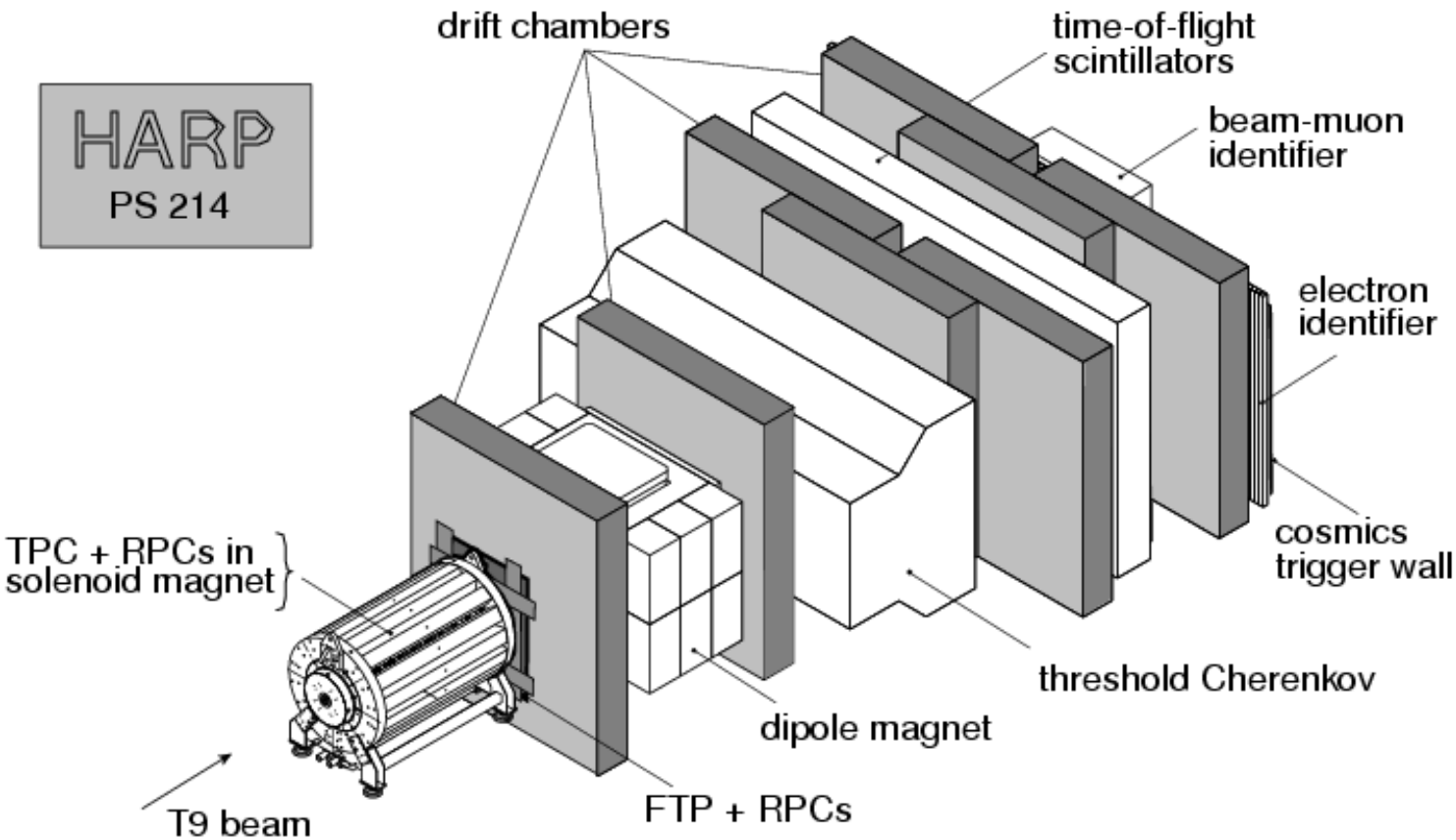
HARP Progress Report



124 people

24 institutes

V. Palladino
Gruppo II INFN
Napoli 20/5/2004

1/3 CERN 1/3 INFN 1/3 altri

G. Catenesi Vice SP

HARP

Verbale
Commenti
Milestones
Attivita'
Allegati

Modulo EC2

Stored in DB

Richiesta 2004

Gruppo
Assegnazione +

Salva su File

Upload File

Cambia pwd

Chiudi Richieste

Chiudi Assegnazioni

Go back

Richieste in blu & Assegnazioni in rosso

Sez. & Suf.	MI			ME			CON			TRA			CAL			MAN			INV			APP			TOTALE		
		sj	ant		sj	ant		sj	ant		sj	ant		sj	ant		sj	ant		sj	ant		sj	ant		sj	ant
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FE.Dot	5			18			5												8						36		
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NA	5			8			33												4						50		
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PD	6			29			7												5						47		
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TS	5			14			1																		20		
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HARP	33			112			57						5						23						230		
	33																								230		
	33			67.5			49																		149.5		
	33			67.5			49																		149.5		

VP e M. Bogomilov …. P. Passeggio e B. D'Aquino

HARP

A systematic **hadroproduction** survey

uncertainties plaguing **neutrino physics** since its origin

2-15 Gev p, π of both charges

on a wide range of targets

for **accelerator** neutrino beams

MiniBoone

K2K

SPL Superbeam

NuFact

for **atmospheric** neutrino "beams"

SuperK

…. HyperK/UNO/Frejus

A tool for NuOsc searches

NA20, Na56(SPY) ….

Attivita' dell'ultimo anno del gruppo Harp

- Data taking concluso con successo (Nov 2002)
- Calibrazione e allineamento conclusa per
  beam defining detectors
  forward spectrometer (piccolo angolo)
- Calibrazioni e correzioni TPC a buon punto
  "post" data taking completato
  analisi in corso

  Detector paper in preparation
- Software tools per l'analisi in stato avanzato
- Physics performance del forward spectrometer adeguate a far partire le prime analisi ….
- Large Angle Physics a seguire ……

→ **un cospicuo numero di pubblicazioni nel 2004/5**

…… dalle minute dello SPSC …..

STATUS OF PS214/HARP

The referee explained the progress in the alignment and calibration of the detector.

The small angle spectrometer is essentially aligned and calibrated. Physics analysis can start soon and the expected results should greatly improve the impact of the K2K and MiniBooNE experiments. Close collaboration has been established with these two groups.

For the large angle region, work is concentrated on the understanding of the TPC. Substantial improvements have already been achieved in the corrections of several TPC distortions. Further work on the reconstruction software is needed.

The referee would like to see an enlargement of the analysis group. The Committee acknowledged the good progress made in the understanding of the subdetector perfor mance. The Committee is concerned about the size of the analysis team and, through its referee, will follow carefully progress in forthcoming months.

