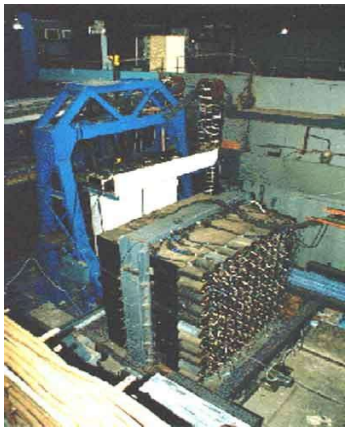
OKA:
Status of the experimental program with RF-separated K beam at U-70 Protvino, Russia.

V.F. Kurshetsov, IHEP, Protvino

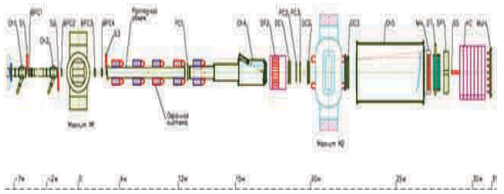
Representing the OKA collaboration (IHEP-INR-JINR-...)

GAMS: Meson Spectroscopy



SPHINX: Baryon Spectroscopy

ISTRA+: Kaon Decays



OKA

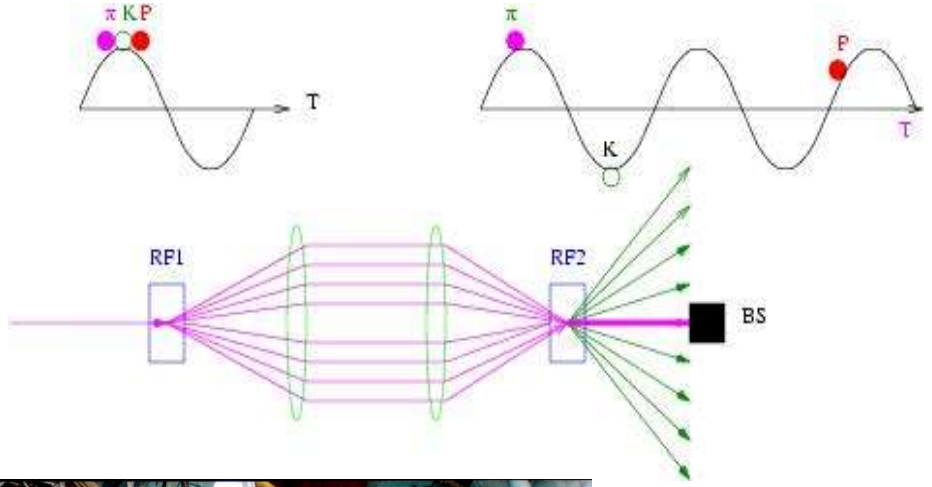
Experiments with KAons

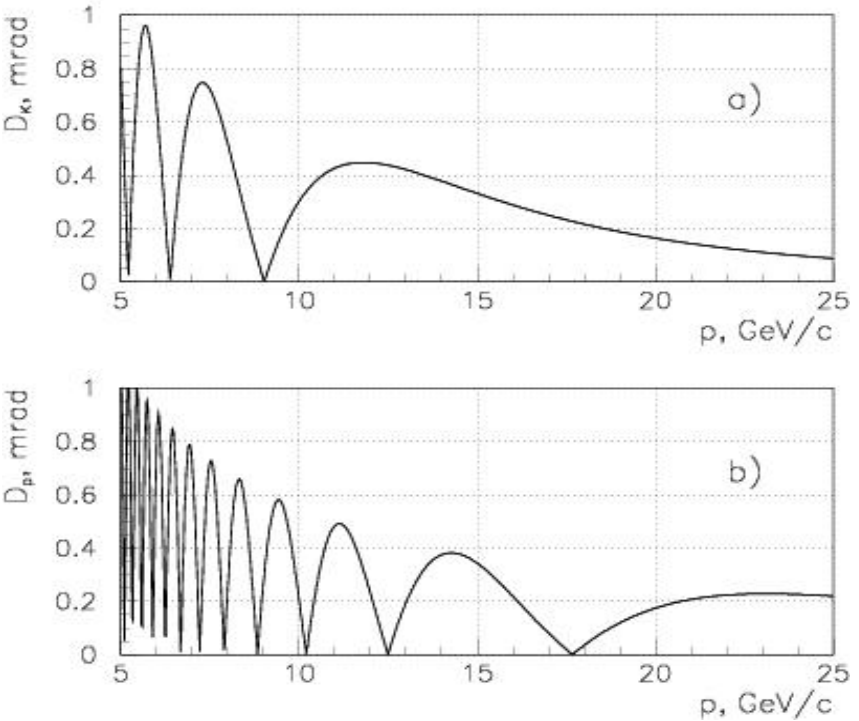
Last status OKA report at KAON's:
V.F. Obraztsov, KAON-05, Evanston, 17 June 2005

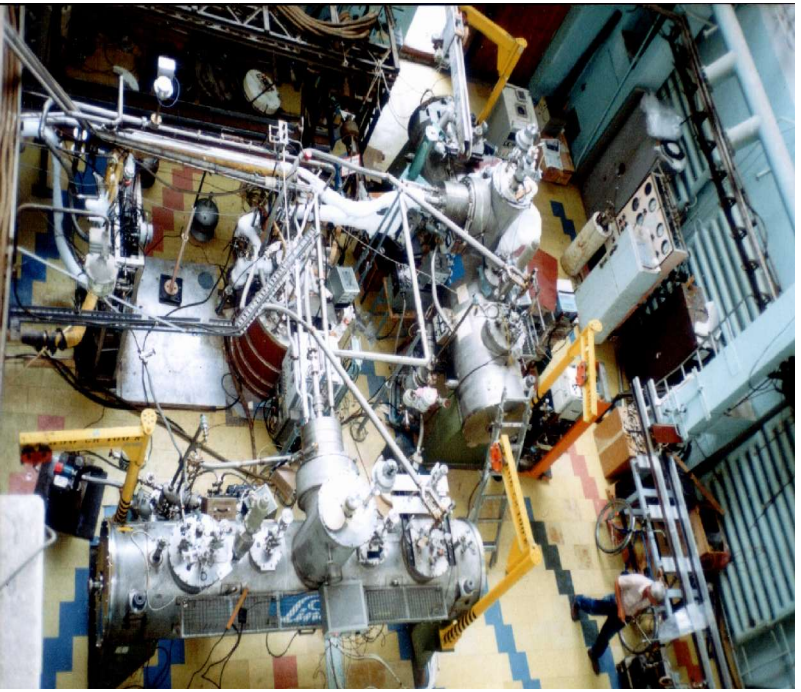
A detailed description of the project, its history, possible parameters of the beam and OKA setup as well as physical program, as we understood it at that time, can be found there.

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).





