high-pT hadrons, jets and photons in ALICE

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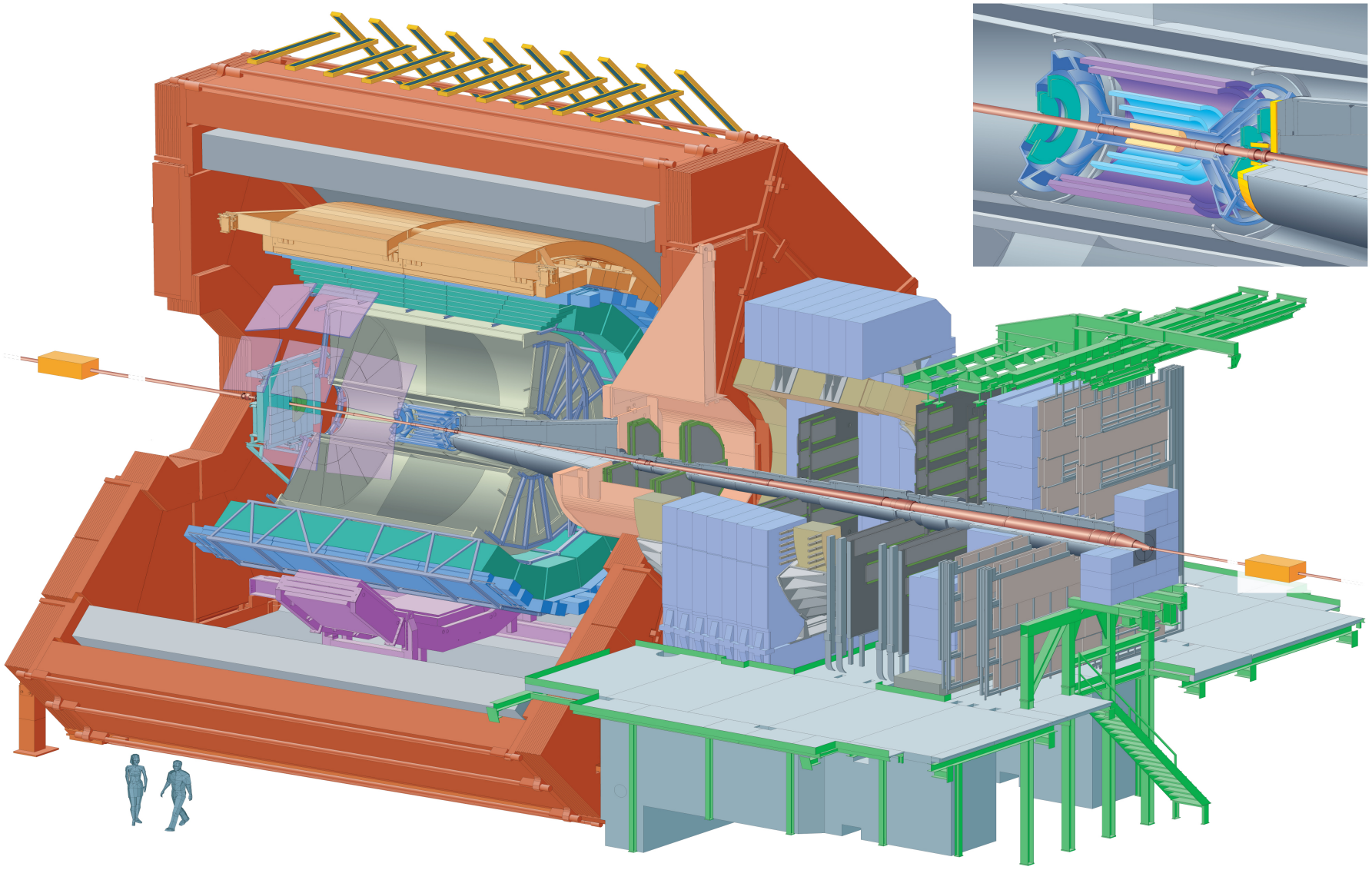
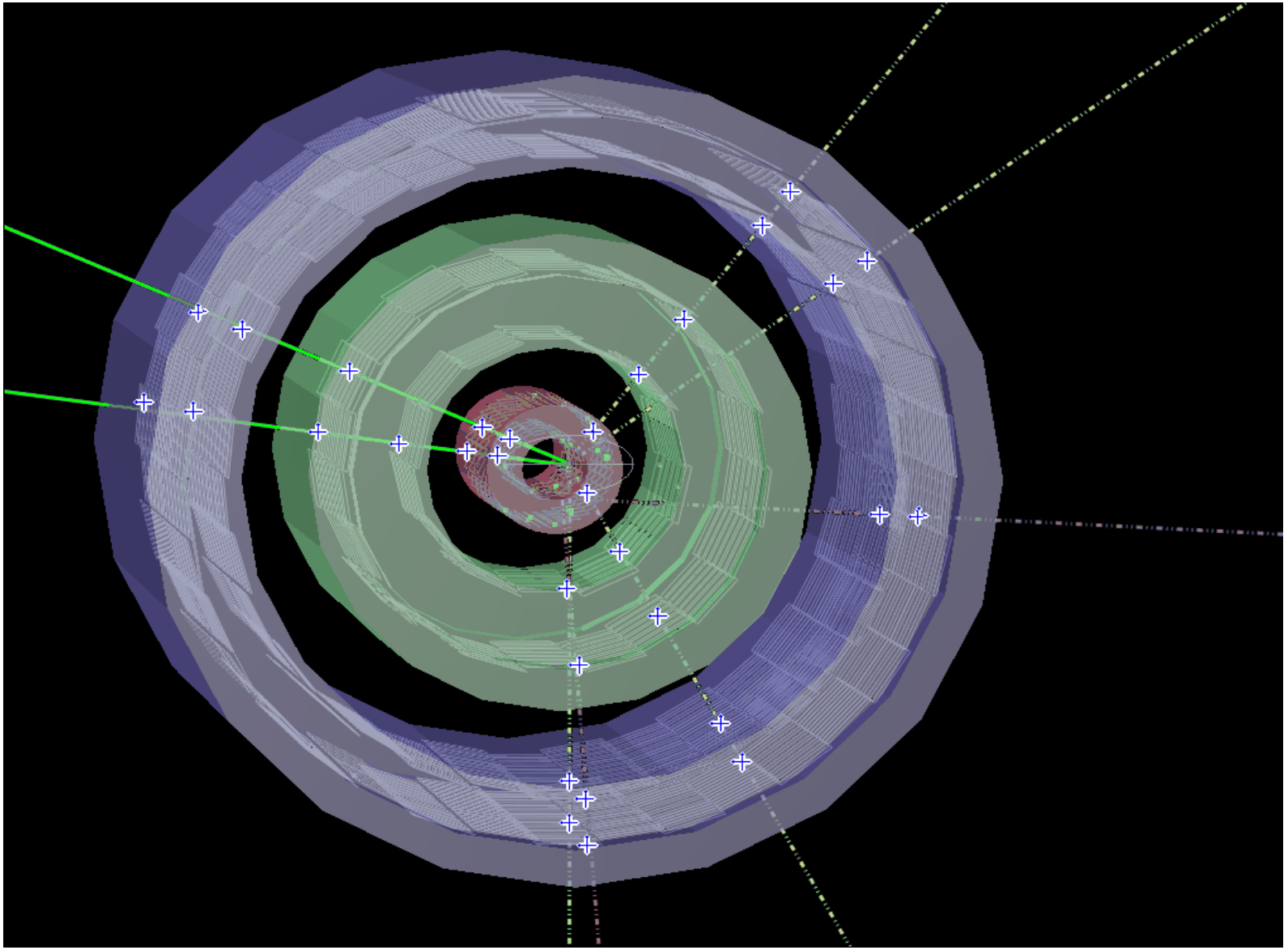
- dihadron correlations and intinsic k_T
- Underlying Event
- neutral meson production
- high pt hadron suppression
- jet reconstruction in Heavy Ion events

