PHENIX Run-6 Summary& Plans

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RHIC Spin Meeting at Stony Brook

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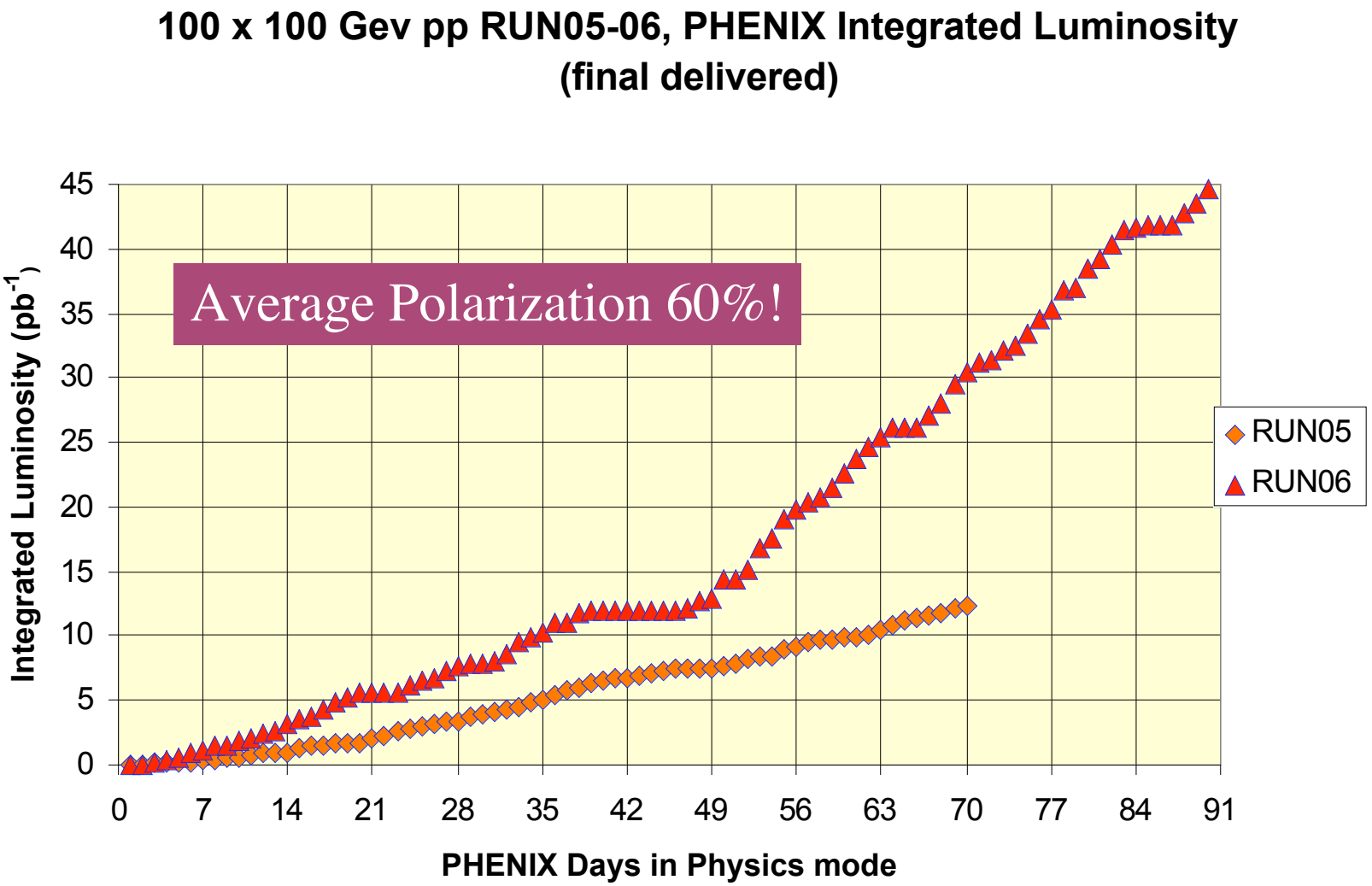
A walk through this talk

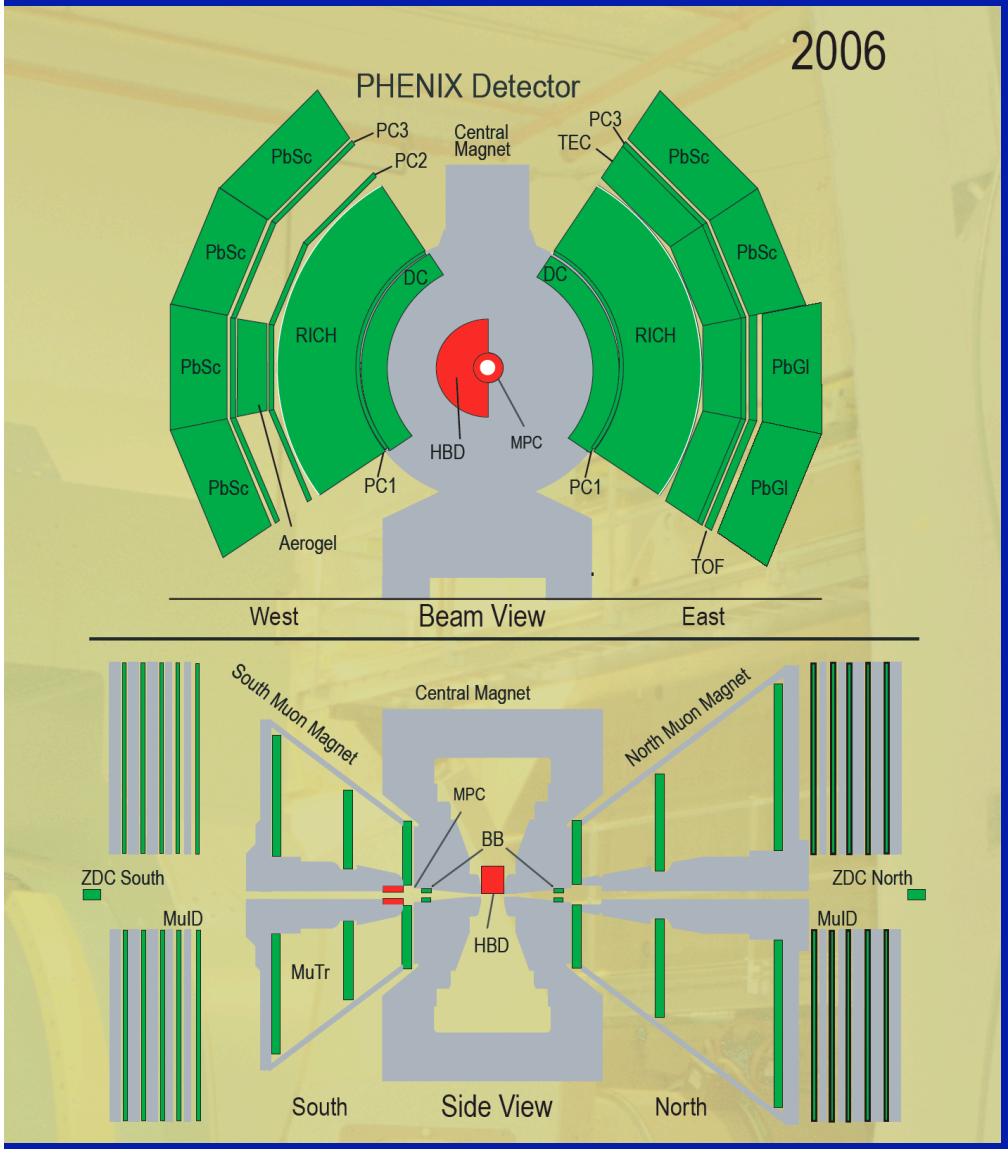
- PHENIX Run-6 planning and aspirations
- Run-6 Reality
  - Run-6 data summaries
  - Data handling, analysis plans & expected results
- Comments on various aspects of PHENIX and CA operations
  - Where do we (RHIC and experiments) **not** take data?
  - When & why does PHENIX **not** take data?
- Problems that need to be fixed within PHENIX
  - Worries about new detector insertion now and future
- Comments on Run-7,8 & 9

RHIC Luminosity Run-6 vs. Run-5

Plot by Phil Pile



PHENIX Detector in 2006



Central Arm Tracking

Drift Chamber, Pad Chambers

Time Expansion Chamber

$-0.35 < \eta < 0.35$

$\delta\phi \sim 90$ on each side (east & west)

