Two-particle azimuthal correlations at high transverse momentum in Pb-Au at 158 AGeV/c

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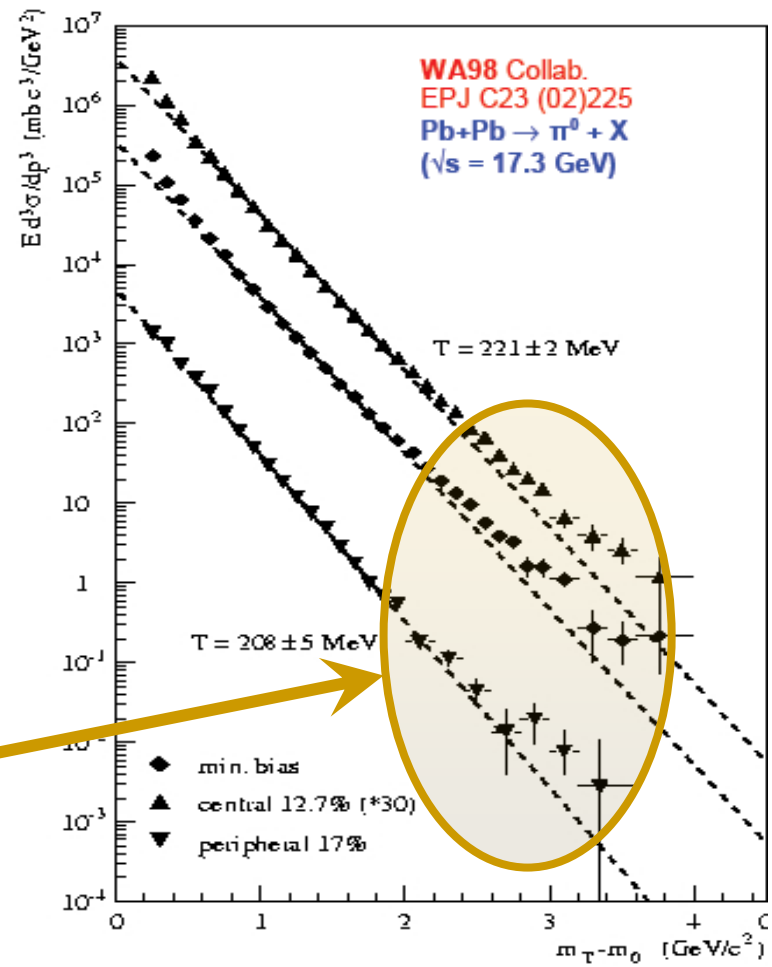
Outline

- Motivation and previous CERES correlation measurements
- Ceres Setup
- Triggered 2-particle correlations
  - the new look at TPC data
- Exploring the away-side
- Conclusions and outlook

Motivation

- Studies of high-Pt phenomena at RHIC – lots of data with more understanding (initial CGC, high-pT suppression/quenching/E_{loss} story, gluon radiation, Mach cones from supersonic partons) - what about SPS aside from previous CERES correlation work ?

- SPS and high-pT:
  - almost nothing on jets – almost no jets – call me a "mini" issue
  - different initial conditions, gluon density (low), larger parton x, different kinematics…
  - low cross-section for large q^2 as compared to RHIC and "in exchange" smaller signal/bg
  - suppression vs E_{loss} or Cronin hiding suppression
  - spectra not exponential!



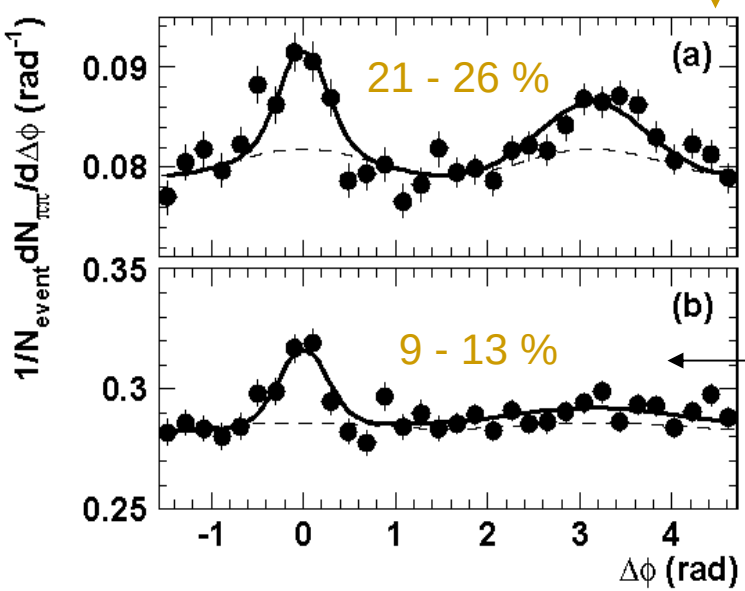
- Long story short: CERES upgraded with the TPC provided more interesting data… let's have a look on the correlations…