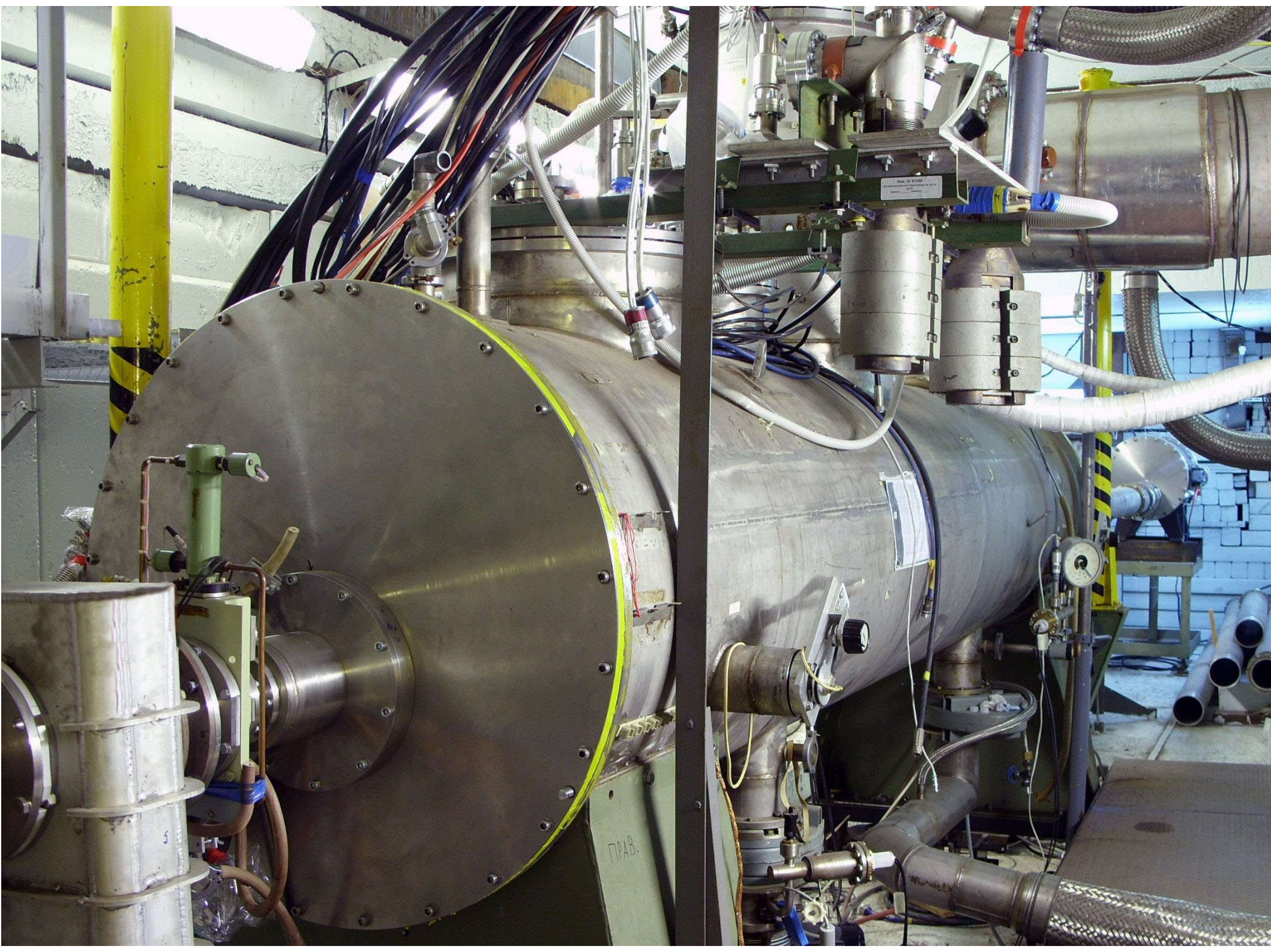


RF Separatores during low temperature tests

Channel 21K

Хвост канала 21К

Криогенная система канала 21К

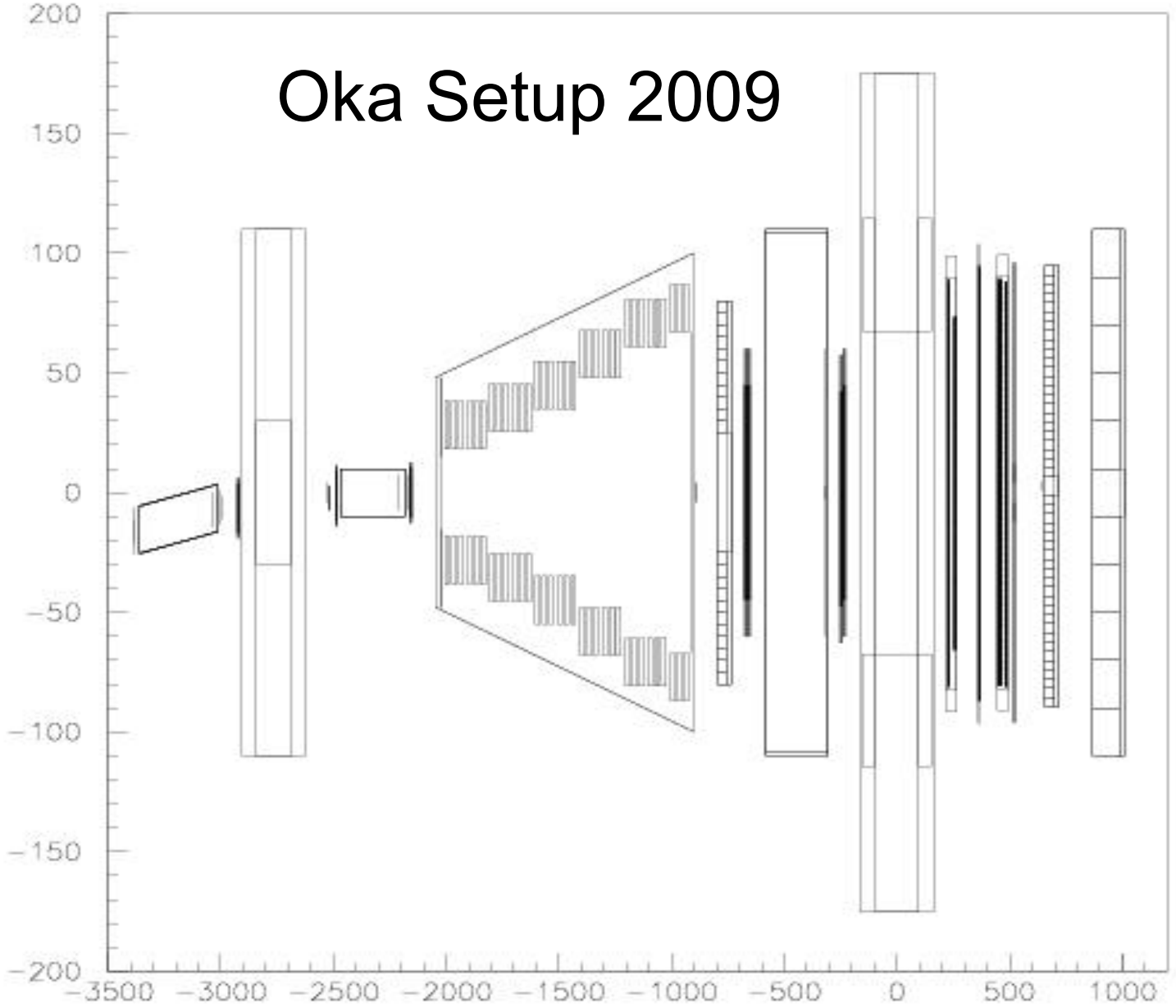

ПРАВ.