Calorimetry

PbGl, PbSc

Particle Id

Muon Identifier: North Muon Identifier, RICH, TOF

TEC

Muon Arm Tracking

Muon Tracker: North Muon Tracker

Global Detectors

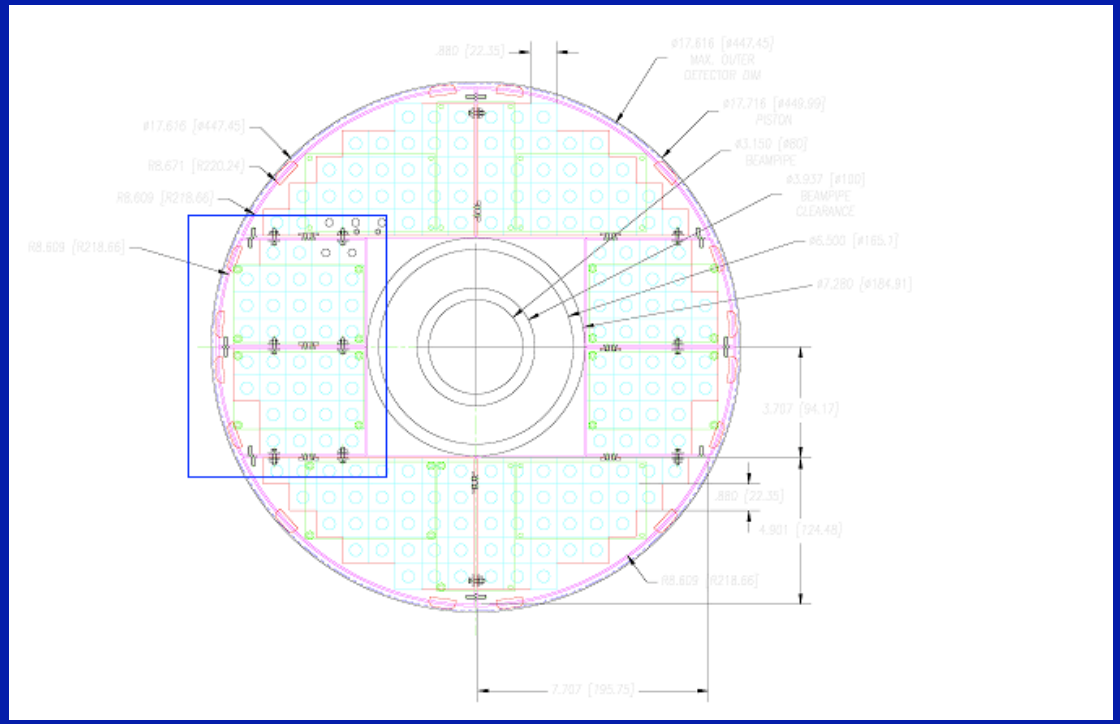
BBC

ZDC/SMD Local Polarimeter

Forward Hadron Calorimeters

Engineering Run for: Muon Piston Calorimeter (MPC) & Prototype Hadron Blind Detector (HBD)

THE MUON PISTON CALORIMETR



SOUTH INSTALLED IN RUN-6, NORTH EXPECTED IN RUN-7

PHENIX Run-6 Planning

From Run-3+4 to Run-5 we had achieved an improved figure of merit (P^4L) of ~25 for the longitudinal asymmetry physics (ΔG) program.

Based on CA projections another such factor seemed unlikely, and the cold snake had only given us ~50% polarization

What qualitatively new physics could PHENIX pursue in a short pp run?