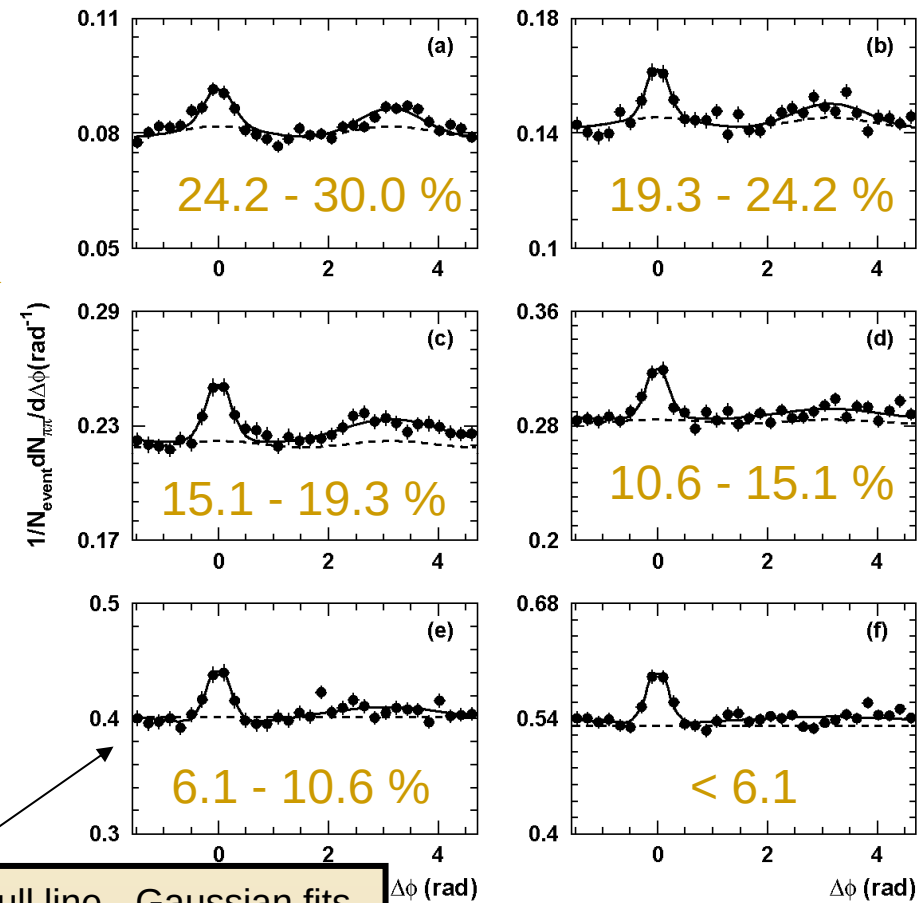
Pioneering plots: high-pT 2-pion azimuthal correlation - pre-TPC CERES analysis

Two-particle azimuthal correlations of pions with pT > 1.2 GeV/c - centrality dependent.

