pm 1.8) \times 10^{-18}$ GeV	$\pm 0.50 \times 10^{-18}$ GeV	$\pm 0.35 \times 10^{-18}$ GeV
Δa_X	$(0.9 \pm 1.6) \times 10^{-18}$ GeV	$\pm 0.44 \times 10^{-18}$ GeV	$\pm 0.31 \times 10^{-18}$ GeV
Δa_Y	$(-2.0 \pm 1.6) \times 10^{-18}$ GeV	$\pm 0.44 \times 10^{-18}$ GeV	$\pm 0.31 \times 10^{-18}$ GeV

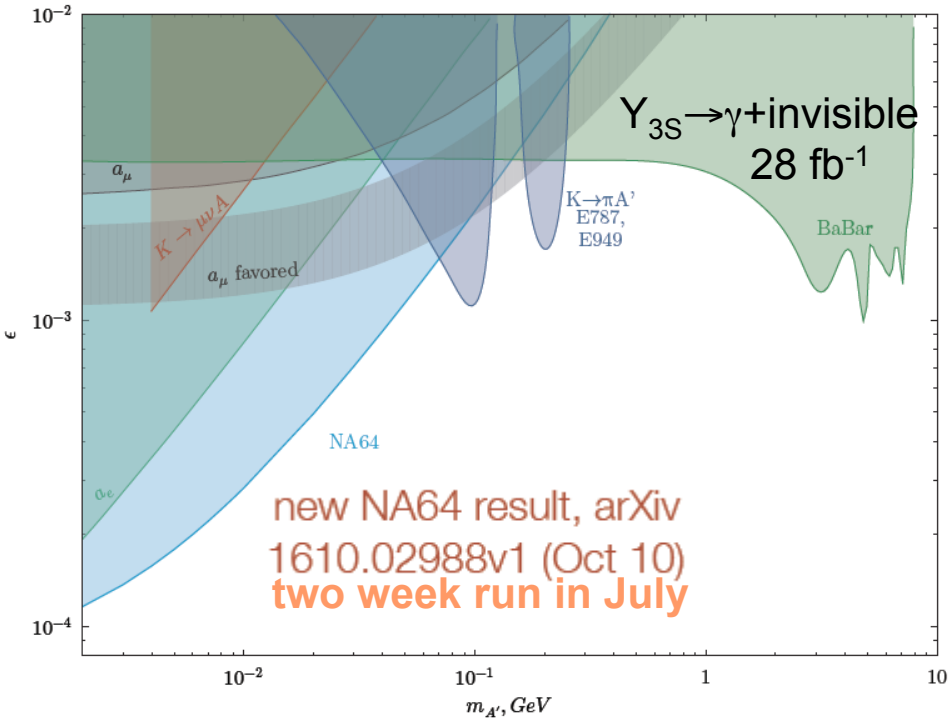
Dark forces at KLOE-2: invisible U decays?



χ ≡ very light dark matter
NOT excluded by present limits

could explain $(g-2)_\mu$

monochromatic photon
$E_\gamma = (s-m_U^2)/2\sqrt{s}$



At KLOE-2:

- A single photon trigger has been setup and is currently in test phase, with a threshold at ~ 350 MeV.
- In addition trigger efficiency to single photon events is not negligible (~50%) due to the presence of the machine background (rejectable with TOF techniques) => use already collected data (advantage: low threshold)

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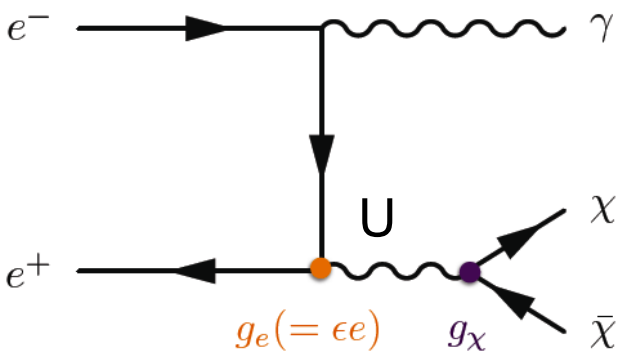

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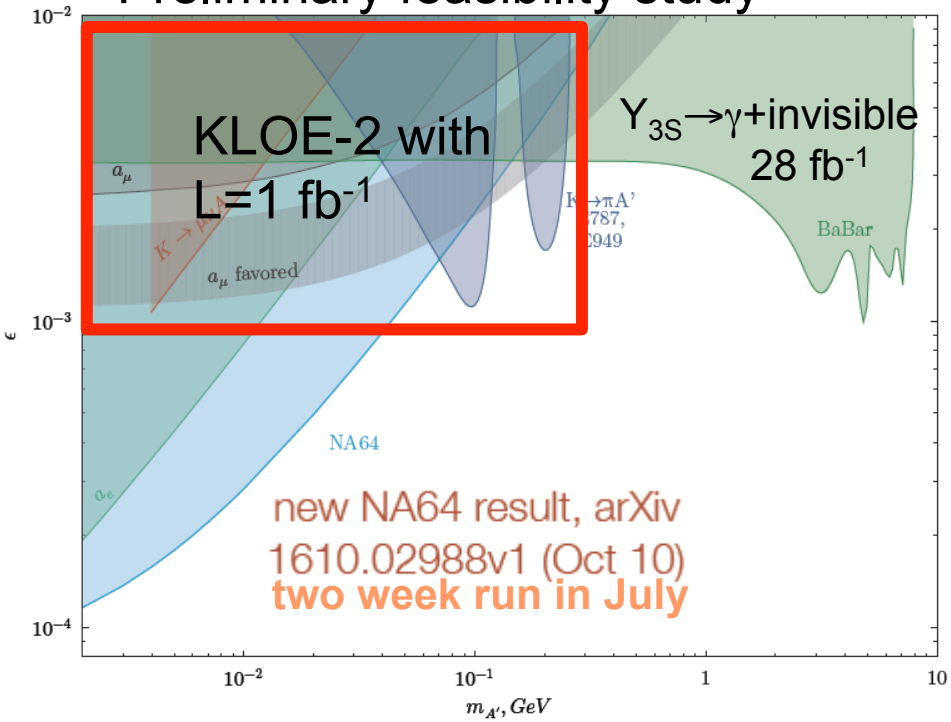
Preliminary feasibility study



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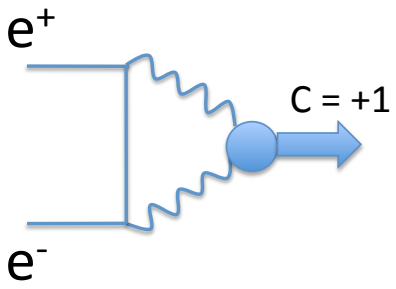
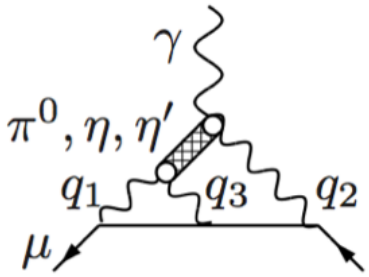
Proposal: search for e+e- -> η'(958) reaction



C-even states can be produced in e^+e^- collision via two-photon reaction.

(π^0, $\eta(547)$, $\eta(958)$, $f_0(980)$, $a_0(980)$, $f_2(1270)$, $f_0(1500)$…)

Observation of these reactions could help to calculate light-by-light contribution to g-2 of muon.



Proposal presented at WS by E. Solodov (Novosibirsk)

CMD-3 result (PLB740 (2015) 273)

e+e- -> η' -> π+π-η -> π+π-γγ

$\Gamma(\eta' \to e^+e^-) < 0.0024$ eV

$BR(\eta' \to e^+e^-) < 1.2\ 10^{-8}$

Unitarity limit (a fatctor ~ 300 lower):

$\Gamma(\eta' \to e^+e^-) = 7.5\ 10^{-6}$ eV

$BR(\eta' \to e^+e^-) = 3.8\ 10^{-11}$

At KLOE-2 at $\sqrt{s}$ = 958 MeV

L = 160 pb^{-1} to reach unitarity limit;

FF enhancement might be ~5-10

Preliminary technical considerations on running DAFNE out of phi peak by C. Milardi at WS

Running DAΦNE at the center of mass energy of 958 MeV requires a comprehensive preliminary study and a not negligible investment in terms of work, time and manpower

- Numerical simulations about:
  - *Stay clear aperture*
  - *Transverse betatron coupling compensation*
  - *Crab-Waist optics*
  - *Dynamic aperture*
  - *Background on the detector*
- Commissioning and luminosity tuning

Moreover the following points must be taken carefully in to account

- *Crab-Waist* conditions could not be recovered
- Data taking might require longer time since a considerably lower luminosity is expected

Publications

U boson search in $e^+e^- \to U\gamma$, $U \to e^+e^-$	PLB 750 (2015) 633
Search for dark higgsstrahlung process	PLB 747 (2015) 365
BR and Transition Form Factor of $\phi \to \eta e^+e^-$	PLB 742 (2015) 1
BR and Transition Form Factor of $\phi \to \pi^0 e^+e^-$	**PLB 757 (2016) 362** ←
Dalitz plot analysis of $\eta \to \pi^+\pi^-\pi^0$	**JHEP 1605 (2016) 019** ←
Hadron Vacuum Polarization in $e^+e^- \to \mu^+\mu^-\gamma$	**Submitted to PLB (arxiv.org/abs/ 1609.06631)** ←
U boson search in $e^+e^- \to U\gamma$, $U \to \pi^+\pi^-$	**PLB 757 (2016) 356**
T and CPT test with $\phi \to K_S K_L \to 3\pi^0\, \pi l\nu$, $\pi\pi\, \pi l\nu$	In progress
BR and charge asymmetry in $K_S \to \pi e\nu$	Finalizing systematic errors studies

Measurements of the running of $\alpha_{e.m.}(s)$ via $e^+e^- \to \mu^+\mu^-\gamma$

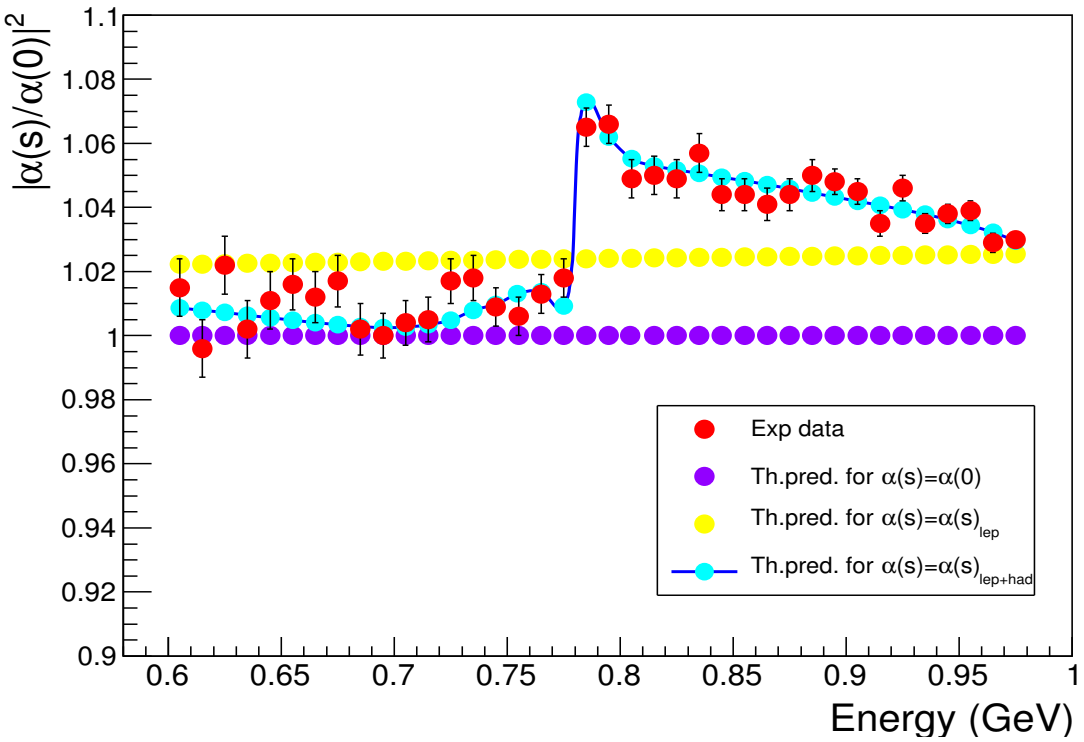
$$\left|\frac{\alpha(s)}{\alpha(0)}\right|^2 = \frac{\frac{d\sigma^{ISR}}{dM_{\mu\mu}}}{\frac{d\sigma^{MC}}{dM_{\mu\mu}}}$$