Transverse physics with back-to-back pion correlations

A short 62.4 GeV pp run for comparison with HI data

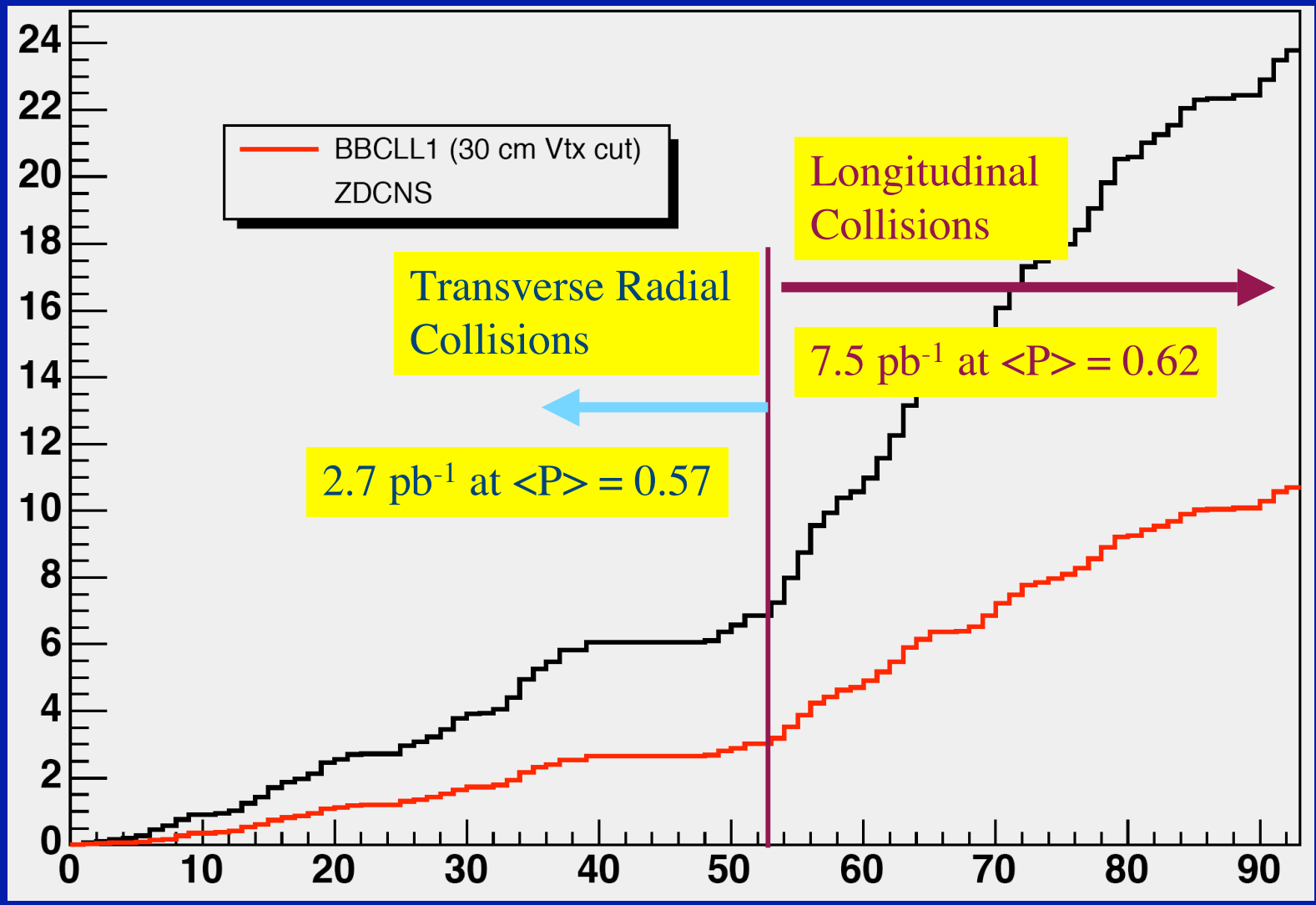
Machine studies for 500 GeV program

Proposed and supported a (1 day test + 2 day operations) of 22 GeV CM Collisions

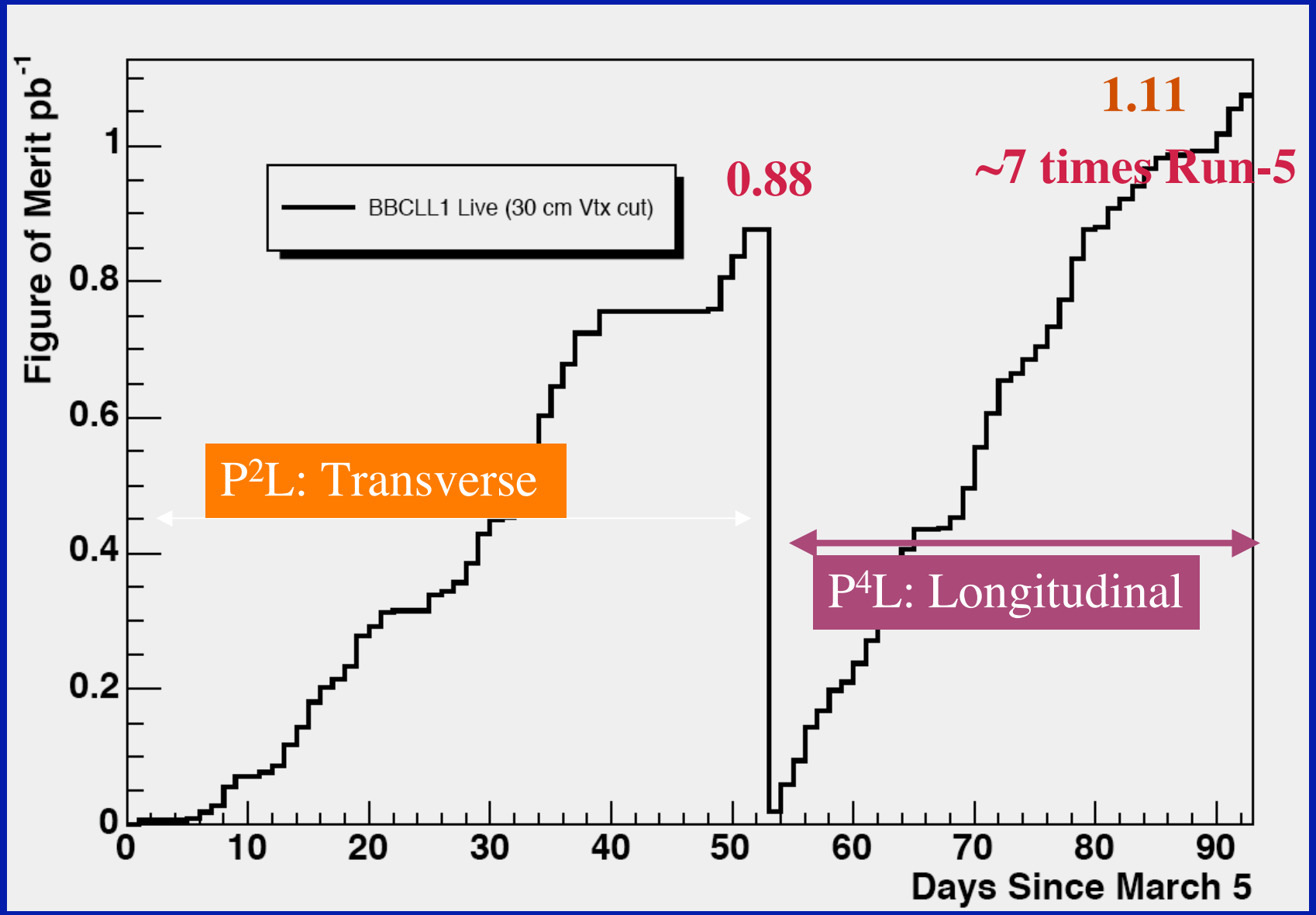
If remaining time was not enough for a change of species accumulate luminosity and polarization towards the ΔG program

