ALICE
Status Report
105th LHCC Meeting - Open Session

Mateusz Ploskon
on behalf of the ALICE Collaboration
Outline

• Activities during 2010/2011 shutdown
• Proton-proton collisions: summary of results and new measurements
• Overview of the first publications in Pb-Pb
• Performance and new physics results from heavy-ion collisions
• Outlook
ALICE performed a very busy shutdown program that was concluded successfully on time. The EMCAL system was finalized (6 supermodules) and 3 TRD modules were installed.

Many other maintenance activities of detectors, infrastructure and central systems e.g.

TPC: Replacement of damaged frontend cards, change of TPC gas to improve stability, laser system upgrade.

PMD: New re-circulating ventilation system for more efficient cooling.

Muon Tracking: Repairs of LV bus patches to improve pedestal stability.

DAQ: Major upgrade including move from SLC 4.8 to SLC 5.5 & 32 bit to 64 bit architecture.
ALICE present status

3/5 PHOS
10/18 TRD
18/18 TOF
7/7 HMPID
10/10 EMCAL

March 23, 2011
TRD installation

TRD module before insertion
ALICE publications from p-p collisions

- Multiplicity & distributions
  - 900 GeV, 2.36 TeV: EPJC: Vol. 68 (2010) 89
  - 7 TeV: EPJC: Vol. 68 (2010) 345

NEW since the last LHCC:

- Strangeness ($K_0, \Lambda, \Xi, \Omega, \phi$)
  - [Link](http://arxiv.org/abs/1012.3257) accepted by EPJC
- Identified charged particle spectra in pp at 900 GeV
  - [Link](http://arxiv.org/abs/1101.4110) accepted by EPJC
- Pion Bose-Einstein correlations in pp at 0.9 TeV and 7 TeV
- $J/\psi$ production – under Collaboration review

In this talk we focus on material that has not been discussed earlier

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HEAVY FLAVOR AND QUARKONIA IN PROTON-PROTON COLLISIONS
D meson production in p-p

Preliminary cross sections (with $10^8$ m.b. events): $D^0$, $D^+$, $D^*$

Feed-down from B mesons (after cuts ~10-15% for $D^0$, $D^+$, 5% for $D^*$) subtracted based on FONLL b cross section

Will be done based on data (displaced D mesons) with full 2010 sample (5x more statistics)

In addition: extended reach towards $p_t=0$ and $p_t=20-25$ GeV possible
D meson production in p-p

Preliminary cross sections (with $10^8$ m.b. events): $D^0$, $D^+$, $D^*$

pQCD predictions (FONLL and VFNS) consistent with the data

FONLL: Cacciari et al. in preparation,
GMVFNS, Kniehl et al. in preparation
Electrons from HF decay in p-p

- High quality tracks in TPC and ITS
  - Hit in innermost pixel layer to reduce γ conversions (beam pipe + ~1/3 inner pixel = 0.5% $X_0$)
- Electron identification: TOF + TPC-dE/dx
- Two procedures to extract heavy flavor cross section:
  1. subtract cocktail of “photonic” electron sources, based on measured $\pi^0$ cross section
  2. select electrons with large displacement to primary vertex → beauty dominance (in progress)

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Electrons from HF decay in p-p

1.6x10^8 m.b. events

Cocktail of background electron sources subtracted from the data

Cross section of electrons from charm and beauty decays in |η|<0.8

Good agreement with pQCD FONLL

Outlook: extend to higher p_t beyond 10 GeV/c
electron ID in TRD and EMCal
Good agreement at low $p_t$ (charm dominant) between electrons from HF and electrons obtained by “decaying” the D meson cross sections
More! Particle production in p-p

Already measured and reported:
\[ \phi \rightarrow K^+K^-, \Sigma^* \rightarrow \Lambda\pi, \]
\[ \Omega \rightarrow \Lambda K, K^* \rightarrow K\pi, \Xi \rightarrow \Lambda\pi \]

... and more on the way!

First Upsilon (\(\mu\mu\)) signal in p-p

Signal \(\sim 2000 \Lambda^* \rightarrow 1 \Lambda^*\) per \(10^4\) events

\[ \Lambda(1520) \]

ALICE Performance

\(2.4 < p_t < 3.0\) GeV/c

\(\Sigma(1385)^\pm\)
ALICE MEASUREMENTS IN Pb-Pb
First measurements in heavy-ion collisions at LHC

• Particle production
  – Multiplicities – how does the particle production depend on energy and impact parameter of the collisions? Are we able to describe it?

