

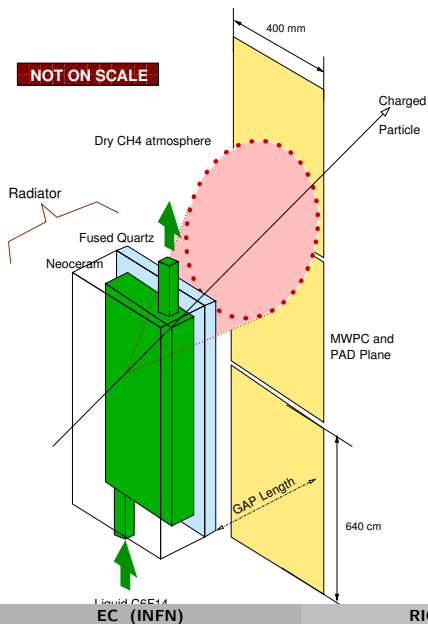
Transversity Readiness Review RICH Upgrade

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19 Mar 2007

- 1 RICH Overview
- 2 Upgrade (Description, Performance)
- 3 Manpower
- 4 Costs / Funding
- 5 Timeline

Existing RICH schematic view



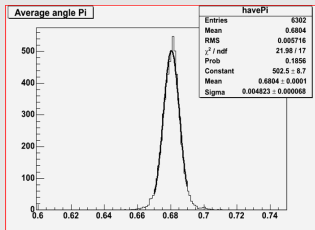
Main sub-Components

- Mech. Structure: 6 frames + honeycomb cap + 3 pan planes
- Radiator:
 - ▶ Liquid C₆F₁₄ Freon (15 mm) at Room temperature
 - ▶ Vessel: 1.9 × 0.31 × Neoceram (4 mm) / Quartz (5 mm)
- Proximity Gap: 10 cm
- Photon Detector:
 - ▶ MWPC (2 wire planes)
 - ▶ 3 PAD PLANES (~ 11000 pads/chs)
- Dry Methane at STP

+ the evaporation facility
(now at Stony Brook University)

Present RICH performance at $2.0 \pm 5\%$ GeV/c $\Rightarrow \pi/K$ rejection 1:1000

Hyper. Exp. Data

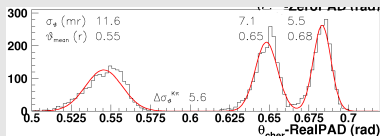


Mean Hits (for π): $N_{PAD,\pi} = 13$

Angle resolution: $\sigma_{\theta_\pi} = 5$ mrad

$$\rightarrow \Delta\theta_{\pi,K} = 6\sigma_{\theta_\pi}$$

GEANT3 MonteCarlo



Pretty good agreement between experimental data and MC:

$$\sigma_{\theta_\pi}^{EX} / \sigma_{\theta_\pi}^{MC} \sim 0.9$$

$$N_{PAD,\pi}^{EX} / N_{PAD,\pi}^{MC} \sim 0.9$$

$$\Delta\theta_{\pi,K}^{EX} / \Delta\theta_{\pi,K}^{MC} \sim 1.07$$

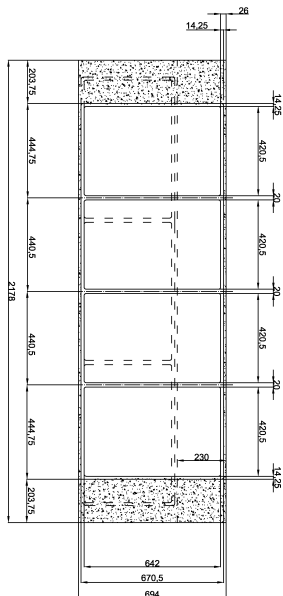
At 2.4 GeV/c: $\Delta\theta \sim 4.1\sigma \Rightarrow \pi : K \sim 1 : 140$

Transversity Requirement: $\pi : K \sim 1 : 1000 \Rightarrow \Delta\theta \geq 4.7\sigma$

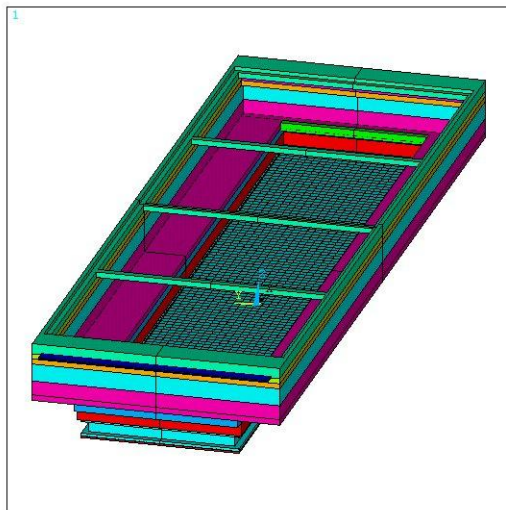
RICH (Mechanical) Upgrade

Increase (+33%) the photo-detection plane reusing as much as possible the present RICH parts.