MC with $\alpha=\alpha(0)$

$$\left|\frac{\alpha(s)}{\alpha(0)}\right|^2 = \left|1/(1-\Delta\alpha(s))\right|^2$$

$$\Delta\alpha(s) = \Delta\alpha_{lep} + \Delta\alpha_{had}$$

(we neglect the top contribution)



Extraction of real and imaginary parts of $\Delta\alpha(s)$

$$Re\,\Delta\alpha = 1 - \sqrt{|\alpha(0)/\alpha(s)|^2 - (Im\,\Delta\alpha)^2}.$$

$$Im\Delta\alpha = -\frac{\alpha}{3}R(s) \qquad R(s) = \sigma_{tot}/\frac{4\pi\alpha(s)^2}{3s}$$

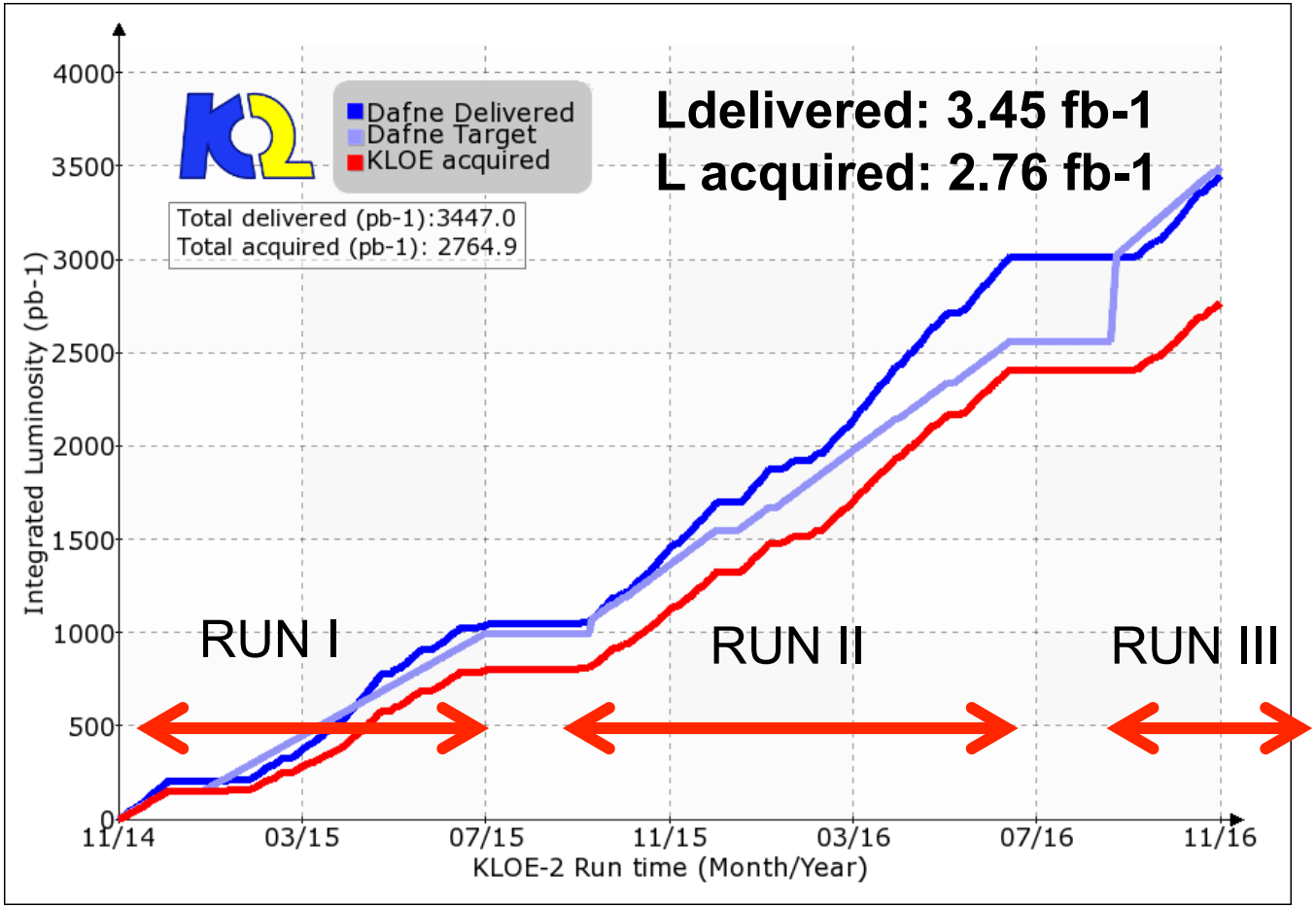
$$R(s) = R_{lep}(s) + R_{had}$$

Submitted to PLB (arXiv 1609.06631 [hep-ex])

(invitation to give a seminar at CERN)

Status of KLOE-2 operation and detector

Luminosity: summary and plans



RUN-III started on
12 September 2016

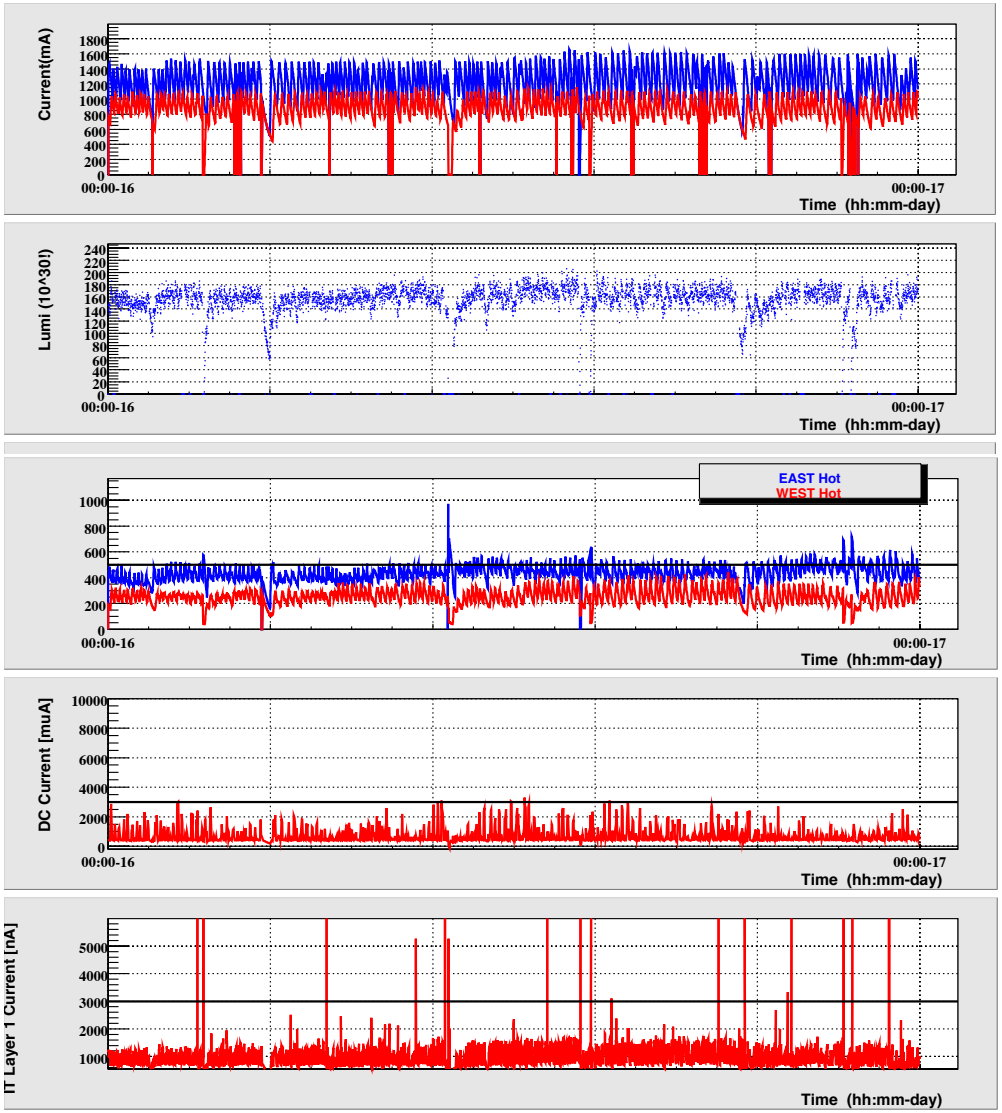
New Intermediate
Luminosity milestone:
L delivered = 5 fb^{-1}
by 31 July 2017

KLOE-2 goal:

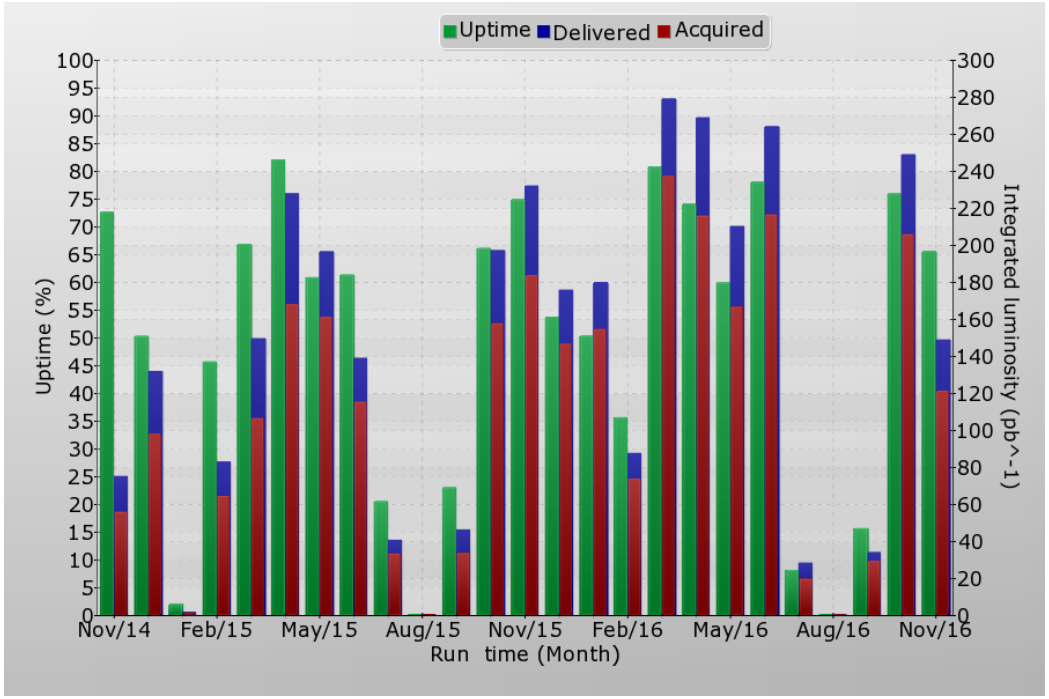
L acquired > 5 fb^{-1}
=>
L delivered > ~ 6.2 fb-1

Best DAΦNE performance:
Peak luminosity: ~2.2 x 10^{32}
maximum daily integrated luminosity (delivered): ~13 pb^{-1}

DAFNE performance



Best day:
integrated luminosity (delivered): ~13.3 pb^{-1}
integrated luminosity (acquired): ~11.0 pb^{-1}



