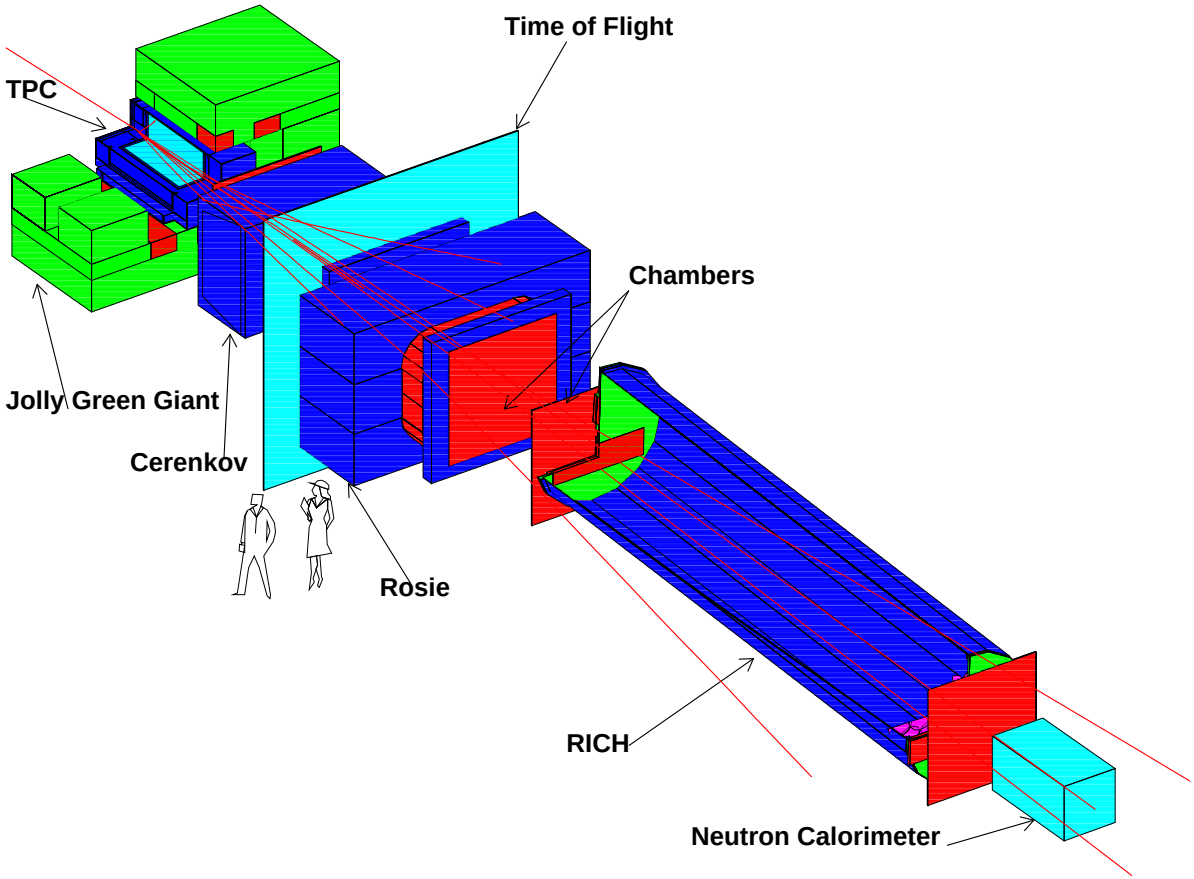
MIPP and its relevance to Kaon production