BMBF Forschungsschwerpunkt
ALICE Experiment 201

A Large Ion Collider Experiment

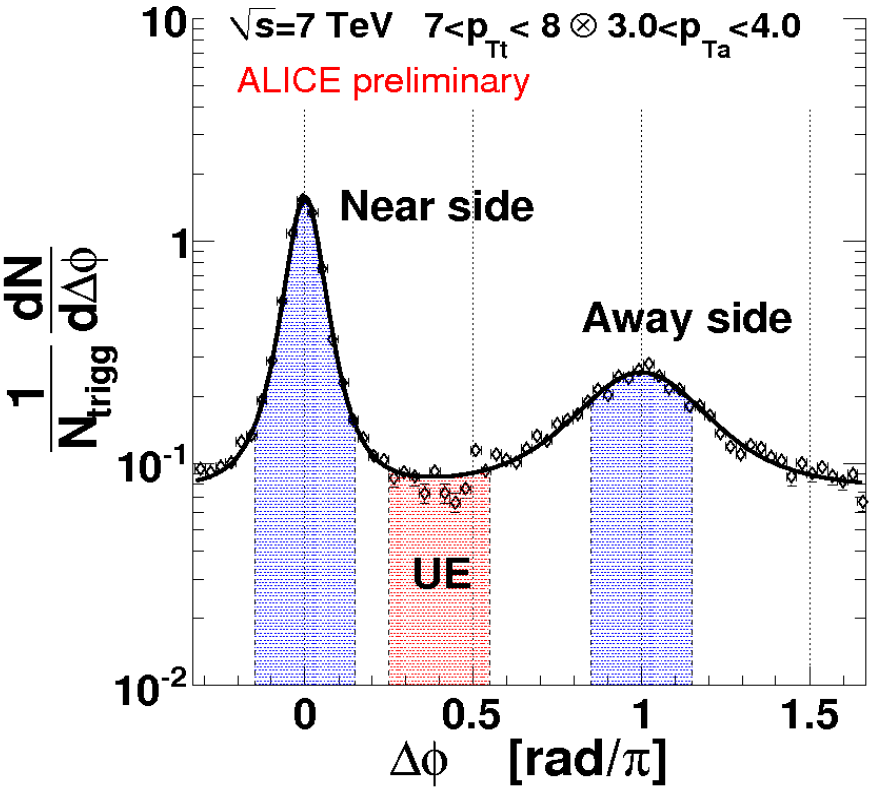


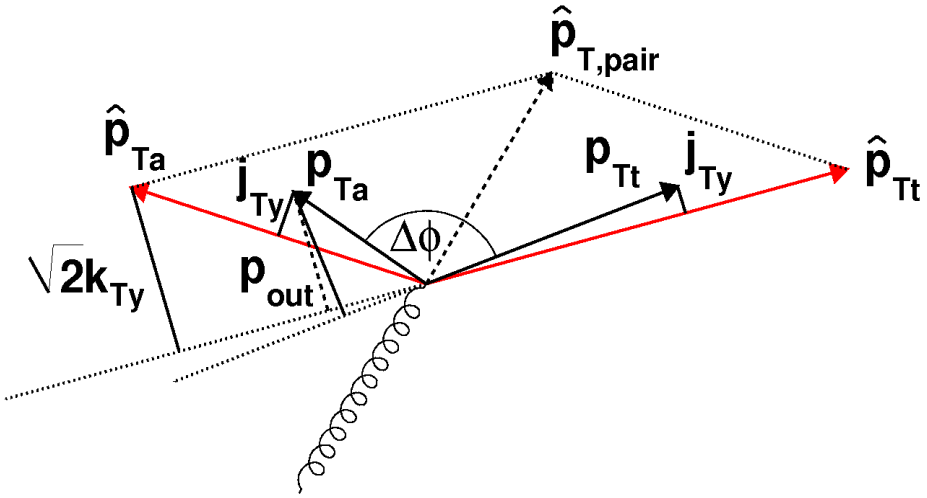
Results from proton collisions



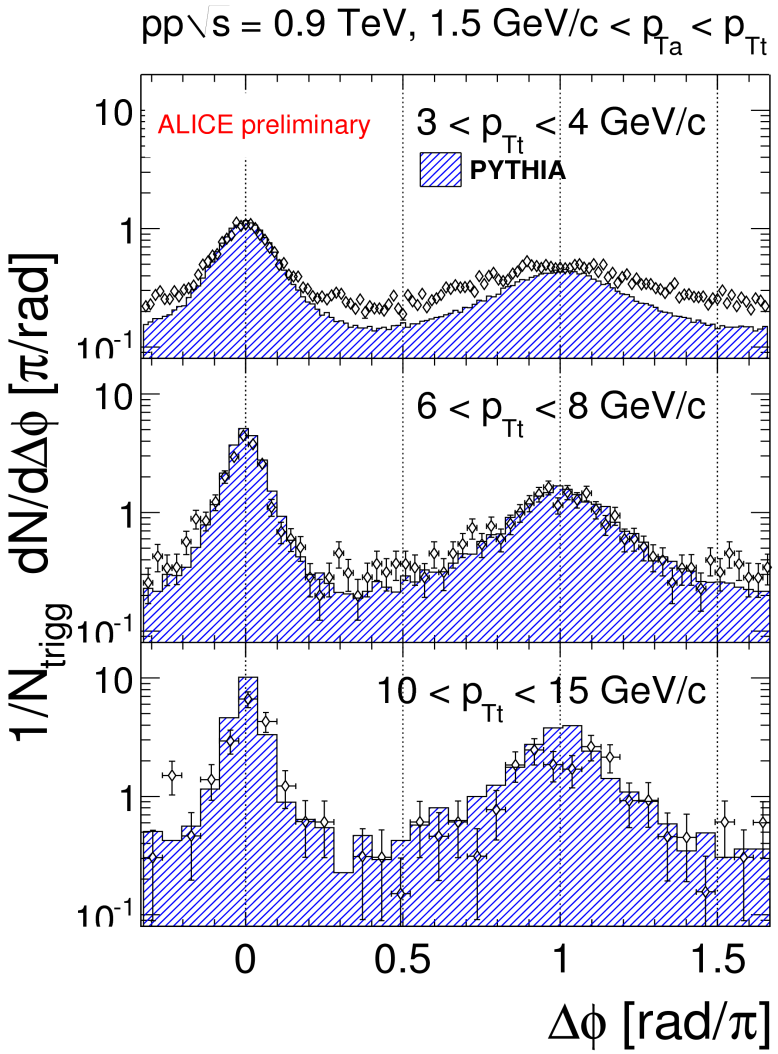
Di-hadron Azimuthal Correlations

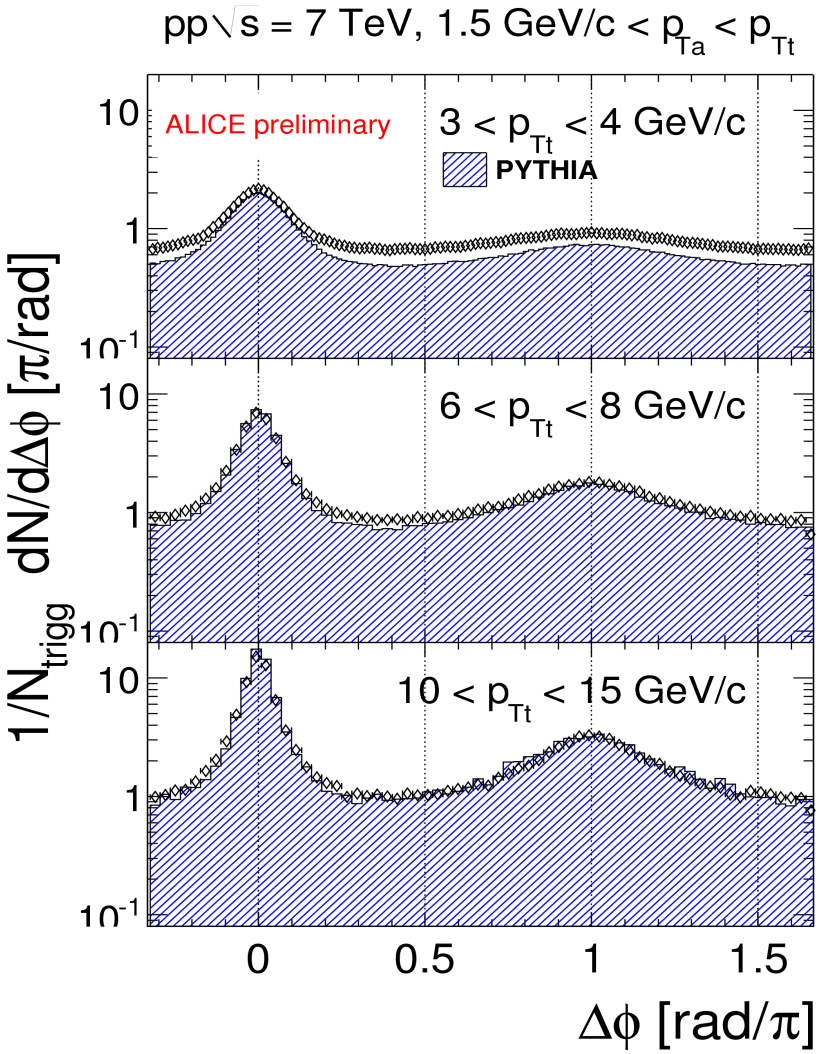
- correlations with respect to high momentum trigger particle
- near side: fragmentation transverse momentum j_T
- away side: net parton pair transverse momentum, intrinsic k_T