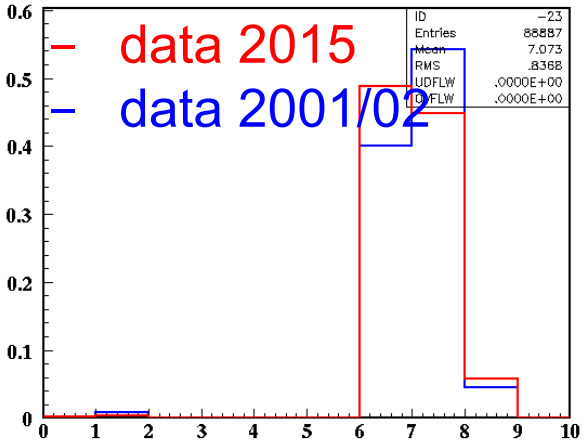
monthly performance

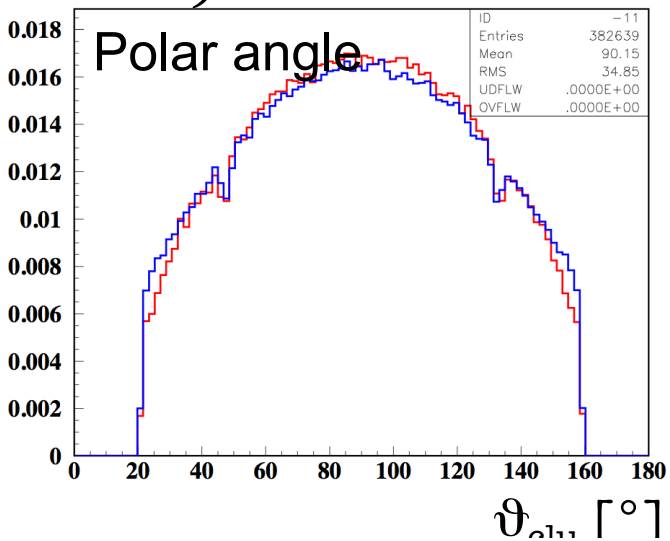
Data Quality: benchmark analyses

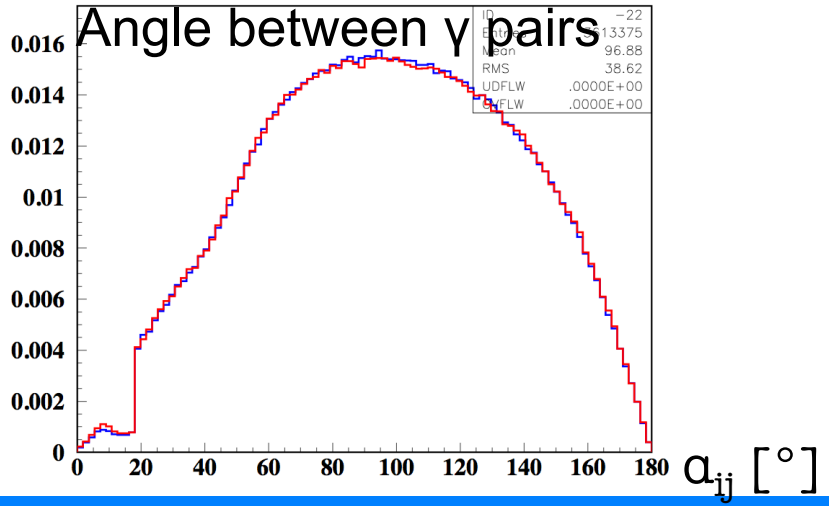
1) $\varphi \rightarrow \eta\gamma$ with $\eta \rightarrow 3\pi^0$ (fully neutral channel)
2) Lifetime of K_S with $K_S \rightarrow \pi^+\pi^-$ (fully charged channel)
3) $\varphi \rightarrow \eta\gamma$ with $\eta \rightarrow \gamma\gamma$ (fully neutral channel)
4) $K_L \rightarrow \pi^+\pi^-$ (fully charged)
5) $K_S K_L \rightarrow \pi^+\pi^- \pi l\nu$, $3\pi^0$

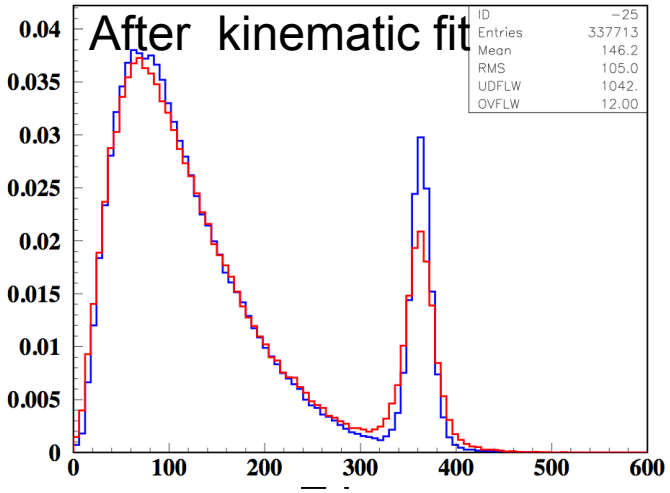
Data quality benchmark (1): $\phi \to \eta\gamma$ with $\eta \to 3\pi^0$

- Neutral rad w/ $N_{prompt} > 5$ clusters
- To select $\varphi \to \eta\gamma$ with $\eta \to 3\pi^0$ (recoil $\gamma \Rightarrow$ 363 MeV)



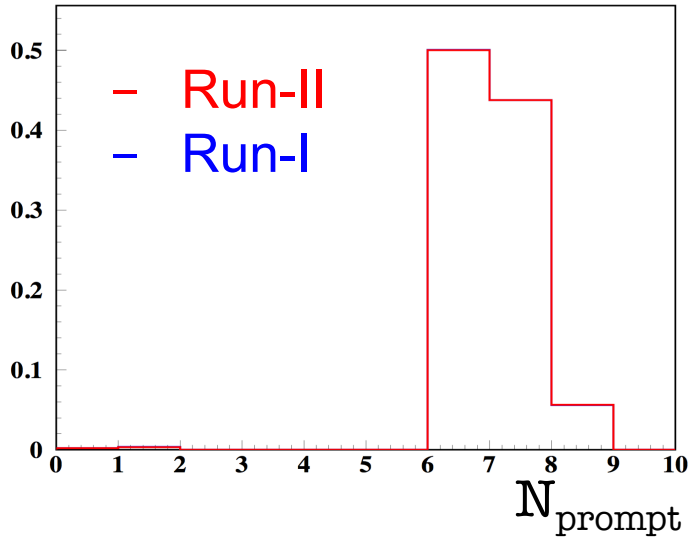


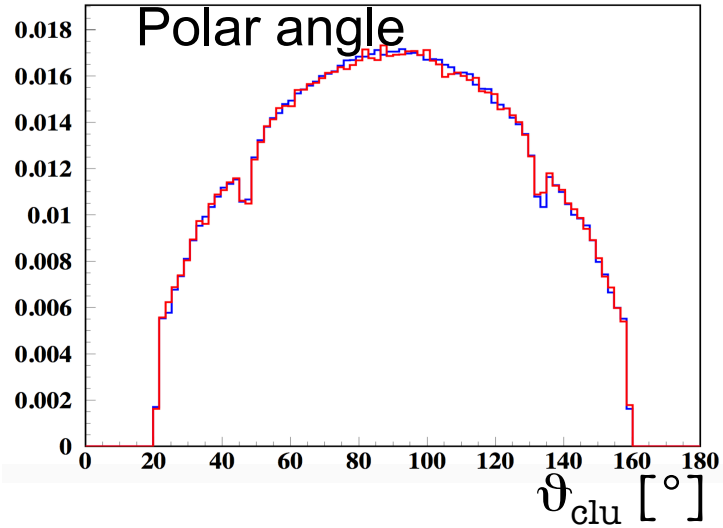


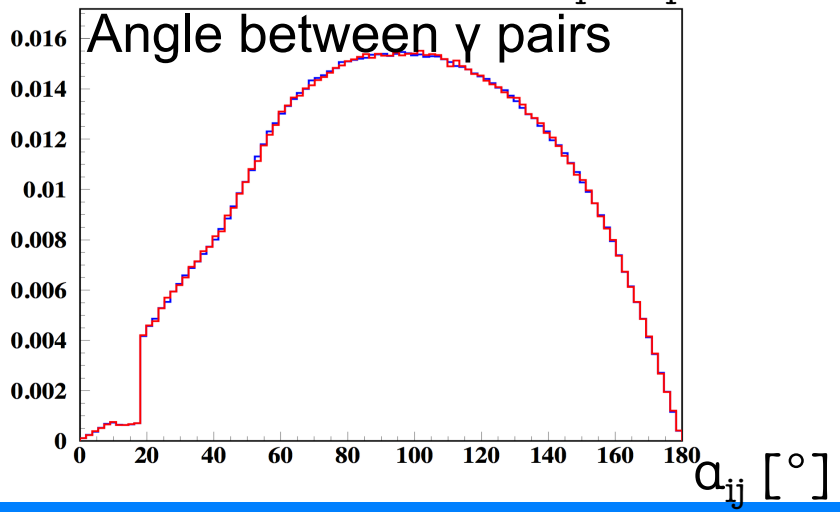


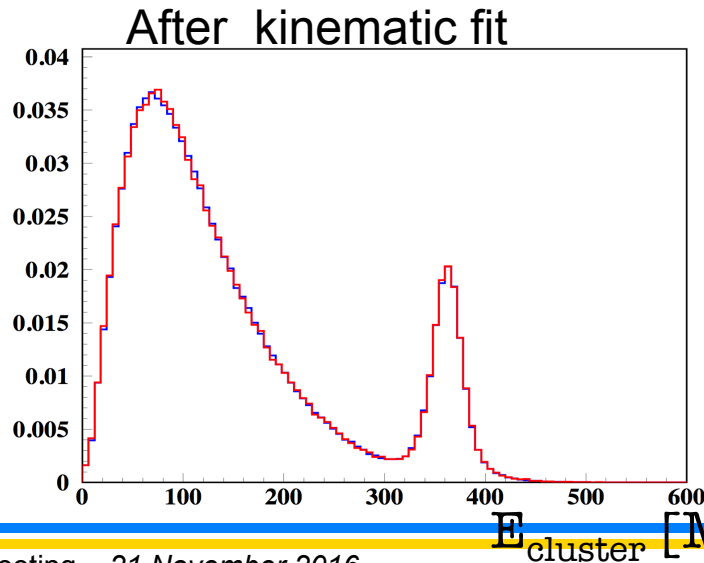
Data quality benchmark (1): $\phi \to \eta\gamma$ with $\eta \to 3\pi^0$

- Neutral rad w/ $N_{prompt} > 5$ clusters
- To select $\varphi \to \eta\gamma$ with $\eta \to 3\pi^0$



