[HIN-14-009] binning check for R_{FB}

Songkyo Lee*, Lamia Benhabib, Yongsun Kim, Kisoo Lee Mihee Jo, Hyunchul Kim

dilepton meeting
19th November 2014

- **Binning for cross-sections**

  y_{CM} = [−2.4, −1.5, −1, 0, 1, 1.5, 1.93] — 6 bins
  p_T = [0, 3, 6.5, 7.5, 8.5, 9.5, 11, 14, 30] GeV/c — 8 bins

- **Binning for R_{FB}**

  y_{CM} = [−1.93, −1.5, 1.2, −0.9, −0.5, 0, 0.5, 0.9, 1.2, 1.5, 1.93] — 10 bins
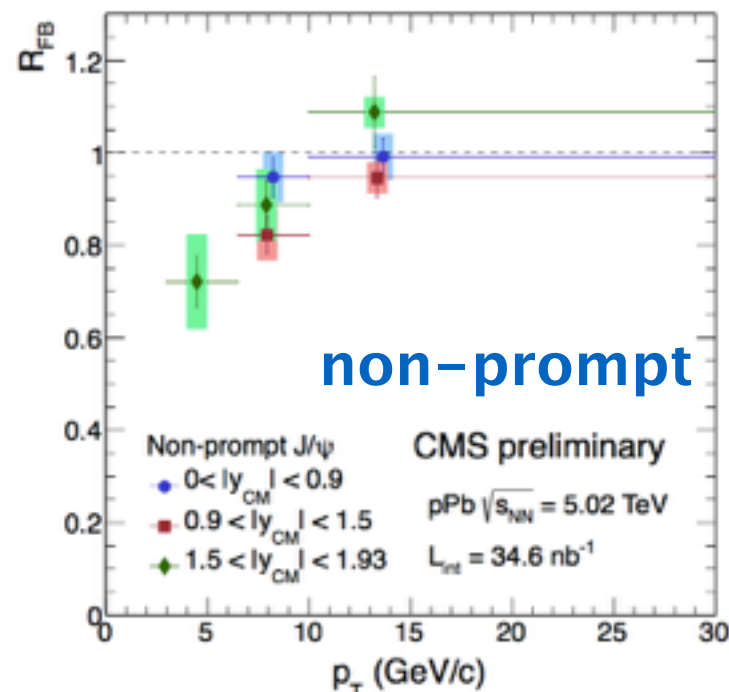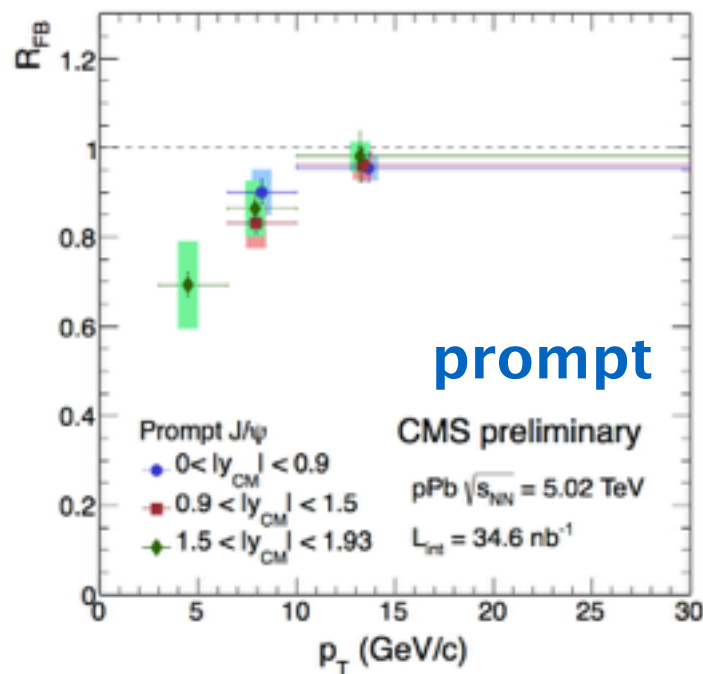 p_T = [3, 6.5, 10.0, 30] GeV/c — 4 bins

- **Motivation of new binning study**

  - Yields have been changed (new ID cut, Zvtx weight & cut, etc.)
  - Make the bin boundaries consistent for cross-sections and R_{FB}
  - First, start from "fine" binning!

  y_{CM} = [−2.87, −2.4, −1.93, −1.5, −1.2, −0.9, −0.5, 0, 0.5, 0.9, 1.2, 1.5, 1.93]
  p_T = [5, 6.5, 7.5, 8.5, 9.5, 11, 14, 30] GeV/c

