



ALICE / IFIN-HH

- experimental context*
- scientific achievements in the past year*
- remarks on additional activities*
- impact*
- 2014-2015 perspectives*



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 at LHC energies

- p-p collisions
- A-A collisions
- p-A collisions

Observables:

- Particle multiplicities:
- 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

Two ways to probe the new state of matter

Use high p_T as probe

Probe the bulk response

Partons loose energy in medium

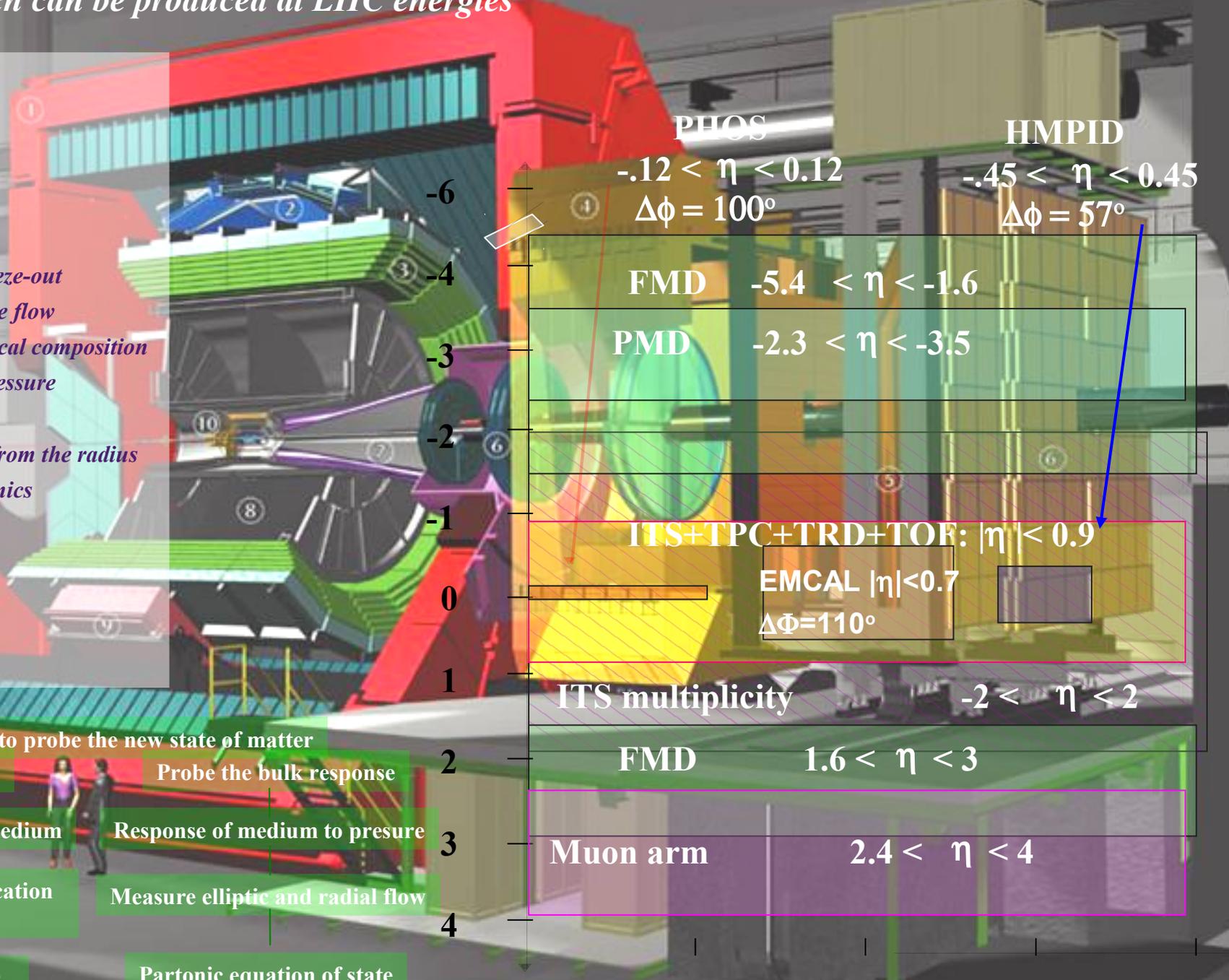
Response of medium to pressure

Measure nuclear modification factor - RAA

Measure elliptic and radial flow

Parton energy loss dE/dx , gluon density

Partonic equation of state EoS



PHOS

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

HMPID

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

FMD $-5.4 < \eta < -1.6$

PMD $-2.3 < \eta < -3.5$

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

EMCAL $|\eta| < 0.7$