Broadening of the away-side component with centrality

CERES Collaboration, G. Agakichev, et al.
Phys. Rev. Lett. 92 (2004) 032301

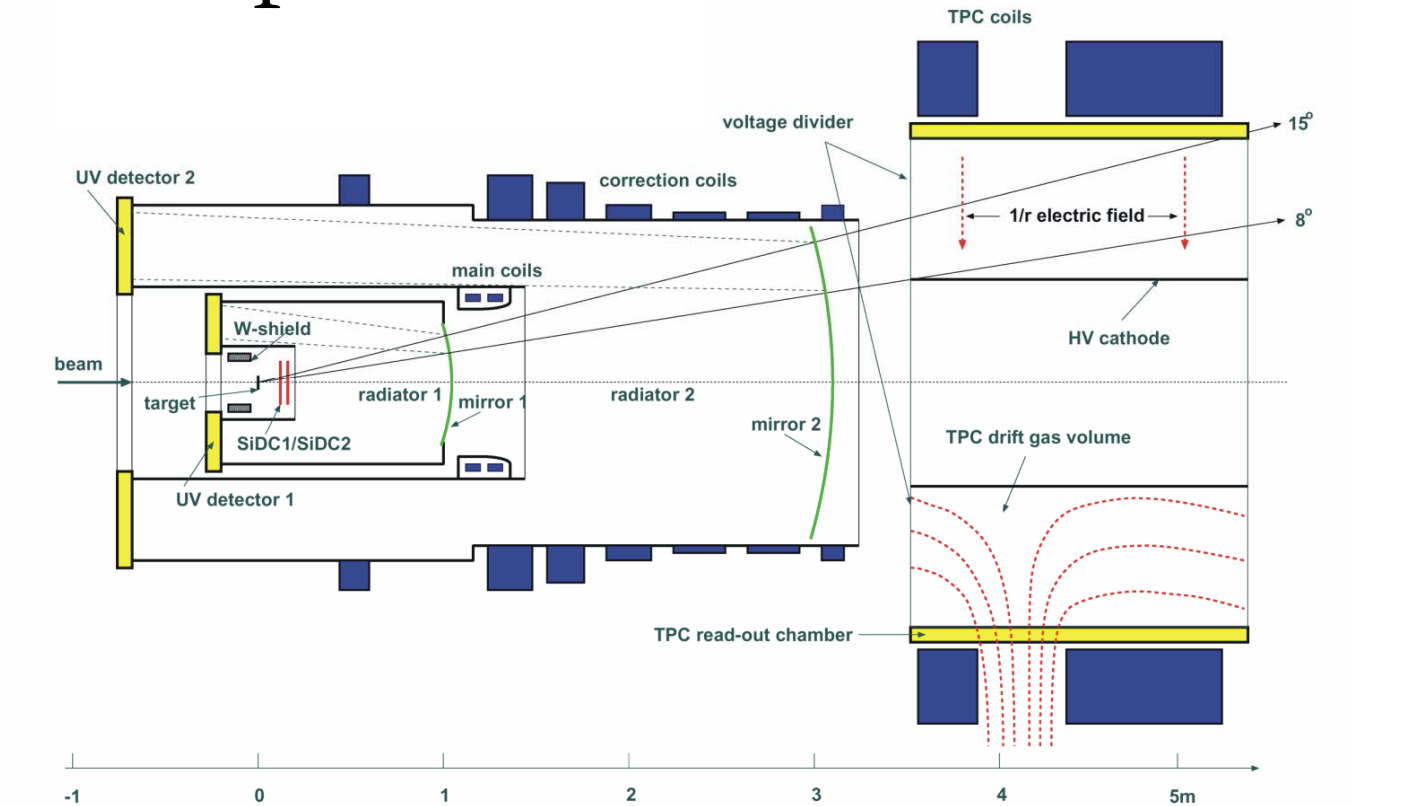




The full line - Gaussian fits to semi-hard components on top of elliptic flow modulated background (dashed line)

J. Bielcikova, PhD thesis
Prague/Heidelberg 2003

CERES Spectrometer with the TPC



2 Silicon Drift (SiDC) detectors, 2 RICH detectors, TPC : $\Delta p/p = ((2\%)^2 + (1\%\ p\ (\mathrm{GeV}/c)^2)^{1/2}$

Acceptance: $8^o < \theta < 15^o$ ($2.1 < \eta < 2.65$), full azimuth

Data set: 30 mln Pb+Au events (year 2000 run)

Centrality selection: 5%, 5-10%, 10-20% most central

Azimuthal angular 2-particle correlations - the recipe

Procedure (PHENIX: nucl-ex/0507004):

1. Accumulate: $Y_{AB}(\Delta\phi)=\phi_A-\phi_B$ (A != B)
2. Accumulate: $Y^{mixed}(\Delta\phi)=\phi_A-\phi_C^{mixed}$
3. Divide normalized yields:

$$C(\Delta\phi)=\frac{Y_{same}(\Delta\phi)}{Y_{mixed}(\Delta\phi)}\frac{\int Y_{mixed}d\Delta\phi}{\int Y_{same}d\Delta\phi}\propto\frac{dN^{AB}}{d(\Delta\phi)}$$

4. Assume:

$$C(\Delta\phi)=C_0\left(1+2\left\langle v_2^A v_2^B\right\rangle\cos(\Delta\phi)\right)+J(\Delta\phi)$$

5. Fix (C_0) and subtract the flow (ZeroYieldAtMinimum)
6. Normalize and extract **J**
   - jet associated particles(pairs) per trigger

