Status of W analysis in PHENIX Central Arm

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For the PHENIX collaboration
RHIC Spin Collaboration meeting
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Introduction

- A task force was formed before Run9.

- EMCal dynamic range change (25GeV/tower to 50GeV)
- EMCal calibration during the run.
- Fast track analysis with a striped data sample. (We made a parallel output stream.)
- Continue to work on the offline analysis.

- In this talk, the analysis status and key issues are shown. But there is no new physics plot.

Run9pp 500GeV

Period: March 16, 2009 to April 13,2009

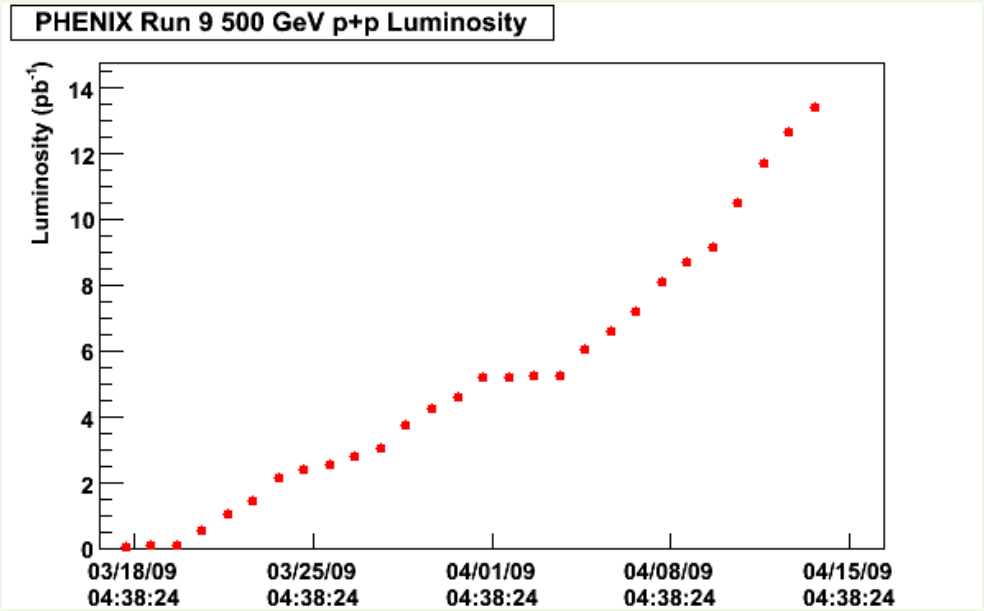
Trigger: EMCal trigger (~8GeV threshold) ~100Hz

Special runs:

vernier scans for the luminosity measurement (~5runs)

zero field runs for tracking calibration (~20runs)

Integrated luminosity



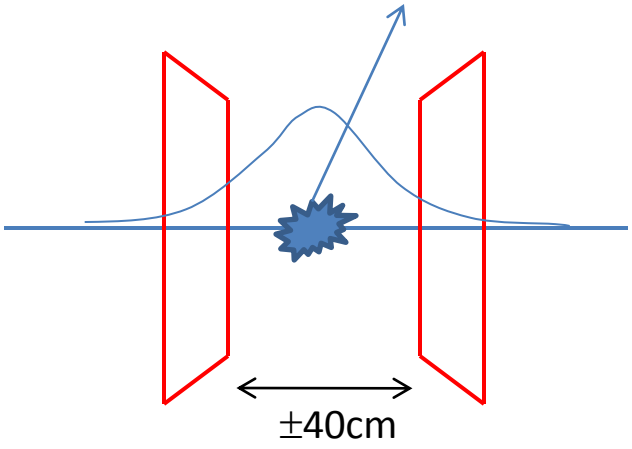
John Haggerty
at RHIC AGS meeting

- 43 physics fills in 28 days
- 220 TB recorded physics
- 50.2 pb^{-1} delivered
- Polarization ~35%