 $\Delta\phi = 110^\circ$

ITS multiplicity $-2 < \eta < 2$

FMD $1.6 < \eta < 3$

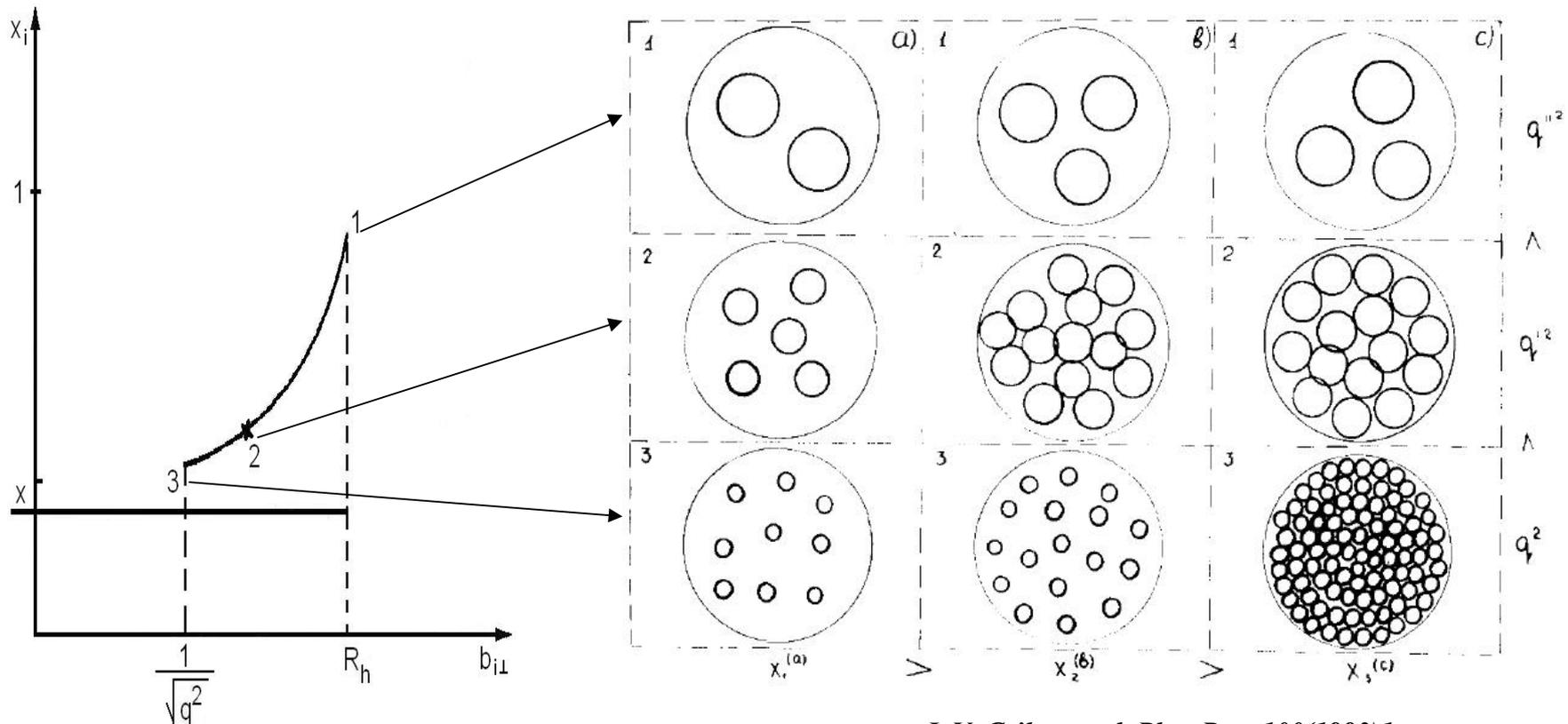
Muon arm $2.4 < \eta < 4$

90 ° 180 ° 270 ° 360 °

Physics motivation

Semihard processes in QCD

- A free fast hadron is at each moment a cloud of quasireal partons which belong to a number of cascades
- If a parton in the cascade meets on its way some object and interacts with it
 - the fate of the whole cascade changes – the coherence is broken
 - partons do not assembly back – continue to live and decay in secondary hadrons
 - some times the struck cascade can interact with some other cascades



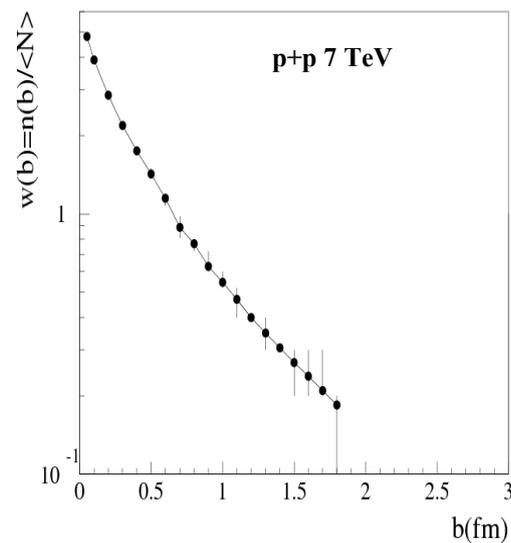
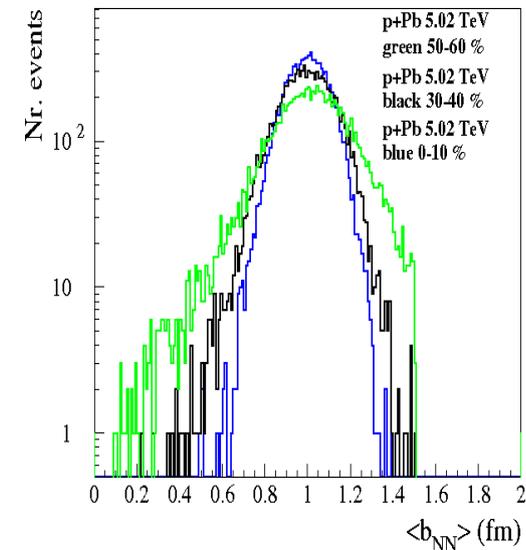
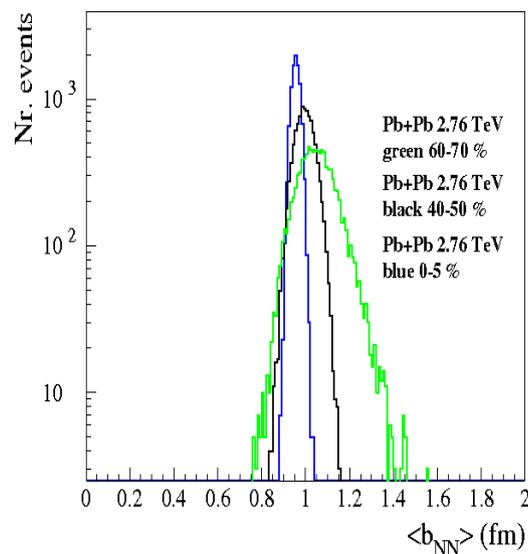
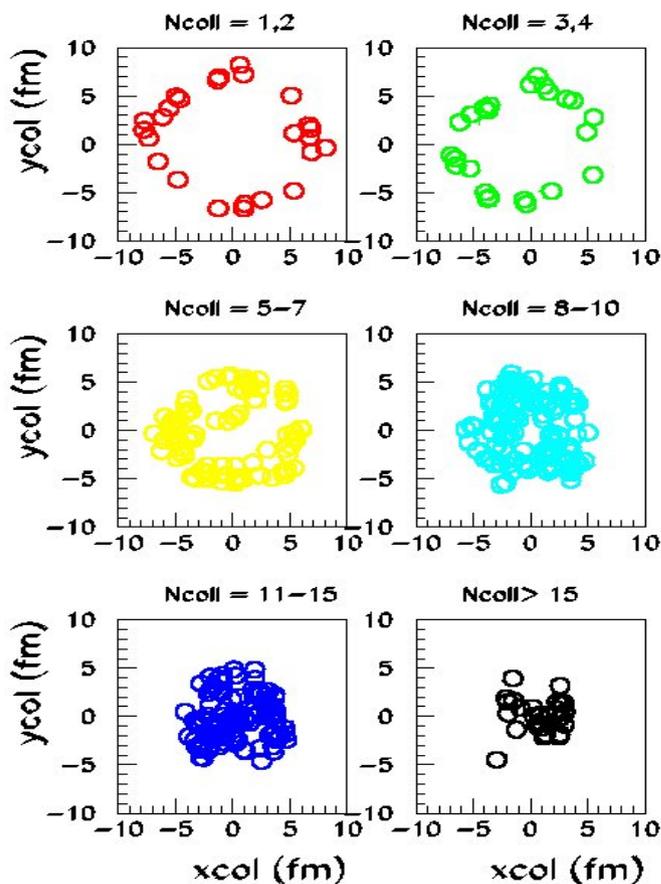
L.V. Gribov et al, Phys.Rep. 100(1983)1

⇒ MPI & rescattering

Physics motivation

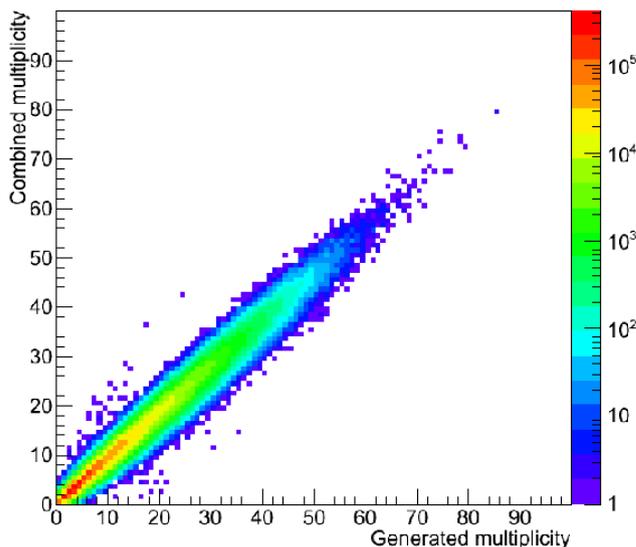
*Pb + Pb 2.76 TeV head on collision; $b=0$
Glauber approach*