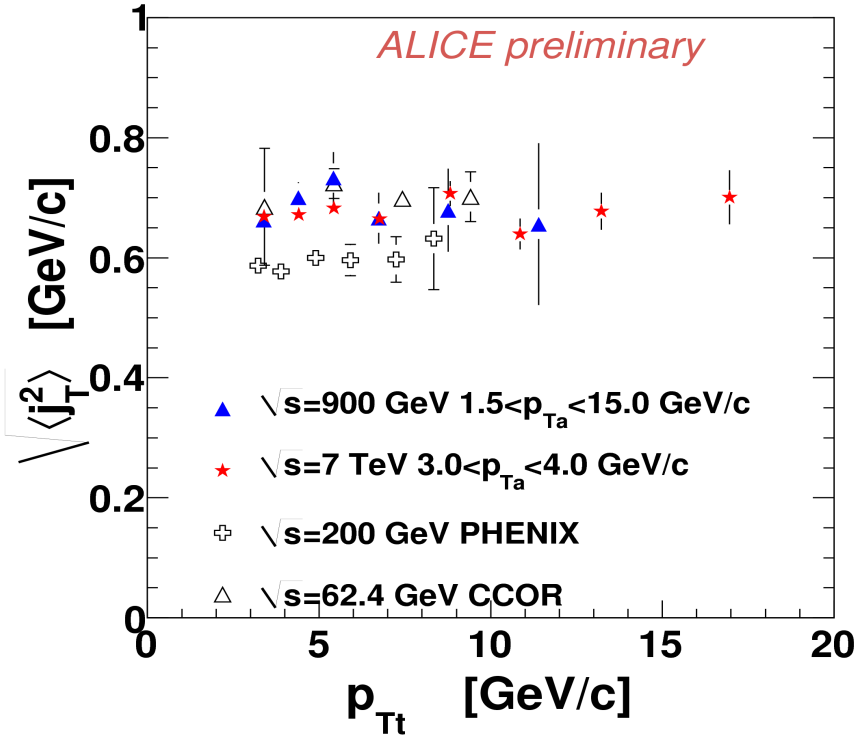


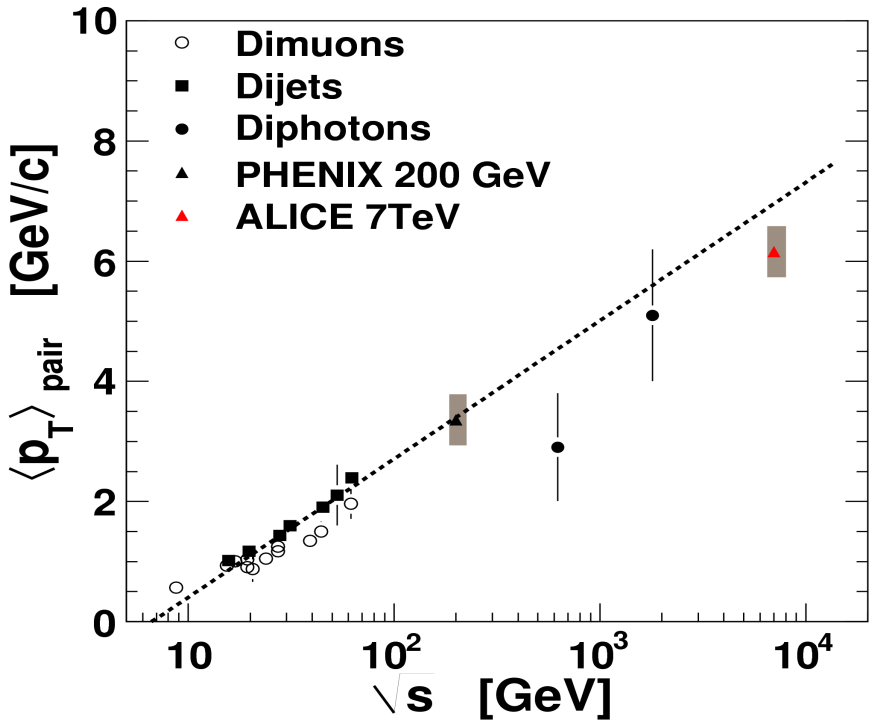
- angular correlations for $\sqrt{s}$ = 900 GeV and 7 TeV pp collisions
- Pythia (Perugia0) does not reproduce UE for small leading particle p_T
- increase in uncorrelated background from 900 GeV to 7 TeV





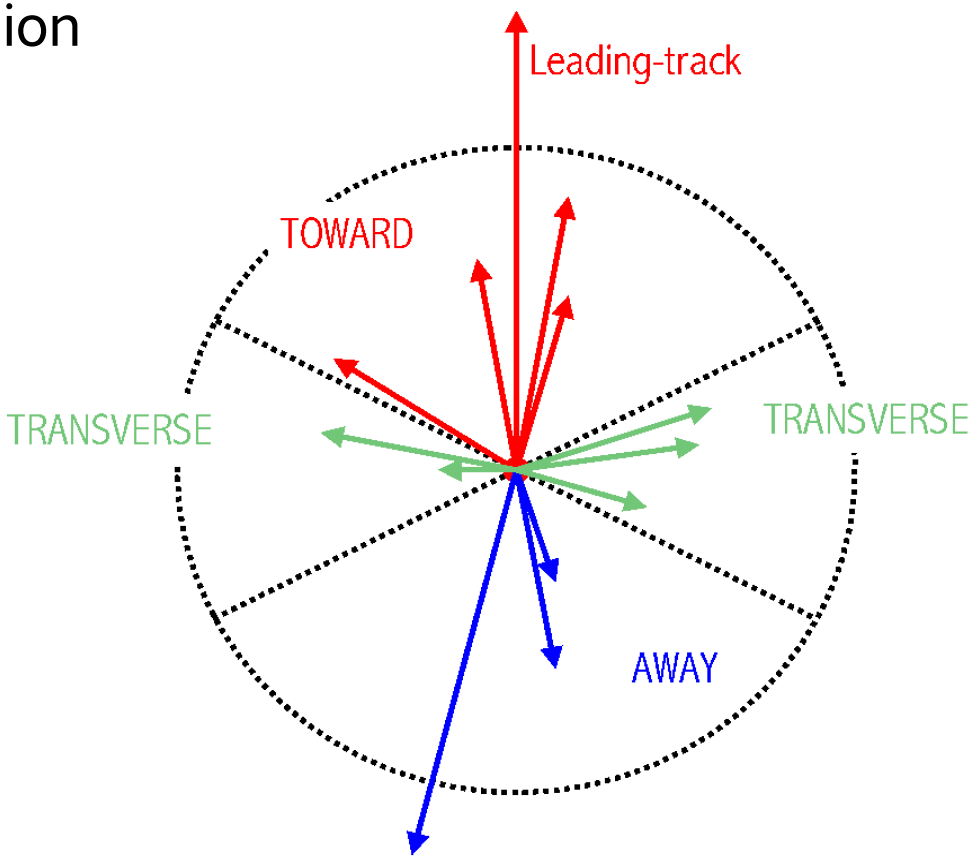
- fragmentation transverse momentum: independent on trigger pt
- partonic transverse momentum $\sqrt{< k_T^2 >} = 4.9 \pm 0.1\ GeV/c$
- increase with $\sqrt{s}$ as expected