PHENIX Operations & Run-6 data

PHENIX Accumulations at 200 GeV

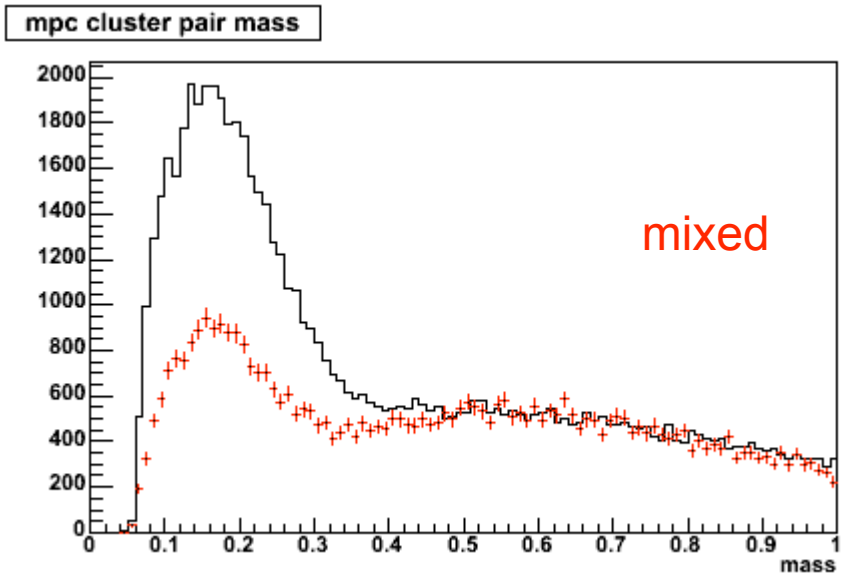


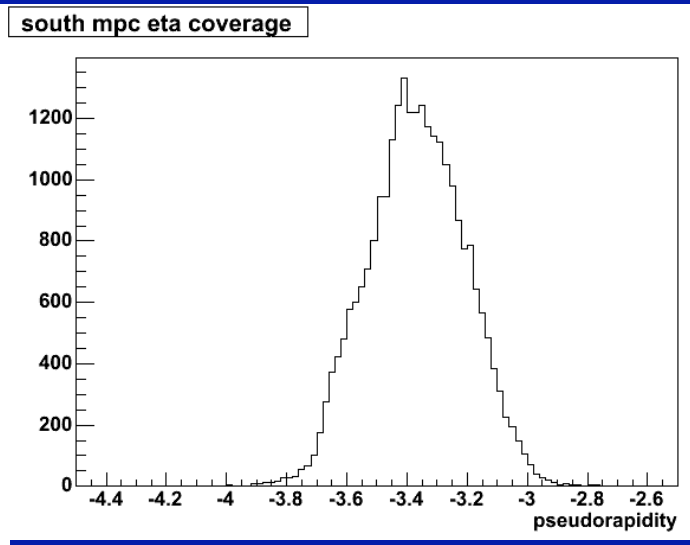
Run-6 Data Figure of Merit

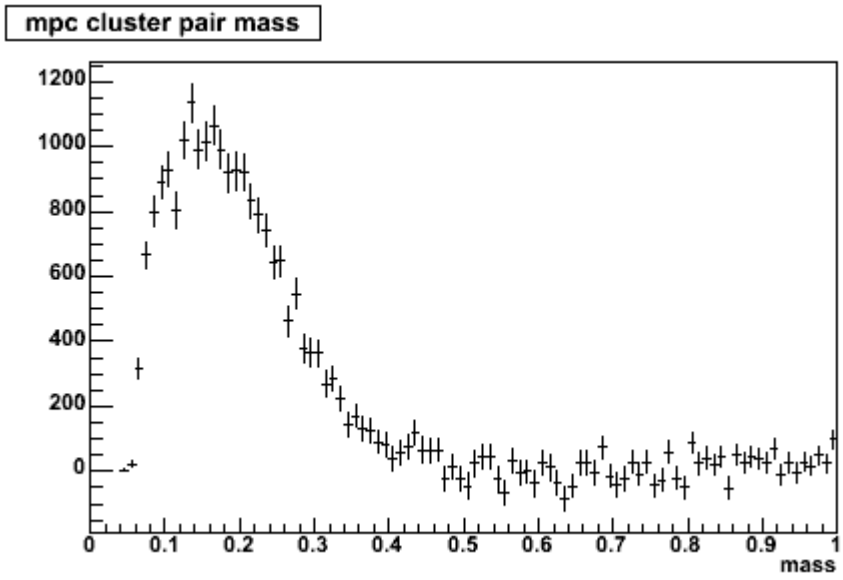


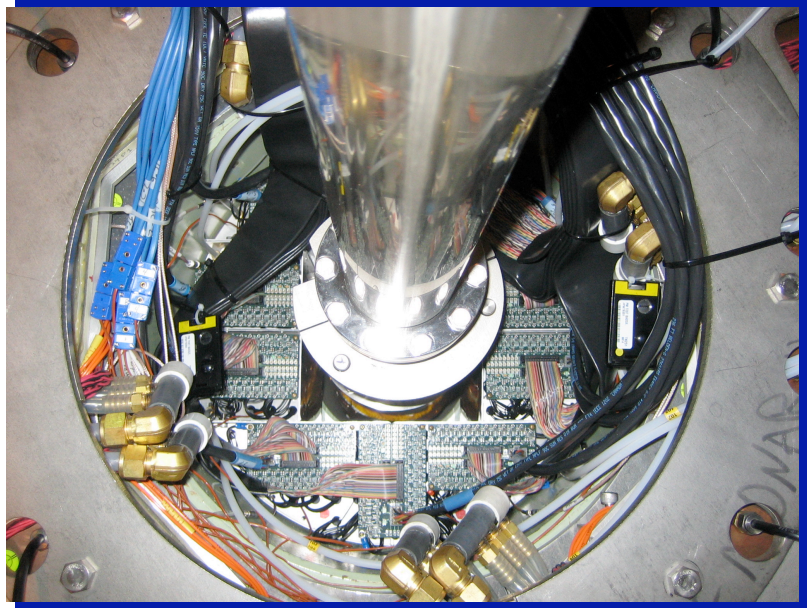
62.4 GeV operations

- **Principle Aim: To get a comparison data set for HI Au-Au and Cu-Cu data at the same CM energy**
  - Any data set around **100 nb^{-1}** was the goal, and this was reached
  - As a secondary goal, we would have liked to see ~150 nb^{-1} longitudinal polarized collisions to measure ΔG in a different kinematic region
    - This was not reached, but a good data set with about **80 nb^{-1} LONGITUDINAL luminosity** is on tape
    - **20 nb^{-1} with transverse collisions** allowed to see first results from the MPC (muon piston calorimeter)
- While the operation was marred by frequent interruptions and I still believe that over all this was a successful run for PHENIX, in spite of lower than expected spin data.


mpc cluster pair mass
mixed
mass

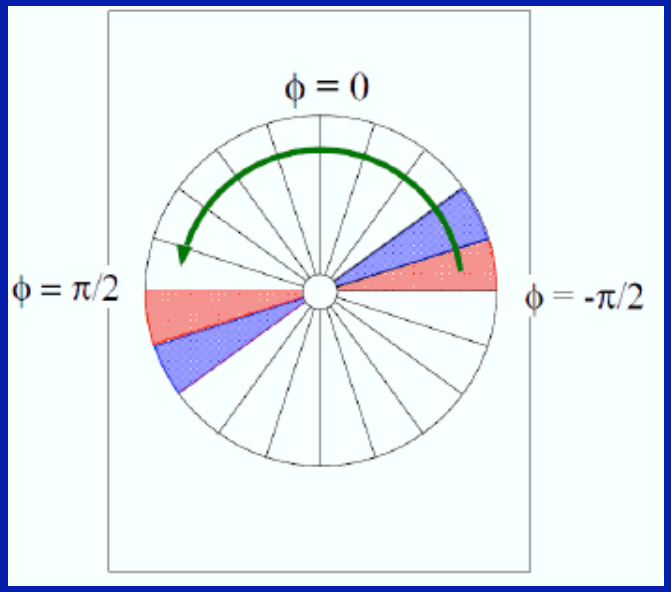

south mpc eta coverage
pseudorapidity

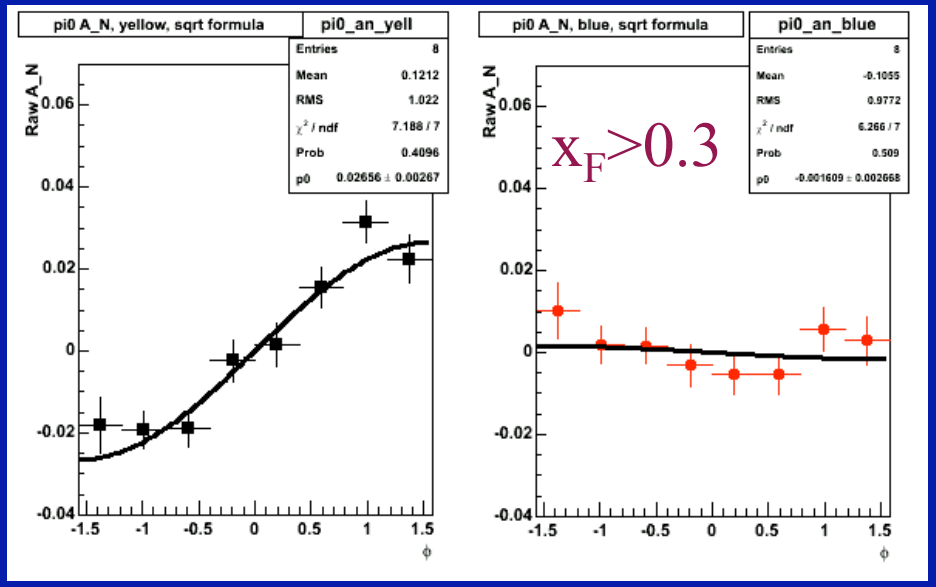

mpc cluster pair mass
mass



MPC Left-Right Transverse Asymmetry

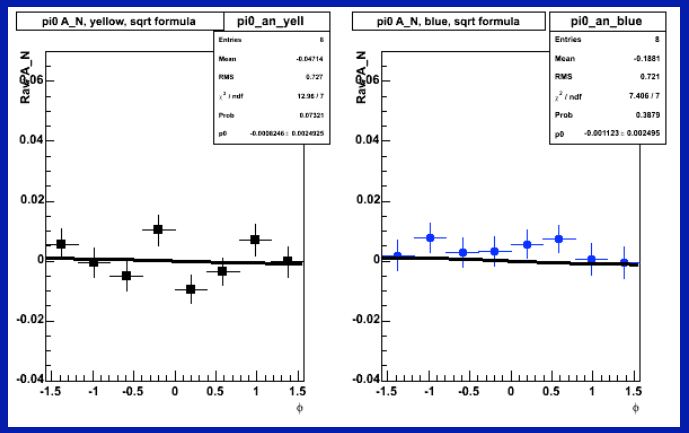
$$A_N \equiv \frac{1}{P}\frac{\sigma_\uparrow - \sigma_\downarrow}{\sigma_\uparrow + \sigma_\downarrow} \approx \frac{1}{P}\frac{\sqrt{N_L^\uparrow N_R^\downarrow} - \sqrt{N_L^\downarrow N_R^\uparrow}}{\sqrt{N_L^\uparrow N_R^\downarrow} + \sqrt{N_L^\downarrow N_R^\uparrow}}$$

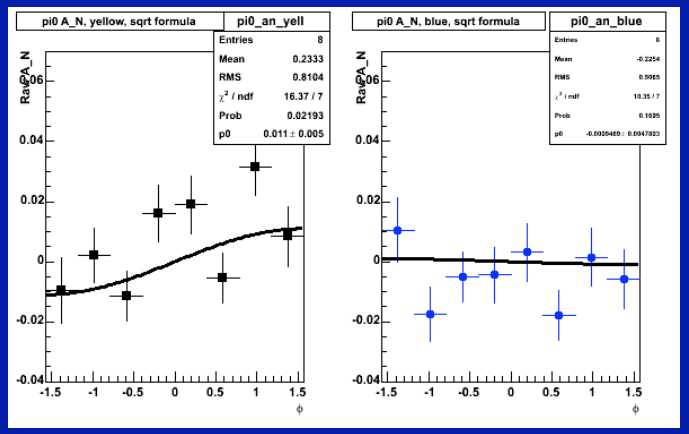


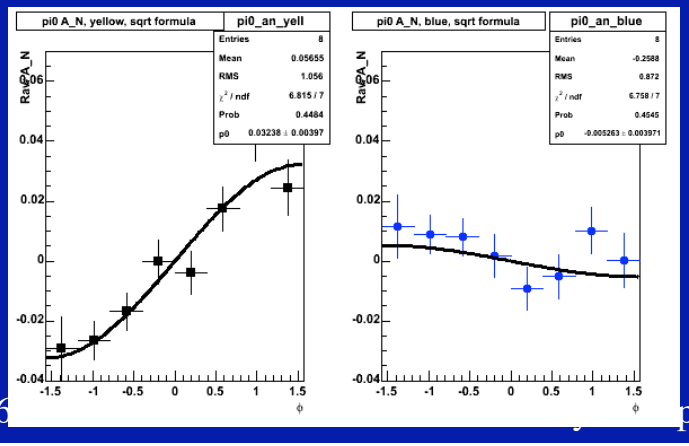


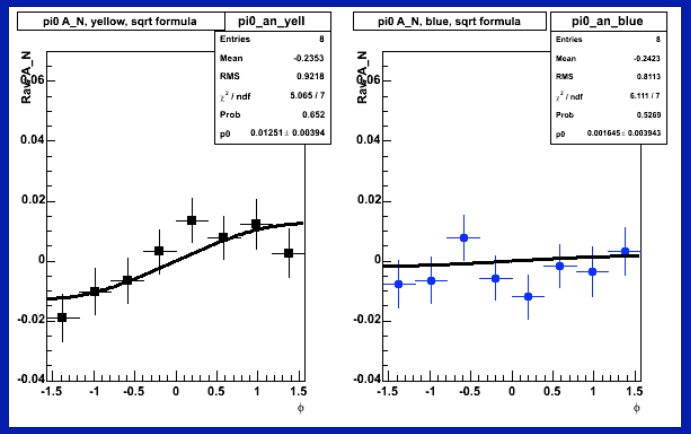
- Asymmetry seen in yellow for high xf, not in blue
- Using runs 20596, 20597, 20598 (transverse 62 GeV)
- 3x4 tower sum clustering, no splitting
- cuts: mass > 0.01 && mass , 0.30
- no bkg subtraction, yet

