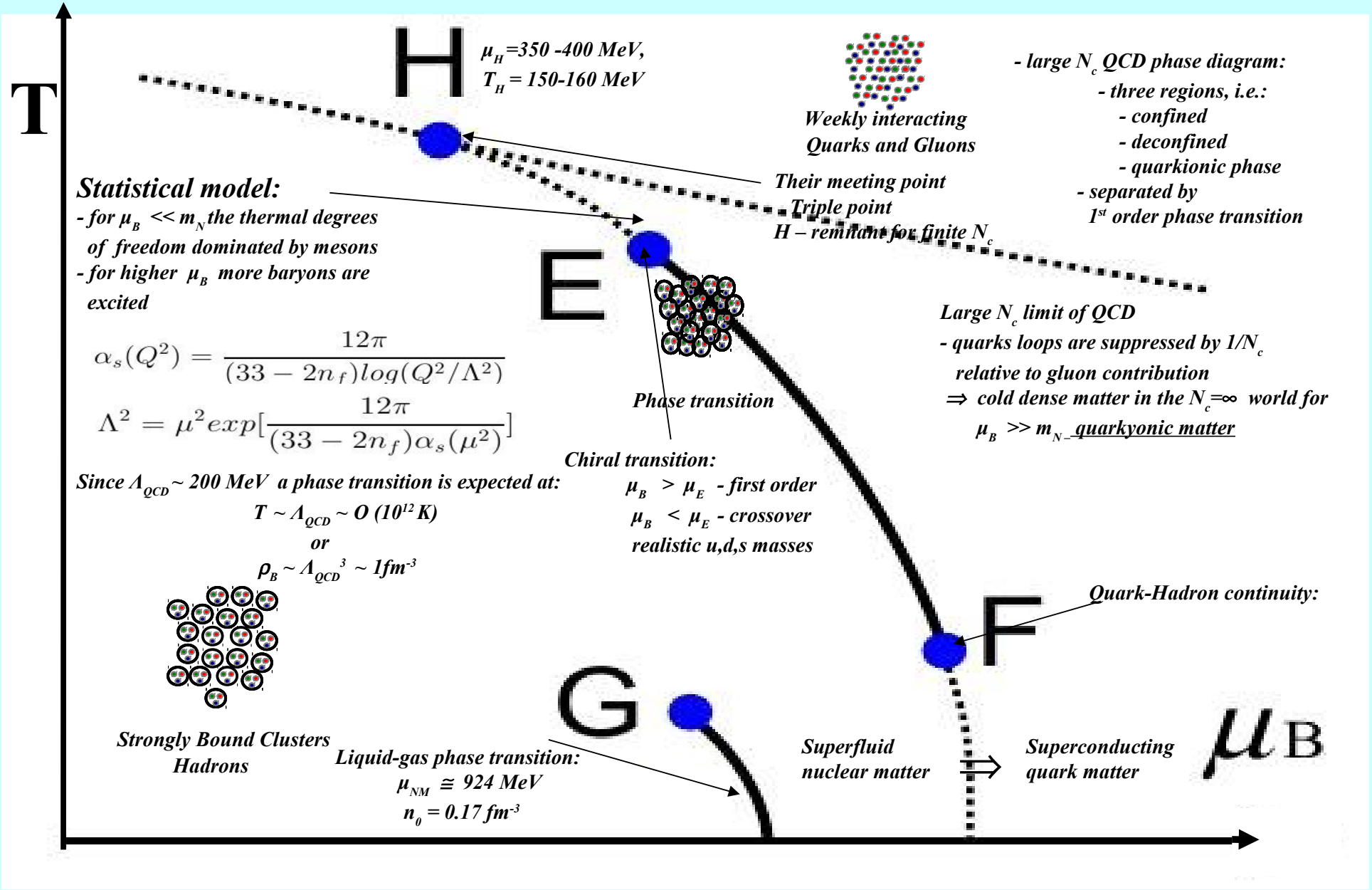
ALICE / IFIN-HH

- *the scope of the project*
- *2012 activities and results*
- *the local infrastructure*
- *impact*
- *2013-2014 perspectives & Upgrade*

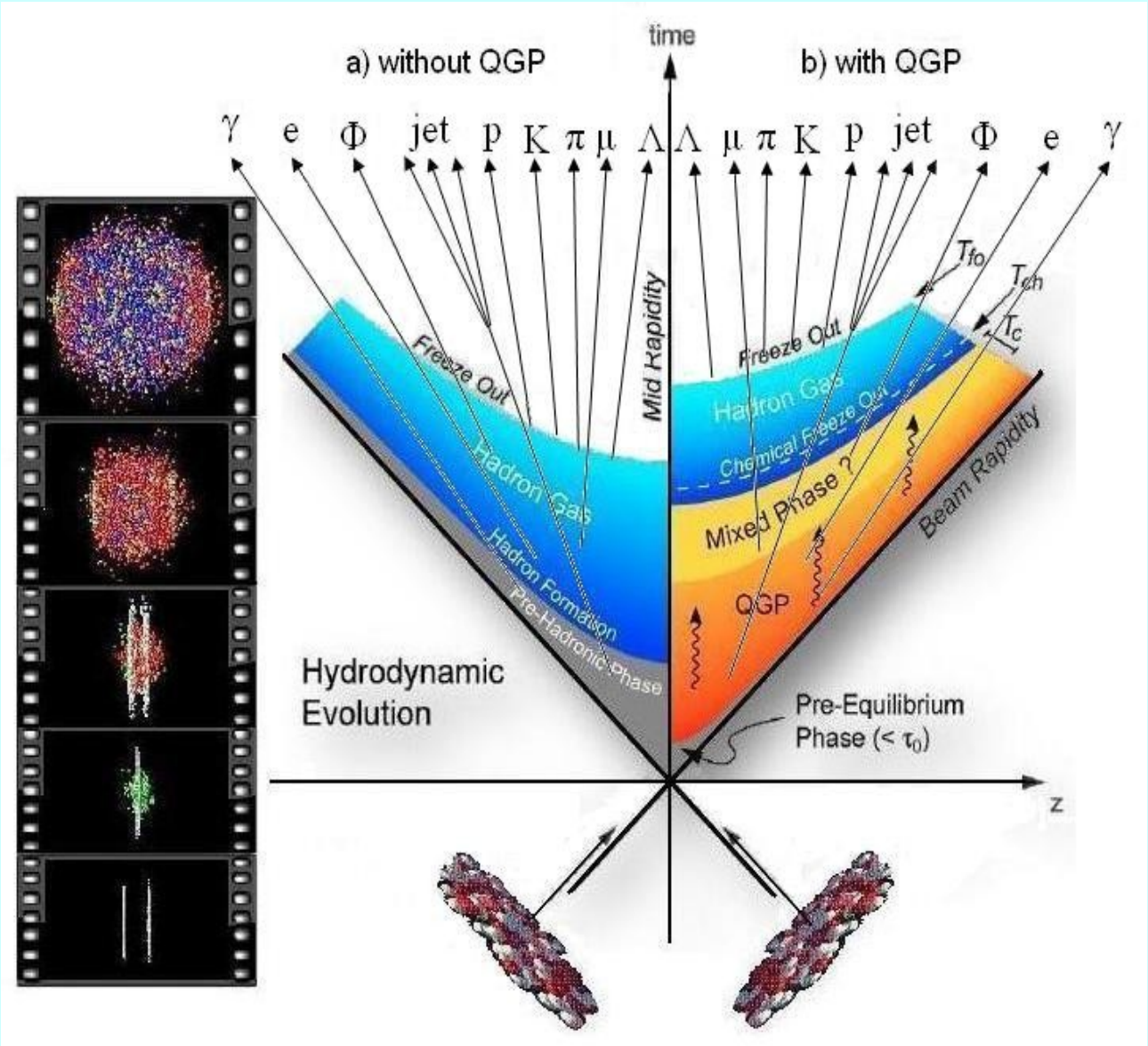
DFH

Mihai Petrovici, November 12, 2012, ISAB, Bucharest

Expectations based on QCD



Is there a way to produce such states of matter in the Laboratory ?



A word of caution!