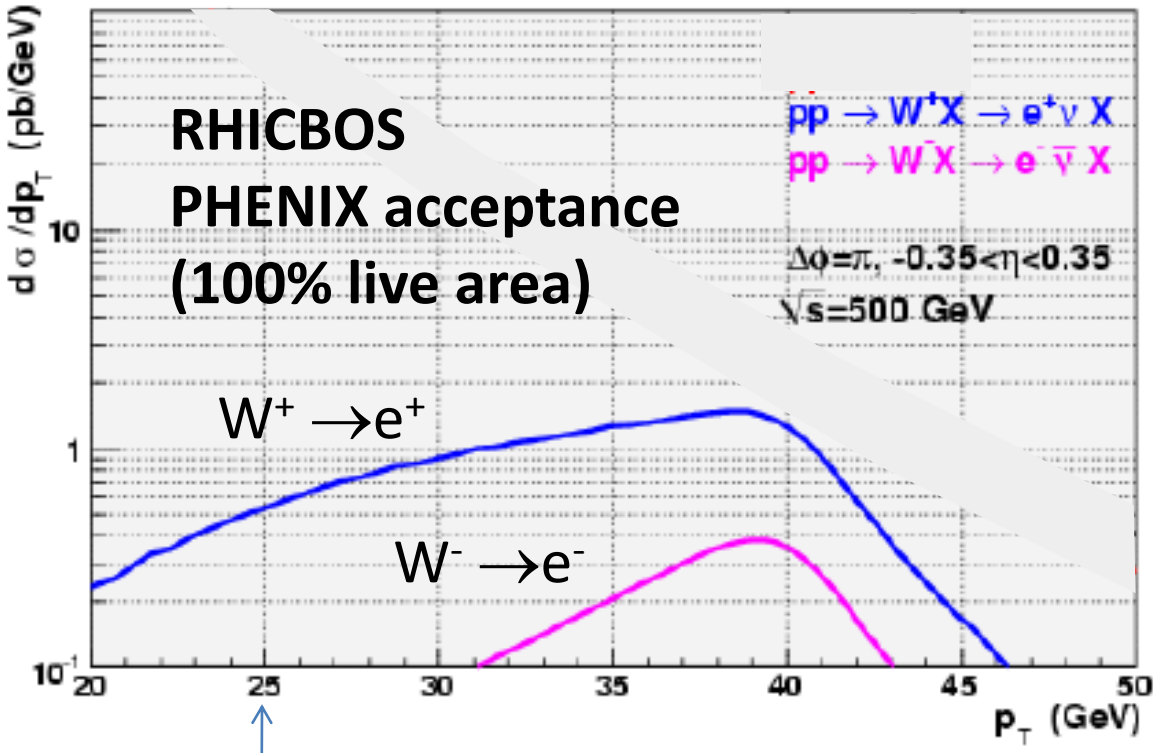
Vernier scan analysis is updated.

$\int L$ = 11/pb for the central arm analysis.

Because of the acceptance, ~60% of all collisions are available in the central arm analysis.



Expectations



pT> 25GeV

signal

e+ : 200

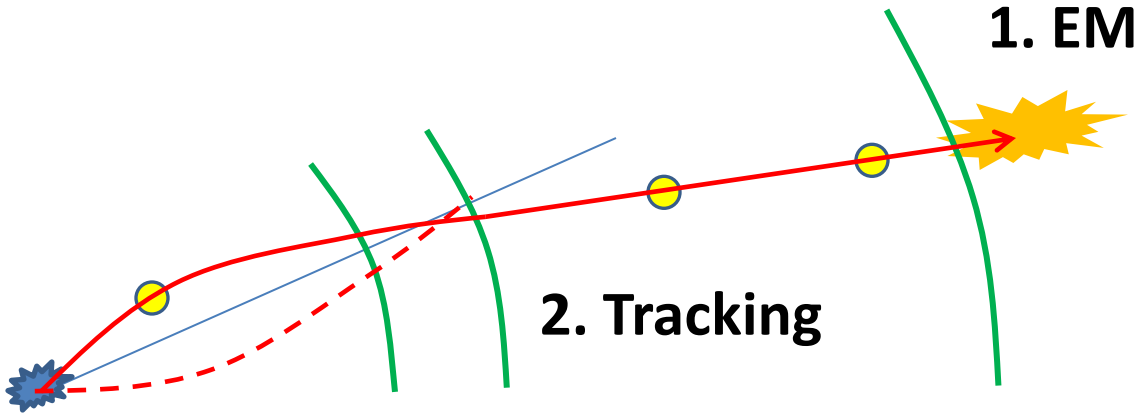
e- : 35

with 11/pb

Goals of Run9pp analysis

- Cross section measurement
  - To confirm our signal and to understand the background
- Spin asymmetry (A_L)
  - For a practice (W+ has a solid non-zero expected value.)

Analysis Outline



4. Event shape

— Integrated luminosity,
— Relative luminosity

Analysis issues

—Electron ID at this high energy (above 15GeV) .

Cerenkov counter (RICH) : charged pions are also above the threshold
Energy/momentum cut : It's not effective because of low momentum resolution (small bend) $\Delta p/p$~40%@40GeV.
EMCal shower shape : Efficiency evaluation at this energy region is difficult.