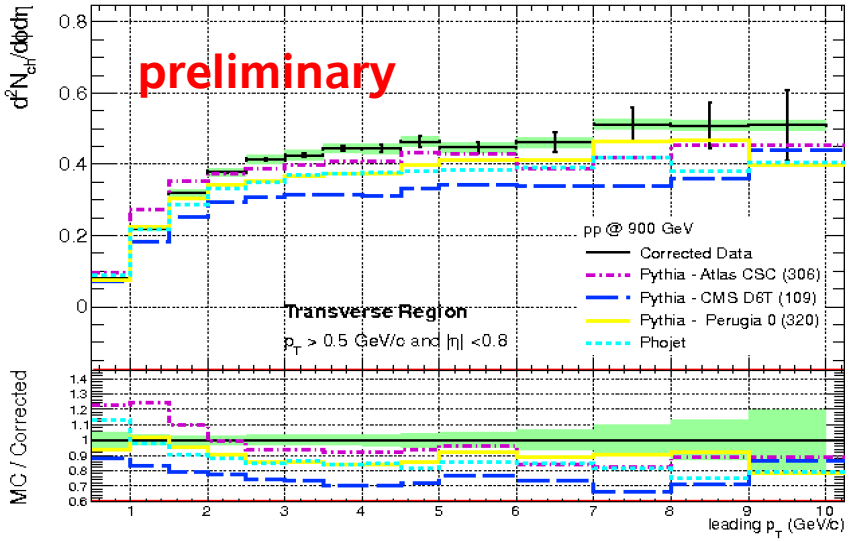


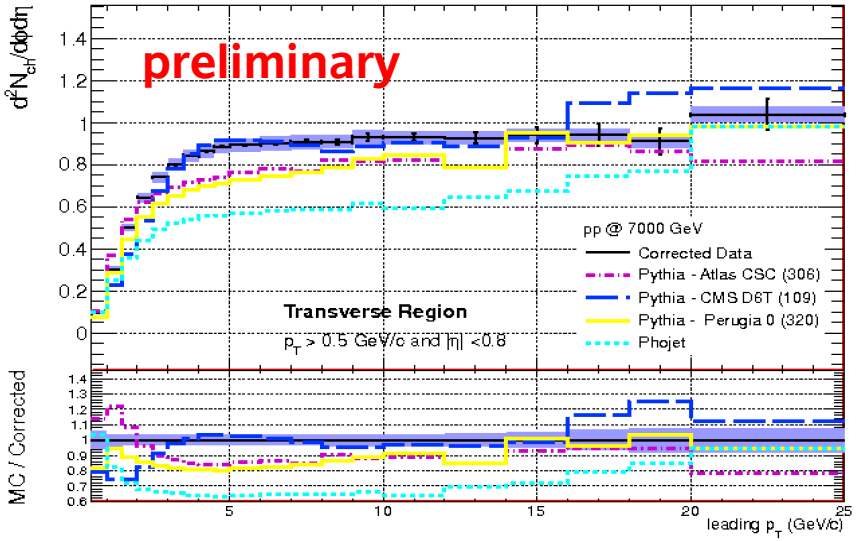
Underlying Event Analysis

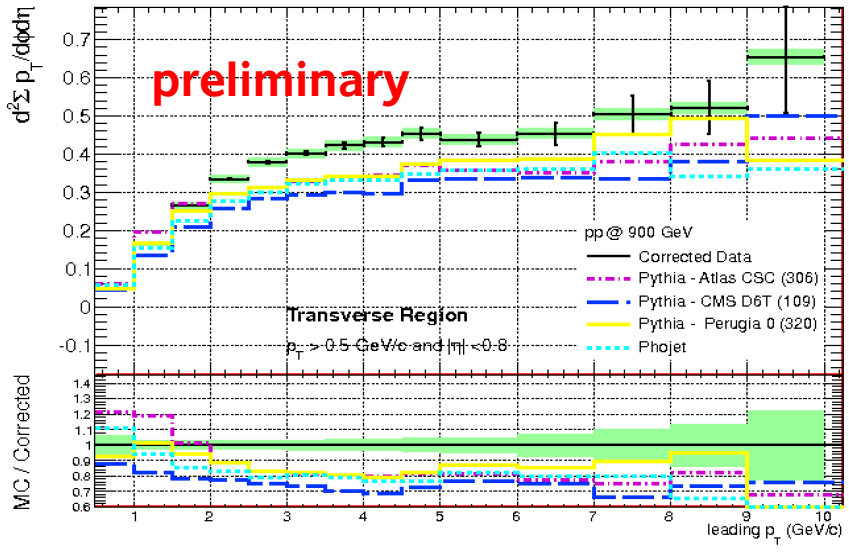
- UE = everything which is not hard scattering
- initial + final state radiation, multi-parton interactions
- topological selection with respect to leading charged particle: 'toward', 'away', 'transverse' region
- $|\eta|$ < 0.8, p_T > 500 MeV/c
- pT > 150 MeV/c in preparation

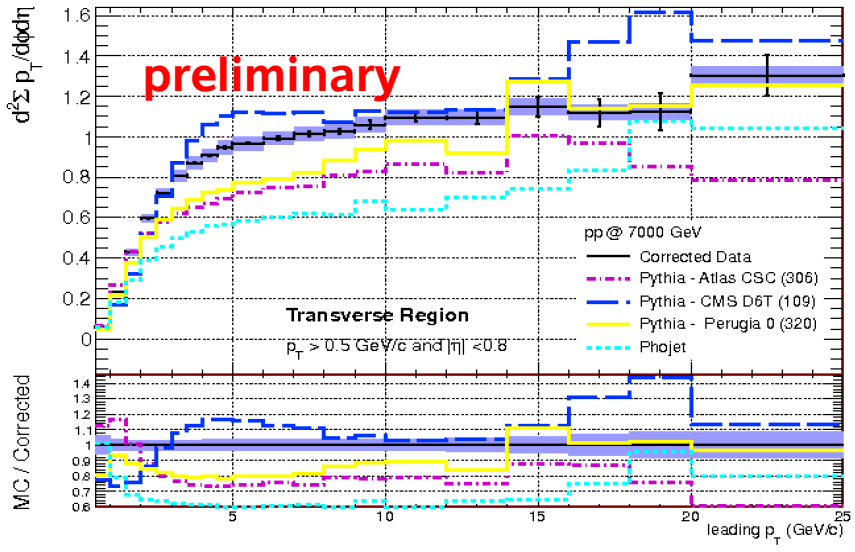


- charged particle number and p_T density in transverse region









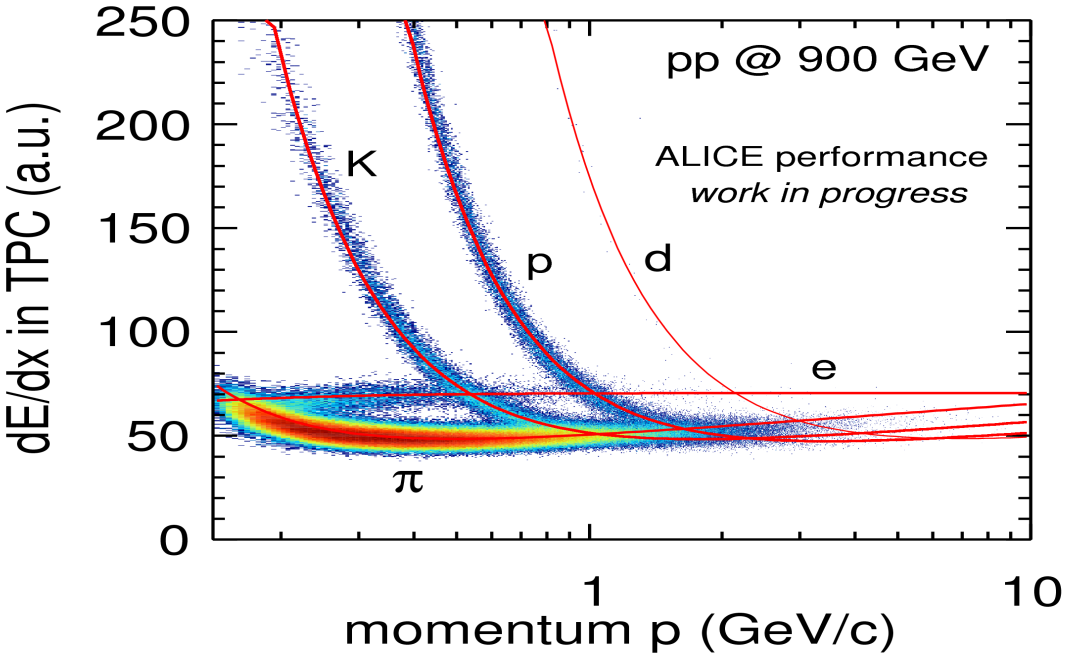
- ALICE can combine UE analysis with PID !