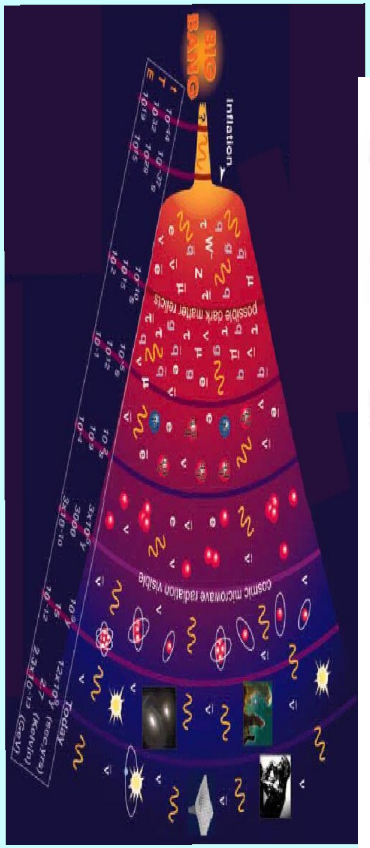
- **finite size**

- **highly non-homogenous**

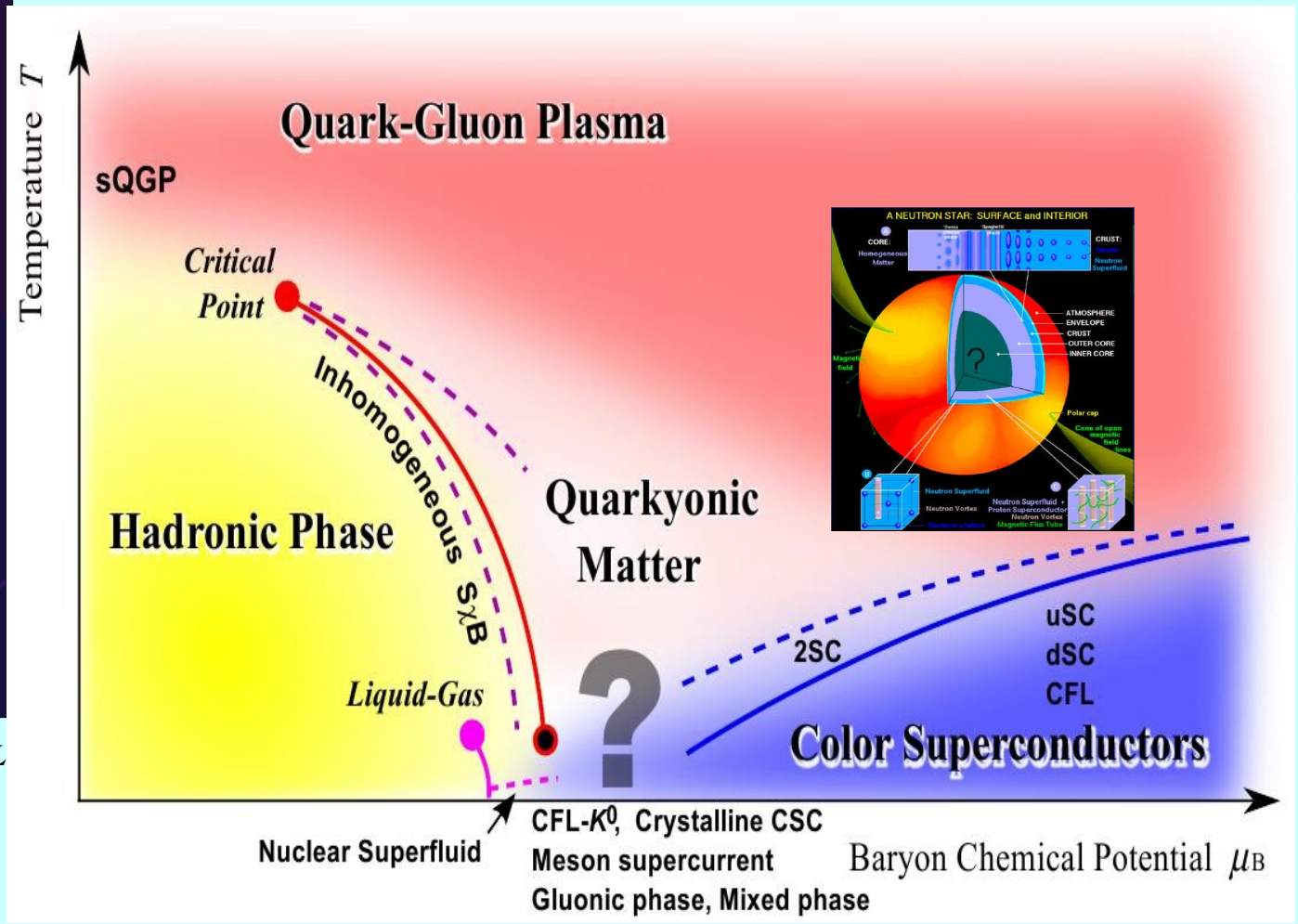
&

- **dynamical effects**

QCD Phase Diagram



Particle Data Group BNL



K. Fukushima and T. Hatsuda, Rept. Prog. Phys., 014001(2011); arXiv: 1005.4814

ALICE-a general-purpose heavy-ion experiment designed to explore ultra-dense and high temperature region of the QCD phase diagram far above the QGP transition temperature which can be produced in nucleus-nucleus collisions at LHC energies

Observables:
- *Particle multiplicities:*
  - *p-p collisions*
  - *A-A collisions*
  - *p-A collisions*
- *Particle spectra*
- *Chemical and kinetic freeze-out temperature and collective flow*
- *Hadron yields and chemical composition*
- *Elliptic flow and early pressure*
- *Particle correlations*
- *Space-time information from the radius parameter and the dynamics*
- *Fluctuations*
- *Jets*
- *Photons*
- *Heavy-quark production*
- *Quarkonia production*

PHOS
$-.12 < \eta < 0.12$
$\Delta\phi = 100^o$

HMPID
$-.45 < \eta < 0.45$
$\Delta\phi = 57^o$

FMD $-5.4 < \eta < -1.6$

PMD $-2.3 < \eta < -3.5$

ITS+TPC+TRD+TOF: $|\eta| < 0.9$

EMCAL $|\eta|<0.7$
$\Delta\Phi=110^o$

ITS multiplicity $-2 < \eta < 2$

FMD $1.6 < \eta < 3$

Muon arm $2.4 < \eta < 4$

-6 -4 -3 -2 -1 0 1 2 3 4

90 ° 180 ° 270 ° 360 °

Two ways to probe the new state of matter

Use high p_T as probe

Partons loose energy in medium

Measure nuclear modification factor - RAA

Parton energy loss dE/dx, gluon density

Probe the bulk response

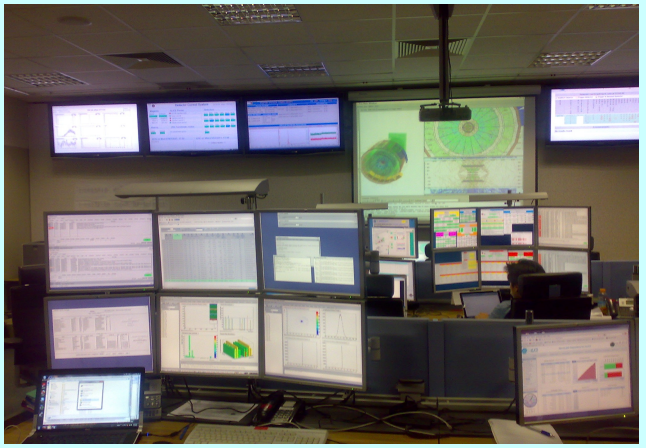
Response of medium to presure

Measure elliptic and radial flow

Partonic equation of state EoS

2012 activities and results

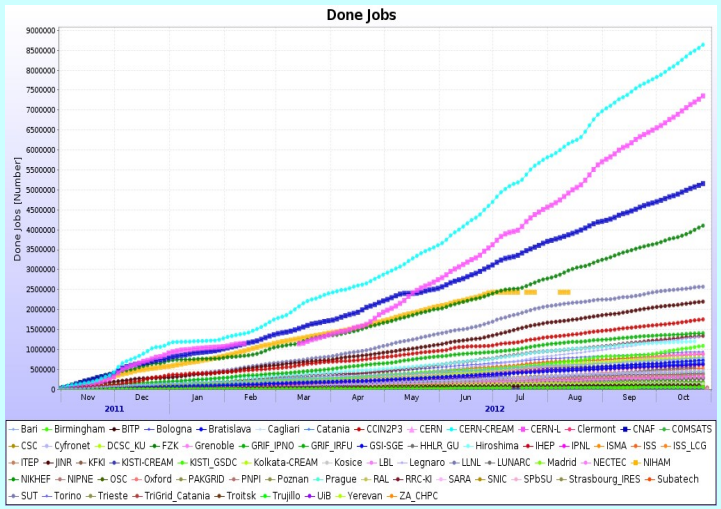
- p+p & p+A experiments; shifts at the Subdetectors and Central Subsystems:
  - TRD + TPC
  - DCS
  - DAQ
  - DQM + HLT
  - Offline

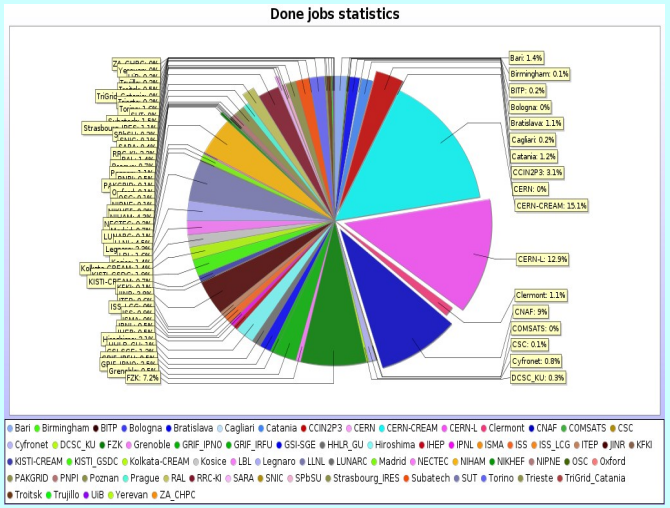


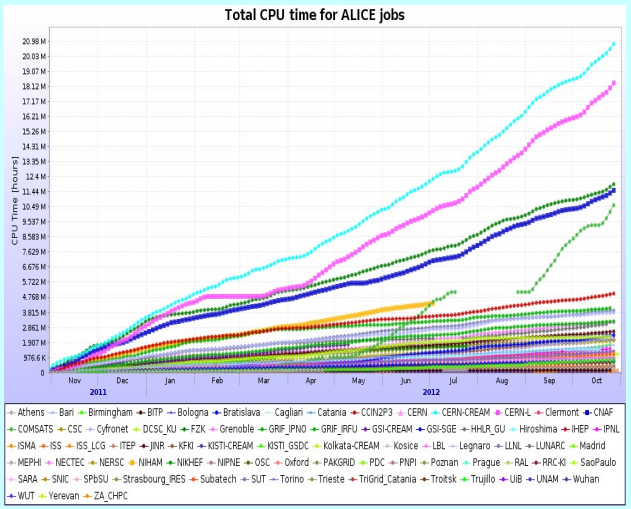
-2 blocks TPC+TRD
-2 blocks at Detector Control System
-2 blocks at Data Acquisition system+Central Trigger Processor+High Level Trigger
-1 block at Data Quality Monitoring (2011)
-5 shifts as Shift Leader in Matters of Safety