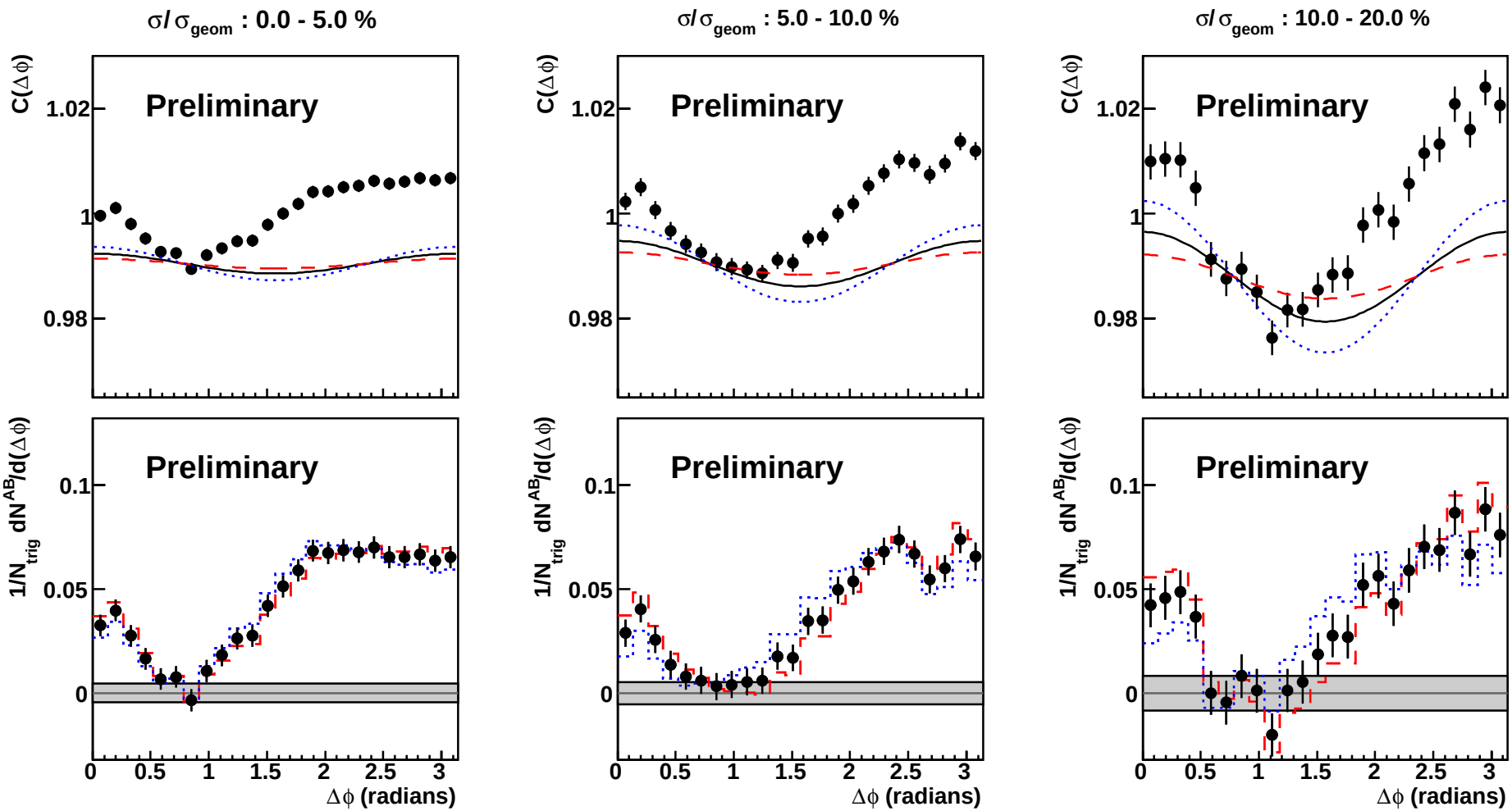
$$\frac{1}{N_{trig}}\frac{dN^{AB}_{(Di-)Jet}}{d(\Delta\phi)}=\frac{J(\Delta\phi)}{\int C(\Delta\phi')'d(\Delta\phi')}\frac{N^{AB}}{N^{A}}$$

N^A – number of triggers
N^{AB} – pairs
Assuming $\varepsilon^{AB}=\varepsilon^A\varepsilon^B$
the trigger efficiency cancels out