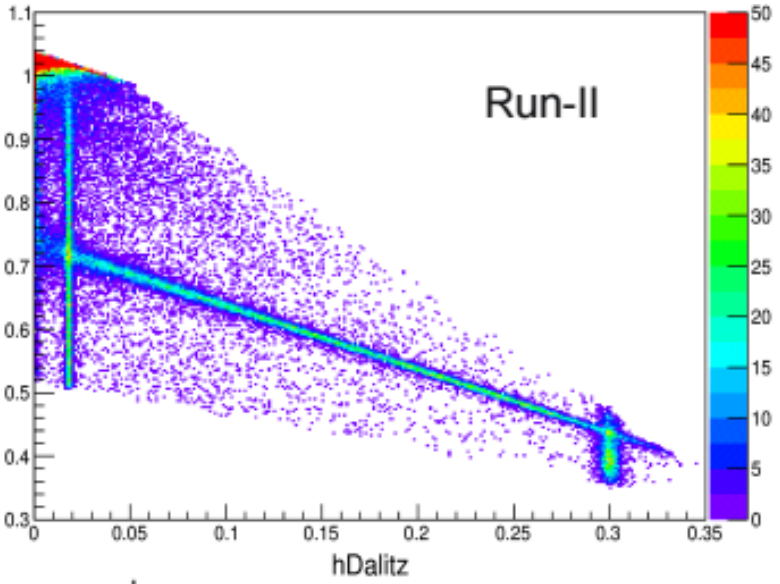


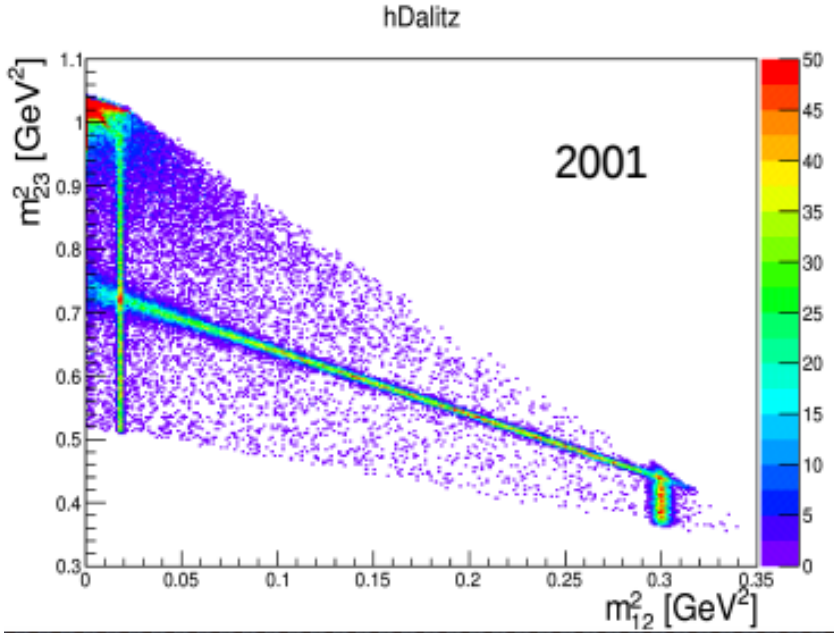


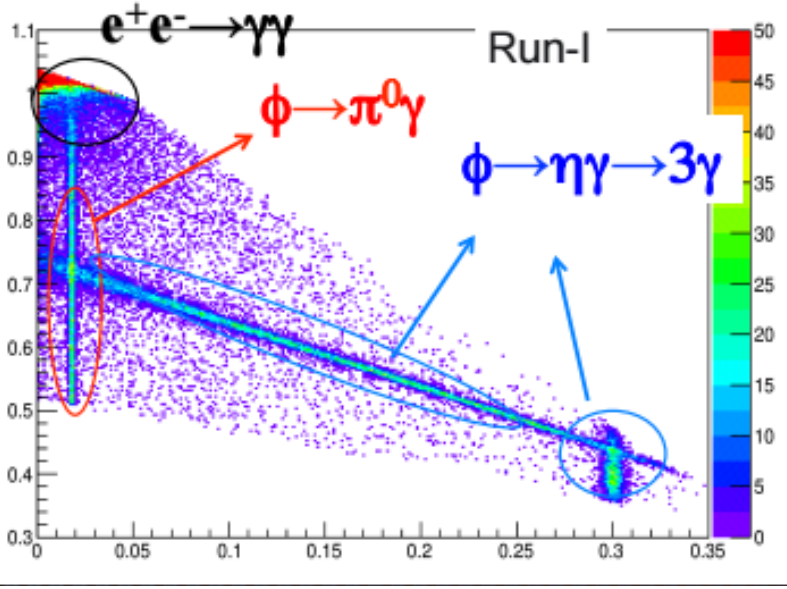


Data quality benchmark (2): $\phi \to \eta\gamma$ with $\eta \to \gamma\gamma$

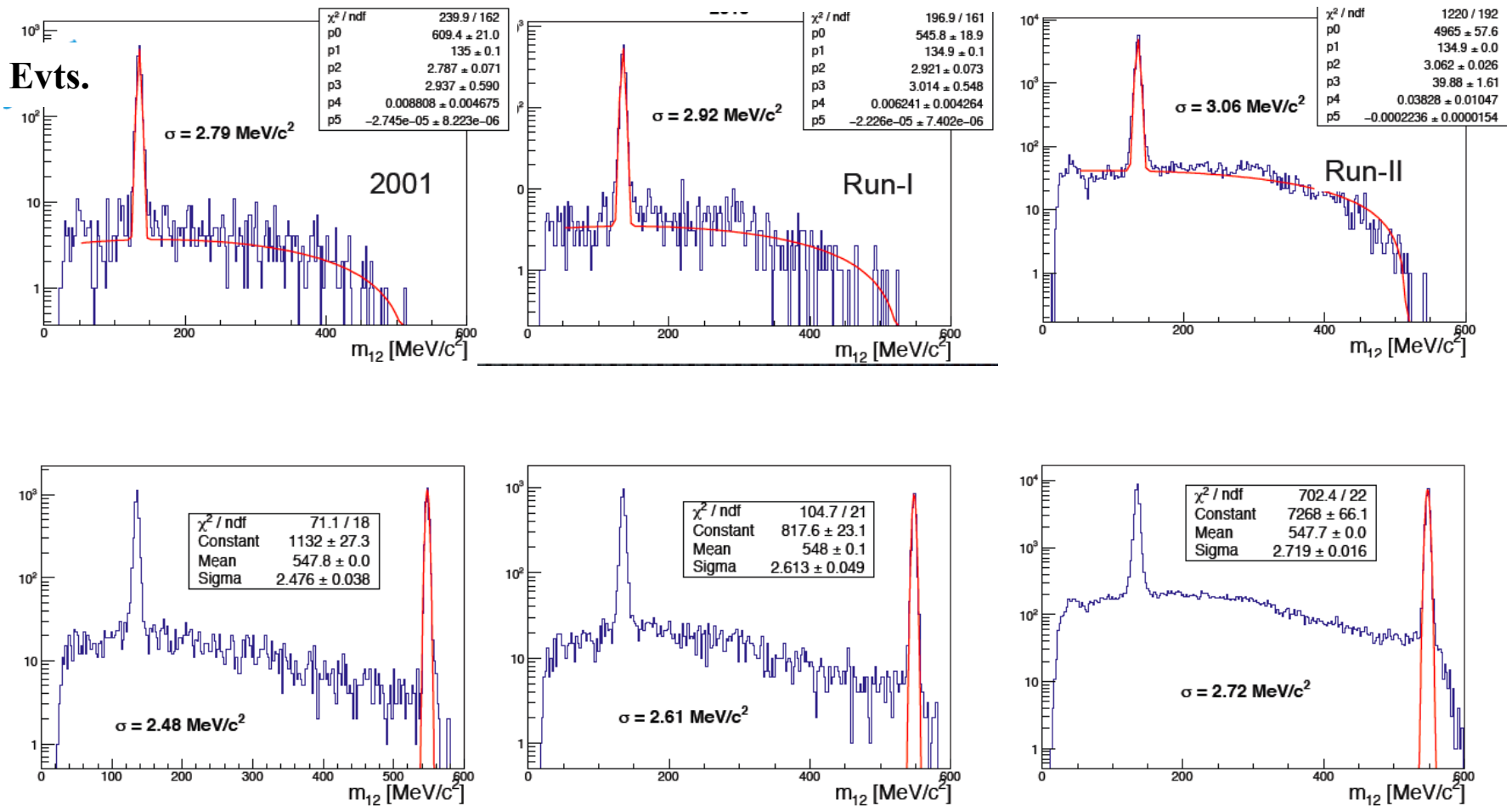
- E1 < E2 < E3
- Kinfit $\chi^2 < 35$
- Cuts to select eta and pion peaks





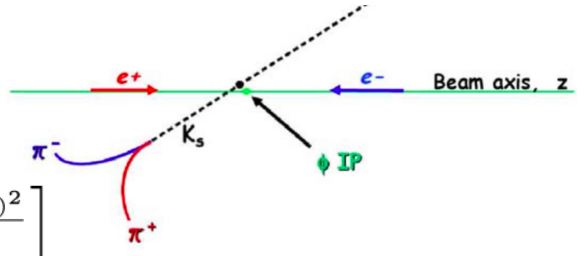


Data quality benchmark (2): $\phi \to \eta\gamma$ with $\eta \to \gamma\gamma$



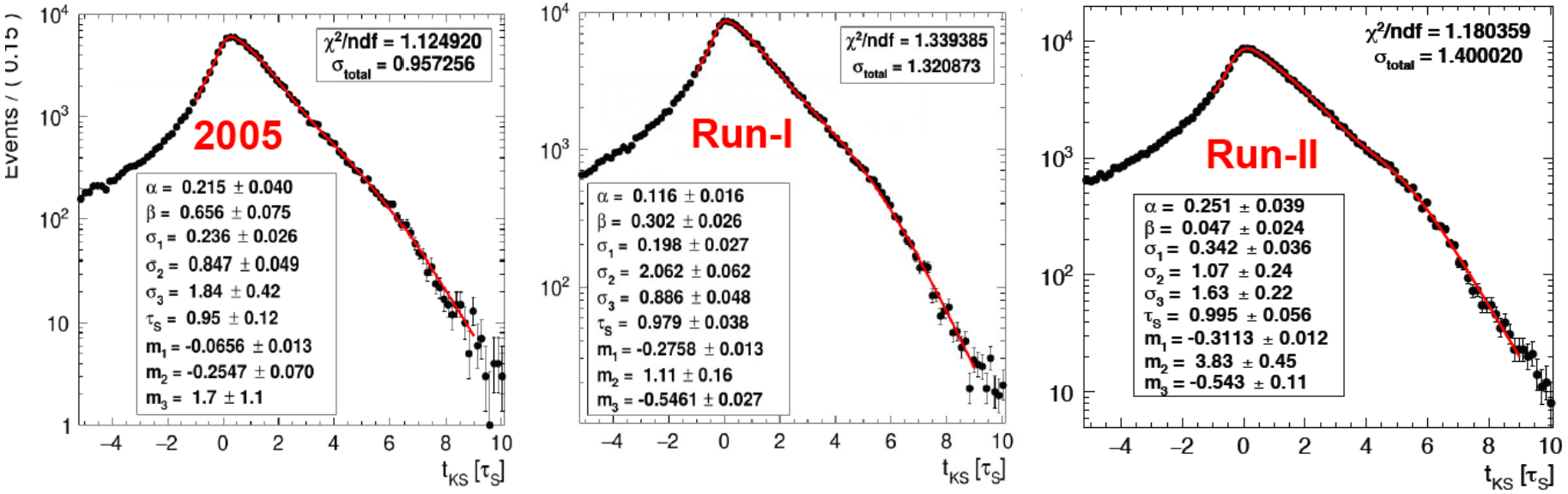
Data quality benchmark (3): $K_S \to \pi^+\pi^-$

- **Exponential folded with a triple gaussian**



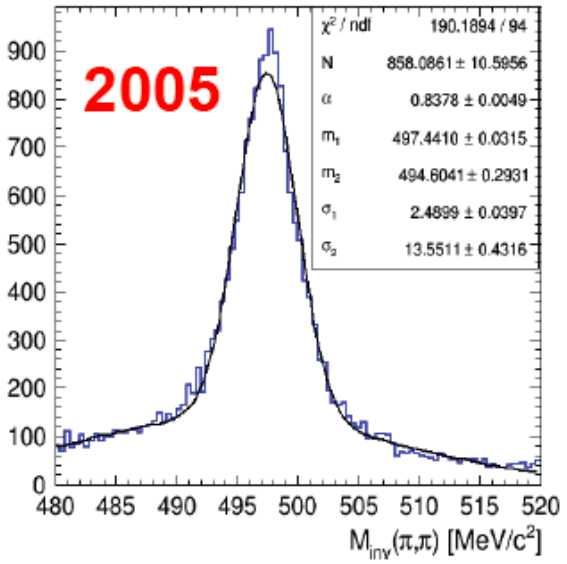
$$f(t) = e^{\frac{-t}{\tau_S}} * \left[\alpha \cdot e^{\frac{1}{2}\frac{(t-m_1)^2}{\sigma_1^2}} + \beta \cdot \cdot e^{\frac{1}{2}\frac{(t-m_2)^2}{\sigma_2^2}} + (1-\alpha-\beta) \cdot e^{\frac{1}{2}\frac{(t-m_3)^2}{\sigma_3^2}} \right]$$

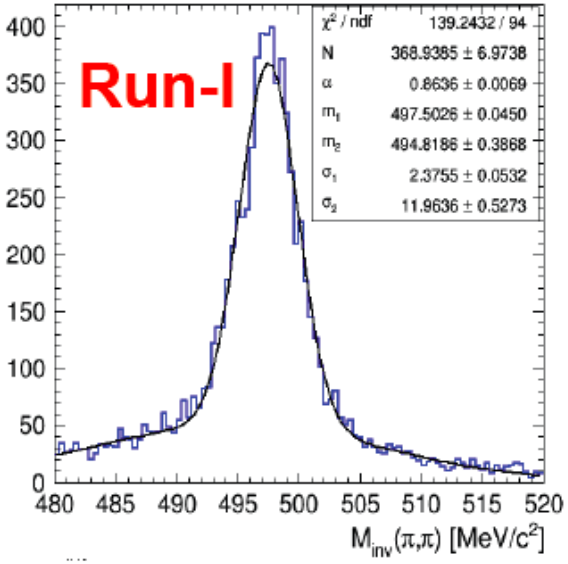
$$\sigma_{total} = \sqrt{\alpha\sigma_1^2 + \beta\sigma_2^2 + (1-\alpha-\beta)\sigma_3^2}$$