1 block=6 shifts

- NIHAM contribution to ALICE GRID







2012 activities and results

- TRD tracking - *Performance, Flexibility, Development*

The TRD tracking

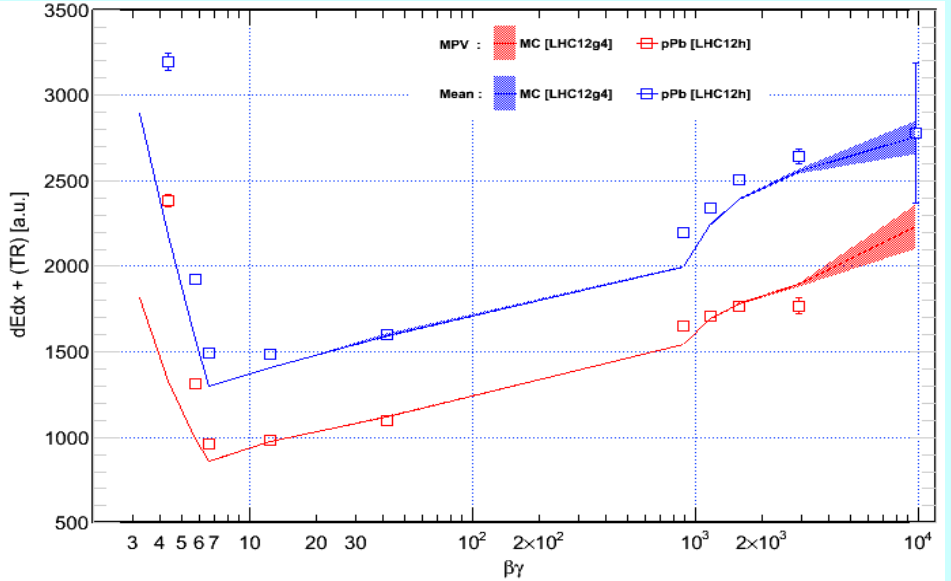
→ is a component of the ALICE barrel tracking
→ together with ITS, TPC and TOF which provide
→ improved p_t resolution for tracks @ vertex and
→ electron identification through dE/dx+TR

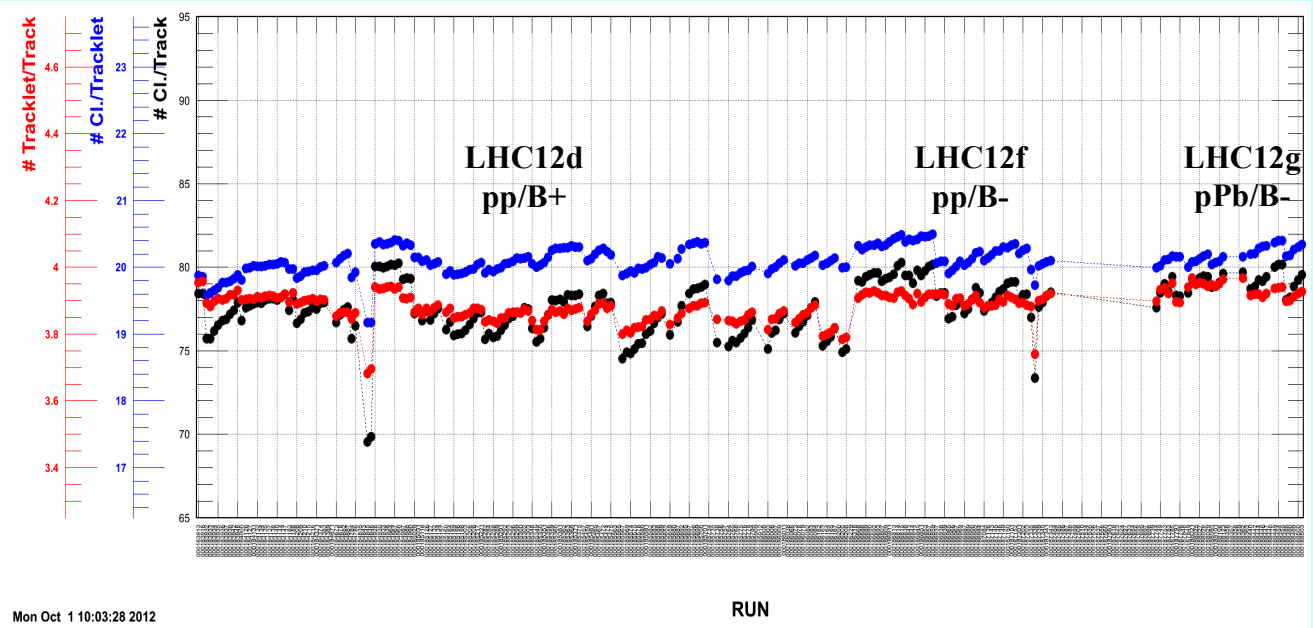
Is performing

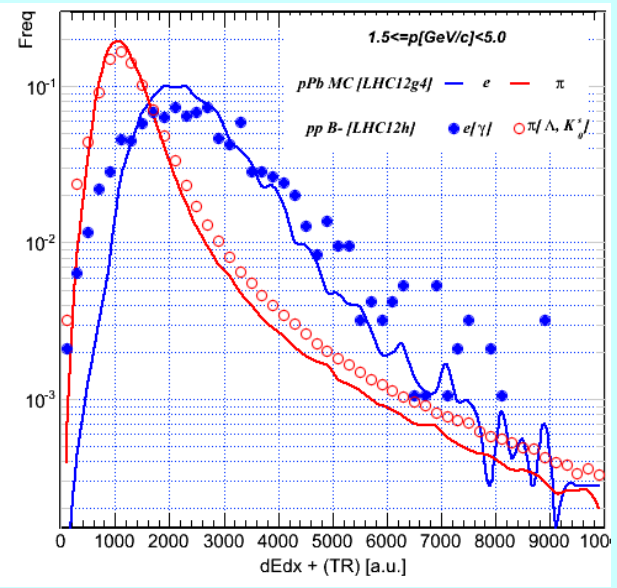
→ good/stable efficiency & resolution
→ stable in different interaction systems (pp, pPb,PbPb)
→ identical for Measurements and MC

Should perform

→ ITS-TRD tracking for ALICE upgrade (on work)
→ Stand-alone TRD tracking (on work)
→ diagnostic of TRD/barrel tracking (development)