The correlations

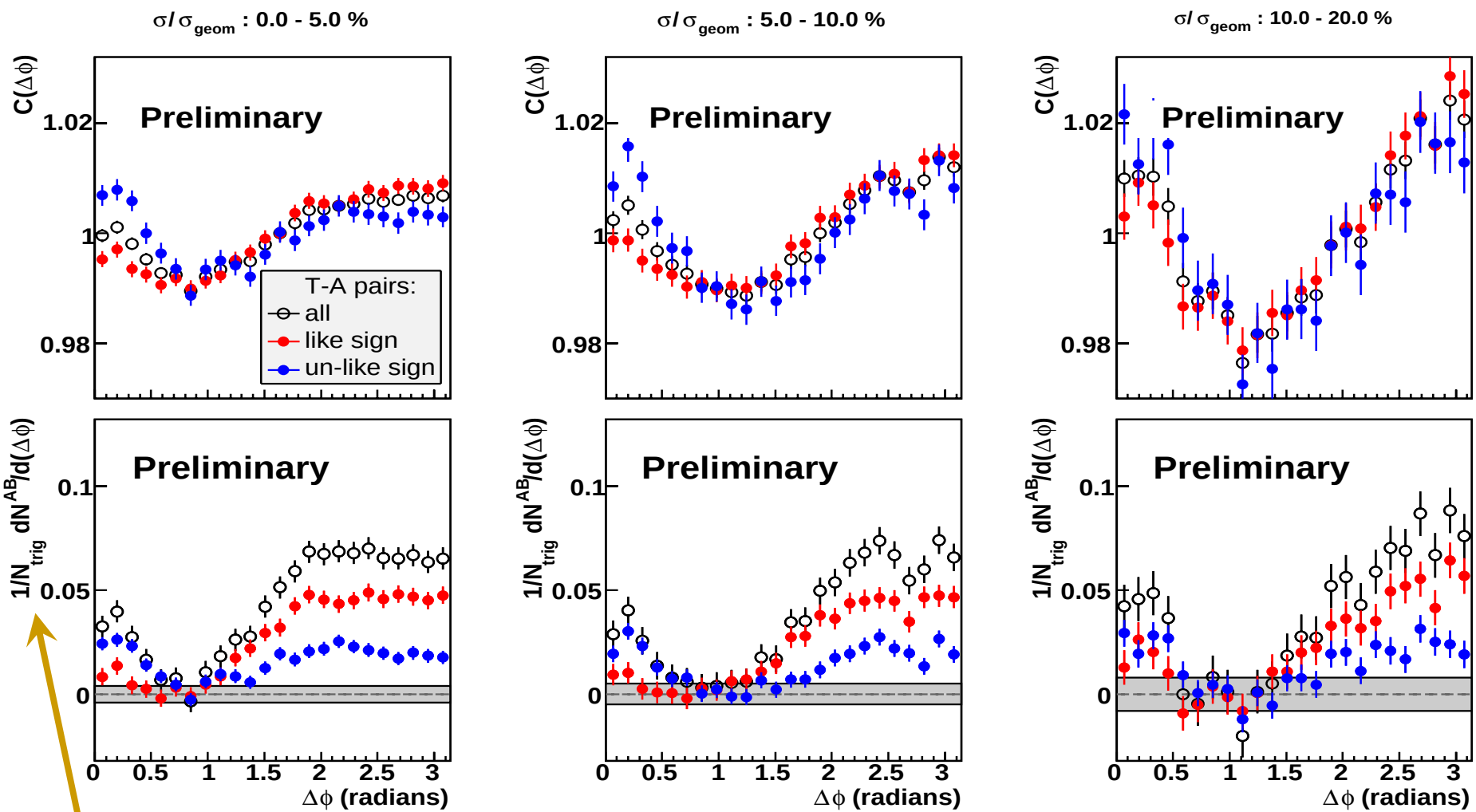
All charged with

$1.0 < p_T^{assoc} < 2.5 < p_T^{trigg} < 4.0$ GeV/c



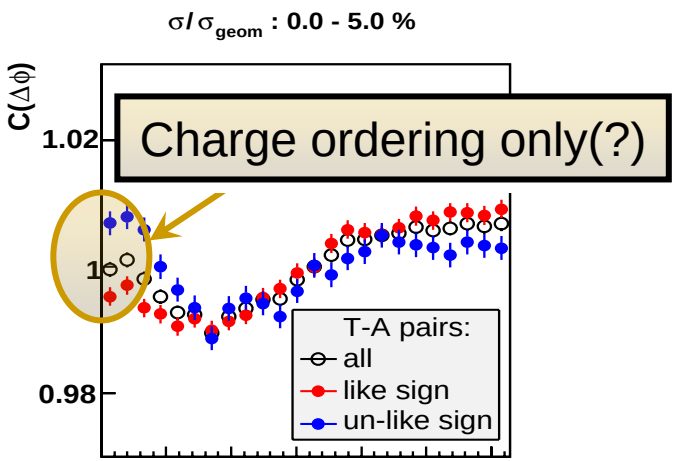
— Flow (v_2) from the reaction plane analysis: nucl-ex/0510057 and refs there —

Trigger-associated charge selection

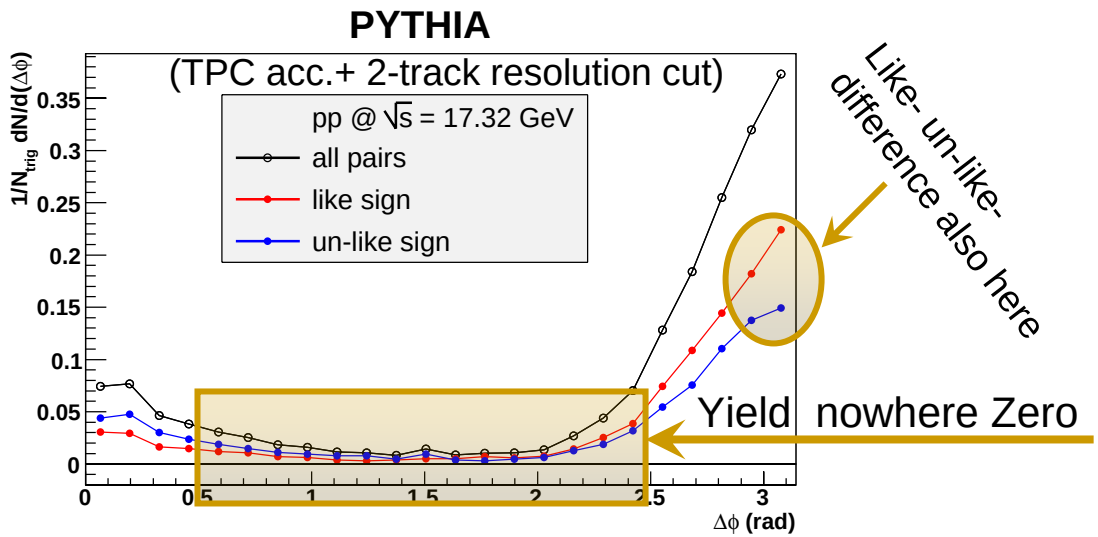


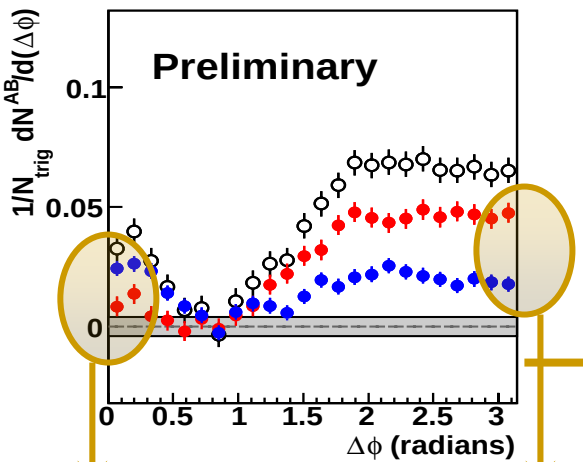
Normalized to the total number of triggers (no charge selection)

