ANCS
Autoritatea Nationala pentru Cercetare Stiintifica

CNMP
CENTRUL NATIONAL DE MANAGEMENT PROGRAME

IFIN-HH

ALICE

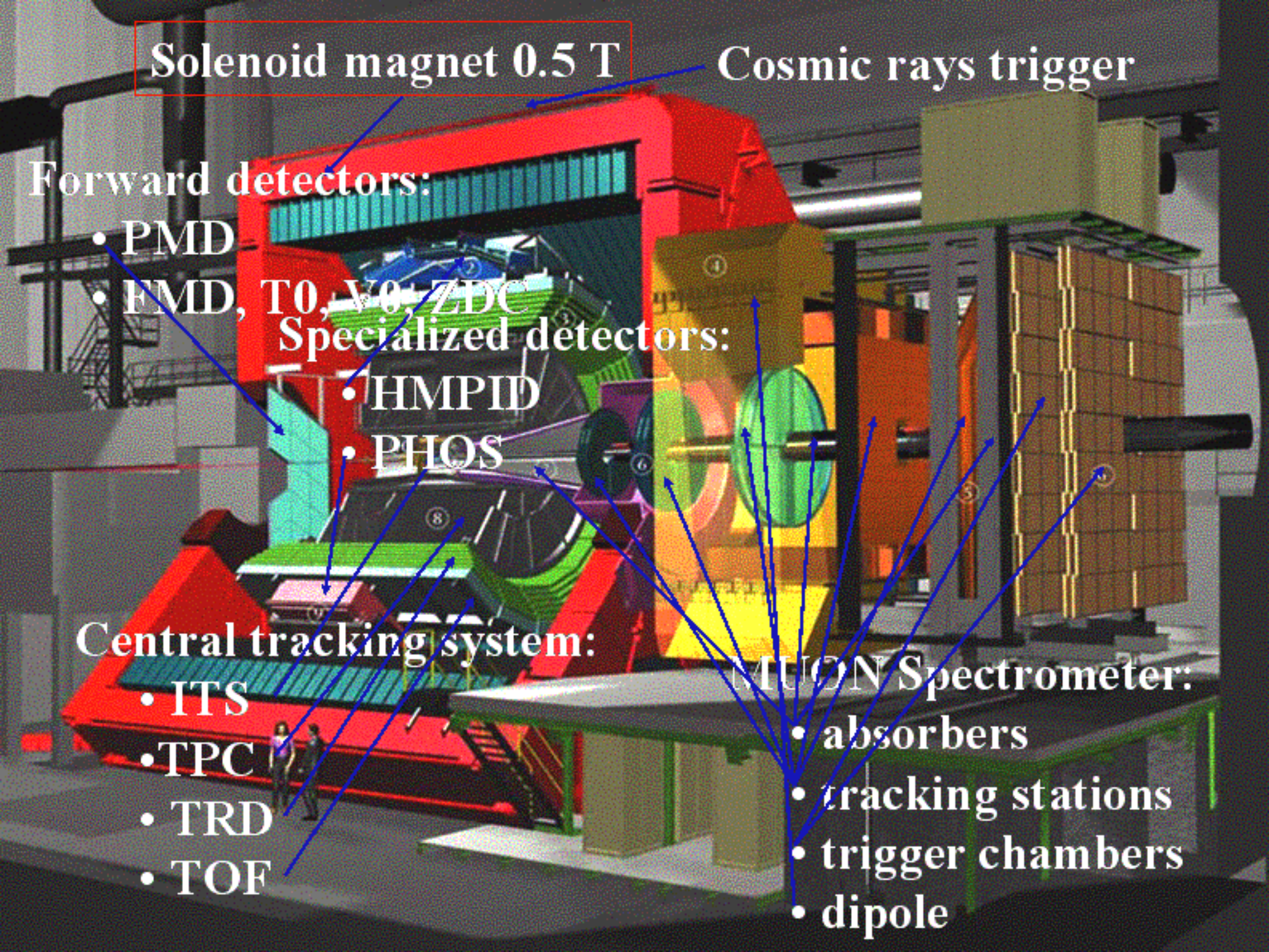
CERN

DFH-IFIN ALICE Romanian Branch Progress Report

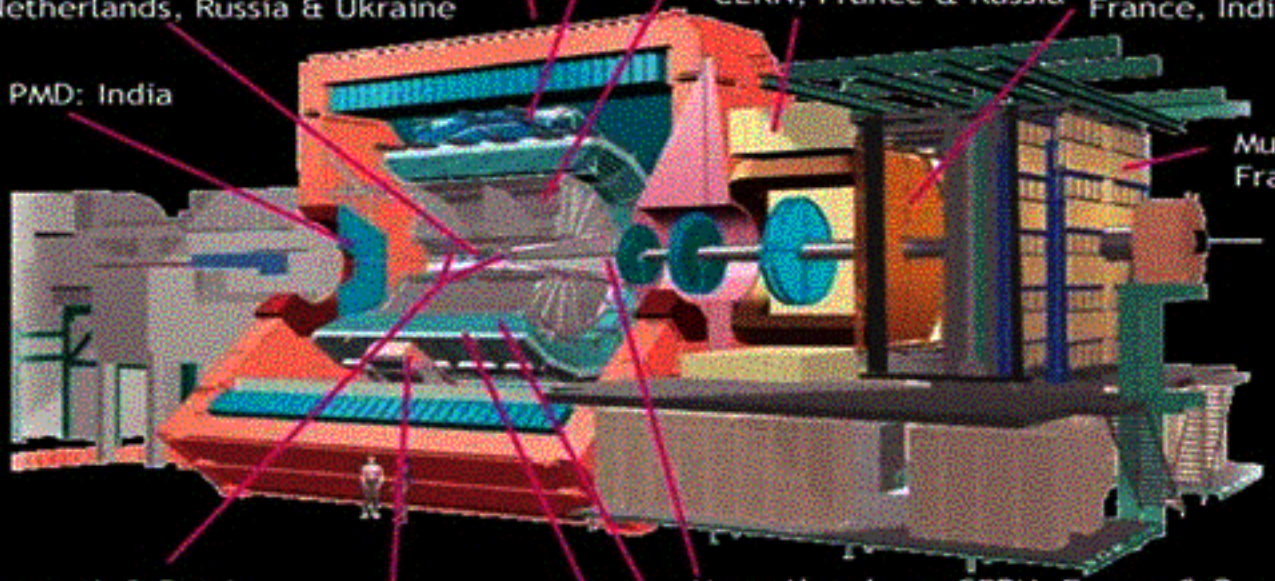
- **ALICE-TRD construction, tests, installation, operation**
- **Computing activities – hardware & software – AliEn**
- **Physics**
- **Financial aspects**
- **Outlook**

Mihai Petrovici on behalf of DFH-NIPNE ALICE Romanian Branch, Bucharest, June 23, 2008

- **ALICE-TRD construction, tests, installation, operation**


Solenoid magnet 0.5 T
Cosmic rays trigger
Forward detectors:
• PMD
• FMD, T0, V0, ZDC
Specialized detectors:
• HMPID
• PHOS
Central tracking system:
• ITS
• TPC
• TRD
• TOF
MUON Spectrometer:
• absorbers
• tracking stations
• trigger chambers
• dipole

OVERVIEW OF THE PARTICIPATION OF COUNTRIES IN THE ALICE DETECTOR CONSTRUCTION*



Acorde: Mexico

HMPID: CERN, Croatia, Italy & Russia

TPC: CERN, Croatia, Denmark, Germany, Poland, Slovak Rep. & Sweden

ITS Pixel: CERN, Italy & Slovak Rep.
ITS Drift: Czech Rep., Italy, Russia, Ukraine & USA
ITS Strip: CERN, Finland, France, Italy, Netherlands, Russia & Ukraine

Dipole Magnet: CERN, France & Russia

Muon Tracking: Armenia France, India, Italy & Russia

PMD: India

Muon Trigger: France & Italy

ZDC: Italy
not visible, installed next to the beampipe inside the LHC tunnel.

FMD: Denmark & Russia
T0: Finland & Russia
V0: France & Mexico

Muon Absorbers: CERN, France & Russia

TRD: Germany, Russia JINR & Romania

PHOS: China, Czech Rep., France, Norway, Poland & Russia

TOF: Italy & Russia

DAQ: CERN, Germany, Hungary, Norway and United Kingdom

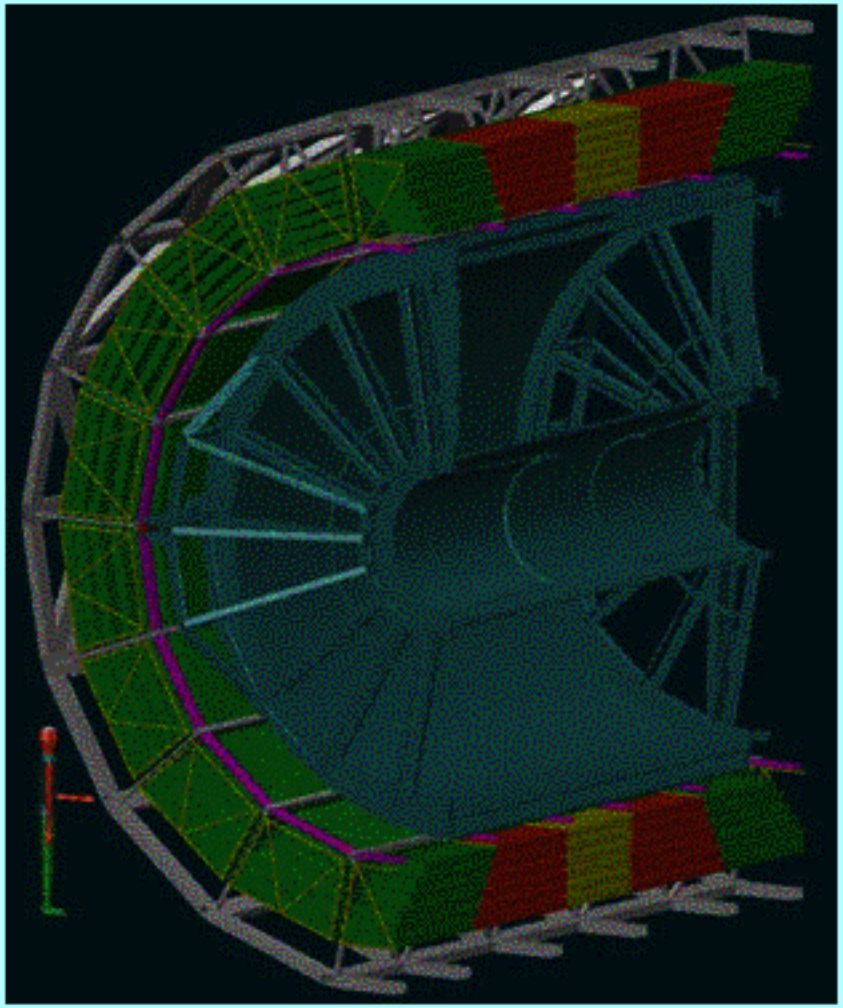
HLT: Germany & Norway

Trigger: Slovak Rep. & United Kingdom

Computing: Armenia, CERN, Cuba, Italy, Slovakia, Poland and Korea

* according to the Memorandum of Undertanding for Collaboration in the Construction of the ALICE Detector (RRB-D-00-41) and to the addendum to the Memorandum of Understanding for Maintenance and Operation of the ALICE Detector CORE Computing.

TRD – sub detector



Purpose:

- *electron ID in central barrel p>1GeV/c*

Parameters:

- *18 supermodules segmented in*

  6 layers, 5 stacks

- *540 modules – 750m^2*

- *Lenghth: 7m*

- *X/X_0 – 15%*

- *28 m^3 Xe/CO_2 (85:15)*

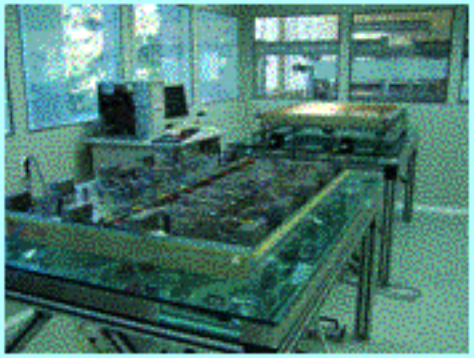
- *1.2 million channels*

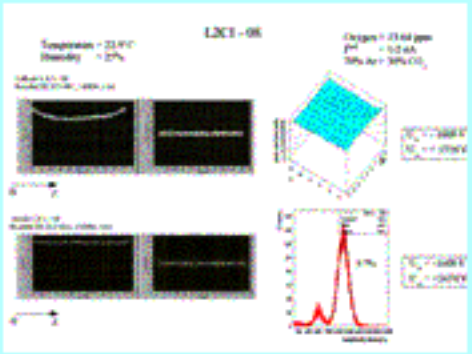
- *15 TB/s on-detector badwidth*

DFH(NIHAM) – DetLab activities







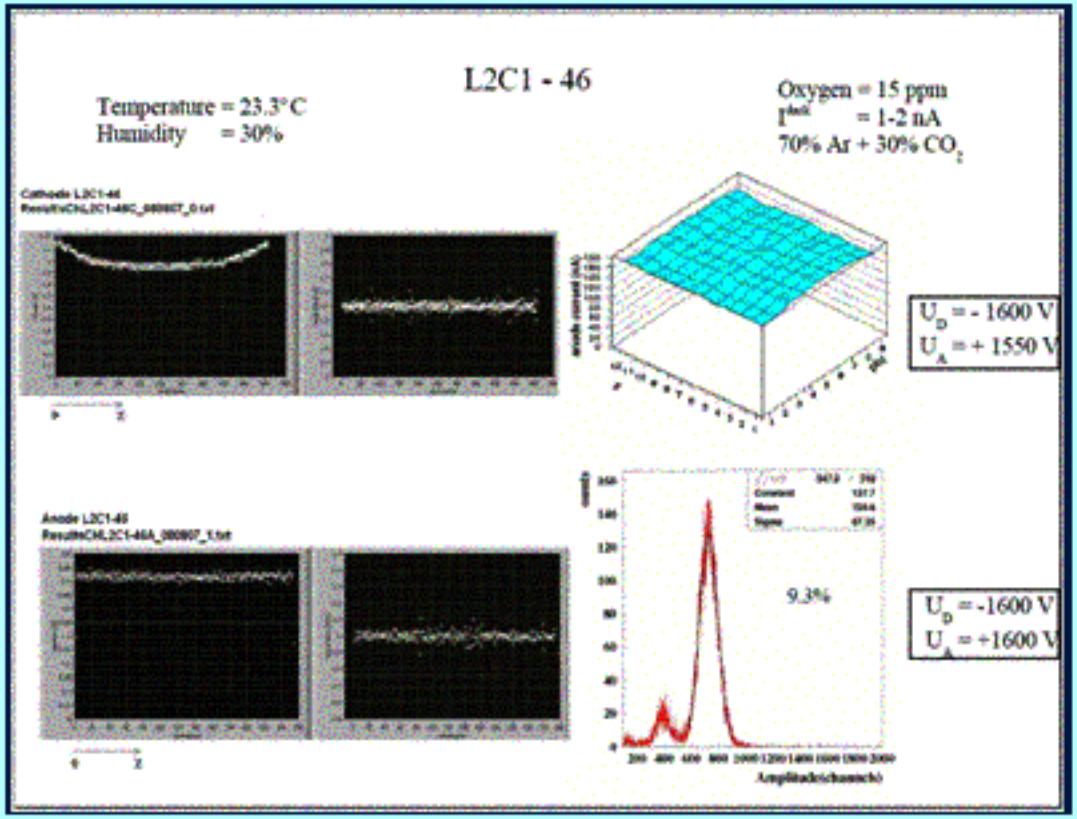


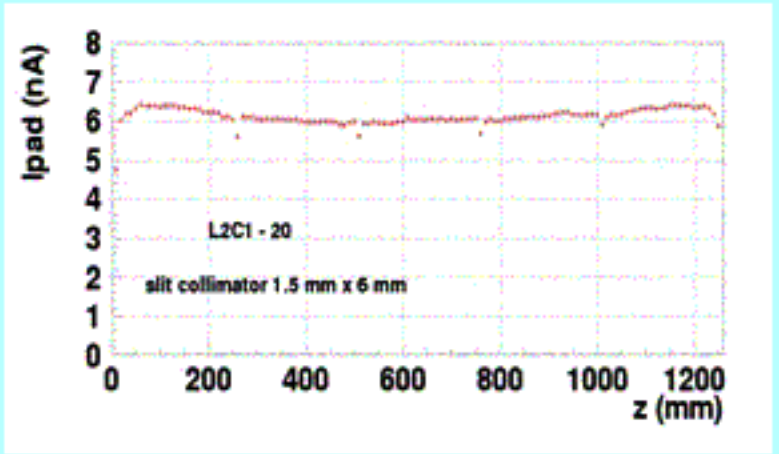




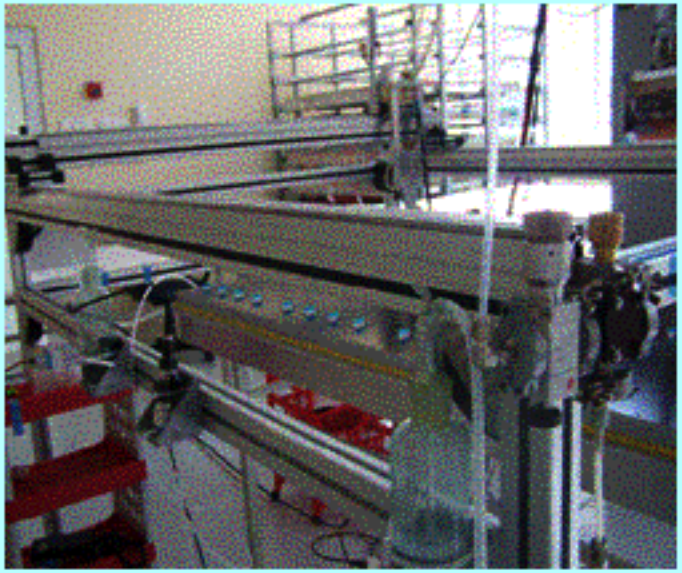
Chamber tests

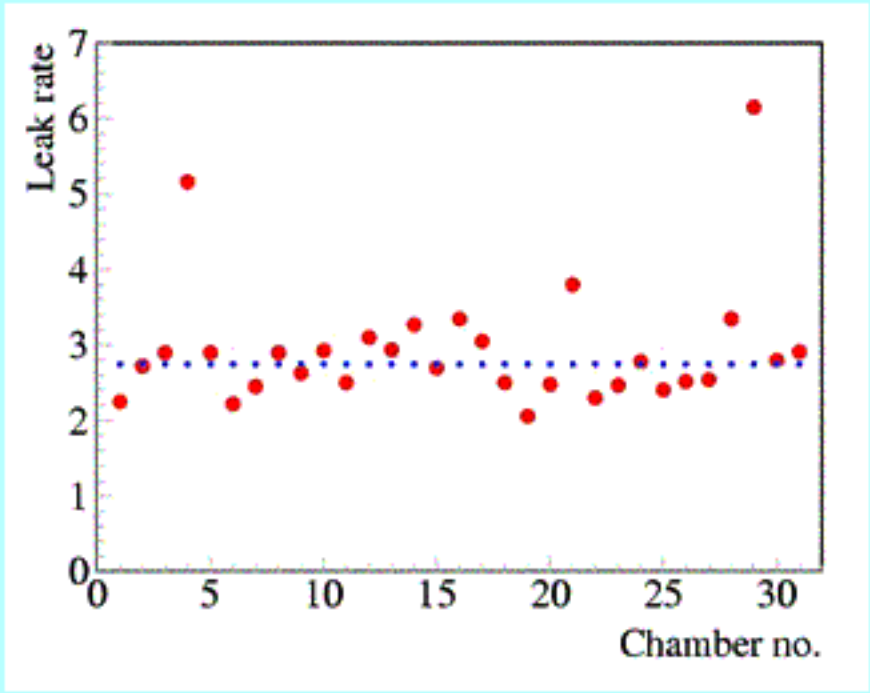
- *wire tension measurement*
- *dark current*
- *gain uniformity*
- *^{55}Fe energy resolution*
- *finer scanning of the gain uniformity across anode wires*
- *Oxygen content in normal operation mode*