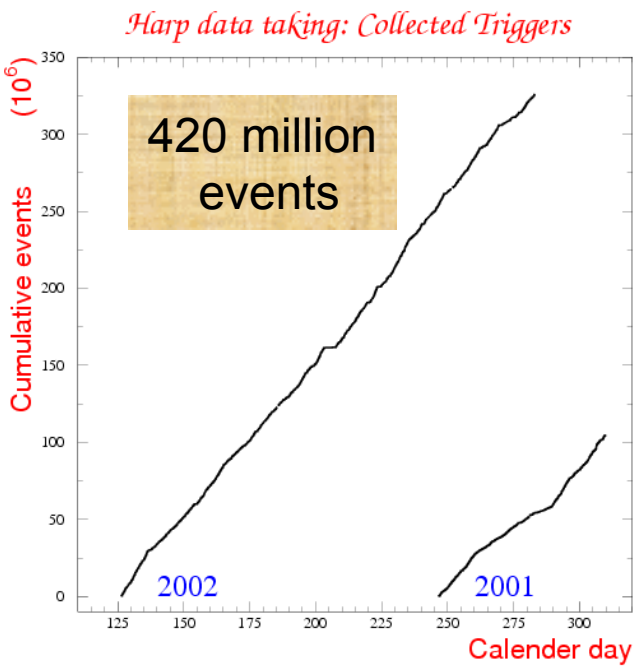
The Committee supported the Collaboration in the choice of the analysis strategy, and urged the Collaboration to publish results as soon as possible in view of their importance for neutrino physics results.

Data taking

- Il programma e' stato completato con successo
- Nonostante le condizioni non ottimali del fascio nel 2002 le high performance del DAQ system (94%) responsabilita' del gruppo di **Bari** hanno permesso di raccogliere la statistica sufficente

50 Tbytes of data

Target material		Target length (λ%)	Beam Momentum (GeV)	#events (millions)
Solid targets	Be	2 (2001)	±3	233.16
	C		± 5	
	Al		± 8	
	Cu	5	± 12	
	Sn		± 15	
	Ta	100	Negative only 2% and 5%	
	Pb			
K2K	Al	5, 50, 100, replica	+12.9	15.27
MiniBooNE	Be		+8.9	22.56
Cu "button"	Cu		+12.9, +15	1.71
Cu "skew"	Cu	2	+12	1.69
Cryogenic targets	N_7	6 cm	±3	58.43
	0_8		± 5	
	D_1		± 8	
	H_1		± 12	
			± 15	
	H_2	18 cm	±3, ±8, ±14.5	13.83
Water	H_20	10, 100	+1.5, +8(10%)	9.6

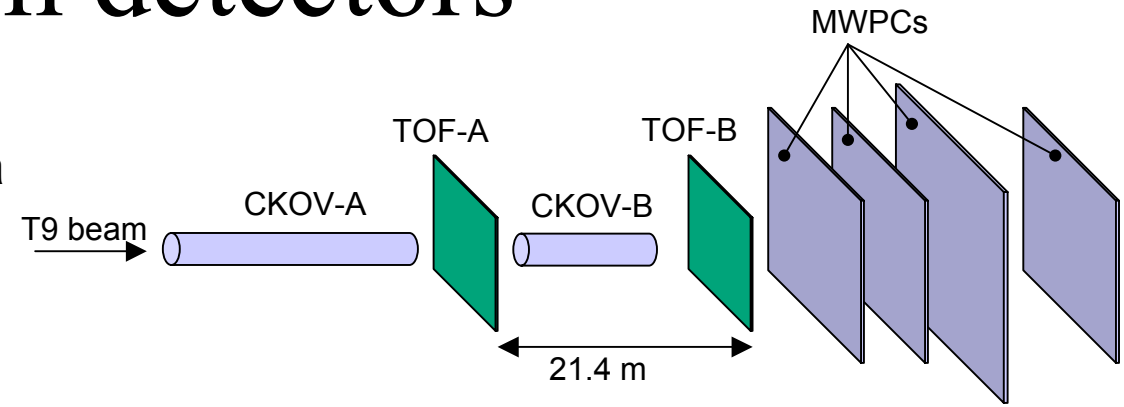


Beam detectors

T9 beam line normalmente usata per test-beams

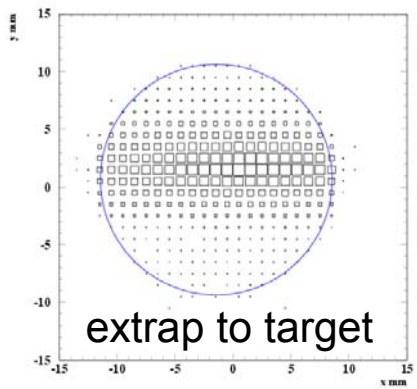
↓

Necessita' beam detectors precisi



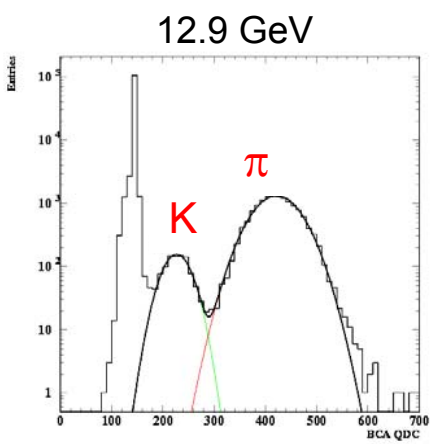
MWPCs

- Beam tracking
- 96% tracking eff using 3 out of 4 chambers
- <100 μ*m* resolution



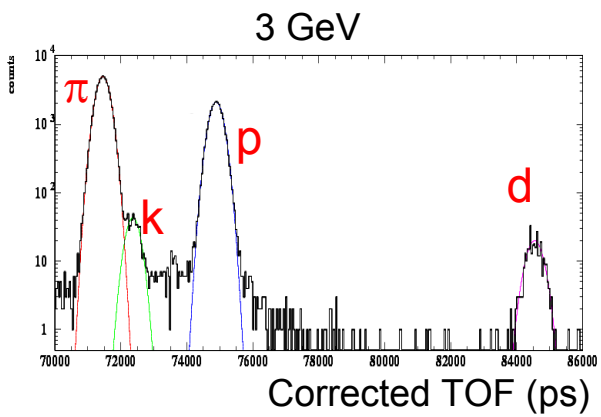
Beam cherenkov

- e id at low energy
- π id at high energy
- K id above 12 GeV
- ~100% eff in e-π tagging