Like the like-sign more than the unlike on the away

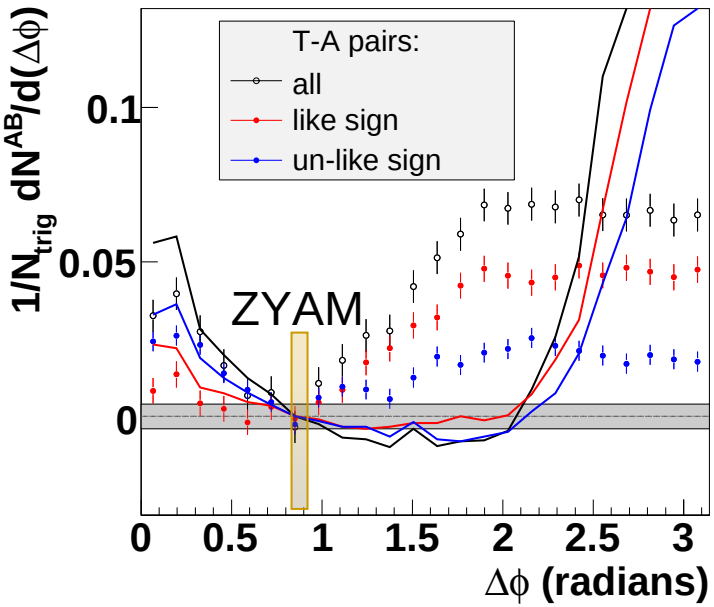


Charge ordering only(?)





comparing the yields



Features seen in the RHIC data
- meson/baryon triggered correlations

Conclusions and Outlook

- Strong, centrality dependent modification of the away-side peak in heavy-ions at SPS as compared to the N(aive)N(aive) expectations

- 2-particle correlations show different contributions to the (di-)jet yield from like- and unlike-sign pairs
  - charge conservation in the fragmentation (near side)
  - meson-baryon trigger type dependence (also seen in the RHIC data – away and near side) – centrality dependent

- 3-particle correlations should provide more discriminating information on the mechanisms leading to the modifications of the away-side – analysis in progress

CERES Collaboration

D. Adamova, G. Agakichiev, D. Antończyk, A. Andronic, H. Appelshäuser, V. Belaga, J. Bielcikova, P. Braun-Munzinger, O. Busch, A. Castillo, A. Cherlin, S. Damjanovic, T. Dietel, L. Dietrich, A. Drees, S. Esumi, K. Filimonov, K. Fomenko, Z. Fraenkel, C. Garabatos, P. Glässel, G. Hering, J. Holeczek, S. Kniege, V. Kushpil, B. Lenkeit, W. Ludolphs, A. Maas, A. Marin, J. Milosevic, A. Milov, D. Miśkowiec, R. Ortega, Yu. Panebrattsev, O. Petchenova, V. Petracek, A. Pfeiffer, M.Płoskoń, S. Radomski, J. Rak, Ravinovich, P. Rehak, W. Schmitz, J. Schukraft, H. Sako, S. Shimansky, S. Sedykh, J. Stachel, M. Sumbera, H. Tilsner, I. Tserruya, G. Tsiledakis, T. Wienold, B. Windelband, J.P. Wessels, J.P. Wurm, W. Xie, S. Yurevich, V. Yurevich