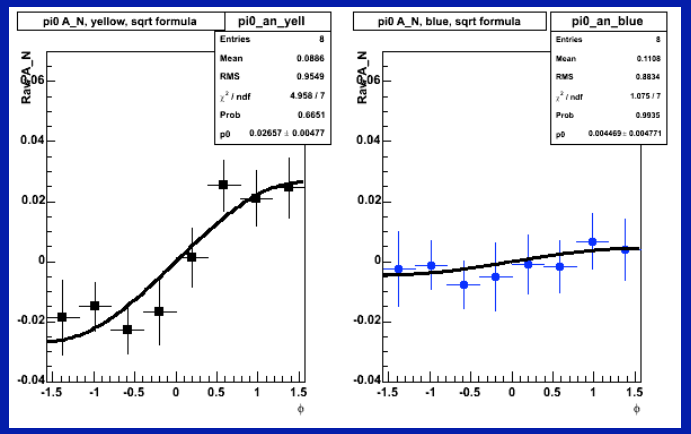
MPC 62 GeV Transverse Asymmetries





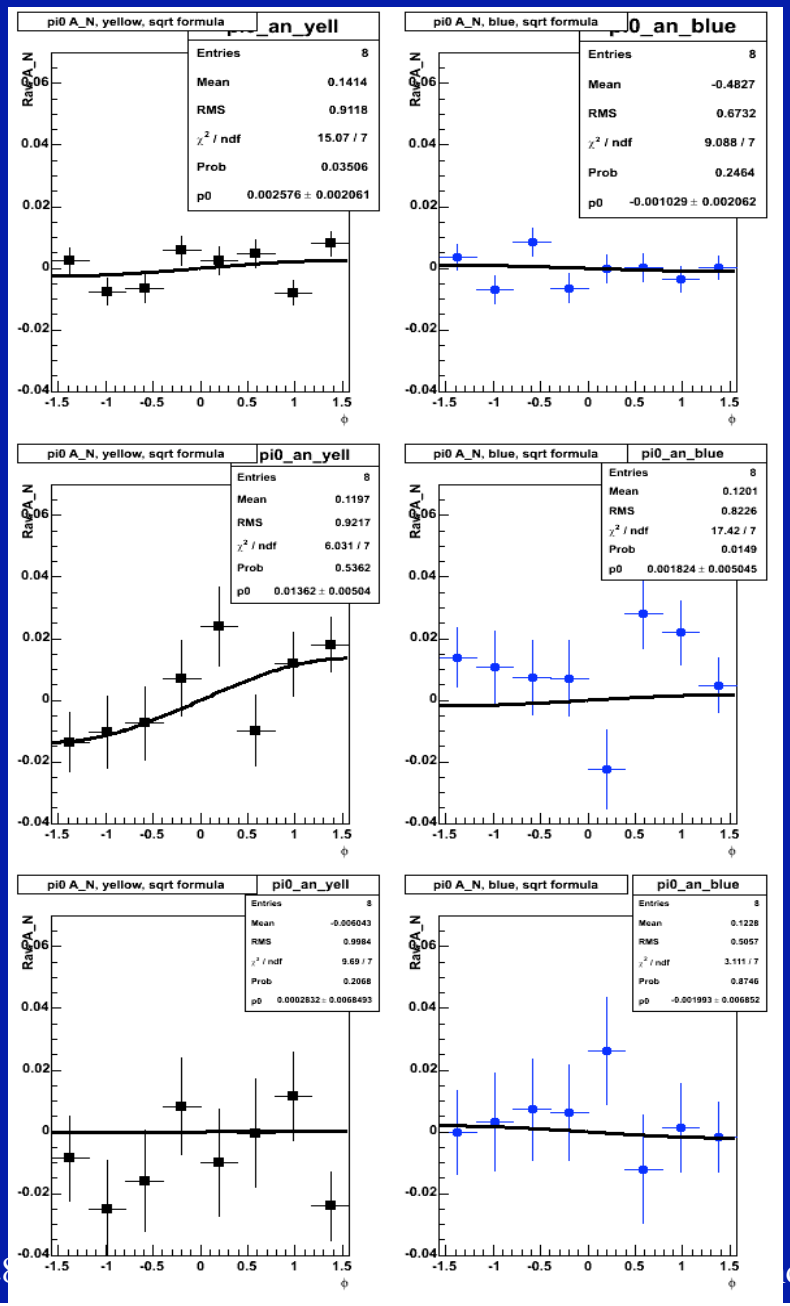


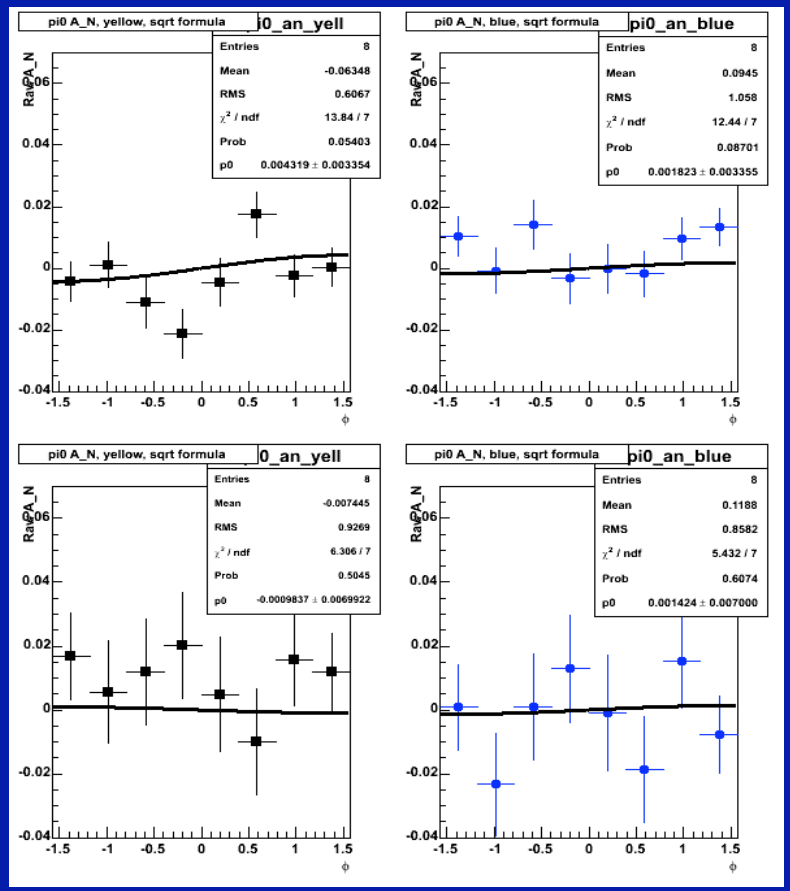




asymmetry only in yellow
A function of x_F

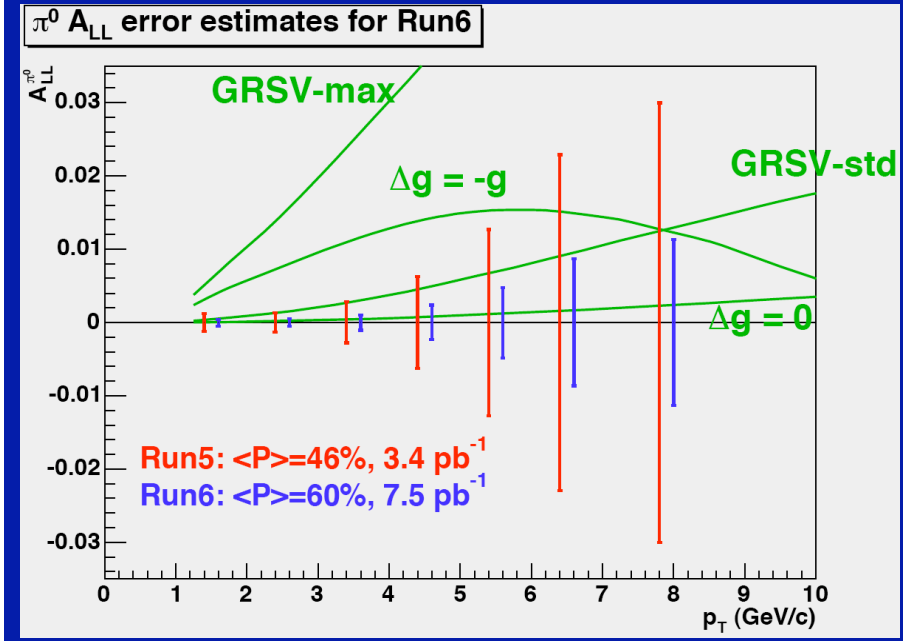
MPC 62 GeV Long. Asymmetries

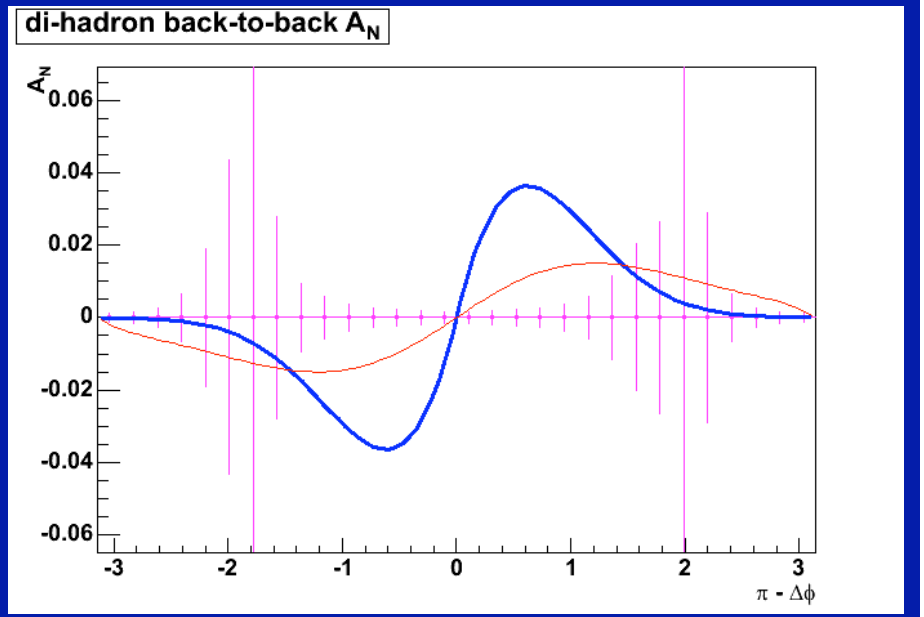




asymmetry disappears!

Expected Spin Results from this run….





Others include: (not shown)

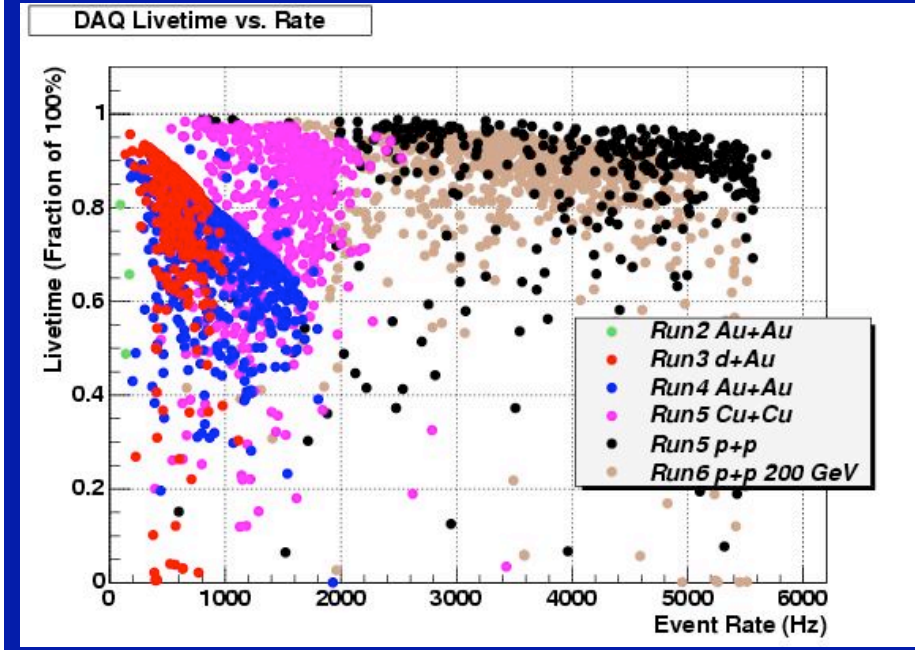
1) longitudinal double spin asymmetry at 62.4 GeV,
2) first spin results both in longitudinal & transverse operations from the muon arms,
3) And the HI physics related results from comparison of ongoing 62.4 GeV

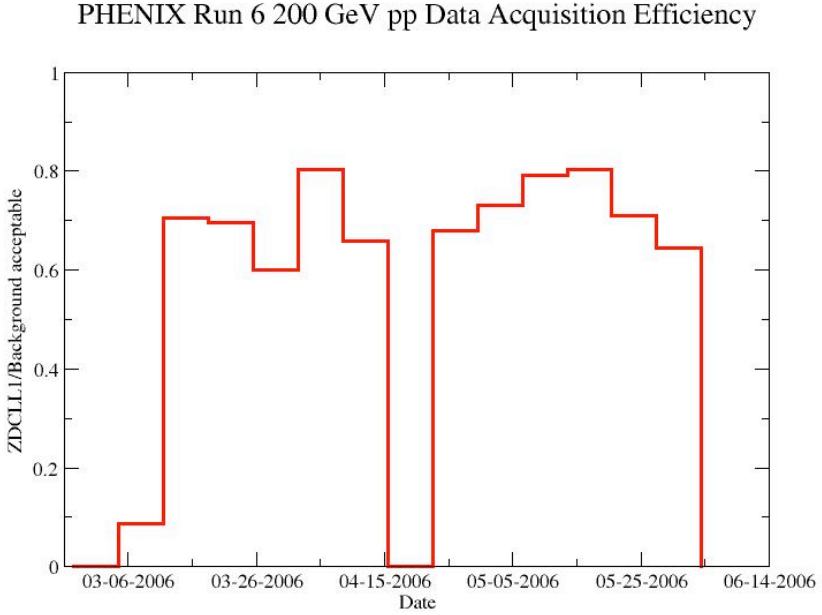
PHENIX Operations

PHENIX Operations Crew in Run-6

- **Run Coordinator (for the run)** + Operations Manager
- **Supported by a Superb technical support teams from CA and 1008**
- **2-week long** duties of **Period Coordinators**
- **Weekly** shifts: **Shift Leader and DAQ Operator**
  - Supported by 3 more people supporting: Detector monitoring, Online Detector Response monitoring and Data handling
- Watch Shifts with SL and 2 support personnel began February 5, 2006
- **Detector Specialists Shifts** of 2 weeks at a time **on call**
- Full shift operations began February 20, 2006
- CAD declared physics March 5, 2006
- PHENIX declared physics March 8, 2006, although PHENIX was already taking data on March 5 when physics was declared by CA.
- **>300 of the PHENIX collaborators were at PHENIX this run one time or the other!**
  - ***As evidenced by sometimes having a difficulty in getting a parking spot near the PHENIX counting house***

PHENIX Run-6 Operations…..