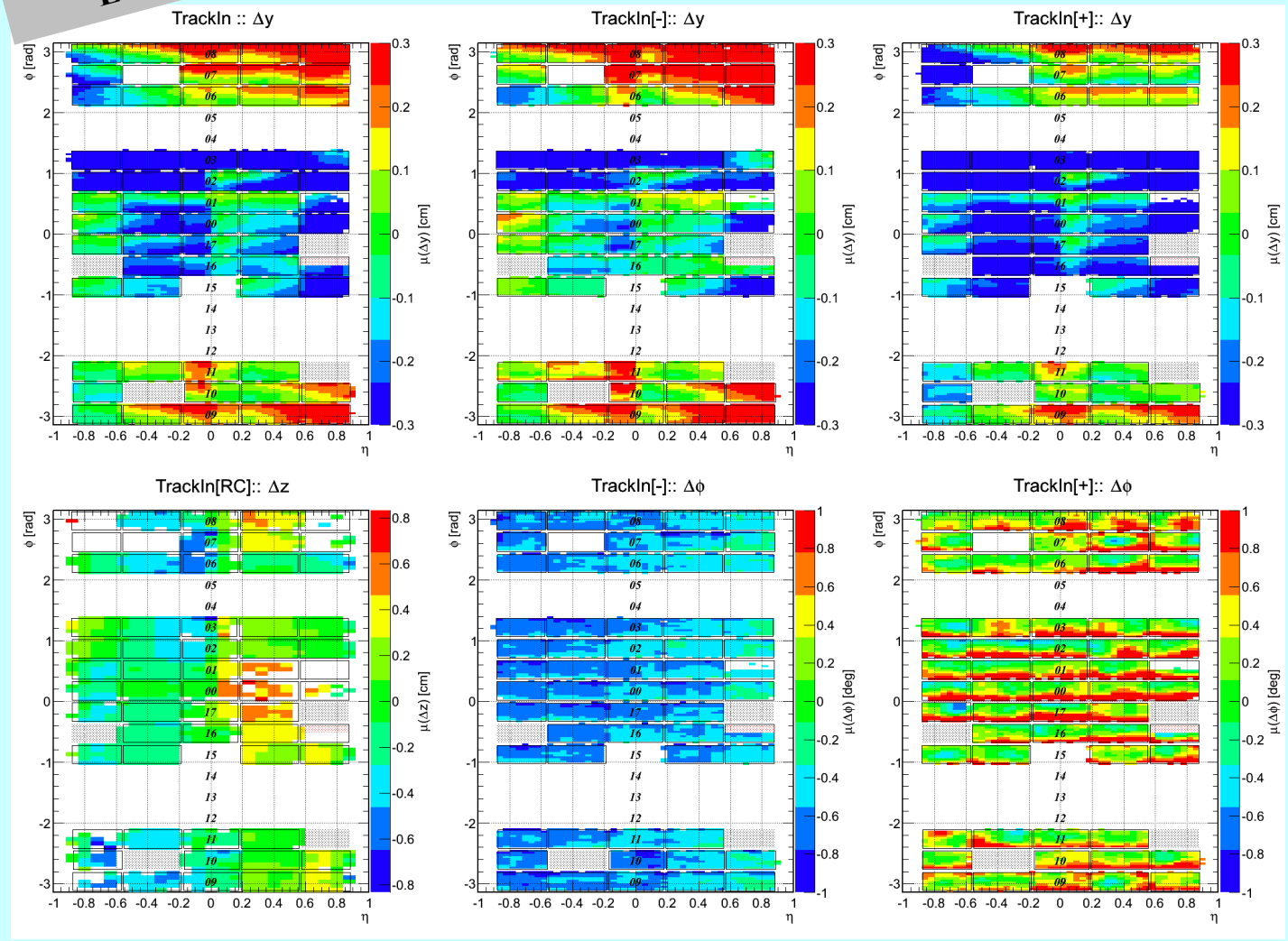
2012 activities and results

- TRD tracking - *Monitoring barrel tracking @ TPC-TRD joining point*

QA performance plot from LHC12d/185359

The TRD detector provides spatial measurements on 3 direction
Shifts are used to check calibration quality in and inter detectors

→ **rφ** see **μ(Δy)**
→ **z** see **μ(Δz)**
→ angular see **μ(ΔΦ)**



spatial resolution monitoring for alignment, efficiency, ExB effects, signal quality, etc

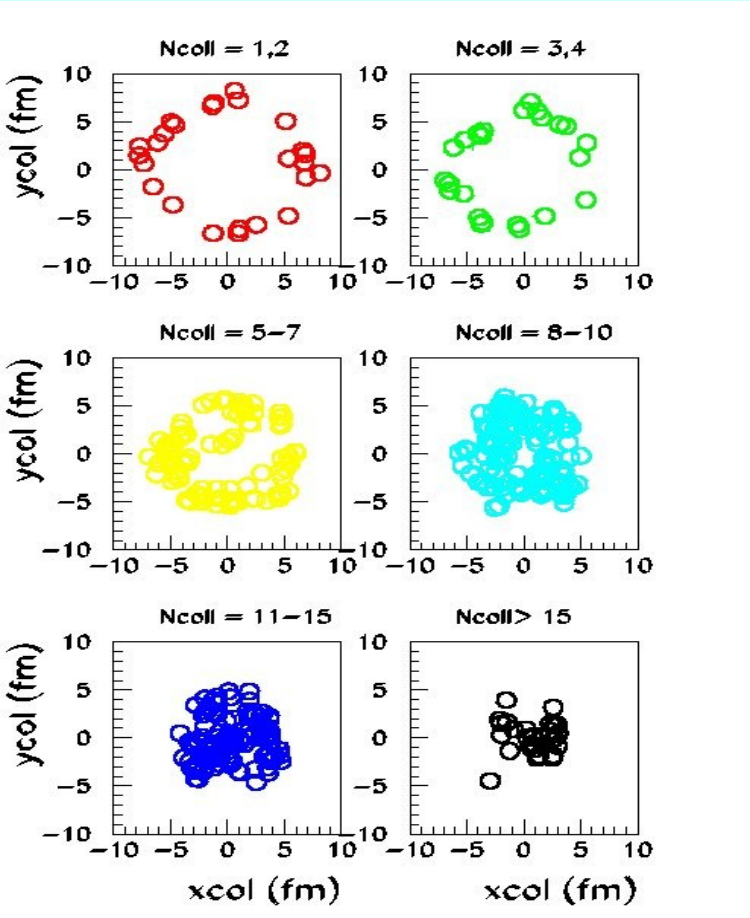
angular resolution monitoring for p_t resolution, drift velocity, ExB effects, etc

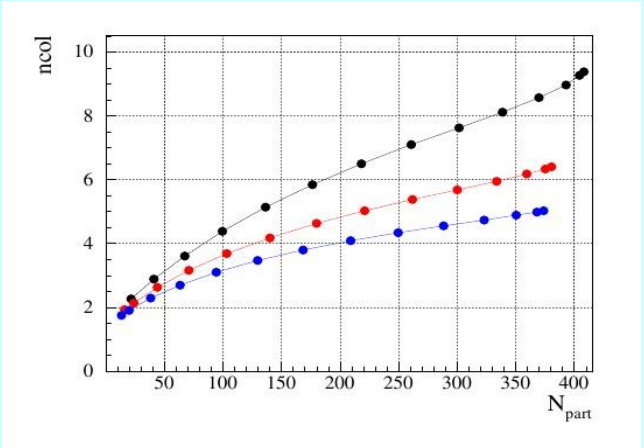
along the pad spatial resolution monitoring for TPC drift velocity, p_z resolution

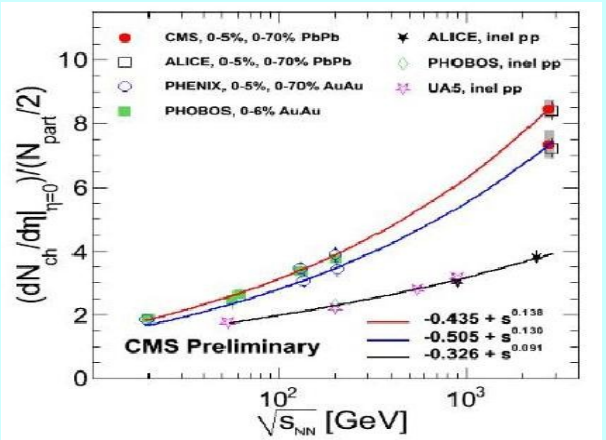
2012 activities and results

- **Studies of event shape variables selection performance for events of interest, analysis of Monte Carlo and experimental data**

Event #n







$\Rightarrow \langle dN_{ch}/d\eta^{\text{"9 coll hot spot"}}\rangle \approx 36$

Which is the difference or similarity between the properties and dynamics of such a hot spot and what is produced in a p+p collision with a similar multiplicity?

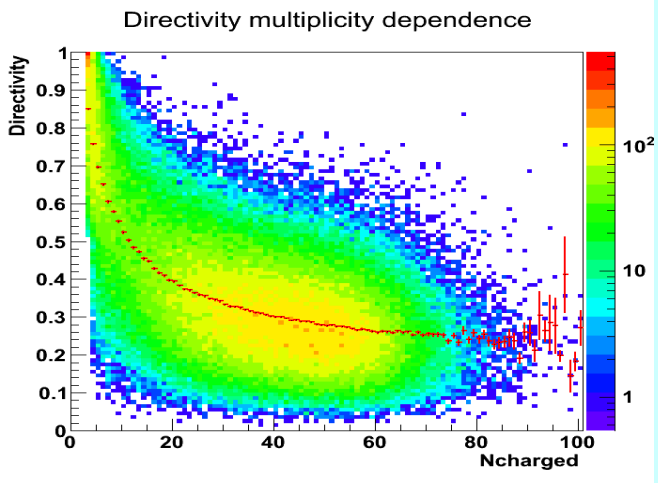
2012 activities and results

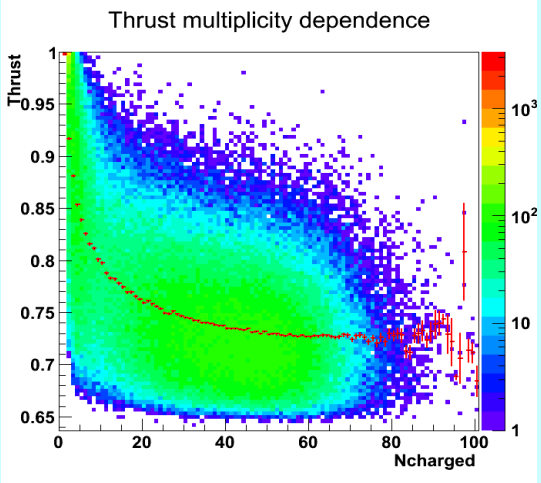
$$S_\perp = \frac{2\lambda_2}{\lambda_2 + \lambda_1}$$

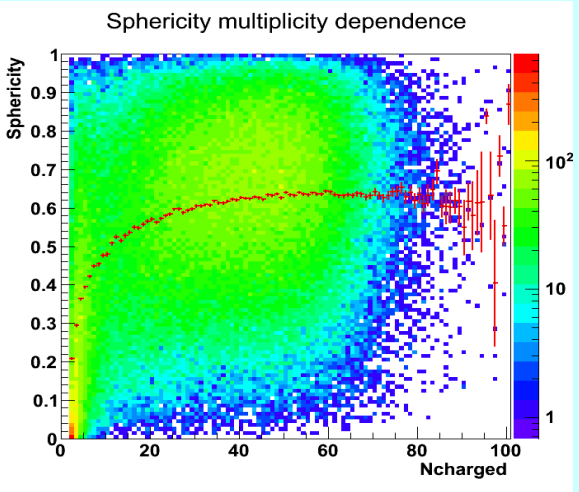
$$D^{\pm} = \frac{\left|\sum_i \vec{p}_{t,i}\right|}{\sum_i \left|\vec{p}_{t,i}\right|}\Big|_{\eta^{pos/neg}}$$

$$T = \underbrace{max}_{\vec{n}_T} \frac{\sum_i \left|\vec{p}_{t,i} \cdot \vec{n}_T\right|}{\sum_i \left|\vec{p}_{t,i}\right|}$$