Event #n



Charged particles and identified charged hadrons p_T spectra as a function of multiplicity in $p+p$ collisions at 7 TeV

Generated - combined multiplicity correlation



Multiplicity dependence:

- tracking efficiency
- matching efficiency
- PID efficiency
- impurity
- feed down and secondary interactions contamination
- trigger and vertex

- systematic errors:
 - tracking
 - priors
 - impurity
 - PID efficiency
 - secondary particles

Systematic errors

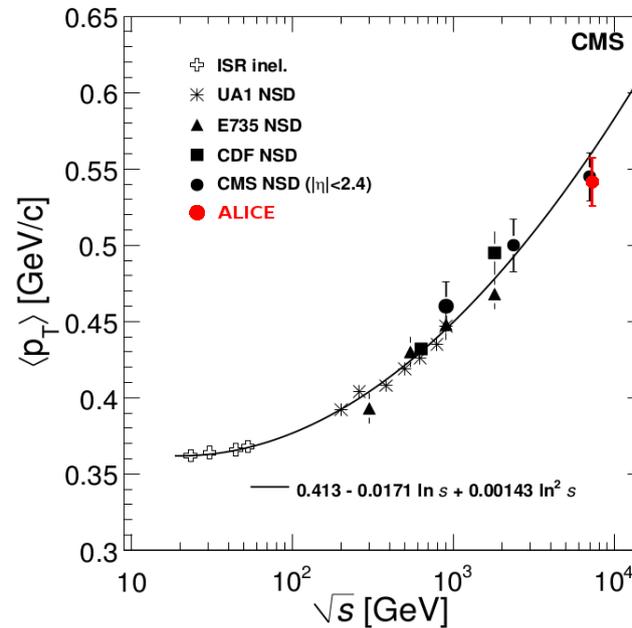
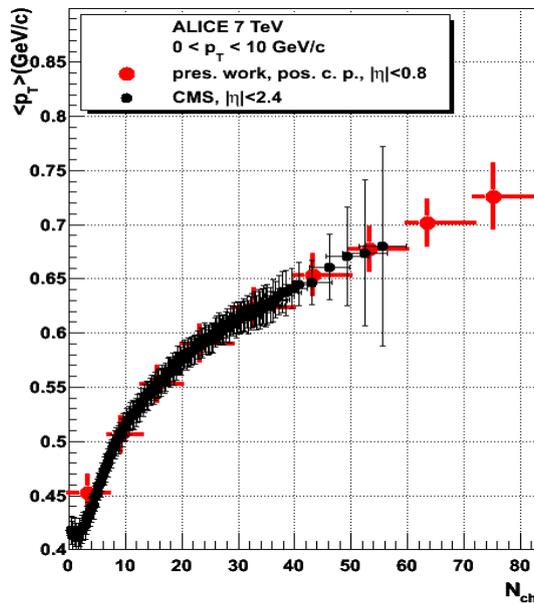
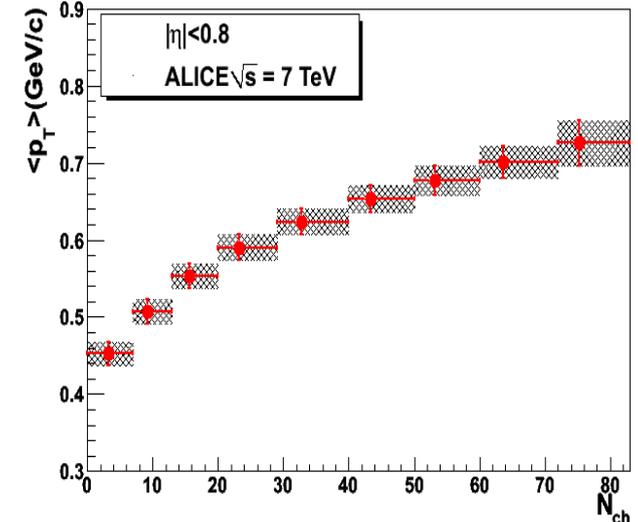
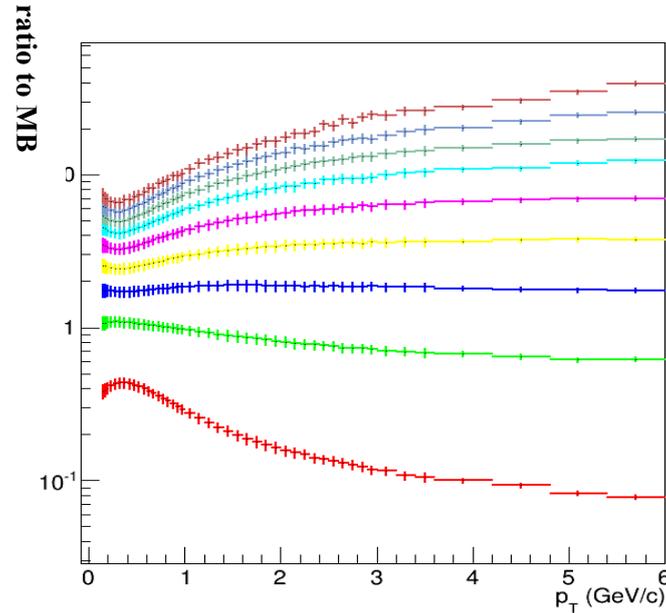
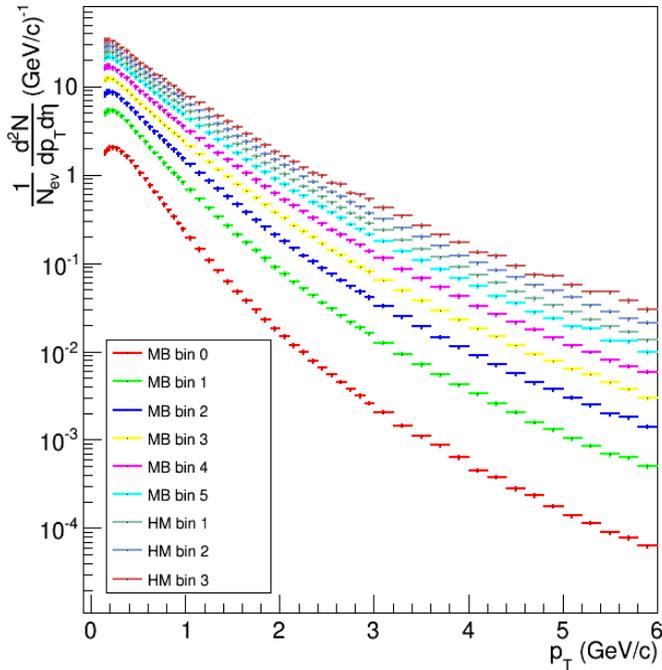
Multiplicity bins

Combined	Generated (PYTHIA)		
	bin limits	Mean	Sigma
0 - 6	0 - 6	3.4	1.7
7 - 12	7 - 12	9.1	2.2
13 - 19	13 - 20	15.9	2.6
20 - 28	21 - 29	23.7	3.2
29 - 39	30 - 41	33.2	3.7
40 - 49	42 - 51	44.1	3.7
50 - 59	52 - 62	-	-
60 - 71	63 - 74	-	-
72 - 82	75 - 86	-	-