Under pressure leak rate tests





- measurement of the O_2 content in gas mixture
- @ 2 mbar under pressure, 20 l/h gas flow
- 29 chambers tested
- the average leak rate - 2.7 l/h

No.	Chamber	O2 (ppm)	Leak rate (l/h)
1.	L3C1#62	45	2.25
2.	L3C1#60	54.4	2.72
3.	L3C1#37	57.9	2.9
4.	L3C1#57	58	2.9
5.	L3C1#52	44.4	2.22
6.	L3C1#38	49	2.45
7.	L3C1#50	58	2.90
8.	L3C1#59	52.6	2.63
9.	L3C1#43	58.6	2.93
10.	L3C1#39	50.1	2.5
11.	L2C1#69	54	2.7
12.	L2C1#65	50.1	2.5
13.	L2C1#67	49.5	2.48
14.	L3C1#41	45.9	2.3
15.	L3C1#24	49.3	2.47
16.	L3C1#40	55.5	2.78
17.	L3C1#66	48.2	2.41
18.	L3C1#58	50.4	2.52
19.	L3C1#61	50.7	2.54
20.	L3C1#54	58.7	2.94

ROC Production planning (March, 30th 2007)

Status (3/2007)

Finished chambers		to be done	Total:	
Bucharest:	67	41	108	
Dubna:	91	14	103	
Frankfurt:	27	44	71	
GSI:		68	78	146
Heidelberg:		39	46	85

Further Production:

Type:	# to be done	Lab	# prod at Lab
LxC0:	14	Dubna	all
L0C1:	44	Frankfurt	all
L1C1:	46	Heidelberg	all
L2C1:	42	Bucharest	20
L3C1	42	Bucharest	20
L4C1	39	GSI	all
L5C1	39	GSI	all

Production rates (historical average):

Bucharest:	1 ch/week
Dubna:	1 ch/week
Frankfurt:	0.7 ch/week
GSI:	1.2 ch./week
Heidelberg	0.5 ch/week

Timescale estimate:

(assuming 4 weeks Summer vacation, 2 weeks Christmas vacation)

Lab	Duration (weeks)	End of prod
Bucharest:	41	3/ 2008
Frankfurt:	63	7-8/ 2008
GSI:	65	7-8/ 2008
Heidelberg	92	2/ 2009

+44 chambers which are not included, leading to additional ~44 production weeks.

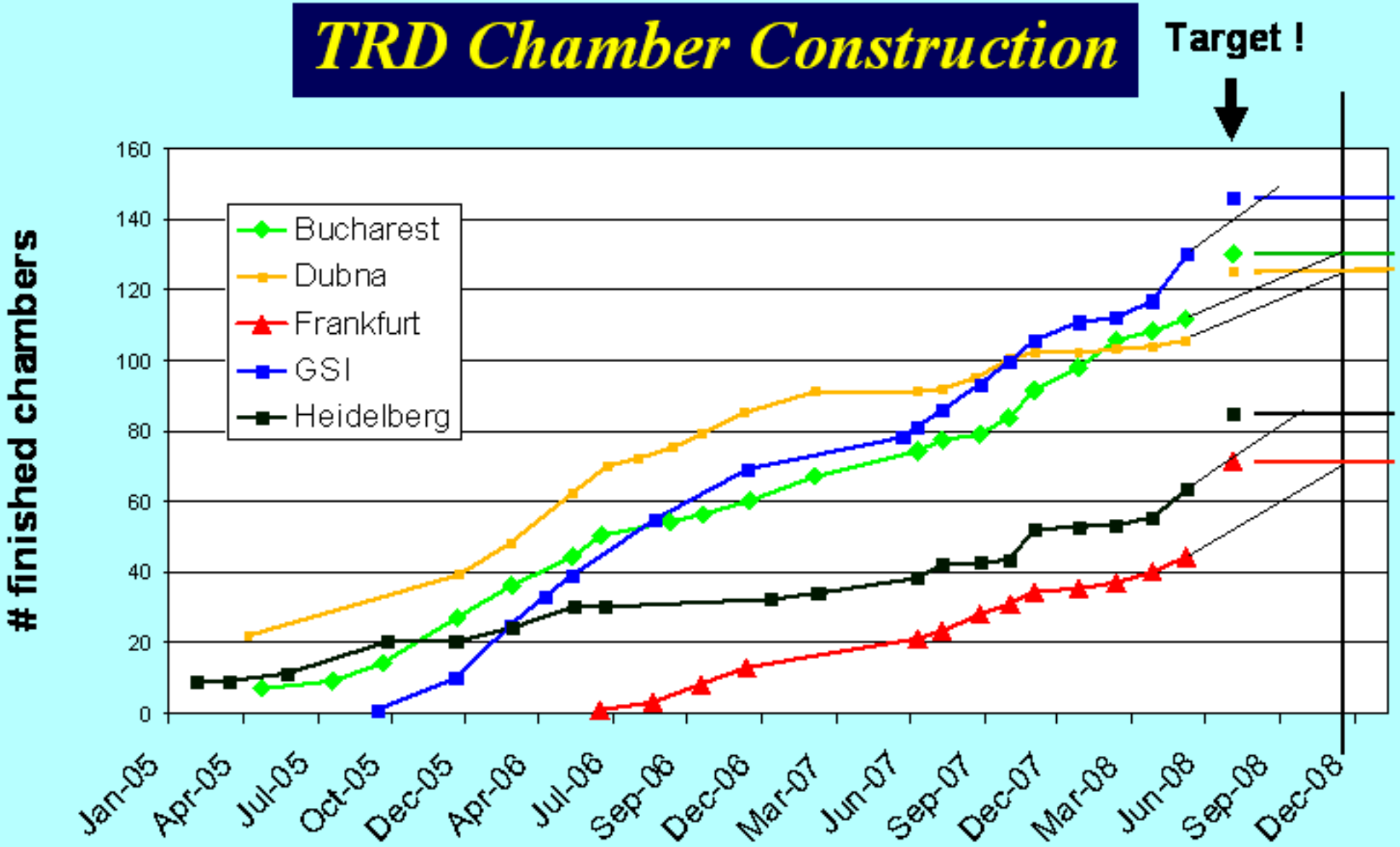
Construction Status – 06.06.08

Status 06.06.2008	Bucharest 03.06.2008	Dubna 06.06.2008	Frankfurt 03.06.2008	GSI 06.06.2008	Heidelberg 05.06.2008	Sum	
wired frames	0	2	2	2	0	6	
taped	7	2	3	6	3	21	
tested taped	0	0	3	0	0	3	
glued (tests not completed)	0	1	2	4	8	15	
finished	108	104	40	127	58	437	
to be repaired					2	2	
Total chambers wired and beyond	115	109	50	139	71	484	87%
Chambers wired and beyond 09.07.2007	79	95	34	85	49	342	
		Apparent momentary production rate [chambers/week]:				3,16	
				Needed production rate:		8,88	

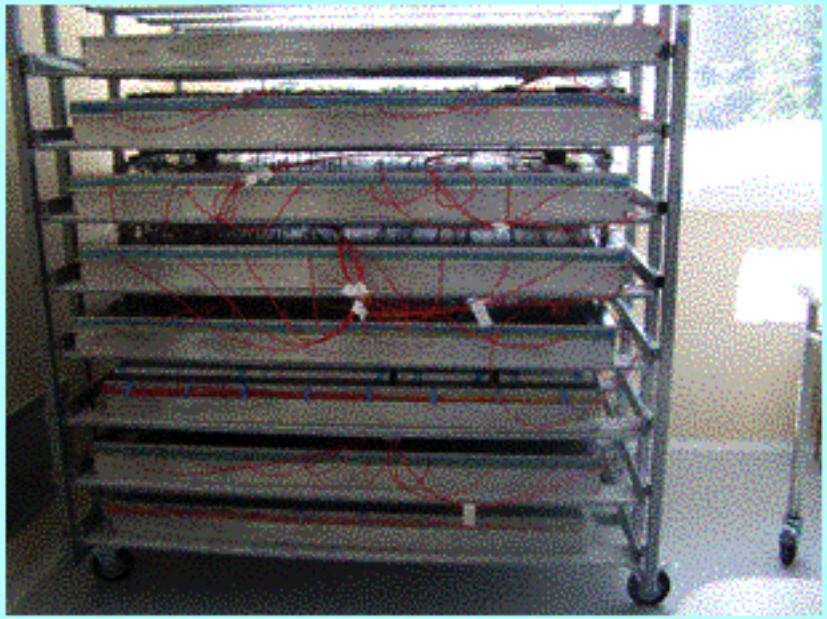
484 out of 540 + 15 (spares) are in production, an overall of 87%

Extrapolation: (555 – 484) / (3,2 ch/week) = 22 weeks i.e. mid Nov. 2008

TRD Chamber Construction



Present status



- **12 taped chambers**
- **3 pad planes**
- **4 frame + radiator**

⇒ ~ Aug – Sept 2008 – the extra 22 chambers ready

Chambers transport

Chambers transport

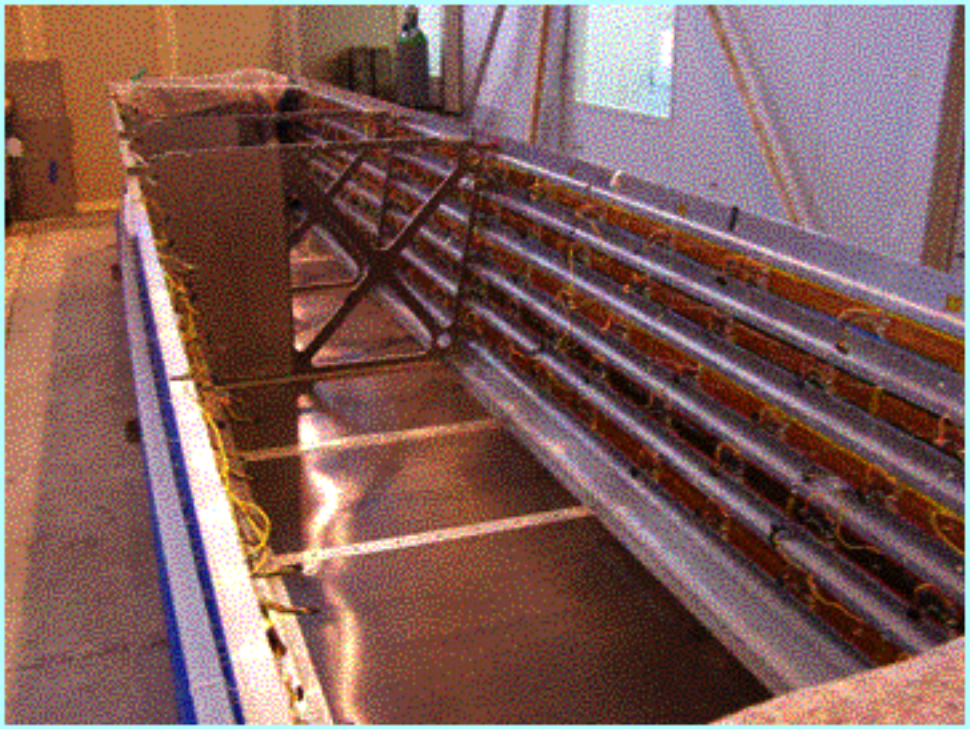
108 chambers finished

Delivery date:

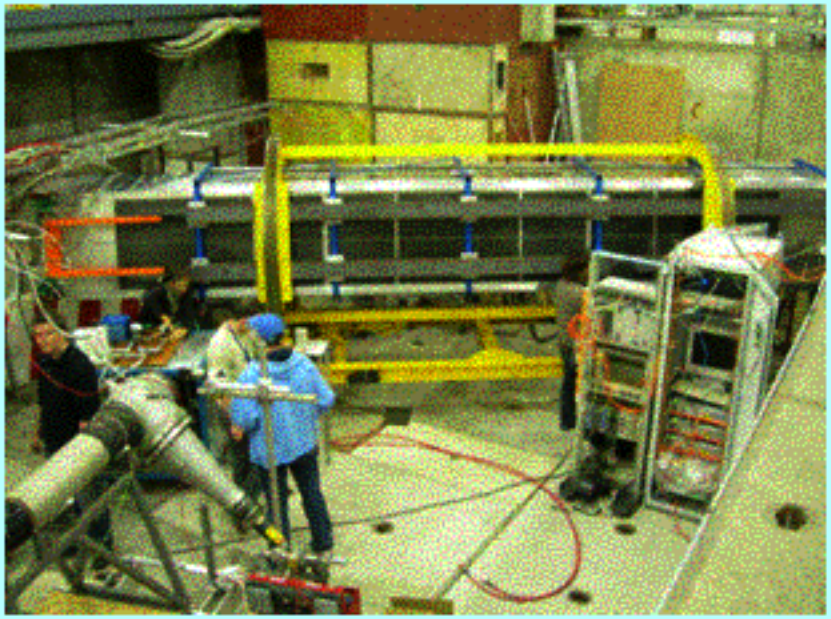
- **May 2005 - 7 chambers**
- **Mar 2006 - 25 chambers**
- **Nov 2006 - 25 chambers**
- **Nov 2007 - 20 chambers**
- **May 2008 - 28 chambers**

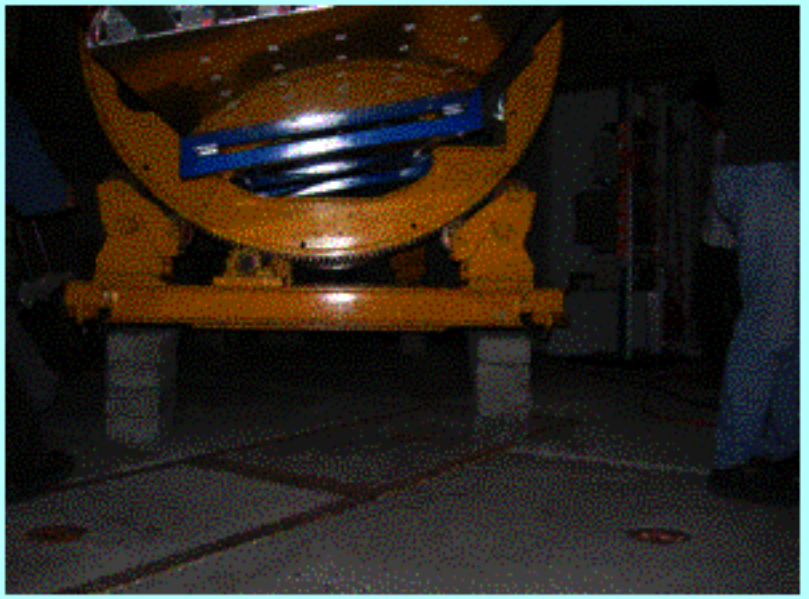
TOTAL: 105 chambers sent to GSI - Darmstadt