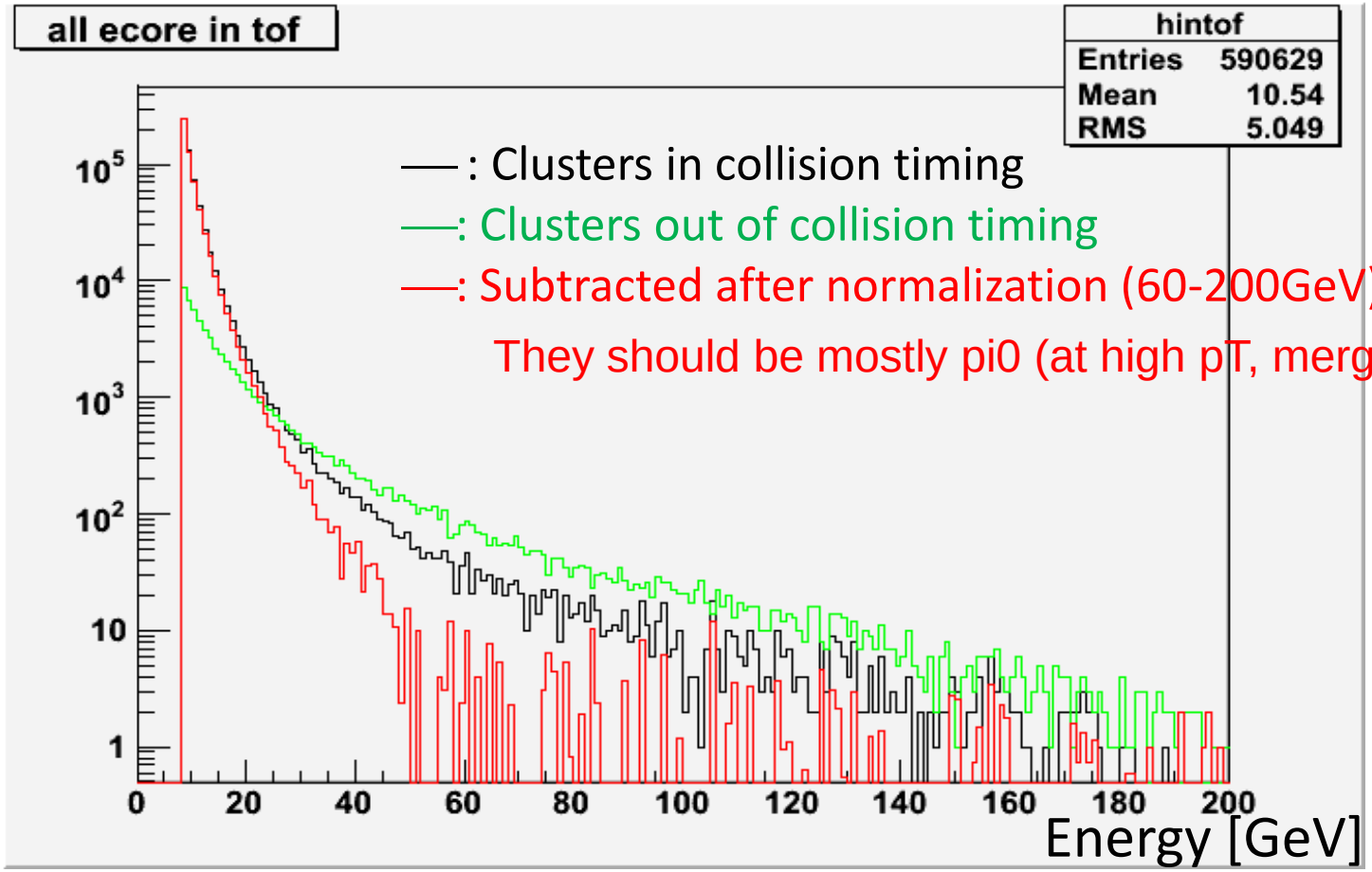
—Charge sign

Small bend : origin of the track, angle at the drift chamber

—High collision rate (~2MHz)

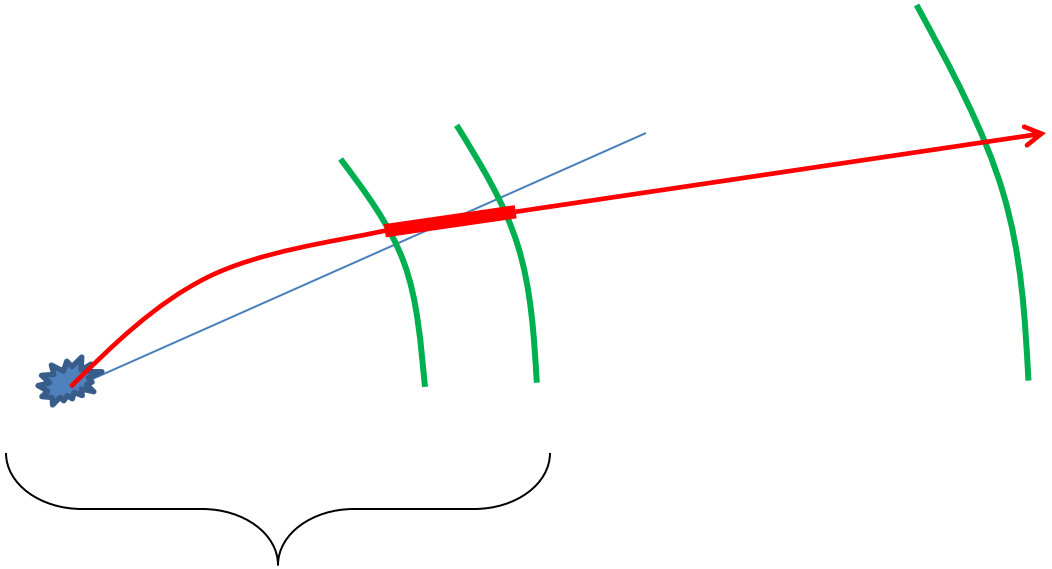
Multi-collision and pile up
BBC z-vertex position (calculated from the arrival times) is affected.

Raw EMCal hit



* Since cosmic rays hit EMCal from any direction,
  it is not necessarily the true energy deposit.
* Shower shape cut also reduces another factor 10.