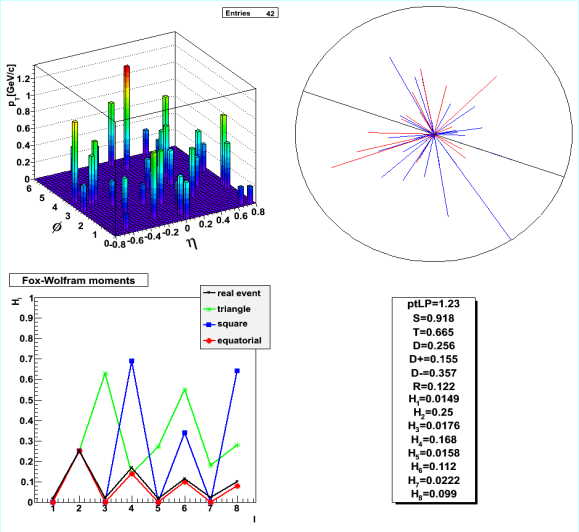
$$S_{xy} = \frac{1}{\sum_i p_T^i} \sum_i \begin{pmatrix} p_x^{(i)2} & p_x^{(i)} \cdot p_y^{(i)} \\ p_x^{(i)} \cdot p_y^{(i)} & p_y^{(i)2} \end{pmatrix}$$

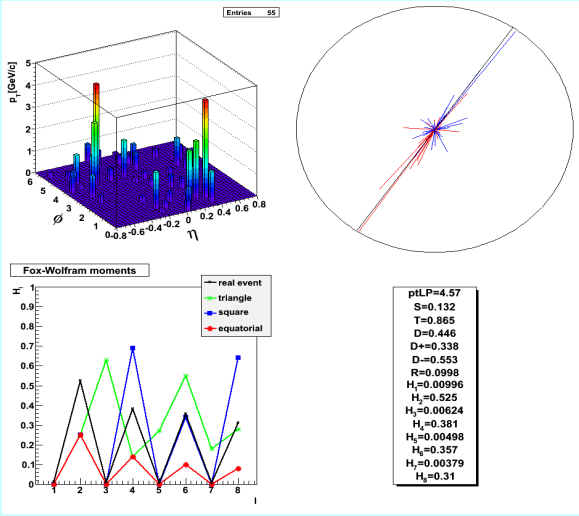




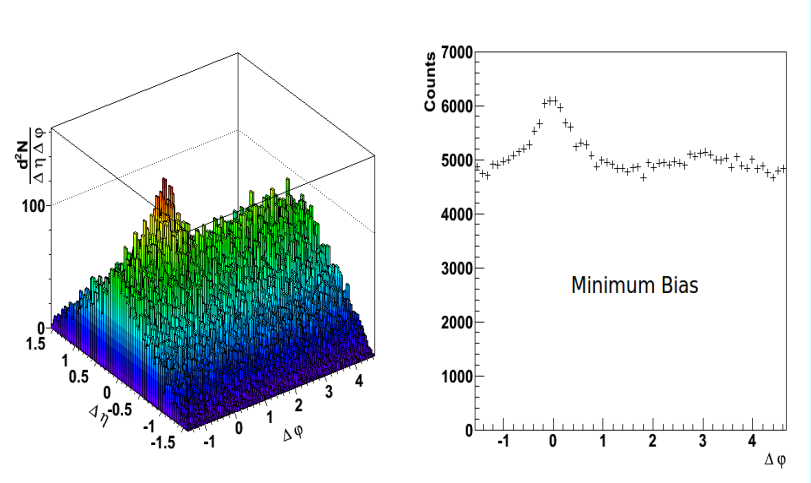


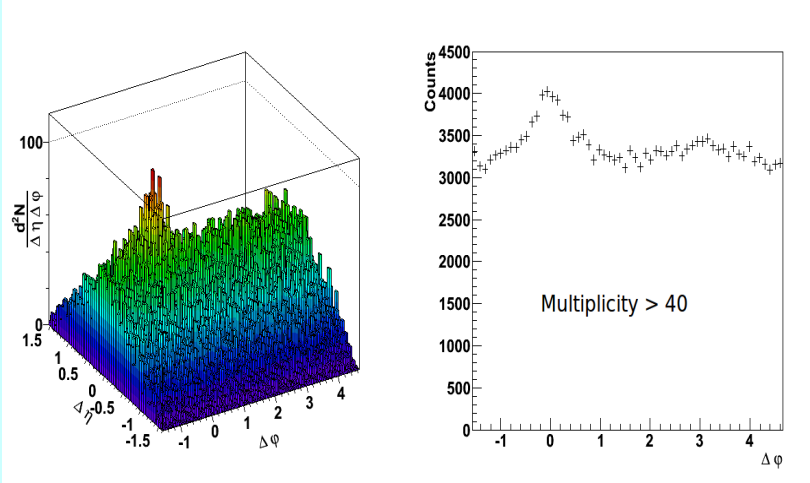
$$H_l = \frac{\sum_{i,j} p_i p_j P_l(cos\phi_{ij})}{\sum_{i,j} p_i p_j}$$

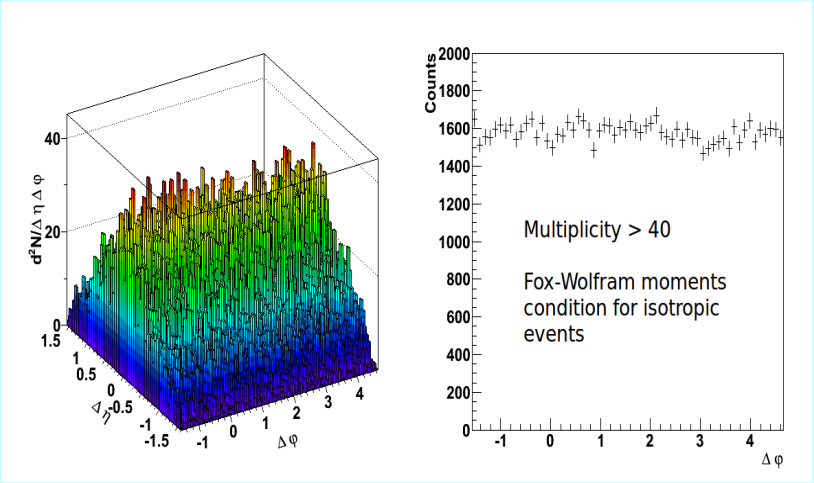




2012 activities and results







2012 activities and results

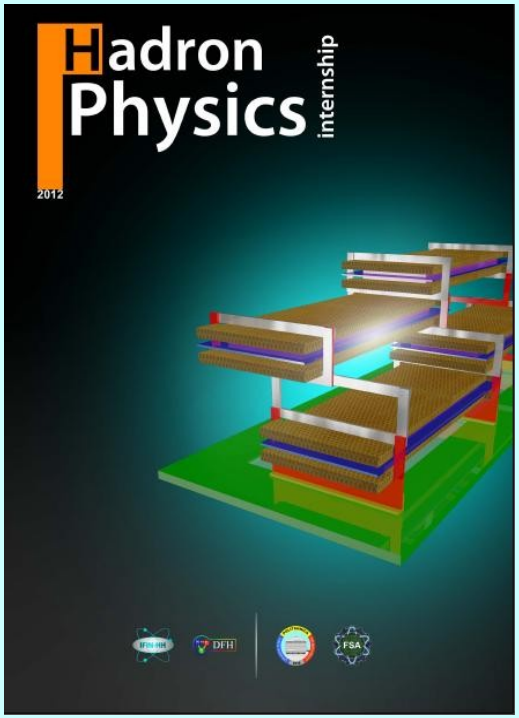
Internal ALICE presentations, internal notes, internal refereeing, published papers :

- 19 presentations in PAG and PWG of ALICE Collaboration
- 2 internal notes
- 2 posters at EuNPC
- Institute review – 2 ALICE papers
- coauthors at 27 published papers

ALICE upgrade:

In-kind contribution – TPC readout chambers suing GEM technology

Summer Student Program – 3rd edition:



Outreach:

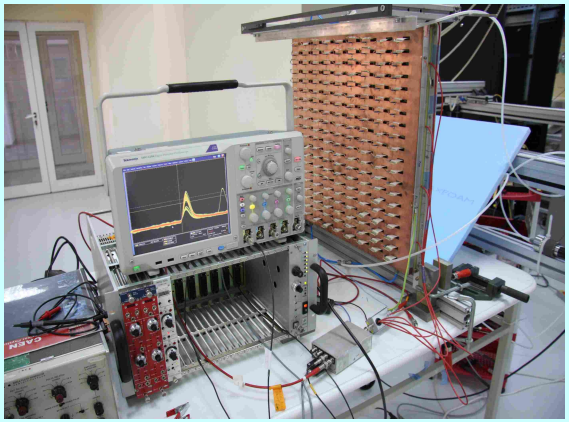
- http://niham.nipne.ro
- *http://alicematters.web.cern.ch/?q=ifin-hh*
  IFIN-HH, Romania - 'The Thinkers' of ALICE -ALICE Matters
- *https://espace.cern.ch/alice-mgt-vipvisits/Romania/default.aspx*
  Romania_and_ALICE_2012Feb_NIPNE