R_FB vs p_T

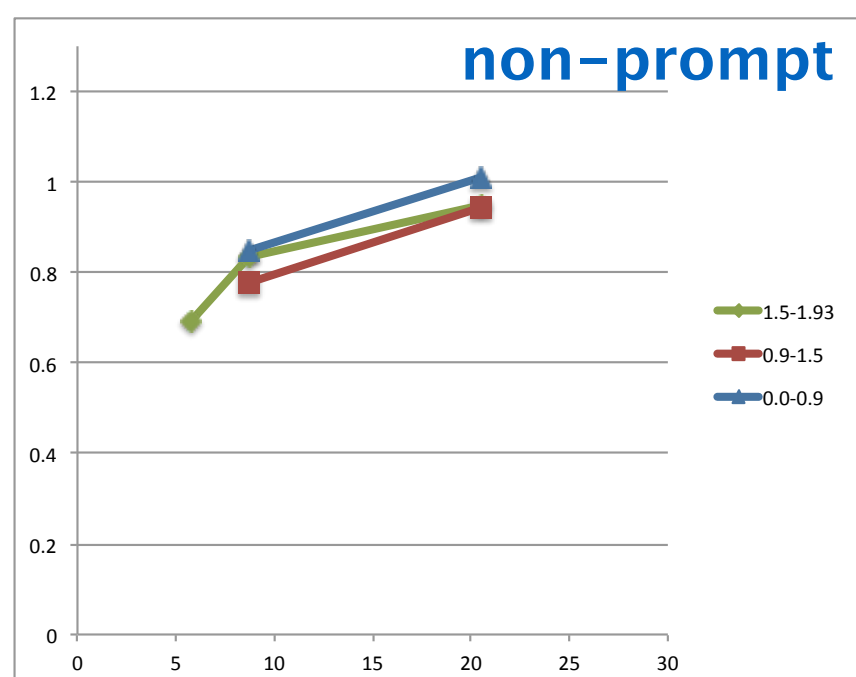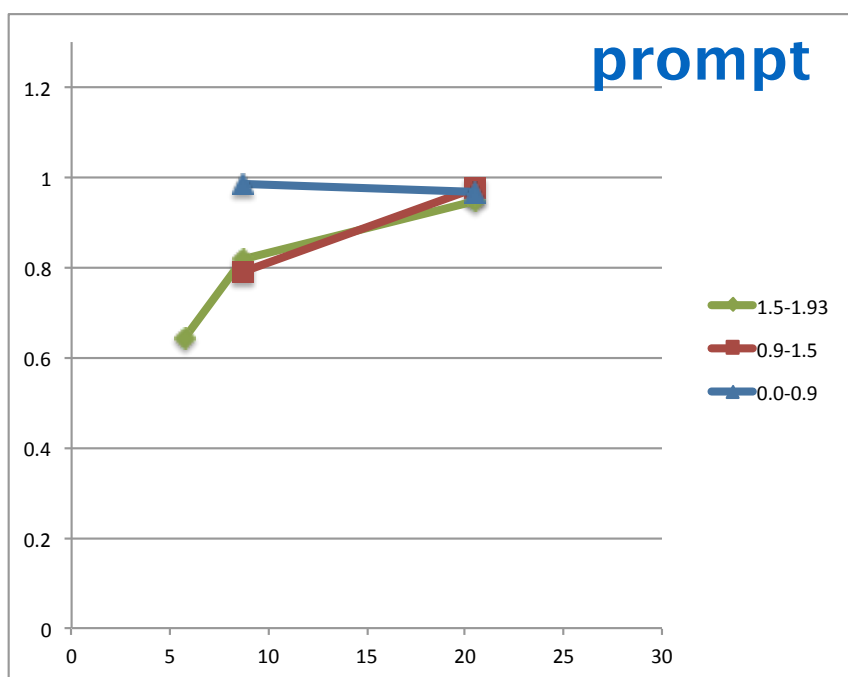
R_{FB} vs p_T

- **Previous results**

- p_T = [3, 6.5, 10, 30] GeV/c

- correct MC sample
- new soft muID
- z vertex weight & cut applied
- new binning
- uncertainties are not drawn
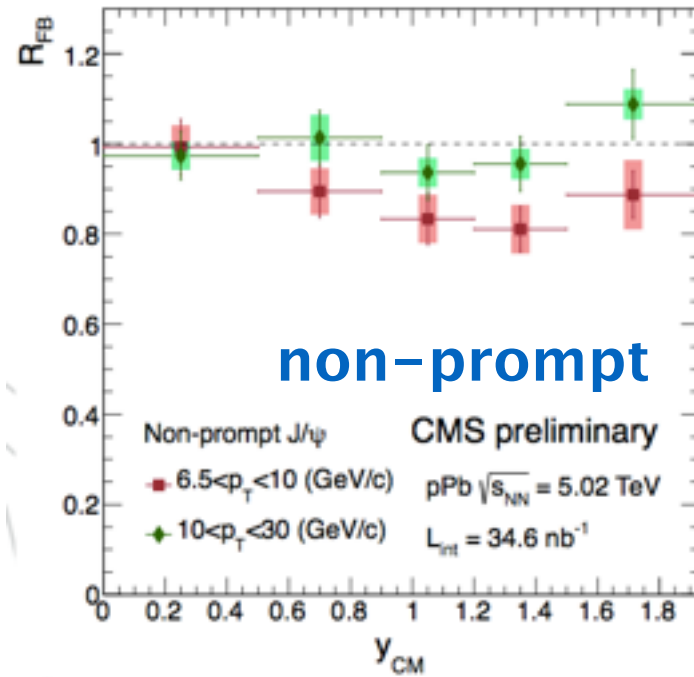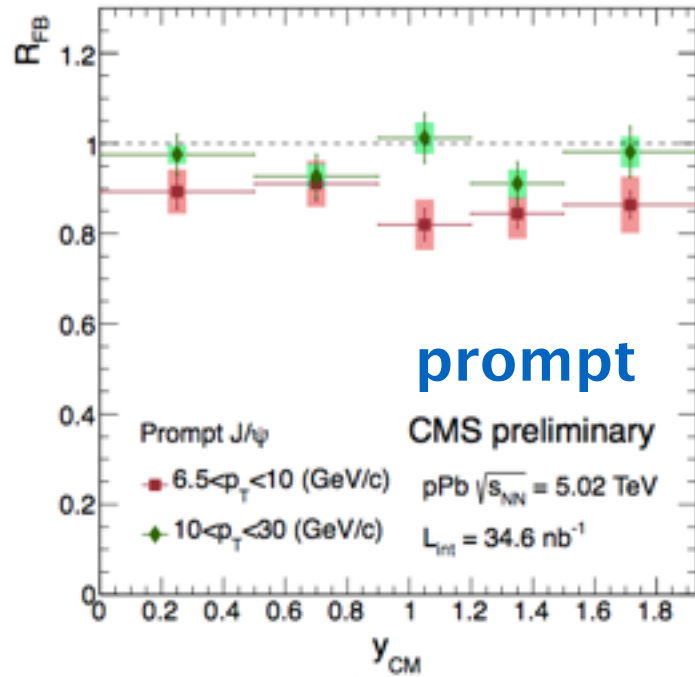- Data points at bin center