Tracking

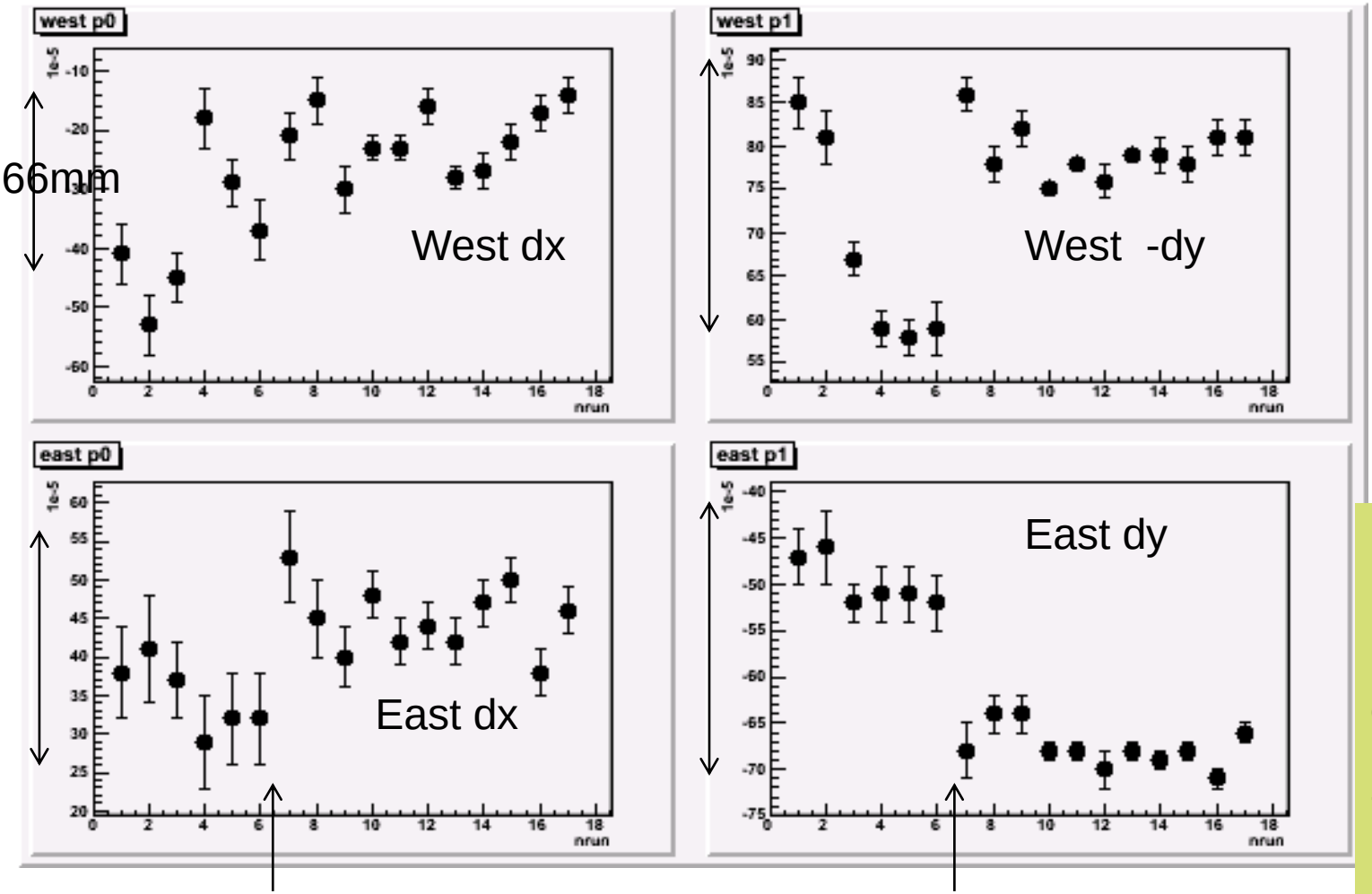


No inner tracking system (yet) in the magnetic field.

The origin (x0,y0) determination
DC angle resolution vs the integral of magnetic field

(x0,y0) determination

The shift to the nominal value from zero field runs analysis (#1~#17)
The east carriage was moved between #6 and #7.



East carriage maintenance.