• Emission of particles – collectivity – dynamical evolution
  – Azimuthal anisotropy – how the initial spatial anisotropy manifests itself in final momentum anisotropy? – Collective flow at LHC?
  – Collectivity? How do the source dimensions evolve with energy?

• Parton energy loss
  – Is QCD medium at LHC opaque to high energy partons?
  – Evolution of jet quenching with energy?
Particle production in Pb-Pb

Energy dependence

Centrality dependence

Energy dependence

$p-p \sim s_{NN}^{0.11}$

$A-A \sim s_{NN}^{0.15}$ (most central)

Multiplicity dependence on centrality: similar trend as at RHIC
Particle production in Pb-Pb

Energy dependence

Centrality dependence

PRL 106, 032301 (2011) [22 citations]

PRL 105, 252301 (2010) [36 citations]

Feedback within the heavy-ion community:
1. Multiplicity is crucial [input] for modeling
2. Saturation models tend to predict lower multiplicity
3. Data driven extrapolations did not seem to anticipate the results
Particle production in Pb-Pb: Azimuthal anisotropy

$\varphi = \arctan \frac{p_y}{p_x}$

$\nu_2 = \frac{\langle p_x^2 \rangle - \langle p_y^2 \rangle}{\langle p_x^2 \rangle + \langle p_y^2 \rangle}$

Initial spatial anisotropy

$\varepsilon = \frac{\langle y^2 \rangle - \langle x^2 \rangle}{\langle y^2 \rangle + \langle x^2 \rangle}$

Final momentum anisotropy

 Reaction plane defined by “soft” (low $p_T$) particles

$\Delta \varphi = \varphi - \varphi_{Reaction Plane}$

Elliptic flow

$\frac{dN}{d\Delta \varphi} \propto 1 + 2\nu_2 \cos(2\Delta \varphi)$
Particle production in Pb-Pb: Azimuthal anisotropy

1. Collective behavior observed in Pb-Pb collisions at LHC (+0.3 $v_2^{RHIC}$) $v_2(p_T)$ similar to RHIC – almost ideal fluid at LHC?
2. New input to the energy dependence of collective flow
3. Additional constraints on Eq-Of-State and transport properties

APS Viewpoint: A “Little Bang” arrives at the LHC by Edward Shuryak

PRL 105, 252302 (2010) [30+ citations]
Jet quenching via hadron suppression

\[
\text{Ratio} = \frac{\text{#(particles observed in AA collision per N-N (binary) collision)}}{\text{#(particles observed per p-p collision)}}
\]

1. Strong depletion of high-pT hadrons in A-A collisions – consistent with parton energy loss (jet quenching)
2. Qualitatively new feature: evolution of \( R_{AA} \) as a function of \( p_T \)
3. New, much anticipated constraint for parton energy-loss models
1. Energy dependence:
   - system with larger (30%) volume and lifetime (w.r.t RHIC); follows the trend of multiplicity; faster expansion <=> larger collective flow

2. Pair momentum dependence:
   - larger radii, strong dependence on kT; Rout/Rside smaller than at RHIC; overall agreement with extrapolations

3. Important constrains to [hydrodynamical] modelling
Obtaining a more detailed view...

PARTICLE PRODUCTION IN Pb-Pb
Particle ID separation with TOF

Central Pb-Pb collisions \(|y| < 0.5\)

Note: time resolution in Pb-Pb ~90ps – better than in p-p (~110ps)
Particle identification in Pb-Pb

Raw yields: a global fit of Time-Of-Flight signal - mass hypothesis $i$ ($\pi$, $K$, $p$) constrains the integral of the fit to the total number of entries in the TOF PID.

Central Pb-Pb collisions $|y| < 0.5$

Gaussian ($\mu=0$, $\sigma=1$) PID response with a small exponential tail - fit the actual signal of particle type $i$.

Protons: $0.95 < p_T < 1.05$ GeV/c

Mismatch background well below 10%
Combinatorial background:
mixed events from the kaon-pion invariant mass distribution.