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

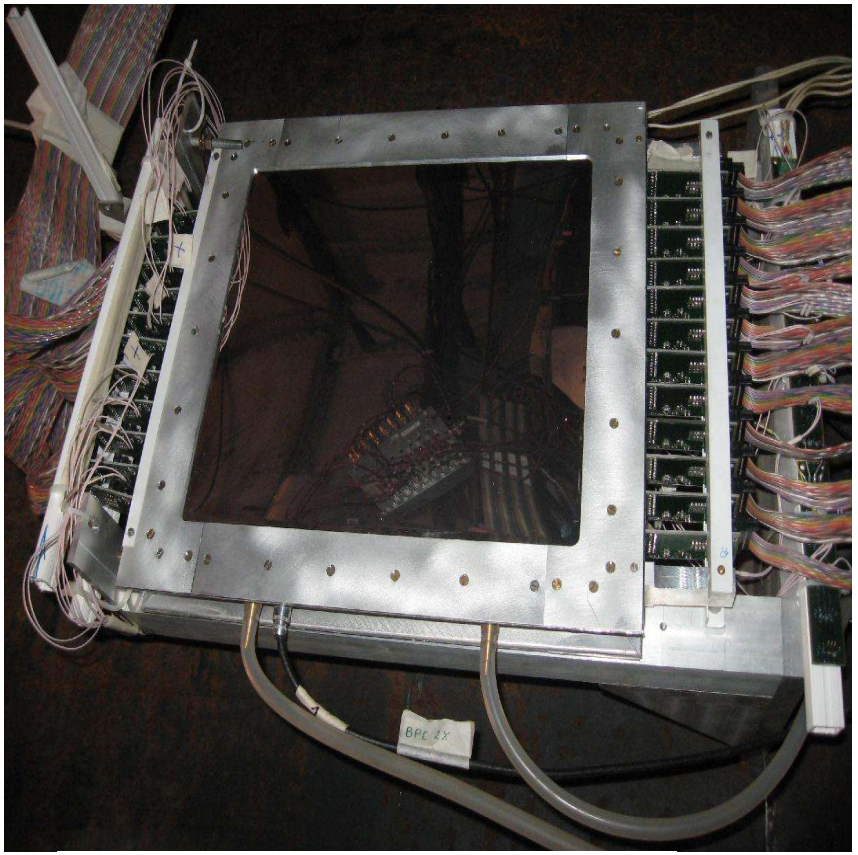
Oka Setup 2009

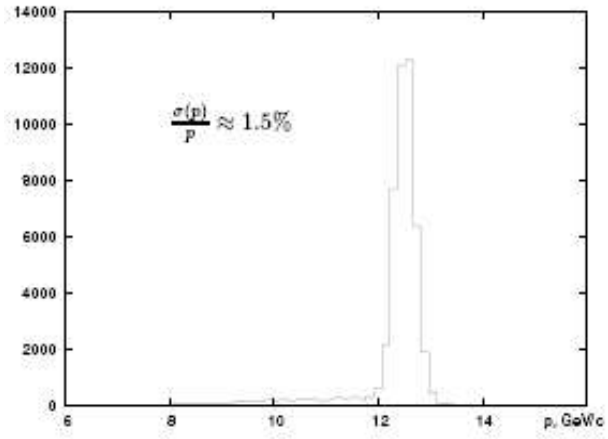


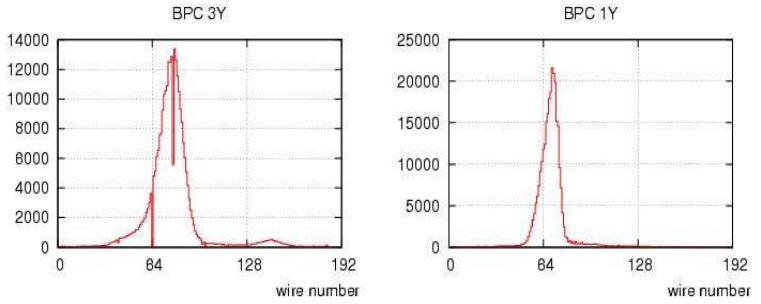
OKA setup at U-70

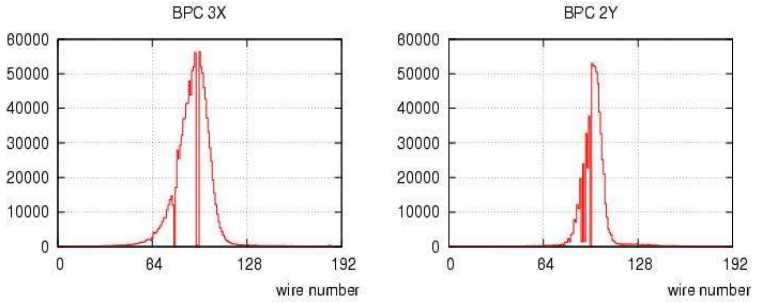
1. Beam spectrometer:
   1mm pitch PC, ~1500 channels; Cherenkov counters
2. Decay volume with veto system:
   11m; Veto: 670 Lead-Scintillator sandwiches 20* (5mm Sc+1.5 mm Pb), WLS readout
3. PC's and DT's for magnetic spectrometer:
   ~5000 ch. PC (2 mm pitch) + 1300 DT (1 and 3 cm)
4. Pad Hodoscope ~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

