

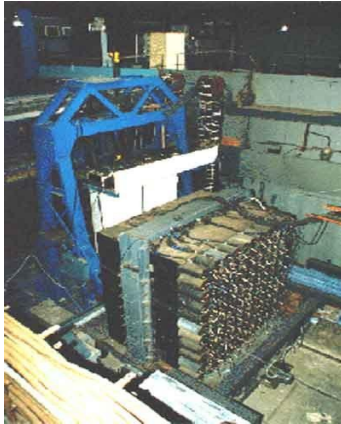
OKA:

Status of the experimental program
with RF-separated K beam at U-70
Protvino, Russia.

V.F. Kurshetsov, IHEP, Protvino

Representing the OKA collaboration (IHEP-INR-JINR-...)

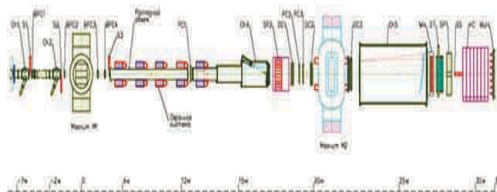
GAMS: Meson Spectroscopy



SPHINX: Baryon Spectroscopy



ISTRA+: Kaon Decays



OKA



Experiments with KAons

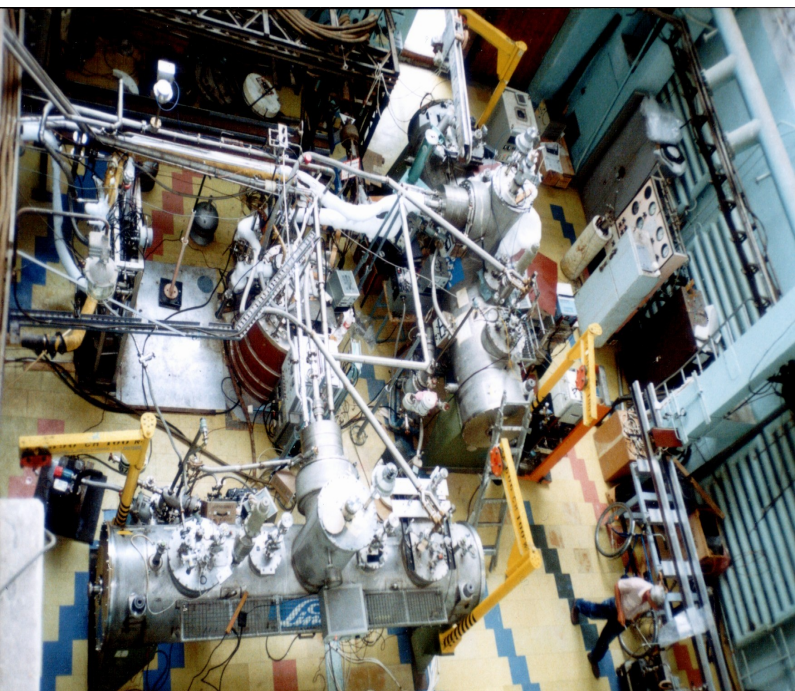
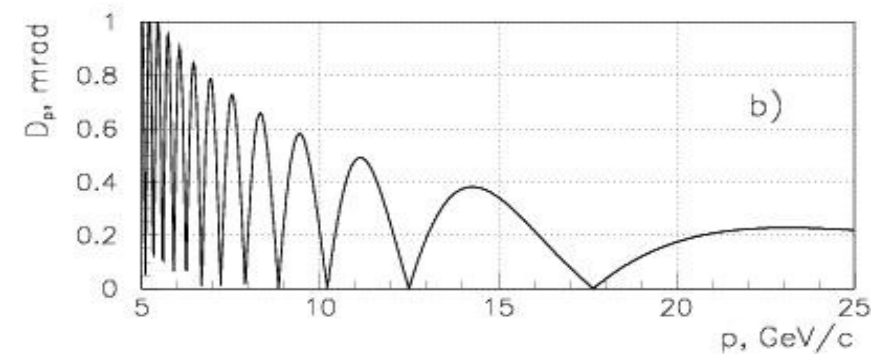
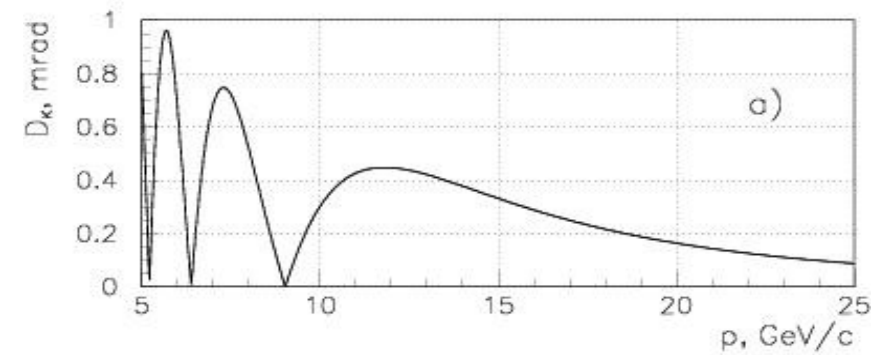
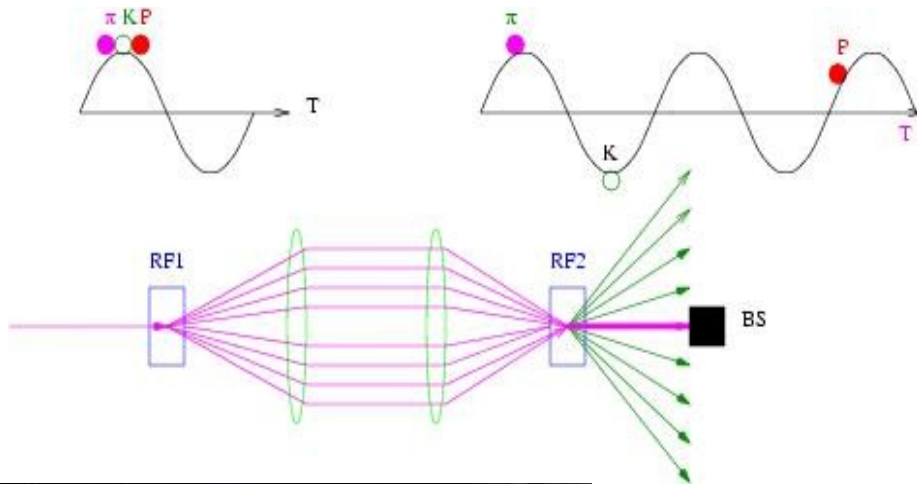
Last status OKA report at KAON's:
V.F. Obraztsov, KAON-05, Evanston, 17 June 2005

A detailed description of the project, its history, possible parameters of the beam and OKA setup as well as physical program, as we understood it at that time, can be found there.

Conclusions from his report:

1. The construction of the RF separated high energy kaon beam at IHEP, Protvino is close to completion.... The complex startup of the separated beam is scheduled for December 2005.
2. The experimental setup is under construction.

Scheme of RF-separation (Panofsky).