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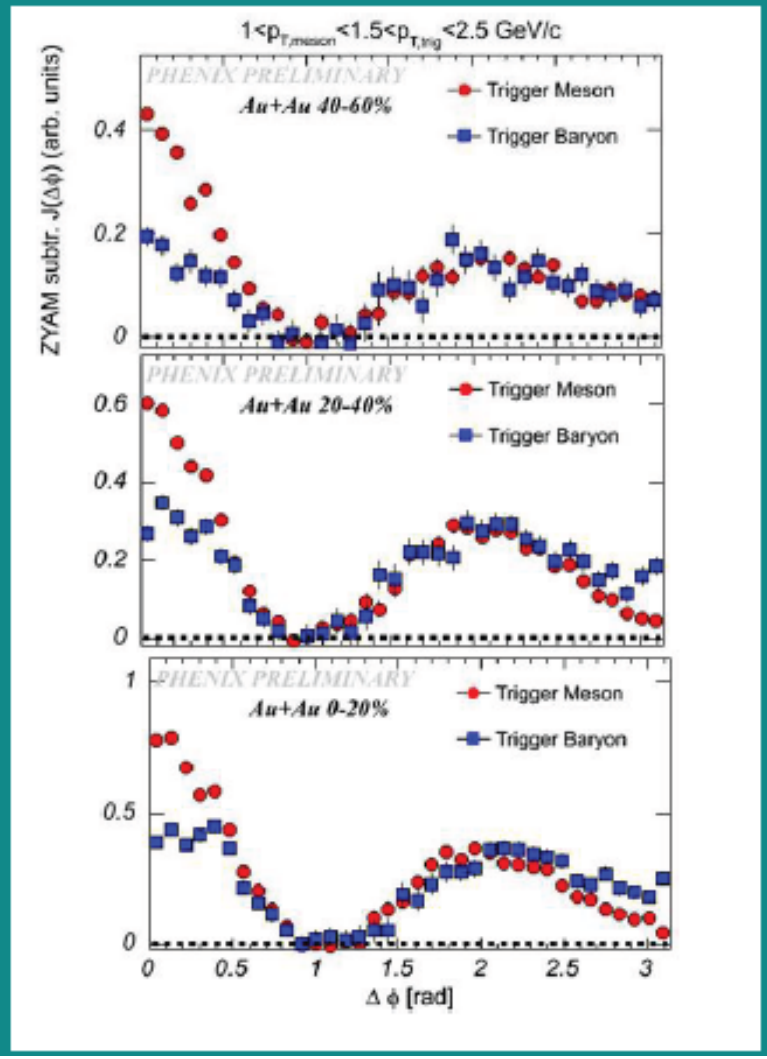
Heidelberg University, Germany
JINR Dubna, Russia
Weizmann Institute, Rehovot, Israel
SUNY at Stony Brook, USA
CERN, Switzerland
BNL, Upton, USA
Münster University, Germany
MPI Heidelberg, Germany

This was in the backup slides…

Baryon-Meson Dependence



Clear baryon-meson dependent shape evolution of away-side with increasing centrality

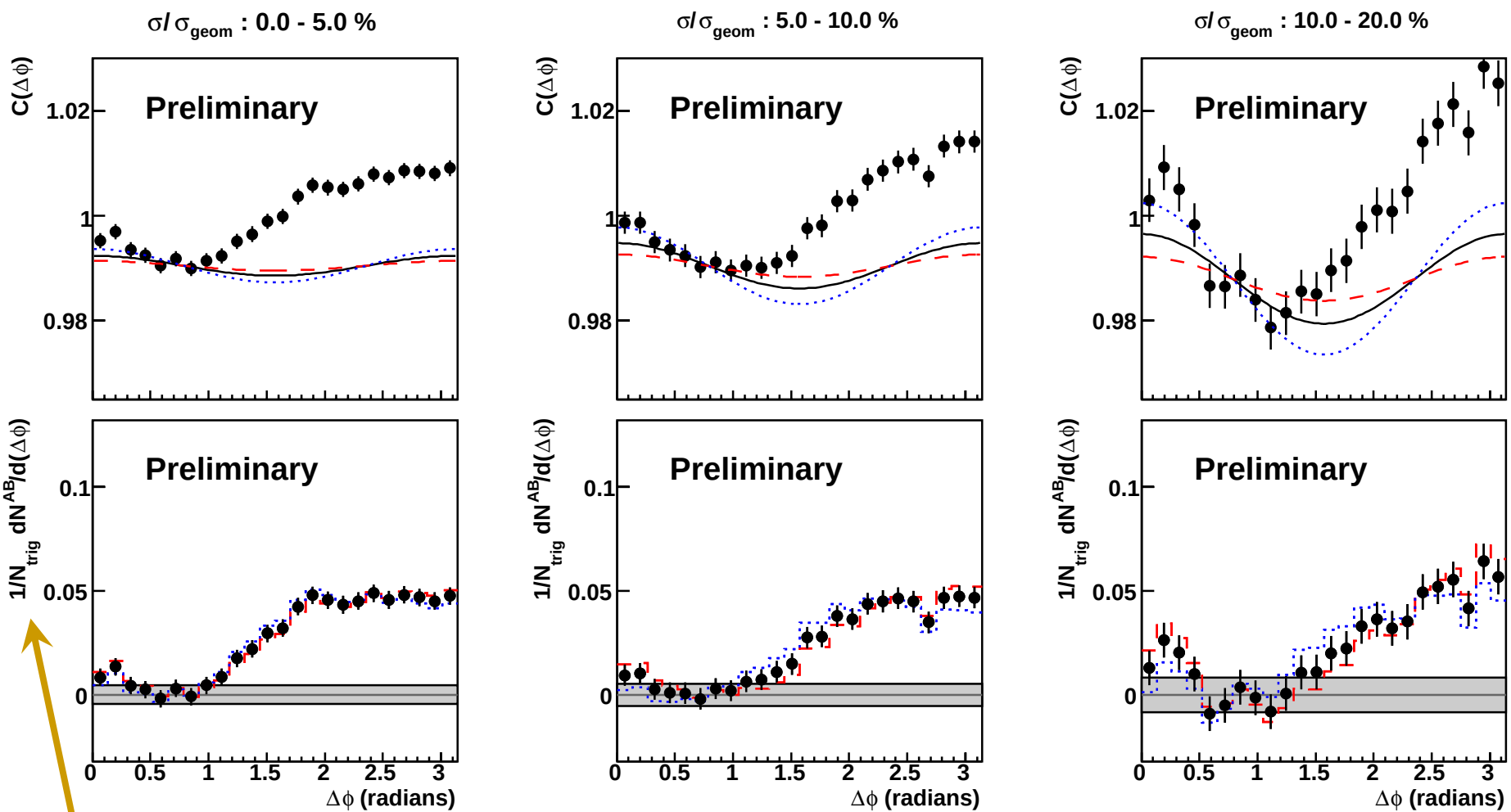
Highlights from the PHENIX Experiment - Part 2 -