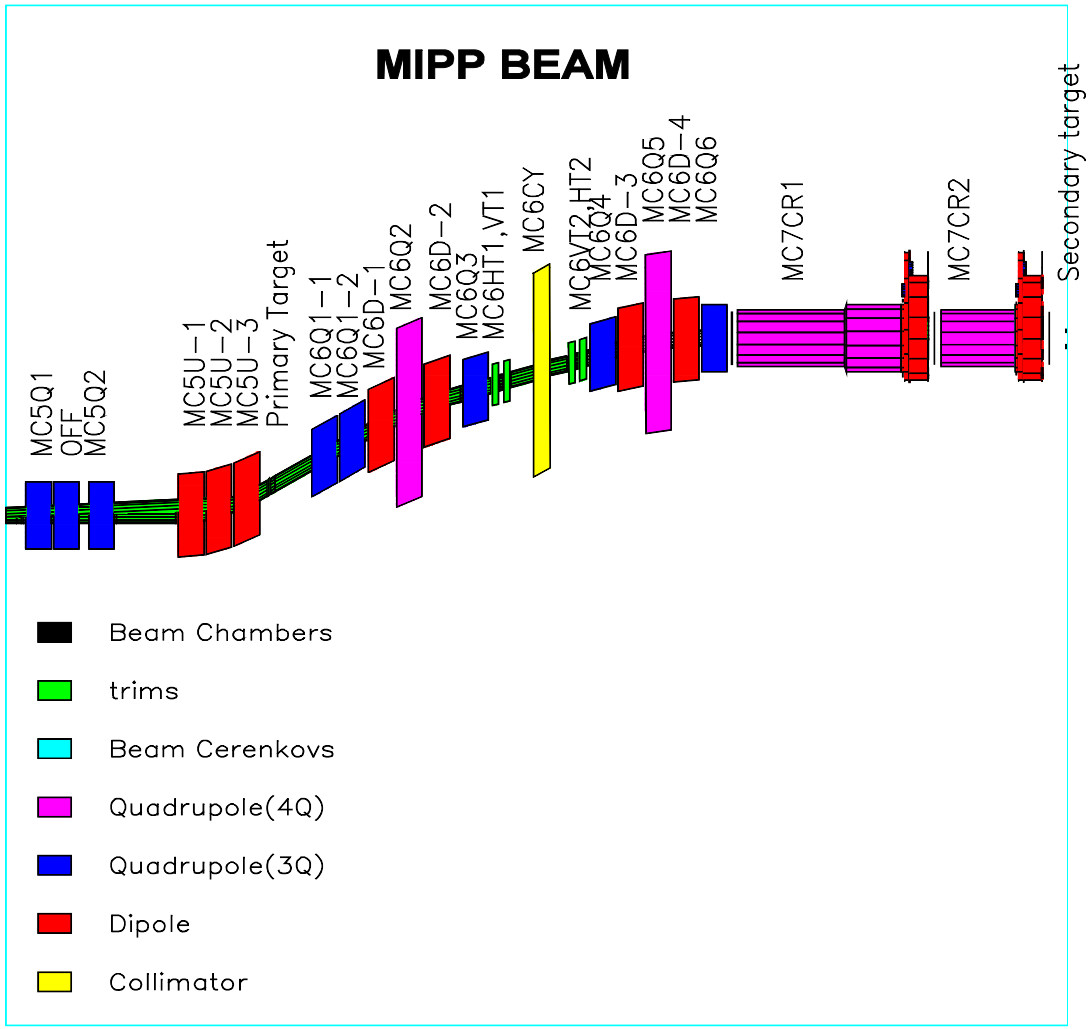
MIPP

Main Injector Particle Production Experiment (FNAL-E907)