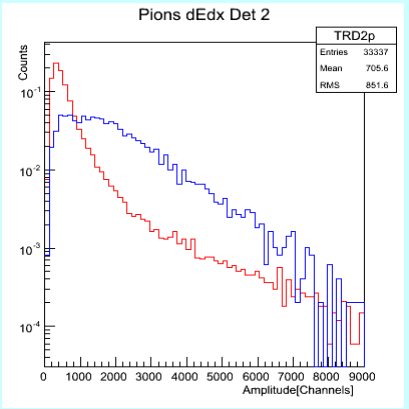
2012 activities and results

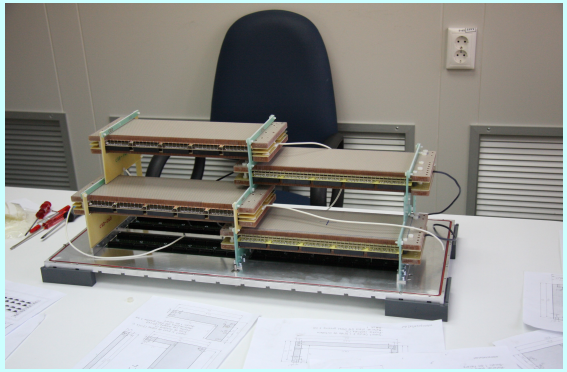
Numerous visits in DFH of Romanian and foreign delegations:

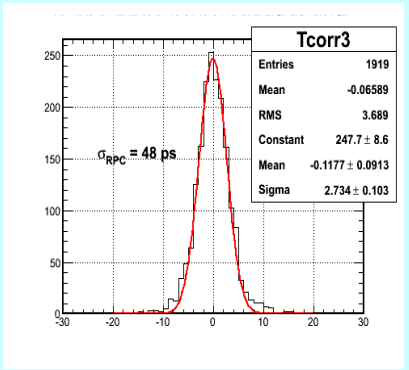
Impact on other activities and collaborations:

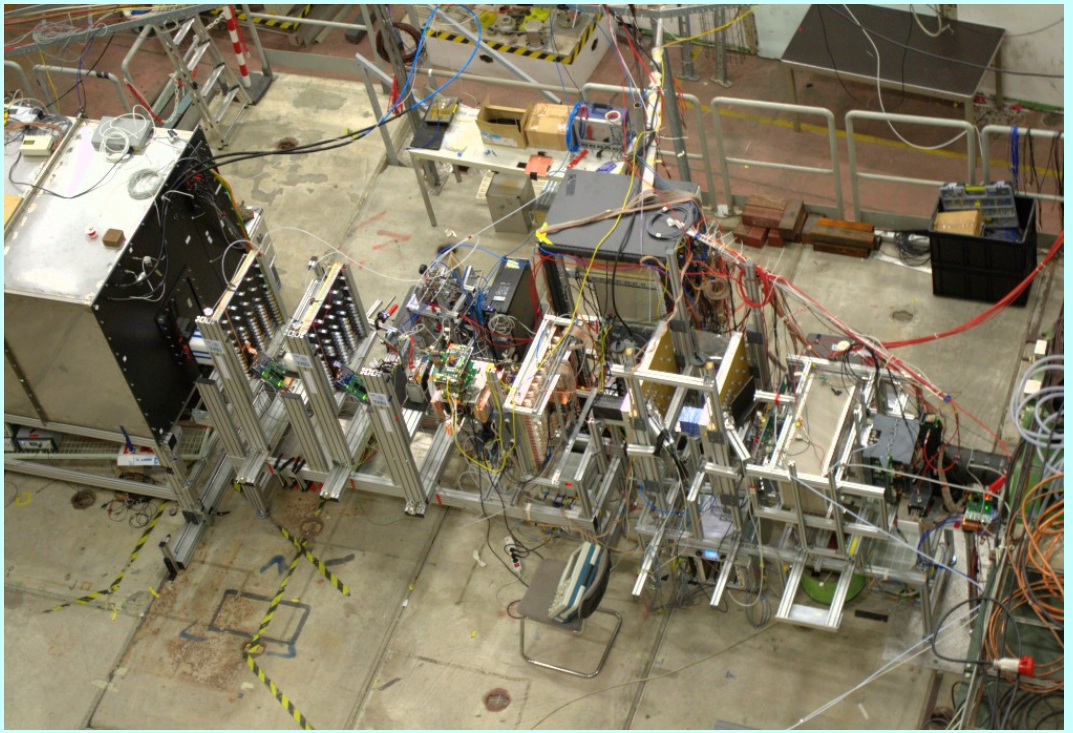
In-beam test configuration of the RPCs and TRDs prototypes for CBM at T9 – PS, CERN, Oct.-Nov. 2012







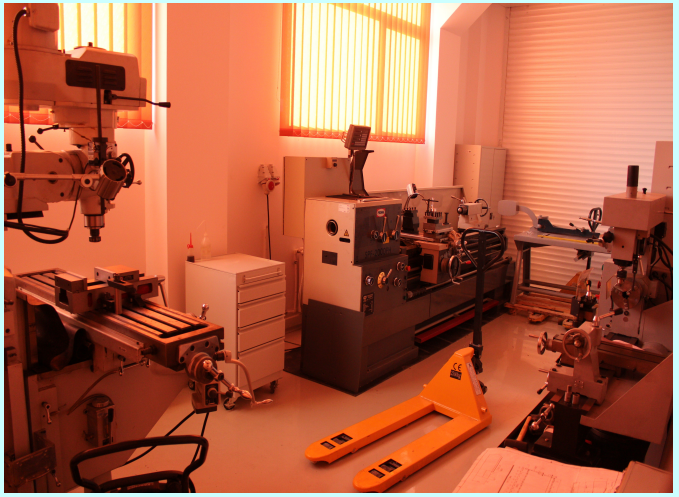




Extended infrastructure

NIHAM Analysis Facility

New mechanical workshop

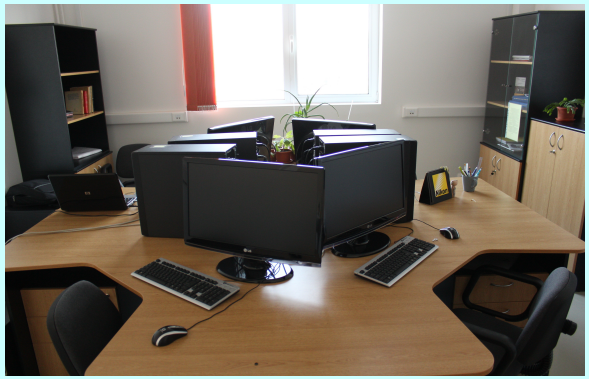


- ~150 places – Conference Hall
- ~11 offices
- 2 detector labs – tests
- 2 electronic labs – tests
- 2 meeting rooms
- mechanical workshop
- large hall for mounting and testing large volume sub-detectors for large scale experiments

Foyers

Conference Hall

Meeting Room



PhD, Master and Diploma students Offices

IEC May 2012 for institutional financing

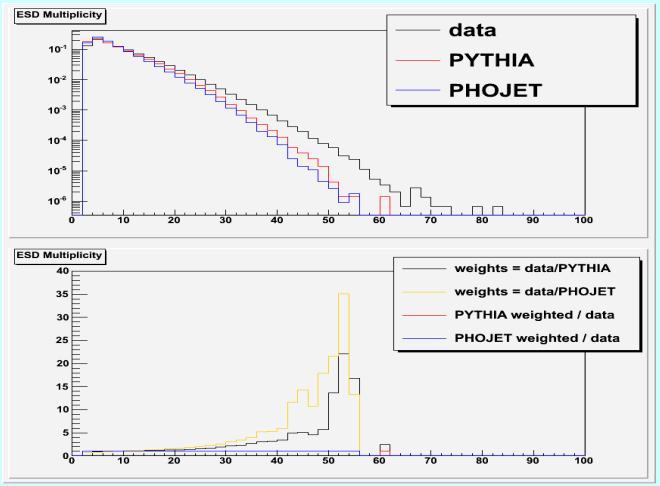
"With no doubt this department is to be ranked excellent as it has an outstanding impact and visibility in both science and technology within the various international collaborations where it is involved"

2013

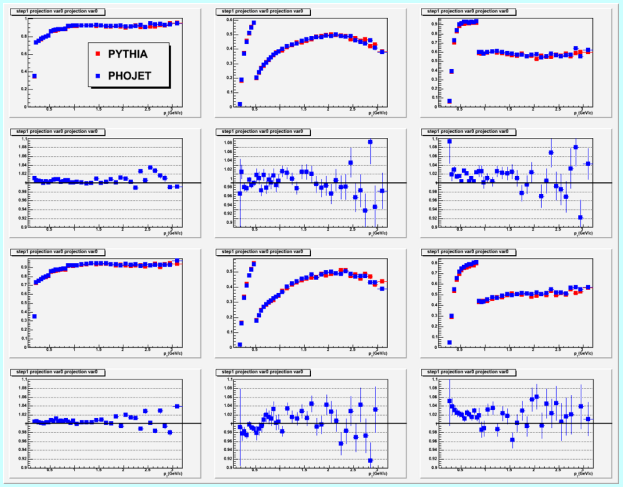
- Studies of efficiency correction, analysis of Monte Carlo and experimental data