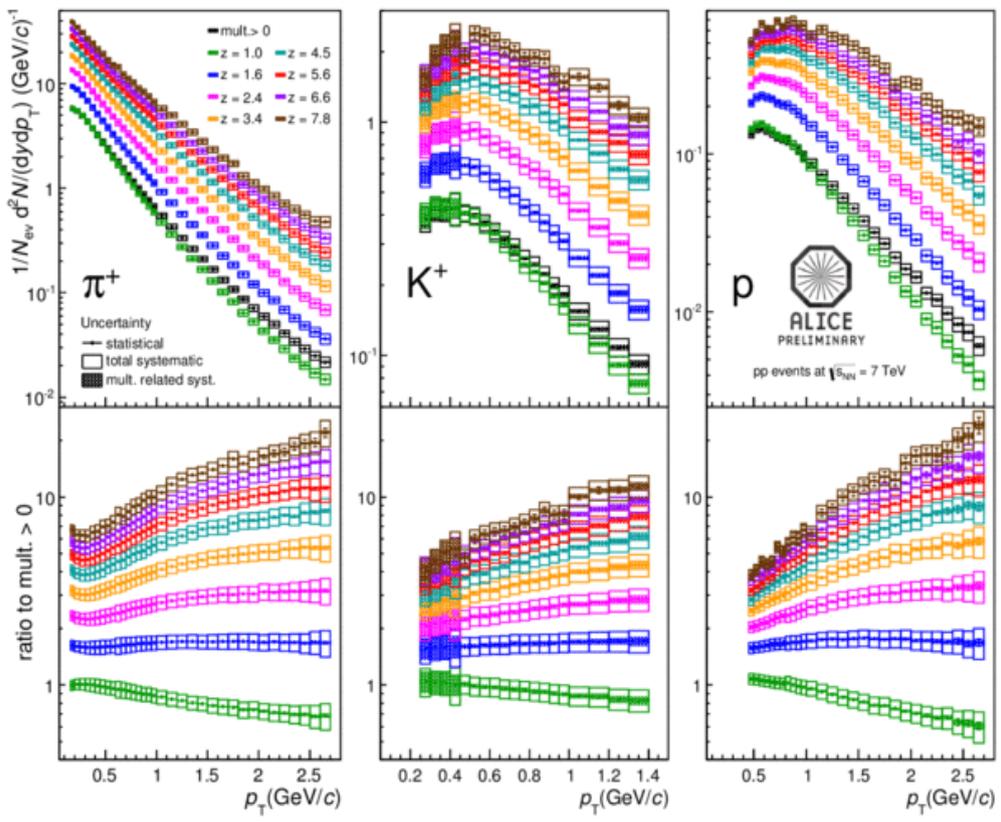
PYTHIA tune D6T

	standard	low	high	pions	kaons	protons	
MB	TPC clusters	70	60	80	0 - 4%	1 - 5%	0 - 3.5%
	TPC χ^2	4	3	5	0.5 - 4%	0 - 6%	0 - 6%
	DCAz	2 cm	1 cm	3 cm	<1%	0.5 - 2%	0.5 - 1.5%
	Mismatch probability	<0.01	<0.009	<0.011	<1%	0.5 - 3.5%	1%
	TRD presence	all tracks	WITH TRD	WITHOUT TRD	1 - 6%	2 - 6%	1 - 4%
	Tracking		dedicated study		4%	4%	4%
	Matching		dedicated study		3%	6%	4%
	PID priors	MB	mult <6	mult >49	<1%	0.5 - 2%	0.5 - 2%
	PID purity	none	-	>80%	0.5 - 4%	2 - 12%	1 - 4%
	multiplicity bins	tracking efficiency			<1%	2%	1%
matching efficiency		MB	7 - 12	29 - 39	negligible	negligible	negligible
PID efficiency					<1%	0 - 30%	0 - 2%
misidentified					<1%	<1%	<1%
secondary particles		MB	-	mult >49	<0.5%	-	0.5%

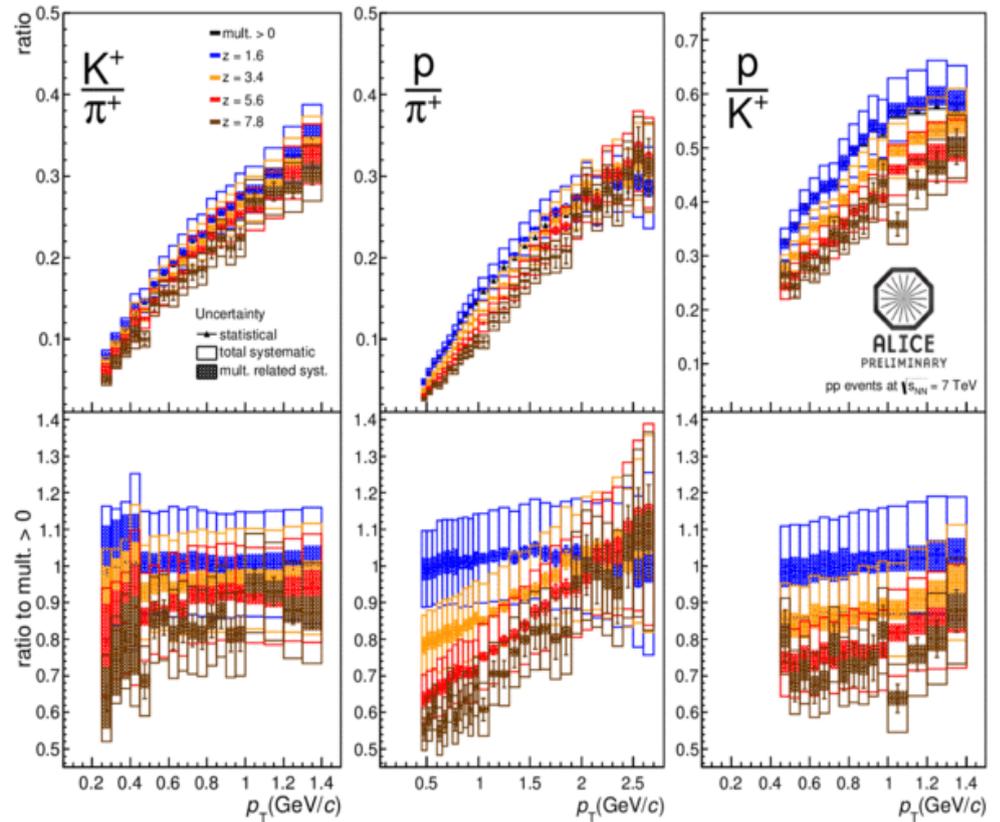
Charged particles p_T spectra as a function of multiplicity in $p+p$ collisions at 7 TeV