- **New results**

- p_T = [5, 6.5, 11, 30] GeV/c
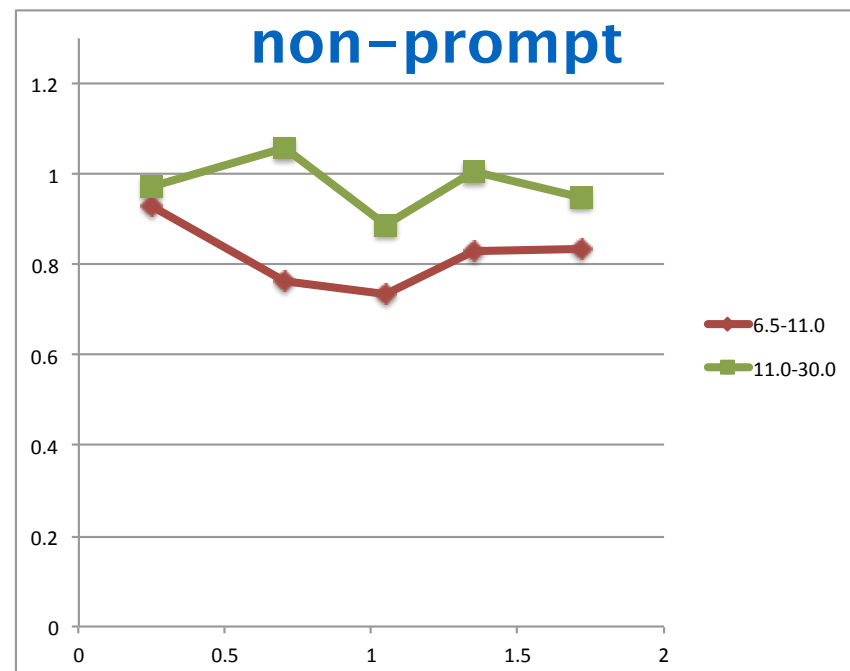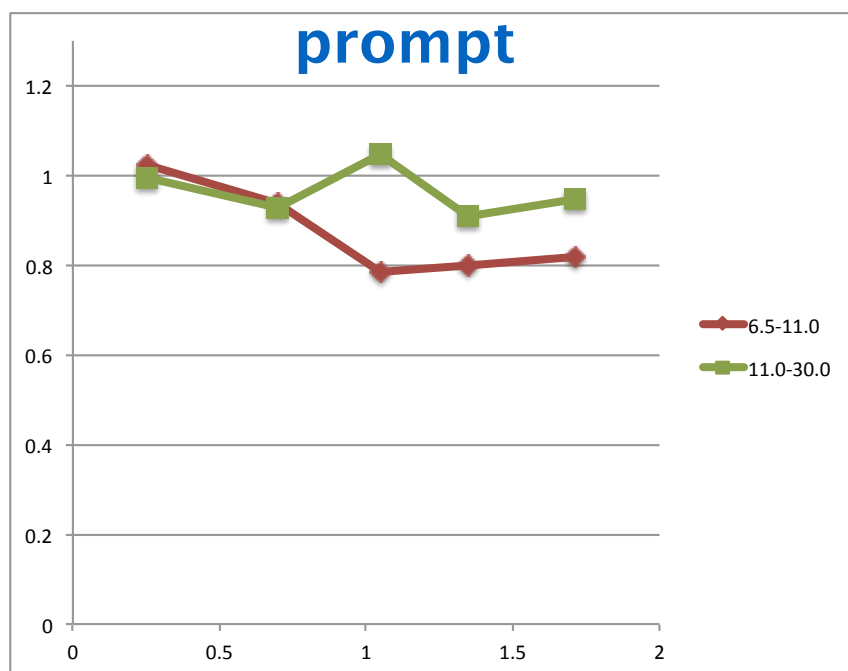
- Agree within uncertainties

Previous results

- p$_T$ = [6.5, 10, 30] GeV/c

- correct MC sample
- new soft muID
- z vertex weight & cut applied
- new binning
- uncertainties are not drawn

New results

- p$_T$ = [6.5, 11, 30] GeV/c

- Agree within uncertainties

- **Check 3 different binning options**

  - For the current fine binning, some bins have too poor statistics.
  - confirm that acceptance & efficiency are not affected much by bin size.
  - Check 2nd run first

- **Option 1) fine bin (same with slide 3)**
  y_{CM} = [0, 0.5, 0.9, 1.2, 1.5, 1.93]   — 5 bins
  p_T = [5, 6.5, 7.5, 8.5, 9.5, 11, 14, 30] GeV/c   — 7 bins

- **Option 2) rapidity bin merged**
  y_{CM} = [0, 0.9, 1.5, 1.93]   — 3 bins
  p_T = [5, 6.5, 7.5, 8.5, 9.5, 11, 14, 30] GeV/c   — 7 bins

- **Option 3) p_T bin merged**
  y_{CM} = [0, 0.5, 0.9, 1.2, 1.5, 1.93]   — 5 bins
  p_T = [5, 6.5, 8, 10, 13, 30] GeV/c   — 5 bins