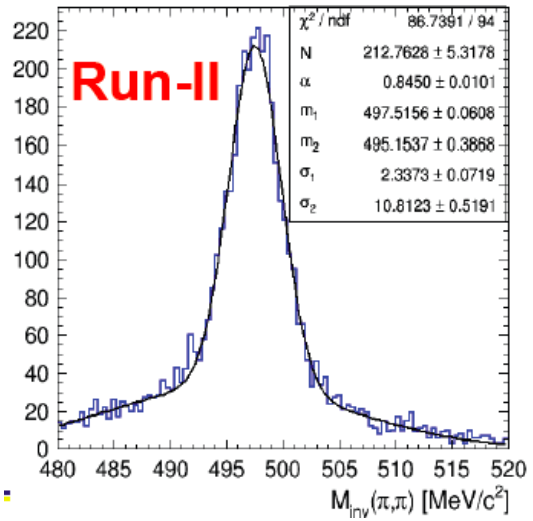
	2005	Run-I	Run-II
τ_S [τ_S units]	0.95 ± 0.12	0.979 ± 0.038	0.995 ± 0.056

Data quality benchmark (4): $K_L \rightarrow \pi^+\pi^-$





	M_K [MeV]	σ_M [MeV]
2005	497.44	2.49
Run-I	497.50	2.38
Run-II	497.52	2.34

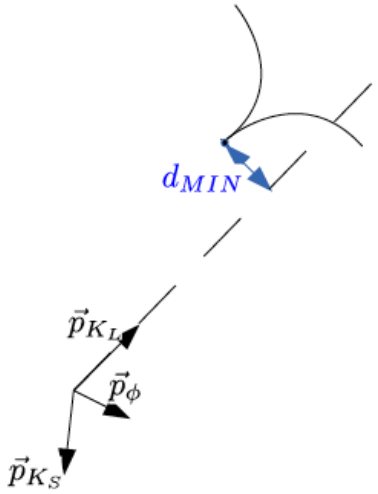


Data quality benchmark (5): $K_S K_L \to \pi^+\pi^- \pi l \nu$; $K_L \to 3\pi^0$

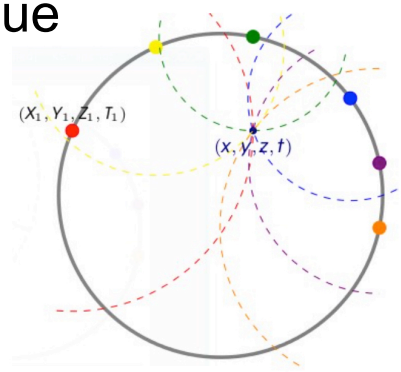
Channels relevant for the direct T and CPT tests

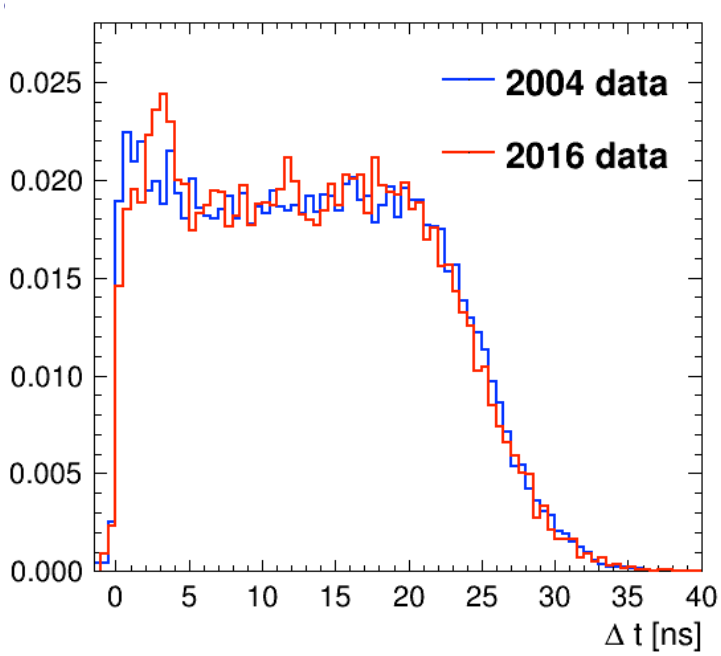
$K_S K_L \to \pi^+\pi^- \pi l \nu$

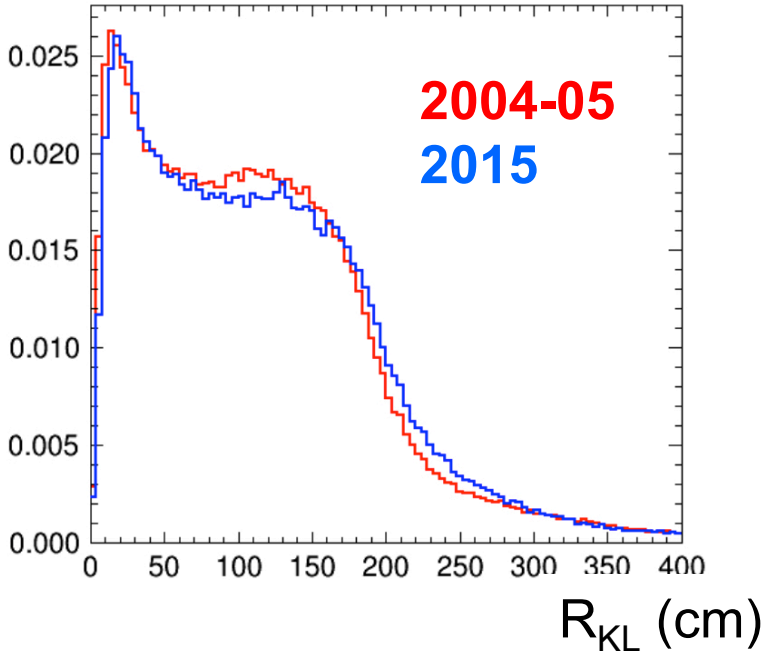
- Select $K_S \to \pi^+\pi^-$
- Look for the vertex with 2 tracks closest to the KL tagging line



$K_L \to 3\pi^0$ decay vertex reconstructed using a "GPS" technique







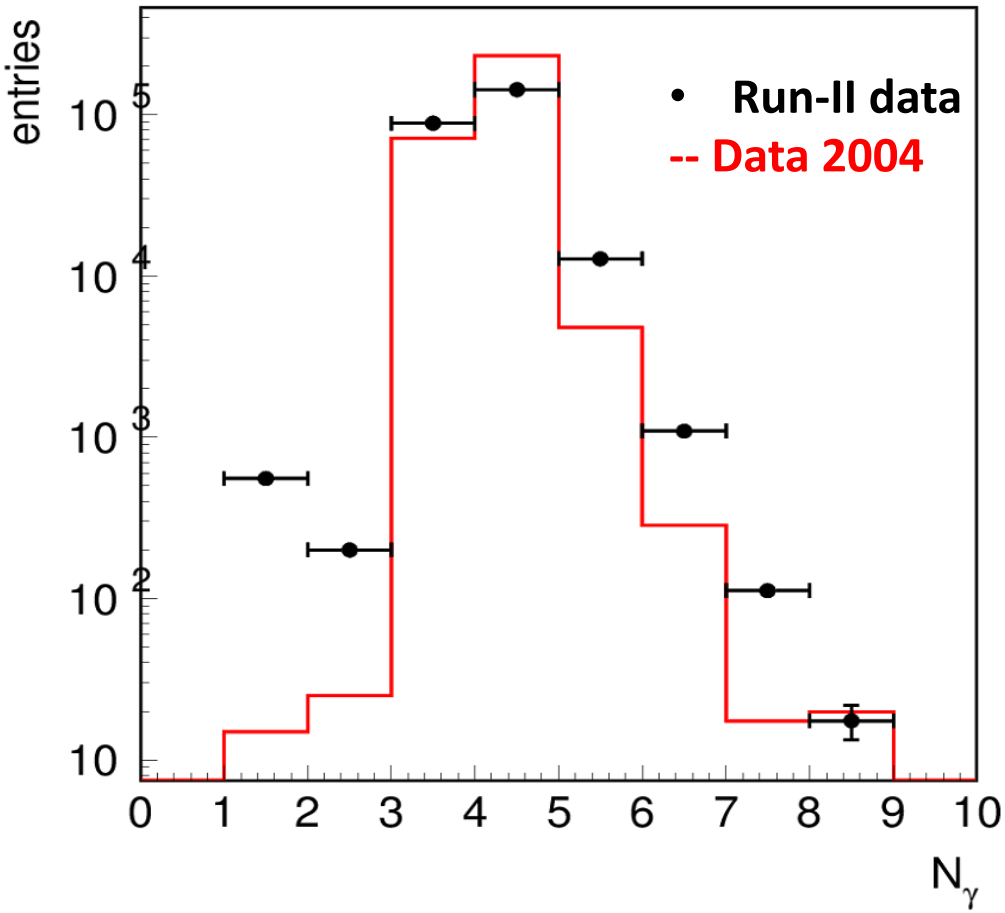
Data Analysis: $K_S \to 3\pi^0$ new data (i)

- Analysed data
  - KLOE-2 data: Run II data: runs 78000-78300; in total 21.89 pb^{-1}
  - KLOE data: runs 30300 (201.9 nb^{-1}), 30301 (199.1 nb^{-1}); in total 0.401 pb^{-1}

- Preselection based on the $K_S \to 3\pi^0$ with the same requirements (at least 3 prompt photons + K_L-crash):
  - K_L-crash: E>100 MeV, $0.17 < \beta < 0.28$
  - prompt photons: $E_{cl} > 7$ MeV;

    $|\cos\theta_{cl}| \leq 0.915$ and

    $|\Delta T_{cl}| \leq \mathrm{Min}(3.5 \cdot \sigma_T(E_{cl}), 2\ \mathrm{ns})$



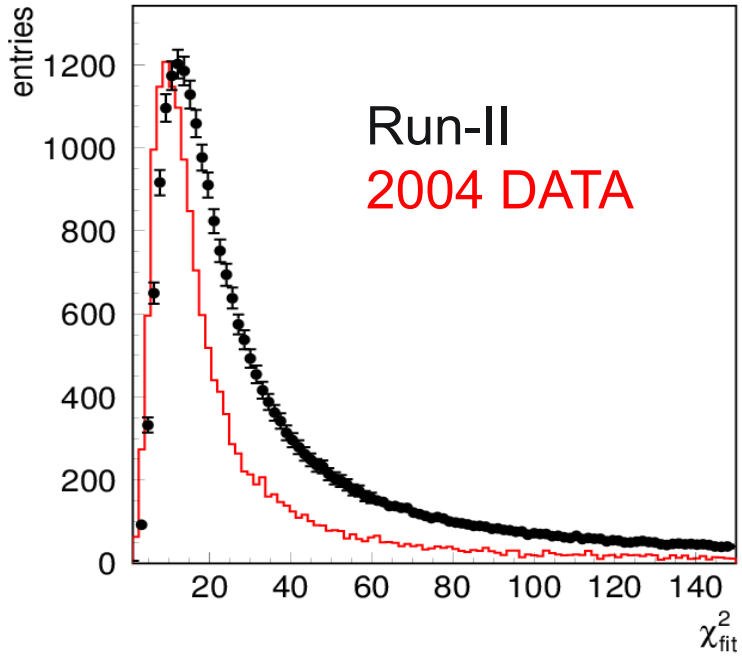
- $K_S \to 2\pi^0$ (4 prompt photons) used for normalization in order to minimize the systematic errors and tag-bias

KLOE set the best upper limit on $BR(K_S \to 3\pi^0) < 2.6 \times 10^{-8}$ with 1.7 fb^{-1} [PLB 723 (2013) 54]