Henner Büsching

Brookhaven National Laboratory for the PHENIX Collaboration

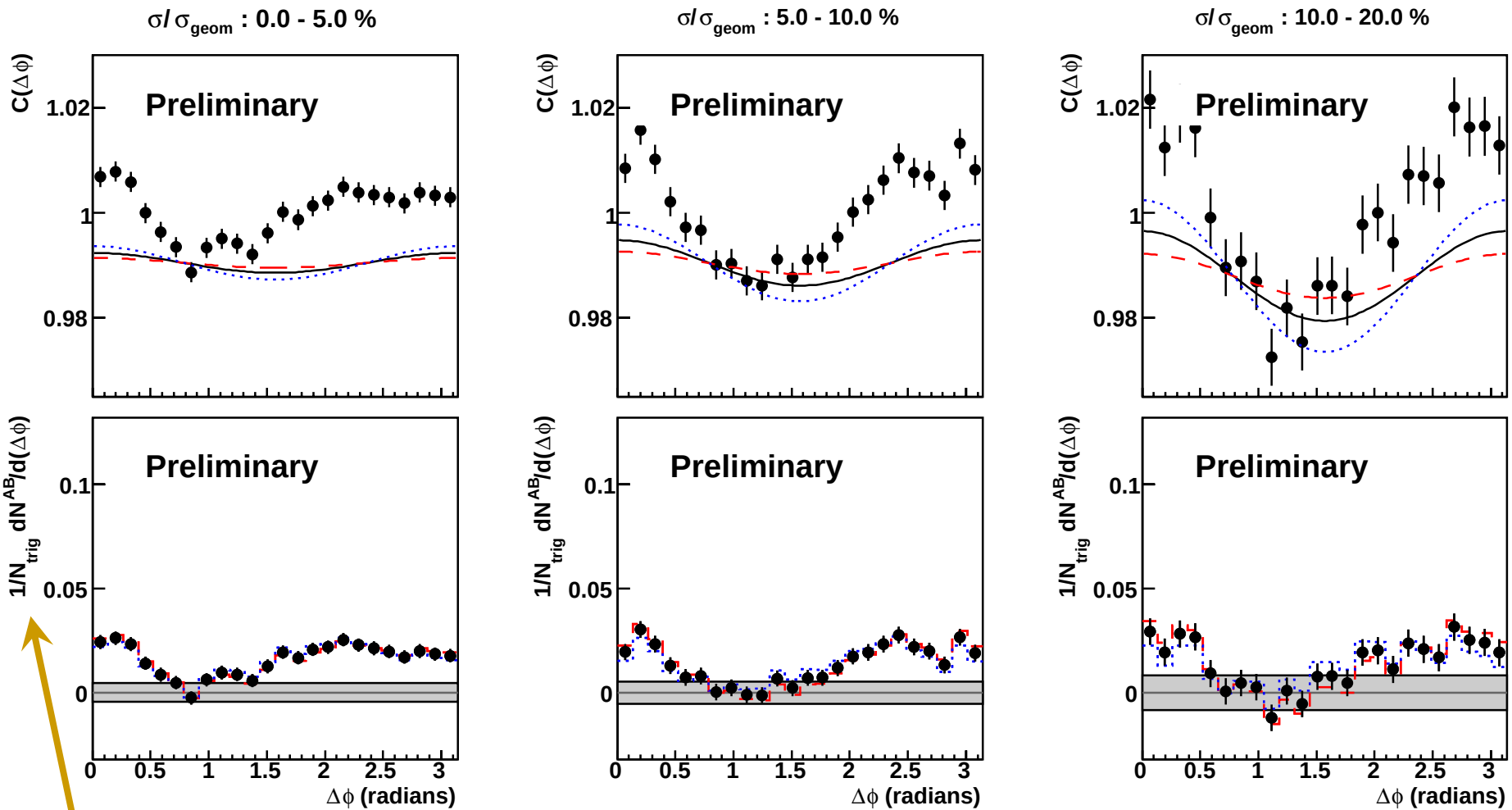
Quark Matter - Budapest , Aug. 4 2005

Like-sign pairs



Normalized to the total number of triggers (no charge selection)

UnLike-sign pairs



Normalized to the total number of triggers (no charge selection)