Prompt J/psi (2nd run only)
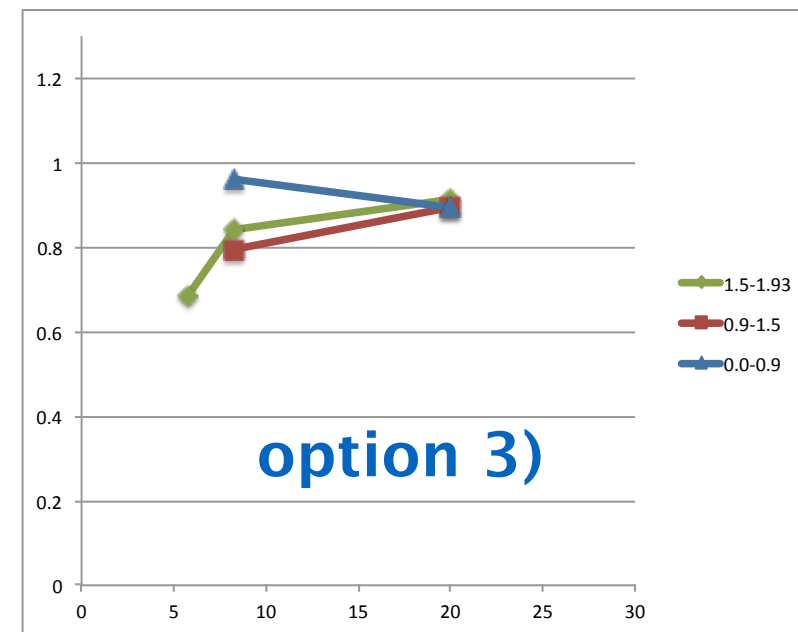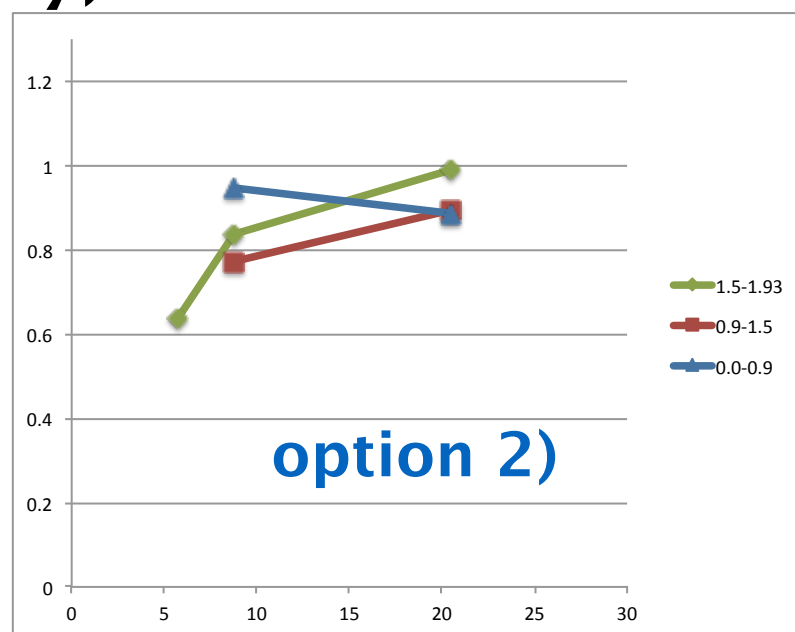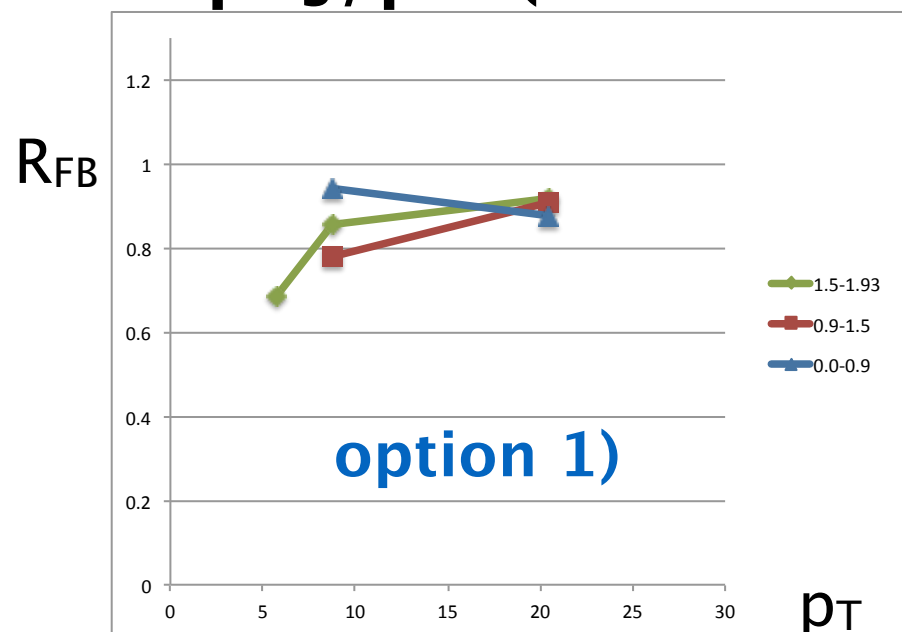
Non-prompt J/psi (2nd run only)
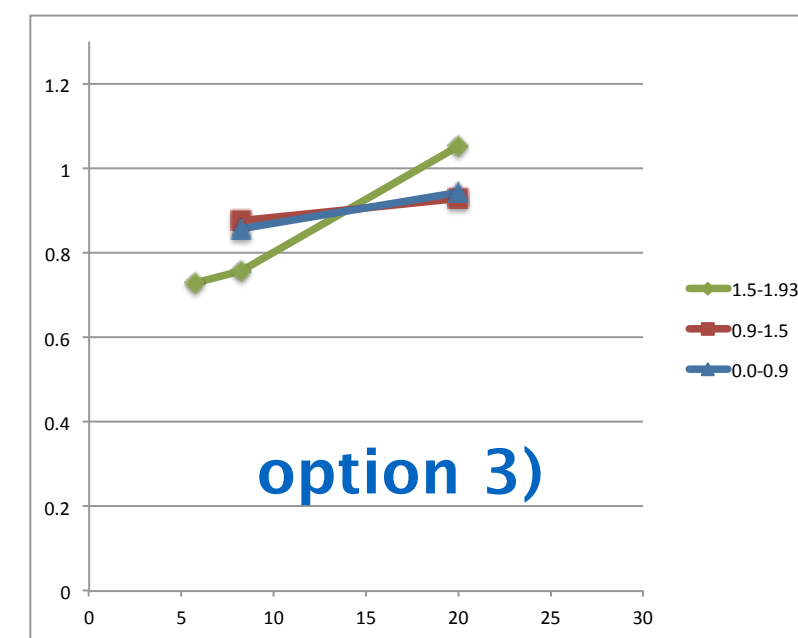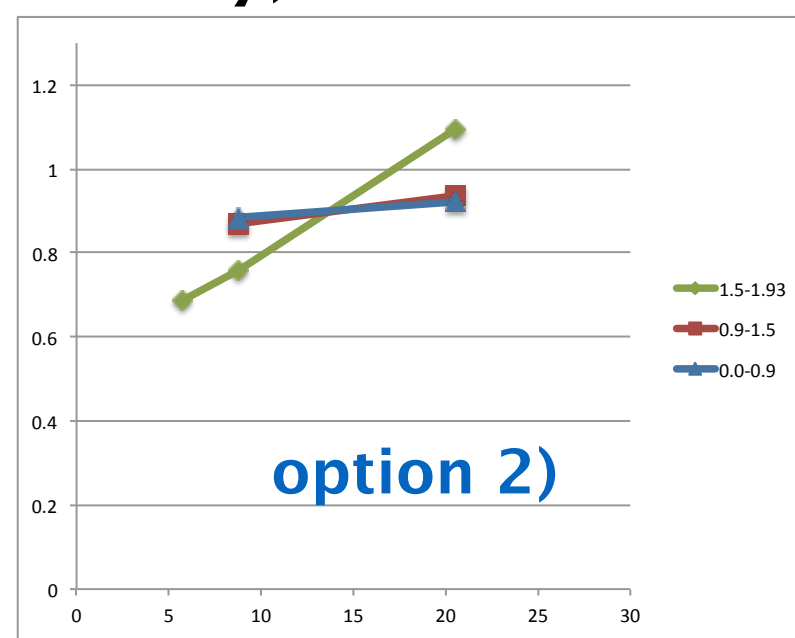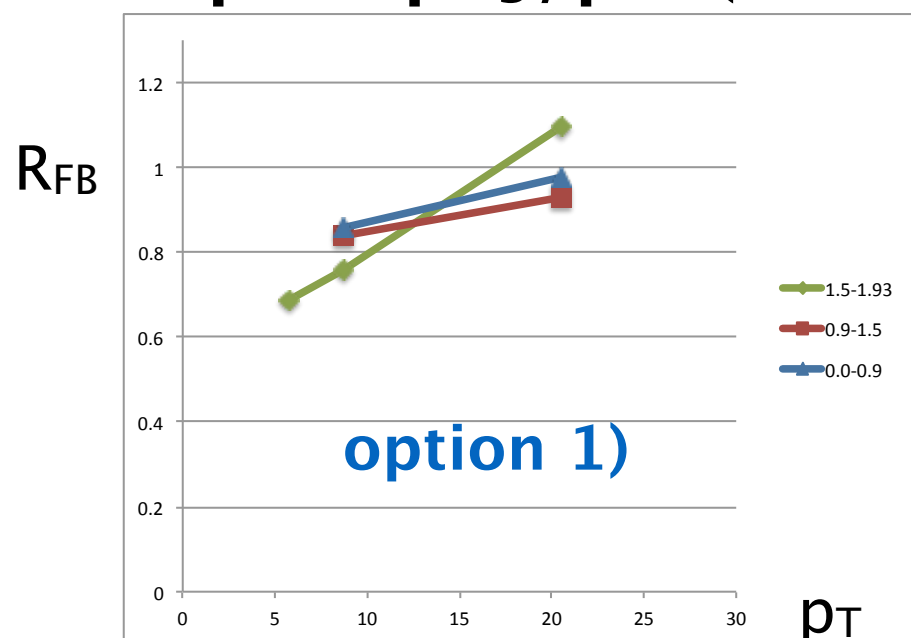
- Results agree for different binning
- We would choose <u>option 2</u>. <- finer p$_T$ bins would be better for cross-sections