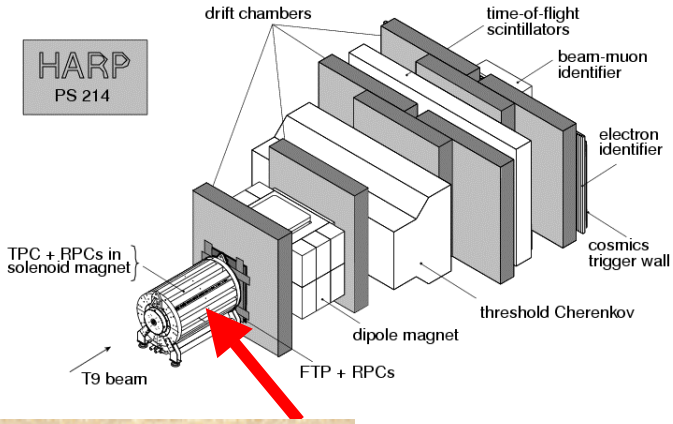


Beam Tof

- π/k/p separation at low energies (≤5 GeV)
- 170 ps resolution

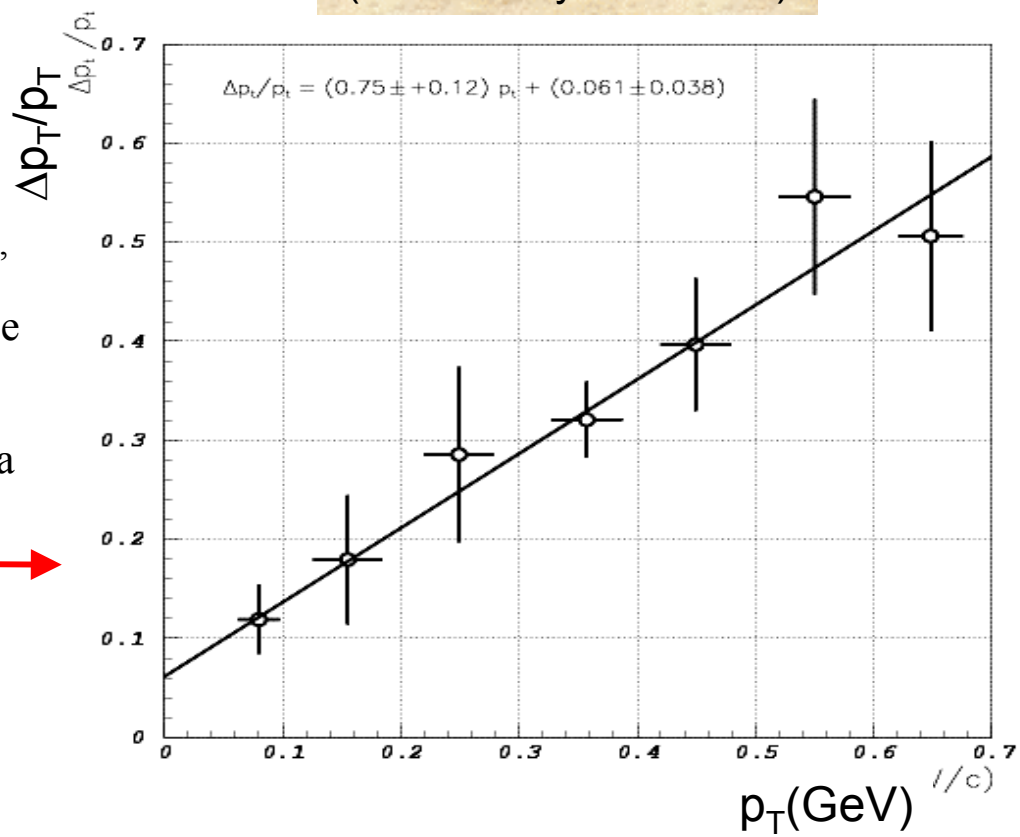


TPC (Ba-LNL-Ts)



- Tracking device for large angle region (above ~100 mrads)
- Le Calibrazioni con X-ray sources e cosmic rays sono state effetuate
- La Full reconstruction chain e'stata realizzata
- I problemi emersi dallo studio dei da sono stati compresi :
  - Inhomogeneous E and B field effect
  - Cross-talk
  - Variable distortions (charging, beam, dead pads effects,…)
- Gli algoritmi di correzione per tutte le distorsioni sono in progress
- La risoluzione in impulso senza correzioni e' fra il 20% e il 40% nella regione di interesse.
- **Si punta a migliorare di un fattore 2**.

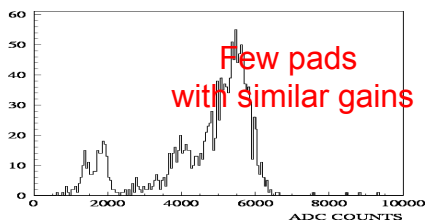
Momentum resolution
(without any correction)

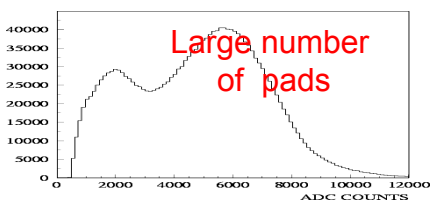


TPC-Calibrations

Krypton/cosmics (periodically)

- ^{83}Kr gas injected.
- Homogeneous illumination of the TPC.
- Used for:
  - Channel equalization, cross checked with cosmic rays (~5%)
  - Energy calibration





14% energy resolution
(without any correction)

post data-taking

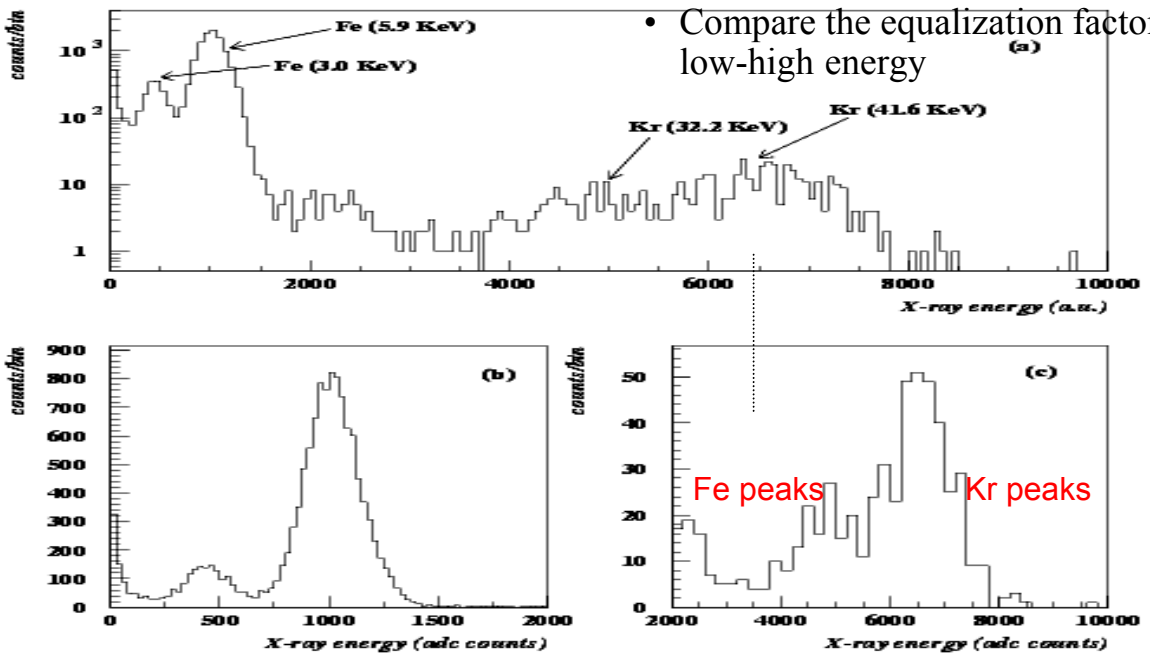
Individual pulse injection in all 3972 pads