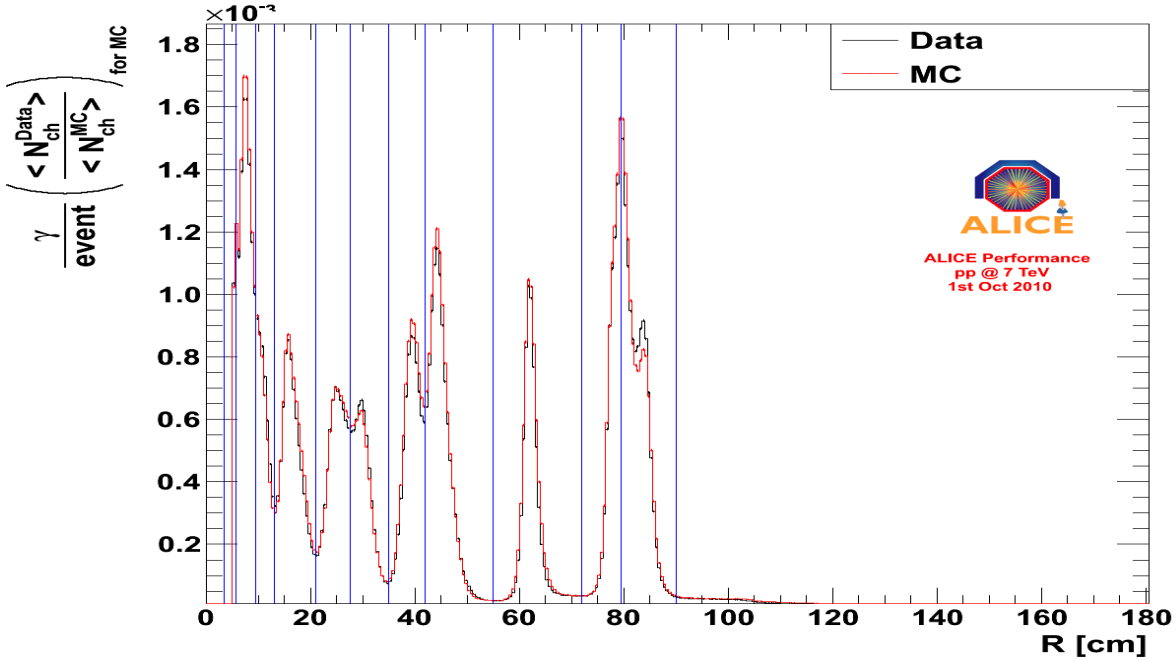
neutral pion reconstruction in ALICE

- 3 detection methods
  - in calorimeters: PHOS, EMCal
  - TPC tracking + PID: 4 conversion electrons
- complementary p_T coverage
- very different systematics (acceptance, conversion probability)