RF Separators during low temperature tests

Channel 21K



Хвост канала 21K

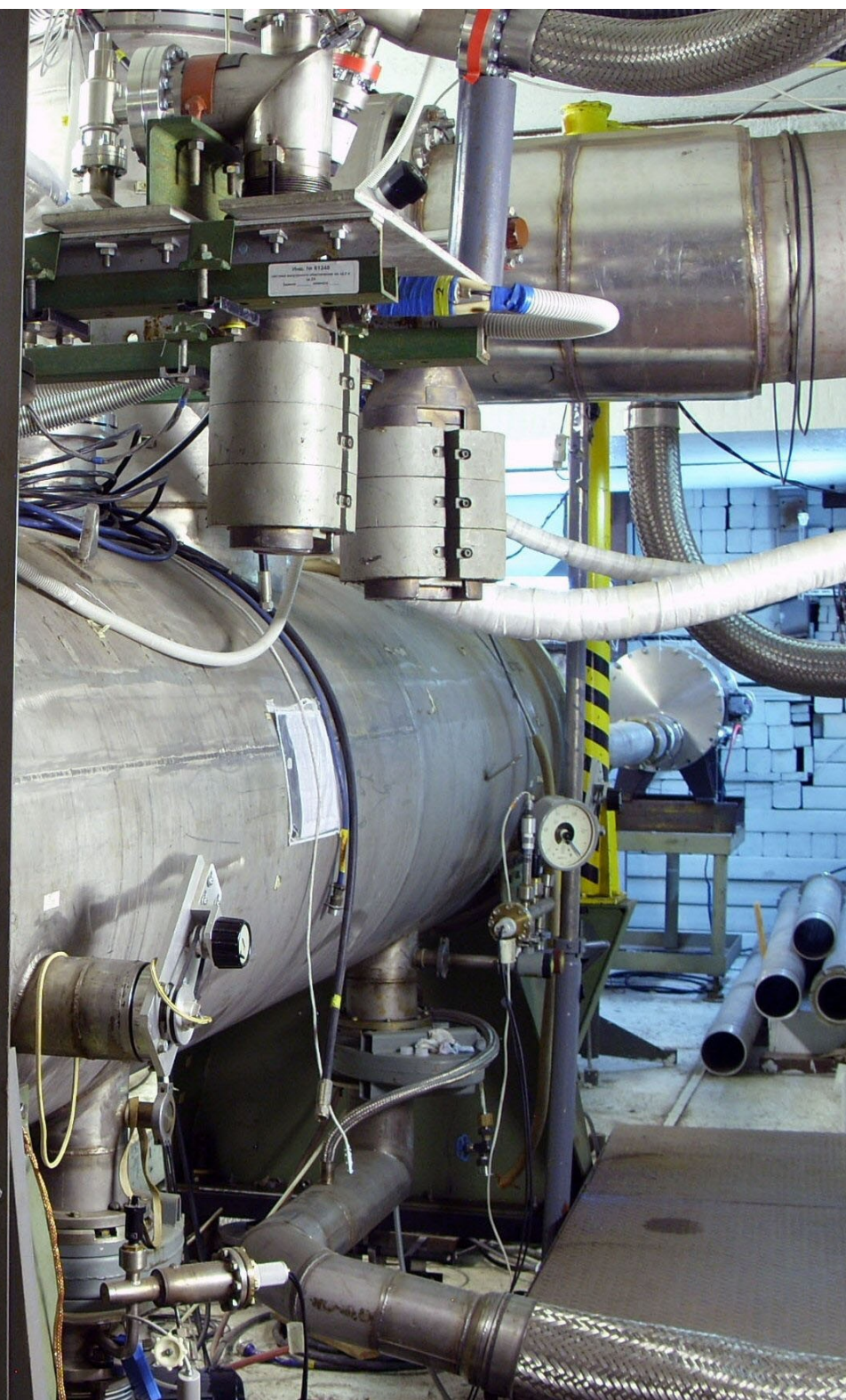
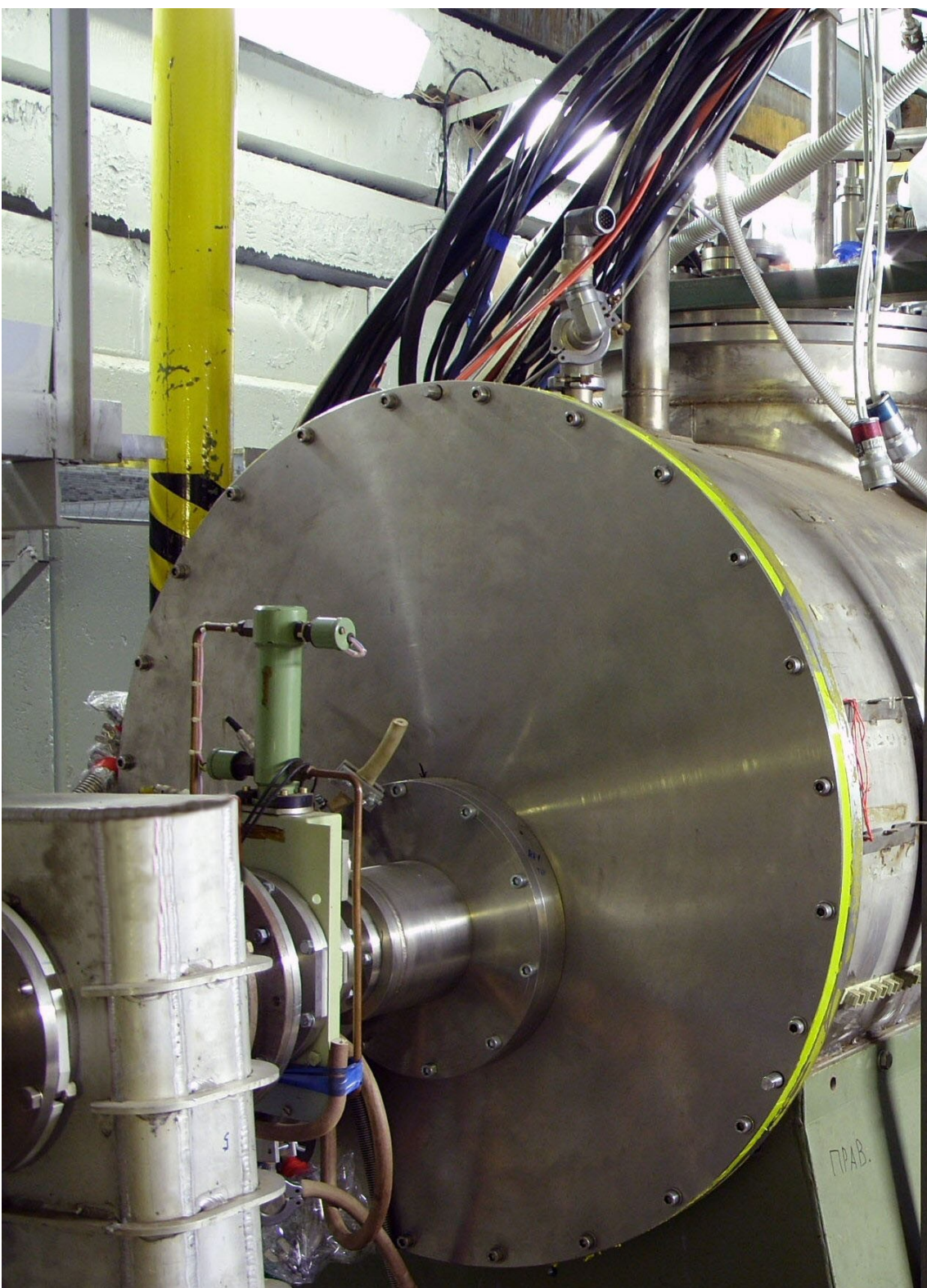


Криогенная система канала 21K



**Высокочастотный
сверхпроводящий резонатор RF2**





Runs at OKA

Run 1 — Dec 2004

Run 2 — Dec 2005

Run 3 — Dec 2006

Run 4 — Dec 2007 *

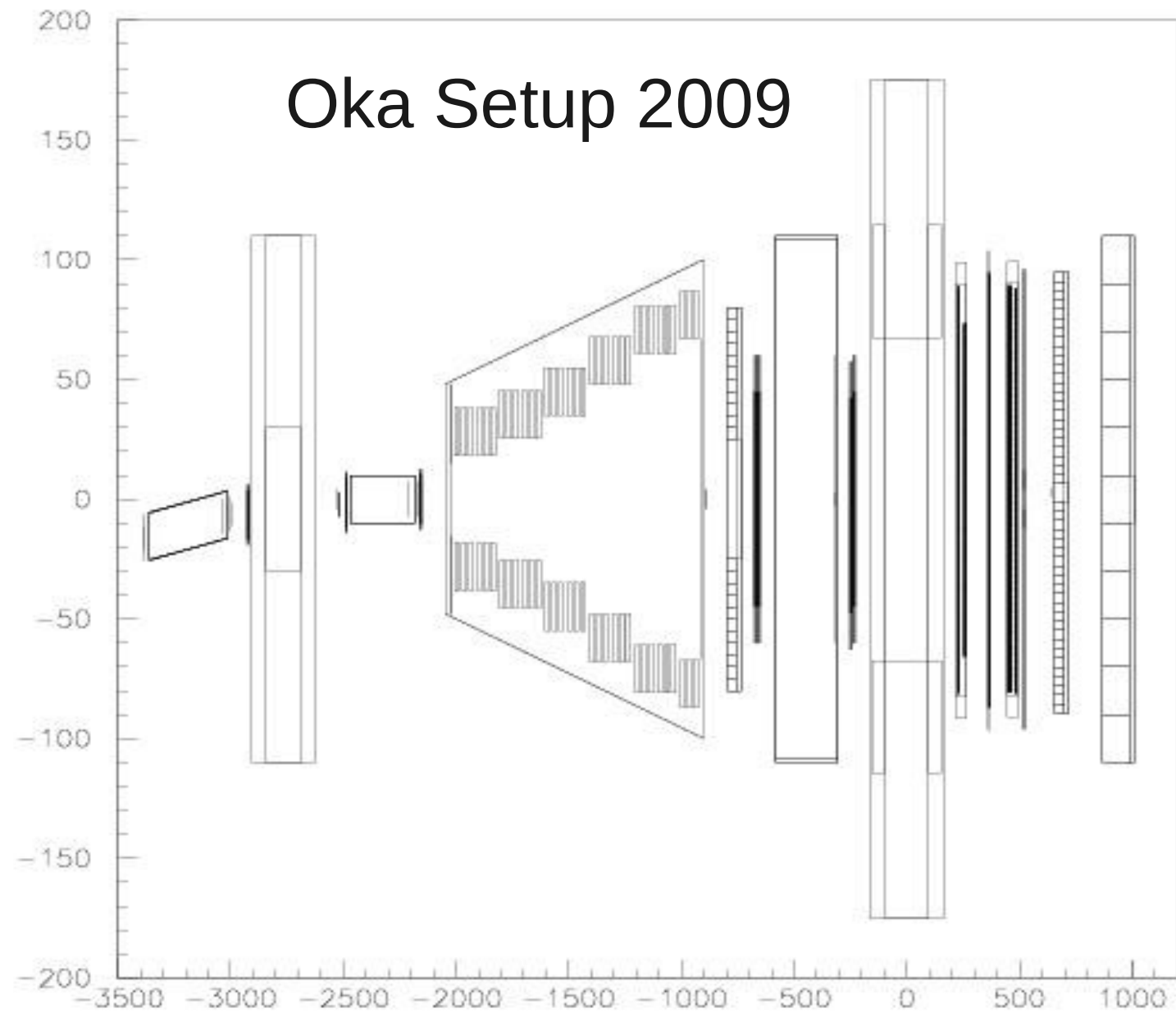
Run 5 — Apr 2008

Run 6 — Dec 2008 **

Run 7 — Apr 2009 **

	Project	December 2007	December 2008	April 2009
RF1, MV/m	1,00	0,32	0,59	0,55
RF2, MV/m	1,00	0,56 (~ 0,90)	0,92	0,91