Gennaio-marzo 2003
- Measure preamp linearity
- Measure x-talk couplings

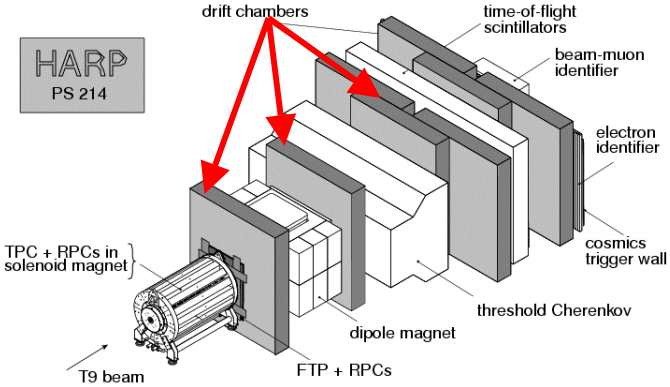
Aprile –Giugno : spostamento area sperimentale

^{55}Fe and ^{83}Kr X-ray sources

Da luglio fino a ieri
- Measure linearity of energy response
- Compare the equalization factors for low-high energy

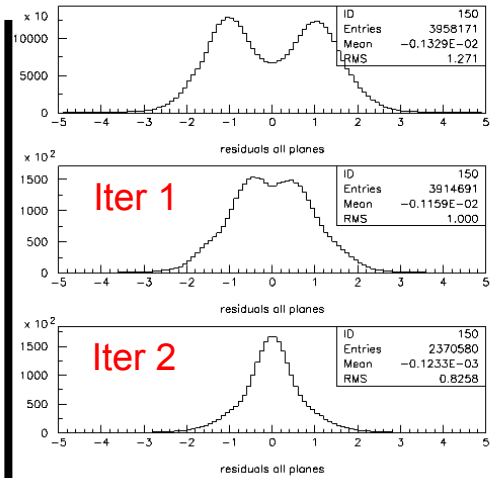


Drift Chambers



Alignment

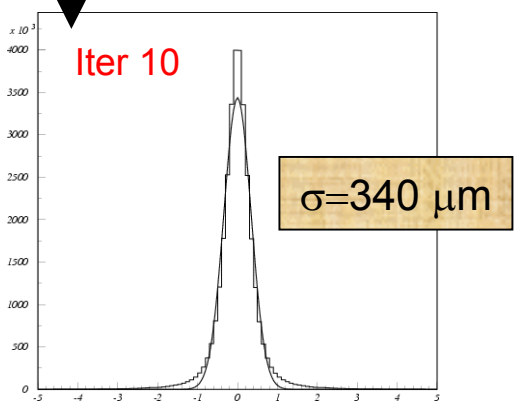
Cosmic rays



- Reused from NOMAD
- Tracking device for low angle region (<300 mrads)
- Alignment with cosmic and beam muons. Corrections on:
  - Wire positions
  - Wire time pedestal (t_0)
  - Drift velocities per plane
- Plane efficiency studies also with cosmic rays and muons

Performance

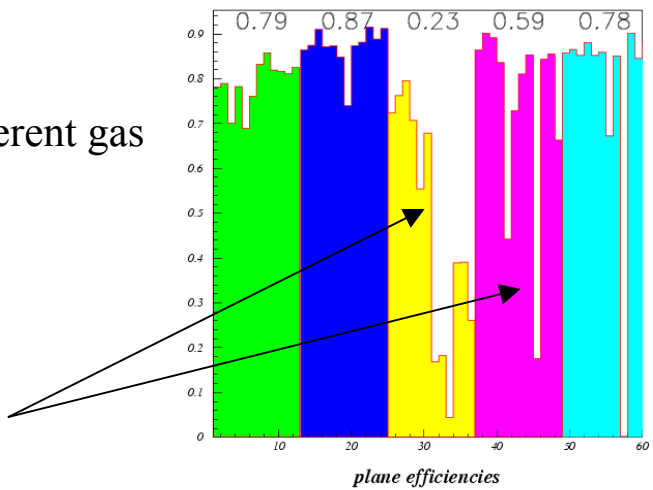
drift distance resolution



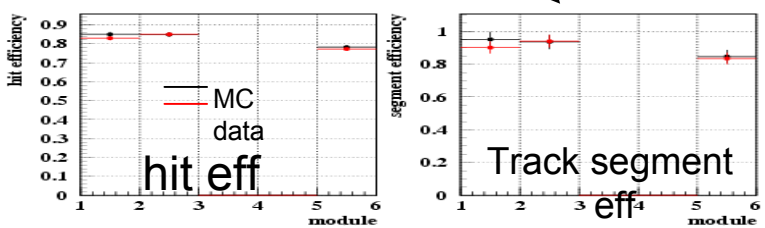
plane efficiency

eff~80%

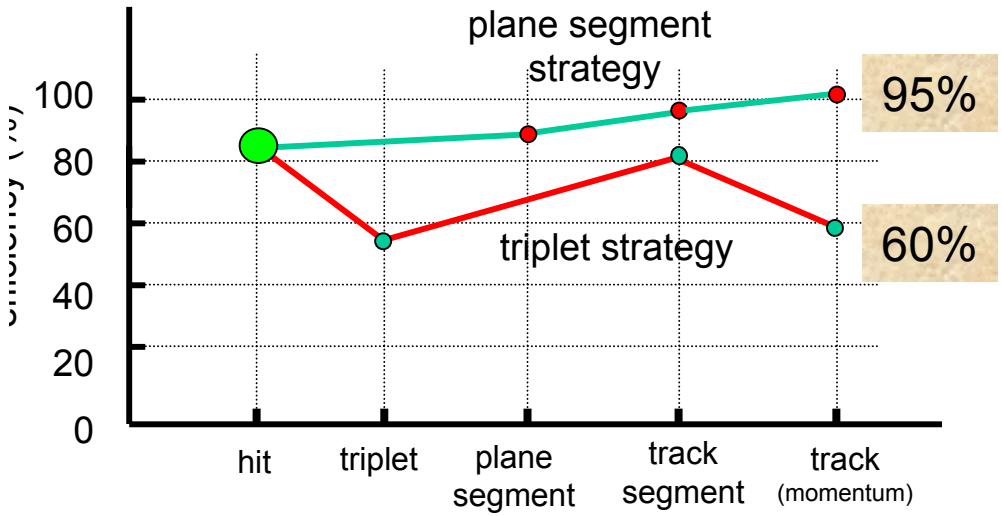
- In NOMAD was >95%
- Due to the use of a different gas (non flammable)