TRD - SM

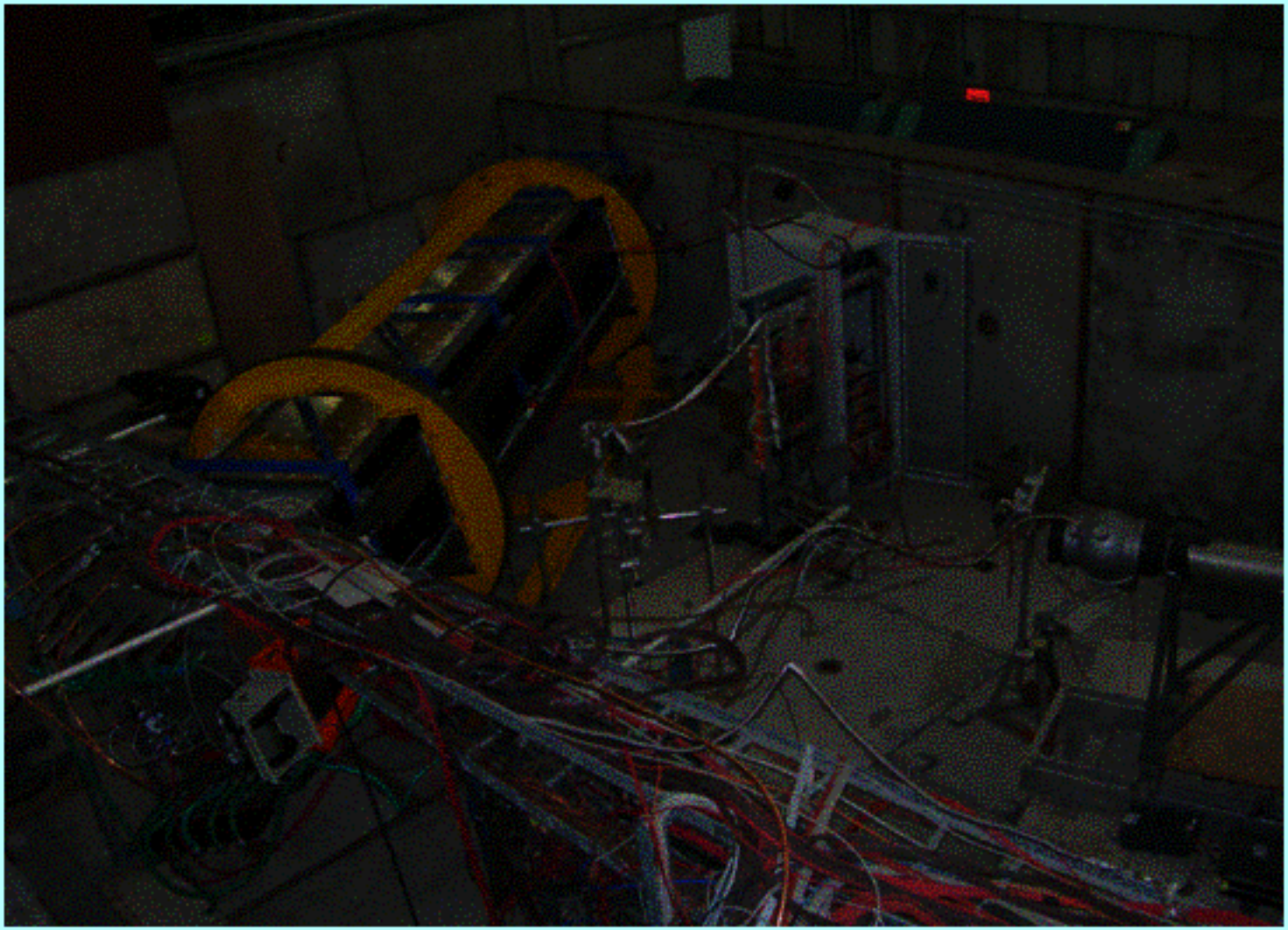


TRD SM – in beam tests

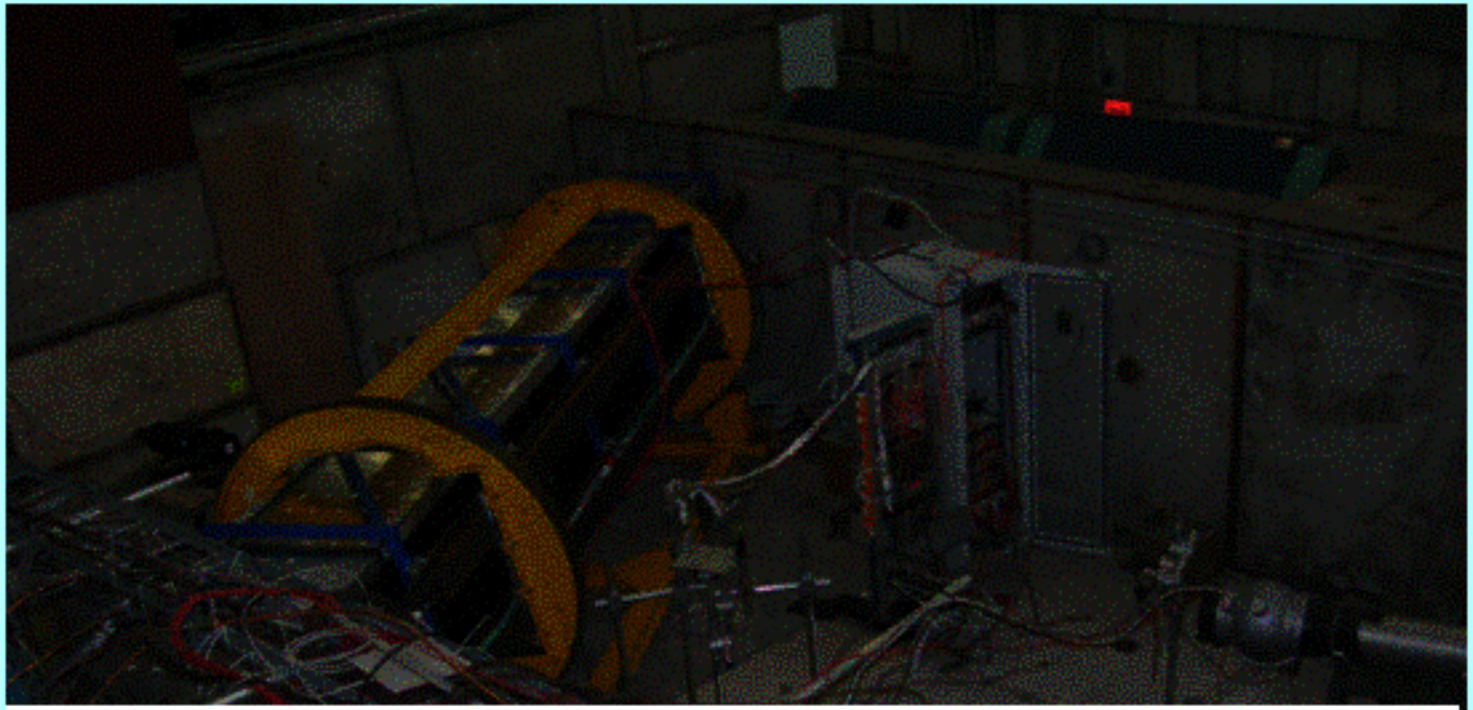


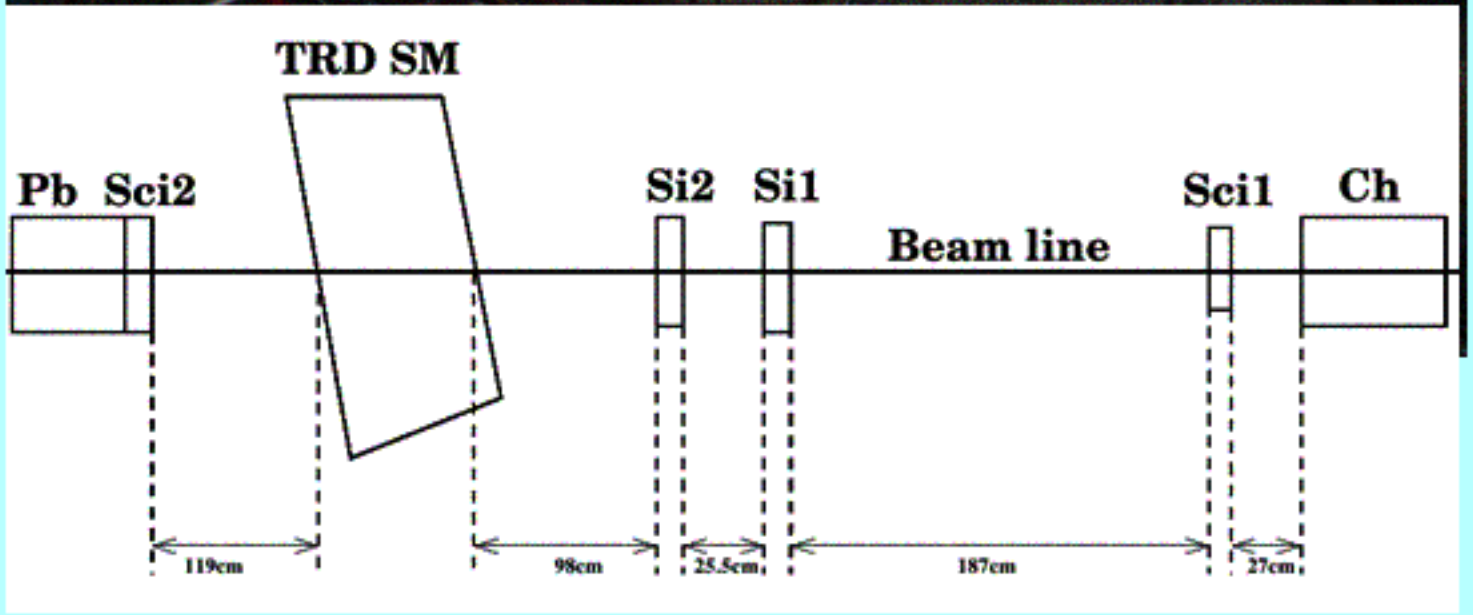


TRD SM – in beam tests

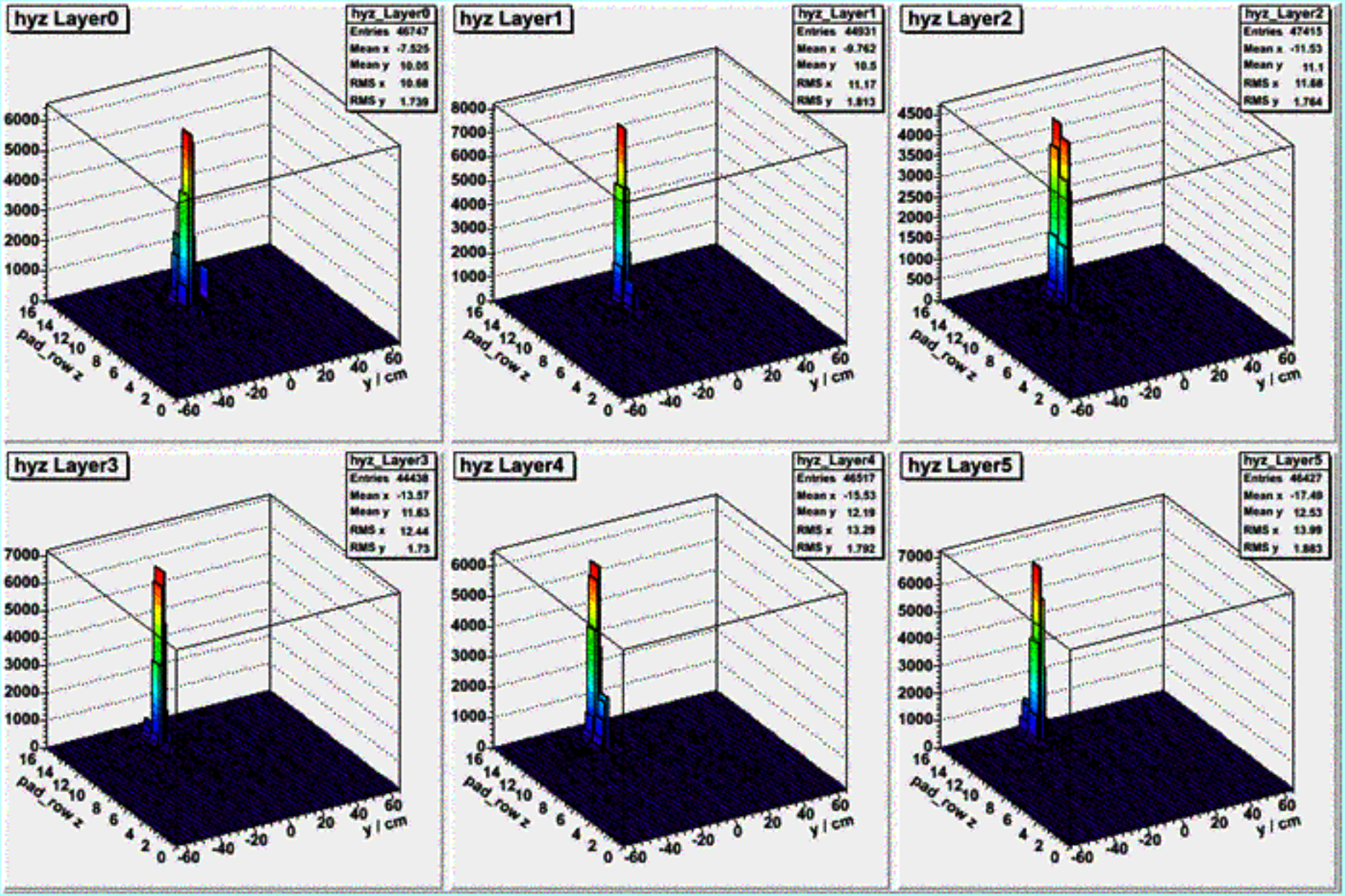


TRD SM – in beam tests

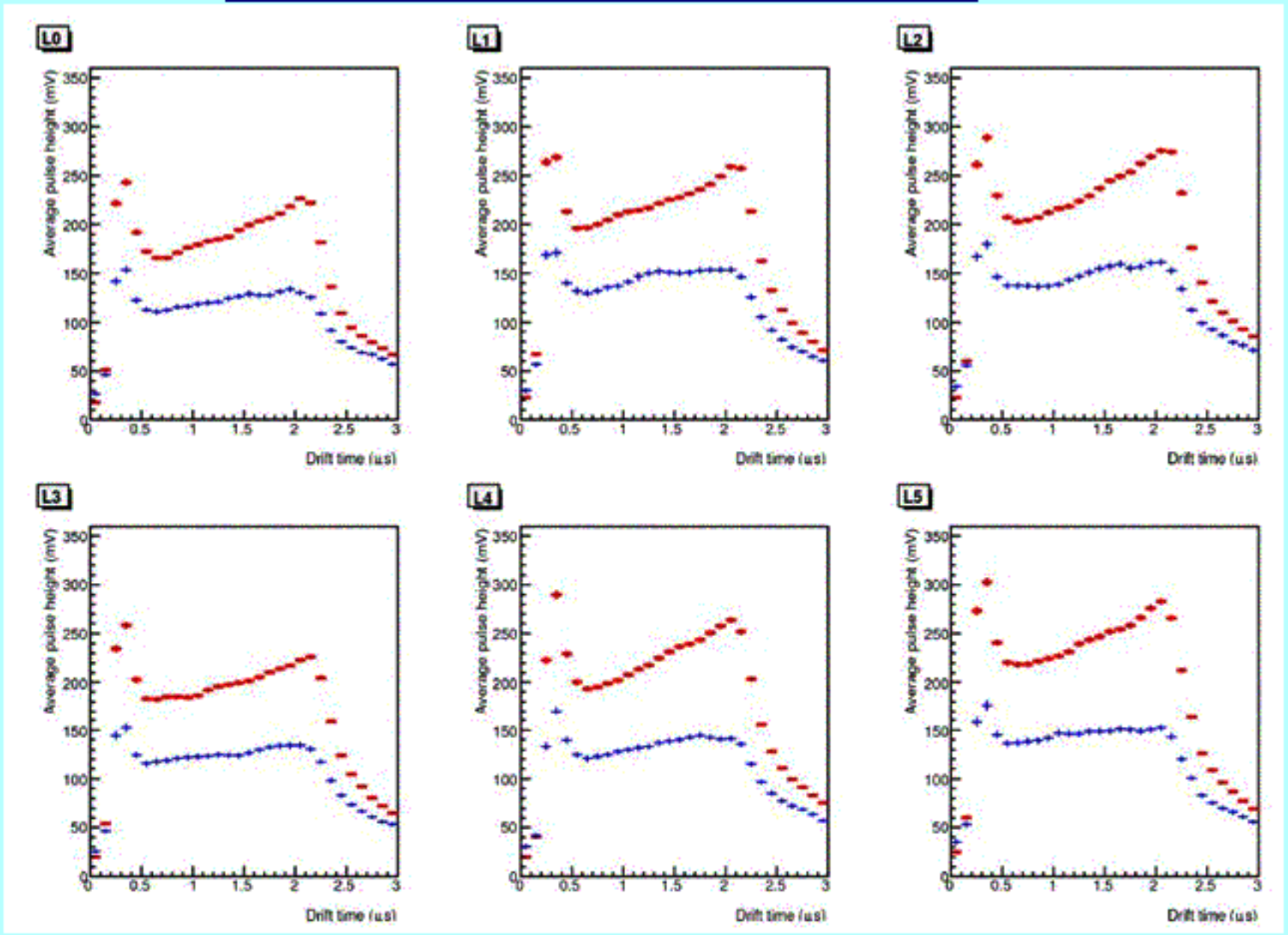




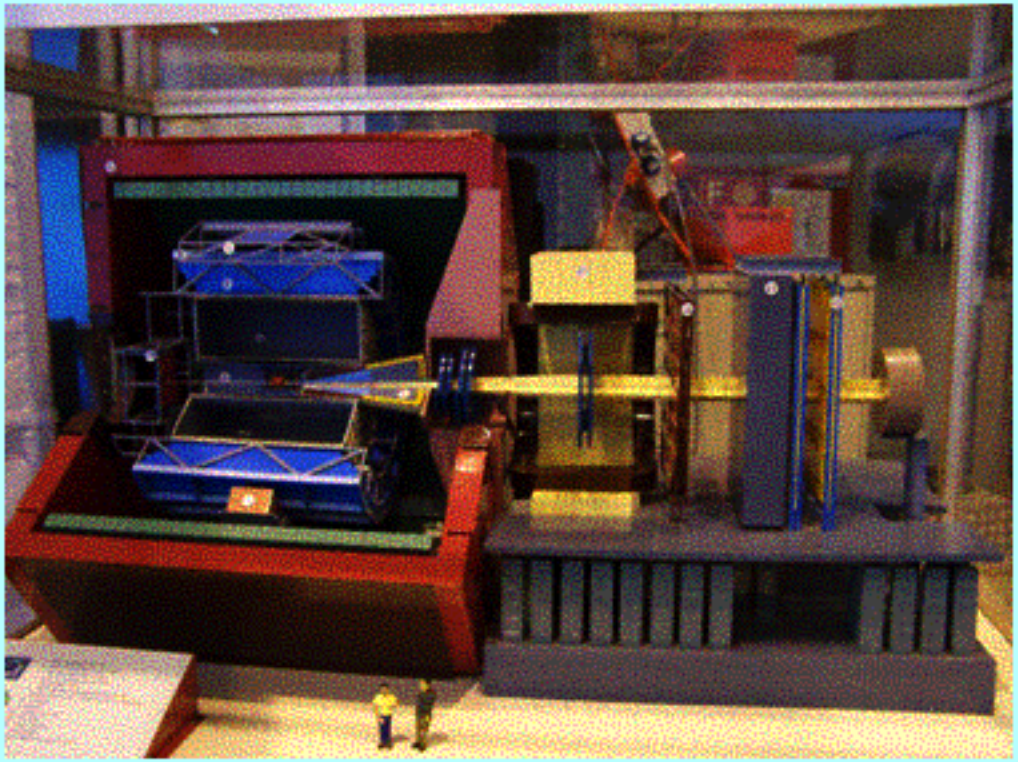
TRD SM – in beam tests

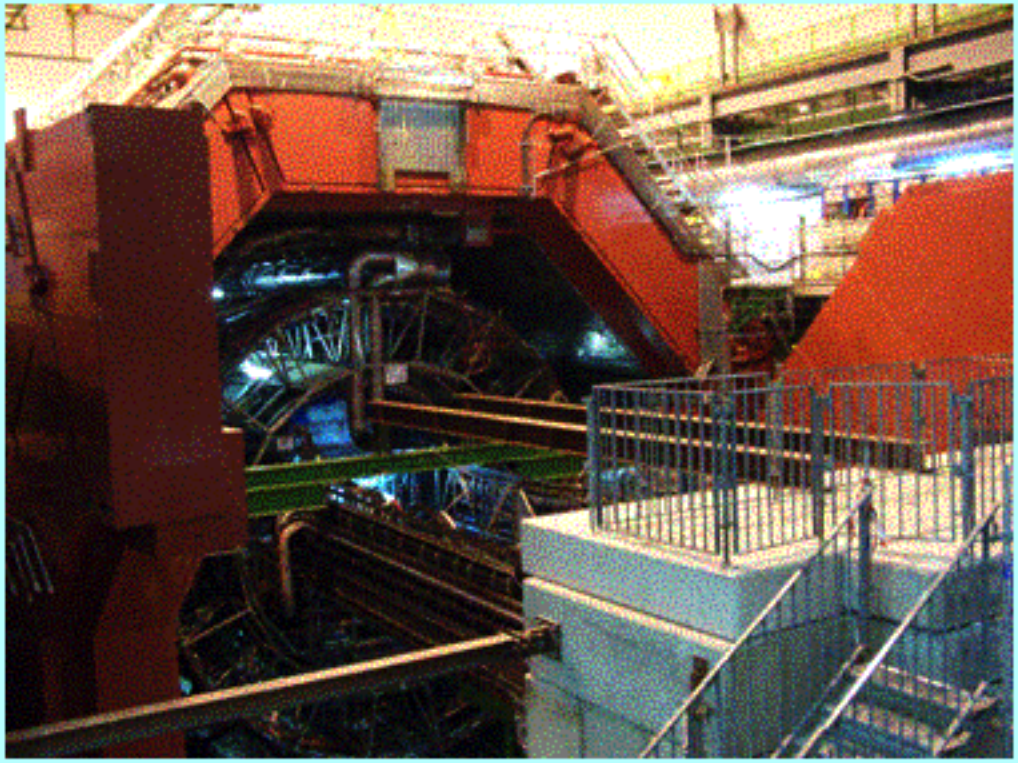


TRD SM – in beam tests

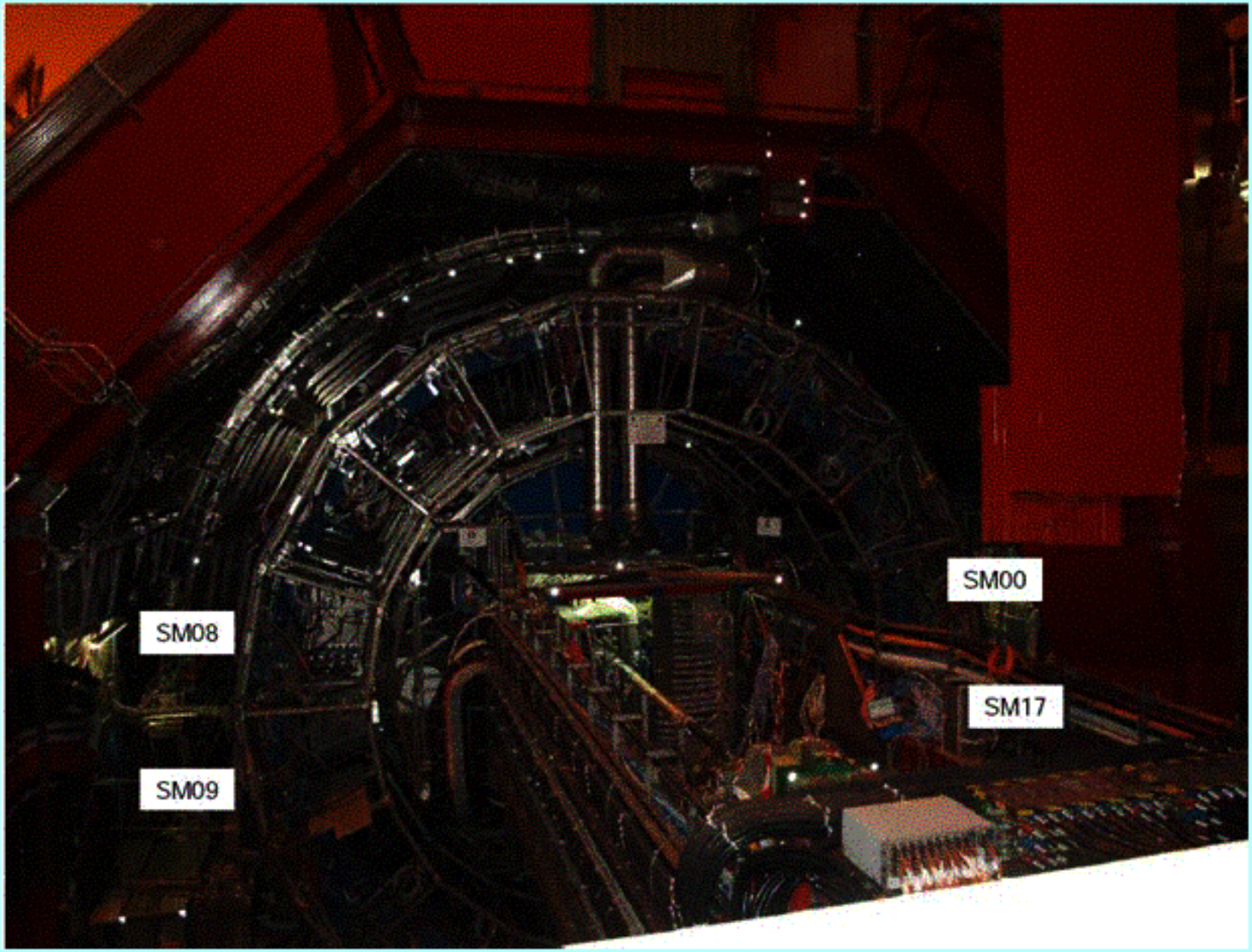


TRD SM – installation



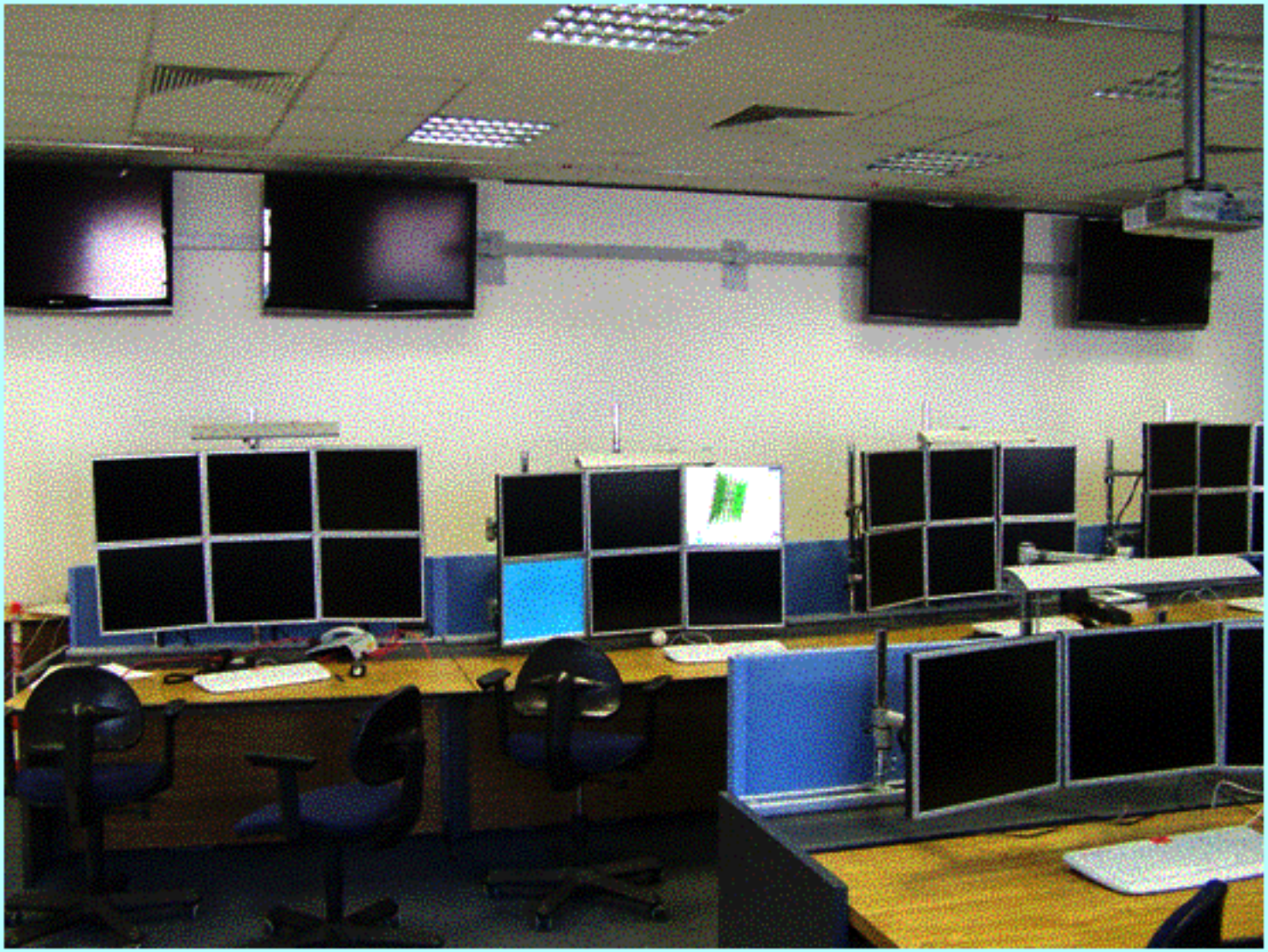


TRD SM – installation



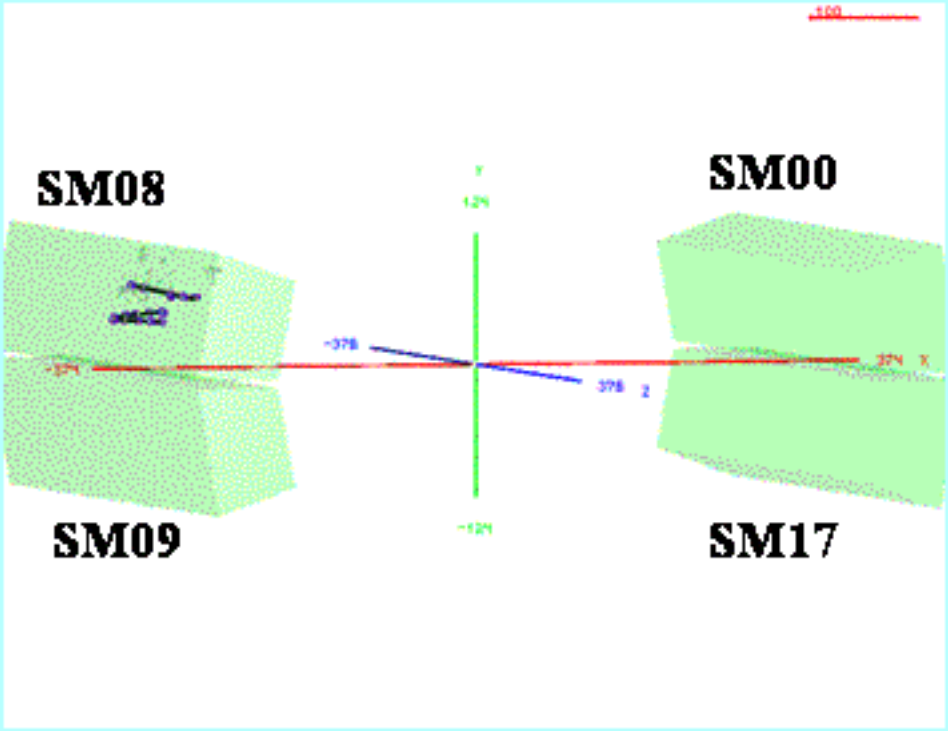
ALICE TRD operation

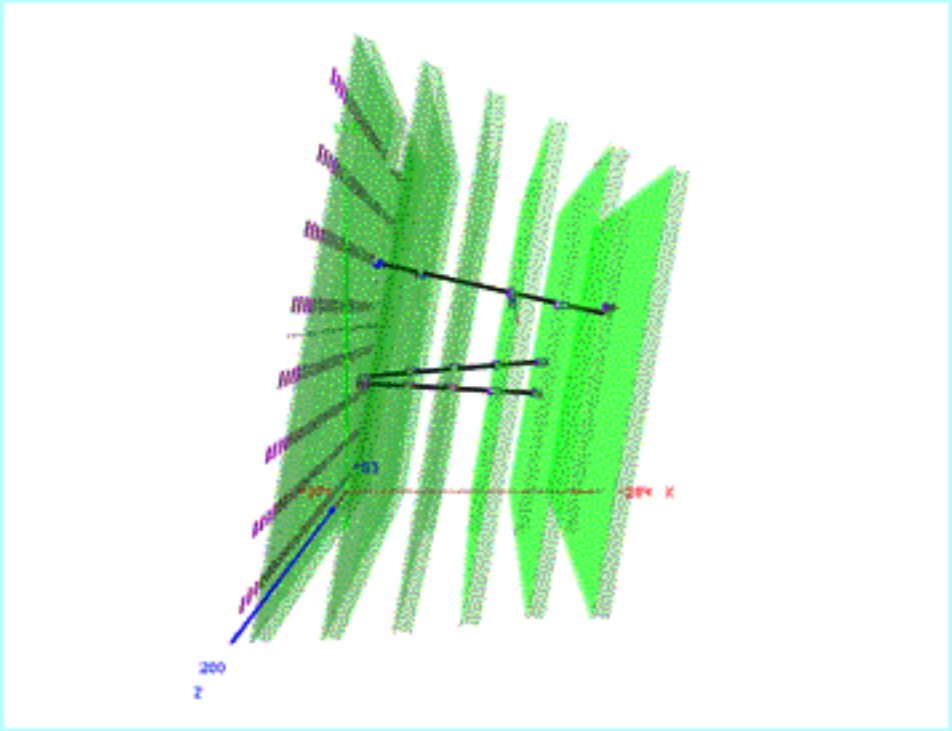
Cosmics



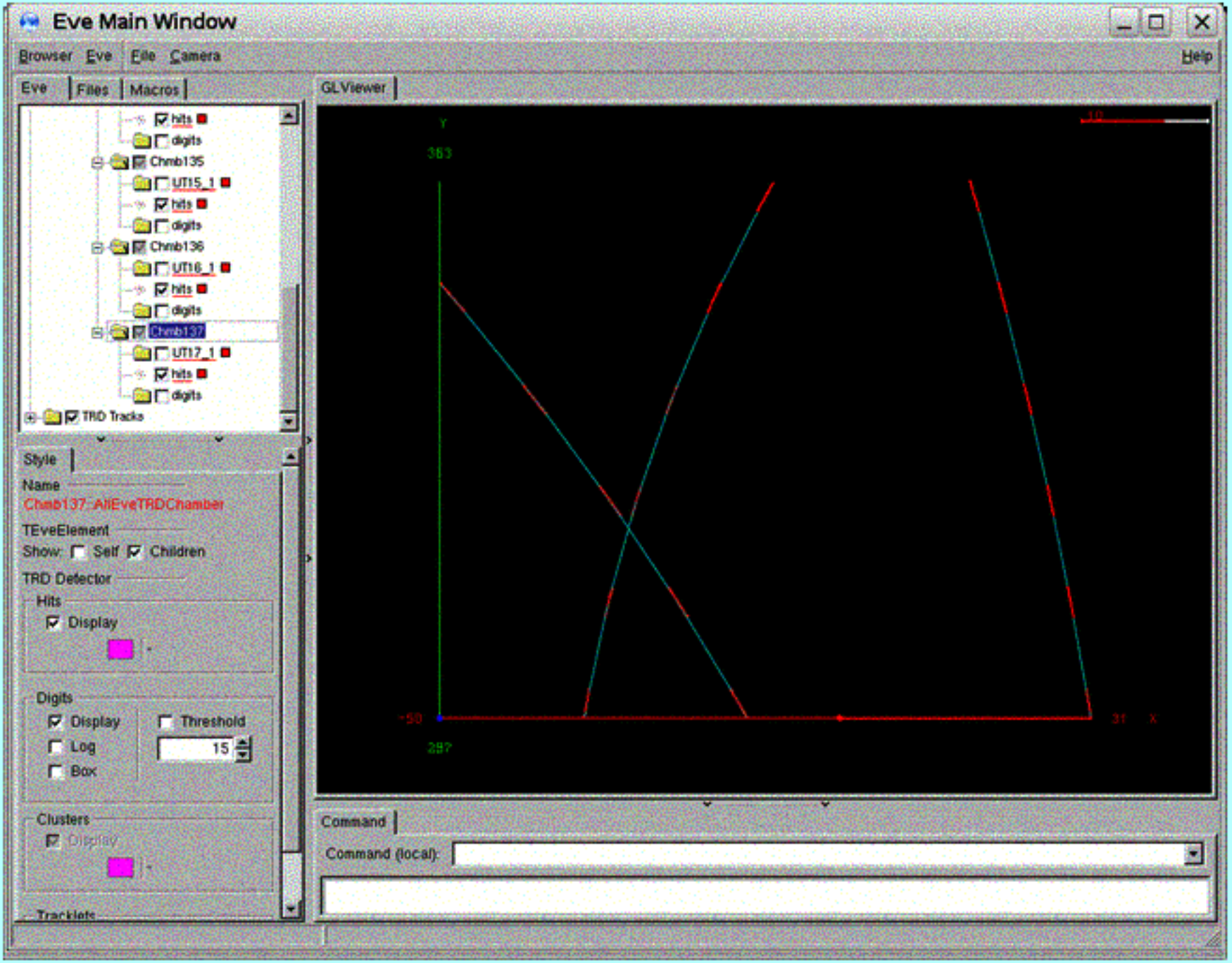
ALICE TRD operation

Cosmics



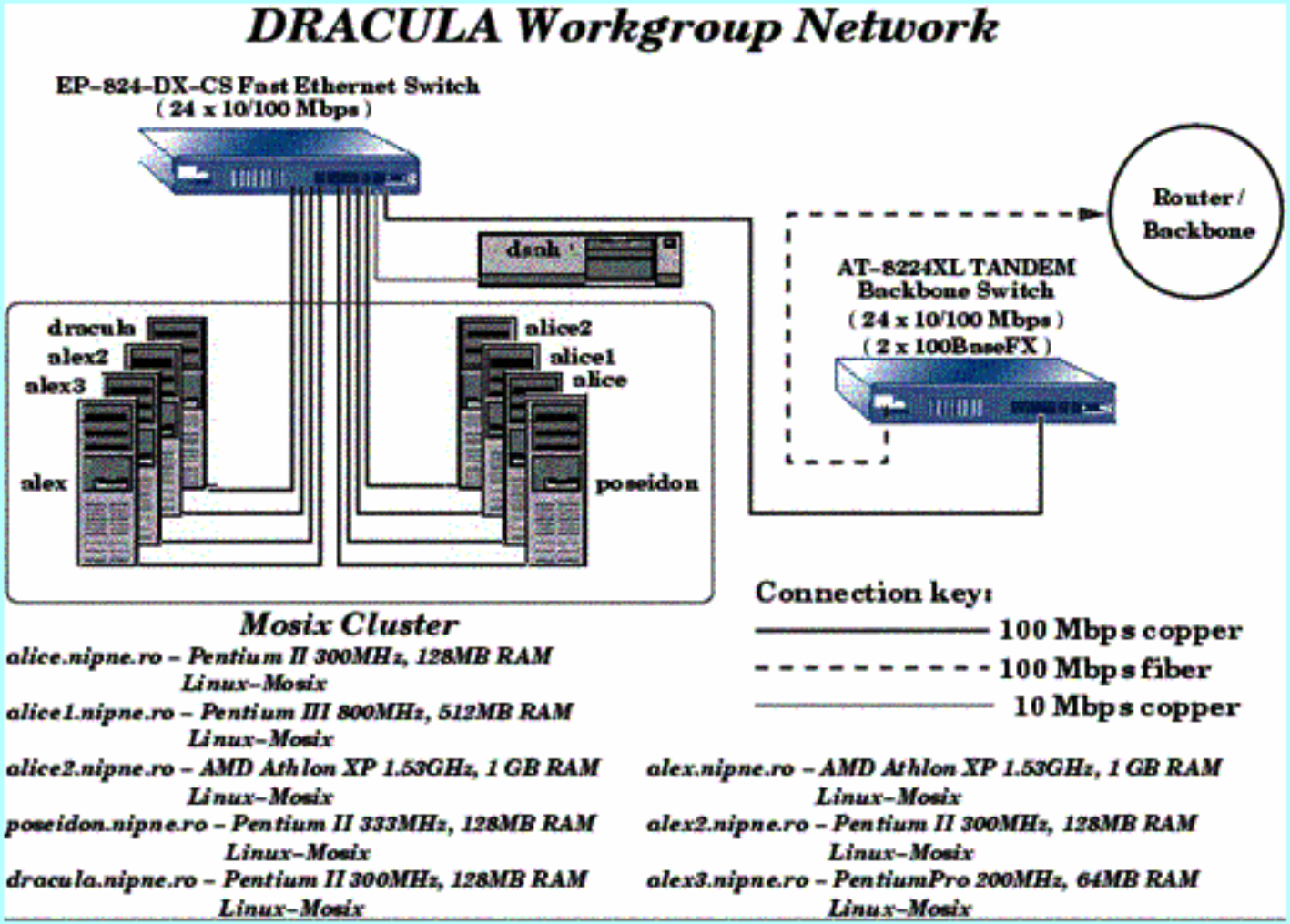


"Demo"


Eve Main Window
Browser Eve File Camera
Help
Eve
Files
Macros
hits
digits
Chmb135
UTI5_1
hits
digits
Chmb136
UTI6_1
hits
digits
Chmb137
UTI7_1
hits
digits
TRD Tracks
Style
Name
Chmb137 AliEveTRDChamber
TEveElement
Show: Self Children
TRD Detector
Hits
Display
Digits
Display
Log
Box
Threshold
15
Clusters
Display
Tracklets
GLViewer
Y
383
-50
297