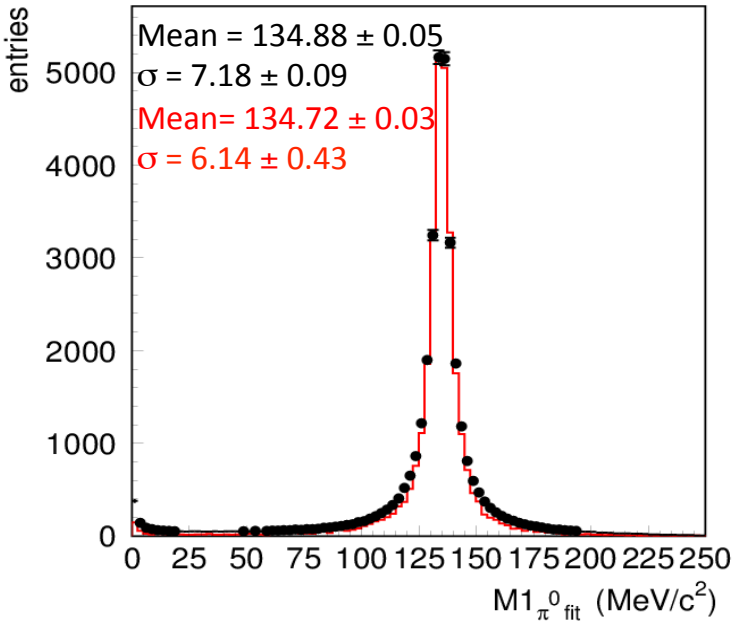
Data Analysis: K_S-> $3\pi^0$ new data (ii)

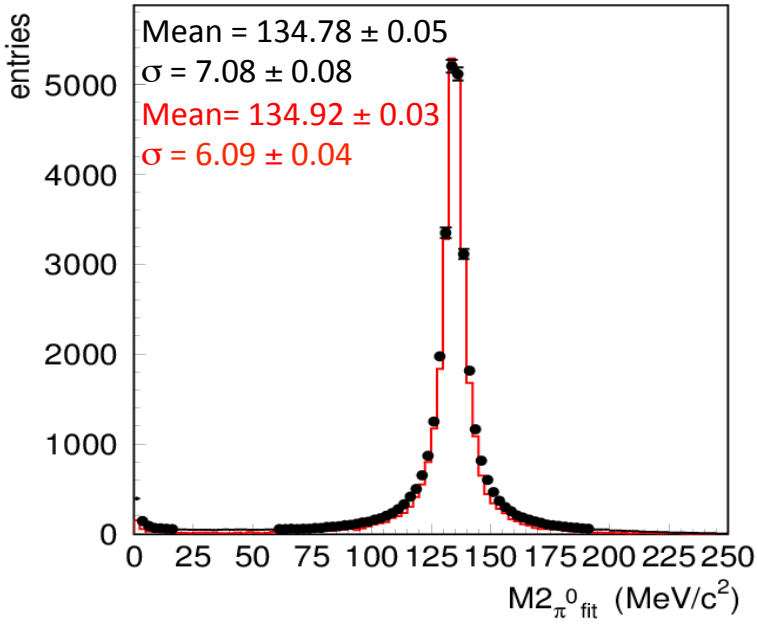
$K_S \rightarrow 2\pi^0$

Normalization sample after kinematic fit



- ✓ 4-momentum conservation
- ✓ K_S mass
- ✓ Energy and timing for photons



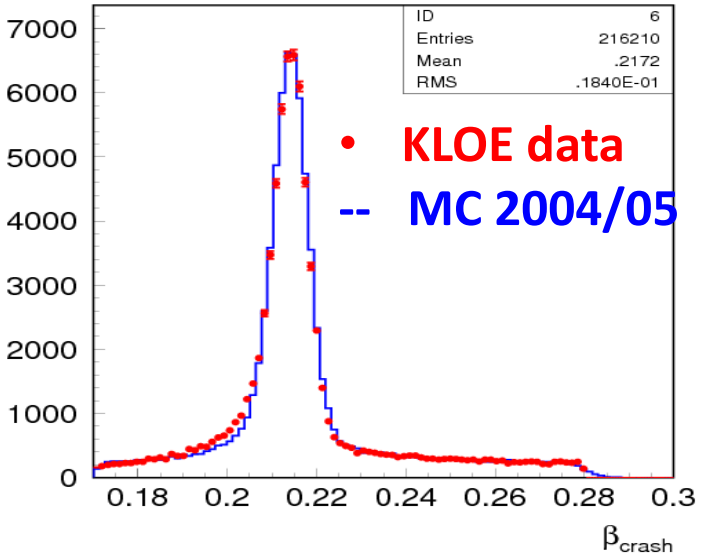


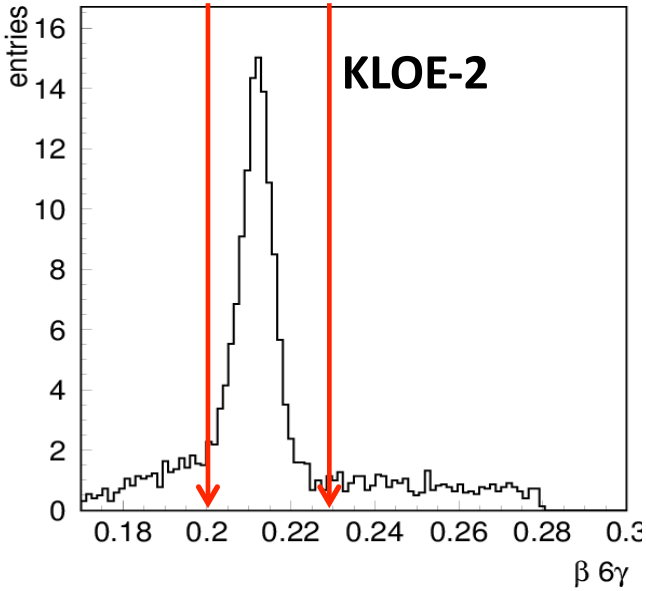
Data Analysis: $K_S \rightarrow 3\pi^0$ new data (iii)

$K_S \rightarrow 3\pi^0$ sample

Hard K_L-crash

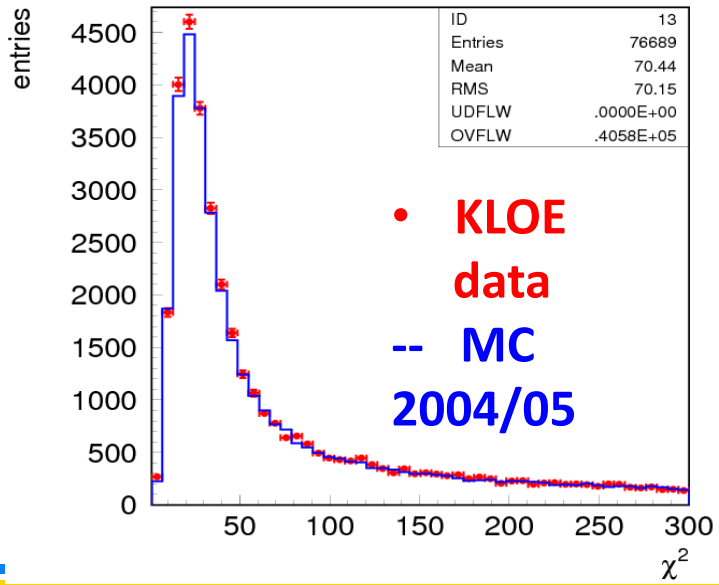
cuts on the velocity of the tagging K_L meson in the Φ rest frame (β) and energy (E_{cr}) of the K_L cluster

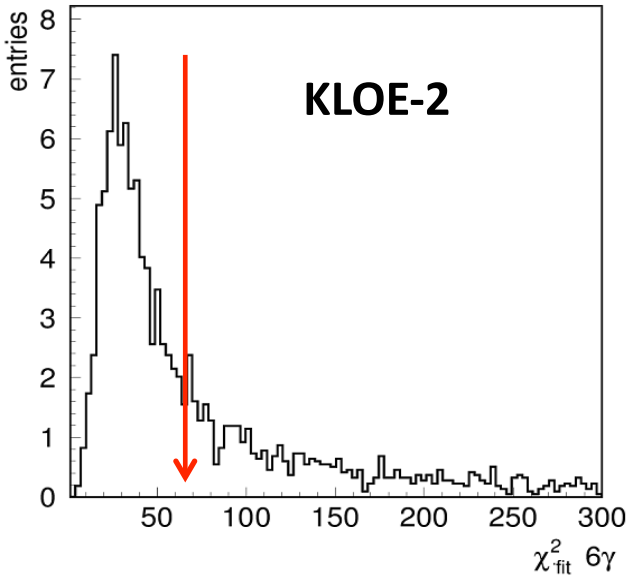




Kinematic fit

K_S mass, total 4-momentum conservation, consistency between the measured time and position of each cluster



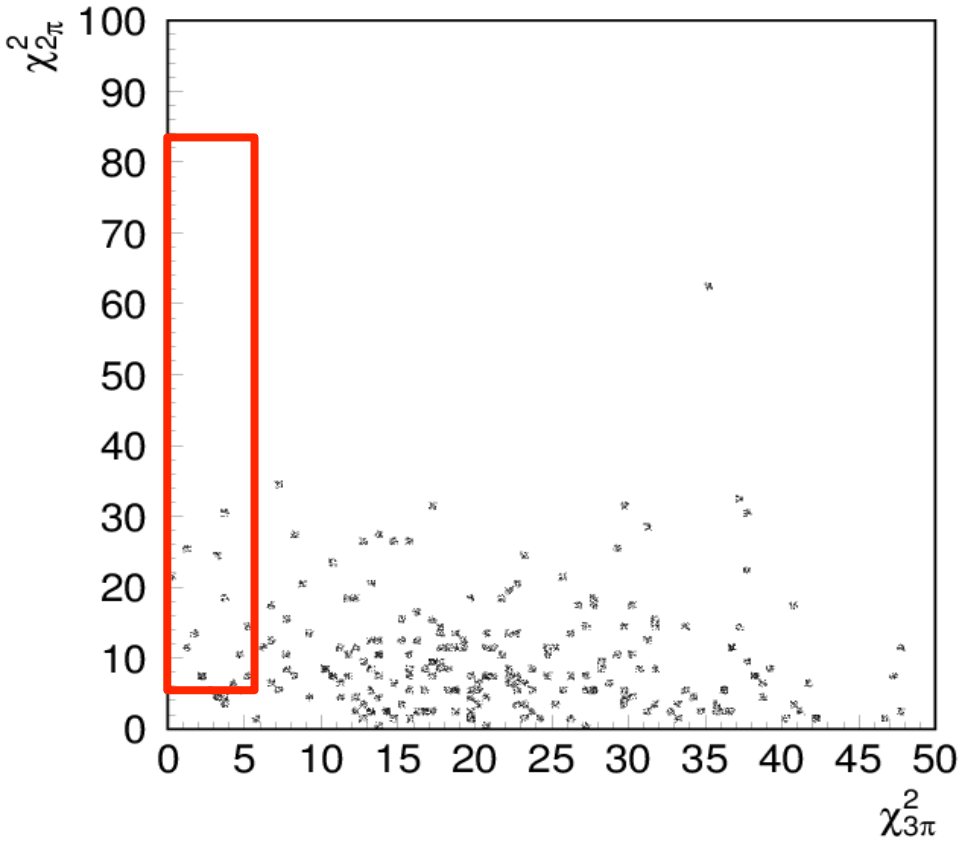


Data Analysis: $K_S \to 3\pi^0$ new data (iv)

Signal region definition

$\chi^2_{2\pi}$: pairing of 4 out of 6 photons (π^0 masses, E_{Ks}, P_{Ks}, angle between π^0's)

$\chi^2_{3\pi}$: pairing of 6 clusters with best π^0 mass estimates



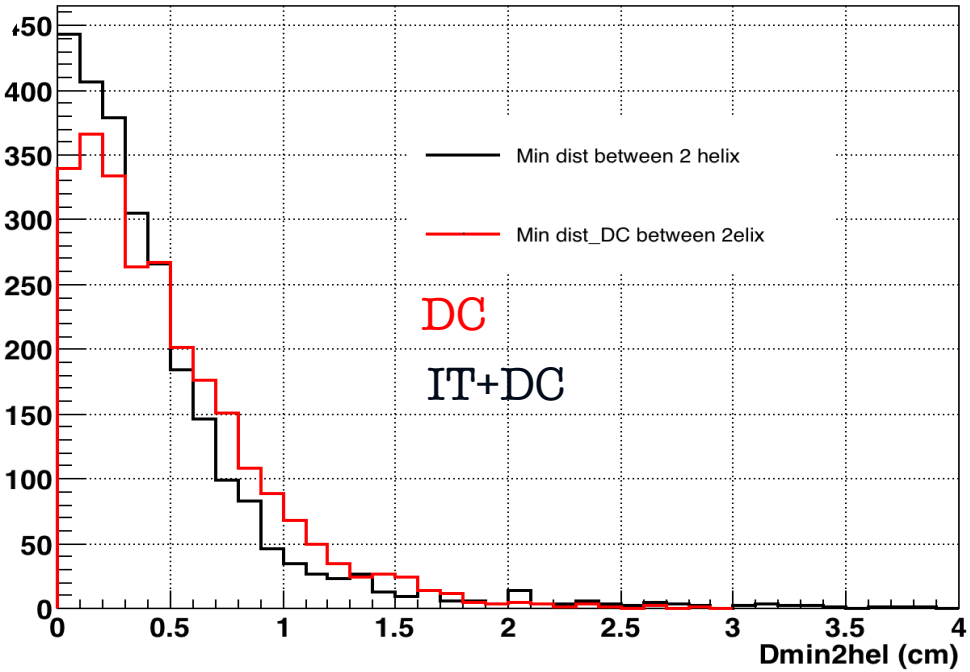
Track Veto → **χ^2_{fit}** → **$\Delta E/\sigma_E$** → **Sbox** → **R_{min}** → **counting**