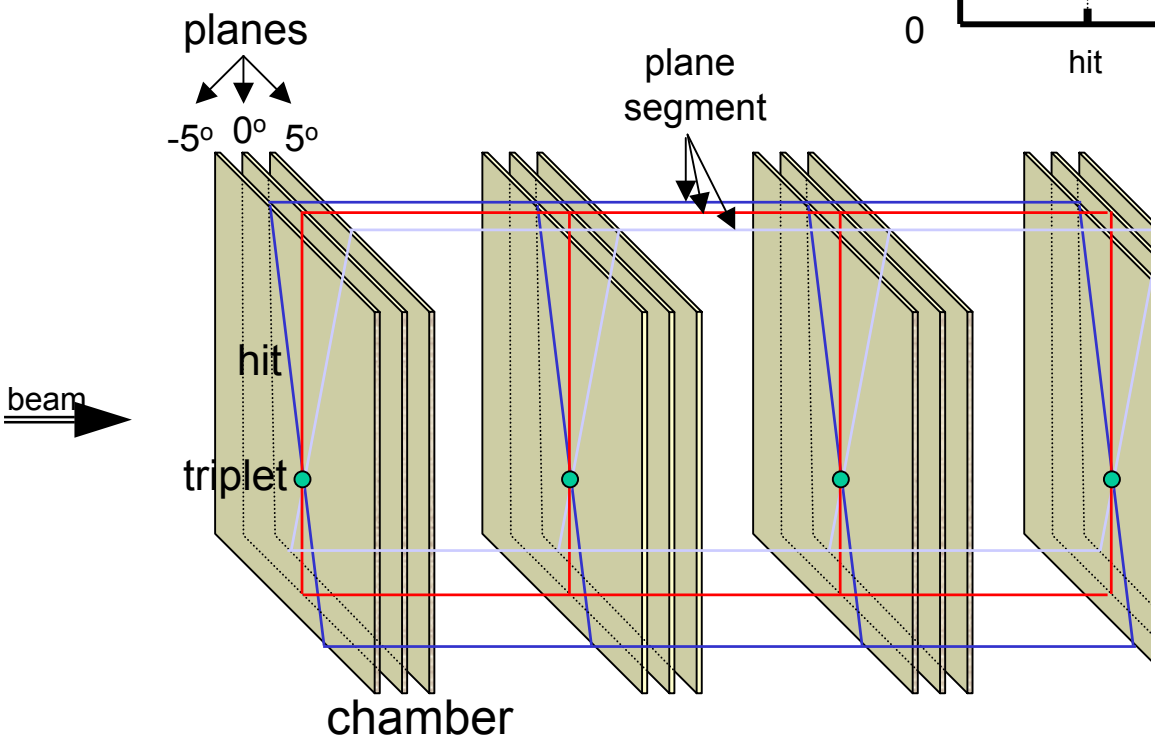


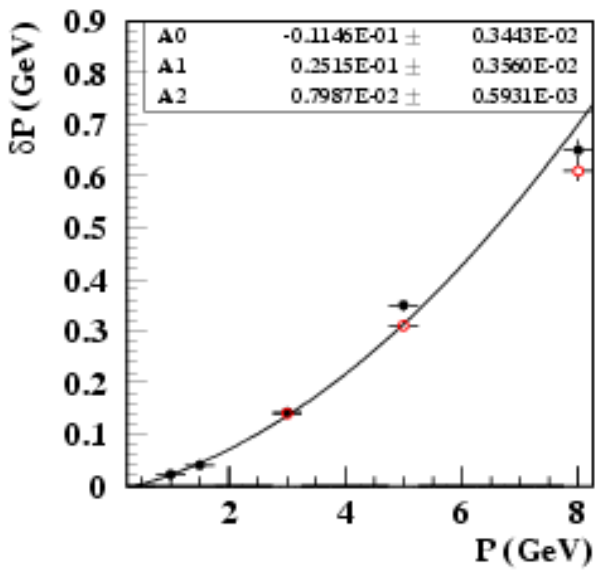
Drift chamber Reconstruction



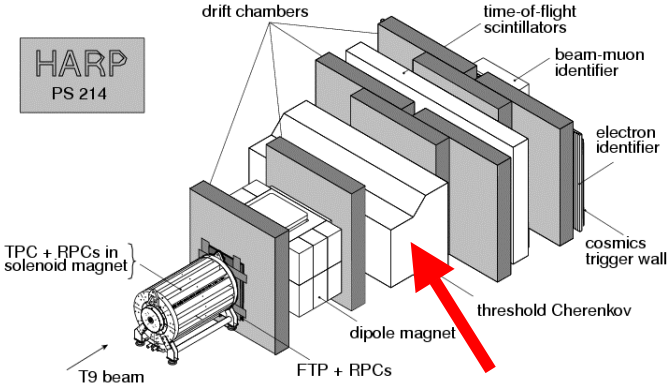
MC well behaved



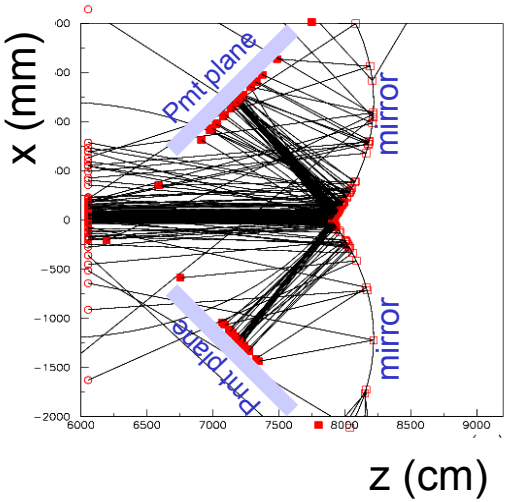




Cherenkov (TS)