conversion method

- TPC tracking and electron ID
- 'V0' topology



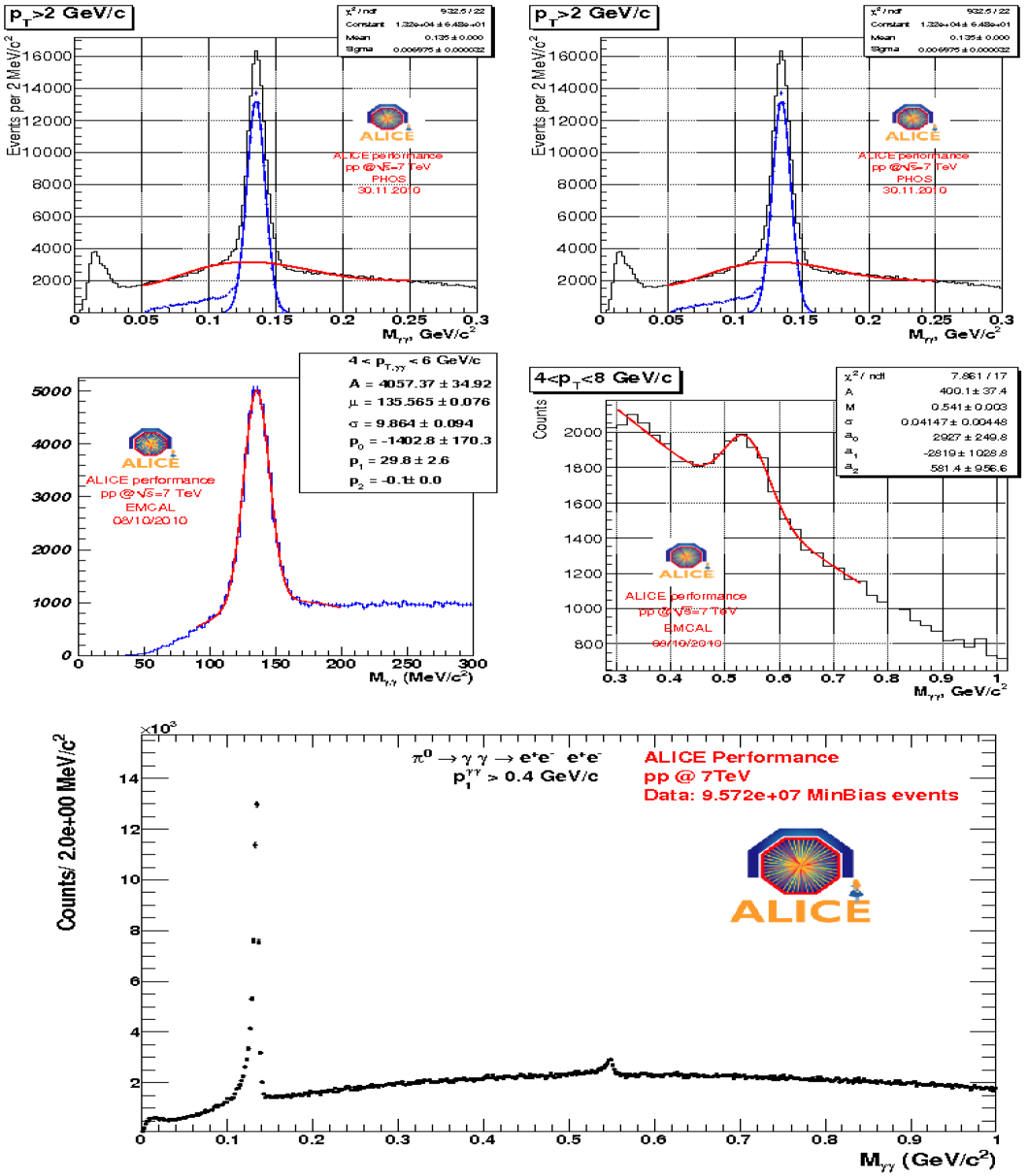


- radial distribution of conversion points
- material budget understood

-> vital for photon and electron reconstruction

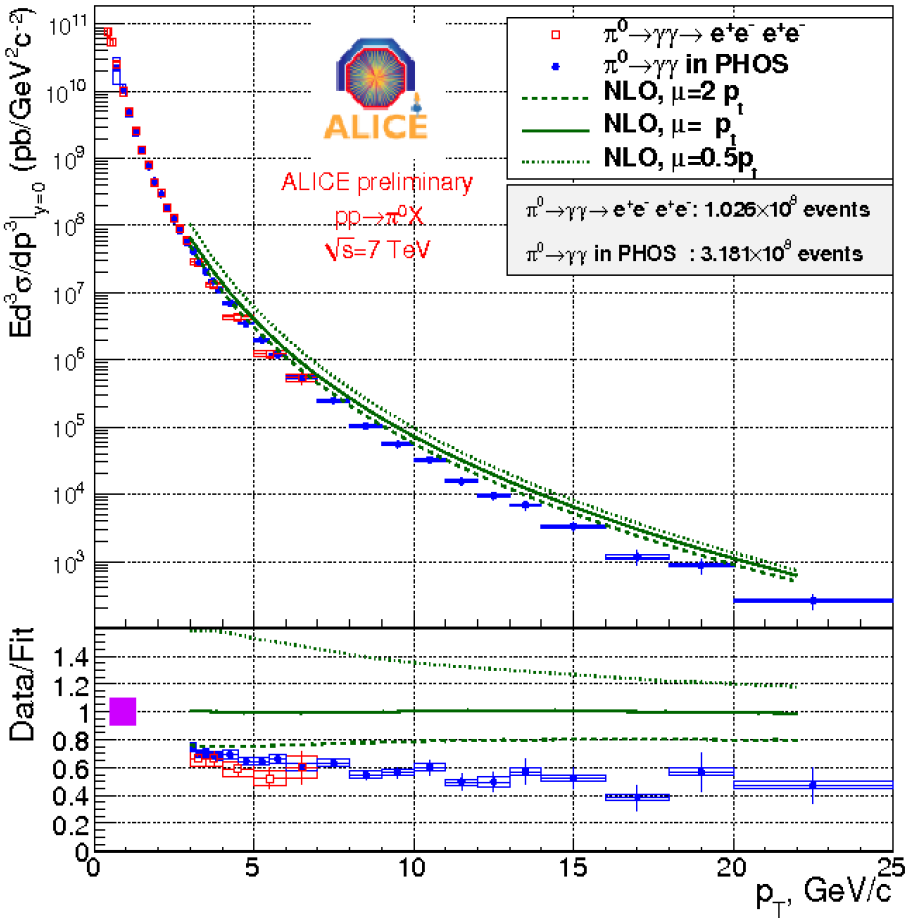
invariant mass distributions

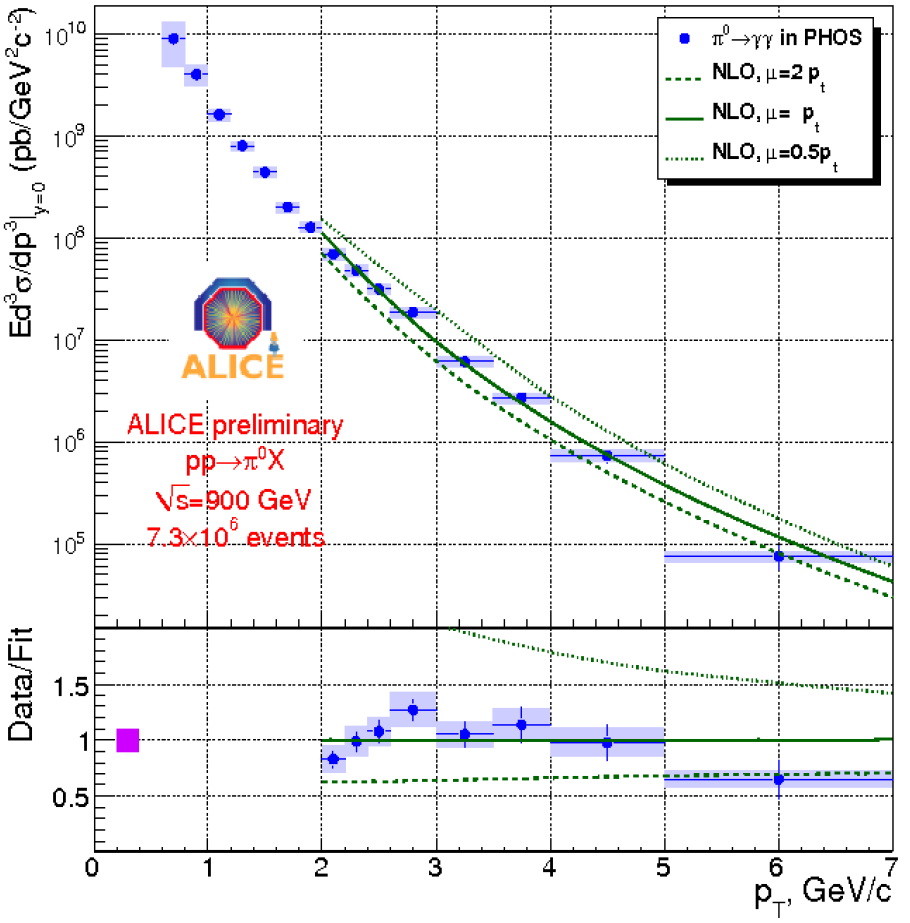
- η reconstruction prerequisite for direct photon measurement



neutral pion cross-section

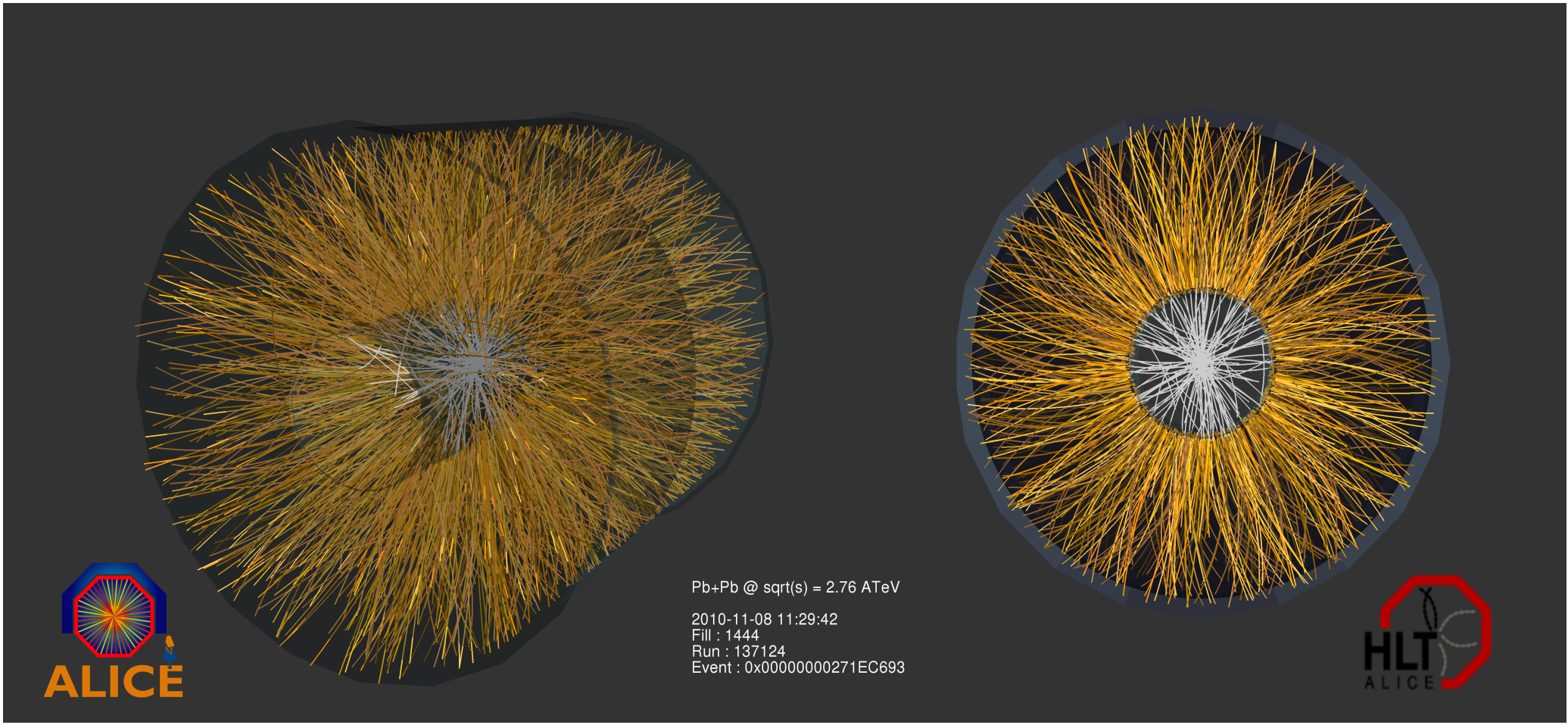
- negligible pile-up probability: precise determination of σ
- fair agreement with QCD NLO calculations