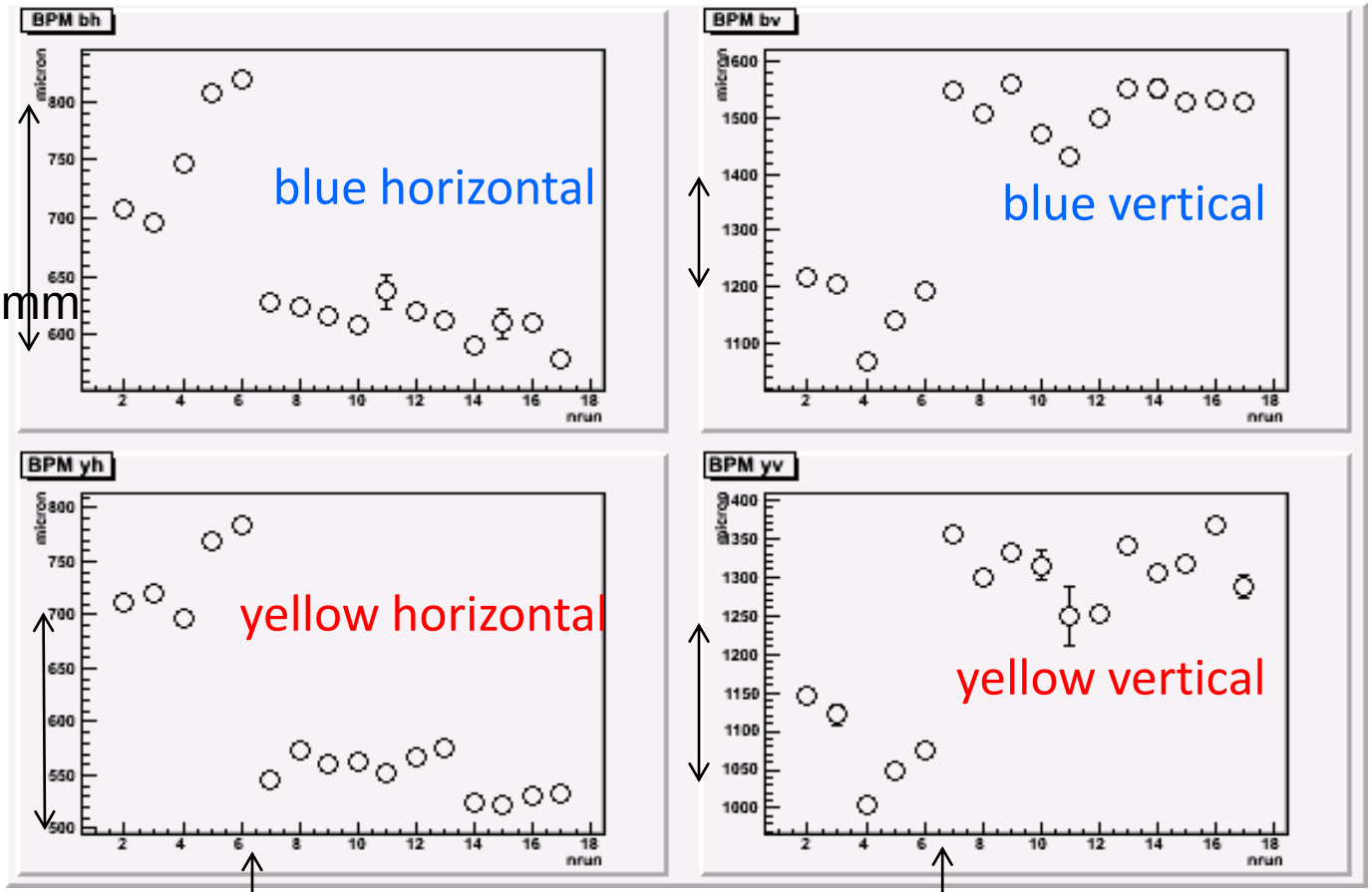
Carriage movement?

It is enough controlled.
(DC resolution ~2mm.)

Next page :
BPM data

BPM data

(blue,yellow)*(horizontal,vertical)*(north, south)



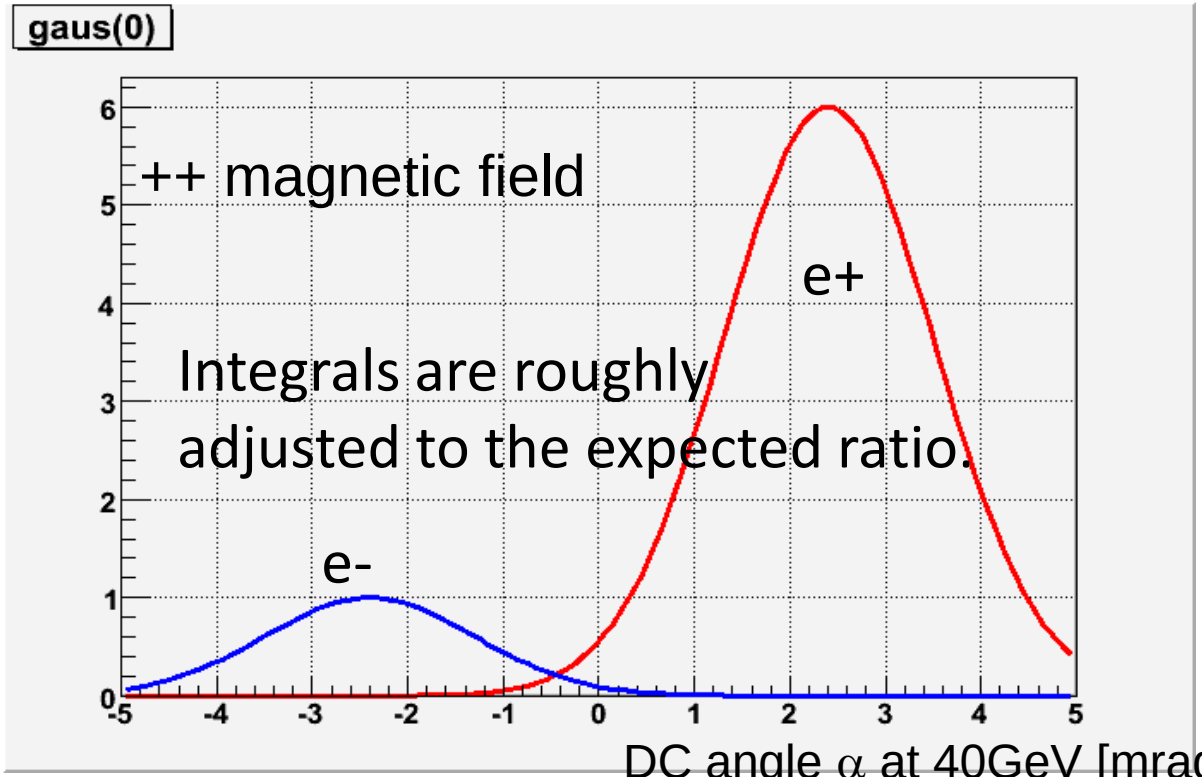
It doesn't need to be coincide with our arm movement

We suspect some beam parameter change at the maintenance day.