31
X
Command
Command (local):

- **Computing activities – hardware & software – AliEn**

November 2002, the first international GRID application in Romania within AliEn



CPU – 330 Si95
Disk Storage 350 GB
7 hours for a full Central Event (HIJING + GEANT)

M. Petrovici et al, Int. GRID Workshop, April 2002, Bucharest

Distributed computing - 2005

- The first production cluster, 1 frontend machine (dual Xeon 3GHz, 2GB RAM, 2.4 TB raw HDD), 6 nodes (dual Xeon 3GHz, 4GB RAM) another 4 at the end of the year, all server-class, 32bit
- 1 Gb/s network
- Placed in the NIHAM Detector Laboratory, cooled by the Lab's unit
- Among the first AliEn2 sites (May-June 2005, C. Schiaua)
- In production since September 2005
- 838 jobs done

C. Andrei et al, Int. GRID School, 2005, Varna

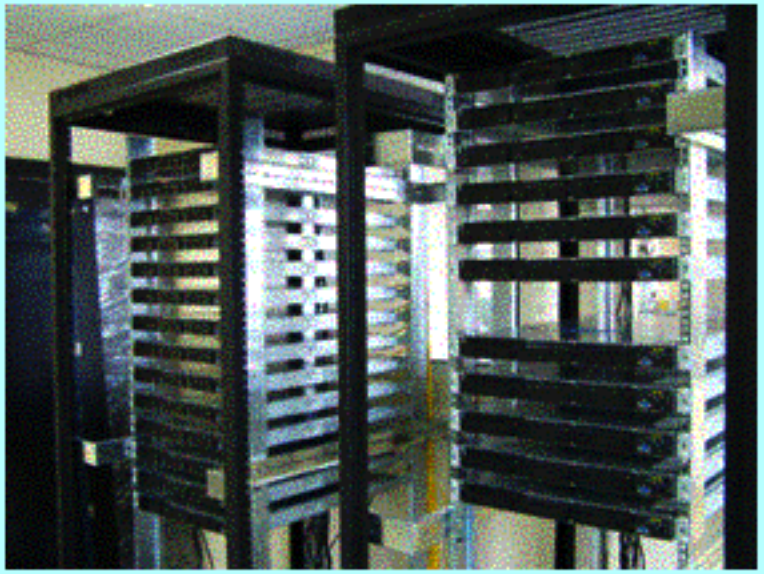
2006 - takeoff

- 40 new machines deployed during the year (dual Xeon 3.2 Ghz, 2 MB L2, 4GB RAM)
- EGEE site (C. Aiftimiei, C. Schiaua)
- Policy:

  - *"Regarding GRID, there is nothing more important than having a running and used site"*

  - *Exploit to the maximum extent the "dedicated" character of the site in order to achieve high stability and availability*