Good agreement with PDG ($M_{PDG} = 895.94 \pm 0.22$ MeV; $W_{PDG} = 48.7 \pm 0.8$ MeV)
π⁰ reconstruction from converted photons in Pb-Pb

\[ \pi^0 \rightarrow \gamma\gamma \rightarrow e^+e^-e^+e^- \]

Similar mass resolution as in p-p
Particle production in ultra-peripheral Pb-Pb collisions

\[ Pb + Pb \rightarrow Pb + Pb + \rho^0 \]

- Invariant mass of \textit{unlike sign} (2-track) events with event \( p_T < 0.15 \text{ GeV/c} \)
- Pion mass is assumed.
- \textbf{Trigger}: both tracks with hits in Silicon-Pixel-Detector and Time-Of-Flight
- \textbf{Expect a low mean } \( p_T \)
Particle production in ultra-peripheral Pb-Pb collisions

\[ Pb + Pb \rightarrow Pb + Pb + \rho^0 \]

- Invariant mass of **unlike sign** (2-track) events with event \( p_T < 0.15 \text{ GeV/c} \)
- Pion mass is assumed.
- **Trigger:** both tracks with hits in Silicon-Pixel-Detector and Time-Of-Flight
- **Mean** \( p_T \sim 0.05 \text{ GeV/c} \)
Electromagnetic dissociation (EMD) with ALICE ZDC's

Ultra-peripheral heavy-ion interaction -> EMD of nuclei

Most probable channel:
GDR followed by neutron emission

Model QED description: RELDIS
– EMD events and cross-sections
  Pshenichnov, I.A., et al.
  • Phys.Rev. C60 (1999) 044901
  • Phys.Rev. C64 (2001) 024903

Trigger ZNA || ZNC selects:
single EMD (~185 b);
mutual EMD (~5.9 b)
nuclear (7.8 b)

ZDCs: 115 meters away from IP2 on both (A,C) sides,

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Single and mutual EMD with ZDC

ZDC signal: Single EMD + Mutual EMD + Nuclear effects

Mutual EMD event selection: ZNC & ZNA + ZDC time selection + (ZEM1<10 || ZEM2<10) estimated from simulations to reject nuclear events

Data: 1n peak resolution ~20% consistent with RELDIS calculation

Ratios: 1n/2n; 1n/3n; 2n/3n are under investigation

Fit constrains: \[ \mu_{2n} = 2\mu_{1n}; \sigma_{2n} = \sqrt{2}\sigma_{1n}; \mu_{3n} = 3\mu_{1n}; \sigma_{3n} = \sqrt{3}\sigma_{1n} \]
Anti-Matter production in $p+p$ and $Pb+Pb$ collisions

Natasha Sharma (Panjab University, Chandigarh), on behalf of the ALICE collaboration, LHCC Meeting, March 2011

Extraction of yields

Housed in the L3 magnet at point 2 at CERN, the ALICE Time Projection Chamber is the largest of its kind in the world. It is the main tracking device of the experiment and provides also particle identification via the specific energy loss. Since the specific energy loss of a particle depends for a given momentum only on charge and rest mass, the simultaneous measurement of track curvature and signal height allows particle identification. The Inner Tracking System gives a precise determination of the event vertex, by which primary and secondary particles are separated.

These figures show the particle identification through their specific energy loss vs rigidity in the ALICE TPC.

Outlook

Work in Progress

$pp \, @ \, \sqrt{s} = 7 \, TeV$

$PbPb \, @ \, 2.76 \, TeV$

• Nearly 11 M minimum bias events are analyzed for PbPb collisions and over 350 M events are analyzed for $pp \, @ \, \sqrt{s} = 7 \, TeV$

• Nuclei and anti-nuclei produced in the collisions have Distance of Closest Approach (DCA) always near to zero.

• Nuclei can also be produced by interaction with the material. Their yield is then determined after background subtraction in the DCA $XY$ distribution.

• Four candidates of $^4He$ are found in the $PbPb$ collisions at $\sqrt{s_{NN}} = 2.76 \, TeV$

• Out of these, three candidates are confirmed by Time of Flight (TOF) measurement

• Final spectra will be obtained after including efficiency and annihilation probability

• Work in progress for anti-hypertriton

• Work in progress to estimate anti-$^4He$ yields

The raw yields are determined by analyzing the DCA distribution (left) for different $pt$ bins.

Goals

• Comparison of yields in $pp$ and $PbPb$ collisions

• Comparison of particle ratios with thermal and coalescence model

• Understanding of the production mechanism

Particle Identification
HEAVY FLAVOR AND QUARKONIA IN Pb-Pb COLLISIONS
New Signals in PbPb

First D0 signal in CENTRAL PbPb.