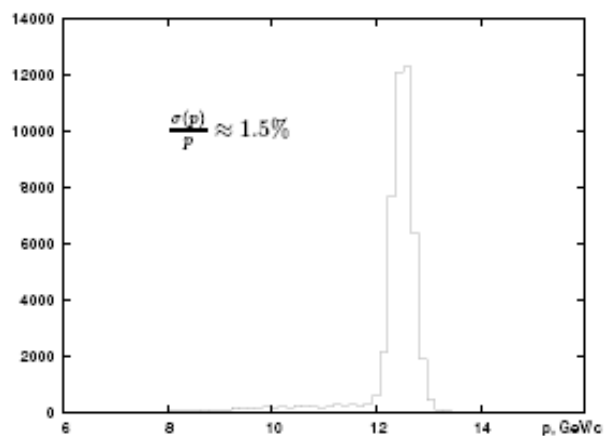
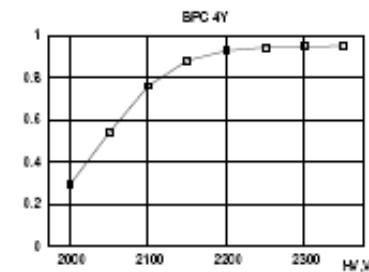
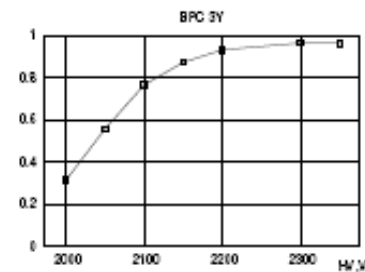
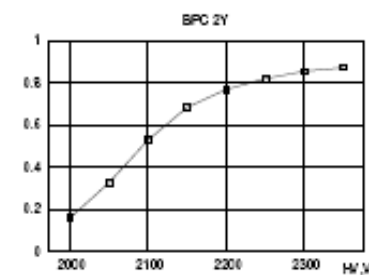
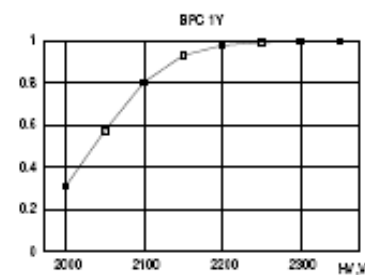
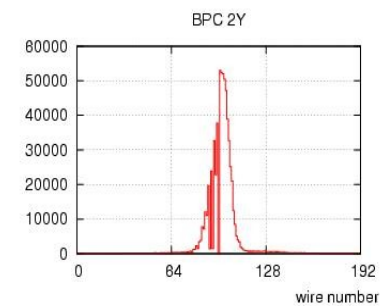
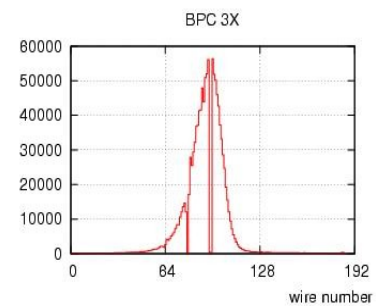
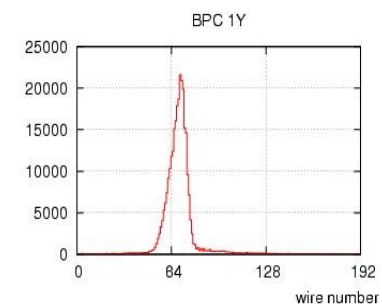
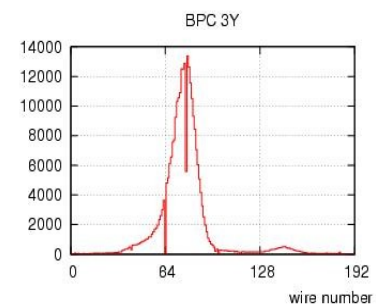
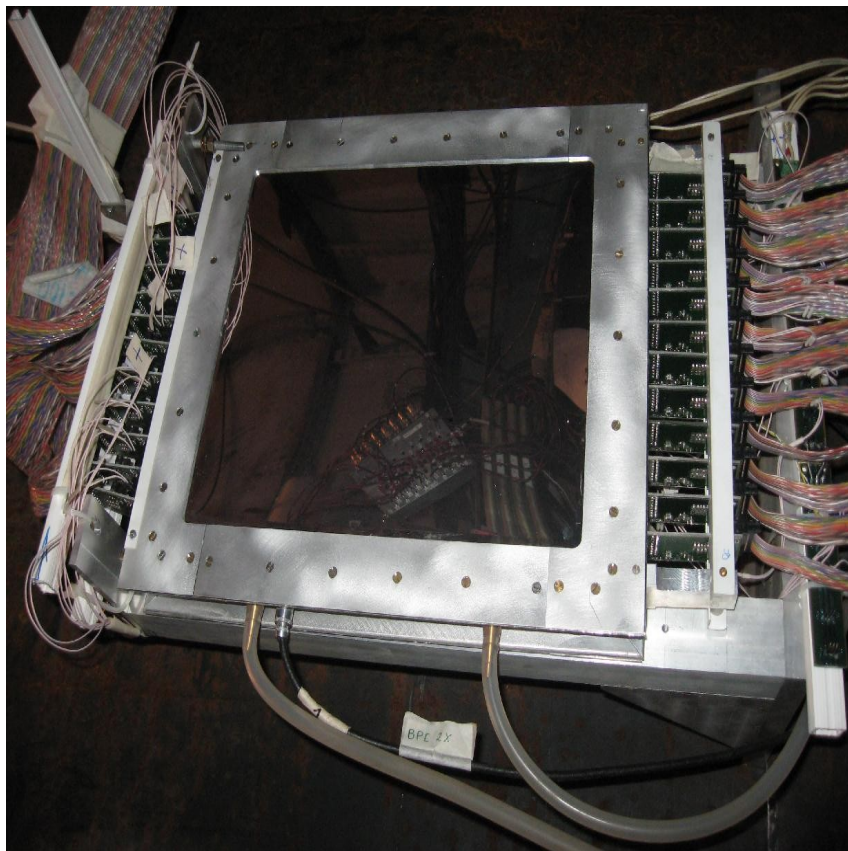
Oka Setup 2009