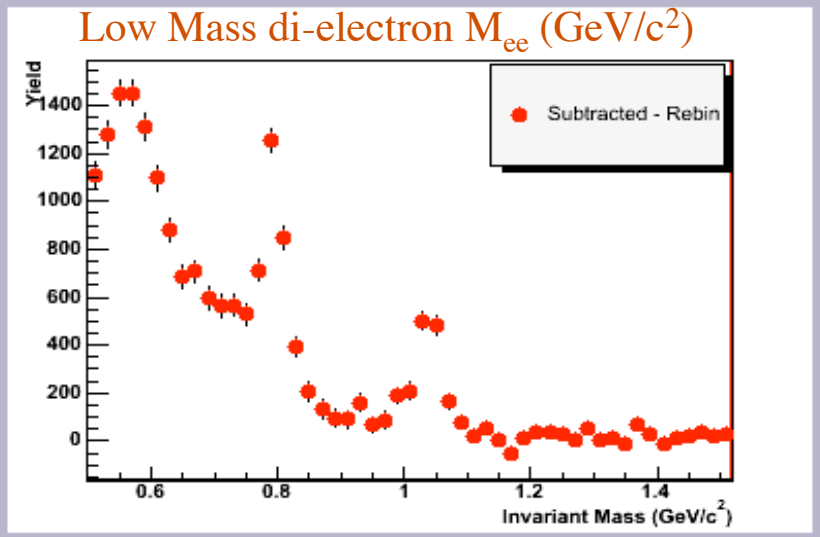
Routine operations with DAQ live fractions times > 80-90% at DAQ rates of (2.0-5.5) kHz

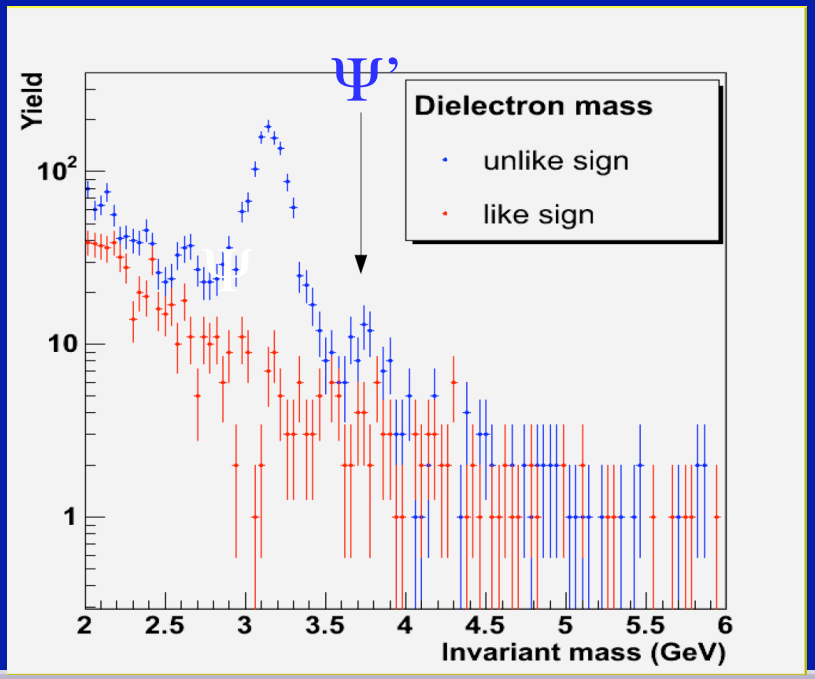
DAQ operational 70-80% (when backgrounds acceptable)

Overall PHENIX DAQ experience was much more enjoyable than the first few years! (comments by our shift crew)

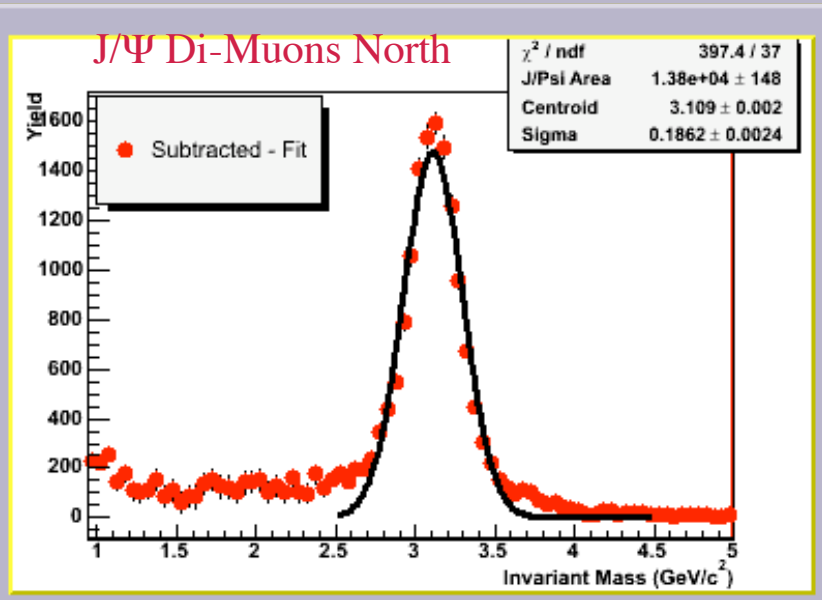
Level 2 Filter

Low Mass di-electron M_{ee} (GeV/c^2)