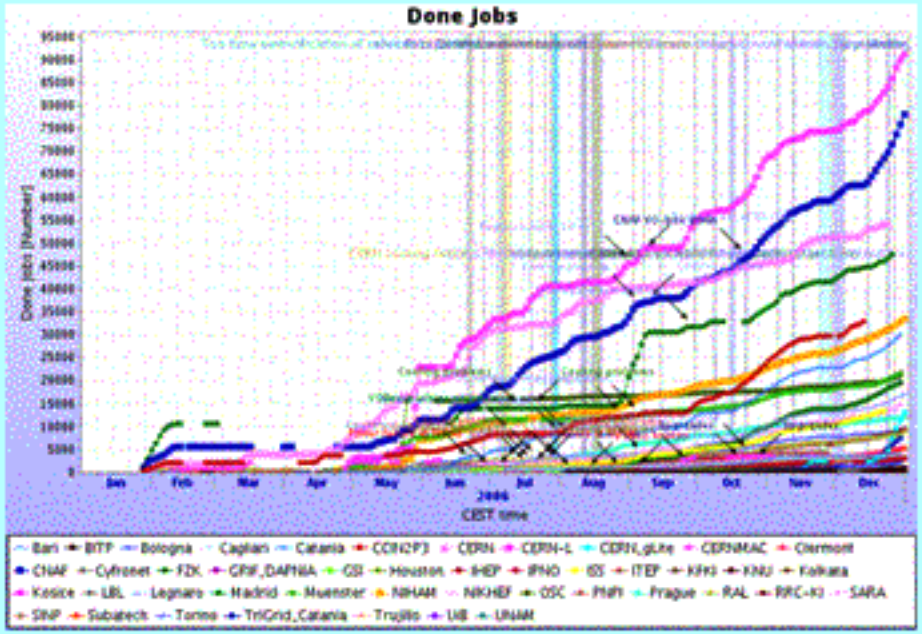
  - *Try to find as fast as possible solutions for the problems showing up during production*

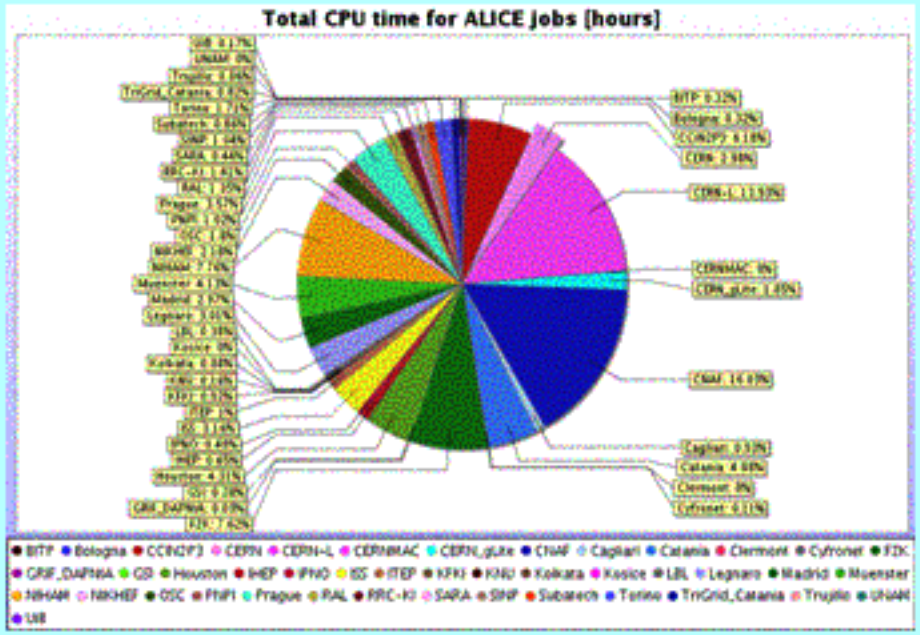


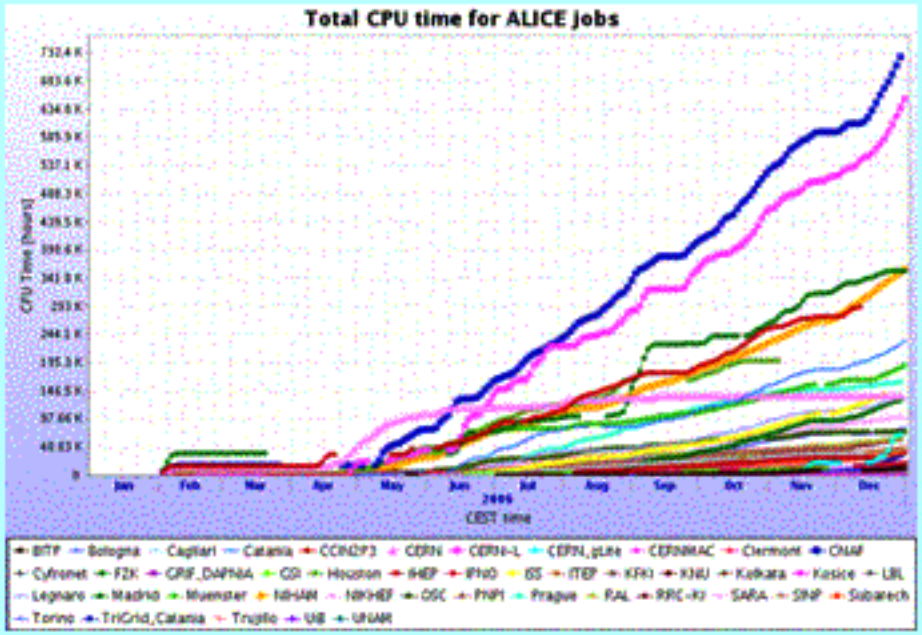
C. Schiaua, invited talk, International GRID Workshop, Sinaia 2006

2006 - takeoff

- ~33500 jobs DONE
- ~360 kHours CPUTime
- ~7% of ALICE
- Starting with September 2006, NIHAM Storage Element was used by ALICE production jobs to store log files







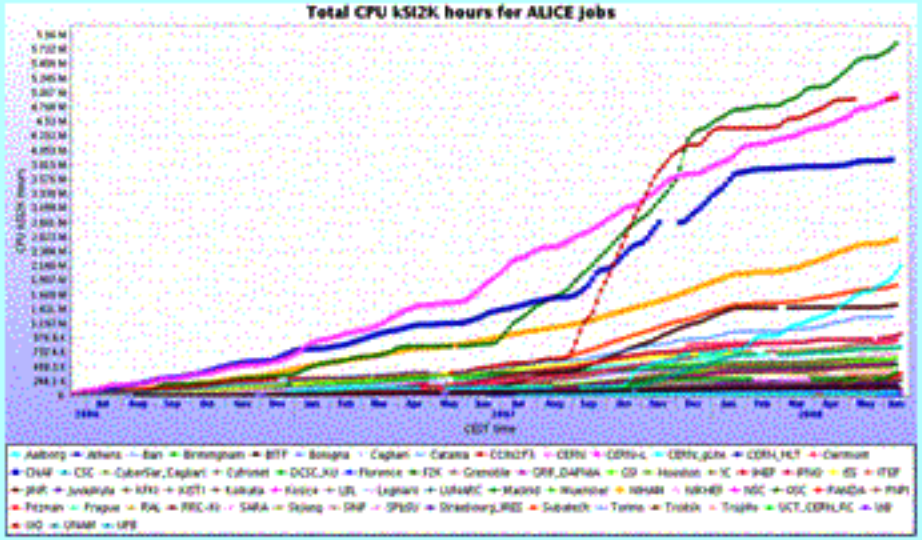
NIHAM Data Centre
Tier2 ⇒ Tier1

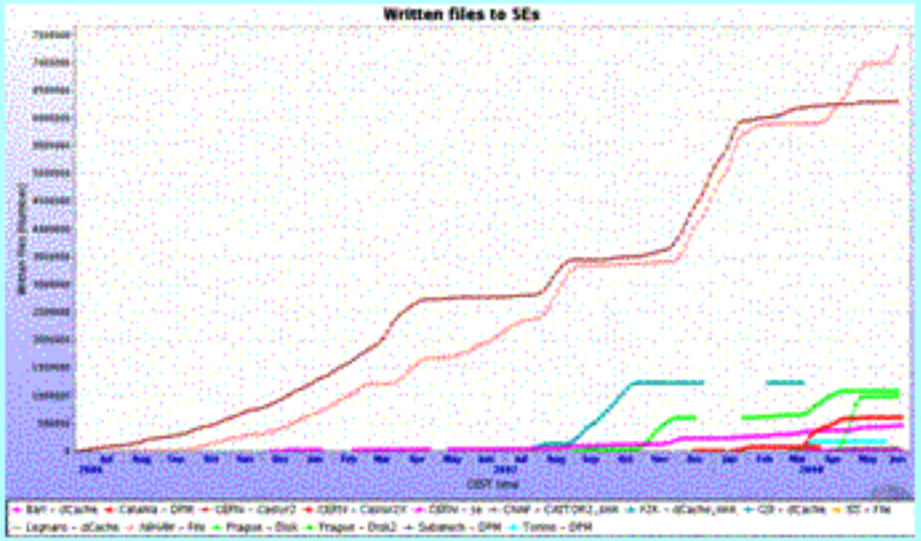
Present status

- ~ 700 CPU cores, 2GB RAM/core
- 144 TB (raw) dedicated storage
- 1 Gbit/s internal network.
- 10 Gbit/s uplink
- 3 cooling units, industrial grade.
- 3 x 80 kVA UPS, industrial grade.
- Diesel generator, 600 kVA

GRID site

- ~900 kSI2k CPUs.
- ~120 TB effective disk storage (xrootd).
- ALICE-dedicated, mostly AliEn-only.
- ~2.3 kSI2k Mhours (~260 kSI2k years) delivered in the last 2 years.
- ~7.3 million files written on NIHAM storage in the last 2 years.
- ~5% of ALICE.
- > 97% availability.