*The coordinates to be checked.

DC angle resolution

One track resolution

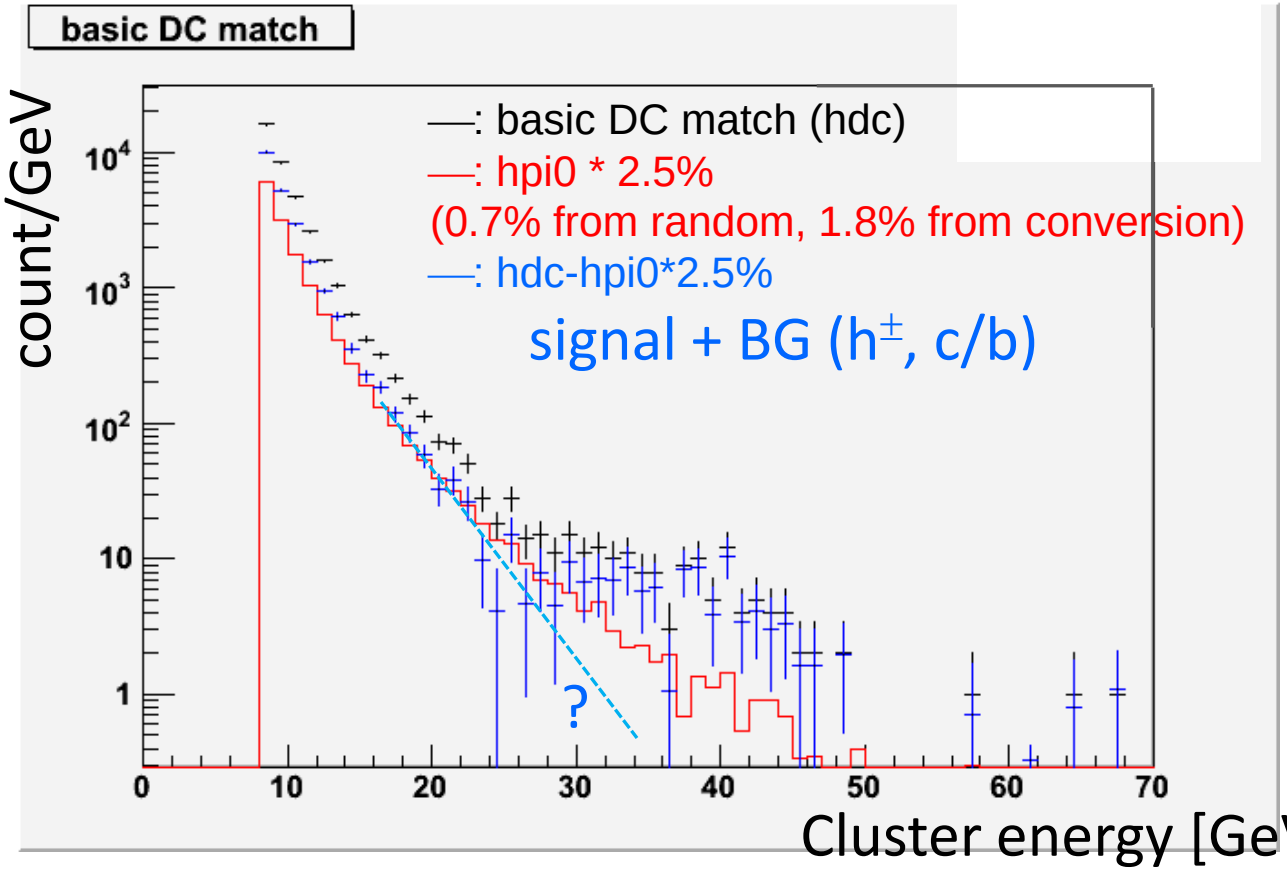


At 40GeV,
α=2.3mrad
($\propto$1/momentum)

dα=1.1mrad

2 sigma effect for the charge determination is expected.
e- has more contamination.

After charge track requirement



#signal (>25GeV) = ~120 (both charges)
This is roughly consistent with the RHICBOS expectation folded with our various acceptance and efficiencies.

* The final check of the acceptance is on the way.

Background components

- Accidental track match
  - Cosmic rays
  - pi0
- True track match
  - Charged hadron + hadronic shower
  - Pi0 decay + conversion
  - Charm/Bottom decay (true electrons)

True background

- Z bosons decay
  - Most likely we can't detect both leptons.
  - W/Z~10, but for $W^- \rightarrow$ electron, it's not negligible.
- W to tau, tau to electron
  - Small contribution?

Background estimation

- Data driven method
  - At PHENIX, away side cut introduces a bias
  - Adding up components
- Full MC
  - We need a careful control of every piece.