Multiplicity dependence of efficiency correction

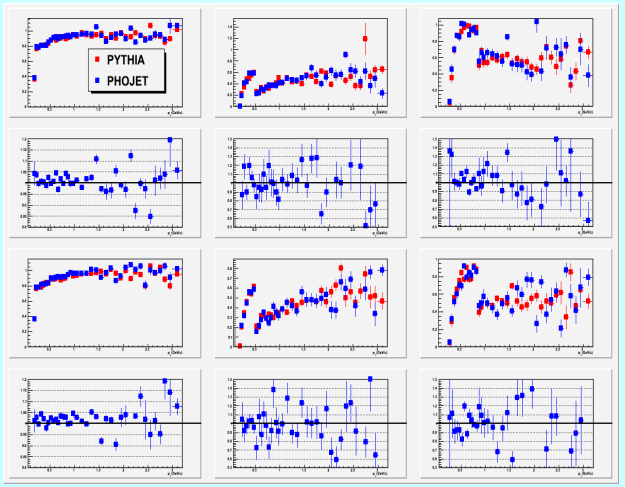
"Weighted" efficiency correction - weights



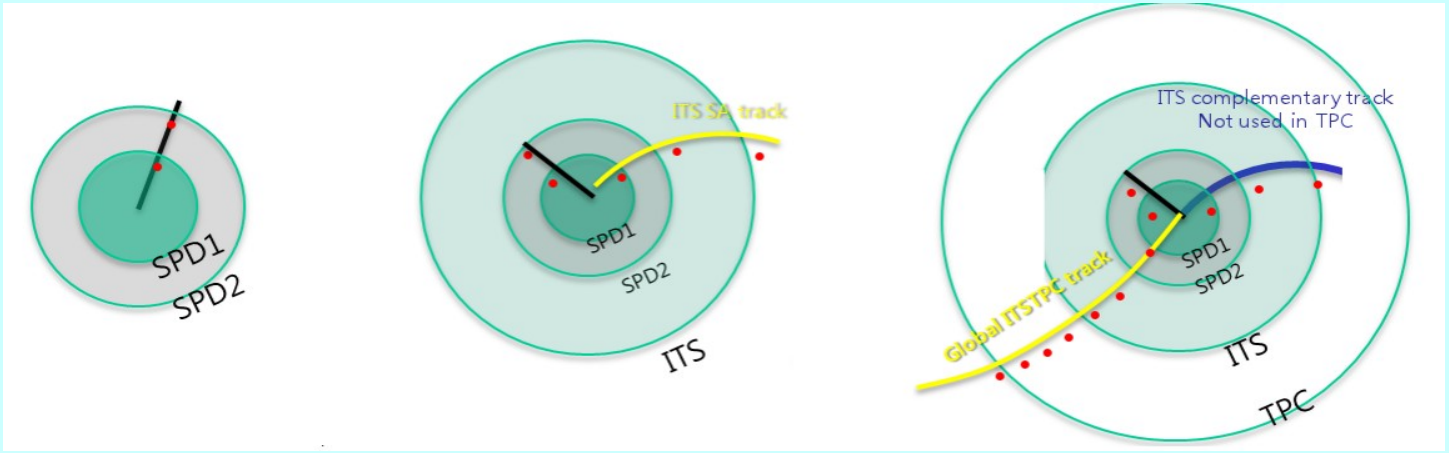
"Weighted" efficiency – MB



"Weighted" efficiency – Mul > 33



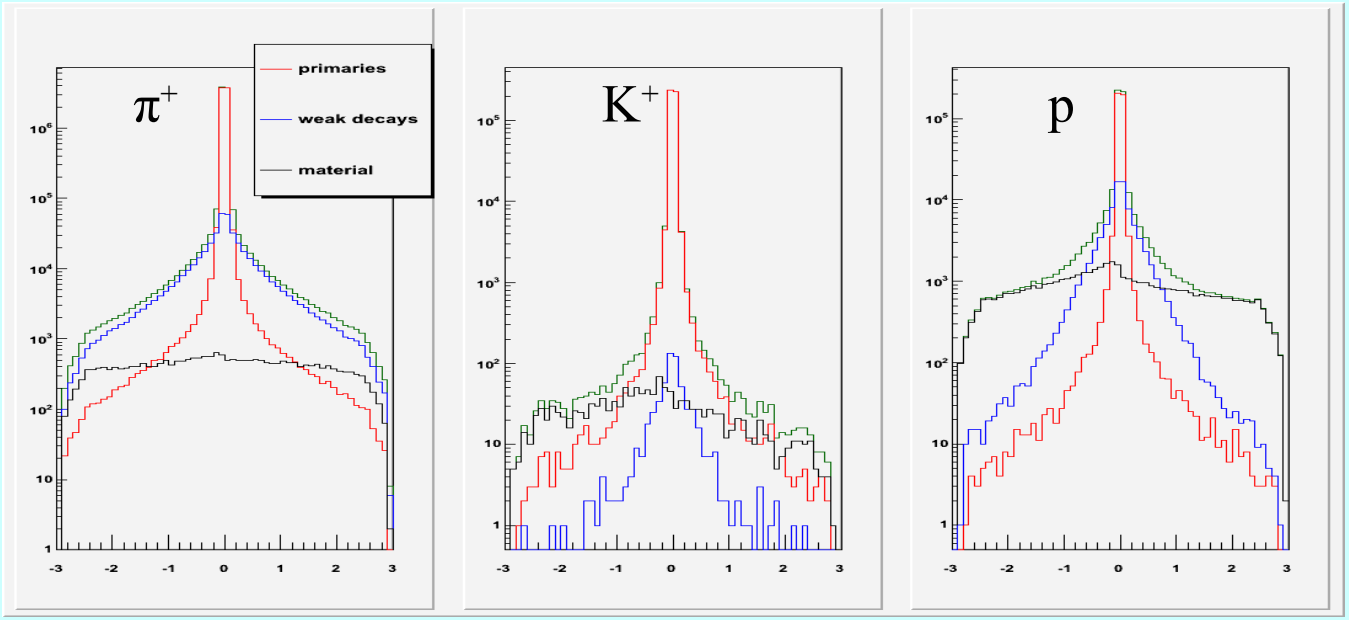
Combined multiplicity



2013

- **Studies of efficiency correction, analysis of Monte Carlo and experimental data**

Correction for material and WD based on DCA distribution



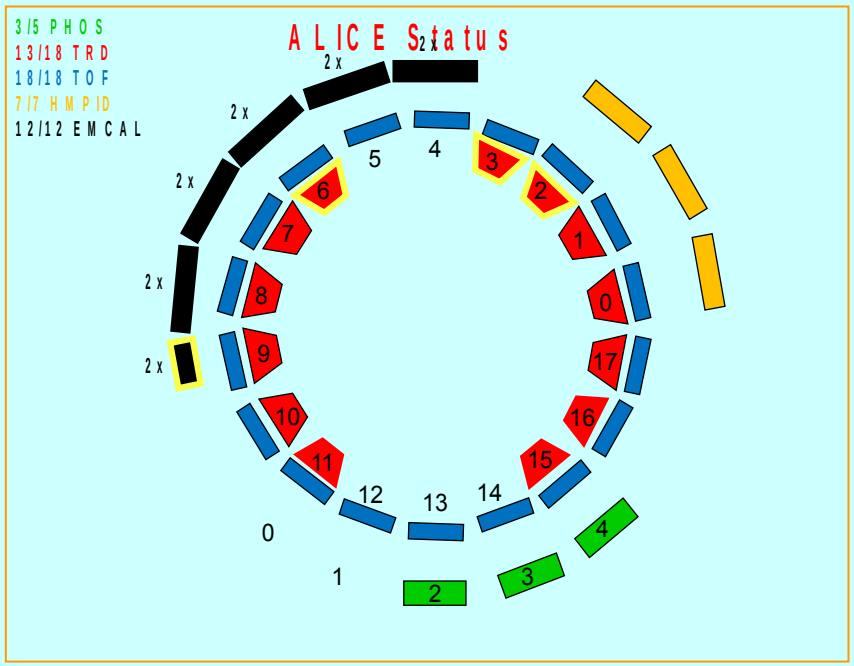
- *combined Bayesian*
- *estimates of the contamination from resonance decays*
  - *THERMINATOR + THERMUS*
  - *with and without expansion*
  - *different expansion profiles*
    - *===> estimates of the systematic errors of*
      - *extracted $\langle p_t \rangle$*
      - *fit parameters*
      - *relative yields as a function of p_t*