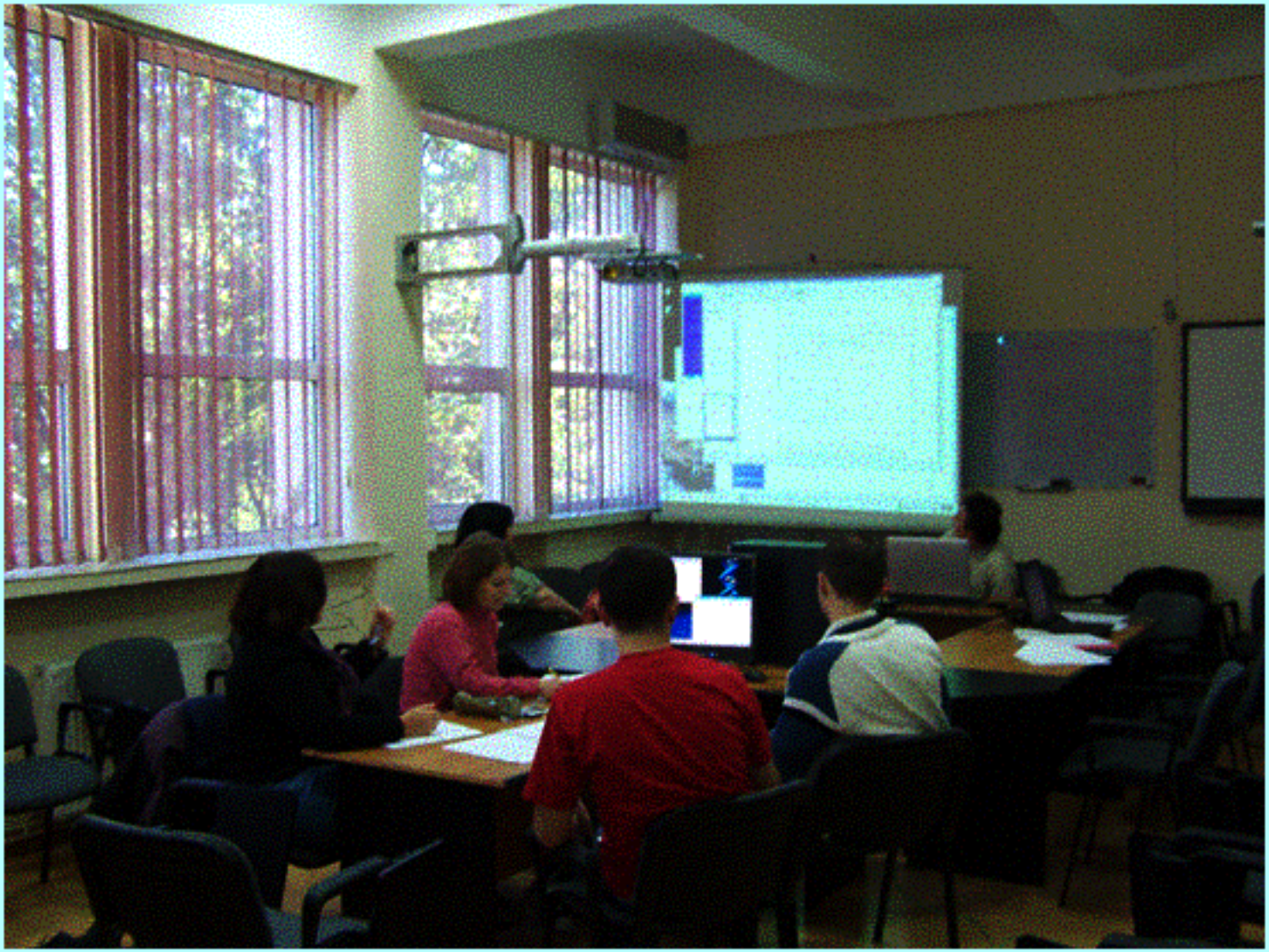
NAF – NIHAM Analysis Facility

- 16 nodes, 128 CPU cores, 2GB RAM/core, 800 GB storage/node
- PROOF cluster
- Batch system
- Dedicated to local analysis, both batch-like and parallel

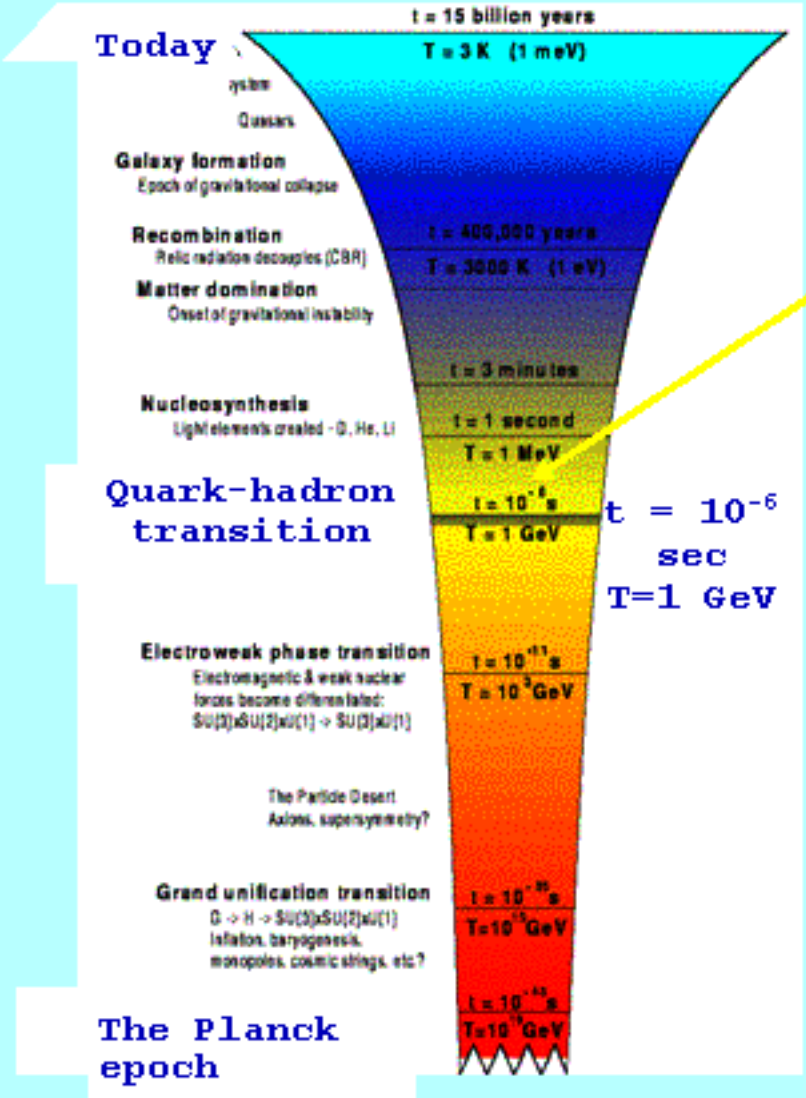
Physics

ALICE Physics & Offline Analysis

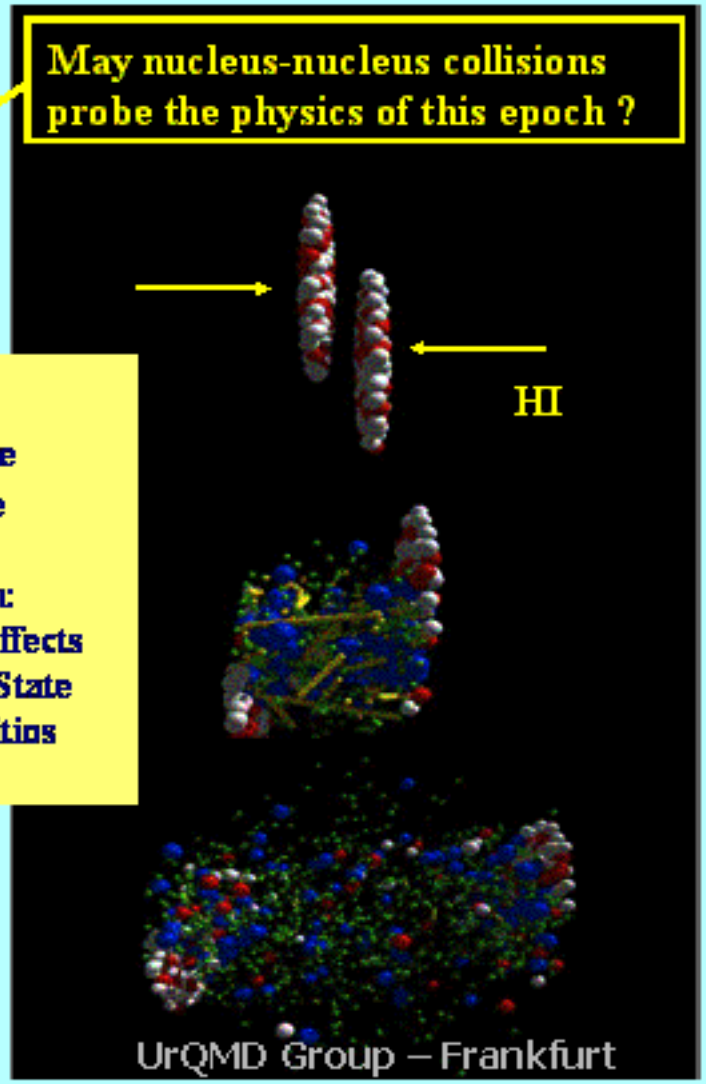
~ 2 NIHAM PWG meetings/week



Collective phenomena in heavy ion collisions



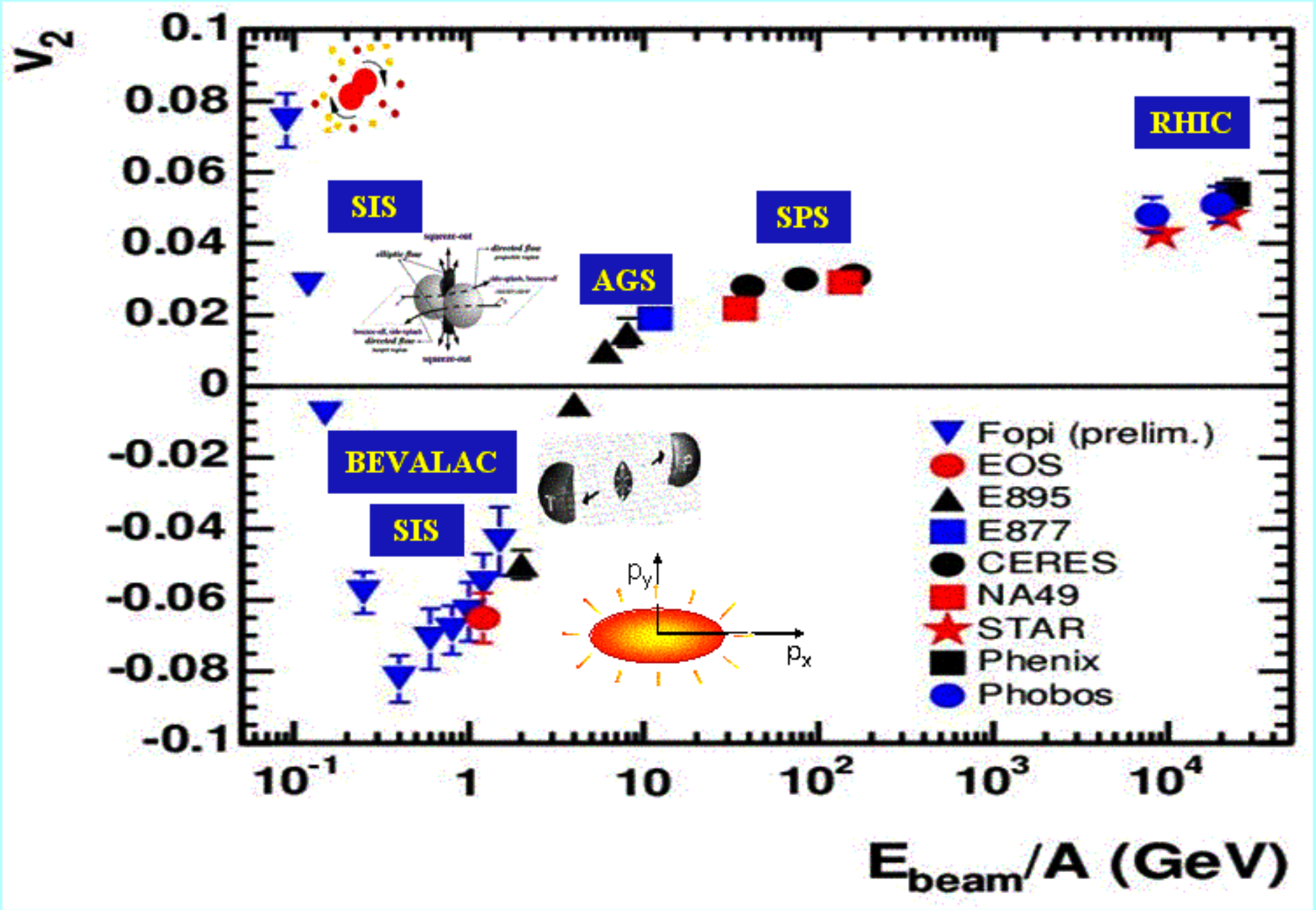
May nucleus-nucleus collisions probe the physics of this epoch ?



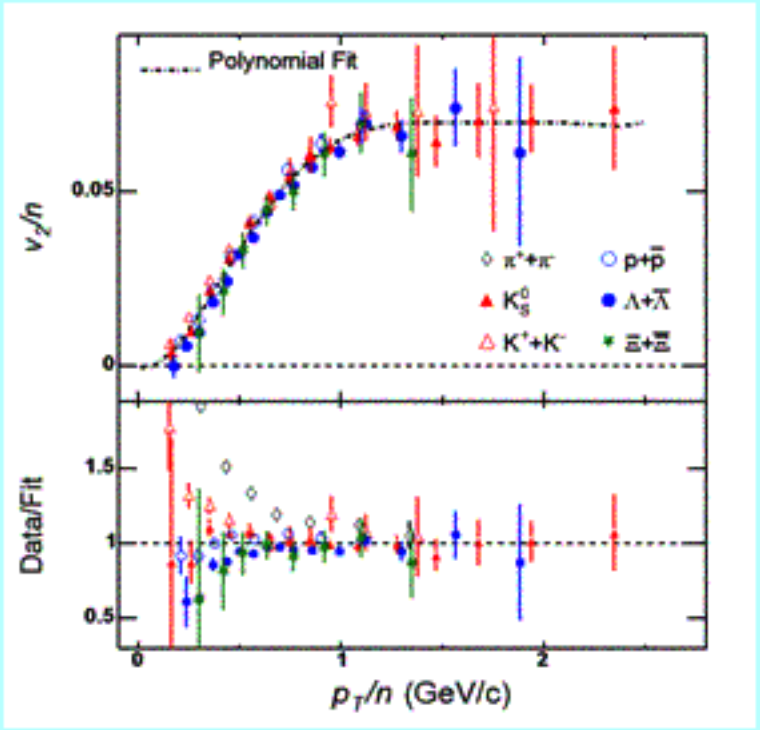
Why Flow?

- Properties of the initial phase
- Information on:
  - In-medium effects
  - Equation of State
  - Phase transitios

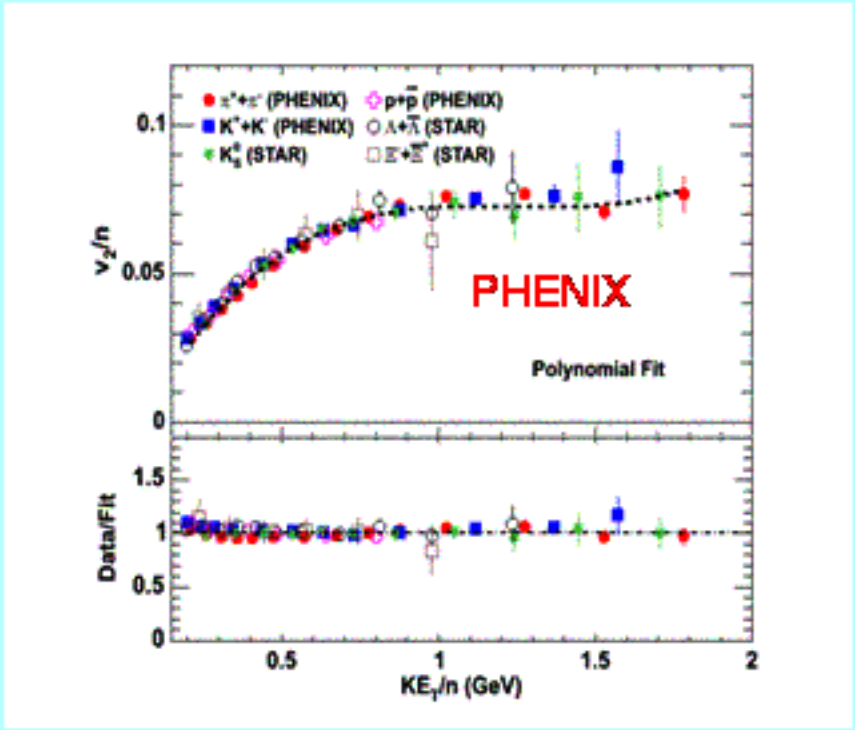
v_2 excitation function



Elliptic Flow - Quark Number Scaling

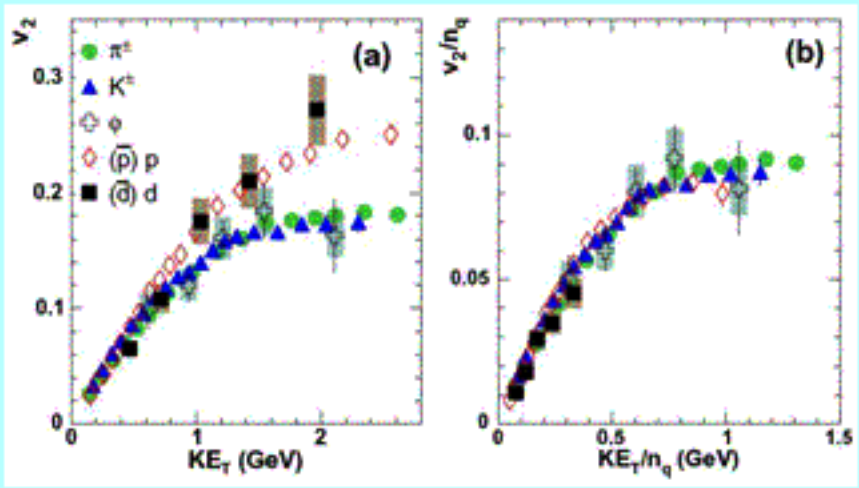


PRL 92 (2004) 052302; PRL 91 (2003) 182301



nucl-ex/0608033

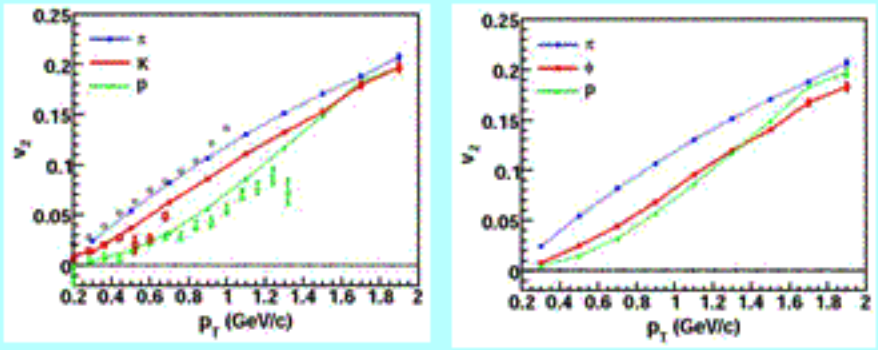
- At the moment of hadronization in nucleus-nucleus collisions at RHIC the dominant degree of freedom is related to number of constituent (valence) quarks
- These 'constituent quarks' exhibit an angular anisotropy resulting from collective interactions
- Hadrons seem to be formed from coalescence or recombination of the 'constituent quarks'