OKA setup at U-70

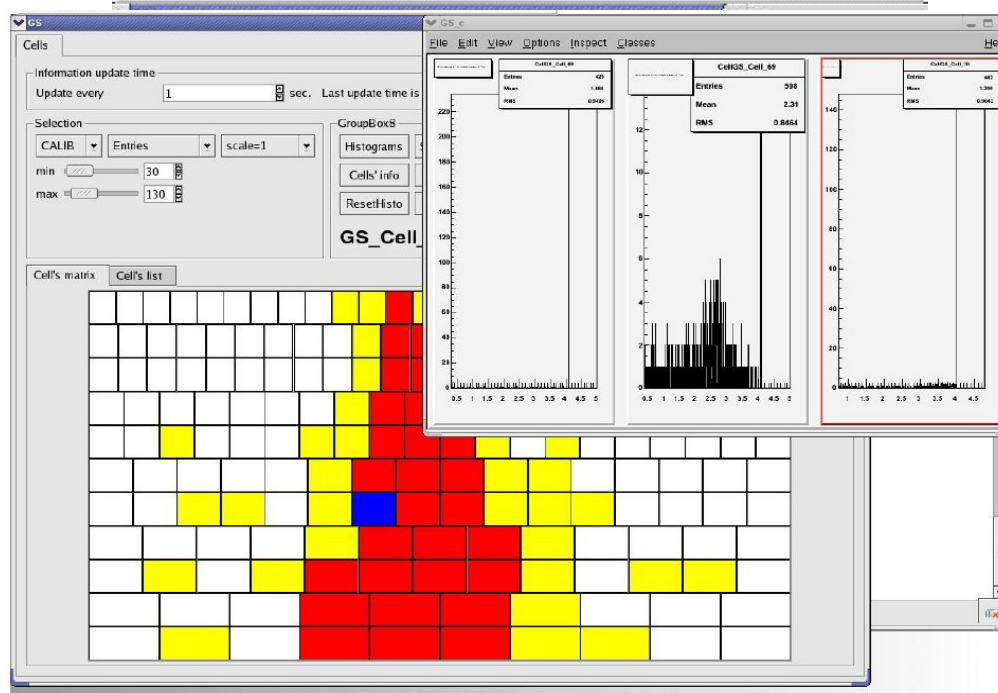
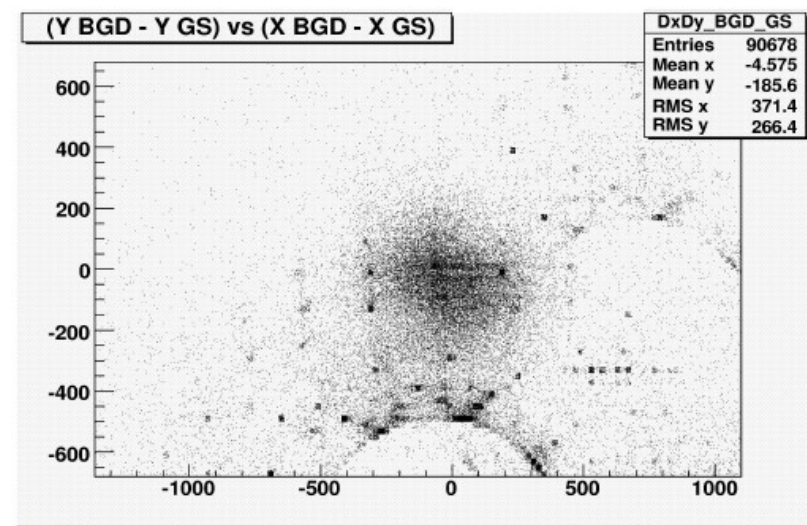
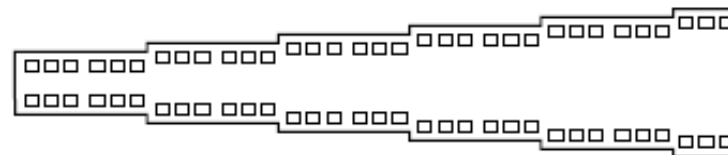
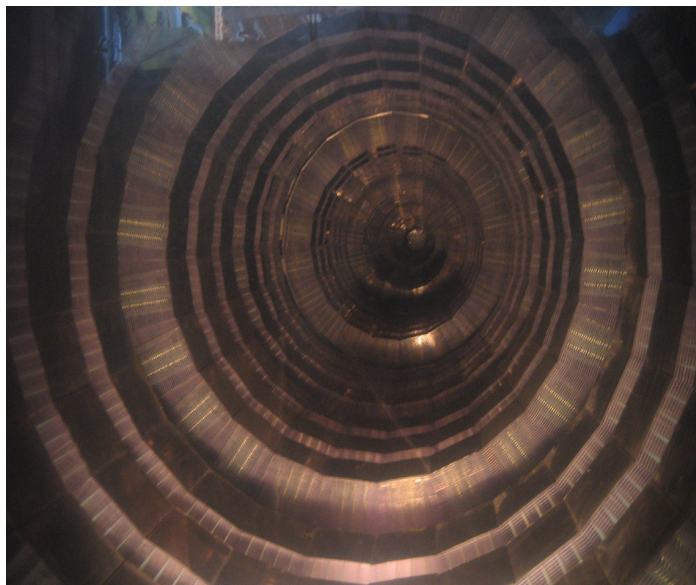
1. Beam spectrometer:
1mm pitch PC, ~1500 channels; Cherenkov counters
2. Decay volume with veto system:
11m; Veto: 670 Lead-Scintillator sandwiches 20* (5mm Sc+1.5 mm Pb), WLS readout
3. PC's and DT's for magnetic spectrometer:
~5000 ch. PC (2 mm pitch) + 1300 DT (1 and 3 cm)
4. Pad Hodoscope ~300 ch.
5. Magnet: aperture 200*140 cm²
6. Gamma detectors:
GAMS2000, EHS-backward EM cal. ~ 4000 LG+ 256PWO crystals.
7. Muon identification:
GDA-100 + 4 muon trigger counters

Beam Spectrometer



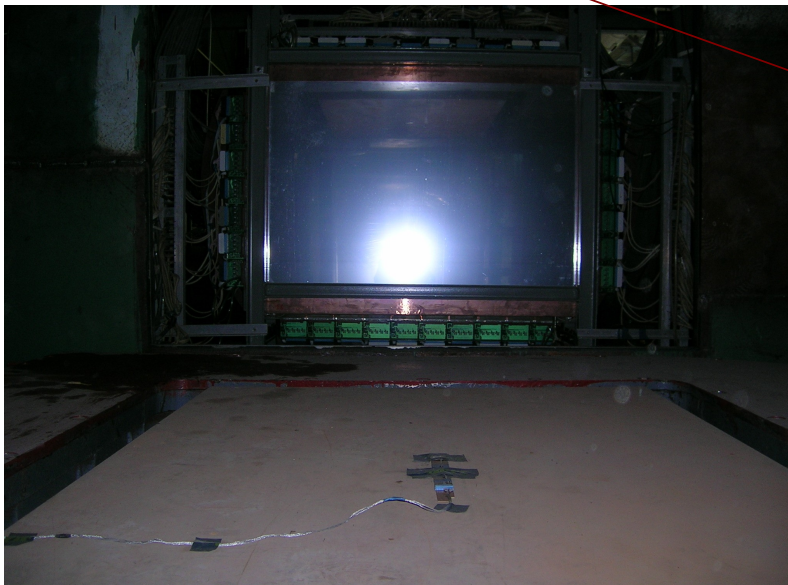
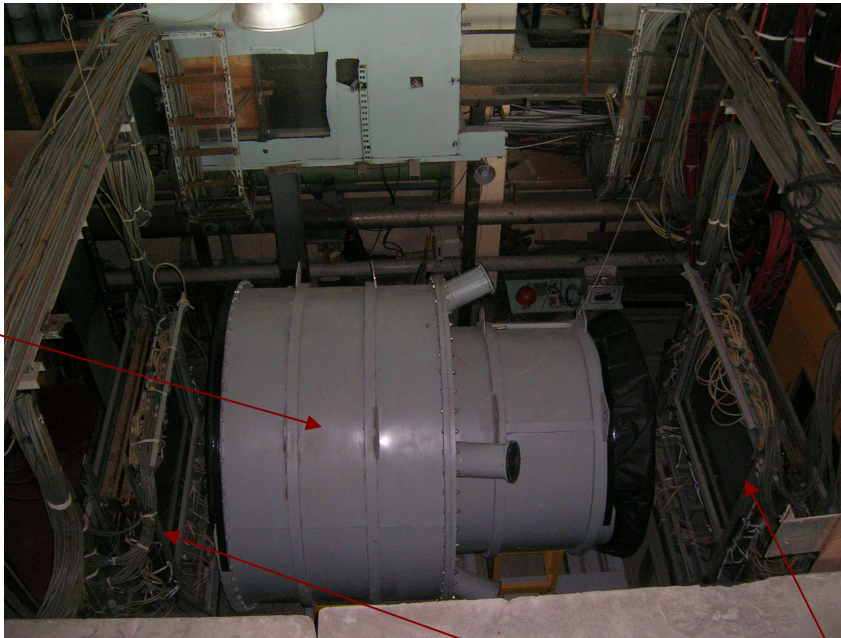
Veto System