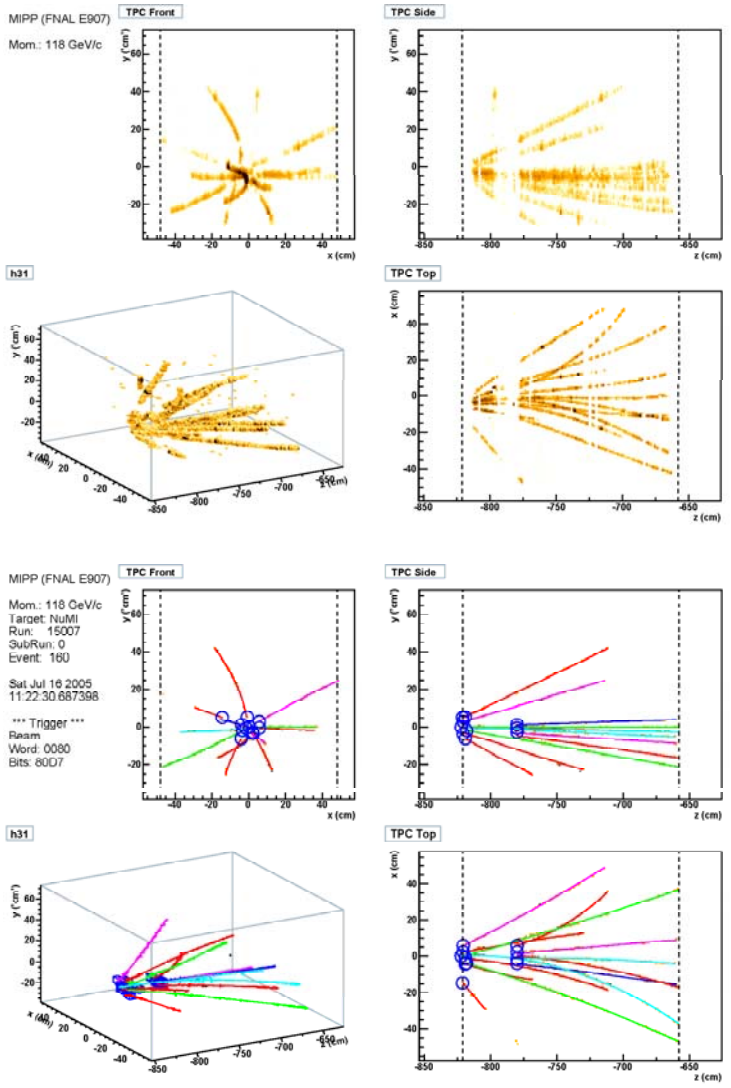


MIPP Secondary Beam

Installed in 2003. Excellent performance. Ran it successfully in MIPP from 5-85 GeV/c secondaries and 120 GeV/c primary protons. Excellent particle ID capabilities using 2 Beam Cerenkovs. 6 beam species ($\pi^{\pm}$,$K^{\pm}$,$p^{\pm}$) in the momentum range ~1-120 GeV/c



MIPP TPC


MIPP (FNAL E907)
Mom.: 118 GeV/c
TPC Front
TPC Side
h31
TPC Top
MIPP (FNAL E907)
Mom.: 118 GeV/c
Target: NuMI
Run: 15007
SubRun: 0
Event: 160
Sat Jul 16 2005
11:22:30.687398
*** Trigger ***
Beam
Word: 0080
Bits: 8007
TPC Front
TPC Side
h31
TPC Top

Data taken so far (20Hz)

Data Summary 27 February 2006			Acquired Data by Target and Beam Energy Number of events, x 10^6									
Target			E									Total
Z	Element	Trigger Mix	5	20	35	40	55	60	65	85	120	
0	Empty	Normal		*0.10*	*0.14*			*0.52*			*0.25*	*1.01*
	K Mass	No Int.				*5.48*	*0.50*	*7.39*	*0.96*			*14.33*
	Empty LH	Normal		*0.30*				*0.61*		*0.31*		7.08
1	LH	Normal	0.21	**1.94**				**1.98**		**1.73**		
4	Be	*p* only									1.08	1.75
		Normal			0.10			0.56				
6	C	Mixed						**0.21**				1.33
	C 2%	Mixed		**0.39**				**0.26**			**0.47**	
	NuMI	*p* only									**1.78**	**1.78**
13	Al	Normal			*0.10*							*0.10*
83	Bi	*p* only									1.05	2.83
		Normal			0.52			1.26				
92	U	Normal						1.18				1.18
Total			0.21	2.73	0.86	5.48	0.50	13.97	0.96	2.04	4.63	31.38

Relevance to ORKA

- For example, there are 1.05 Million events (raw interactions) on Bismuth at with a beam of 120 GeV/c protons only. Platinum is Z=78 and A= 195. Bismuth is Z=83 and A=208. So it is quite close to Platinum. The beam energy of 120 GeV/c is close the planned ORKA energy of 95 GeV/c.

Analysis Cuts

- We have published the forward neutron spectrum from 120 GeV/c Bi data. For this analysis, where cross section was very important, the following cuts were used.
- Total Interaction triggers –1.05 Million
- 644813 - passed beam track selection (single beam trk, beam trk time...)
- 274758 - passed Z-interaction position (+/-5 cm around the tgt). The remainder were interactions in the Interaction trigger.
- 226672 - passed deltaPt cut (the straight through is rejected)
- Of these the first cut is very harsh and selects only those tracks with very clean beam track. However, the beam is entirely low intensity 120 GeV/c protons. So one should be able to relax this cut and gain nearly a factor of 2 in statistics. So I would plan on ~400K triggers.