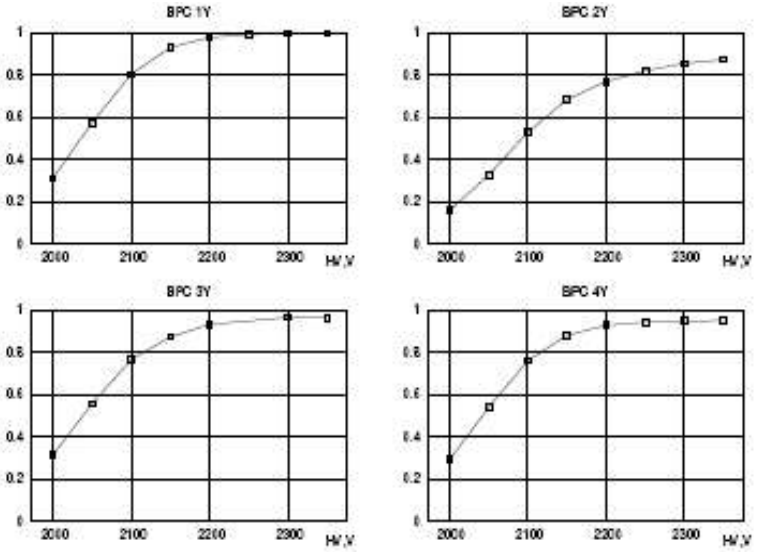
Beam Spectrometer



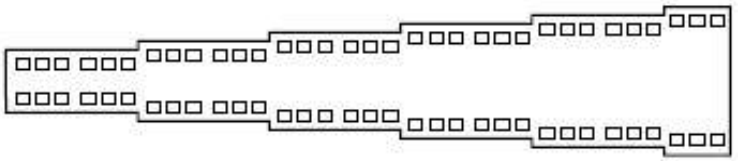




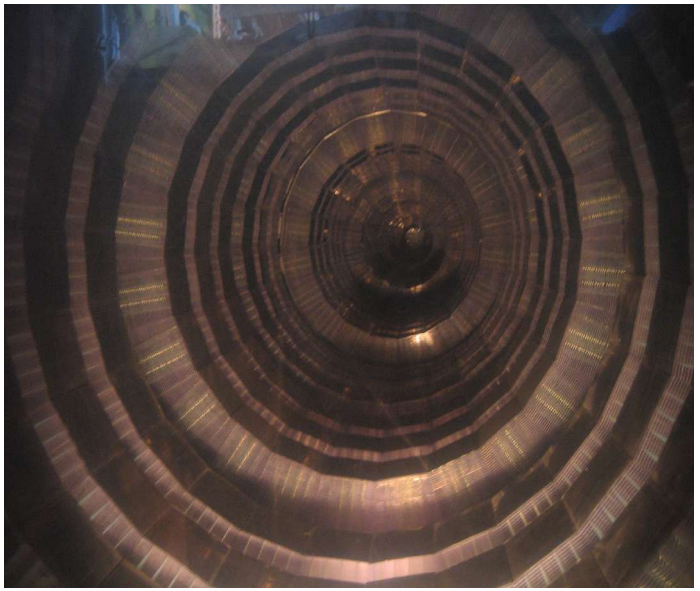


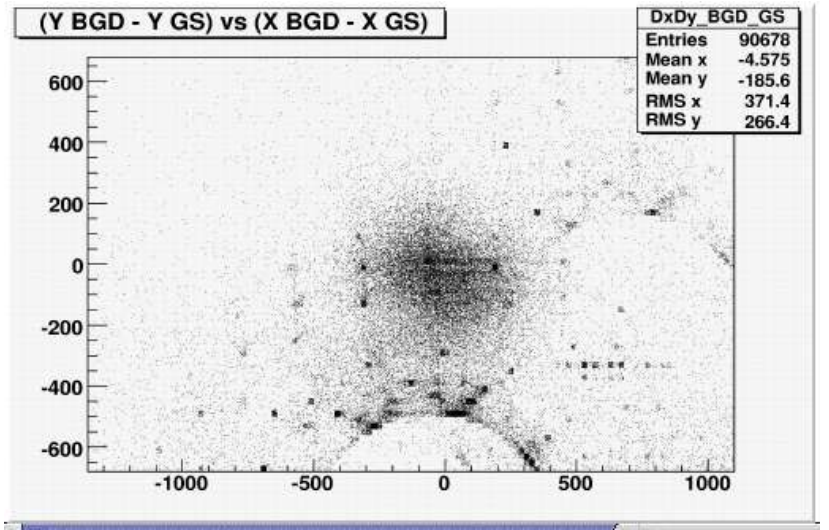


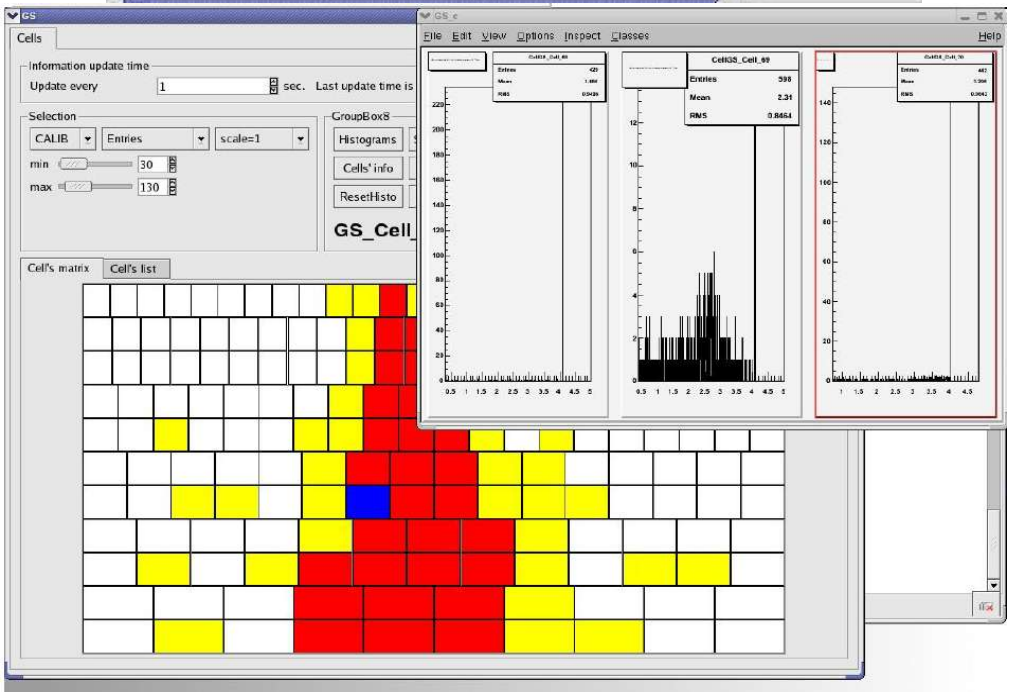
Veto System



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

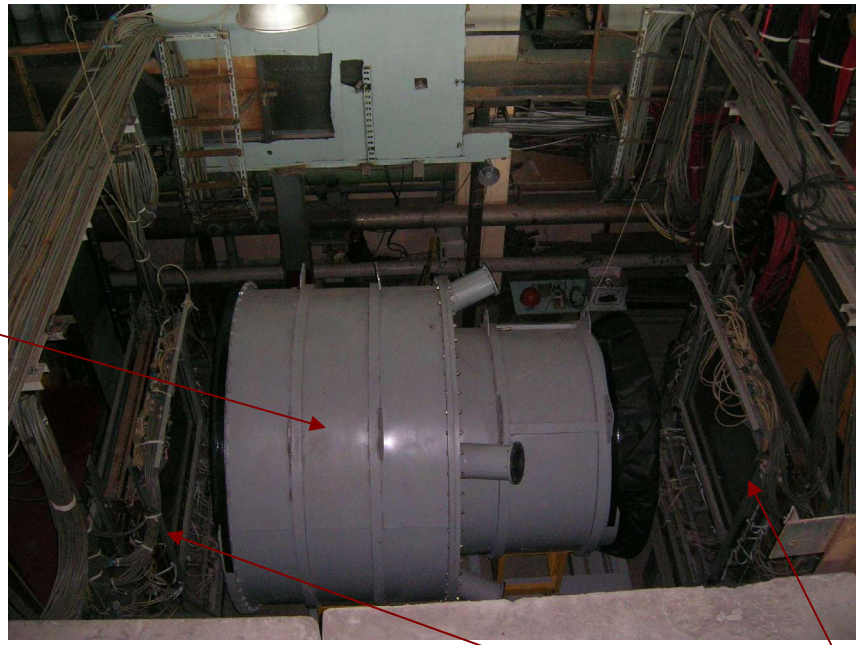


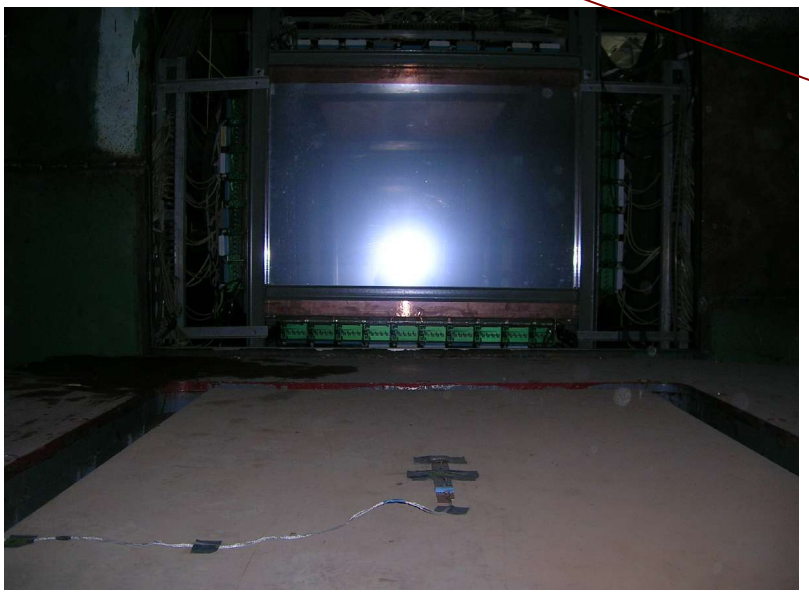


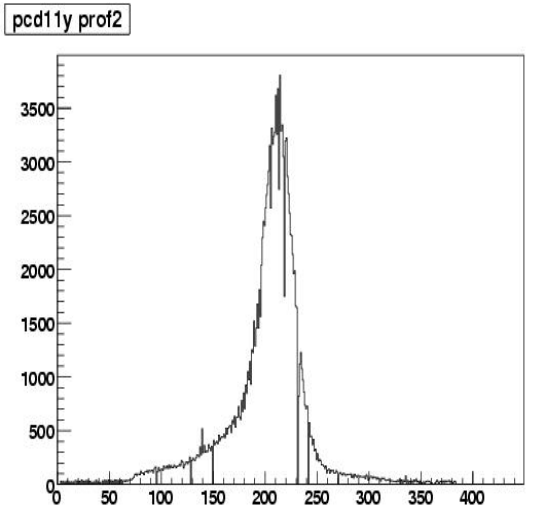


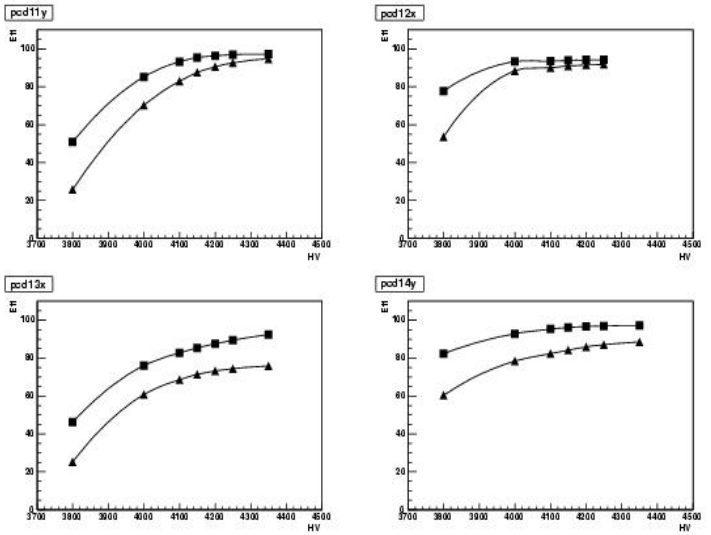
BIG Cherenkov Counter (C3), BIG PC

ε_e~95%





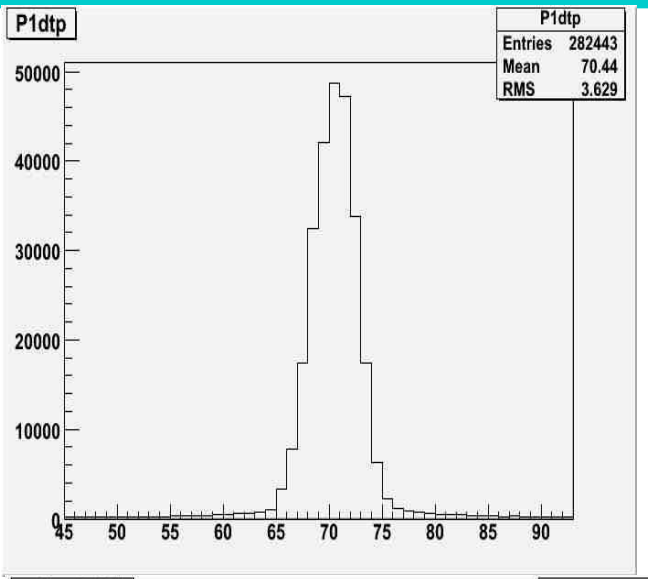


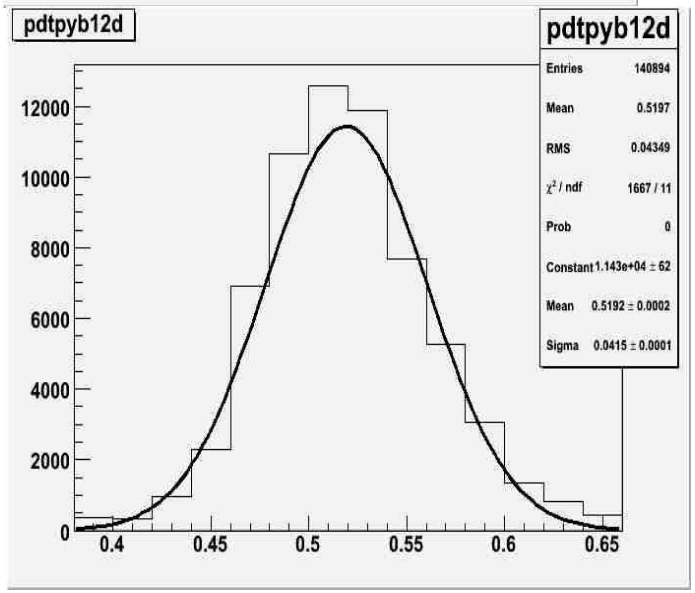


Profile and threshold curves of Big PC