Results from heavy-ion collisions

- Pb+Pb collisions at $\sqrt{s}$ = 2.76 TeV

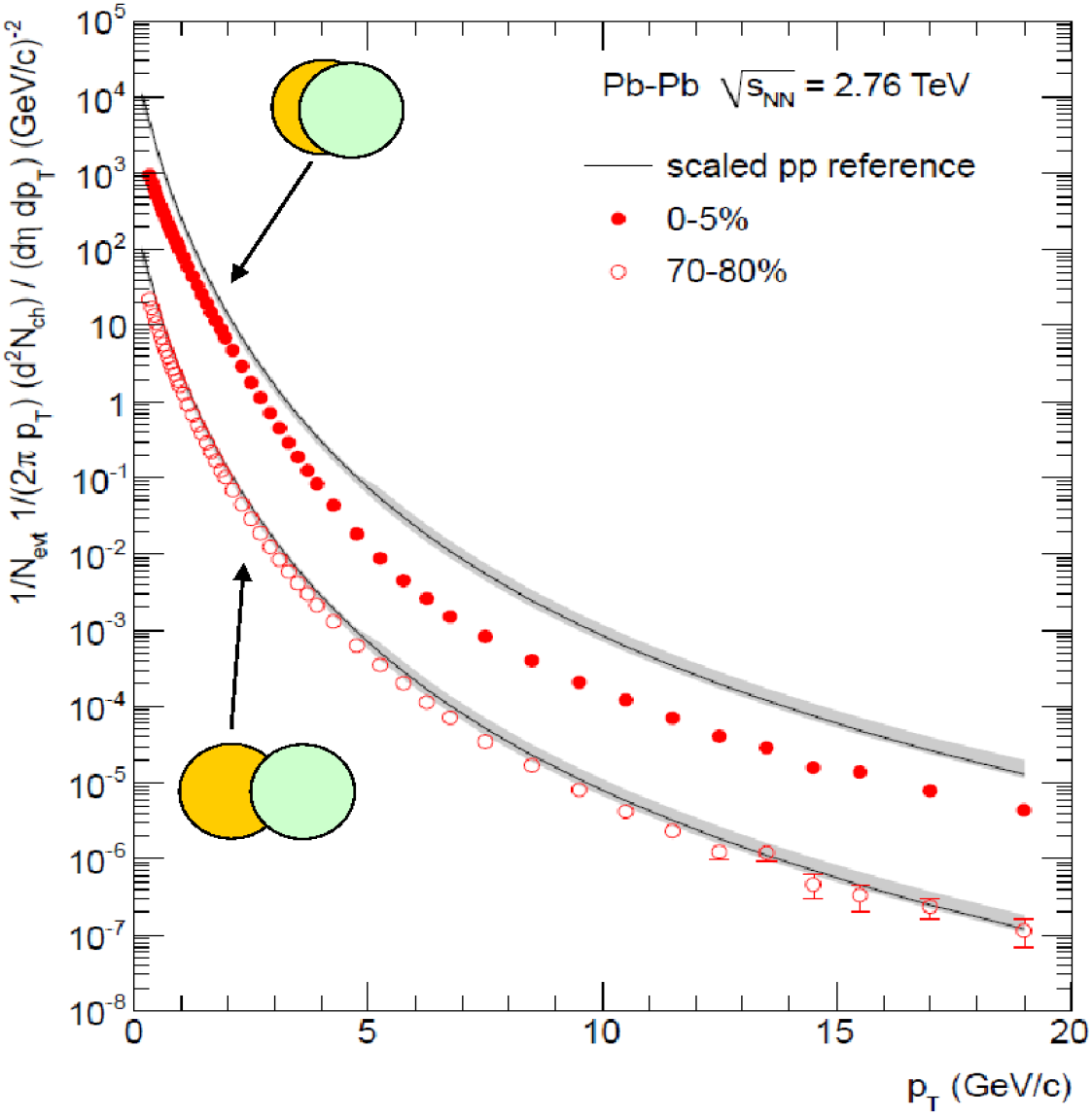


high p_T hadron suppression

- QGP search via hadronic jets modification
- 'jet quenching' = enhanced energy loss of partons in medium

- charged hadron spectra for central / peripheral collisions compared to scaled pp reference

Phys Lett B696 (2011) 30.



charged hadron R_{AA}

$$R_{AA}(p_T) = \frac{1/N_{evt}^{AA} \mathrm{d}^2 N_{ch}^{AA}/\mathrm{d}\eta\ \mathrm{d}p_T}{< N_{coll} > 1/N_{evt}^{pp} \mathrm{d}^2 N_{ch}^{pp}/\mathrm{d}\eta\ \mathrm{d}p_T}$$

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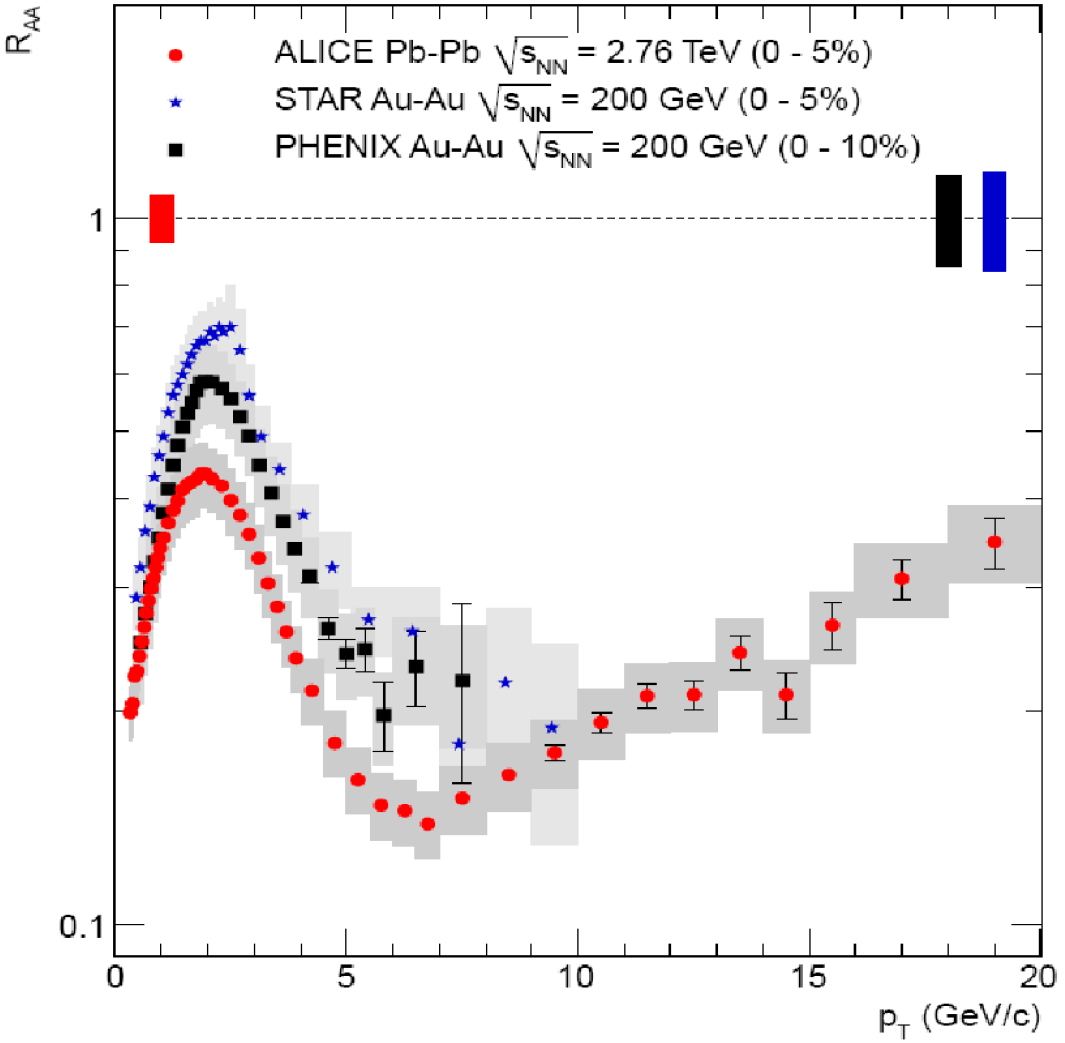
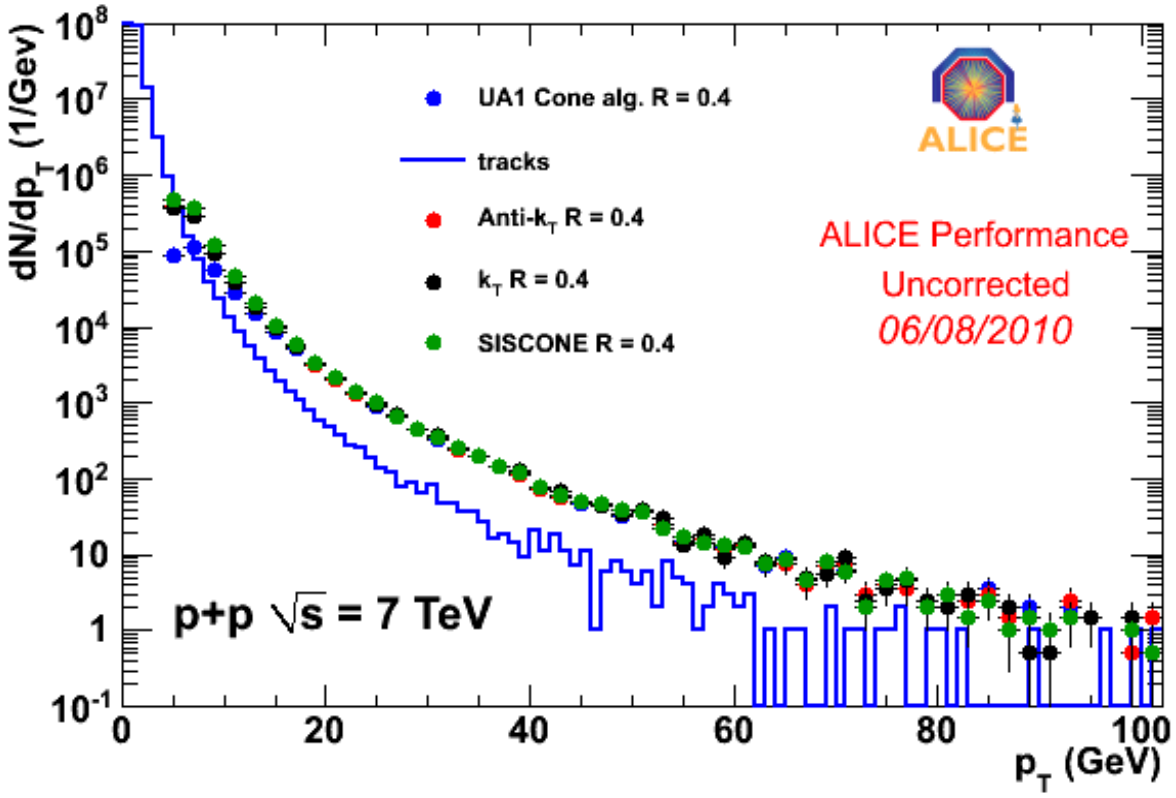


- suppression : $R_{AA} << 1$
- R_{AA} smaller than previously observed at RHIC
- rising trend towards high p_T

