Dielectron Continuum in p+p Collisions

√s = 200 GeV measured by the PHENIX using Hadron Blind Detector

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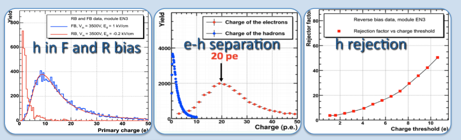
Di-electrons are among the most promising probes for studying the early, hot and dense stages created in relativistic heavy-ion collisions. They are color neutral and so interact only electromagnetically, thus carrying to the detectors information about the conditions and properties of the medium at the time of their creation. The di-electrons are emitted over the entire space-time evolution of the collision and their spectrum thus carries a wealth of information. PHENIX has measured a large, unexpected enhancement in Au+Au collisions in the low mass region (0.2 – 0.8 GeV/c^2), with respect to the baseline cocktail scaled from p+p collisions. However, this result suffers from a large systematic uncertainty due to the huge combinatorial background of uncorrelated pairs from partially reconstructed π^0 Dalitz decays and γ-conversions.

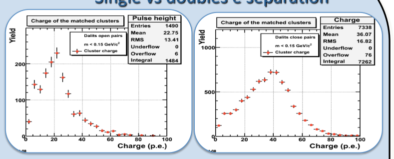
To combat this challenge, PHENIX installed a hadron blind detector(HBD) for the 2009 and 2010 RHIC runs. Its purpose is to tag and reject the combinatorial background coming from these decays. A reliable analysis of the 2010 Au+Au data hinges on a complete understanding of the HBD and its unique characteristics. The 2009 p+p run serves as a crucial testing ground for understanding the systematics associated with this novel detector. The proof-of-principle obtained in the p+p HBD analysis is presented in this poster.

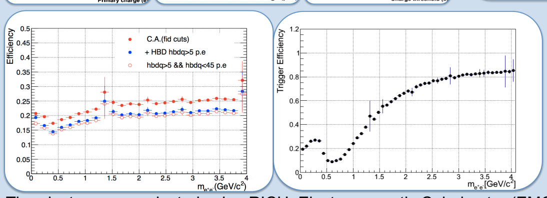
Analysis Details

Hadron Blindness



Single vs doubles e separation

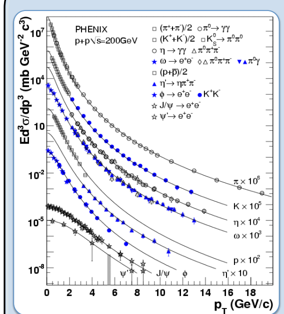




• HBD performed in p+p collisions as expected.
• Good electron-hadron separation and singles vs double separation

• The electrons are selected using RICH, Electromagnetic Calorimeter (EMCal) and HBD. The 2009 p+p data was collected using a cut off of 600 MeV on the energy deposited in EMCal and so referred to as Trigger data set.
• The data is then corrected for various effects such as reconstruction efficiency, eID efficiency pair efficiency, detector dead areas and Trigger efficiency using a full Monte Carlo simulation of the PHENIX detector

Hadron Cocktail



•Charm and beauty contributions were generated using MC@NLO which is next-to-leading order calculation.

•Fit the π^0 and $\pi^{\pm}$ data using the modified Hagedorn functional form.

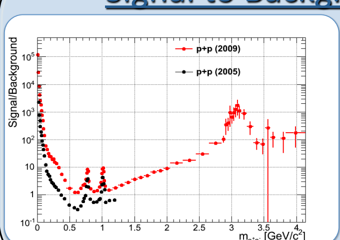
$$E\frac{d^3\sigma}{dp^3} = \frac{A}{\left[e^{-(a\cdot p_T + b\cdot p_T^2)} + \frac{p_T}{p_0}\right]^n}$$

Other mesons
• For other mesons, use m_T scaling of π^0

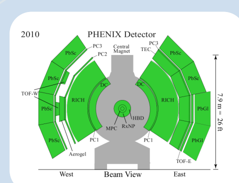
$$p_T \rightarrow \sqrt{p_T^2 - m_{\pi^0}^2 + m_{hadron}^2}$$

• Fix the normalization using the existing data measured using hadronic/leptonic channels
• Put the Ideal PHENIX acceptance filter.

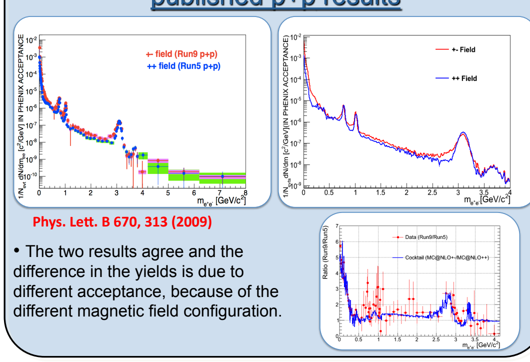
Signal to Background



•At this preliminary stage, even with a very crude single/double rejection cut of 45 p.e and without applying any open Dalitz cut, we observe an improvement of signal-to-background by a factor of ~ 5 compared to PHENIX 2005 p+p data in the mass range 0.2 – 0.5 GeV/c^2



Comparison to previously published p+p results



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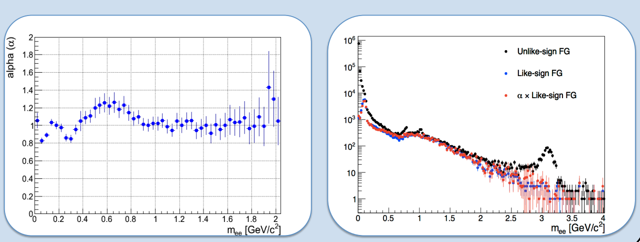
• The two results agree and the difference in the yields is due to different acceptance, because of the different magnetic field configuration.

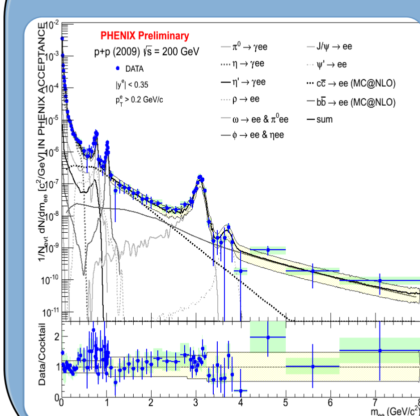
Signal Extraction

• The signal is extracted using the like-sign technique, after the like-sign pairs are corrected for the acceptance difference for ++ and -- pairs. This relative acceptance acceptance correction α is defined as:

$$\alpha = \frac{BG_{+-}}{BG_{++} + BG_{--}}$$



Results/Outlook

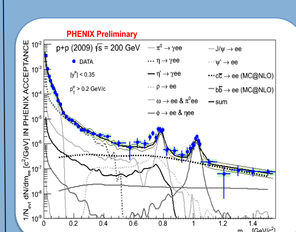


•Proof –of-principle for HBD

• Results from two different runs with very different systematics/sub-detectors show good agreement.

•Data will give us η ➔ e^+e^- branching ratio with a better precision.

• Beauty cross-section may also be extracted.



QM12 QuarkMatter

Stony Brook University