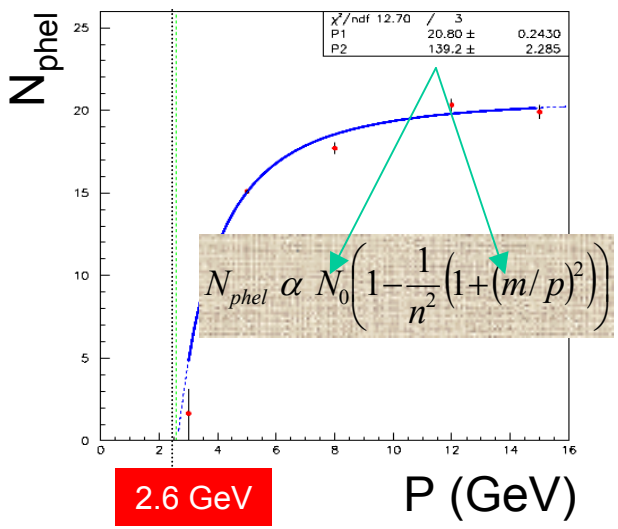
beam

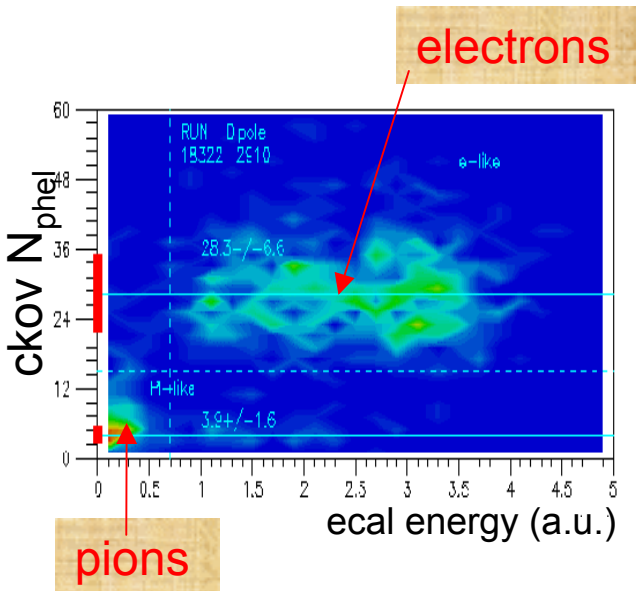


- 31 m^3 filled with C_4F_{10} (n=1.0014)
- LED flashing system for calibration

Performance

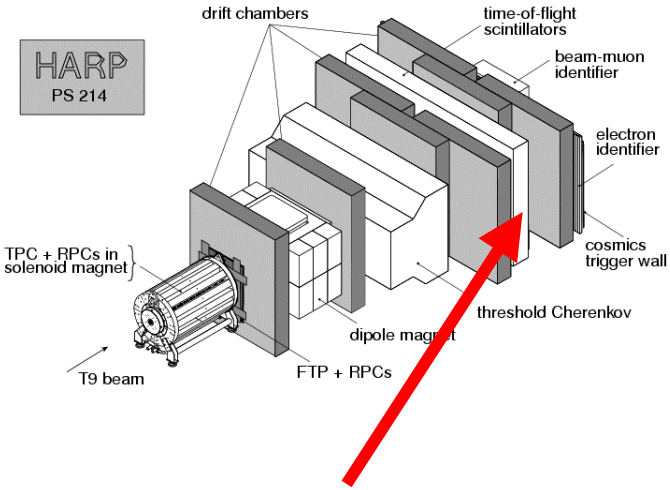
- 80% light collection eff
- 2.6 GeV threshold for pions

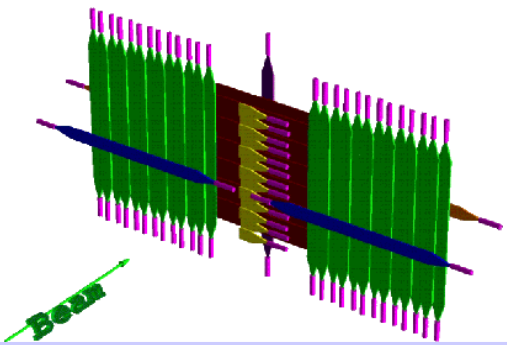


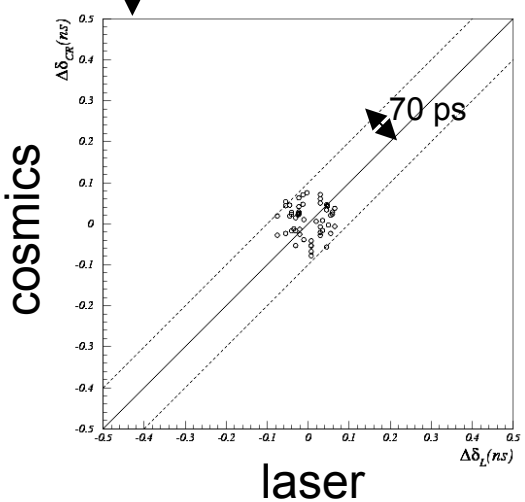


Tof Wall (MI-PD)

- Cosmic ray calibration (every 2-3 months):
  - Measure the relative time-offset between photomultipliers
- Laser calibration (continuous):
  - TOF wall stability check
  - Good agreement with cosmic ray calibration

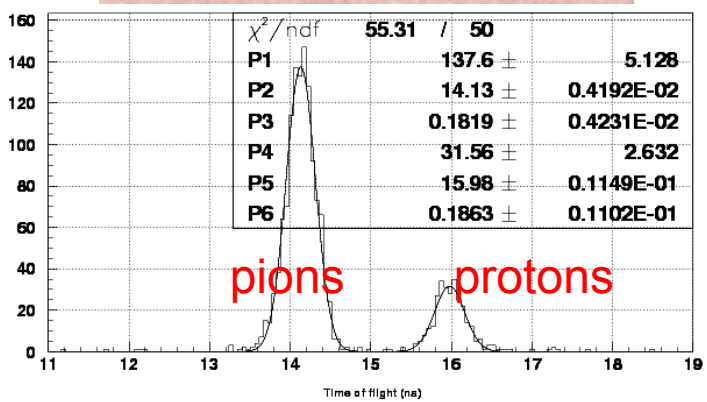






Performance

7σ separation at 3GeV



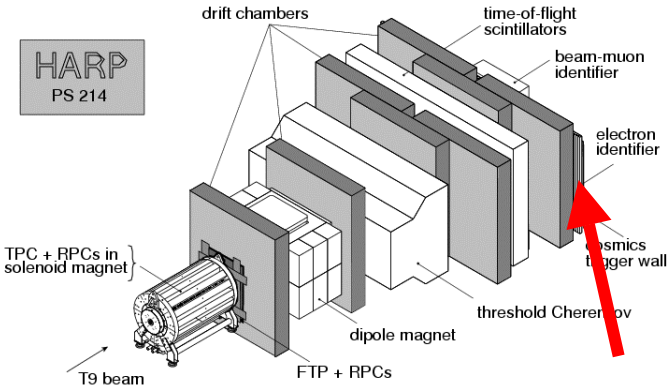
3σ separation

π/p E< 4.5GeV

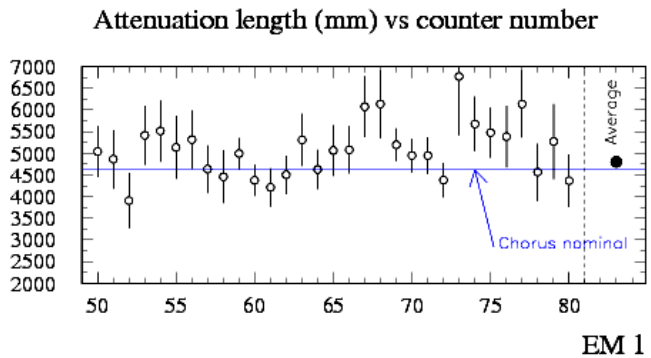
π/k E< 2.4GeV

Electron identifier

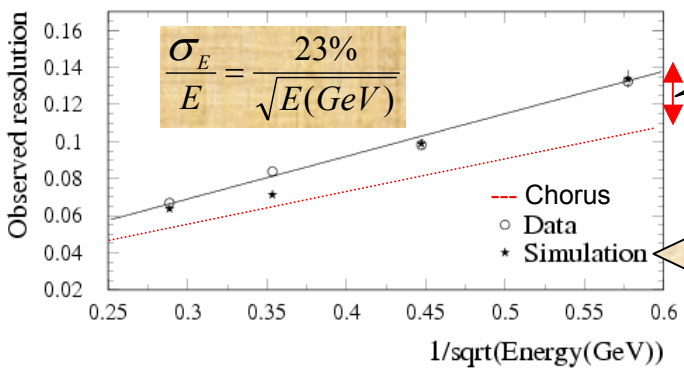
Na, Roma I & III



- Reused from Chorus
- 2 planes (EM1, EM2)
- Serves for:
  - e/π separation
  - π^0 id (iron photon converter)
- Calibration with cosmic rays