  (Jet production, fragmentation, hadronic interaction)

For the asymmetry

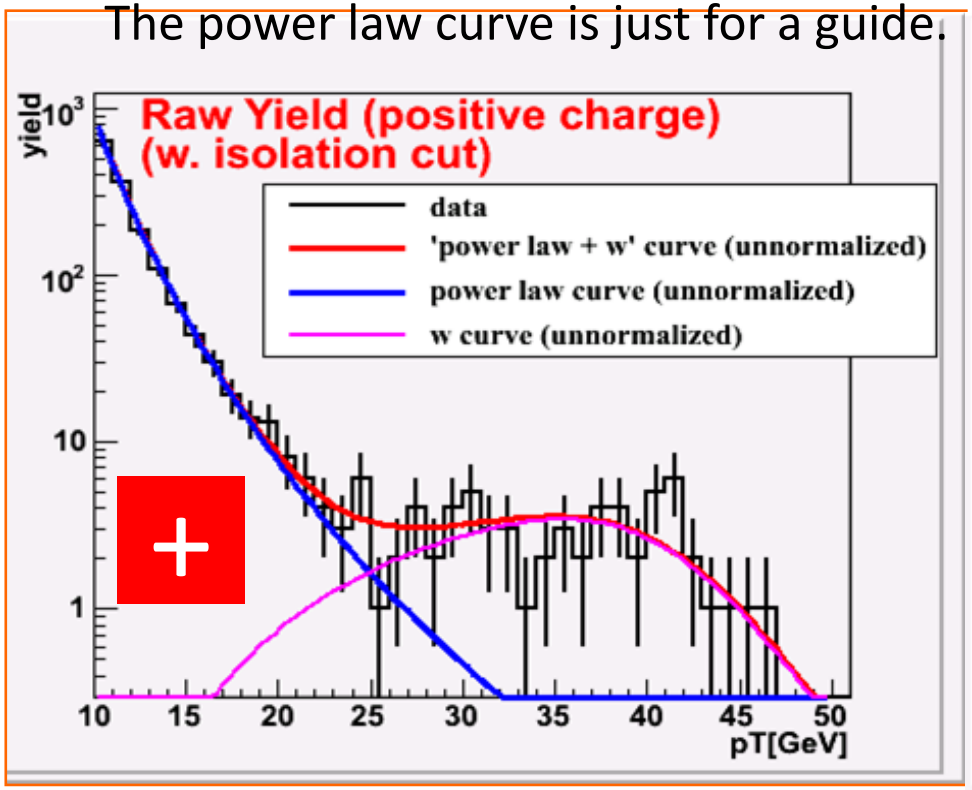
- Any cut can be applied to increase the signal to noise ratio, if it doesn't depend on the spin configuration.
- Less requirement to the efficiency evaluation.

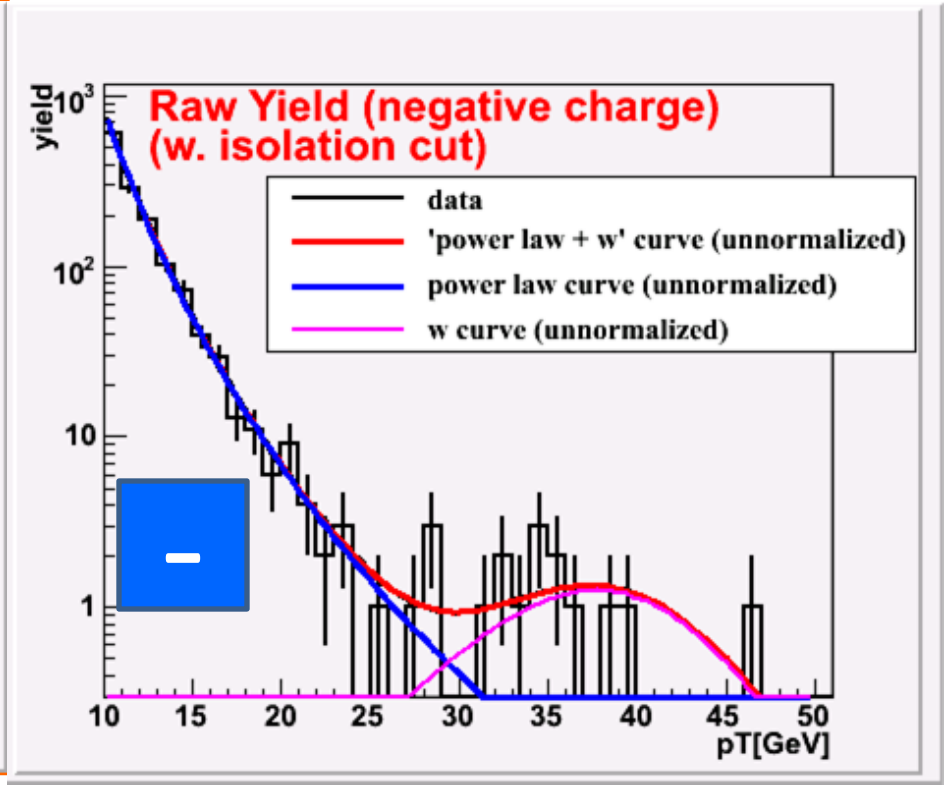
- For example, isolation cut, shower shape cut.

With an isolation cut

An isolation cut (near side) : Σ(momentum + energy) – target energy < 2GeV

The power law curve is just for a guide.