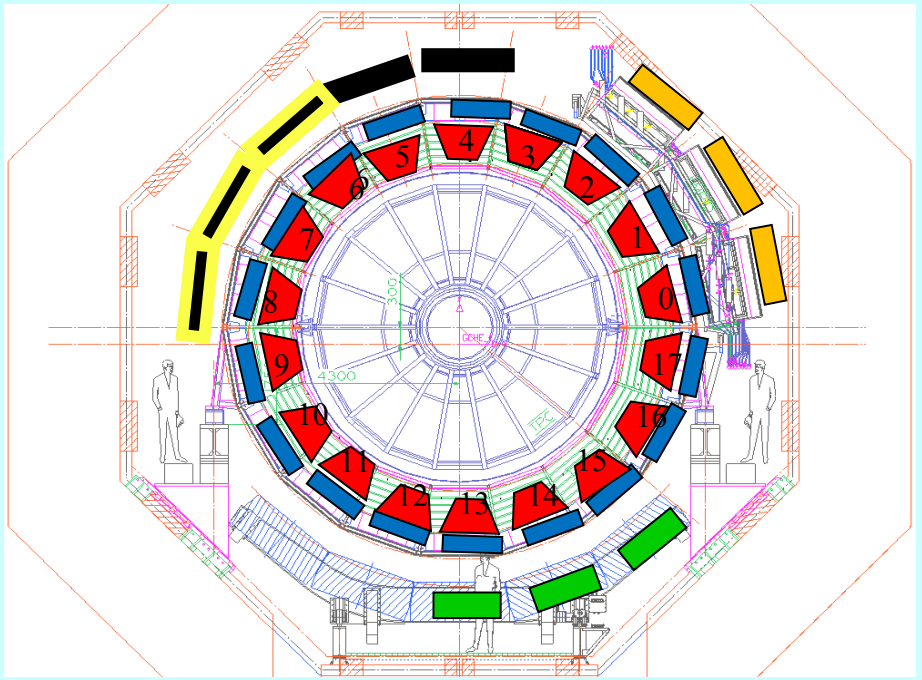
- *BGBW*
- *TBW*
  - *different expansion profile*
  - *etc*

2013 - 2014

TRD installation frame
TRD 4/5 (top) & counterweights

Suspend Miniframe
TRD 12/13/14 with yellow platform (bottom)





2014

Stage III – 11.12.2013 -10.12.2014:

- <u>Upgrade *NIHAM Analysis Facility - NAF*</u>

Efficient management of:

NIHAM – ALICE GRID

&

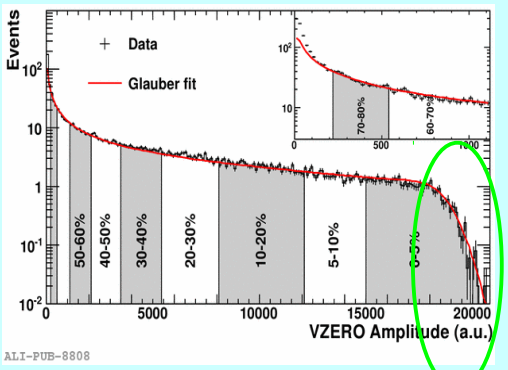
NIHAM Analysis Facility - NAF

- **2014**

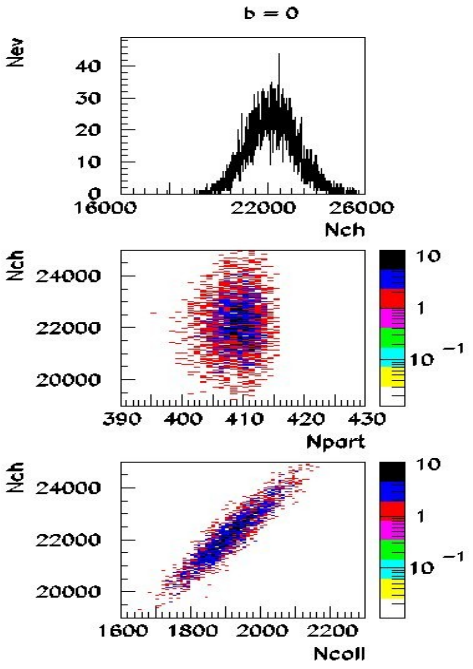
p +p 14 TeV

PbPb at higher luminosity and top energy 5.5 TeV

- <u>**Developing the software environment for analysis and interpretation of the Monte Carlo simulated and experimental data concerning the flow phenomena in central and mid-central Pb+Pb collisions at 2.76 TeV.**</u>



Glauber MC estimates



⇒

- Azimuthal distribution of collective expansion

- Highly central collisions & azimuthal isotropy

- $\pi^{\pm}$, $K^{\pm}$, K^{*}, p, $\bar{p}$, d, $\bar{d}$

- Λ, $\bar{\Lambda}$, $\Xi^{\pm}$, Ω^{-}, J/ψ

ALICE Upgrade

- *TPC readout chambers – GEM technology*

&

- *FASP as an solution for high counting rate FEE*

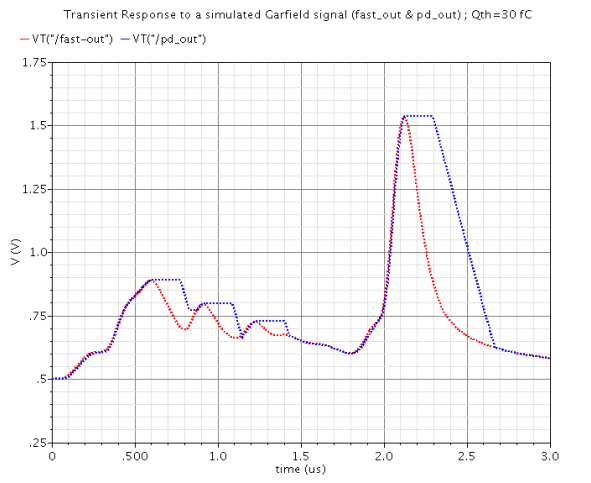


Table 5.18: Expression of interest to the TPC upgrade, subject to funding

Country Funding Agency	City	Institute
Denmark	Copenhagen	Niels Bohr Institute, University of Copenhagen
Finland	Helsinki	Helsinki Institute of Physics
Germany BMBF	Frankfurt	Institut für Kernphysik, Johann Wolfgang Goethe-Universität Frankfurt
Germany BMBF	Heidelberg	Physikalisches Institut, Ruprecht-Karls Universität Heidelberg
Germany BMBF	Munich	Physik Department, Technische Universität München
Germany BMBF	Munich	Excellence Cluster 'Universe', Technische Universität München
Germany BMBF	Tübingen	Physikalisches Institut, Eberhard Karls Universität Tübingen
Germany BMBF	Worms	FH Worms, Worms
Germany GSI	Darmstadt	Research Division and ExtreMe Matter Institute EMMI, GSI Helmholtzzentrum für Schwerionenforschung
Japan	Tokyo	University of Tokyo
Mexico	Mexico City	Instituto de Ciencias Nucleares, Universidad Nacional Autónoma de México
Norway	Bergen	Department of Physics, University of Bergen
Norway	Bergen	Faculty of Engineering, Bergen University College
Poland	Cracow	The Henryk Niewodniczanski Institute of Nuclear Physics, Polish Academy of Science
Romania	Bucharest	National Institute for Physics and Nuclear Engineering
Slovakia	Bratislava	Faculty of Mathematics, Physics and Informatics, Comenius University
Sweden	Lund	Division of Experimental High Energy Physics, University of Lund
USA DOE	New Haven	Yale University, New Haven

ALICE CALENDAR 2013

WK	Monday	ALICE Meetings	General
1	31-Dec		CERN restart 7 / FR restart 7.01/CH restart 7.01
2	07-Jan		
3	14-Jan		pA
4	21-Jan	Mini Week	pA
5	28-Jan		pA
6	04-Feb		
7	11-Feb	**Mini week**	Vac CH 11-15.02.2013
8	18-Feb		
9	25-Feb		VAC FR 25.02 to 10.03.2013
10	04-Mar		VAC FR 25.02 to 10.03.2013
11	11-Mar	OFFLINE Week	LHCC 13-14
12	18-Mar	**ALICE Week**	
13	25-Mar		Vac CH 28-5.04.2013// EASTER 29.03.2013
14	01-Apr		EASTER 01.04.2013
15	08-Apr		
16	15-Apr	LHCP Preview	RRB 15-17 April 2013
17	22-Apr	**Mini week / PWG Approvals**	VAC FR 20.04 to 05.05.2013
18	29-Apr	LHCP Approvals	Wednesday 1st May// VAC FR 20.04 to 05.05.2013
19	06-May		Ascension day Thursday 9 May
20	13-May		**LHCP 2013**
21	20-May	**APW2013 - NO**	Whit Monday 20 May
22	27-May		
23	03-Jun		
24	10-Jun		LHCC 12-13
25	17-Jun	**Mini Week / SQM Preview**	
26	24-Jun	PWG Approvals	

WK	Monday	ALICE Meetings	General
27	01-Jul	SQM Approvals	VAC FR // CH
28	08-Jul	SQM Rehearsals // OFFLINE Week	VAC FR // CH
29	15-Jul	**ALICE week**	VAC FR // CH
30	22-Jul		SQM 2013 // VAC FR // CH
31	29-Jul		VAC FR // CH
32	05-Aug		VAC FR // CH
33	12-Aug		VAC FR // CH
34	19-Aug		VAC FR // CH
35	26-Aug	**Mini week**	VAC FR // CH
36	02-Sep		JEUNE GENEVOIS 05.09.2013
37	09-Sep		
38	16-Sep		
39	23-Sep	OFFLINE Week	LHCC 25-26
40	30-Sep	**ALICE Week / APW2013**	
	07-Oct	**TB/MB**	
42	14-Oct		
43	21-Oct		
44	28-Oct		RRB 28-30 october 2013
45	04-Nov		
46	11-Nov	**Mini week**	
47	18-Nov		
48	25-Nov		
49	02-Dec		LHCC 4-5
50	09-Dec		
51	16-Dec	**Mini week**	
52	23-Dec		ANNUAL CLOSURE 21.12.2013 AU 06.01.2014
1	30-Dec		ANNUAL CLOSURE 21.12.2013 AU 06.01.2015

Holidays at CERN during this week