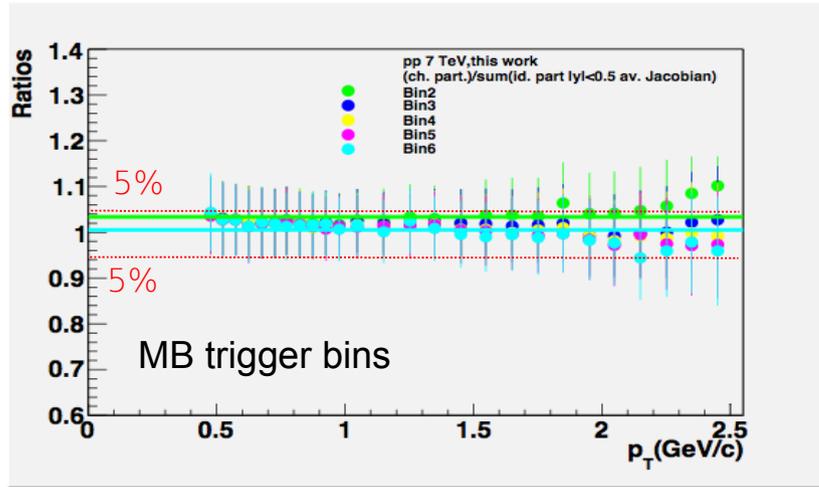
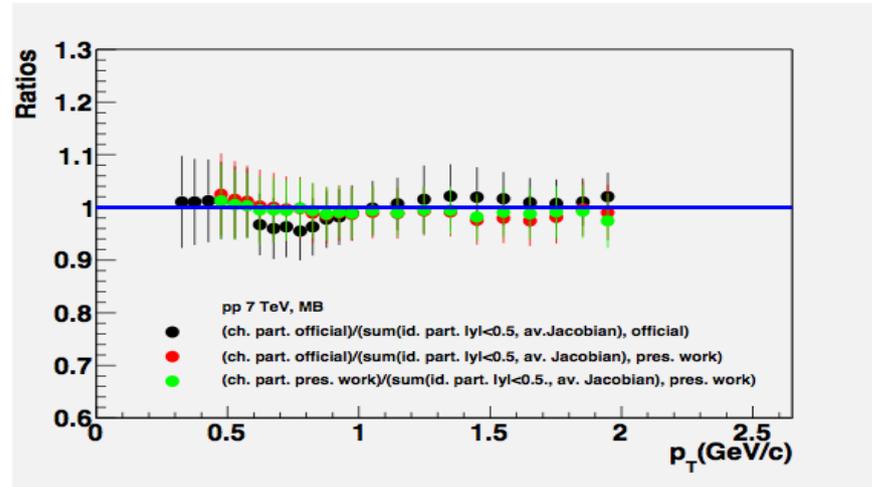
Identified charged hadrons p_T spectra as a function of multiplicity in $p+p$ collisions at 7 TeV



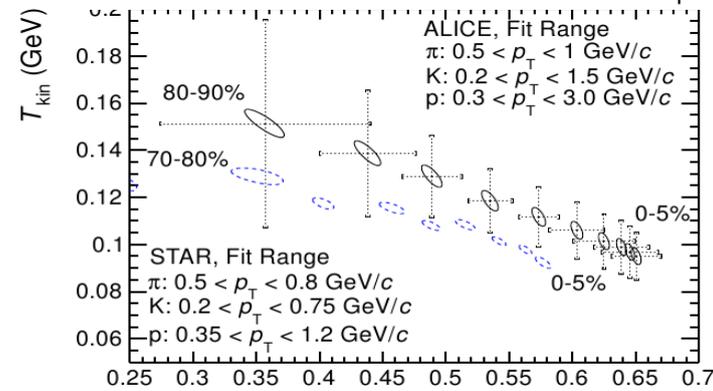
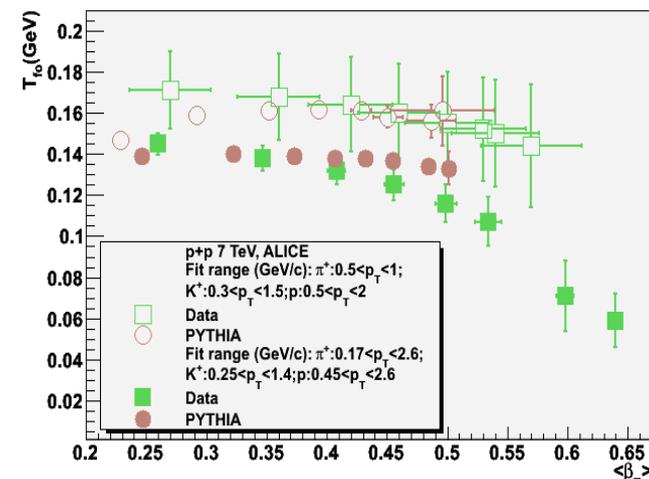
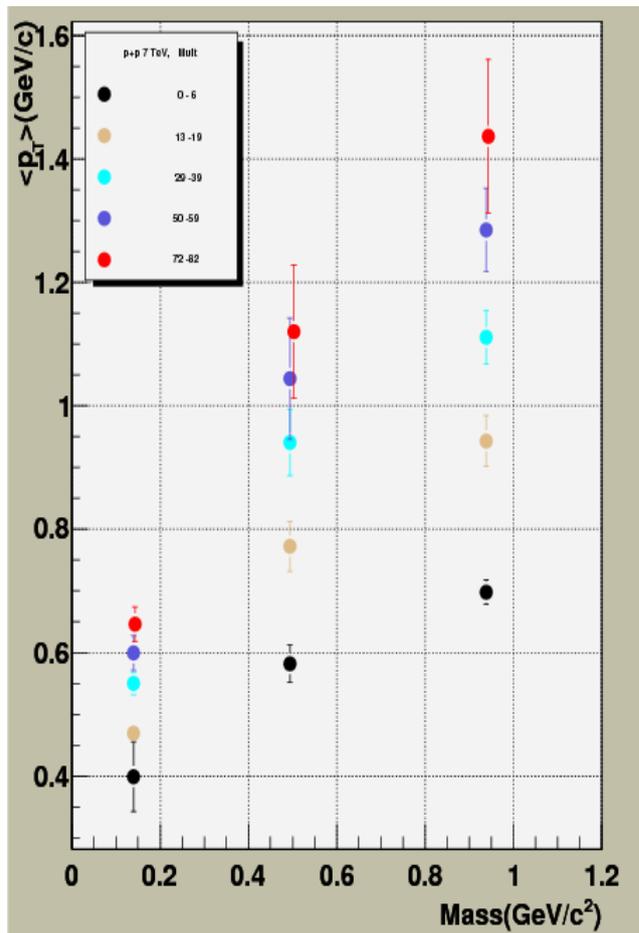
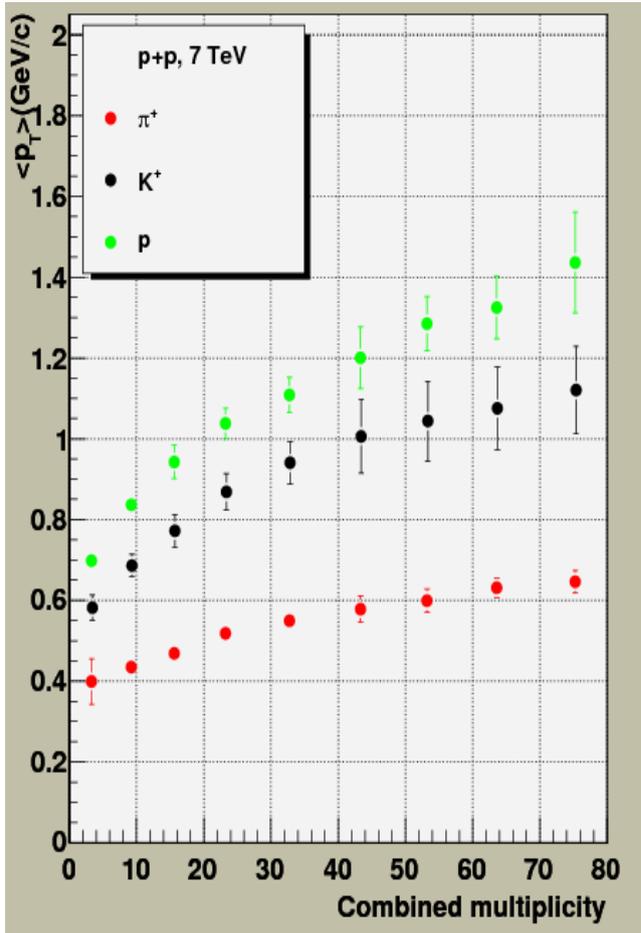
ALI-PREL-51115