First D+ signal in PbPb
RCP and RAA in progress

First J/psi signal in Pb-Pb
RCP and RAA in progress
PREPARING FOR COMPLETE JET RECONSTRUCTION
Charged jets and backgrounds in Pb-Pb

Detailed characterization of the background is a prerequisite for jet reconstruction in Pb-Pb

Shown: FastJet Anti-\(k_T\) (R=0.4)

Definition of \(\delta p_T\):
\[
p_{T}^{\text{rec}} = p_{T}^{\text{true}} + \delta p_T
\]

Measurement:
\[
\delta p_T = p_{T}^{\text{cluster}} - \rho \cdot A - p_{T}^{\text{probe}}
\]

Effect on inclusive spectrum in A-A:
Demonstration of the \(p_T\) smearing (\(f(\delta p_T)\)) due to background fluctuations.

Detailed correction under preparation.

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TWO-PARTICLE AZIMUTHAL CORRELATIONS
Jet quenching: recoil jet suppression via leading hadron azimuthal correlations

Intermediate $p_T$ di-hadrons: Strong modification of the recoil-jet indicates **substantial partonic interaction within the medium** -> quenching

Near-side: selecting the jets with little interaction; similar conclusion for correlations at high-$p_T$

$4 < p_T^{\text{trig}} < 6 \text{ GeV}/c$

$p_T^{\text{assoc}} > 2 \text{ GeV}/c$

$\Delta \phi \sim 180 \text{ deg}$

$4 < p_T^{\text{trig}} < 6 \text{ GeV}/c$

$p_T^{\text{assoc}} > 2 \text{ GeV}/c$

$\Delta \phi \sim 180 \text{ deg}$

$1/N_{\text{Trigger}} dN/d(\Delta \phi)$

$\Delta \phi$ (radians)

$d+Au$ FTPC-Au 0-20%

$p+p$ min. bias

Au+Au Central


$\Rightarrow$ Constraints on jet quenching modelling – what happens at LHC?
Di-hadron Correlations

Two-particle correlations

- conditional [per-trigger] yields

\[ \frac{1}{N_{\text{trig}}} \frac{dN_{\text{assoc}}}{d\Delta \varphi} \quad \text{and} \quad \frac{1}{N_{\text{trig}}} \frac{d^2N_{\text{assoc}}}{d\Delta \varphi d\Delta \eta} \]

At Low-\(p_T\):

Ridge

Hydrodynamics, flow

At High-\(p_T\):

Quenching/suppression, broadening

\(I_{\text{CP}}\): Yields in central v.s. peripheral collisions

\(I_{\text{AA}}\): Yields in A-A compared to p-p
$I_{CP} : [yields: \text{central / peripheral}]$

- Trigger particle:
  - $8 < p_{T,\text{trig}} < 15$ (GeV/c)

- Associated particle:
  - $p_{T,\text{assoc}} < p_{T,\text{trig}}$

- Flat pedestal subtraction $\rightarrow$ data points

- $v_2$ subtracted $\rightarrow$ line
  - Difference only at low $p_T$

- Statistical and systematic uncertainties shown (shaded area)
$I_{CP}$ : [yields: central / peripheral]

Slightly enhanced near-side: $I_{CP} \sim 1.2$ ... unexpected and interesting

Away side suppressed: $I_{CP} \sim 0.6$ ... consistent with in-medium energy loss

Flow contribution small except in lowest bin. $V_3$ component not subtracted
I_{AA,Pythia} : using Pythia as p-p reference

Pythia6 (Perugia-0) validated with correlations DATA at 0.9 and 7 TeV
Uncertainty from extrapolation shown (shaded single rectangles)

Central events
Near side enhanced I_{AA,Pythia} \sim 1.5
Away side suppressed I_{AA,Pythia} \sim 0.5 - 0.7

Peripheral events
Near side enhanced I_{AA,Pythia} \sim 1.2
Away side I_{AA,Pythia} consistent with 1

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Progressing analyses

• **p-p exclusive analyses:**
  – Resonances in p-p
  – Event shape characterization in p-p

• **Pb-Pb exclusive analyses:**
  – Identified particle
    • Including nuclei and anti-nuclei
  – Azimuthal anisotropy – $v_n$
  – Chiral magnetic effects
  – Event-by-event fluctuation
  – HBT v.s. centrality