- **Re-build the last 4 aluminium frames**
- reuse 3 + 1 (existing spare) pad planes (90° rotated)
- use old and new electronics (already available)
- implement additional software for the integration of the new electronics into the DAQ
- evaporate CsI on 4 pad planes (instead of 3)



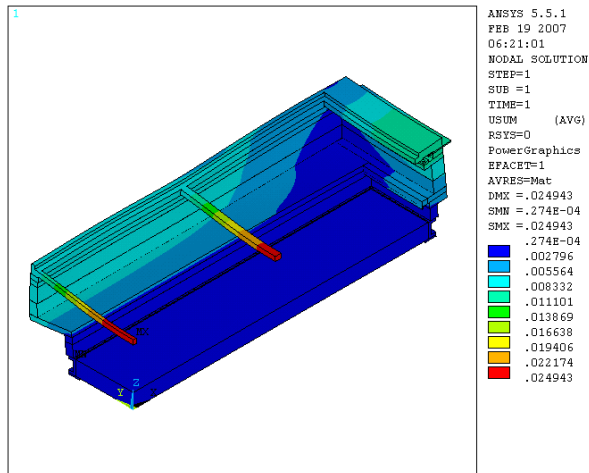
FEM Analysis: $\times 1.3$ (whole detector frame)



```
ANSYS 5.5.1  
FEB 16 2007  
16:08:05  
ELEMENTS  
PowerGraphics  
EFACET=1  
MAT NUM  
  
XV =-.895591  
YV =-.239973  
ZV =.374607  
DIST=691.524  
ZF =135  
VUP =Z  
Z-BUFFER  
EDGE
```

FEM tuned to the existing RICH distortion measurements

FEM Analysis: $\times 1.3$ (Results, in mm)

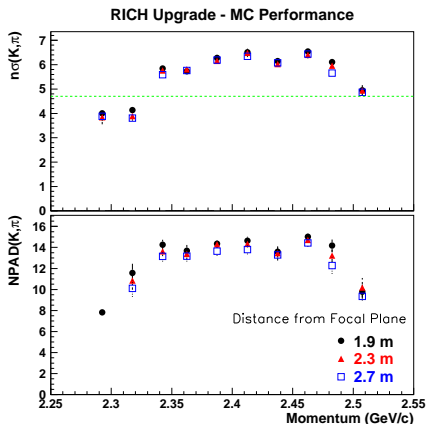


⇒ Distorsions are negligible ⇐

MC simulation, RICH $\times 1.3$

Performance vs momentum acceptance vs RICH location

- Different collection efficiency along the dispersion plane



- Better than 1:1000 π :K rejection on more than 80% of momentum acceptance
- Lower 15% momenta with $\sim 1 : 100$ rejection

→ A1 will help at lowest momenta

(MC tuned to hyper. real data)

Manpower

- Most of the manpower provided by INFN-ISS
- External Italian Company will machine the aluminium frames
- JLab support on:
 - ▶ Logistics in USA, technical maintenance and installation in Hall A (J. Segal)
 - ▶ Minor mechanical work (Mechanical Shop)
 - ▶ New electronics test and integration into DAQ (A. Camsonne)

	Physicist Man	Technician Month
Upgrade		
INFN	4	8
JLab	1.	.5
Installation		
INFN	1.	1.5
JLab	.4	.3

Costs/Funding (upgrade and installation)

	Ilab	INFN
Freon	5	0
Test Set Up (Rome)	0	0
Circulation System	0	0
Gap Extender Frame	0	0
Frame Manufacturing	0	59
Mechanical Support	2	0
HV plane	0	5
LV FE electronics	3	0
New RCB board	0	5
Glove Box Upgrade	0	0
Transport Ilab<->Rome	0	5
Transport SBU->Ilab	5	0
Pad Plane Shells	3	0
Spare Radiator Repair	0	7
	0	0
Hotel at SBU	3	0
Car Rent at SBU (?)	1.5	0
	0	0
Total	22.5	81

Values are in kUSD
1 euro = 1.3 USD

Frame material and manufacturing is the largest cost (official quotation)

Milestones

Upgrade

- End Sep 2007: RICH frames Ready, availability of the upgraded frames (and accessories).
- Mid Nov 2007: RICH Assembled in Rome, ready to be shipped to JLab.
- **Mid Dec 2007: RICH Ready for installation**, all parts of the RICH (included the new electronics) have been tested and ready for integration and installation.

Installation

Starts 2 weeks before obeginning of the Transversity installation, and will takes 8 weeks (test included).

- RICH installation does not interfere with other equipment
- RICH concept is unmodified by the upgrade (different mechanical configuration) ⇒ no new specific test required, no new safety issues