(5mm Sc.+1.5 mm Pb)×21 Full length ~ 11 m., 191 ΦЭУ(PM)-84

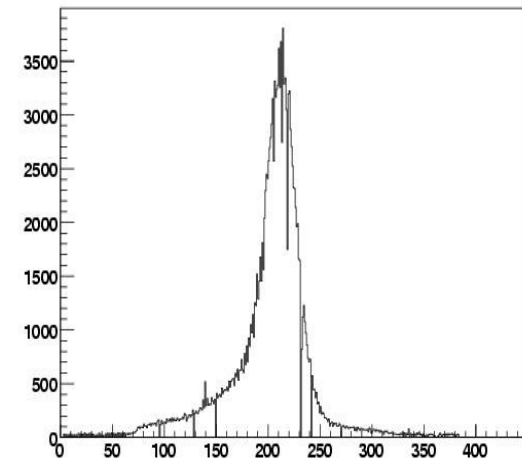


BIG Cherenkov Counter (C3), BIG PC

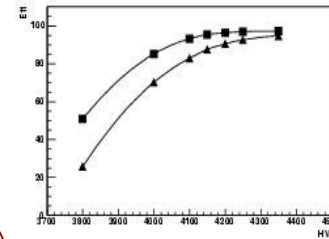
$\epsilon_e \sim 95\%$



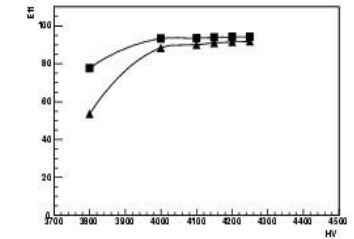
pcd11y prot2



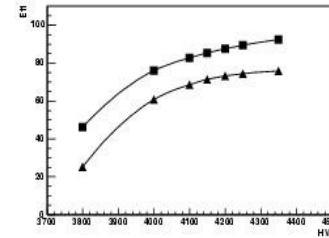
pcd11y



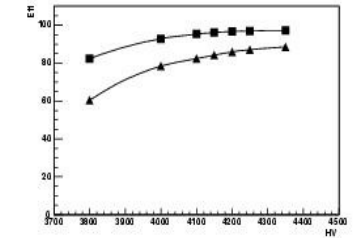
pcd12x



pcd13x



pcd14y



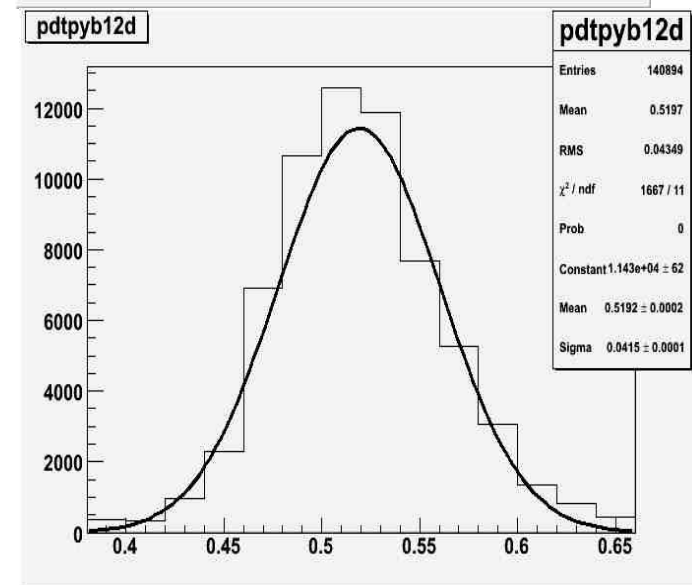
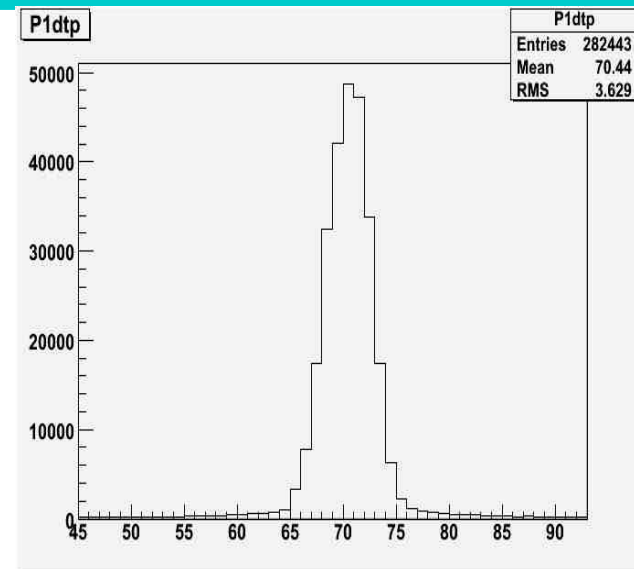
Profile and threshold curves of Big PC

$\text{Ar:lb:Fr}_{12} = 70\%:28.8\%:0.2\%$

Straw-tubes

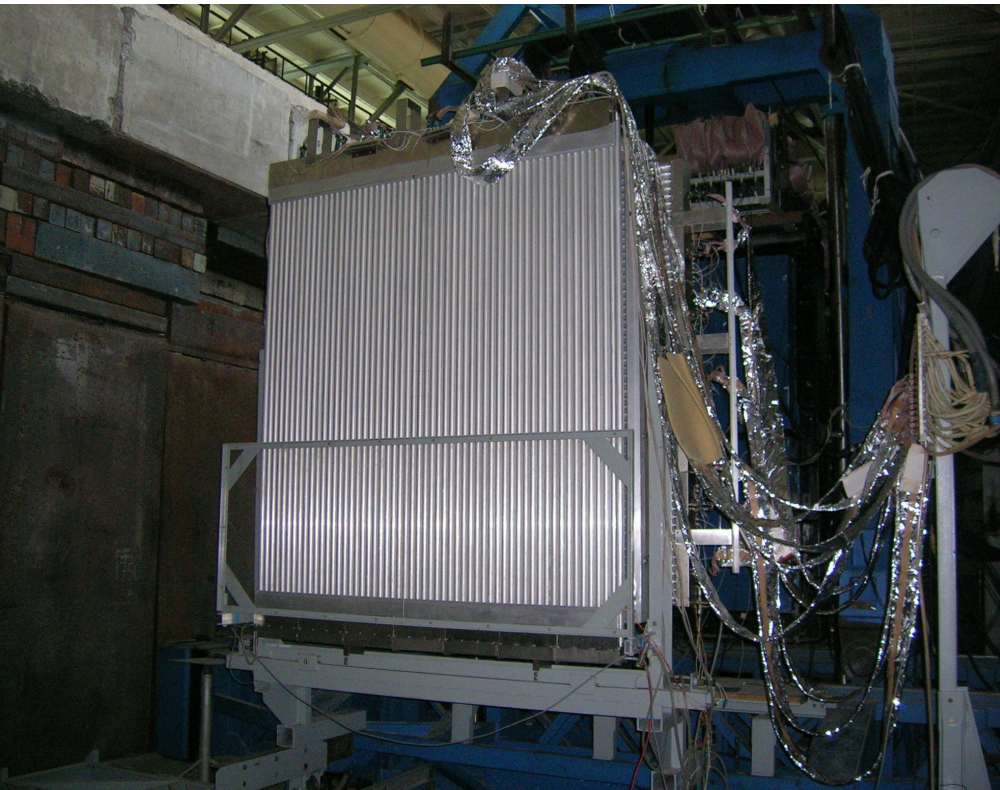


Produced in Dubna (V.D. Peshekhonov) 2 planes
 140x140 cm² + 1 plane 180x180 cm² two layers 9mm straw-tubes, 920 channels overall. Gas mixture Ar:CO₂ 80%:20%

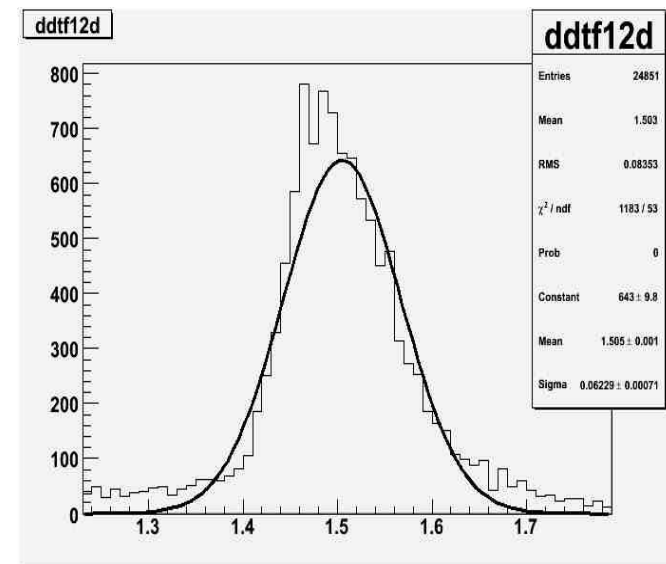
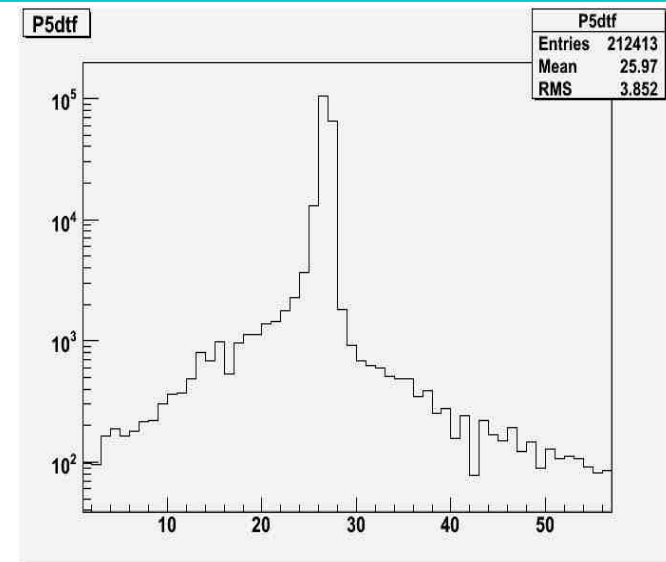


Space resolution $\sigma \sim 300 \mu\text{m}$
 (an error is dominated by TDC bin (5 nsec ,LE-78))

Drift Tubes

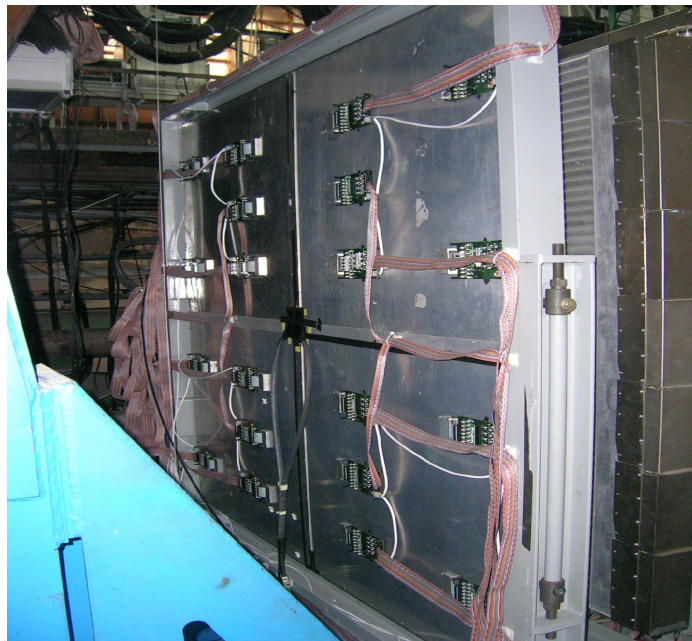


Two planes, each plane — 3 layers of 56 3cm tubes, 336 channels overall. Gas Mixture
Ar:CO₂ 88%:12%