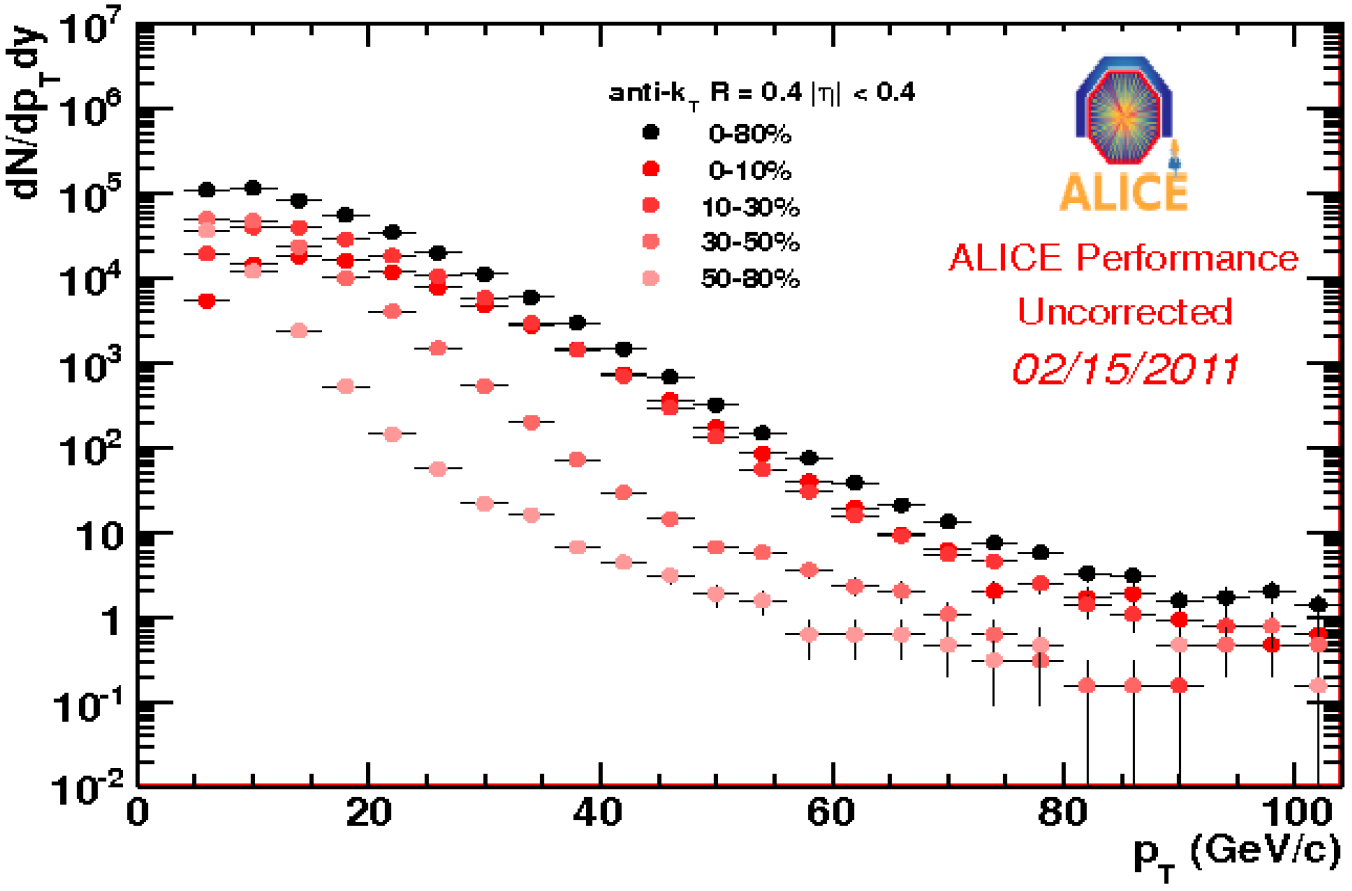
towards full jet reconstruction

- jets from charged particle tracks
- p+p at $\sqrt{s}$ = 7 TeV



jet reconstruction in Heavy Ion collisions

- very high background density in heavy ion environment
- raw jet spectrum,
  bgr subtracted,
  no corrections



- correction for background fluctuations under study

summary & outlook

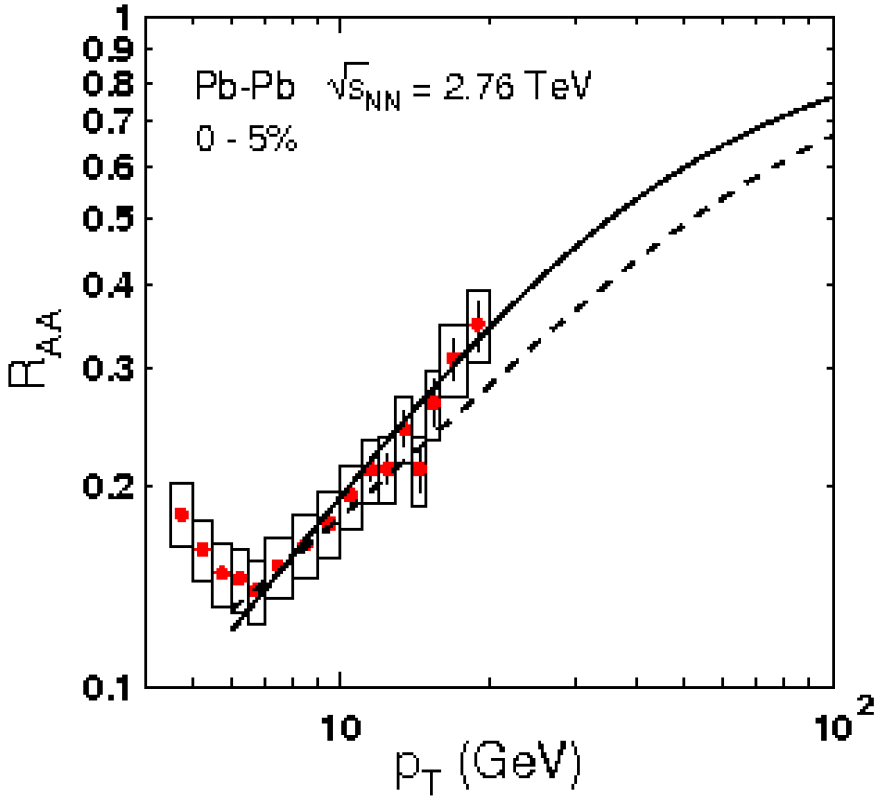
- ALICE explores QCD at unprecedented energies at LHC
- momentum reach covered by ALICE probes perturbative and non-perturbative regime in p+p collisions ...
  - intrinsic kT + Underlying Event
  - neutral meson cross-sections
- ... as well as the medium created in HI collisions
  - high momentum hadron suppression
  - full jet reconstruction underway
- first results on jet reconstruction from EMCal underway
- TRD + EMCal L1 jet trigger expected for 2011 run
- ALICE particle ID capabilities opens new opportunities:

  - hadrochemistry of jets and Underlying Event,

    in p+p and heavy ion collisions

- backup slides -

- B.Z. Kopeliovich, I.K. Potashnikova, I. Schmidt
  arXiv:1012.2854



- $\hat{q}_0$ = 0.8 GeV^2 / fm
- dashed: l_P = 2 fm,
  $\hat{q}_0$ = 1.6 GeV^2 / fm

statistics & Lumi

- MinB: 1 hit in V0A || V0C || SPD
- V0: scintillator ring close to beam pipe +3/-0.9 m IAP
  - 2.8<eta<5.1, -3.7 < eta < -1.7
- total ALICE:
  - 800 M pp MinB @ 7 TeV
  - 8 M pp MinB @ 900 GeV
  - 30M MinB PbPb at 2.76 TeV
- kt: 4.4 M @900 GeV, 84 M @ 7TeV

  10 ub^{-1}, 20 nb^{-1}
- pi0: 5.5 / 2.1 / 0.14 nb^{-1}

  (PHOS 7 TeV /conv 7 TeV / 900 GeV)
- R_AA : 2.3 Mio (Ncoll ~ 1700 for 5% most central)

intrinsic kt extraction

$$\frac{< z_T > \sqrt{< k_T^2 >}}{< \hat{x}_h >} = \frac{1}{x_h} \sqrt{< p_{out}^2 > - < j_{Ty}^2 > (1 + x_h^2)}$$

- quantities on right side: measured
- $x_h = p_{T,A} / p_{T,T}$ hadronic imbalance
- z_T : momentum fraction trigger hadron / original parton
- $\hat{x_h}$: partonic imbalance
- quantities on right side: partonic , use shape of FF

  and extract k_T iteratively