nucl-ex/0703024

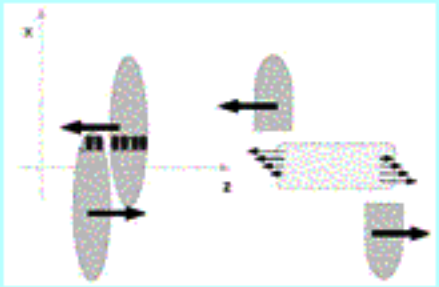
Other effects to be considered

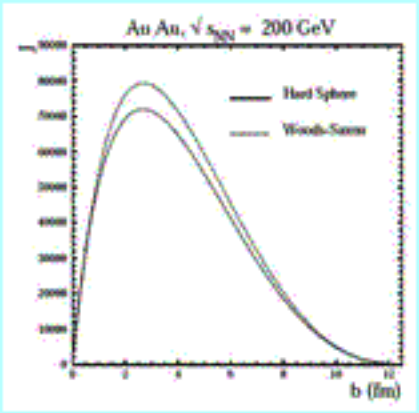
Hadronic dissipative effects



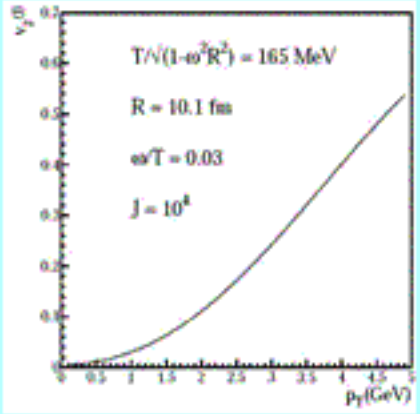
T.Hirano et al nucl-th/0608033

Angular momentum conservation



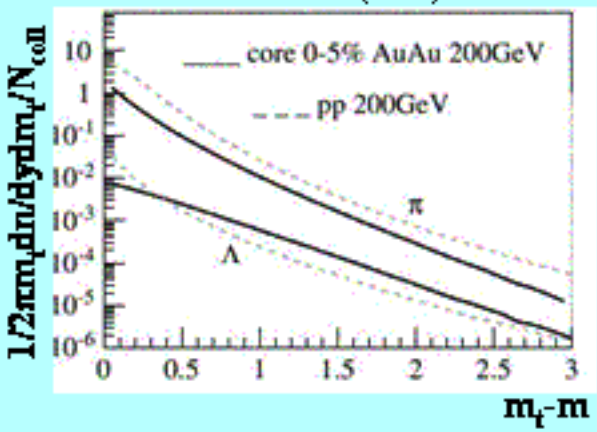


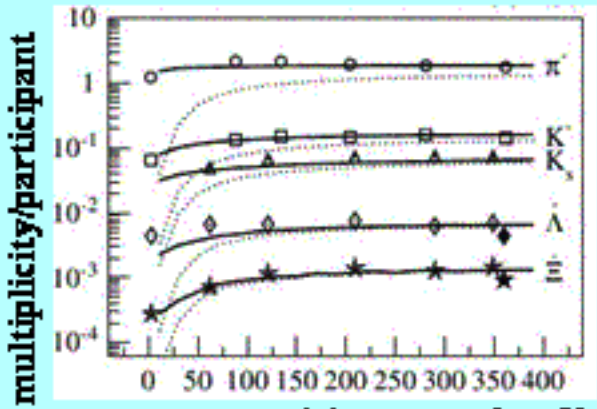
F.Becattini et al nucl-th/0711.1253

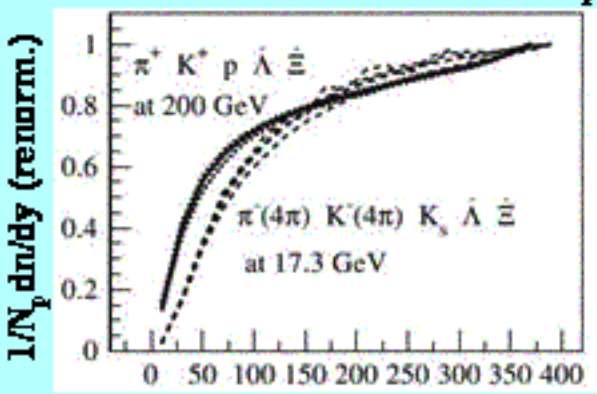


Core – Corona effects

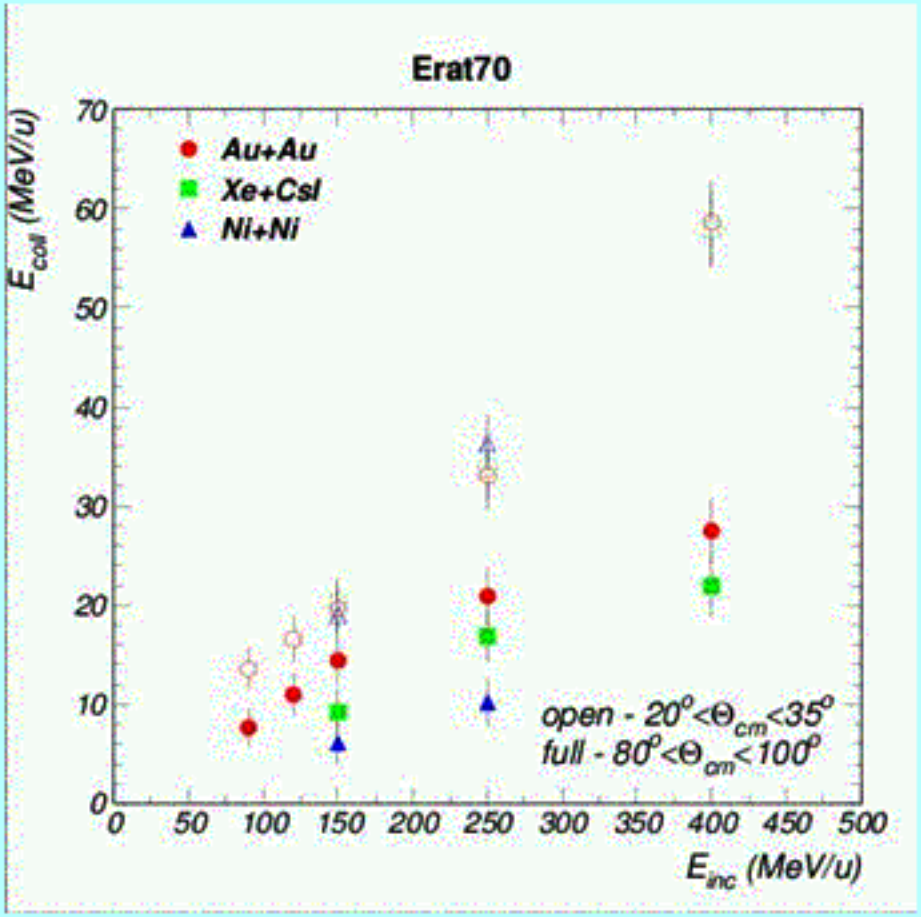
K.Werner PRL 98(2007)152301

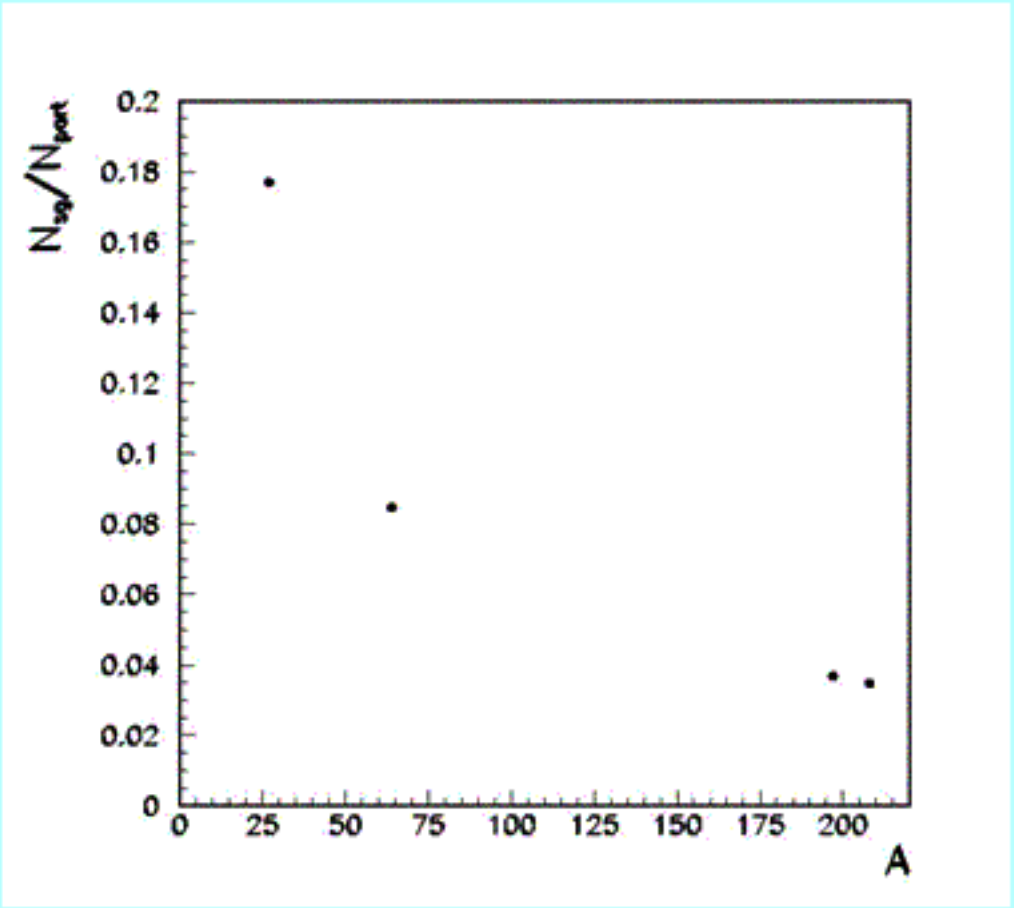




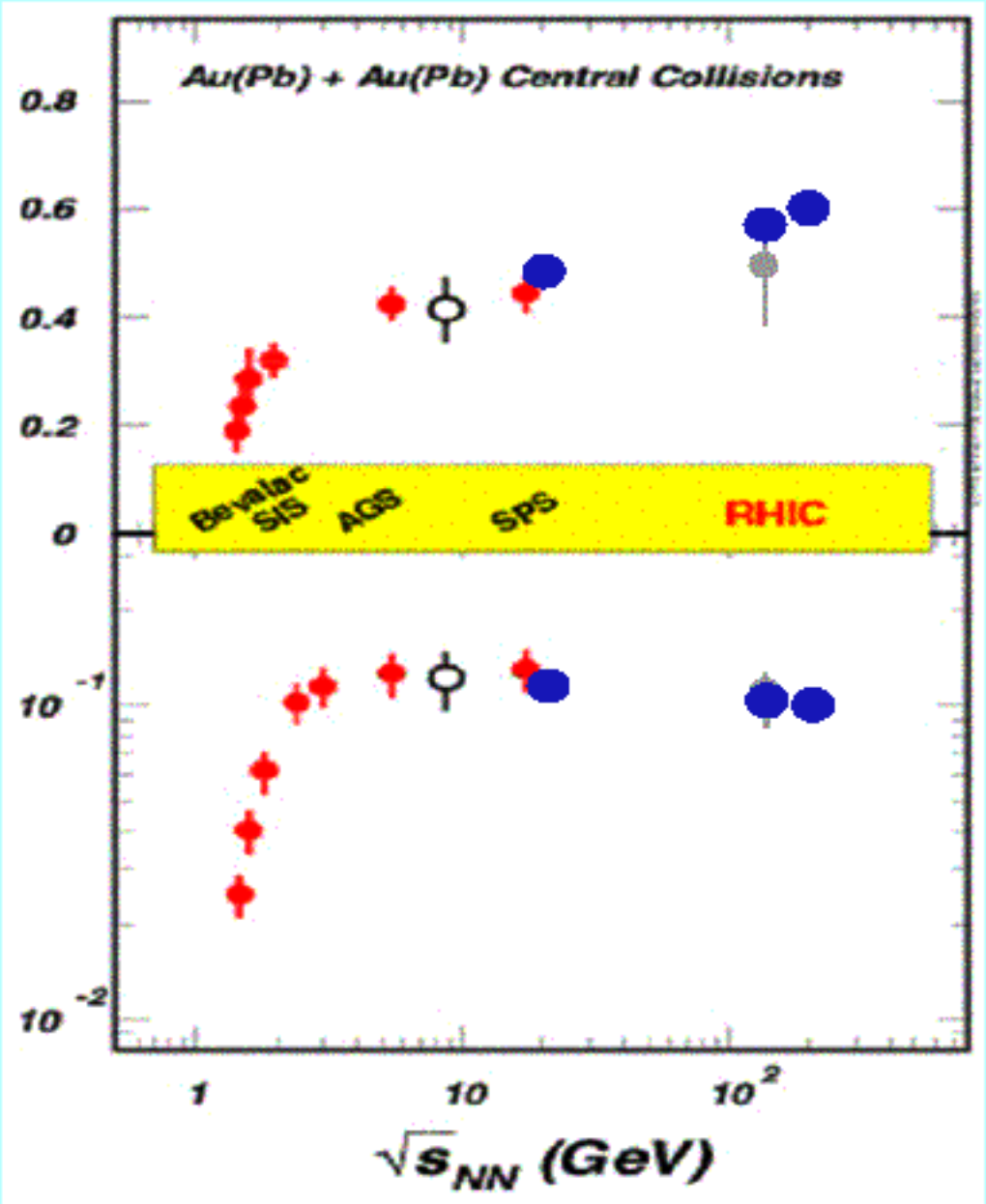


Highly central collisions

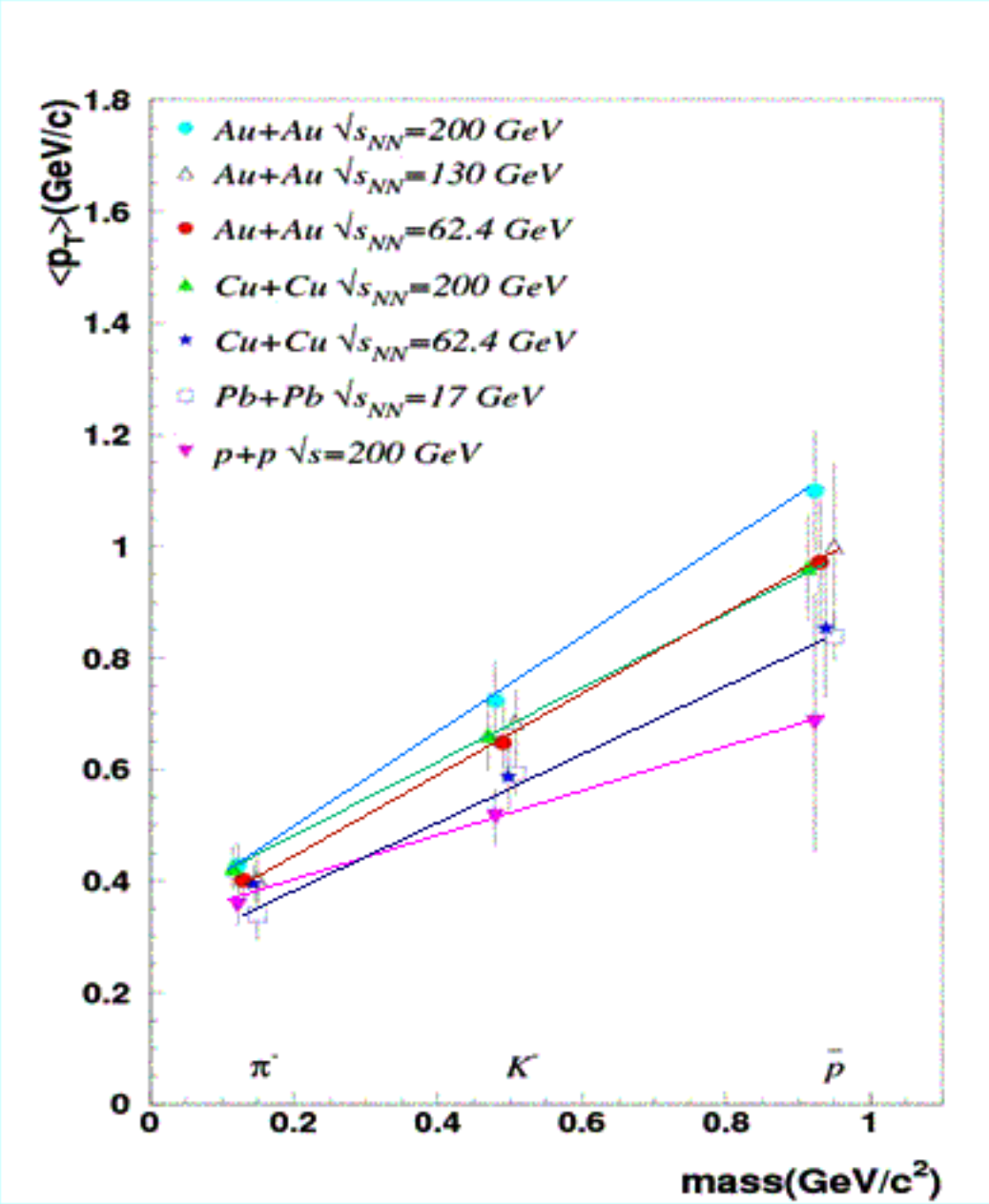




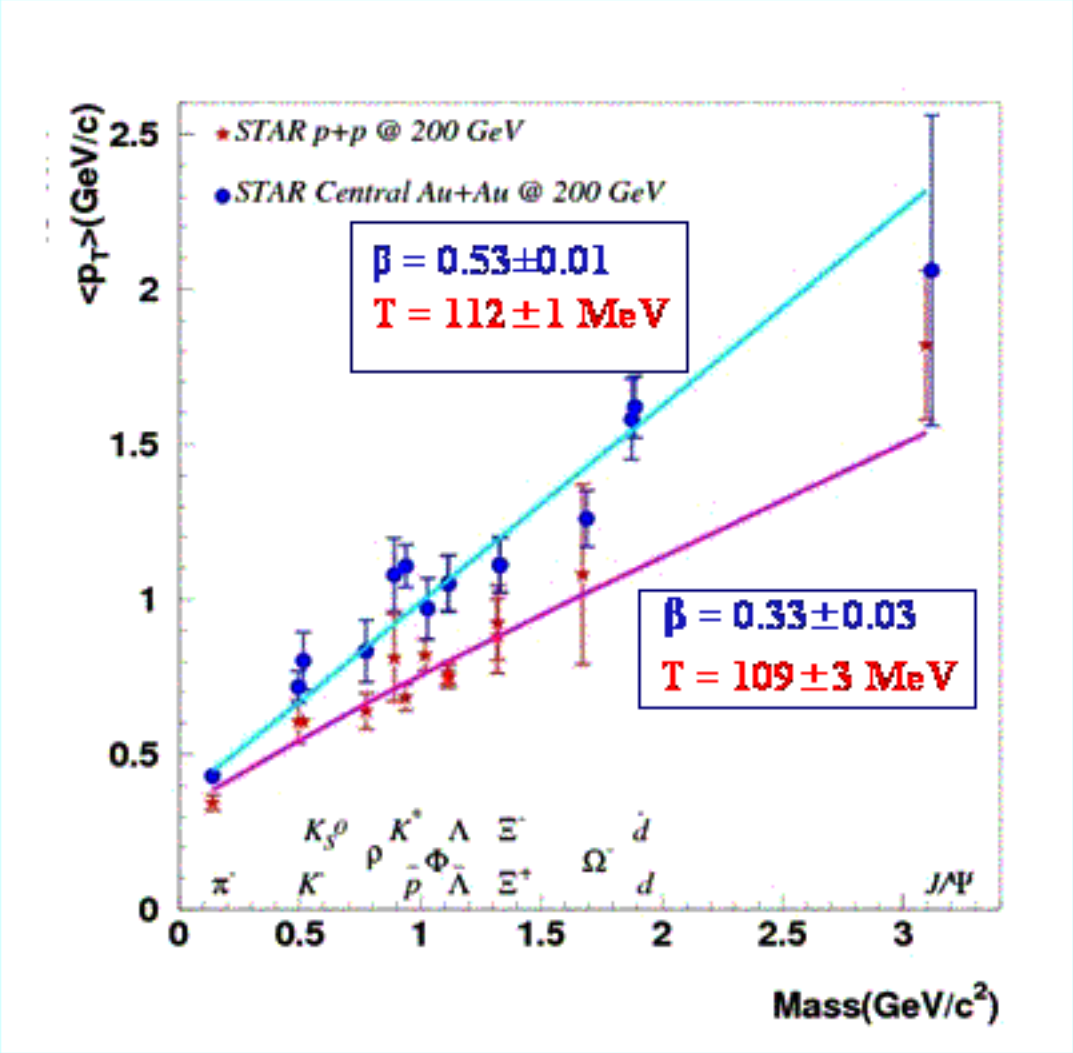
Transverse Flow



Transverse Flow



Transverse Flow



Λ, $\bar{\Lambda}$, Ξ^{*}, Ω^{-}, J/ψ

β = 0.36, T = 172 MeV

π, K, $\bar{p}$, d, $\bar{d}$

β = 0.59, T = 104 MeV

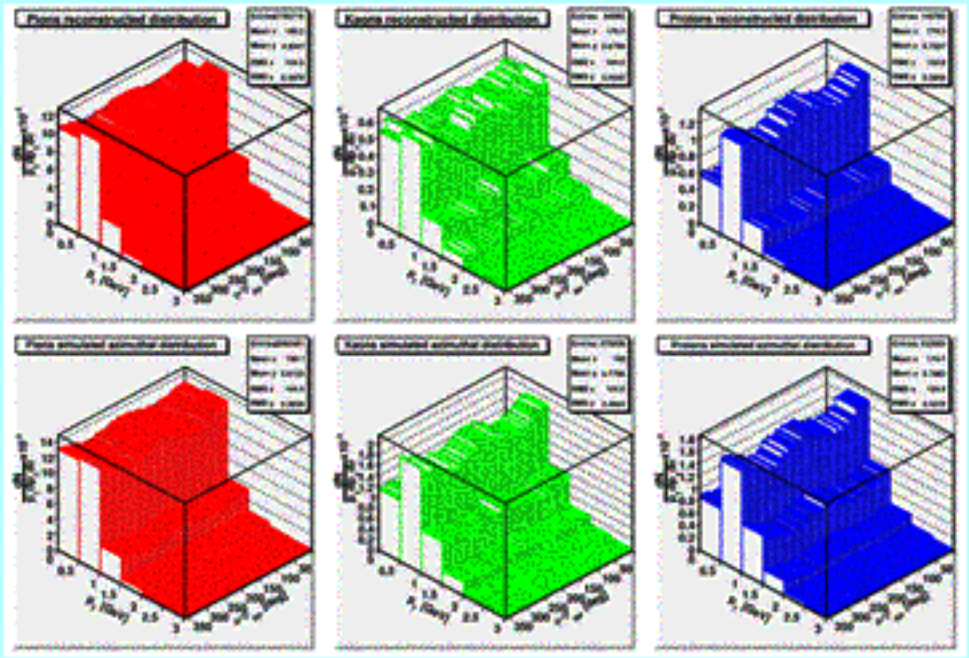
Past-Present-Future

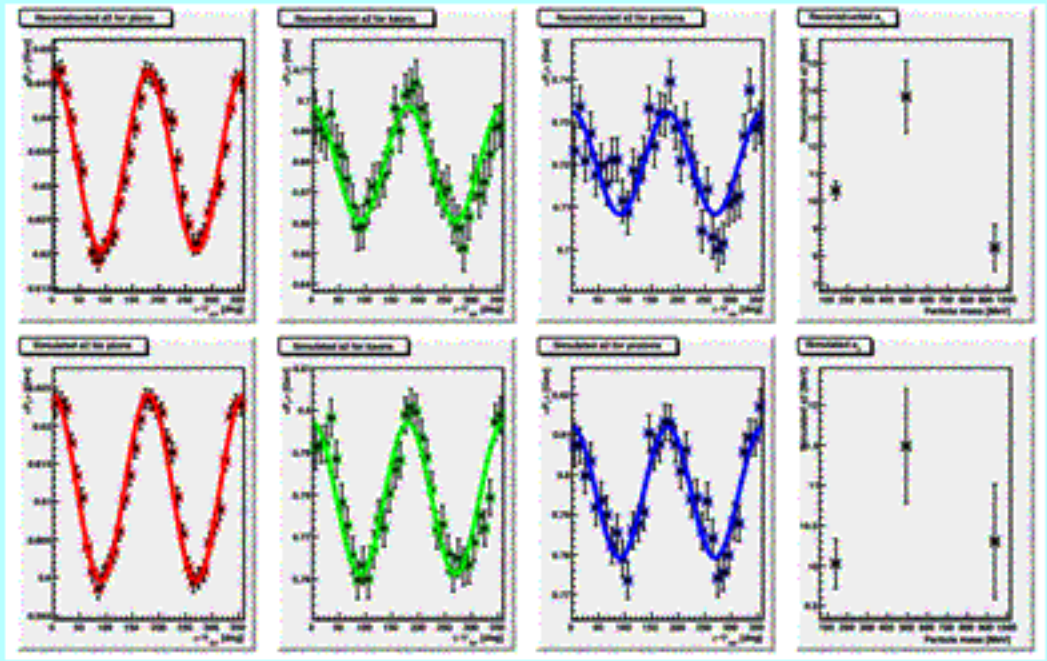
	SPS	RHIC	LHC
$\sqrt{s_{NN}}$ (GeV)	17	200	5500
dN_{ch}/dy	500	850	1500-4000
t^{0}_{QGP} (fm/c)	1	0.2	0.1
T/T_c	1.1	1.9	3-4
e (GeV/fm^3)	3	5	15-60
t_{QGP} (fm/c)	≤2	2-4	≥10
t_f (fm/c)	~10	20-30	30-40
V_f(fm^3)	few 10^3	few 10^4	Few 10^5

Hotter
Denser
Longer
Bigger

LHC: will open the next chapter in HI physics
significant step over & above existing facilities
THE place to do frontline research soon

MC analysis





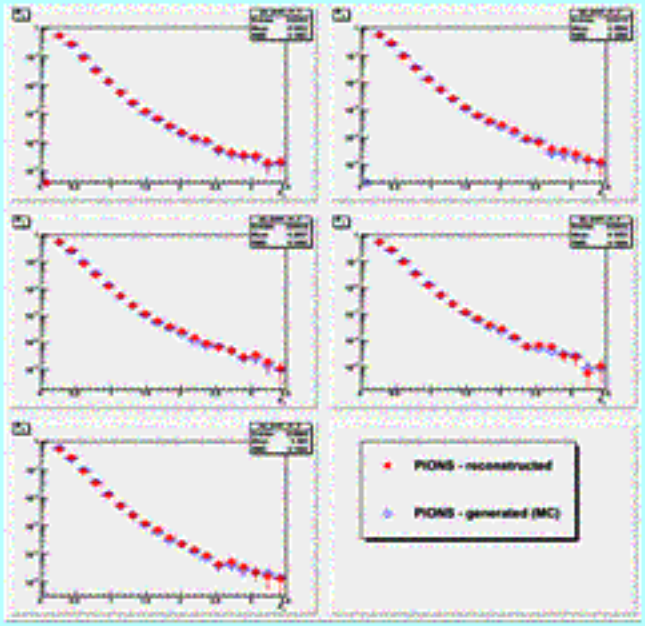
Pb + Pb 5.5 TeV

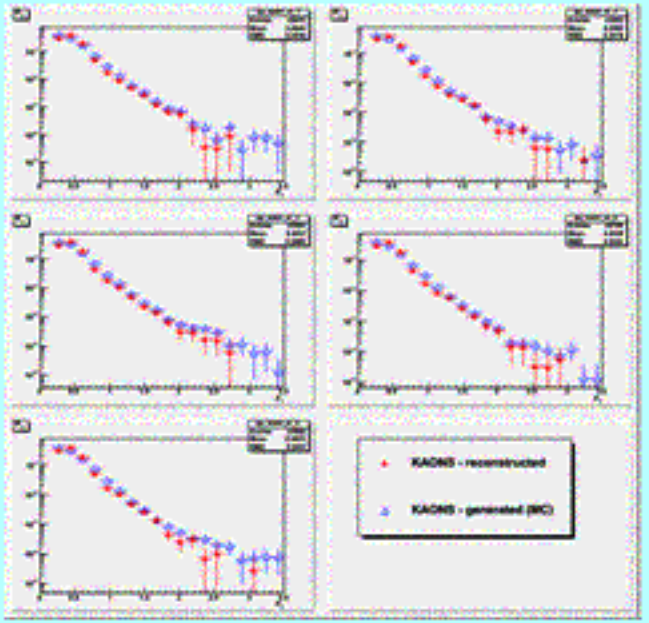