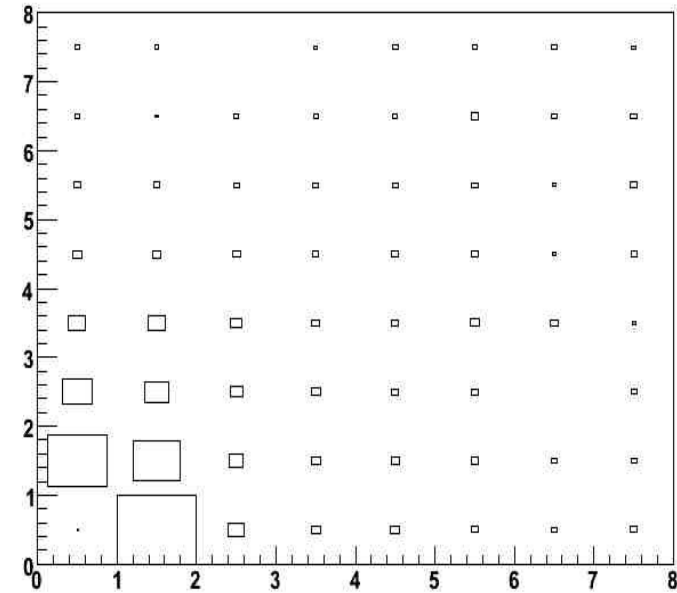


Space resolution $\sigma \sim 400 \mu\text{m}$ (an error is dominated by TDC bin (5 nsec, LE-78))

Pad Hodoscope INR-RAS



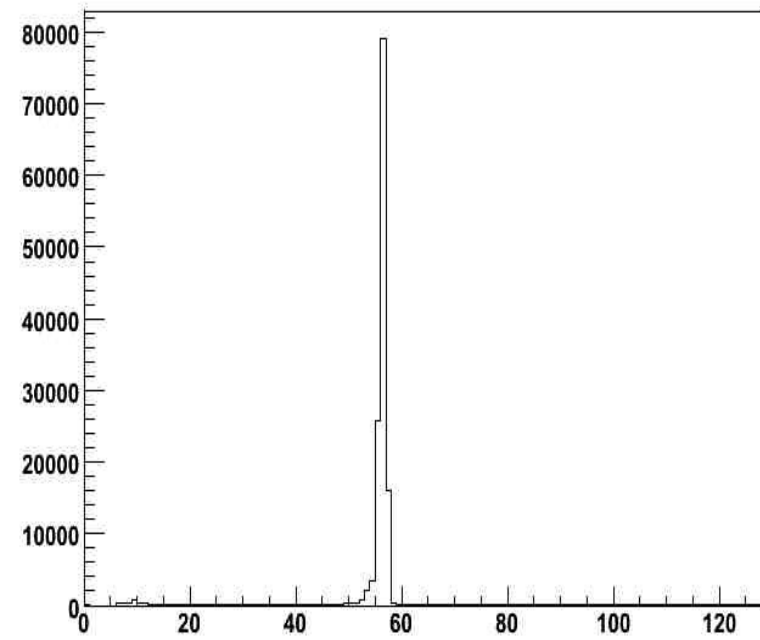
XY



2D profile (1/4 of detector)

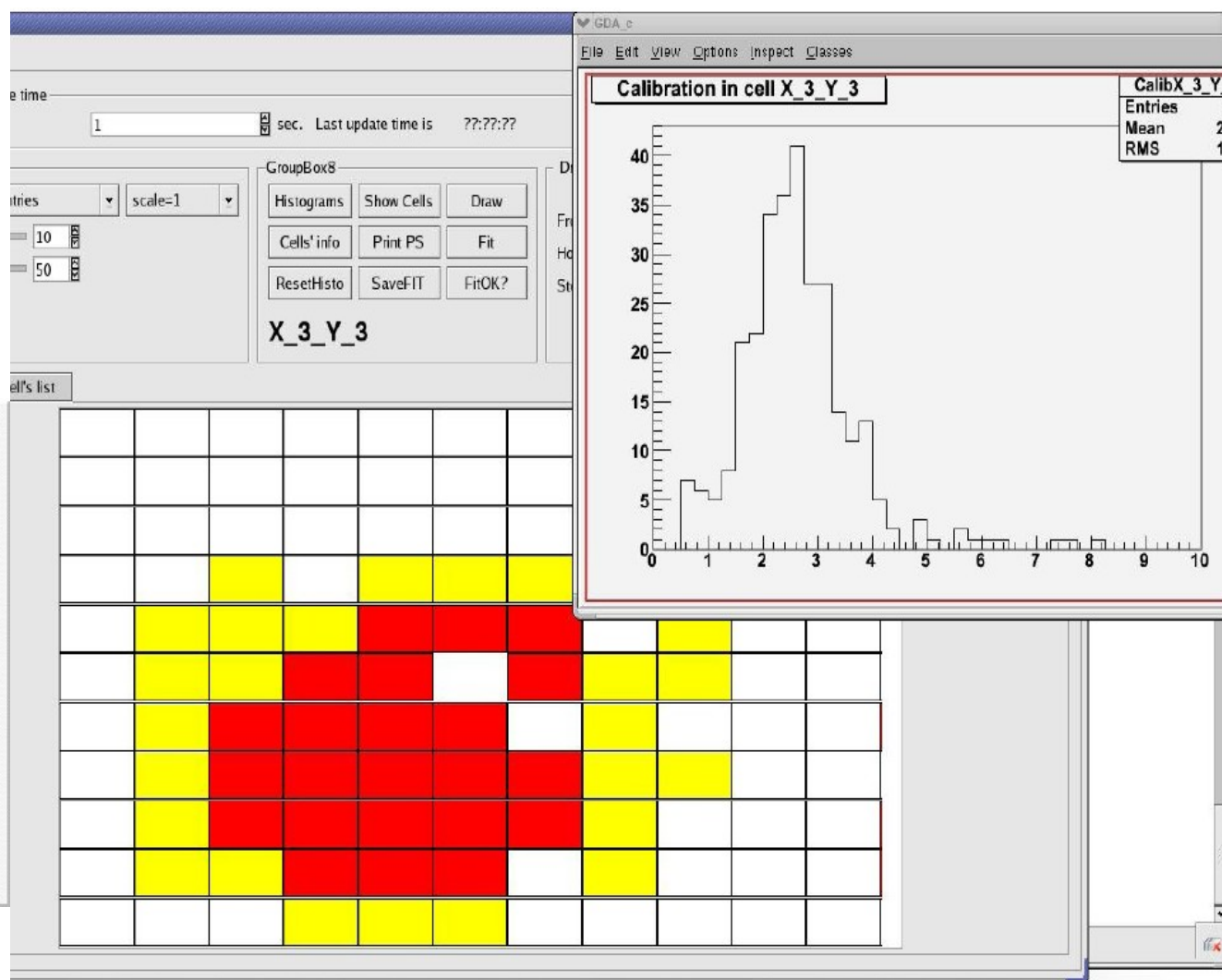
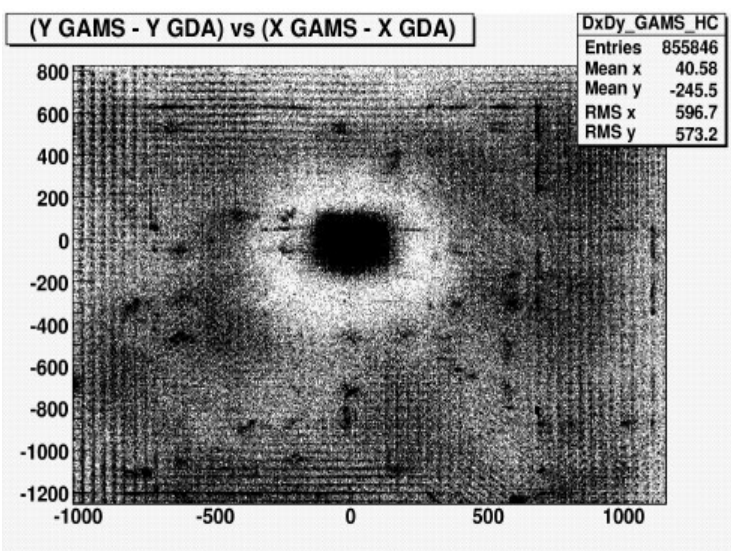
252 + 32 channels, WLS и SiPM

ht



Time distribution (5 nsec./bin)

GDA-100 and Muon Counters



Run April 2009

Mostly technical run from U-70 point of view.

Proton beam in U-70 was 50 GeV/c.

Three days of data taking with separated beam (12.5 GeV/c, 25% Kaons).

One day of calibration with 5 GeV/c electron beam.

Total amount of data written — 830 Gb, 300M physical events + 40M calibration events .

Based on the analysis of 1% of statistics we estimate the number of reconstructable $K \rightarrow 2\pi$ and $K \rightarrow 3\pi$ (charged) decays as 2-3M and 0.5-0.7M correspondingly.