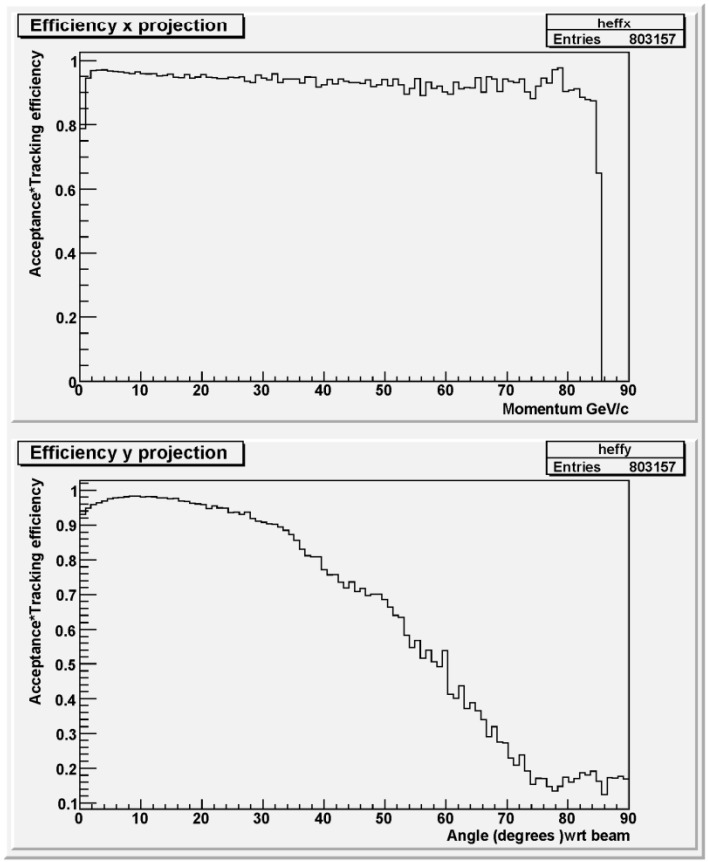
Acceptances

The efficiency is greater than 90% for all tracks. It is to ~80% for low momentum tracks and this is due to wide angle tracks as can be seen by the bottom figure where efficiency drops when the angle gets to 40 degrees or grater. For ORKA, the angle wrt the beam is 20 millisteradians(i.e 16 degrees half cone angle), so MIPP has excellent efficiency in this region.

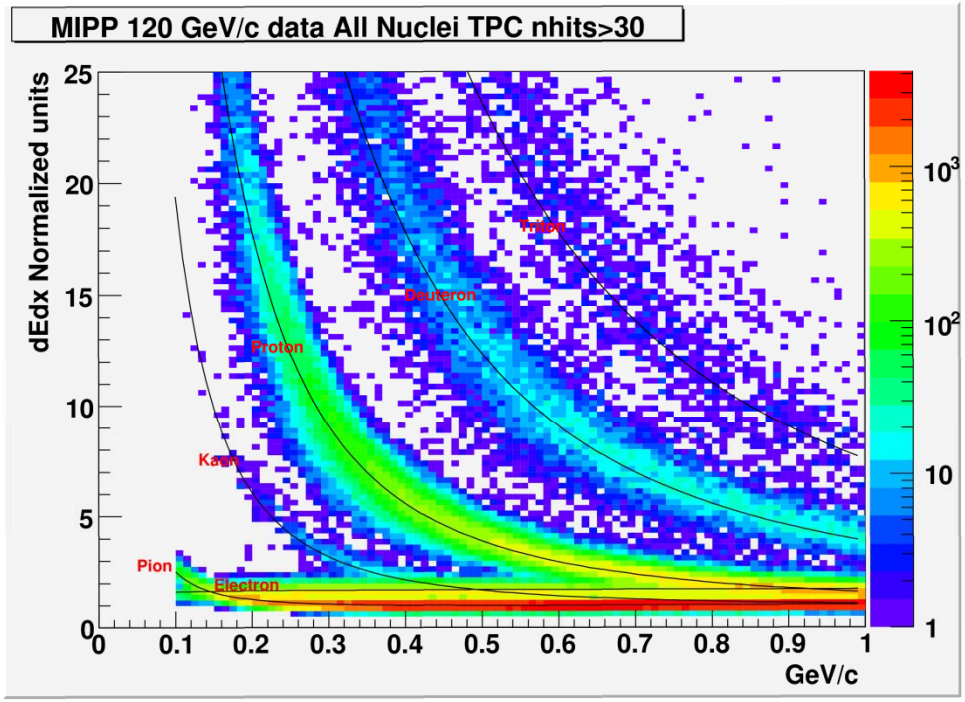
MIPP-I Acceptances
MIPP-II will have backward acceptances.