- **Fitting & Result plots**
  - Include 1st run
  - check fitting quality (e.g. B-fraction vs p_T)
  - Include statistical uncertainties (systematic uncertainties later)

- **Efficiency**
  - working on TNP with the latest package – Yongsun
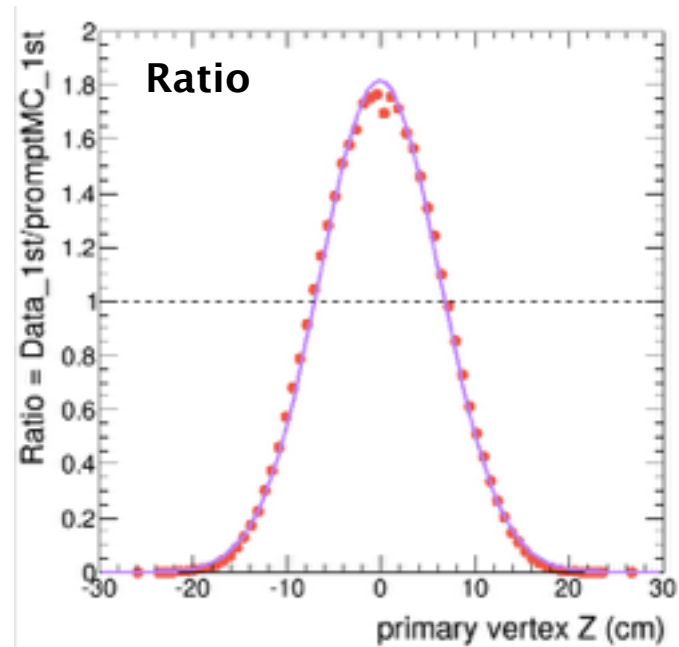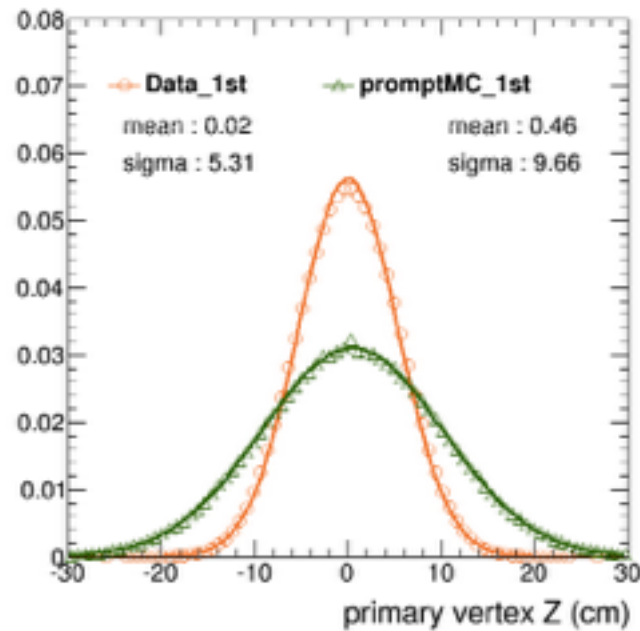 - Unfolding – Songkyo