Software Status

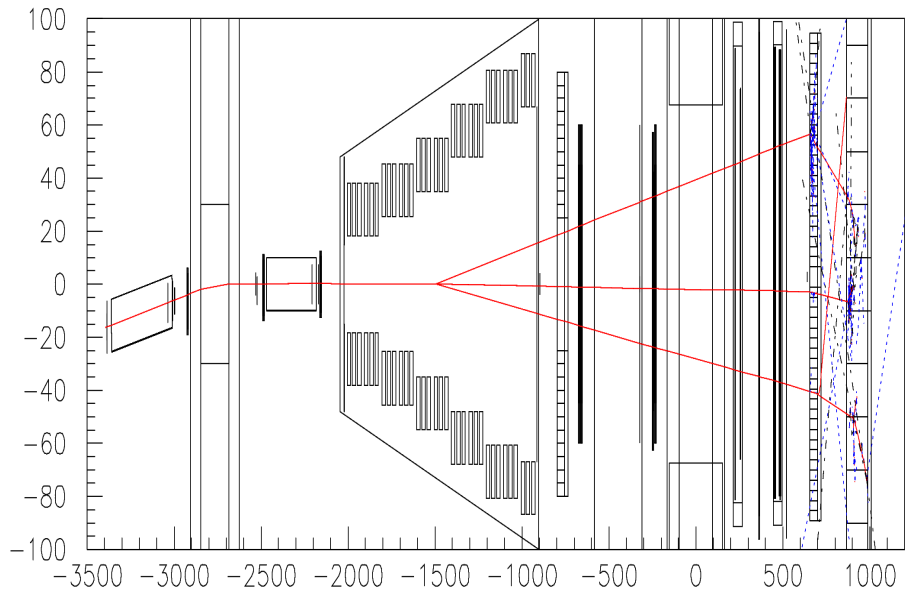
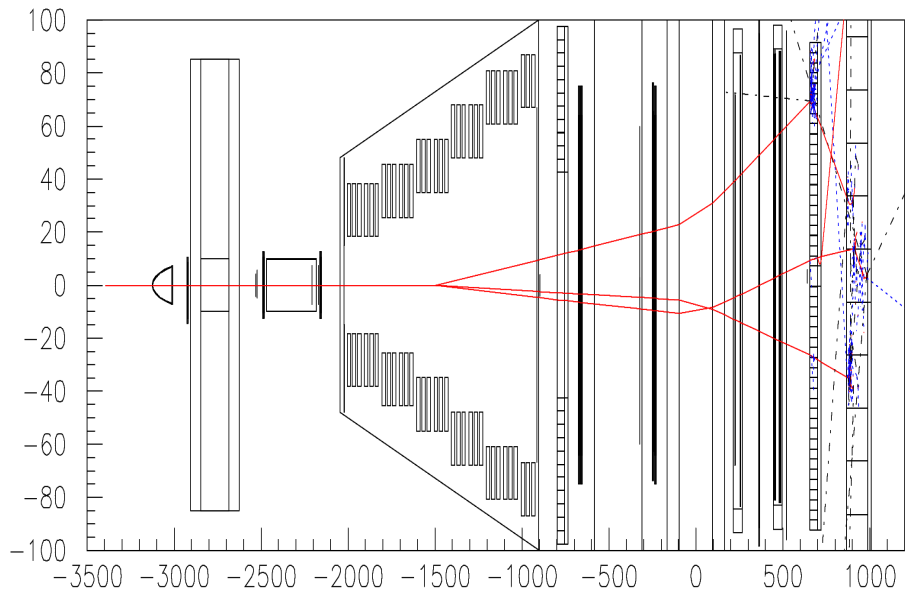
From the very beginning we decided to have two independent (almost) software branches:

Plan A: new software based on modern technologies (C++, Root, Geant4. etc.)

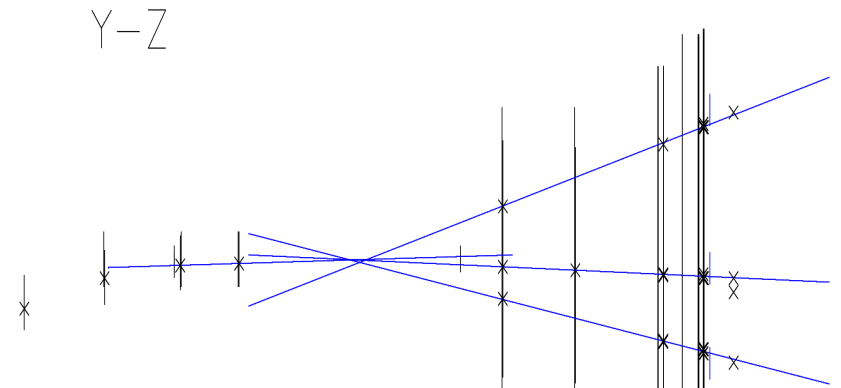
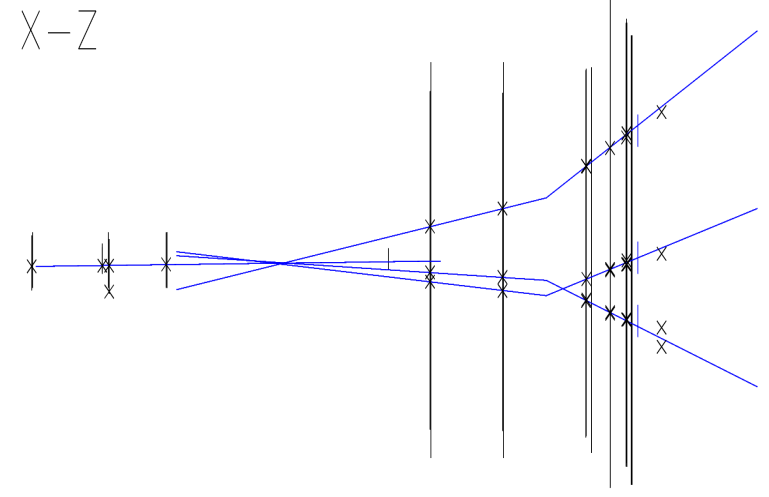
Plan B: software based on Sphinx analysis tools (Fortran with structures, Geant3, Paw, etc.)

Below I will present the results from Plan B implementation.

MC Event



Real Event



Triggers Apr2009:

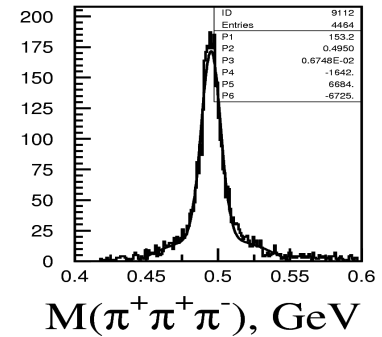
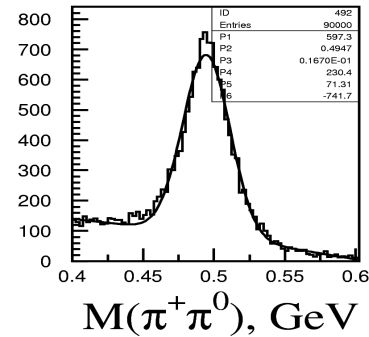
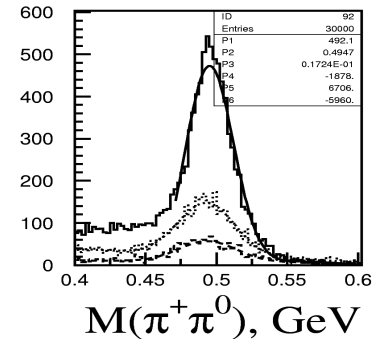
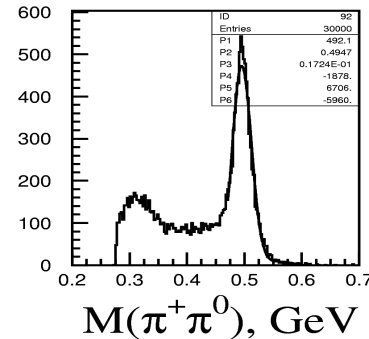
Tr1 = Beam

Tr2 = Kaon * BK

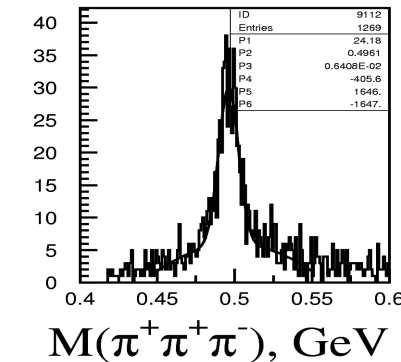
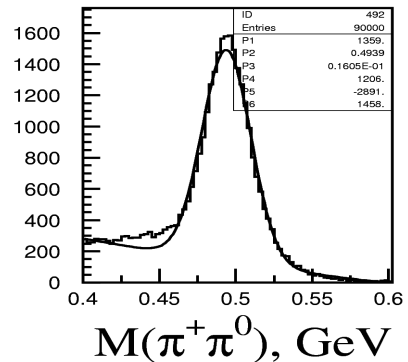
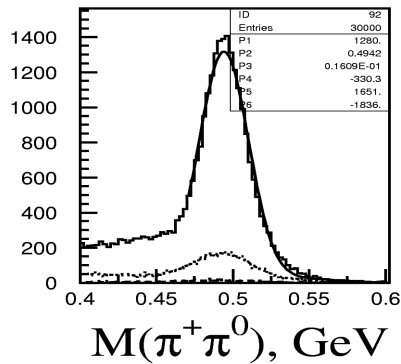
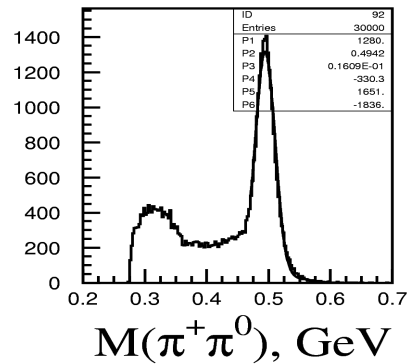
Tr3 = Kaon * BK * C3