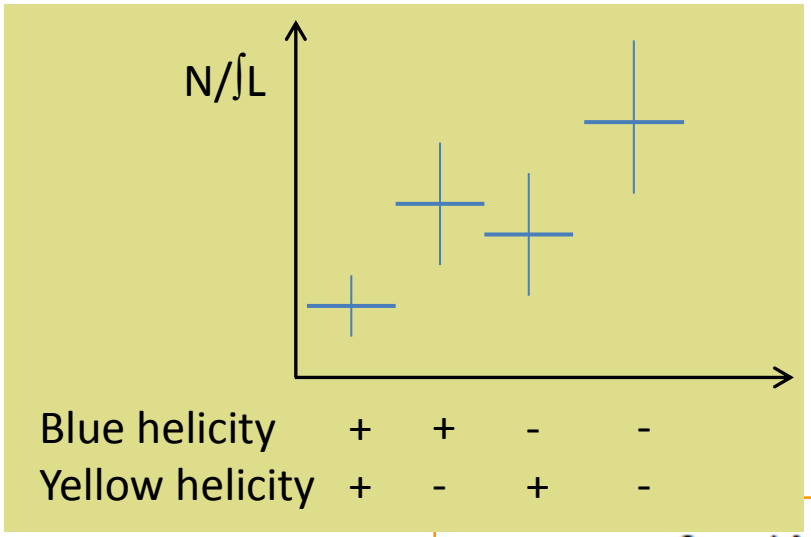
Rough numbers above 25GeV are

e+ : ~60

e- : ~20

Shown by Kenichi Karatsu at DNP/JPS

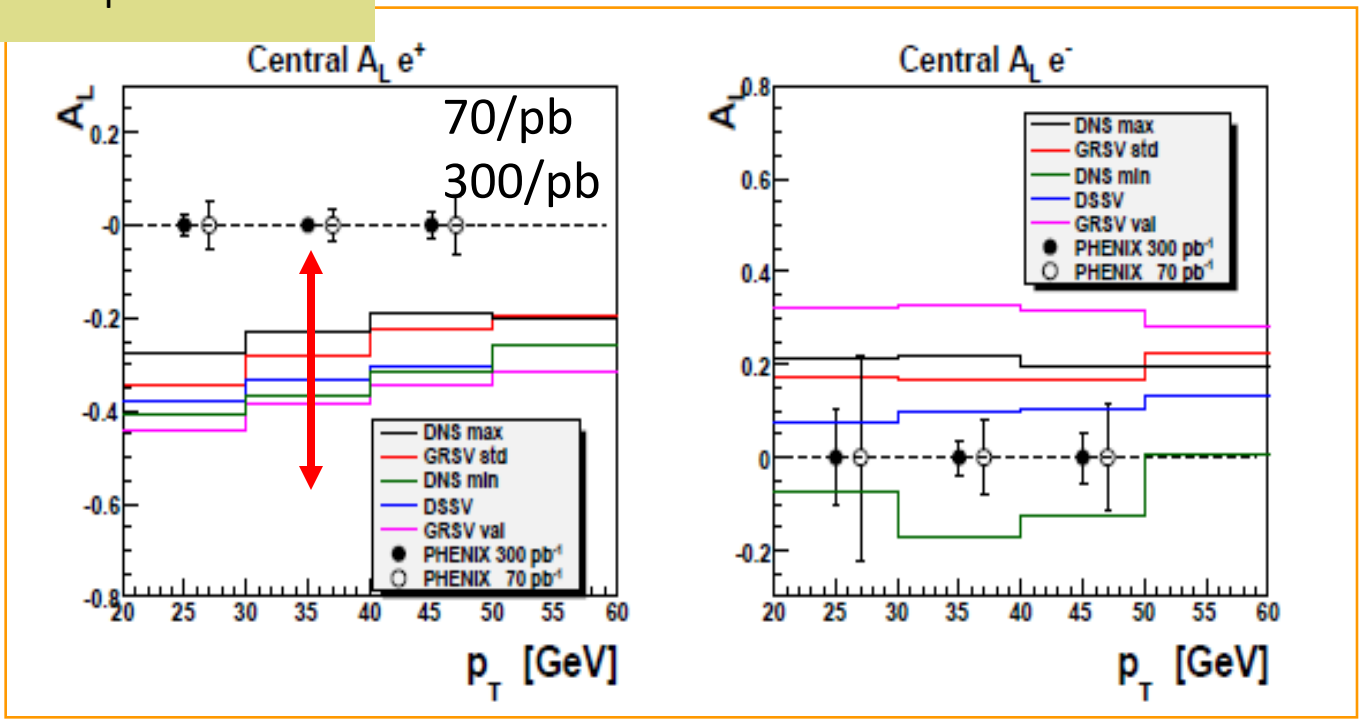
Central arm asymmetry calculation



$\delta A_L = 1/P*1/\sqrt{2N}$

P~35%, N~60 (e^+)

δA_L ~0.26



Next runs (central W)

In addition to the figure of merit (LP^2),

DC/PC repair work

$\rightarrow$ acceptance x2

VTX detector (inner tracker, ~2π coverage)

$\rightarrow$ for accidental match rejection (from z information)

$\rightarrow$ for better charge separation

$\rightarrow$ more efficient isolation cut

$\rightarrow$ only good for z in +-10cm. (It gets worse for the outside.)

Summary

- It isn't a blind analysis. We learned a lot about our detectors.
- It is because the analysis around 40GeV is a new region.

- I think we have collected all pieces of information for Run9 result.
- We start to organize them for the final result.