$Ar:Ib:Fr_{12}$=70%:28.8%:0.2%

Straw-tubes

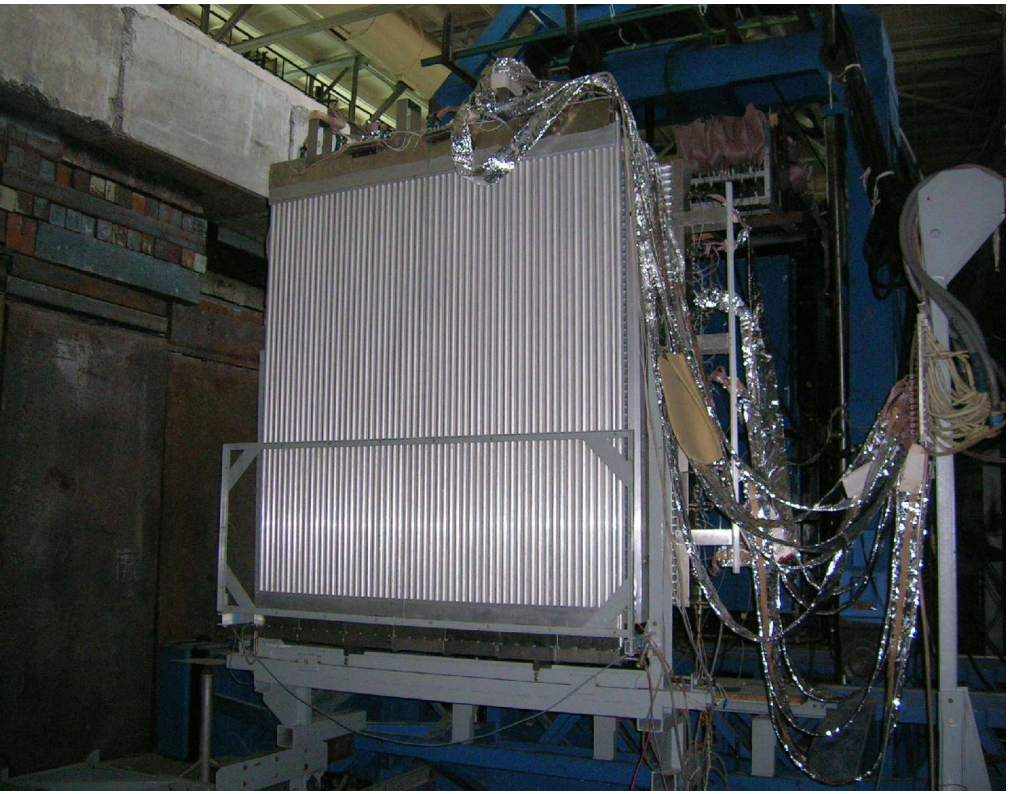


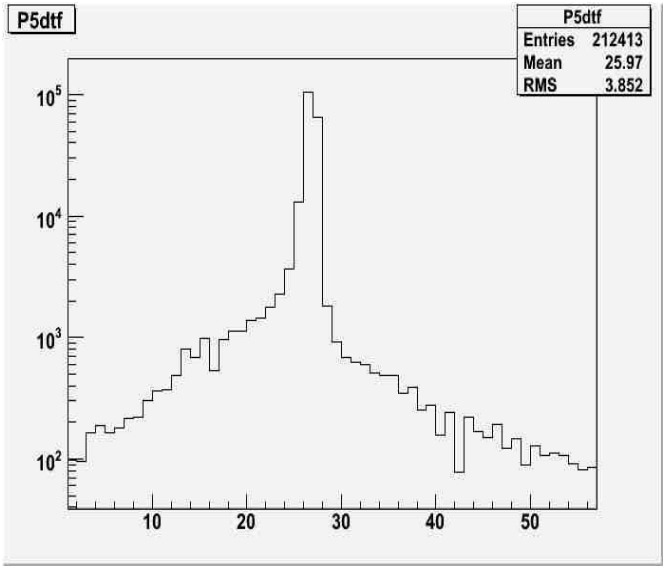


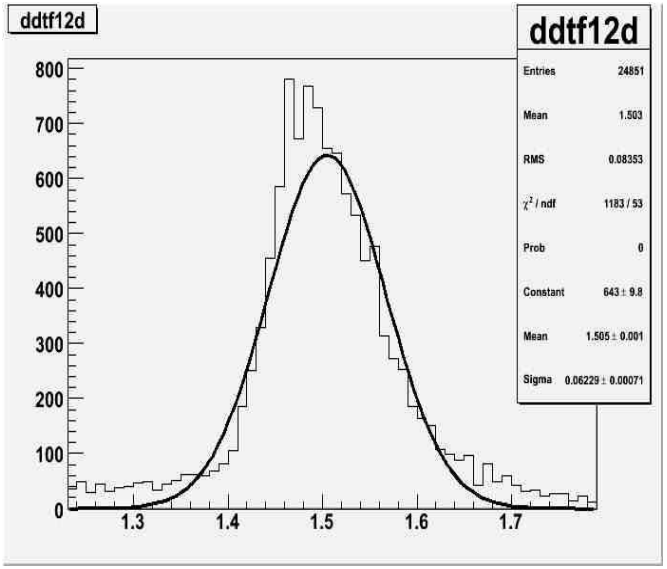
Produsedin Dubna (V..D. Peshekhonov) 2 planes 140x140 cm^2
+1 plane 180x180 cm^2 two layes 9mm straw-tubes, 920 channels
overall. Gas mixture Ar:CO_2 80%:20%

Space resolution σ~300мкм
(an error is dominated by TDC bin (5 nsec ,LE-78)

Drift Tubes



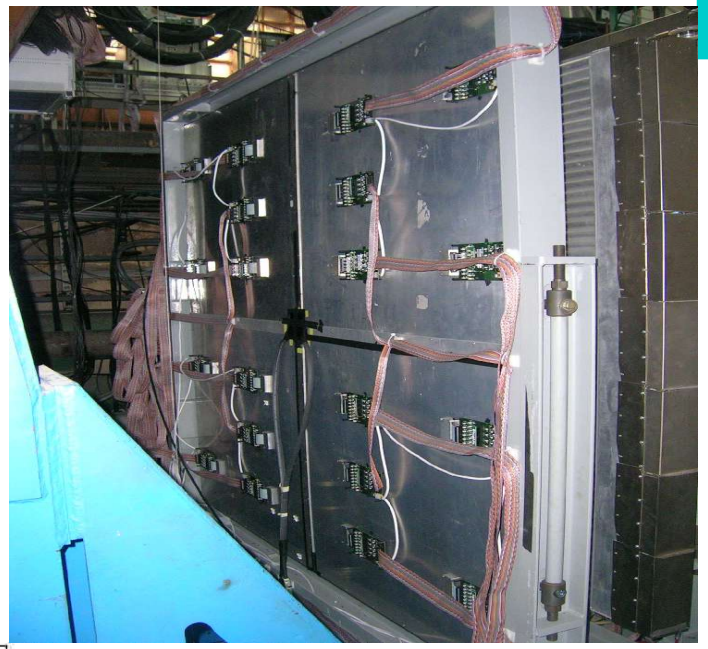


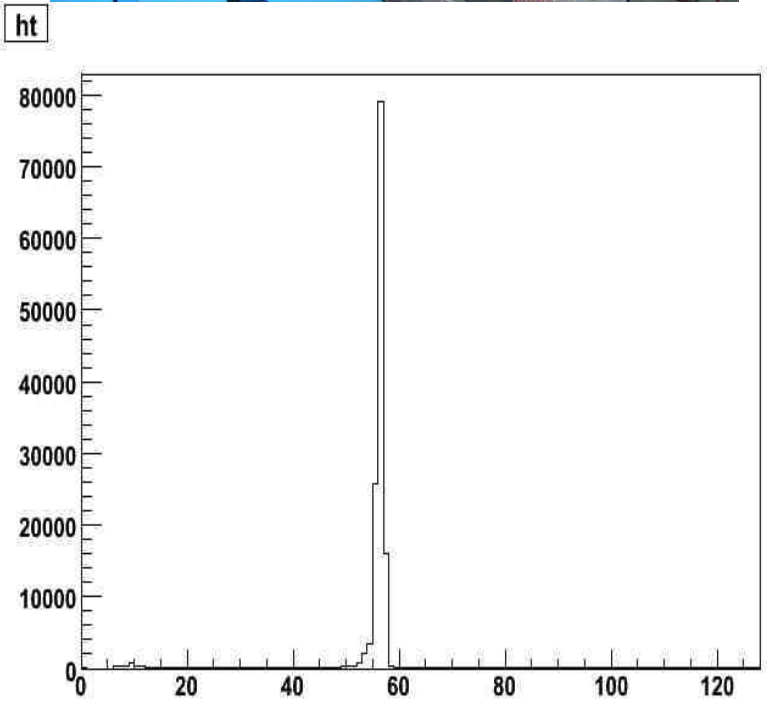


Two planes, each plane — 3 layes of 56 3cm tubes, 336 channels overall. Gas Mixture Ar:CO_2 88%:12%