- **muon ID check**
  - check again after applying z vertex weight – Lamia
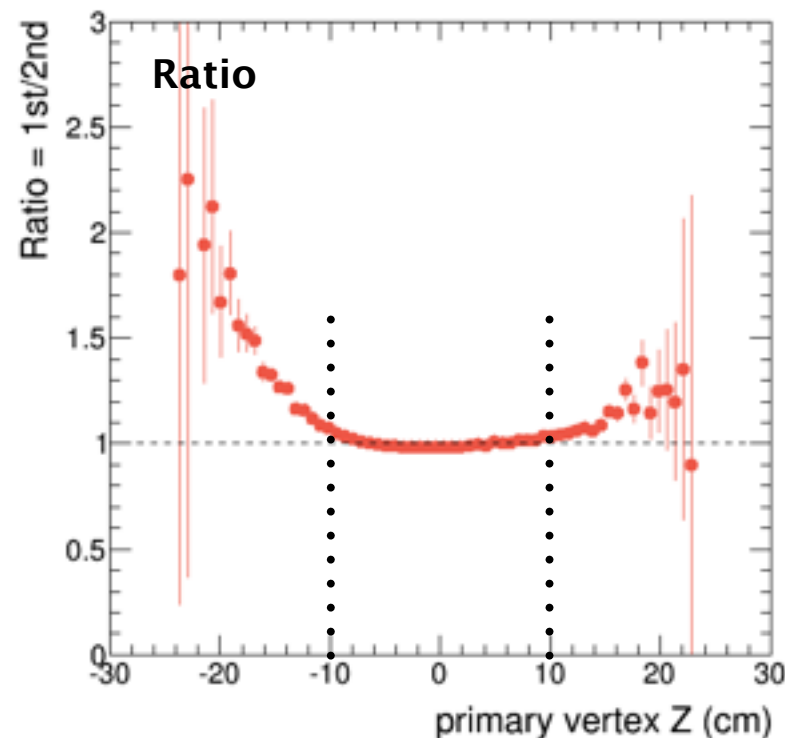
- **We would like to have ARC meeting soon.**

