



J/ψ production as a function of event activity in p+p collisions at $\sqrt{s} = 510$ GeV with STAR at RHIC

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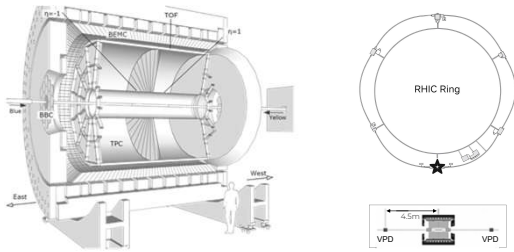


In this poster, we present a preliminary, high-statistics measurement of J/ψ relative inclusive yields versus particle multiplicity at mid-rapidity, in p+p collisions at $\sqrt{s} = 510$ GeV with the STAR experiment at RHIC. Calorimeter-triggered events are selected for mid-rapidity J/ψ candidate through the dielectron decay channel.

Motivation

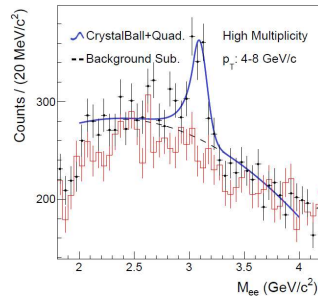
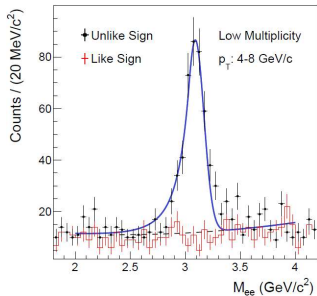
- Study of J/ψ production vs. event activity explores correlation between hard and soft processes
- Existing measurements from STAR and ALICE show a faster-than-linear rise in mid-rapidity J/ψ production vs. charged particle multiplicity [1]
- 2017 data features a 4x increase in integrated luminosity (79.5 pb⁻¹) over the 200 GeV p+p data

The STAR Experiment

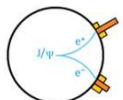


- Time Projection Chamber: momentum, dE/dx
- Vertex Position Detector: MB trigger, vertex, pileup rejection
- Barrel Electromagnetic Calorimeter: evt-trigger, identify e[±]
- Time Of Flight: track veto, PID, event mult. measurement

Signal Extraction



- Invariant-mass analysis in di-electron channel
- Subtract like-sign e⁺e⁻ pairs from unlike-sign e[±]e[∓] pairs
- Like-sign used to initialize parameters of background
- CrystalBall + quad. fit



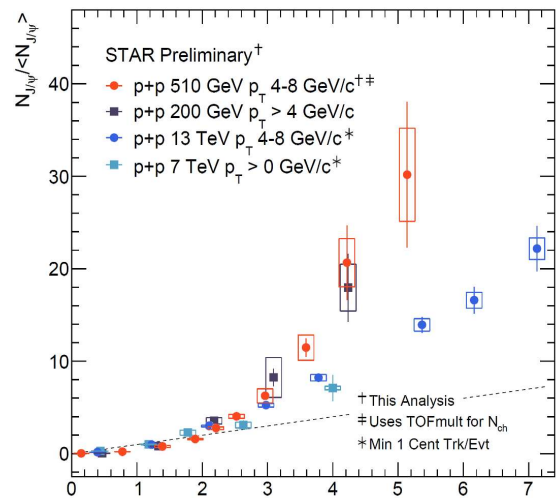
$$M_{ee} = \sqrt{2EE(1 - \cos\theta)}$$

$$M^2 = (E_1 + E_2)^2 - \|\mathbf{p}_1 + \mathbf{p}_2\|^2$$

Corrections and Calibrations

- Event TOF multiplicity characterization requires a luminosity-dependent correction
- Correct for multiplicity-dependent event triggering and vertex finding efficiencies for both MB and J/ψ events
- Future unfolding of TOFmult into charged-particle multiplicity

Results and Conclusions

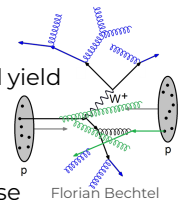


STAR, Physics Letters B 786 (2018) 87–93
 ALICE, Phys. Lett. B 810 (2020) 135758
 ALICE, Physics Letters B, 712 (2012) 165–175
 [1] EPJ Web of Conferences 339, 04009 (2025)

- Higher reach in multiplicity than 200 GeV result
- Improved multiplicity granularity
- Normalized yields at 510 GeV are consistent with 200 GeV
- 200, 510, GeV and 13 TeV results: similar p_T ranges
- Hint of splitting between RHIC and LHC energies

Interpretations

- Multi-parton interactions may cause a faster-than-linear rise in normalized yield due to high Q² coinciding with the closer proximity of additional partons
- Higher overall cross-sections at CERN energies may lead to more gradual rise



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