With old analysis chain and cuts values N_{obs} = 0 event selected as a signal

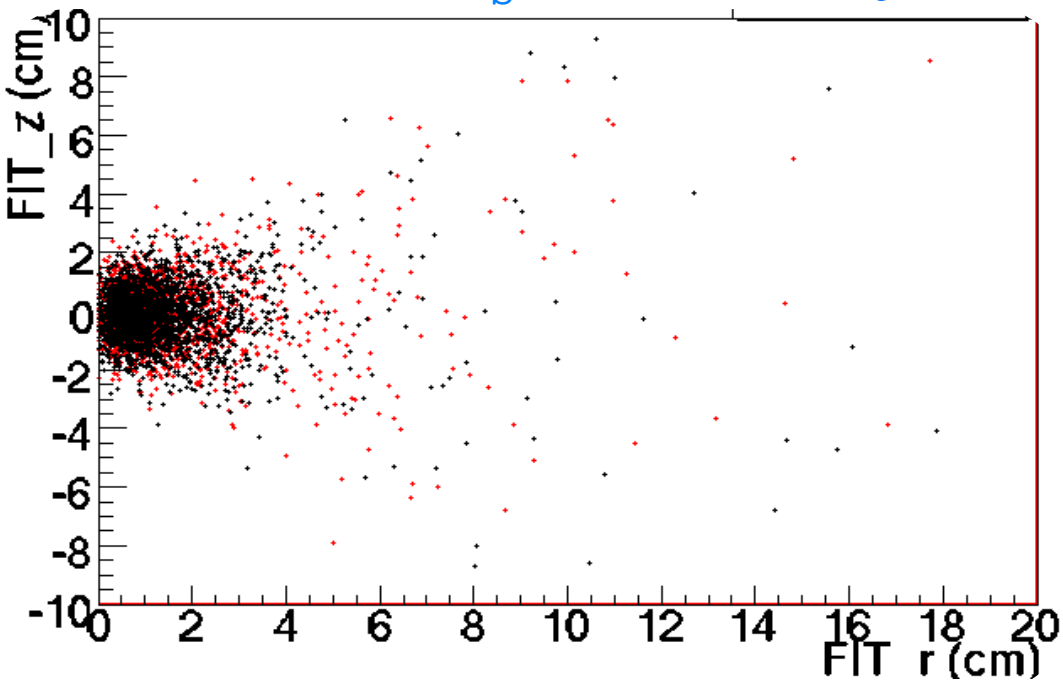
This translates into $O(10^{-6})$ upper limit on $BR(K_S \to 3\pi^0)$ with 20 pb^{-1}

Inner Tracker: integrated DC+IT tracking

- Neutral Kaon data stream and selection of $K_S \rightarrow \pi^+\pi^-$ decays
- Use 1st align & calibration parameters
- Simple vertex finder based on minimum distance between extrapolated tracks
- Comparison between IT+DC and DC simple vertex position



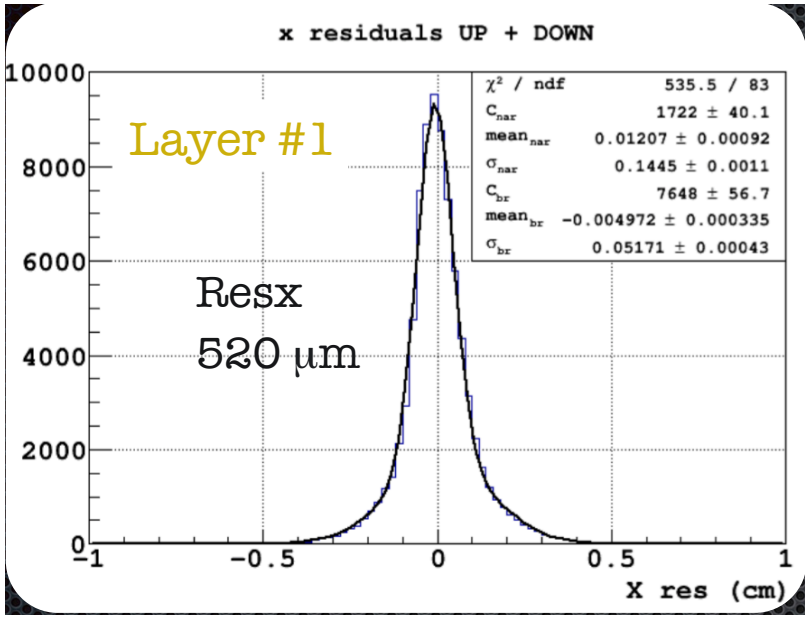
$K_S \rightarrow \pi^+ \pi^-$ decays

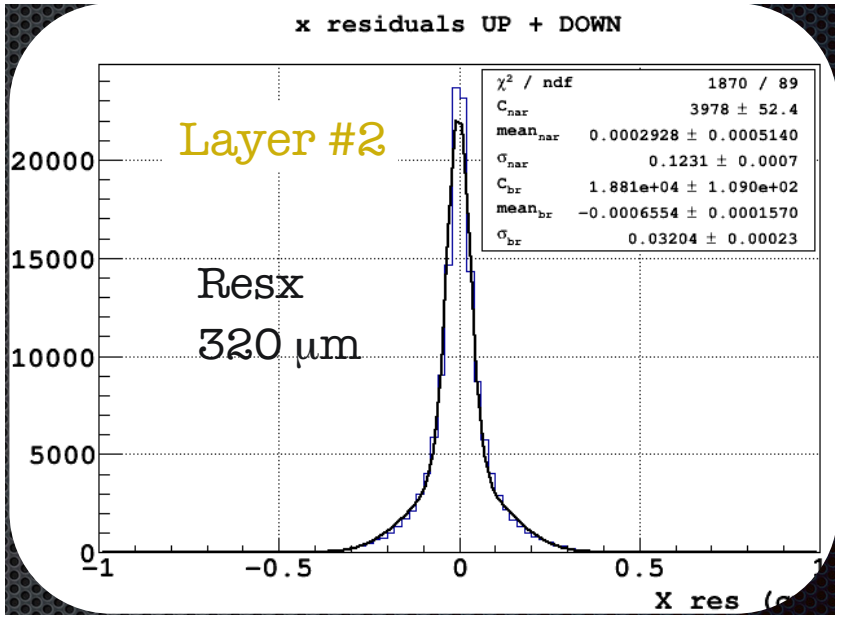


Min distance between helixes

Improving IT calibration

- IT-DC Residuals with cosmic-ray muon sample with B-field off
- Layer #1 Resx ≈ 700 μm and Layer #2 ≈ 400 μm from 1st alignment & calibration





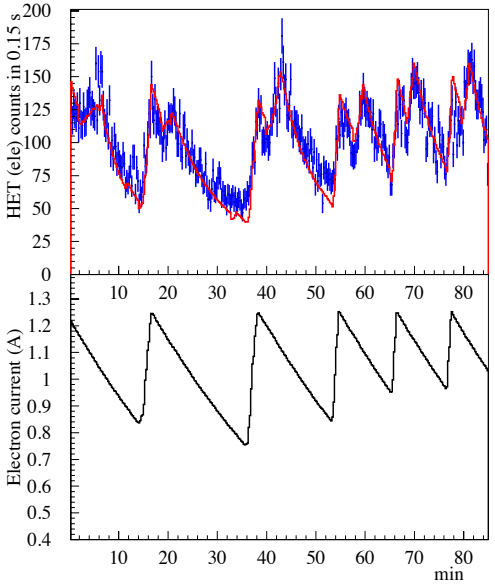
Shift & Rotations & track angle & track E-field corrections

- Still room for improvement from optimization of correction functions. Presently re-running on all layers
- Apply Track-E-field correction to all layers
- Update accordingly align & calibration from cosmic-ray muon data with B-field
- Check with Bhabha scattering events and include in Kalman

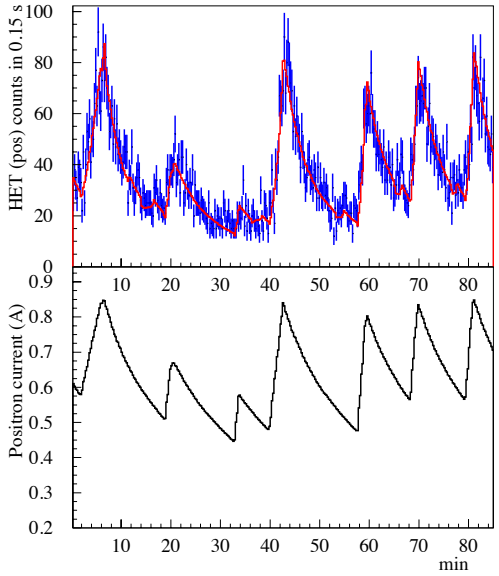
Status of High Energy Tagger

No Collision run

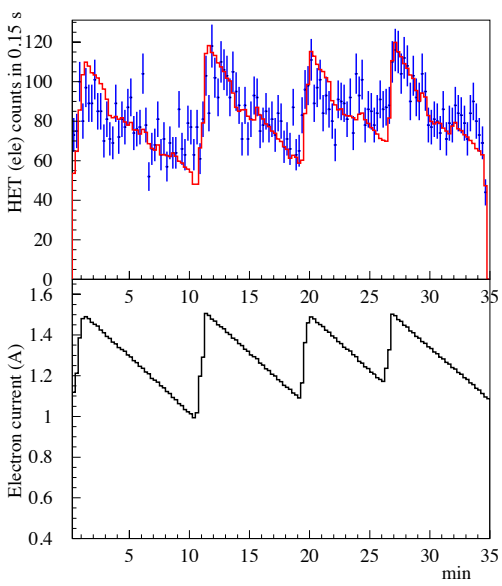
e- 2015



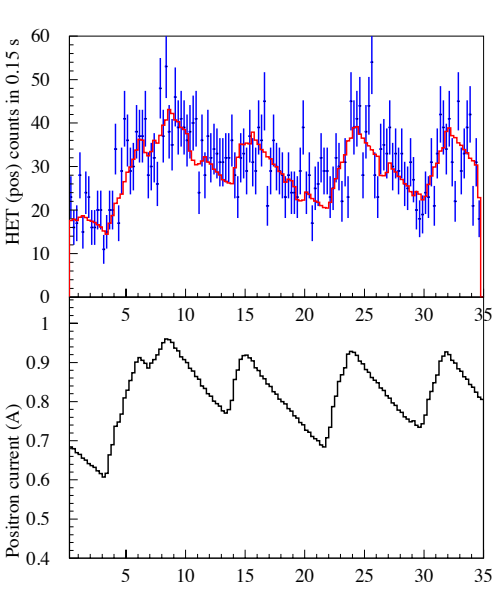
e+ 2015



e- 2016



e+ 2016



- data
- expected

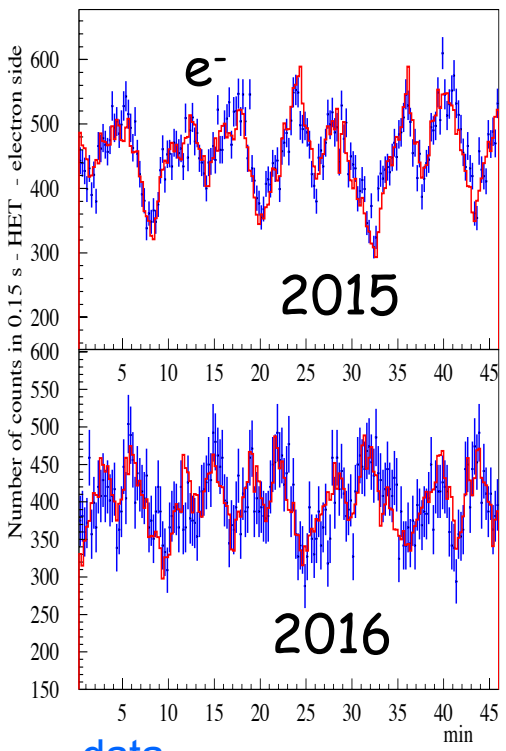
HET-Rate=
KLOE-Trigger-Rate x
$(\alpha_{ele/pos}\,\mathcal{L} + \beta_{ele/pos}\,I^2_{ele/pos})$