Tr4 = Kaon * BK * EGams

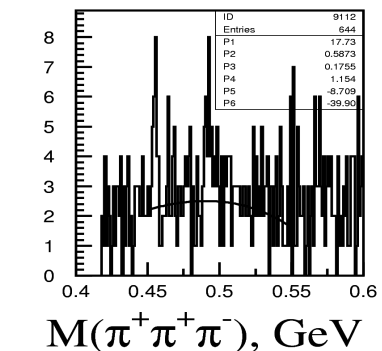
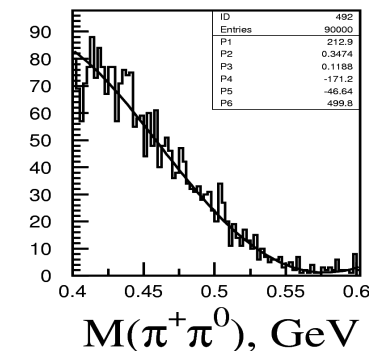
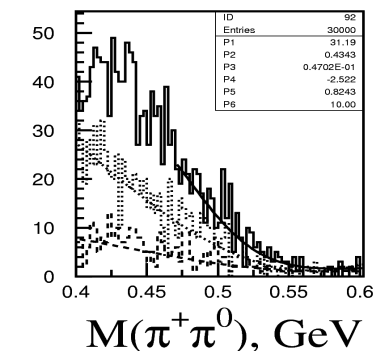
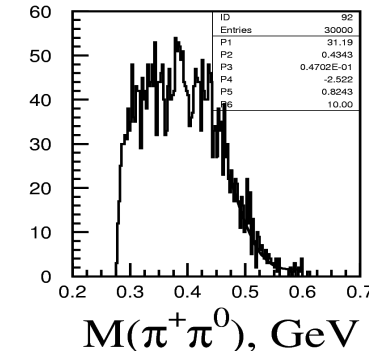
OKA APR2009, RUN 1841, Tr2



OKA APR2009, RUN 1841, Tr4

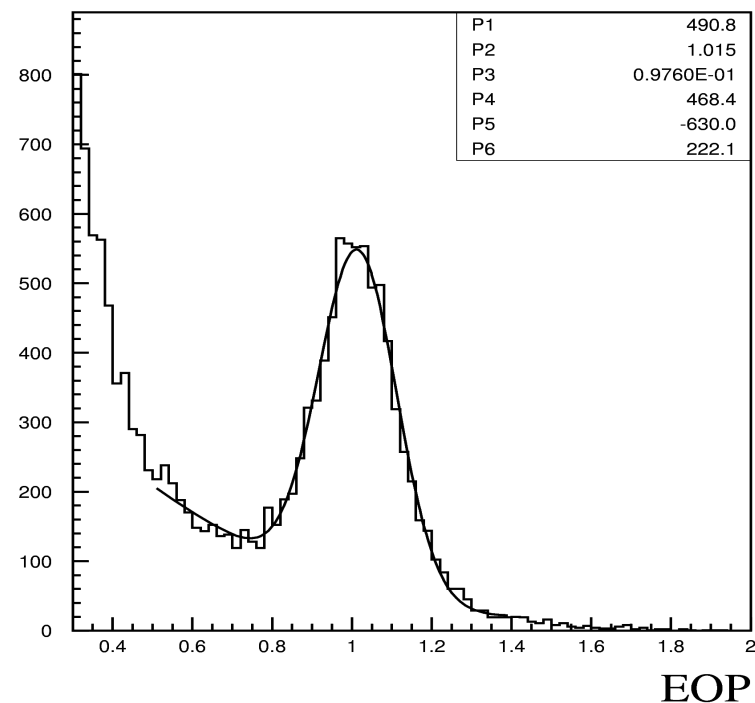


OKA APR2009, RUN 1841, Tr3

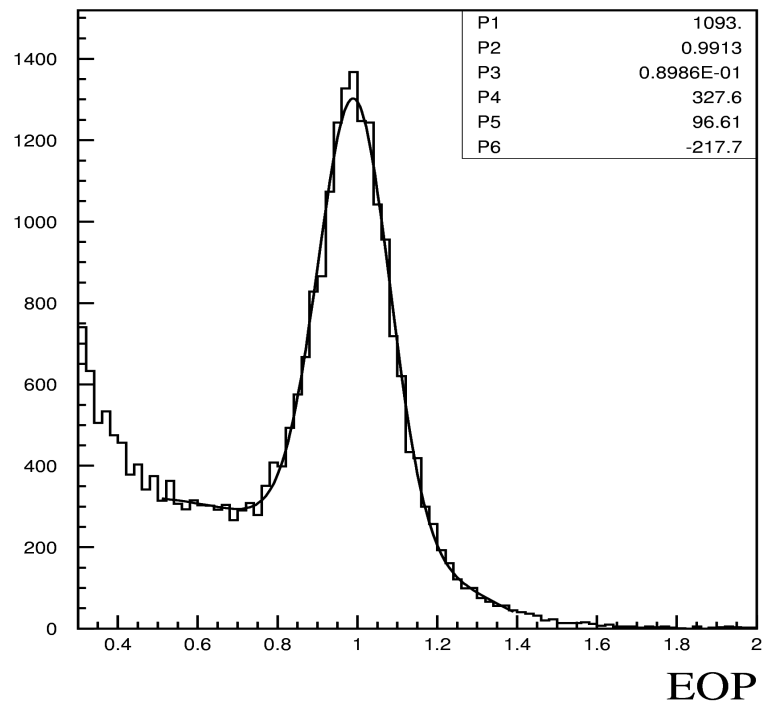


Electrons by different Triggers

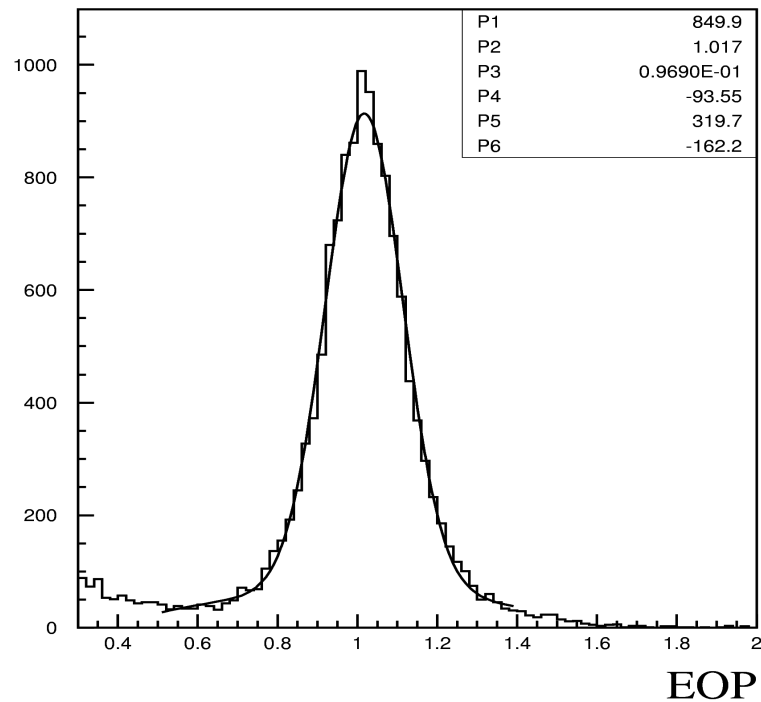
OKA APR2009, RUN 1841, Tr2



OKA APR2009, RUN 1841, Tr4



OKA APR2009, RUN 1841, Tr5



Near-term plan

Next run - November-December 2009

There is a plan how to improve the work of the separator

There is a plan how to improve beam collimation and intensity

With all that we hope to have in December 1M Kaons/spill
(compare to 250k Kaons/spill in April)

Meantime the data analysis should give us better understanding of the installation, better calibration and alignment constants and allow us to find the ways of improvements

Main directions of the experimental program

Kaon Decays:

continuation of the physical program of ISTRA+ (see report by V. Duck at this conference) with the increase in statistics by a factor of 10-100

Fix-Target program:

1. Search for exotic mesons and baryons
2. Spectroscopy and Decays of light mesons
3. Primakoff physics in kaon beam

Conclusions

OKA is a working detector now!

We hope to start the production of physical results in the near future