• **Analyses in both systems:**
  – $R_{AA}$ – extend to high $p_T$
  – $J/\psi$ – p-p under submission, polarization – under study
  – Single electron from heavy-flavor decays
  – Single muons
  – Open charm
  – $\pi^0$ production cross-sections
  – Azimuthal correlations
  – $\Lambda / K^0_s$
  – Multi-strange particle
ALICE Posters

Valerio Altini: Trigger performance of the ALICE Silicon Pixel Detector

Bruno Alexandre Boyer: Measurement of the J/psi cross section in the dimuon channel with the ALICE experiment at LHC

Davide Caffarri: D0 production in pp collisions at \( \sqrt{s_{NN}} = 7 \) TeV and Pb-Pb collisions at \( \sqrt{s_{NN}} = 2.76 \) TeV with the ALICE detector

Veronica Canoa Roman: Diffractive physics studies at ALICE

Gian Michele Innocenti: D+ and D_\_ production in pp collisions at \( \sqrt{s_{NN}} = 7 \) TeV and Pb-Pb collisions at \( \sqrt{s_{NN}} = 2.76 \) TeV in the ALICE experiment

Satyajit Jena: Charge fluctuations in Pb-Pb collisions at \( \sqrt{s_{NN}} = 2.76 \) TeV

Frederick Kramer, Julian Book: Measurement of the J/psi production cross section in pp collisions at \( \sqrt{s_{NN}} = 7 \) with ALICE at the LHC and perspectives for Pb-Pb collisions

Leonardo Milano: Measurement of identified hadron spectra with the ALICE experiment at the LHC

Igor Lakomov: Mean transverse momentum, multiplicity, and their correlation in pp collisions in string fusion model

Carlos Eugenio Perez Lara: "Anisotropic flow of decaying strange particles in ALICE"

Marta Verweij: Background studies for jet reconstruction in heavy-ion collisions

Natasha Sharma: Antimatter production in pp and PbPb collisions

Xiaoming Zhang: Measurement of heavy-flavor production using single muons with ALICE
A Large Ion Collider Experiment

EMCAL
γ, π^0, jets

TPC
Tracking, PID (dE/dx)

PHOS
γ, π^0, jets

TRD
Electron ID (TR)

PMD
γ multiplicity

T0/V0 Trigger

L3 Magnet

ACORDE
Cosmic trigger

HMPID
PID (RICH) @ high p_T

TOF PID

Dipole

ITSMuon μ-pairs

FMD
Charged multiplicity

Not shown: ZDC (at ±116m)
EMCal installation
TRD crew
ALICE heavy flavours in the muon channel in pp and PbPb

Muons from heavy flavour also agreed with pQCD FONLL predictions.

- High quality track in the muon tracking system;
- Matching with muon trigger system remove most of secondaries about pT=2 GeV;
- New tracks cut applied (chi2, DCA ...);
- **New analysis in pp@7TeV**, 15 GeV reach and pT distribution in 5 rapidity bins;
- First analysis in PbPb allows for the determination of RCP and RAA of muon from heavy flavours in the pt range 4-8 GeV/c
Quarkonia in p-p

- Paper released to the ALICE collaboration;
- **Expected submission beginning April**;
- First J/psi wide range rapidity distribution down to pT=0 in pp@ TeV;
- New interesting results from analysis on Jpsi polarization and j/psi in high multiplicity events.
Analysis basics and strategy

• Total available pass1 PbPb statistics was analyzed: 16.1 million nuclear collisions “after physics selection”.

• 10.1 x 1010 tracks inspected and filtered with an offline trigger:

• 768 Anti-He-3 particles after filtering

• Basic track cuts:
  • 80 TPC cls; eta < 0.8;
  • ITS+TPC refit;
  • chi2/clsf < 5; 1 Hit in ITS;
  • DCA < 1cm; no Kink
Anti-Matter production in $p+p$ and $Pb+Pb$ collisions

Natasha Sharma (Panjab University, Chandigarh), on behalf of the ALICE collaboration, LHCC Meeting, March 2011

Extraction of yields

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• $PbPb @ 2.76 \text{ TeV}$

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The raw yields are determined by analyzing the DCA distribution (left) for different pt bins.