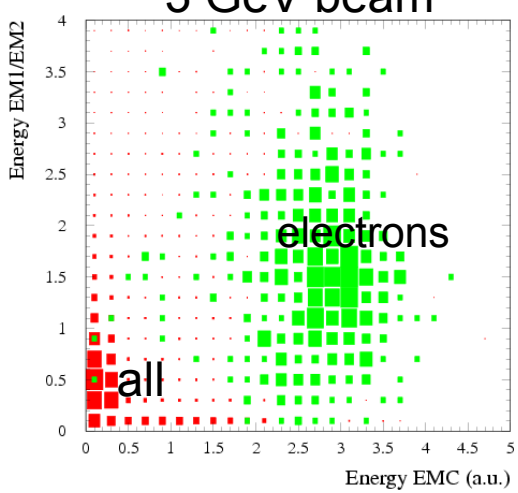
Performance



Spread of electron beam at the entrance of the spectrometer

Chorus resolution + Full T9 beam and SPEC description

3 GeV beam



Software Status:

in progress ma gia operazionale

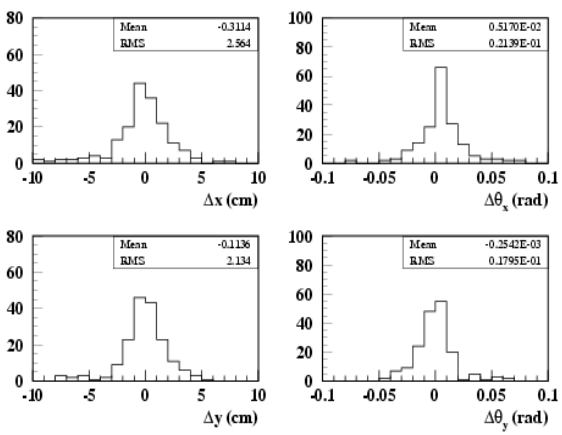
- Analysis package:
  - Exportable DSTs
  - Software running locally (in external institutes and on laptops)
- Reconstruction package:
  - Track fitting, track/measurement matching and merging, track length computation, propagation to any surface
  - Handles multiple scattering and inhomogeneous magnetic fields
  - Vertex fit almost ready
- GEANT4 simulation:
  - Detector description for simulation, reconstruction and event display
  - Response of all sub-detectors (and TPC modelling)
  - T9 beam simulation
- Migration from Objectivity to Oracle completed
  - Interface software almost ready (done)

Matching between subdetectors

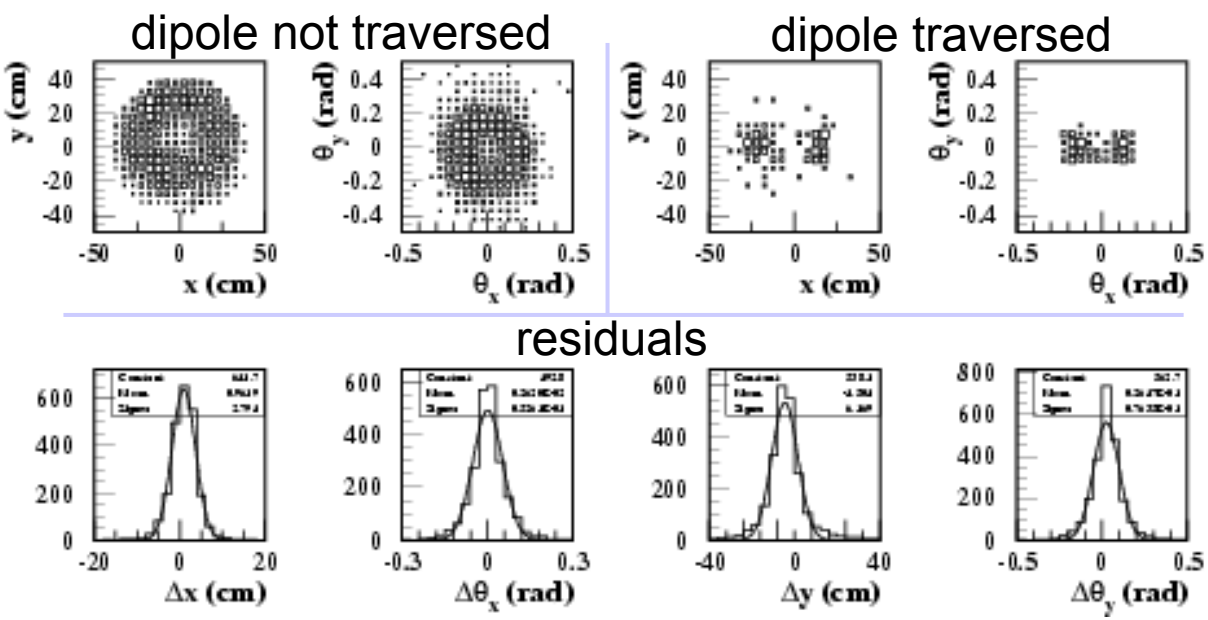
- Global alignment (done)
- PID association to reconstructed tracks (in progress)
- Combined tracking (in progress)