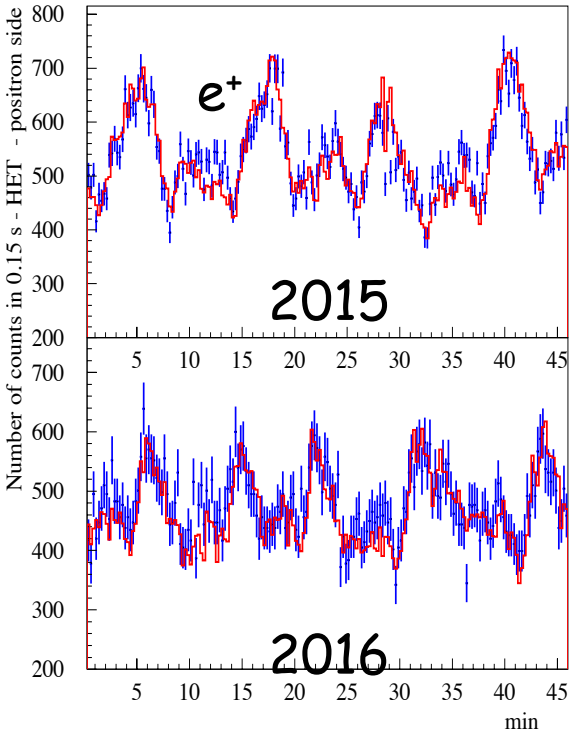
Running at : $\mathcal{L}$=0.2nb^{-1}s^{-1} and I=1A and R_{trig}=1kHz

	2015(e^-)	2016(e^-)	2015(e^+)	2016(e^+)
α	320	290	490	425
β	93	61	88	53
α/β	3.44	4.75	5.57	8.01

Status of High Energy Tagger

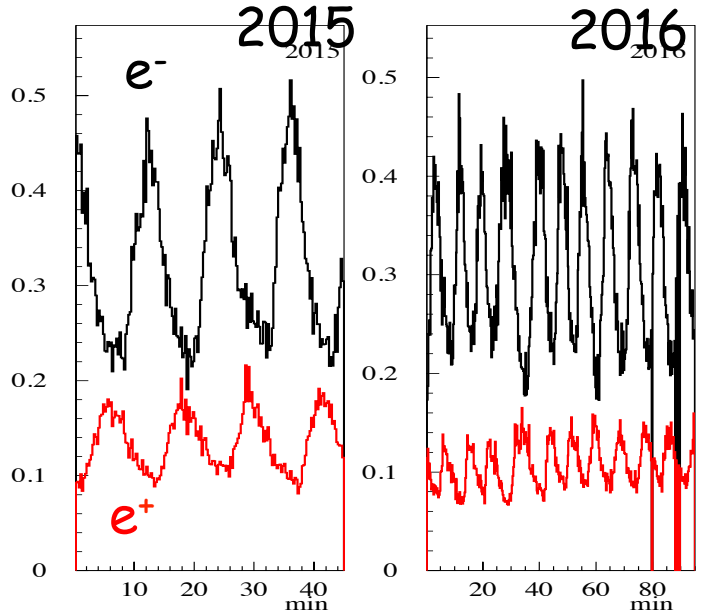
Collision run





- data
- expected

Touschek contribution normalized to the total rate



HET-Rate= KLOE-Trigger-Rate x ($\alpha_{ele/pos}\,\mathcal{L} + \beta_{ele/pos}\,I^2_{ele/pos}$)

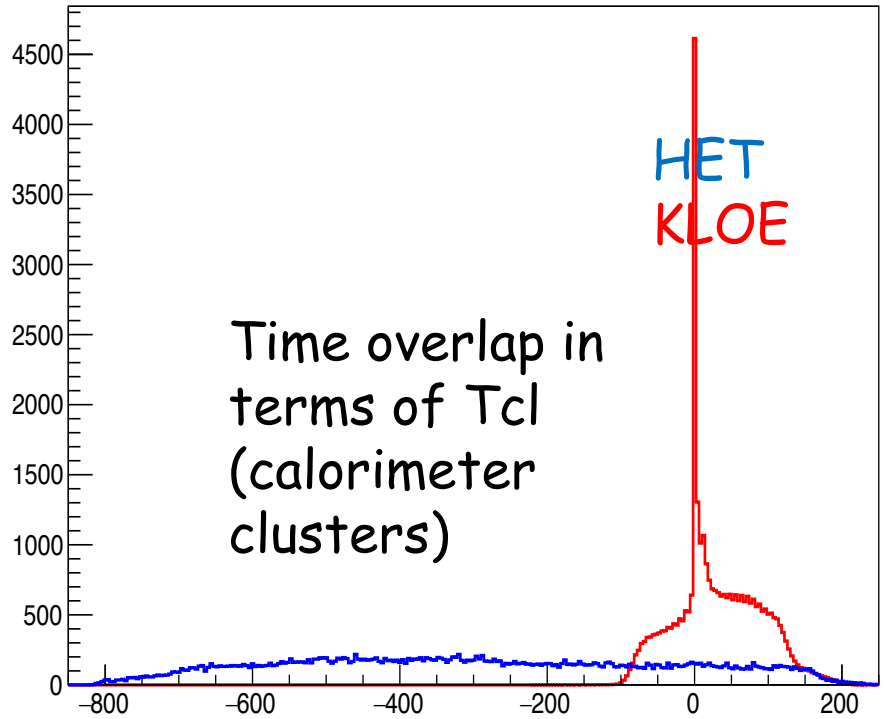
Running at : $\mathcal{L}$=0.2nb^{-1}s^{-1} and I=1A and R_{trig}=1kHz

	2015(e^-)	2016(e^-)	2015(e^+)	2016(e^+)
α	320	290	490	425
β	93	61	88	53
α/β	3.44	4.75	5.57	8.01

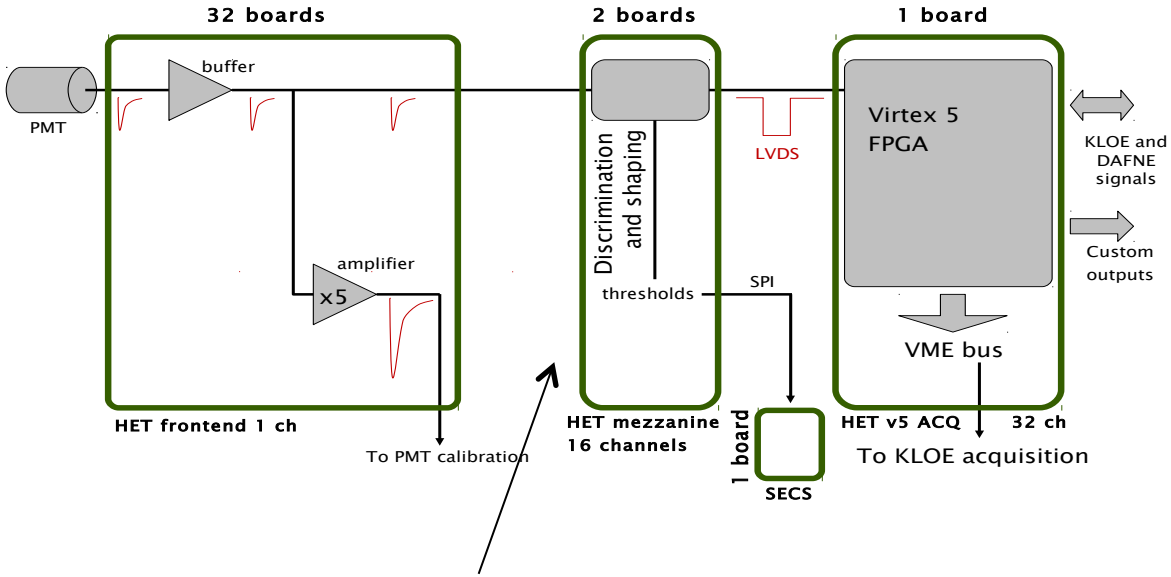
Status of High Energy Tagger

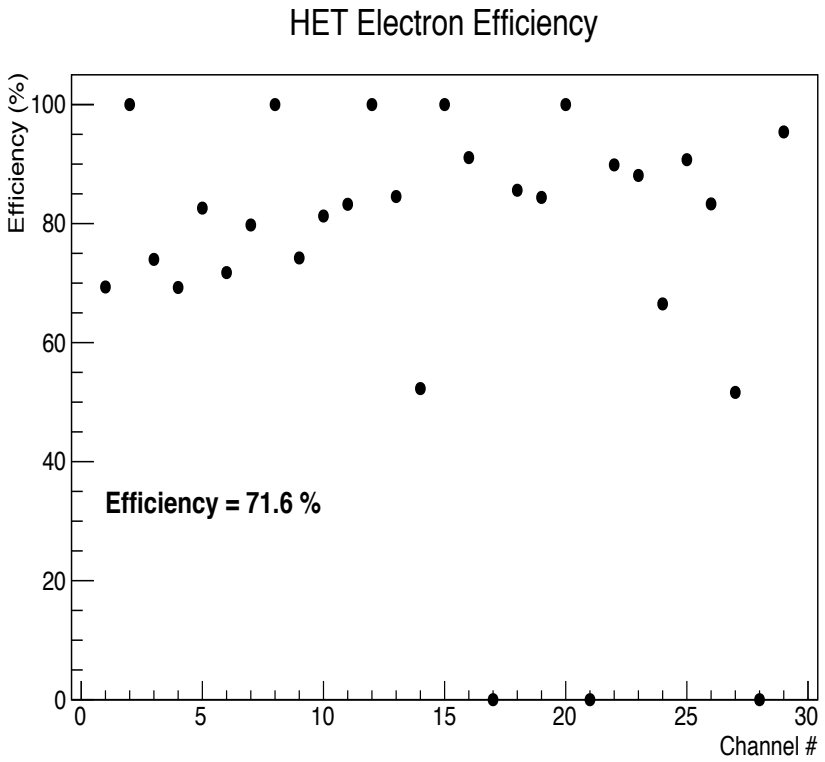
Check of Time window overlap HETe$^-$(e$^+$) - KLOE

Long Plastic from HETs is also acquired by KLOE TDC



Status of High Energy Tagger





- Discriminators provide output signal with a width ~ 2 ns in order to discriminate 2 consecutive bunches in DAΦNE (2.7 ns)
- New discriminators are being built with (i) optimized input stage and coupling, and (ii) addition of a GND layer to improve noise reduction

- they are planned to be ready and installed in the next weeks

Conclusions

- Data taking (RUN-III) started on 12 September (KLOE-2 detector fully operational): L delivered up to now 3.45 fb^{-1}, acquired L~2.76 fb-1
- Next milestone L delivered 5 fb-1 for summer 2017.
- KLOE-2 requirement remains more than 5 fb^{-1} of good acquired luminosity => L delivered > 6.2 fb^{-1}.
- KLOE-2 workshop has been very successful. KLOE-2 Physics program is confirmed to be very interesting and rich. New ideas and proposals (e.g. new CPT tests, search for invisible U boson, search for e+e- => η' at sqrt(s)=958 MeV …)
- Data quality is monitored along the runs and with several benchmark analysis.
- Some analyses have already started (K_S->$3\pi^0$, η decays etc..)
- According to last Scientific Committee recommendations we provided to our referees detailed reports on the status of IT and HET.
- First version of reconstruction with IT+DC tracking & official vertexing ready. Studying IT+DC integrated tracking performance with Bhabha evts and kaon decays. Refining of alignment and calibration in progress.
- HET calibrated with dedicated runs and continuously monitored; KLOE-HET check of time window overlap successfully done; analysis in progress; new discriminators are being installed.