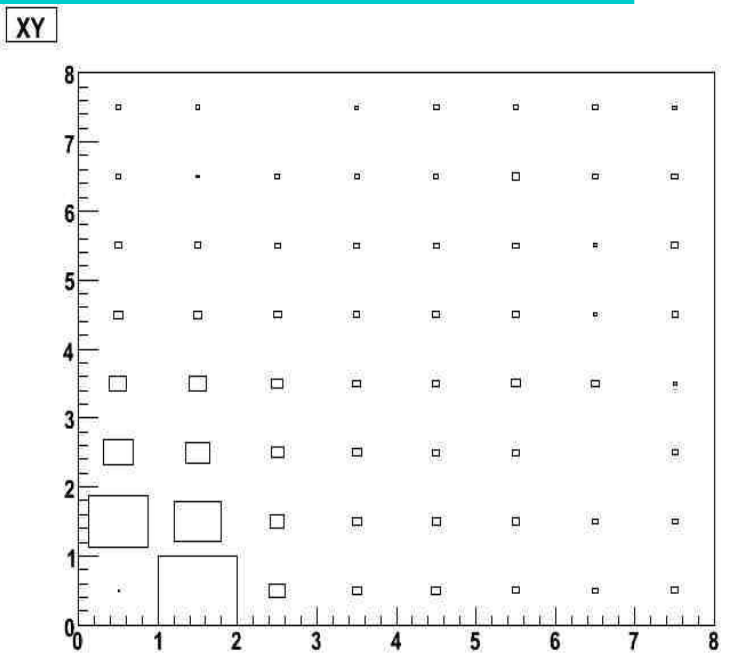
Space resolution σ~400мкм (an error is dominated by TDC bin (5 nsec, LE-78)

Pad Hodoscope INR-RAS





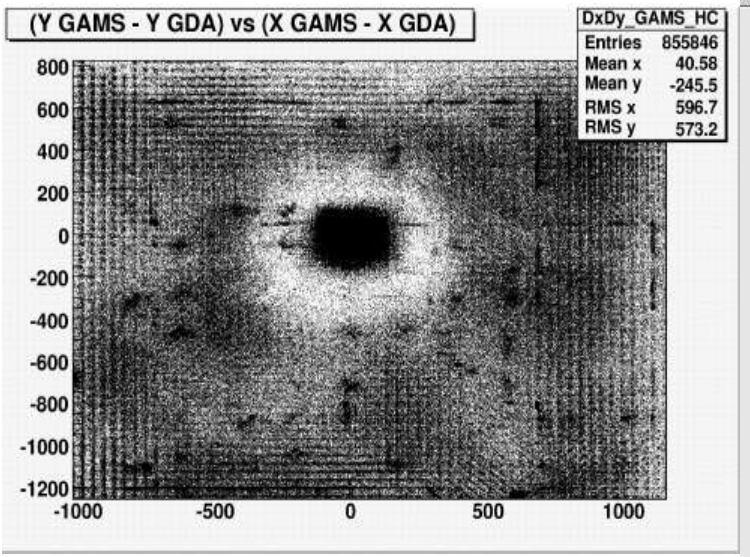
Time distribution (5 nsec./bin)

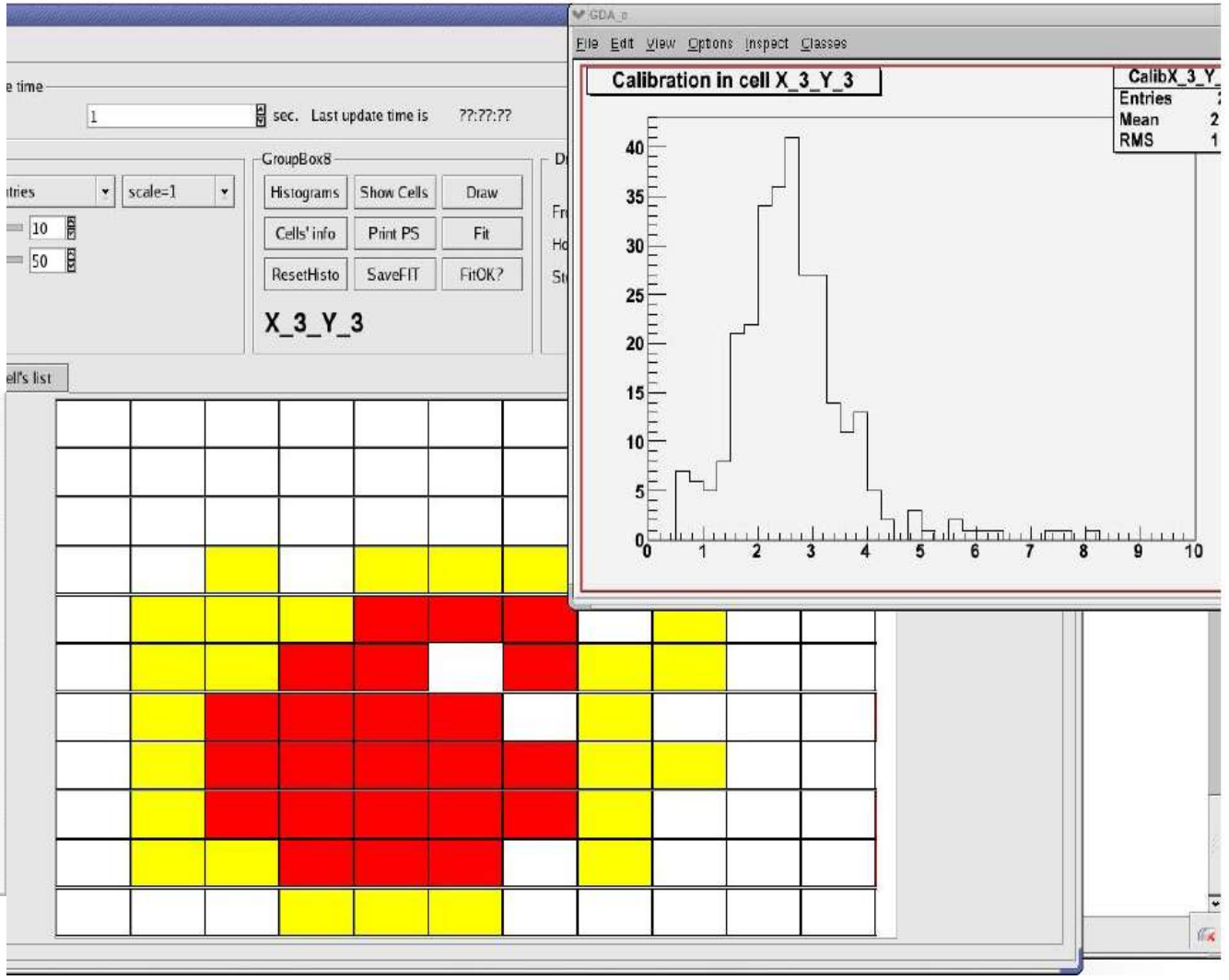


2D profile (1/4 of detector)

252 + 32 channels, WLS и SiPM

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-->2pi and K-->3pi (charged) decays as 2-3M and 0.5-0.7M correspondingly.