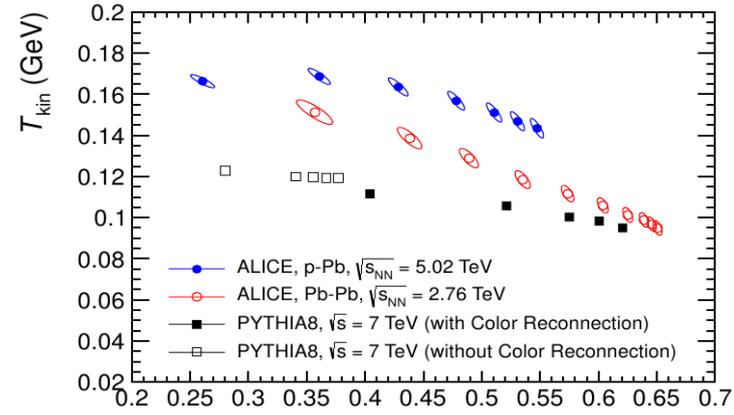
ALI-PREL-51119



Identified charged hadrons p_T spectra as a function of multiplicity in $p+p$ collisions at 7 TeV



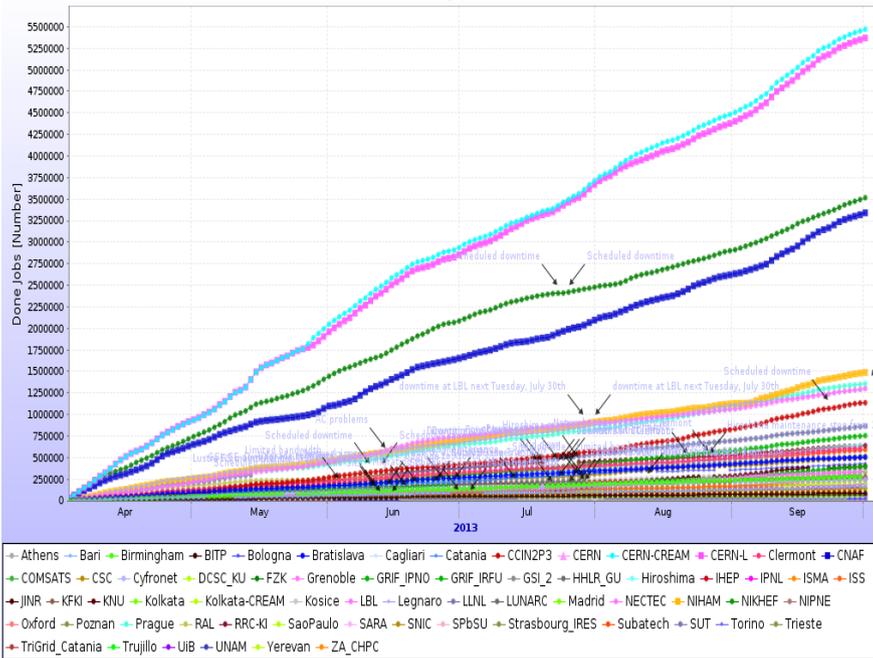
ALICE arXiv:1303.0737v1 [hep-ex] 4 Mar 2013 $\langle \beta_T \rangle$



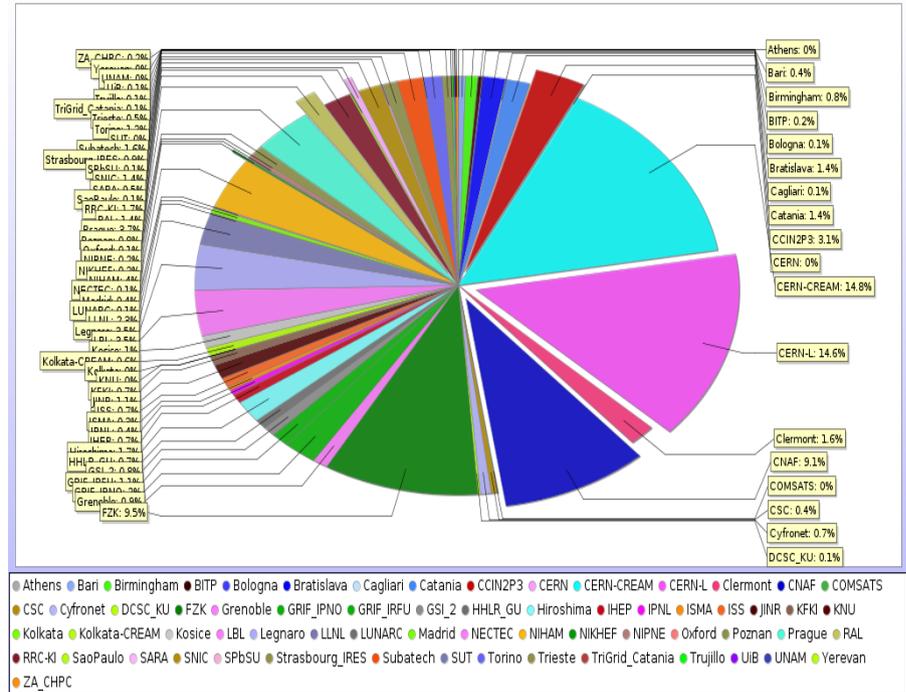
ALICE arXiv:1307.6796v1 [nucl-ex] 25 Jul 2013 $\langle \beta_T \rangle$