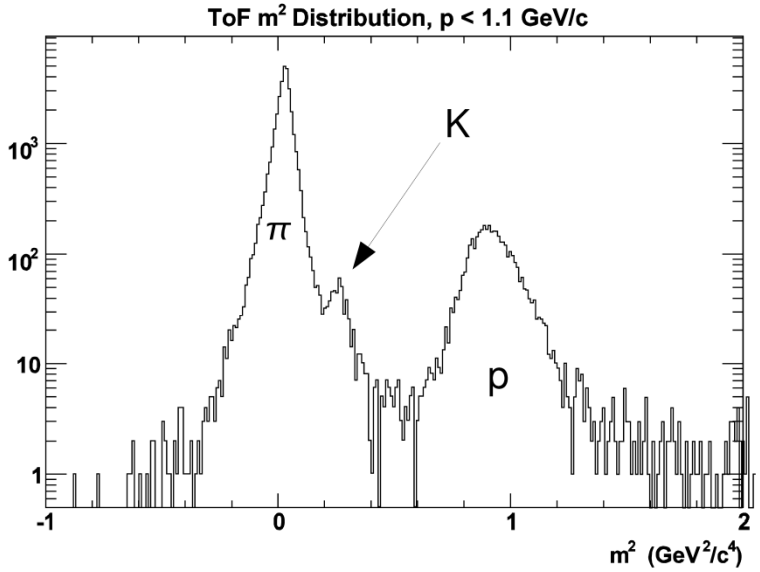
Efficiency vs. momentum

Efficiency vs. θ_{lab}



TPC and TOF particle id.

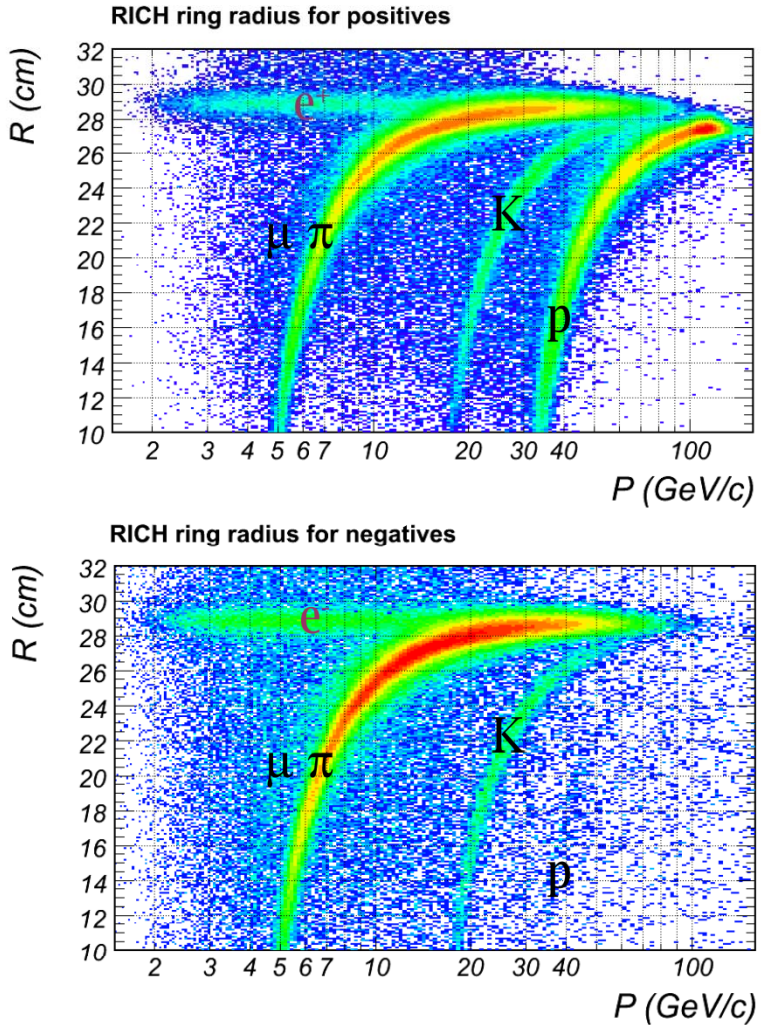




Cross Check using hydrogen data

- We have plenty of hydrogen pp data which is symmetric in the center of mass in all inclusive distributions including kaons. In the lab, the backward CM hemisphere is in the TPC and TOF. In the lab, the forward CM hemisphere is in the RICH. We can cross-relate the two.

RICH particle ID



How ORKA can get access to this data

Status of data

- Both the Monte Carlo and the data are in DST form readable in ROOT.

Collaboration with MIPP-I

- If students of postdocs are involved, we accept them as part of the MIPP analysis (like the Indian students) and they will get their names on the appropriate publications.

Neutron data Published

- Notice the difference between data and various Monte Carlos!! Factors of 2 or more difference is evident.