Tracking devices

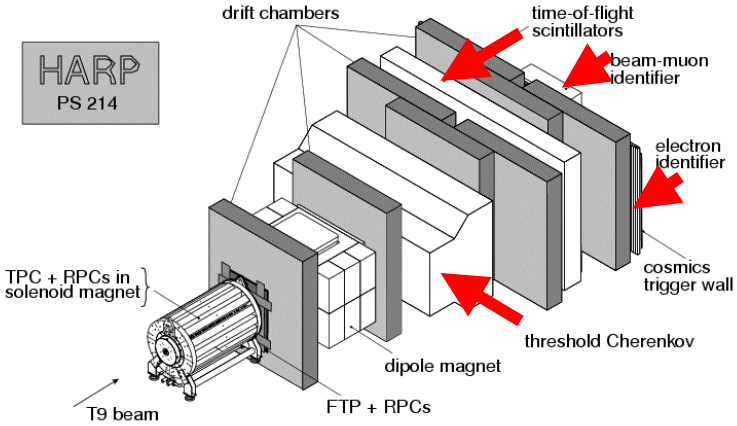
NDC-MWPCs

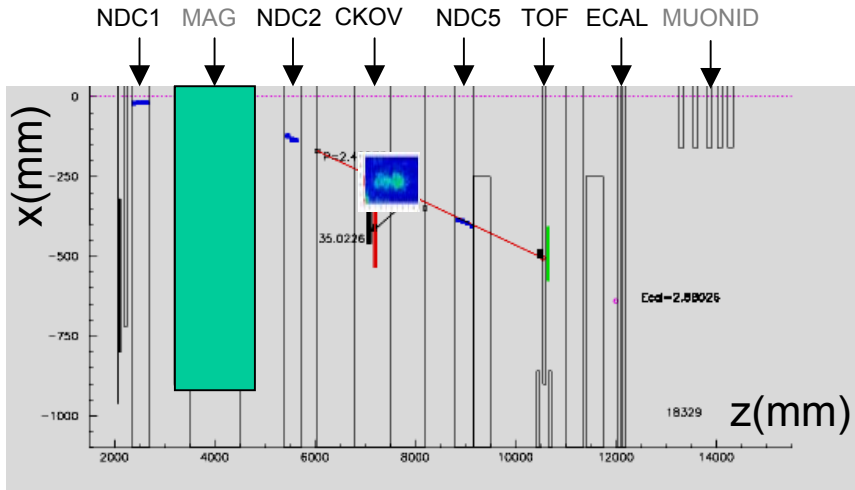


NDC-TPC

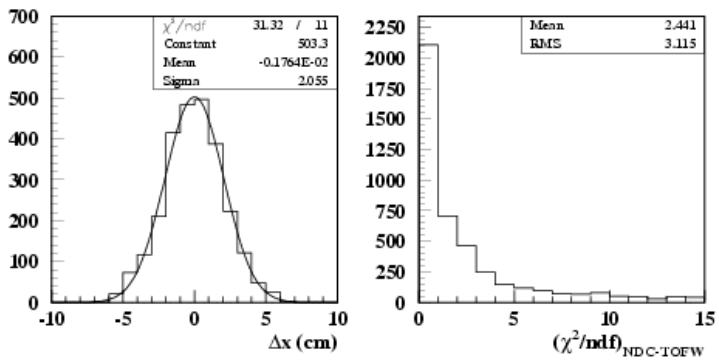


Forward PID detectors

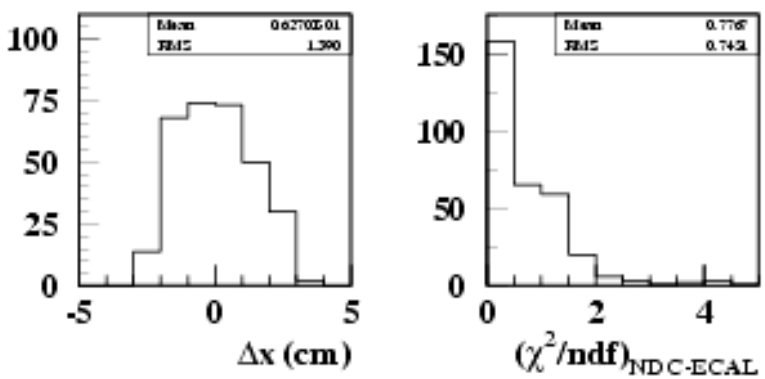


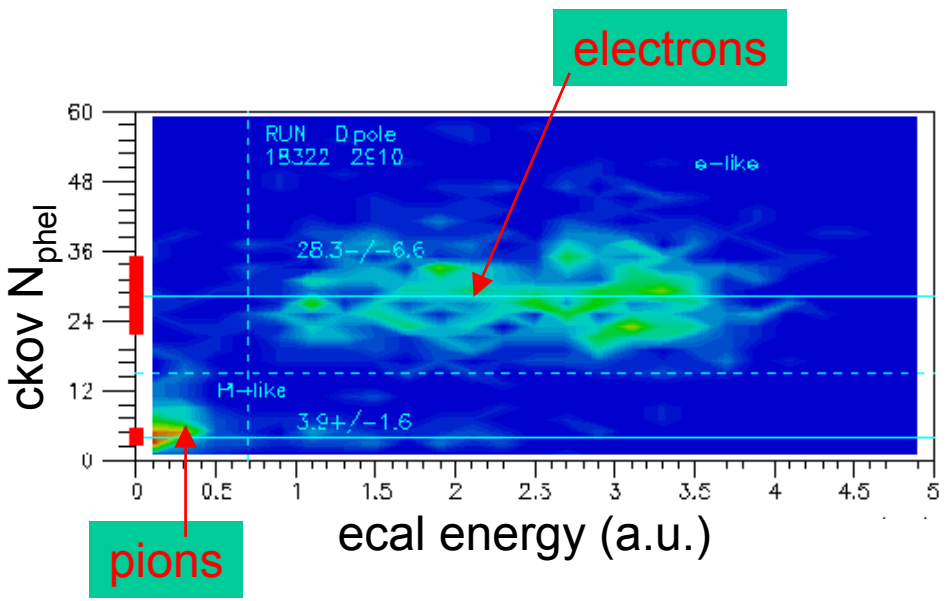


NDC-TOF Wall



NDC-Electron id





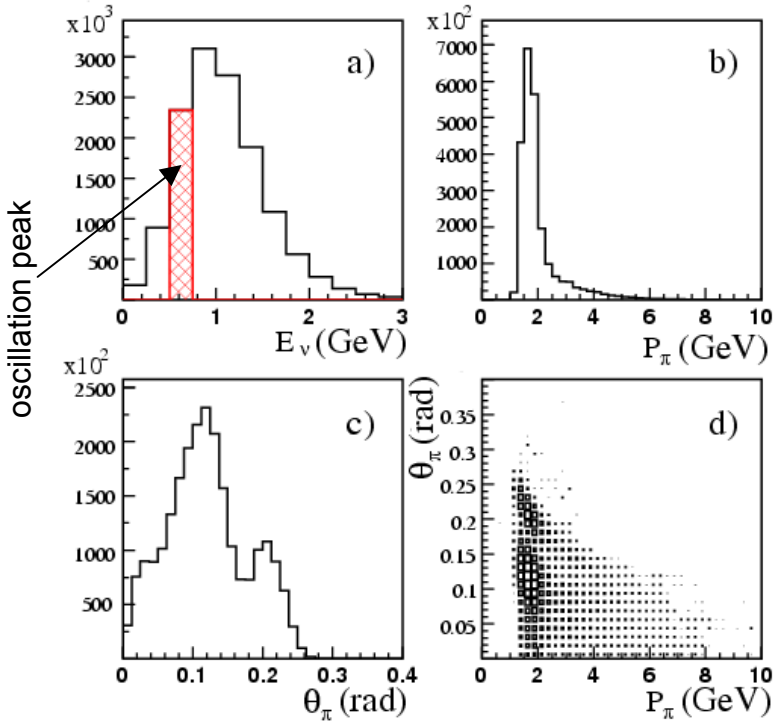
Prospects on physics analysis

- Forward and beam detectors are already functional for analysis:
  - Calibrated and aligned
  - High PID performance
  - Efficient track reconstruction
  - Monte Carlo available

- We have selected strong physics cases within our reach and of our immediate interest

- The forward analysis is of immediate interest to the K2K and MiniBooNE experiments

K2K example



- P>1 GeV → reach forward PID detectors
- P<4.5 GeV → 3σ π/p separation with TOF and overlap with cherenkov
- θ<300 mrads → covered by forward spectrometer

Attivita' dell'ultimo anno del gruppo Harp

- Data taking concluso con successo (Nov 2002)
- Calibrazione e allineamento conclusa per
  beam defining detectors
  forward spectrometer (piccolo angolo)
- Calibrazioni e correzioni TPC a buon punto
  "post" data taking completato
  analisi in corso

  Detector paper in preparation
- Software tools per l'analisi in stato avanzato
- Physics performance del forward spectrometer adeguate a far partire le prime analisi ….
- Large Angle Physics a seguire

→ **un cospicuo numero di pubblicazioni nel 2004/5**