NIHAM contribution to ALICE GRID

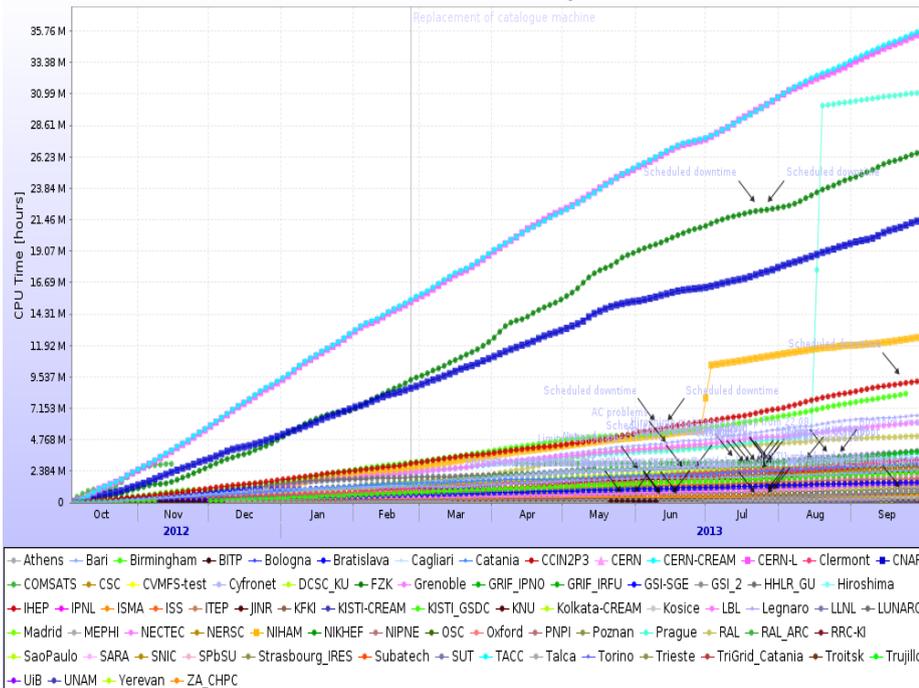
Done jobs



Done jobs statistics

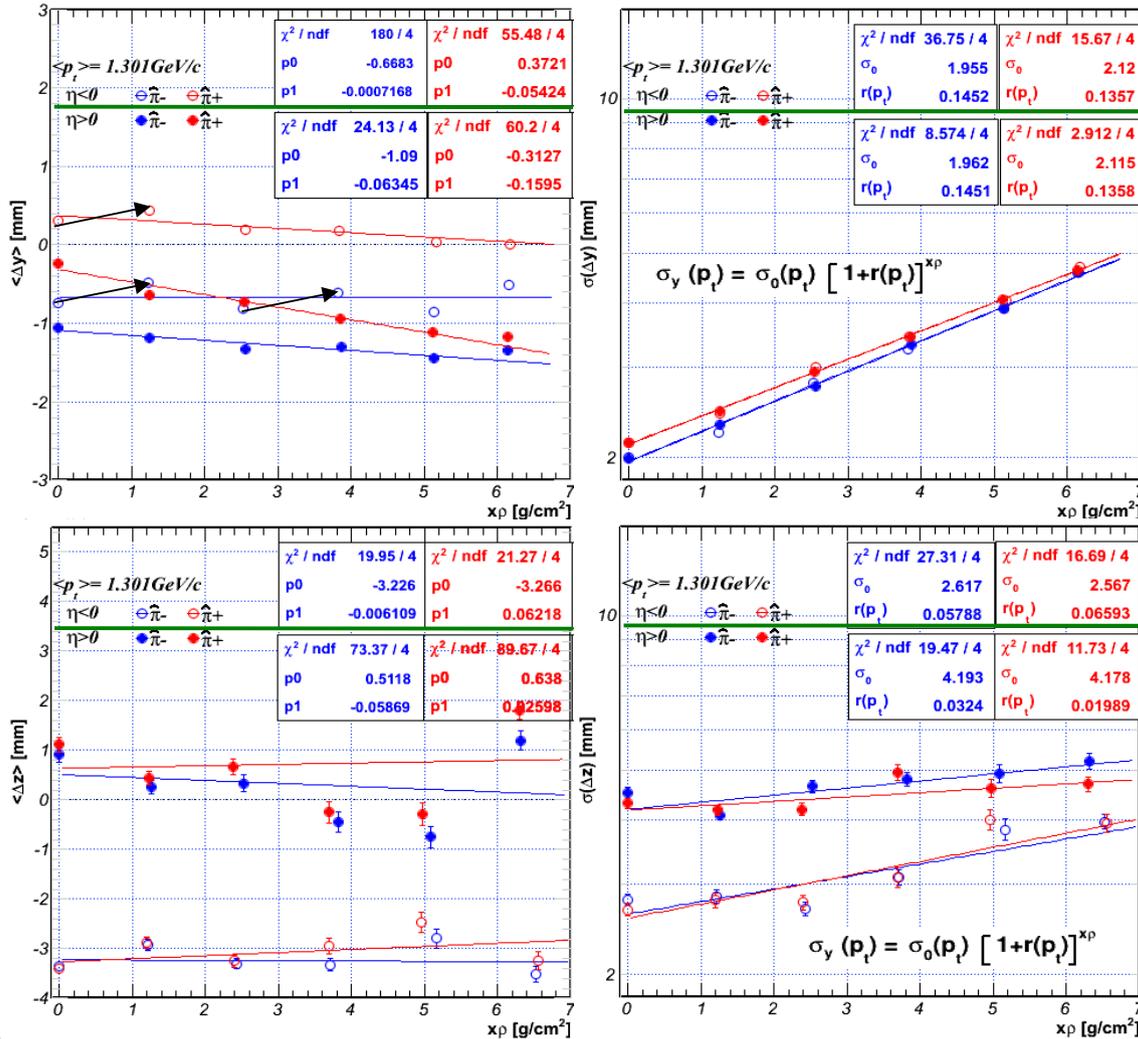


Total CPU time for ALICE jobs



TRD tracking

ALICE-TRD : residuals systematic



ALICE TRD is a 2D position sensitive detector

- constrain TPC calibration parameters
- filter particles for TOF – material budget sensitive
- **r- $\phi(\Delta y)$ TPC – TRD matching ($\langle \Delta y \rangle$)**
 - linear dependence due to p_t systematic
 - layer to layer systematic due to η systematic
 - A/C TPC sides with different p_t systematic
 - charge asymmetry from both TPC and TRD
- **r- $\phi(\Delta y)$ TPC – TRD resolution ($\sigma(\Delta y)$)**
 - charge systematic (TRD reconstruction asymmetry)
 - exponential growth with material budget
 - NO η systematic
- **z(Δz) TPC – TRD matching ($\langle \Delta z \rangle$)**
 - linear dependence due to p_t systematic
 - A/C sides systematic projected on the y resolution
 - NO charge asymmetry
- **z(Δz) TPC – TRD resolution ($\sigma(\Delta z)$)**
 - same resolution order as for Δy (TRUE 2D)
 - η systematic from TPC conserved
 - exponential growth with material budget different from Δy

Outcome

Internal ALICE presentations, internal notes, published papers :

- 20 presentations in Spectra-PAG, PWG-LF, PWG-PP, Physics Forum and ALICE Physics Week
- 2 ALICE Internal Notes – detailed review of the two analyses for preliminary figures requests
- PWG-PP tracking and alignment meeting, Thursday, 26 September 2013
Special meeting on TOF mismatch in PbPb, Thursday, 19 September 2013
CWG7 meeting, Thursday, 30 May 2013
- 14 contributions to TRD & UTRD meetings
- coauthors at 15 published papers, 6 accepted papers and > 50 contributions in conferences proceedings
- *Romanian Contribution to ALICE experiment @ LHC*
Mihai Petrovici – IFIN-HH, on behalf of ALICE Collaboration, 10 May 2013, National Geographic
- 2 PhD Thesis
- 1 PhD student

ALICE upgrade:

- In-kind contribution – TPC readout chambers using GEM technology
Mariana Petris - IFIN-HH, Hadron Physics Department infrastructure for ALICE TPC upgrade
<https://indico.cern.ch/contributionListDisplay.py?confId=256566>
ALICE-TPC Upgrade Meeting Munich, 10-12 June 2013
- TRD upgrade

Impact

Numerous visits in DFH of Romanian and foreign delegations:



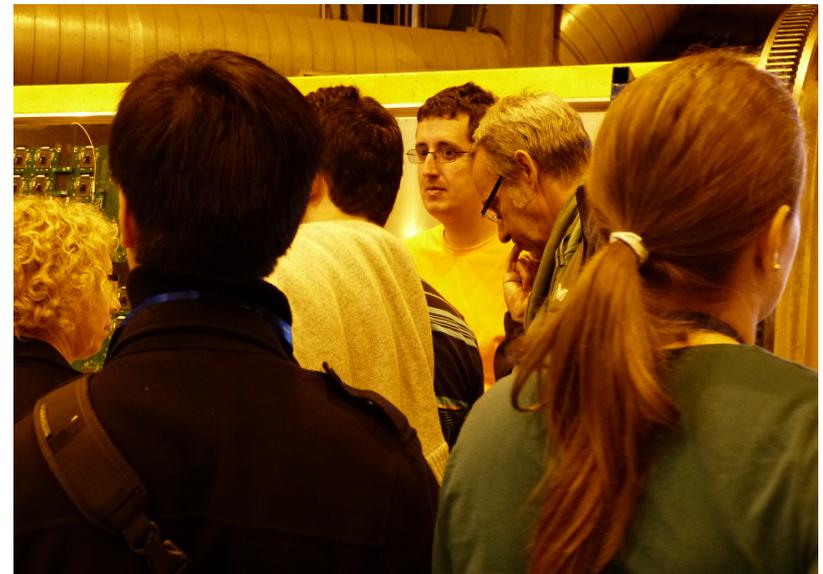
HPD-multi purpose Conference Room



Visit of more than 300 gymnasium pupils and students:



2013 CERN Open Days



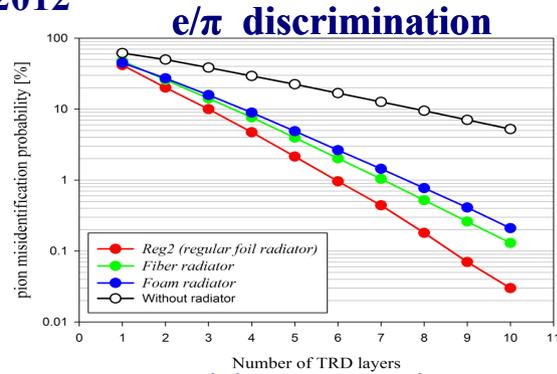
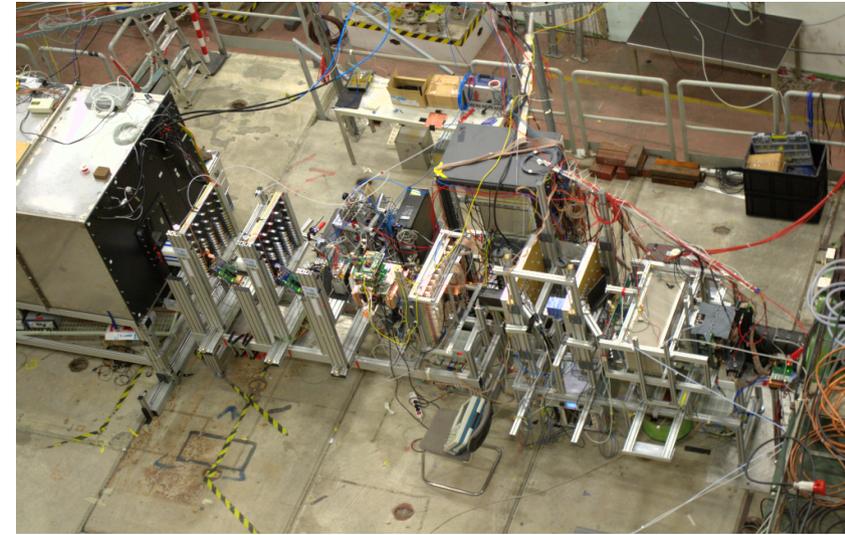
Outreach:

- <http://niham.nipne.ro>

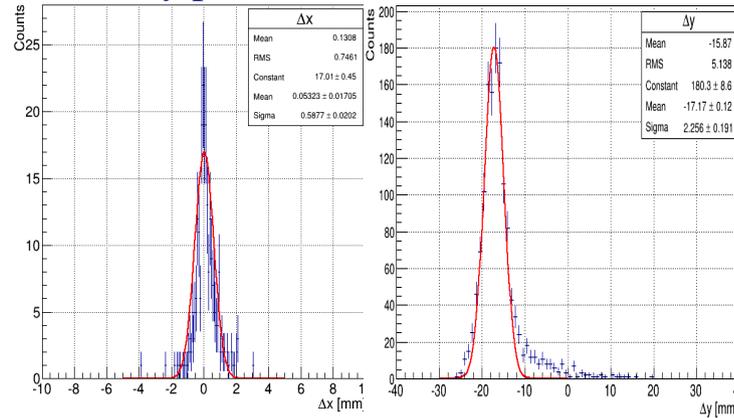
Remarks on additional activities

Impact on other activities and collaborations:

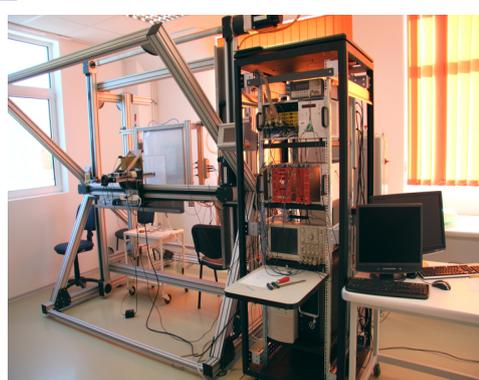
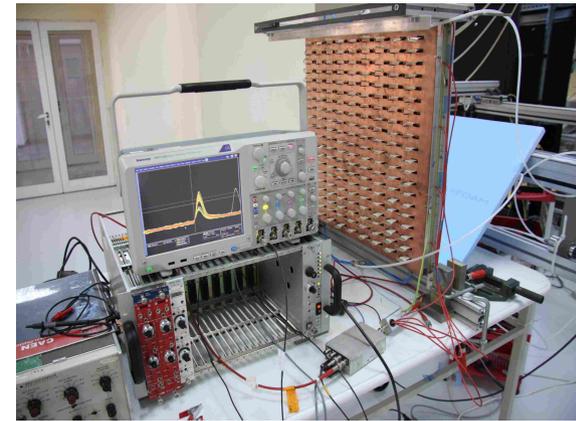
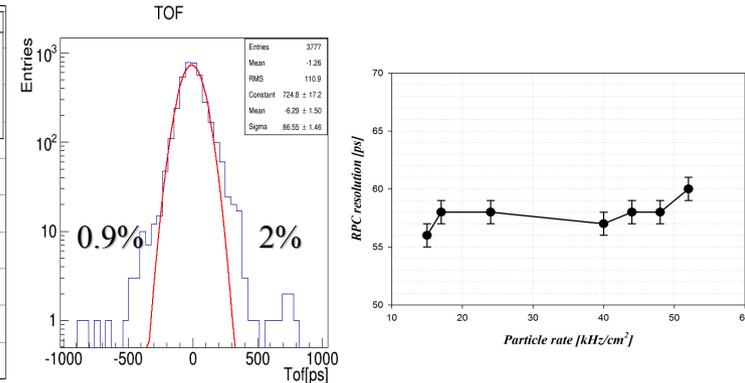
In-beam test configuration
of the RPCs and TRDs
prototypes for CBM
at T9 – PS, CERN, Oct.-Nov. 2012



x-y position resolution



Time resolution



Perspectives for 2014 and 2015

Stage III – 11.12.2013 -10.12.2014:

- Upgrade *NIHAM Analysis Facility - NAF*

Efficient management of:

NIHAM – ALICE GRID

&

NIHAM Analysis Facility - NAF

- Finalize 1-2 papers

2014-2015:

- Event shape + multiplicity analysis

- Comparisons with p+Pb and Pb+Pb

• **2014**

p + p 14 TeV

PbPb at higher luminosity and top energy 5.5 TeV

- Preparation of fast similar analysis once the data at the highest energy will

be available at LHC will become available