GeVSim

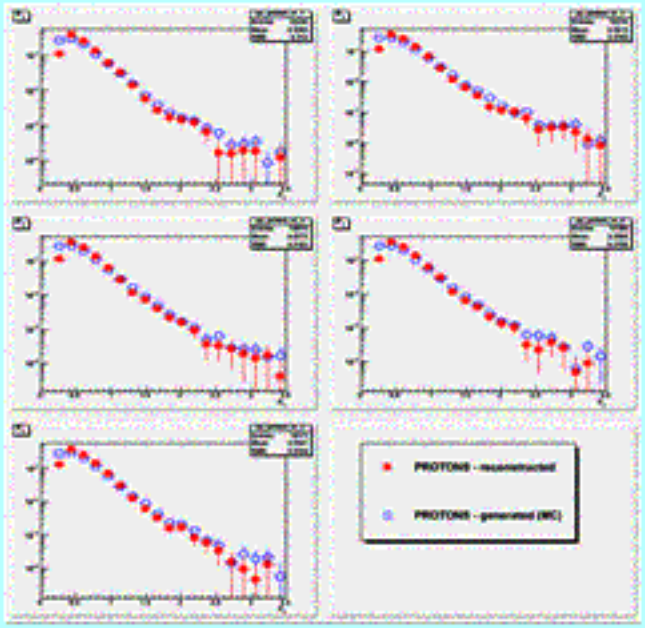
MC analysis

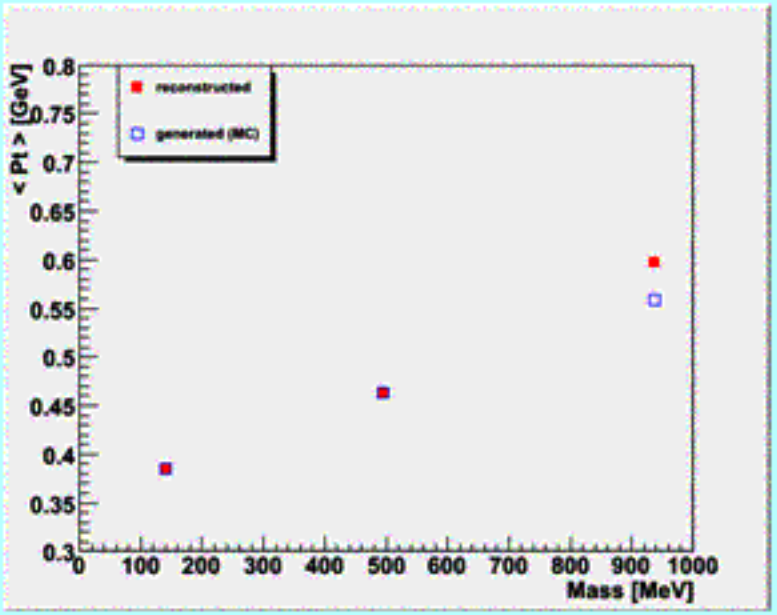
Pb + Pb 5.5 TeV

Hijing









Results

- Heavy Ion Physics with ALICE - **invited talk**
  M. Petrovici
  Four Seas Conference, May 2007, Iasi – Romania

- Selected Aspects of Colective Flow in Heavy Ion Collisions - **invited talk**
  M. Petrovici and A. Pop
  Carpathian Summer School of Physics, Aug.-Sept. 2007, Sinaia-Romania

- NIHAM within ALICE-GRID - **invited talk**
  M. Petrovici and C. Schiaua
  ICFA Digital Devide Workshop, Mexico City, October 24-27, 2007

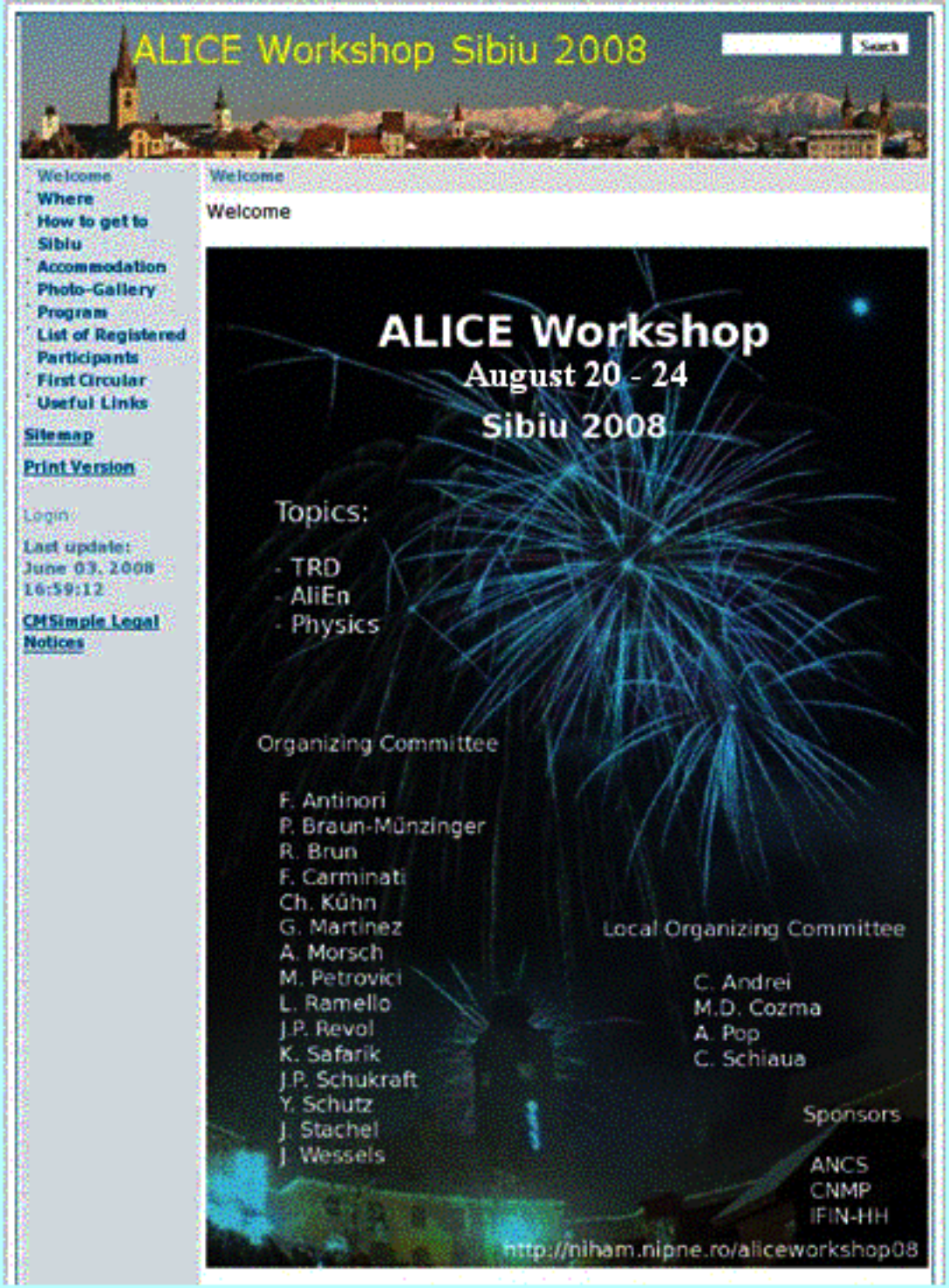
- NIHAM ALICE TRD-chambers status – **presentation**
  M. Petrovici on behalf of DFH-NIPNE ALICE branch
  Hauenstein, Germany, June 6-7, 2008

- Collective phenomena in Heavy Ion Collisions – **invited talk**
  M. Petrovici, C. Andrei, I. Berceanu, A. Herghelegiu, A. Pop, C. Schiaua
  The 3rd Light Ion Nuclear Collisions Workshop 18-21 June, 2008
  Protvino – Russia

- ALICE – Technical Paper I
  ALICE Collaboration
  CERN, October 2007, **published ???**

- Cristian Andrei – Master Thesis

- Andrei Herghelegiu – Master Thesis



http://niham.nipne.ro/aliceworkshop08

Financial aspects

Financial aspects

The activities of which results were summarized above were financed within the following Programs:

- **CEEX**
- **CORINT NUCINT**
- **CORINT EU**
- **CAPACITATI**
- **PARTENERIATE**
- **IDEI**
- **Resurse Umane**
- **PN**

Do we have to continue like this? ⇒ consequences !