Back up

z vertex weight & cut

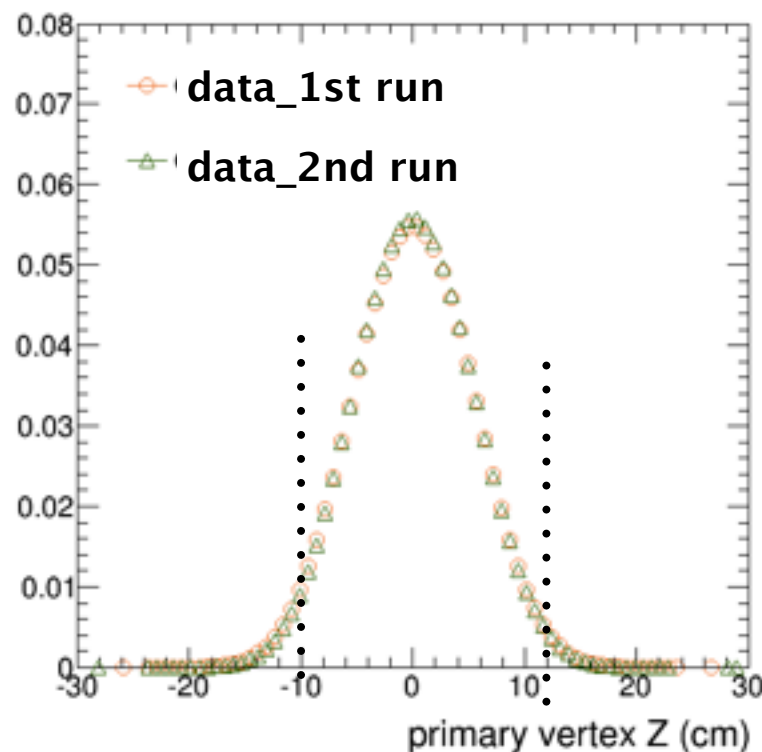## 1) z vertex weight
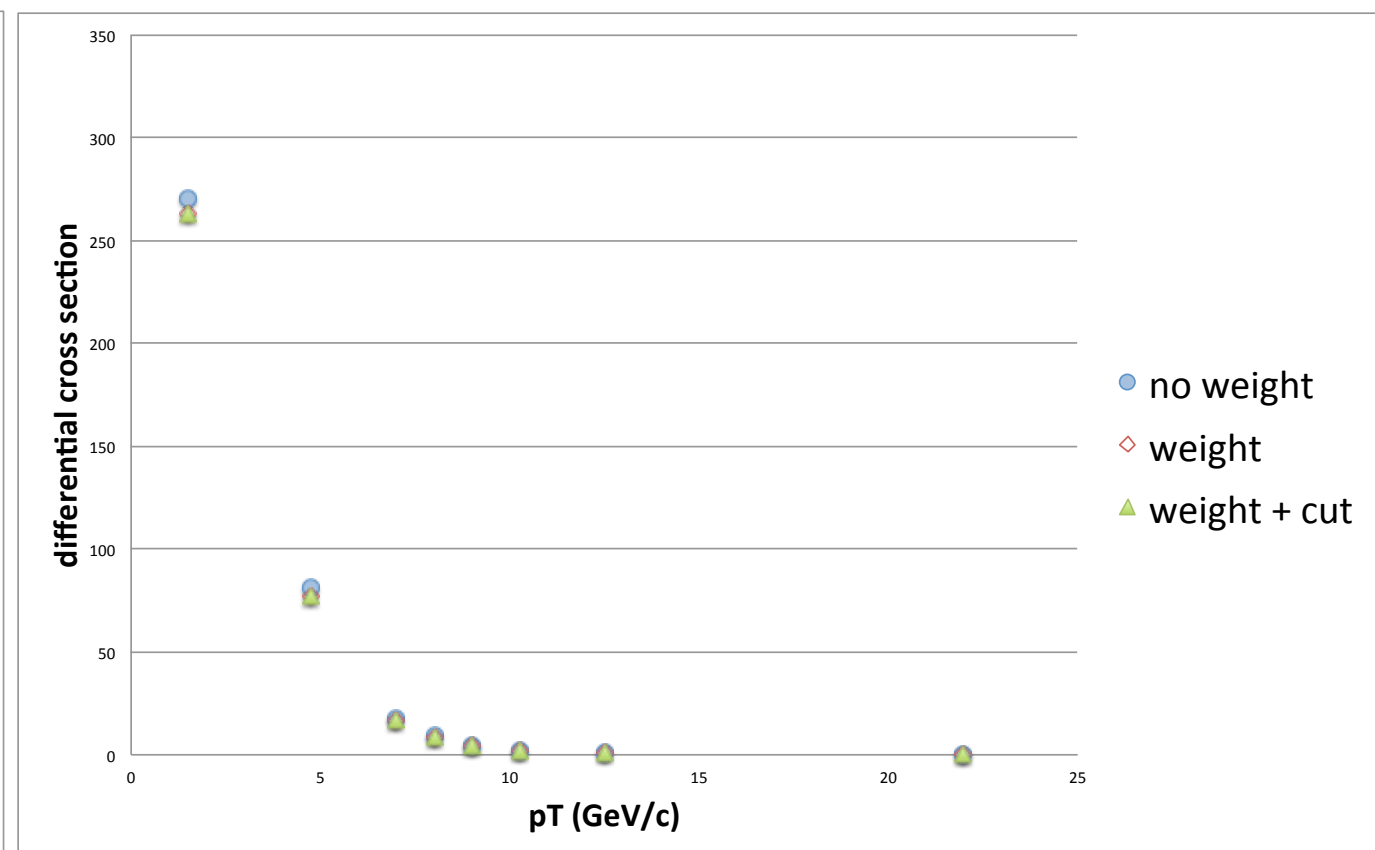

- Reweight MC using ratio function

2) z vertex cut

- Cut in |Zvtx| < 10 cm
  - exclude poor quality events
  - select where distributions match

