Measurement of multiplicity dependence of Upsilon meson production in $p + p$ at $\sqrt{s} = 510$ GeV

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QnA 1/2

- **What is your analysis status?**

  ▶ The analysis is a work in progress; signal extraction in underway, the embedding request is submitted and the unfolding and efficiency corrections will follow soon.

- **Have you presented your analysis in hp-pwg yet?**

  ▶ The analysis has been presented and mostly the multiplicity has been discussed. The conclusion is, that unfolding is needed to correct for the decreasing TPC efficiency at larger luminosities.

- **What is the physics message or motivation?**

  ▶ The main motivation is to study multiplicity dependence and spectra with a very high precision. This will put more constraints on the quarkonium production models as well as provide more insight into interplay between hard and soft processes in high multiplicity p+p collisions. The high-pT data may be used to exclude one of the possible scenarios (String Percolation, CGC). The measured data sample corresponds to 4x (fro BHT1) and 10x (for BHT2) the one of previous measurements in terms of sampled luminosity.

- **Are your plots "STAR preliminary"? If not, what is the estimated time to request for (new) STAR preliminary?**

  ▶ The results are not preliminary yet, our estimate is the summer of this year in time for the QM.

- **Is there any change in your data points/physics message compared with your last "SATR preliminary" results? And have you presented these changes at hp-pwg, if any?**

  ▶ Not relevant, as no preliminaries have been obtained yet.

- **What is the estimated time for the paper proposal?**

  ▶ The current estimate is by the end of the calendar year (November/December).

Previous STAR results

- Υ signal in Run17 p+p 510 GeV data in the dielectron channel and its self-normalised multiplicity dependence
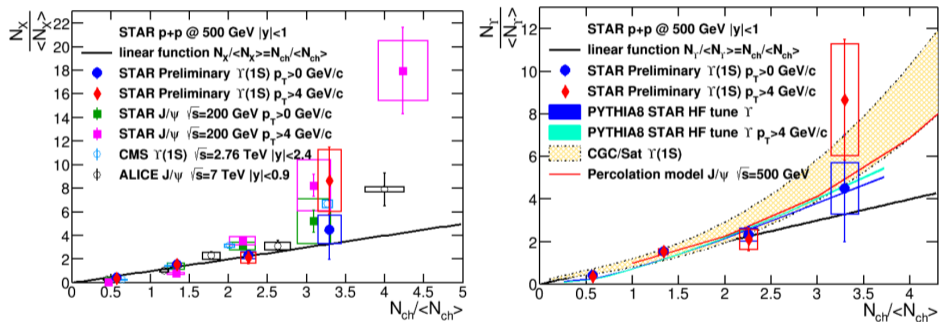

Figure 1: Previous STAR Υ multiplicity dependence results [1]. These results use Run11 data ($\mathcal{L}_{int} \sim 22 \text{ pb}^{-1}$).

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[1] Studies of Upsilon states production vs. p_T, rapidity and charged particle multiplicity in p+p collisions at $\sqrt{s} = 500$ GeV

General overview

- Data used: pp@510 GeV, Run17, SL22b

- Several available HT triggers:
  - **BHT1***VPD30 - DSM-ADC threshold **18** (4.2 GeV), 616M evts, $\mathcal{L} \sim 80$ pb^{-1}
    - ⋆ Trigger IDs: ~~29~~, ~~570204~~, 570214
  - **BHT2***BBCMB - DSM-ADC threshold **25** (5.9 GeV), 462M evts, $\mathcal{L} \sim 340$ pb^{-1}
    - ⋆ Trigger IDs: ~~30~~, 570205, 570215
  - *BHT3 - DSM-ADC threshold 31 (7.3 GeV)*

- MB triggers should correspond to HT ones
  - **VPDMB**-**30** - 1.13B evts
    - ⋆ Trigger IDs: ~~7, 15, 16, 24, 57~~, 570001, ~~590001~~
  - **BBC** - *not decided yet*
    - ⋆ Potential Trigger IDs: 570006, 580006, 590006

Cuts

Event selection

- $|v_z| < 40$ cm (BHT1), $|v_z| < 100$ cm (BHT2)
- BHT1 or BHT2 triggered

TofMult

- nHitsFit ≥ 15
- $|\eta| < 1$
- $p_\mathrm{T} > 200$ MeV/c
- DCA to primary vertex $< 0.5/1.0/1.5/2.0$ cm
- track matched to TOF

TPC electrons

- Fulfill track quality cuts
- $-3.0 < n\sigma_e < 3.0$

Track quality cuts

- nHitsFit ≥ 20
- nHitsRatio $> .52$
- $p_\mathrm{T} > 200$ MeV/c
- DCA to primary vertex < 3 cm

Candidate electron selection

- $-1.0 < n\sigma_e < 3.0$
- $E_\mathrm{TOW}/E_\mathrm{CLU} > 0.5$
- $0.5 < E_\mathrm{CLU}/p < 1.5$
- $p_{\mathrm{T},e} > 1$ GeV/c
- DSM-ADC $>= 18$ (for BHT1)
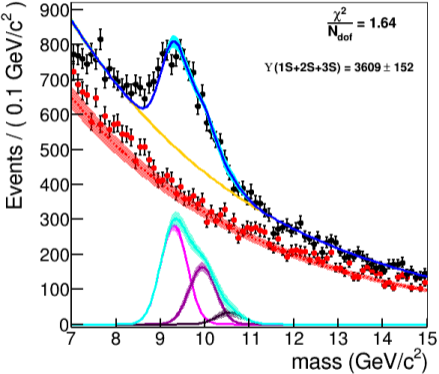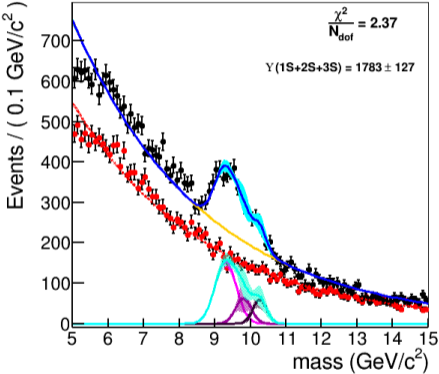- $|\Delta Z| < 5$ cm, $|\Delta\varphi| < 0.020$

Signal extraction

Figure 2: Invariant mass plot in the signal region for BHT1 dataset (left) and BHT2 dataset (right).