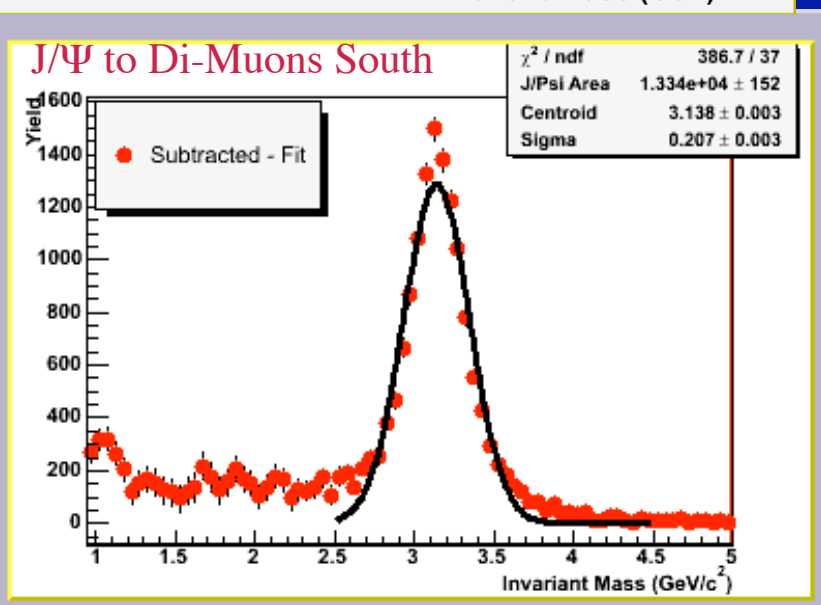




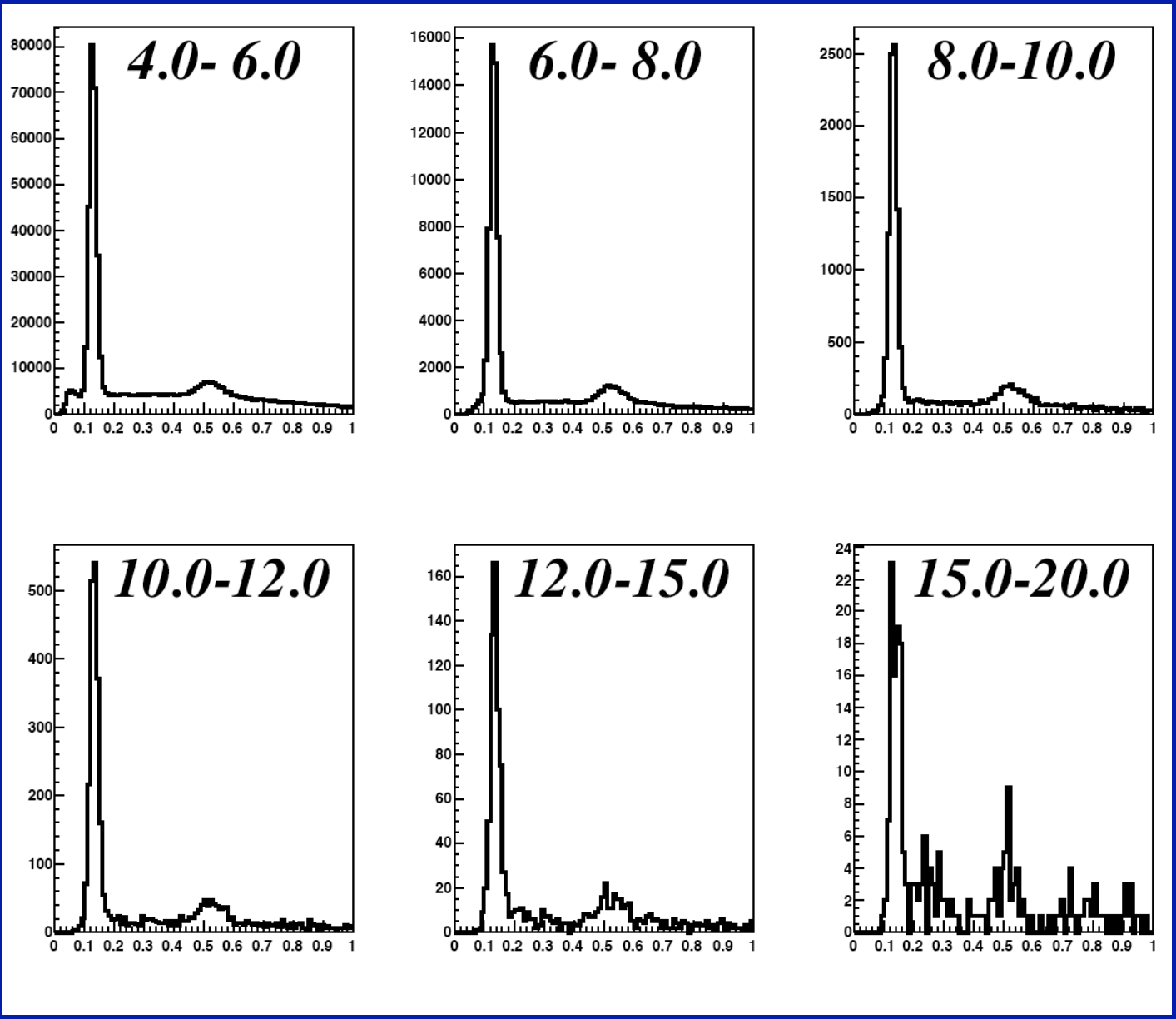
J/Ψ Di-Muons North



J/Ψ to Di-Muons South

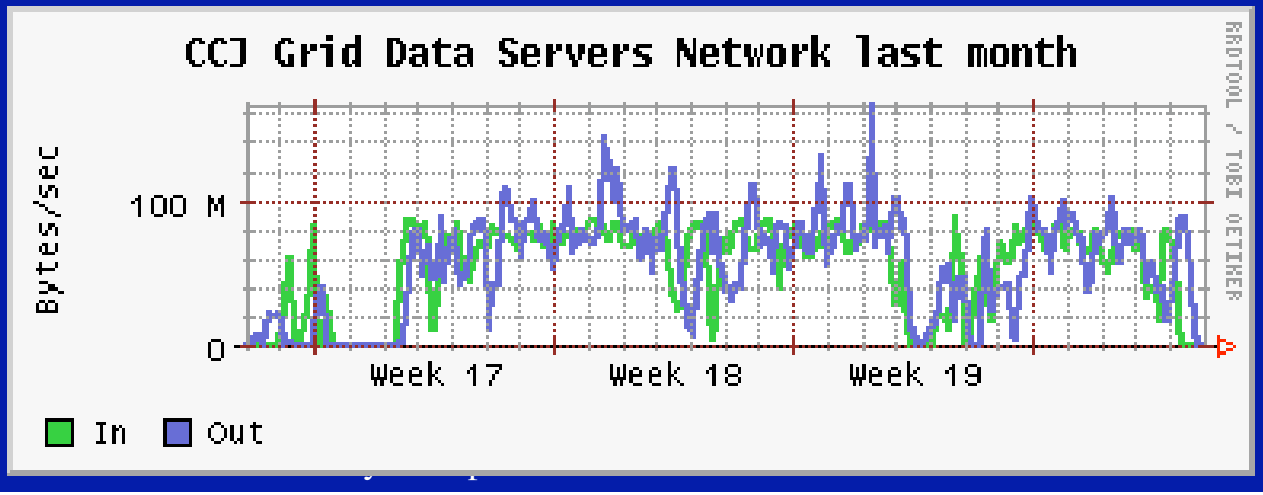


Level 2 filter: $\pi^0 \rightarrow \gamma\gamma$, $\eta^0 \rightarrow \gamma\gamma$



Data Production Plans

- PHENIX Aim: *to finish the production of all its data including the Run-6* ***before*** *the start of Run-7*
- Production of Run-6:
  - RCF (200 GeV CM, transverse radial data set)
  - CCJ/RIKEN (200 GeV CM, longitudinal data set)
  - PHENIX Local farm (62.4 GeV data set)
- Data has been routinely transferred at 80MB/sec to CCJ, and the production will start next month.



New Detectors….. Towards RHICII

- With the large number of new detector systems being planned to be inserted in PHENIX in the next few years, we need to pay special attention to the process we have in place for this.

- Well planned insertion and commissioning of detectors will be extremely important to avoid conflicts between crucial data taking **and** enhancing detector capabilities.

- Simple modifications and extensions of the already existing procedures will be do the job.

Inclusion of New Detectors

- MPC and HBD included in PHENIX in Run-6, both essential for our present and future physics
- Evaluation including safety & design issues before their insertion in PHENIX IR **was extensive & thorough!**

HOWEVER:

- Process of insertion for MPC and HBD was **inefficient**
- **PHENIX management has taken note of this in the PHENIX closeout, and will act on improving this process in future.**

Comments on CA-PHENIX communication (A)

- Daily meetings 8:30 CA meetings: Future RCs or/and PCs need to attend
- Scheduling Physicist Extremely efficient and proficient!
  - Weekly meetings: RCs and Scheduling physicist
  - Email & cell phone communication effective
  - ***Occasional visits by scheduling physics to PHENIX counting room welcome!***
- Weekly Time and Scheduling meetings (Phil Pile Meetings)

- APEX Machine Experiments schedules: **No complaints**
- Weekly, bi-weekly, tri-weekly scheduled maintenance
  - Should try to minimize interruptions
  - Weekly to start with, twice a moth a little later, and then once in three weeks from mid-run onwards
- Consider longer but fewer scheduled maintenances:
  - Jump from 68 nb-1/day to 250 nb-1/day post STAR accident
  - Why was that? Was it the maintenance time windfall of ~7 days?

A- and below

- MCR to SL communication
  - A lot of this depends on personalities
  - Generally PHENIX SL and MCR communication was very good
  - The experienced PHENIX SLs were missing towards the end and did cause some communication problems.
- Polarization measurement:
  - **Even if it is on fixed times, I recommend HIGHLY that MCR should call EXPERIMENTS no matter what.**
    - Repeat measurements always a problem
    - SLs would have a hard time judging the quality of polarization measurement and hence the chance of a repeat measurement
- Vernier scans
  - Were great when Angelika D. was in charge
  - We regretfully saw ONLY THOSE VSs to be good.
  - **Widen this expertise next year**

ACCEPTED RECENTLY BY PHENIX EC

A possible 5 year scenario….

Run 6	***12 wks pp 200 GeV (10/pb)*** ***2 wks pp 62.4 GeV*** ***22 and 500 GeV development***
Run 7	**15 wks 200 GeV Au-Au run HBD, RP (1/nb Run4=0.24/nb)** **10 wks 200 GeV pp (25/pb)** **? Wks 22, 500 GeV development**
Run8	**10 wks 200 GeV d-Au with HBD (28/nb, Run3=2.7/nb)** **10 wks pp 200 GeV** ***5 wks ?? Something else? Species Center of Mass Energy?***
Run9	**15 wks Au-Au low & high energy operation, partial VTX upgrade?** **5(?) wks pp 200 GeV (with VTX upgrade)** **5(?) wks pp 500 GeV (first physics) (commissioning Mu Trig vs VTX)**
Run10	13 wks of 200 GeV UU with VTX & Muon Trigger 12 wks 500 GeV pp VTX and Mu Trigger complete
Run11	15 wks 200 GeV UU with VTX barrel + EndCap + Nose Cone 10 wks 500 GeV pp

My good luck wish for the future:

You do not need the Santa!