z vertex weight & cut

⊕ **e.g. Prompt J/psi, 1st run period, $1.5 < y_{CM} < 1.93$**

* uncertainties NOT drawn
* scale factors NOT applied
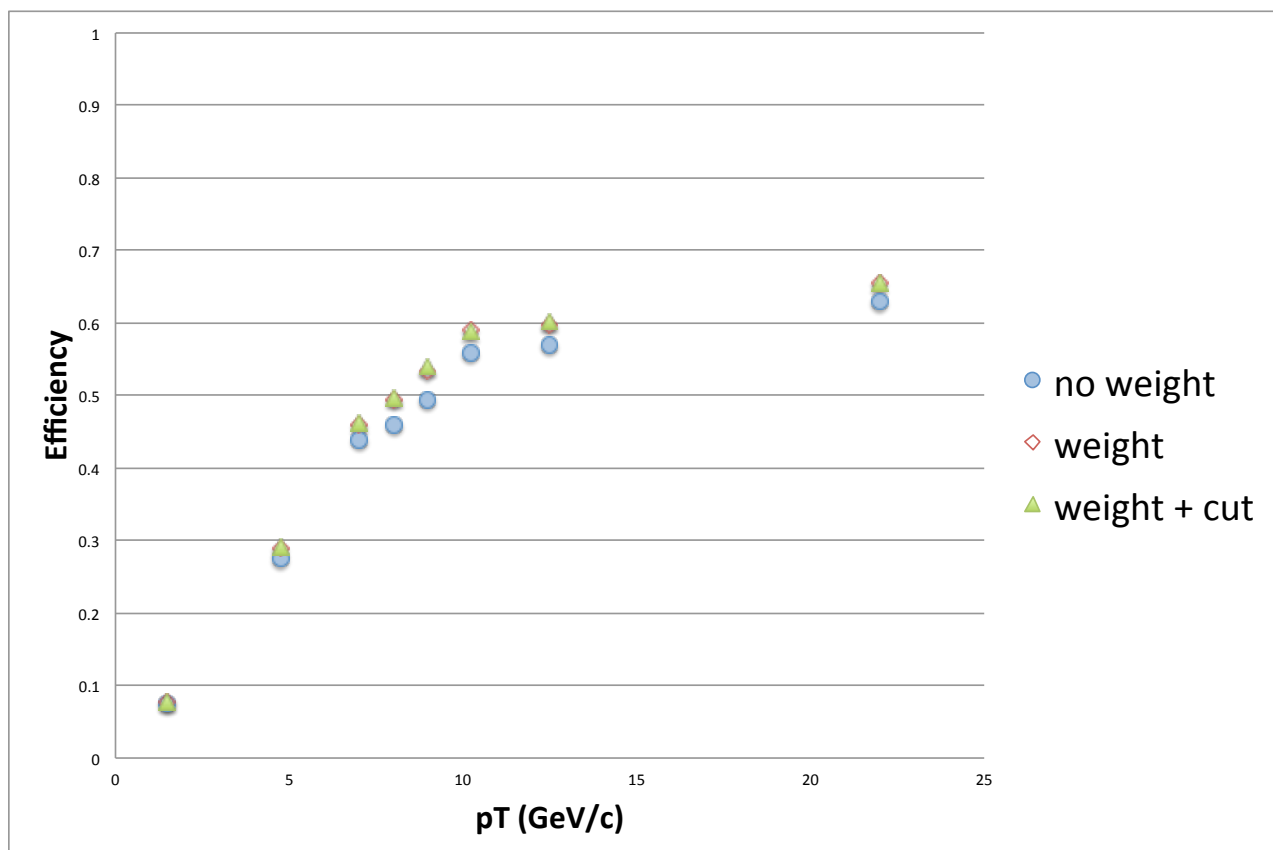
- zVtx Weight : Efficiency values become higher & cross-sections smaller. (Good news?!)
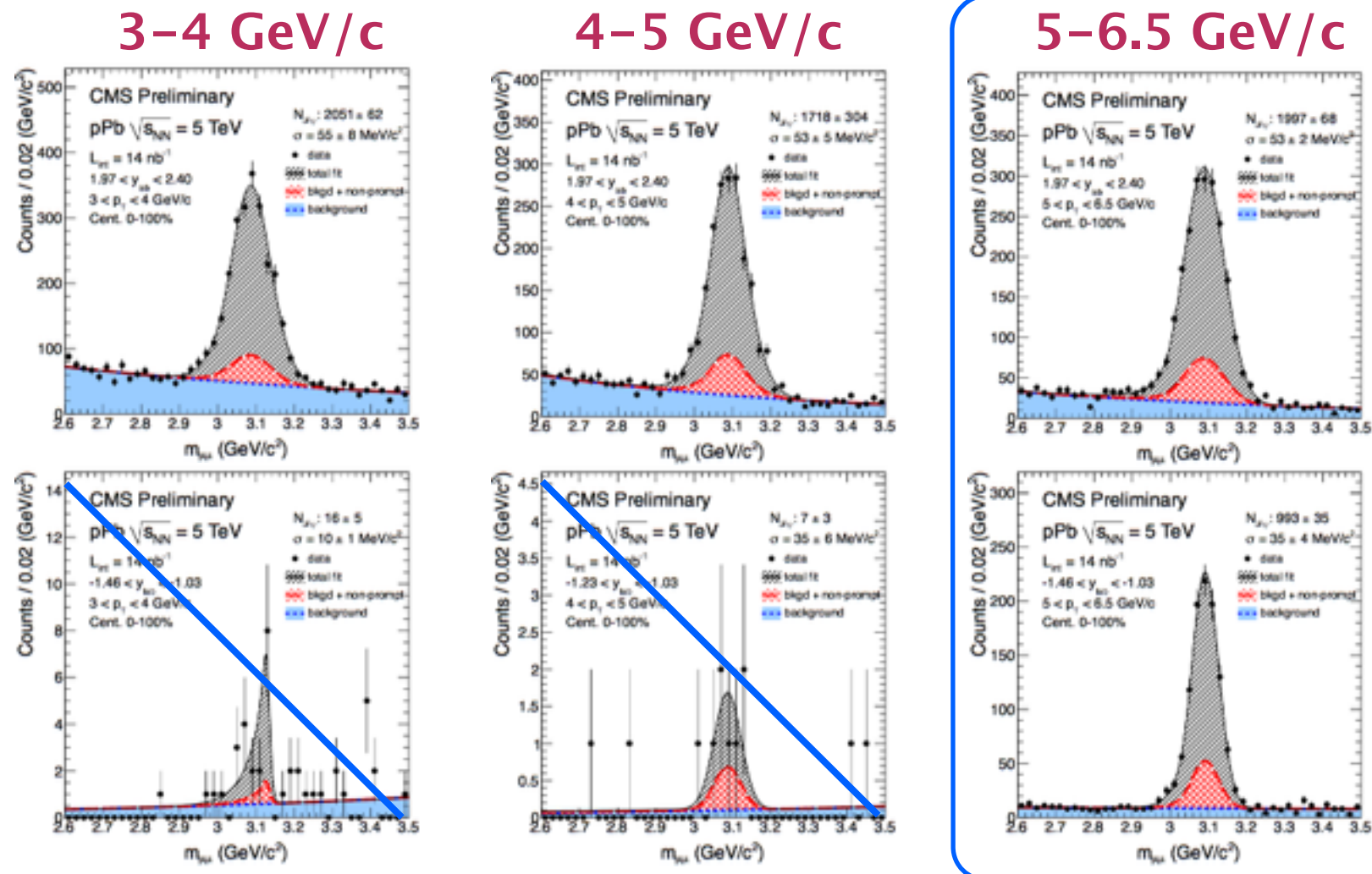- zVtx Cut : Cross-section becomes smaller, but the effect is relatively small.

-> Apply to other study too! (muon ID, TNP, etc.)

binning check

- **Finer bins for p$_T$ < 6.5 GeV/c**

    1) **p$_T$ 3-6.5 GeV/c**
      - change to 3, 4, 5, 6.5 GeV/c (for cross-section measurement)
      - For 3-5 GeV, almost no signal at backward regions (for R$_{FB}$ measurement)
      - we would change the binning from **3-6.5 GeV/c** to **5-6.5 GeV/c**