Software Status

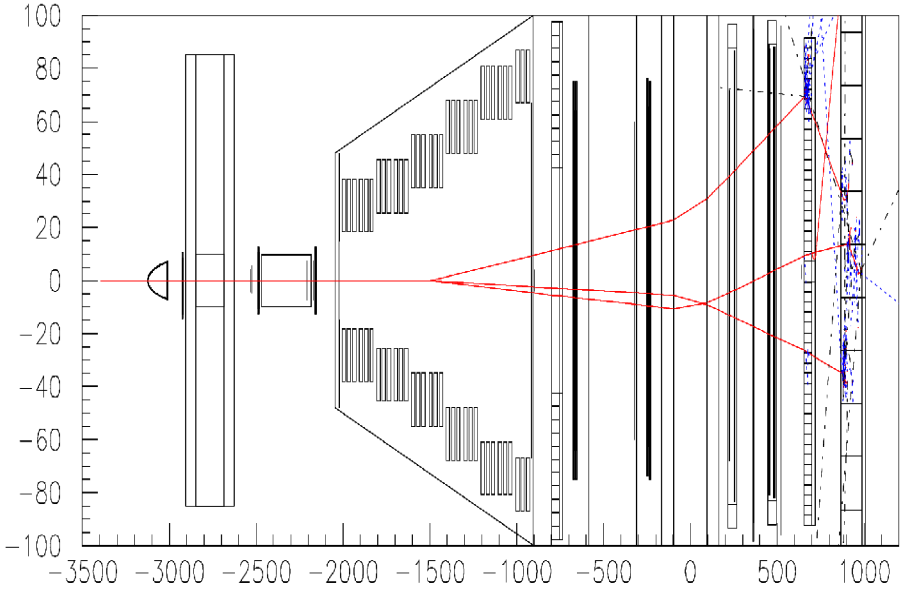
From the very beginning we decided to have two independent (almost) software branches:

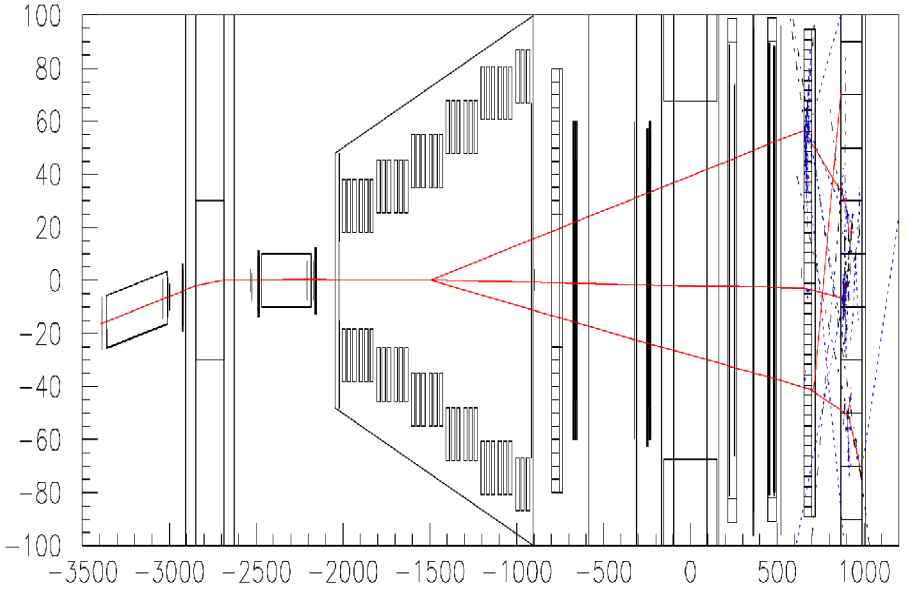
Plan A: new software based on modern technologies (C++, ROOT, Geant4. etc.)

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

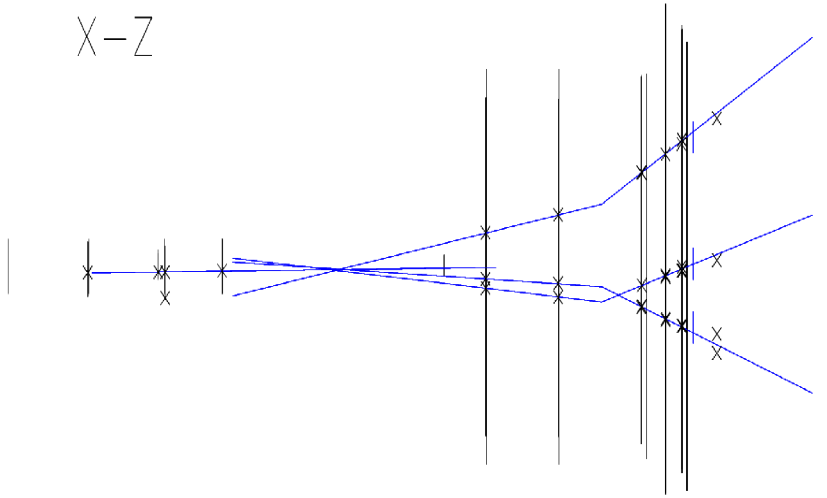
Below I will present the results from Plan B implementation.

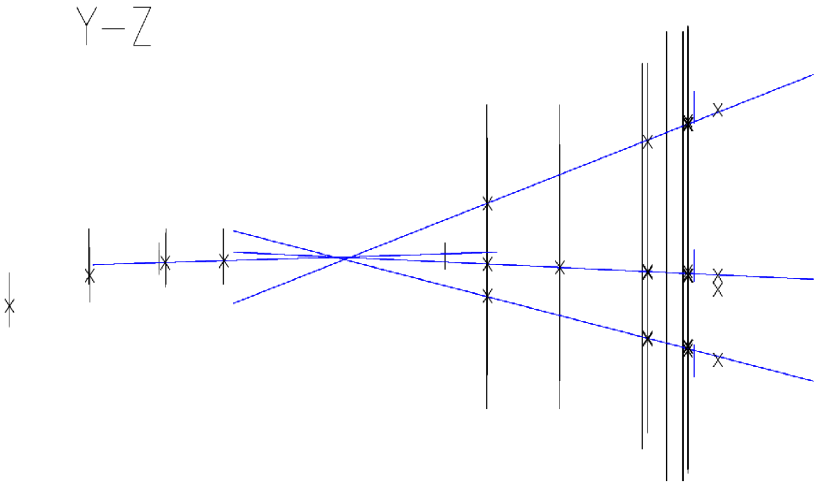
MC Event





Real Event

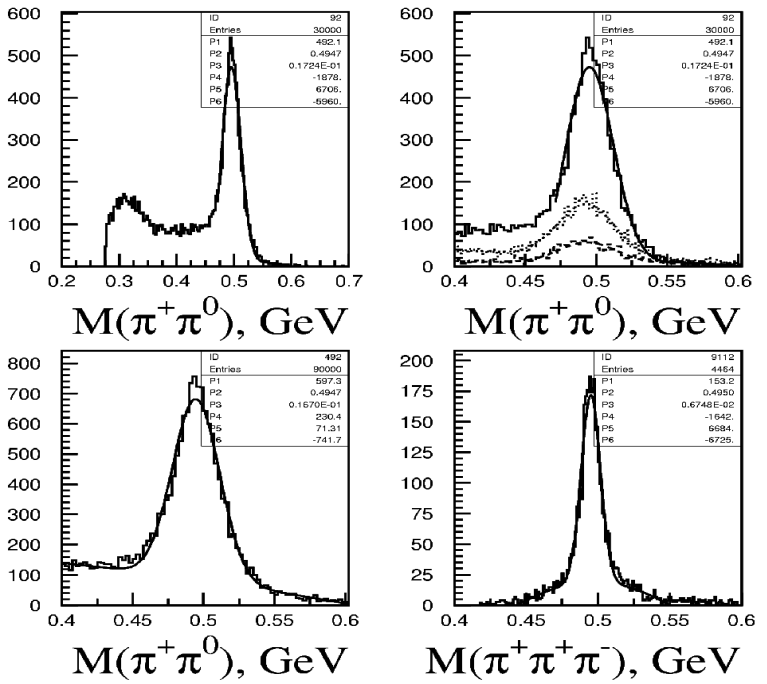




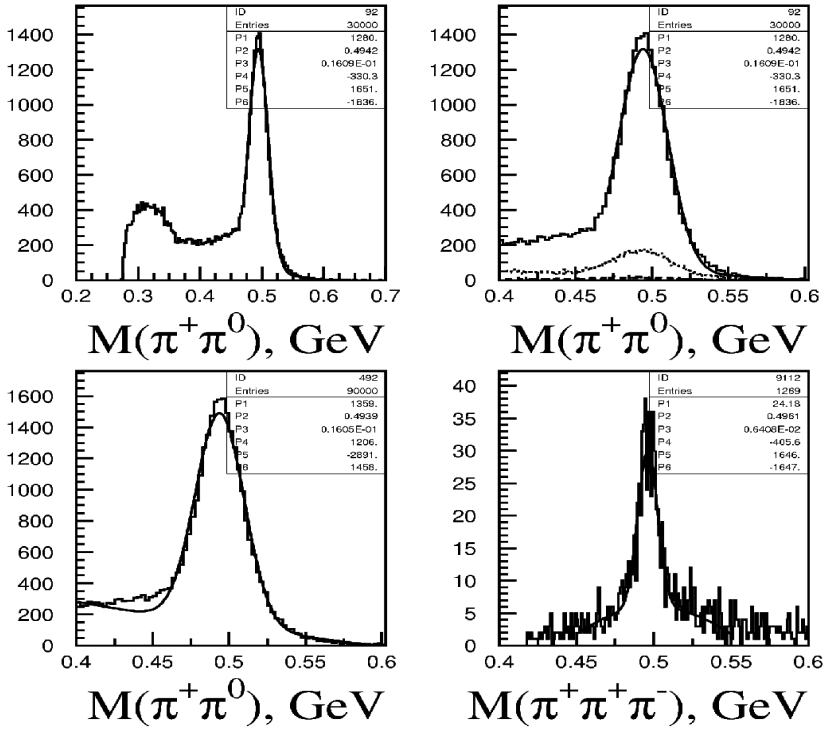
Triggers Apr2009:

Tr1 = Beam
Tr2 = Kaon * BK
Tr3 = Kaon * BK * C3
Tr4 = Kaon * BK * EGams

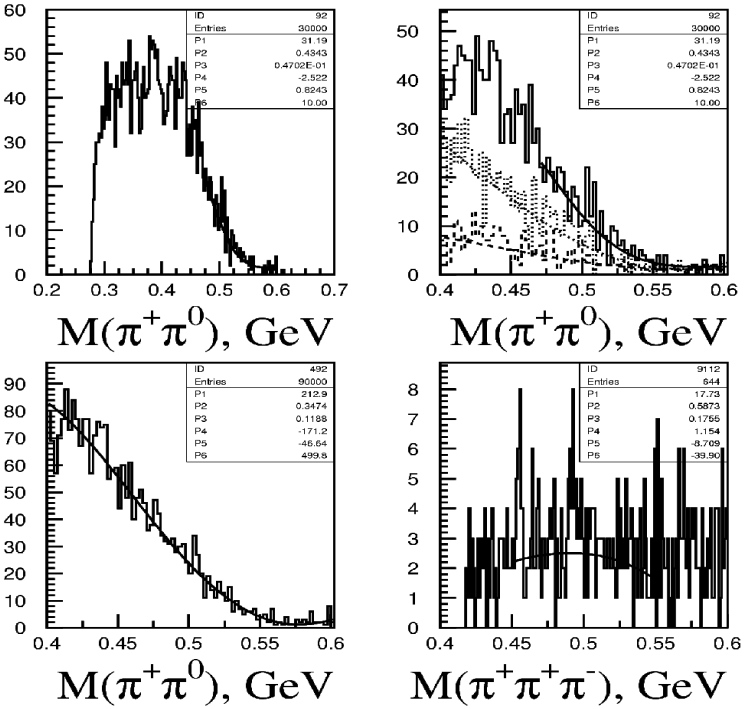
OKA APR2009, RUN 1841, Tr2



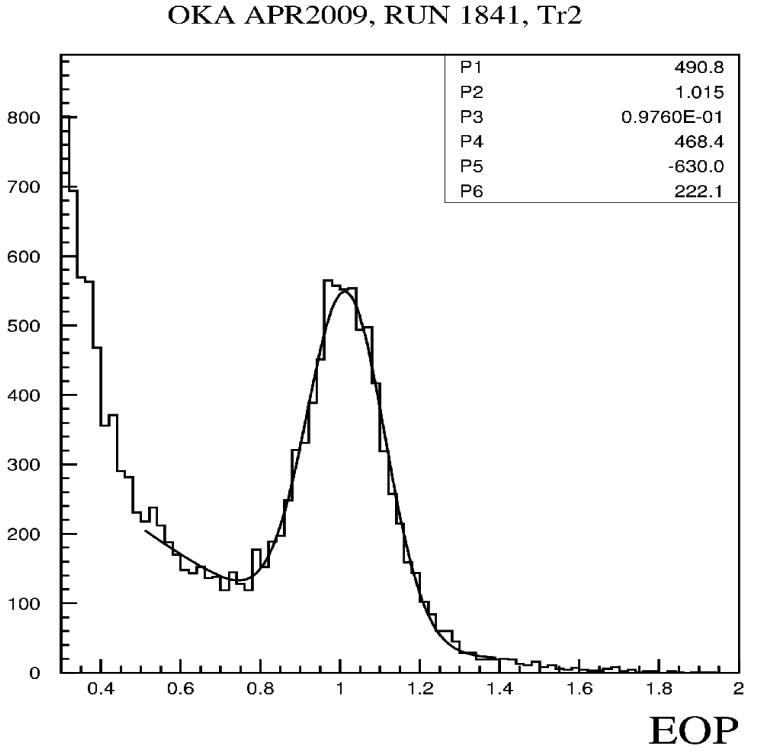
OKA APR2009, RUN 1841, Tr4

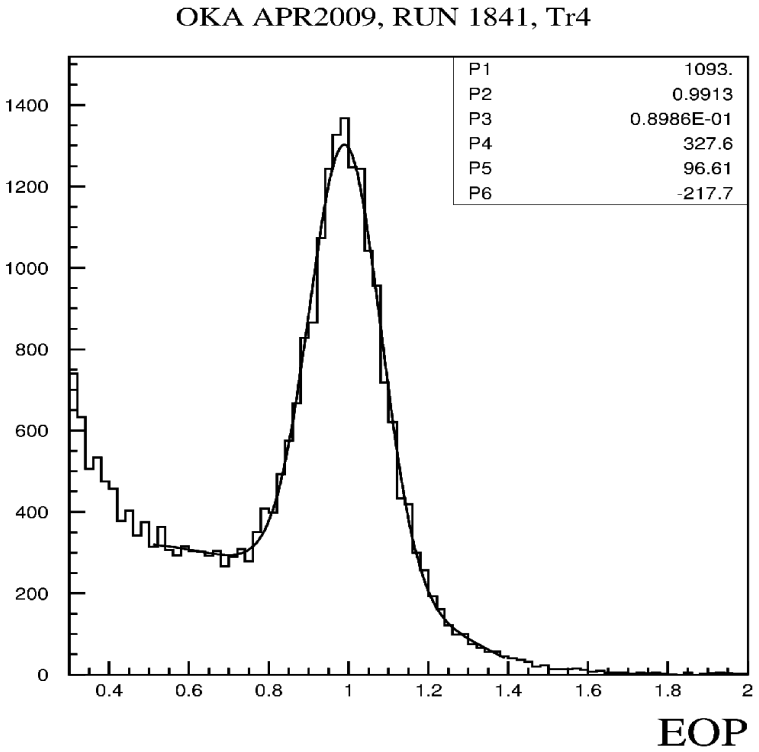


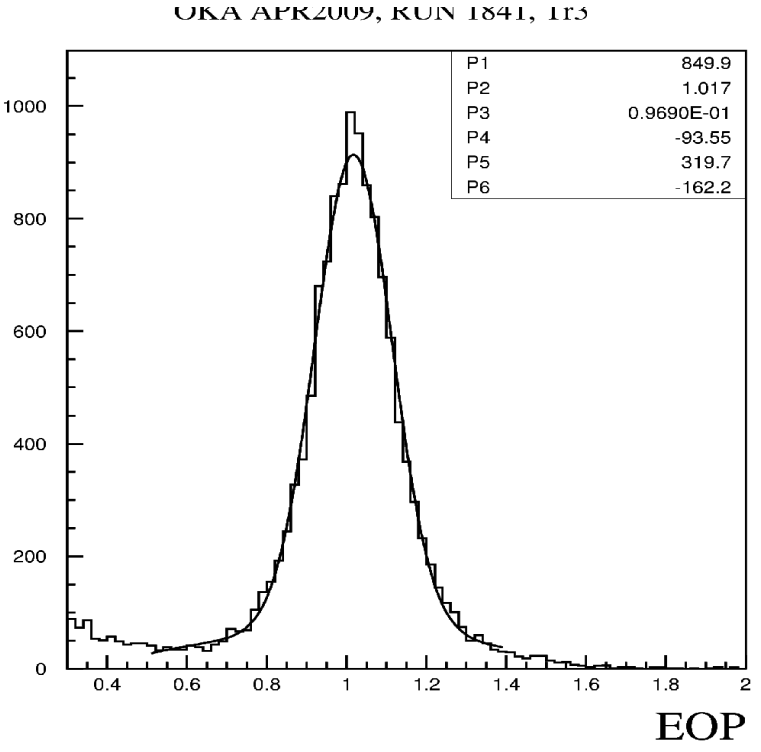
OKA APR2009, RUN 1841, Tr3



Electrons by different Triggers







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. Duk 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