Goals

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• Comparison of particle ratios with thermal and coalescence model
• Understanding of the production mechanism

DCA Study

$\text{DCA}_{Z} < 1.0 \text{ cm cut removes large fraction of background}$

$^3\text{He}$ Entries: $328 \rightarrow 322$

$^3\text{He}$ Entries: $7162 \rightarrow 1527$

(d) $PbPb @ 2.76 \text{ TeV}$

($\bar{d}$)
FROM HIGH-PT CORRELATIONS
Interesting to study yield with respect to unquenched (pp) case
  
  No pp data taken at 2.76 TeV, yet
  Use a MC

Pythia6 tune Perugia-0 has been found to describe di-hadron correlations at 0.9 and 7 TeV well
  Using a scaling factor between 0.8 and 1
  Interpolate to 2.76 TeV
  Factor $0.93 \pm 13\% \text{ (stat/syst)}$

→ Use scaled Pythia reference to calculate $I_{AA,Pythia}$
Di-hadron Analysis

- 12M Pb+Pb collisions used
- Tracking with Time Projection Chamber and Inner Tracking System
  - Flat $\phi$ acceptance $\rightarrow$ No mixed event background needed for acceptance correction (in $\phi$)
- Centrality determination with V0 (forward scintillators) and hits in pixel detector
- Corrections applied for efficiency and contamination
  - Weakly centrality dependent
  - Two-track effects considered

ALICE performance, 14.03.11

Tracking efficiency

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Pedestal and Flow

- Background determination
- Fit in region around $\pi/2$
  - Different ways to estimate uncertainty
- Estimate $v_2$ contribution using ALICE flow measurement
  - Measure in a region where the signal dominates over pedestal and $v_2$ modulation ($8 \text{ GeV/c} < p_{T,\text{trig}} < 15 \text{ GeV/c}$)
  - Difference in measurement indicated when $v_2$ was subtracted

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Yield Extraction

- After pedestal (and optionally $v_2$) subtraction, integrate to obtain yield $Y$
  
  Near side: $-0.7 < \phi < 0.7$
  Away side: $-0.7 < \phi - \pi < 0.7$

- In bins of $p_{T,\text{assoc}}$

- $I_{CP}$ and $I_{AA}$ obtained with

$$I_{CP}(p_{T,\text{trig}}; p_{T,\text{assoc}}) = \frac{Y^{AA}(p_{T,\text{trig}}; p_{T,\text{assoc}})}{Y^{AA}_{\text{central}}(p_{T,\text{trig}}; p_{T,\text{assoc}})}$$

$$I_{AA}(p_{T,\text{trig}}; p_{T,\text{assoc}}) = \frac{Y^{AA}(p_{T,\text{trig}}; p_{T,\text{assoc}})}{Y^{PP}(p_{T,\text{trig}}; p_{T,\text{assoc}})}$$
Systematic Uncertainties

- Detector efficiency and two-track effects
- Centrality determination
- $p_T$ resolution
  - Fold associated $p_T$ distribution with momentum resolution
- Different pedestal determination schemes
  - Discussed above → 7-20%
- Variation of the integration window
  - between ±0.5 rad. and ±0.9 rad.

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<tr>
<td>Detector efficiency</td>
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<td>Centrality selection</td>
<td>2-8%</td>
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<td>$p_T$ resolution</td>
<td>3%</td>
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<td>Pedestal calculation</td>
<td>7-20%</td>
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<tr>
<td>Integration window</td>
<td>0-3%</td>
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Ranges indicate different values for $I_{CP}/I_{AA}$ and near/away side.
Considerations: Near Side Enhancement ($I_{AA} > 1$)

- **Near side enhancement in** $I_{CP}$ and $I_{AA,Pythia}$ in central events
  - Near side is modified $\rightarrow$ trigger particle interacts with the medium

- **Possible explanation**
  - In the presence of quenching same trigger $p_T$ might probe higher parton $p_T$
  - Increased trigger $p_T$ $\rightarrow$ increased yield $\rightarrow$ increased $I_{AA,Pythia}/I_{CP}$
  - $I_{AA,Pythia}/I_{CP}$ on away side would be even lower without this effect!

Toy power law example: $A/(p_T - \Delta p_T)^n$
$I_{AA, \text{Pythia}}$: ALICE vs. PHENIX

- PHENIX subtracts $v_2 \rightarrow$ compare ALICE line with PHENIX
- Much larger $p_T$ reach at LHC
- Slight increase with $p_{T,\text{assoc}} \rightarrow$ not significant, to be studied further

PHENIX, PRL 104, 252301 (2010)

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