Measurement of the Distance of Closest Approach of electrons from heavy flavor hadron decays at PHENIX

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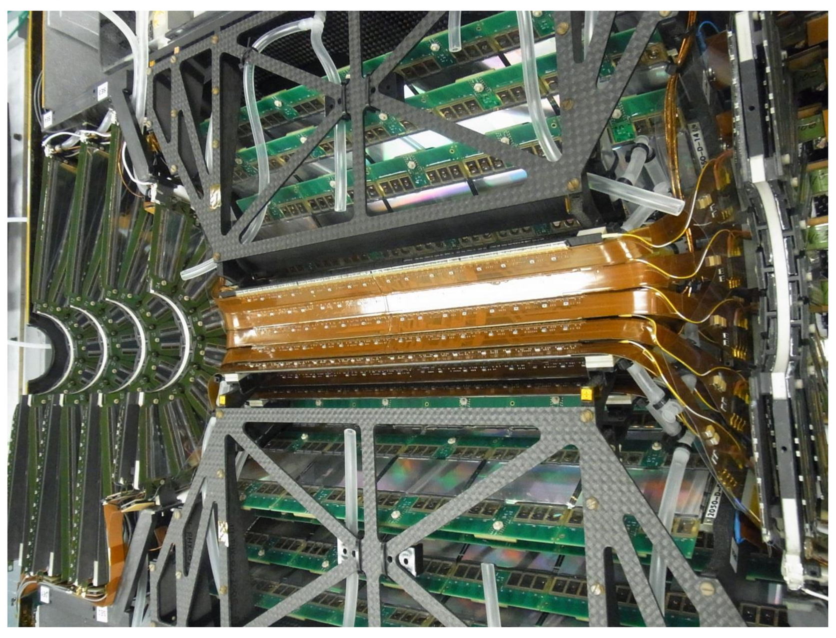
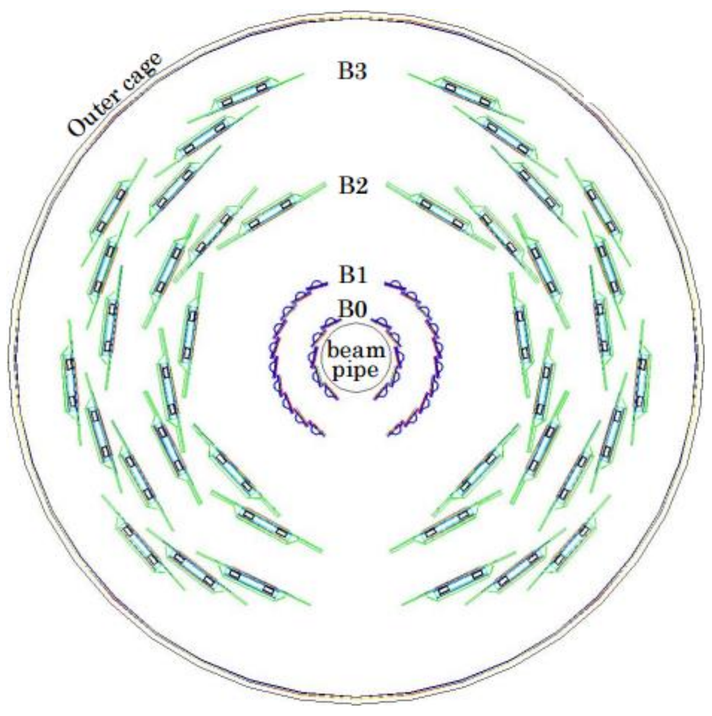
1. The VTX detector

In 2011, the PHENIX detector was upgraded with Silicon Vertex (VTX) Detector. Using the VTX to measure precision displaced tracking, the relative contributions of electrons from charm and bottom hadrons decays are measured in Au+Au collisions[1].

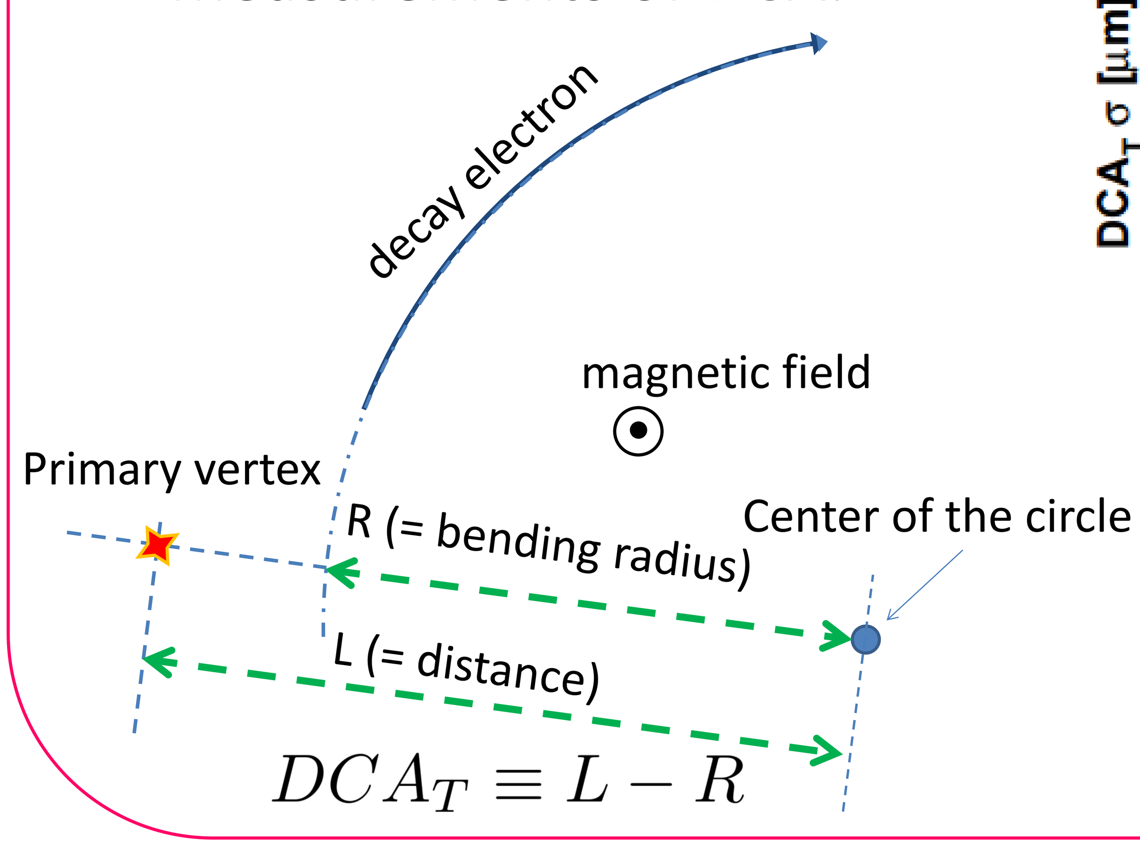


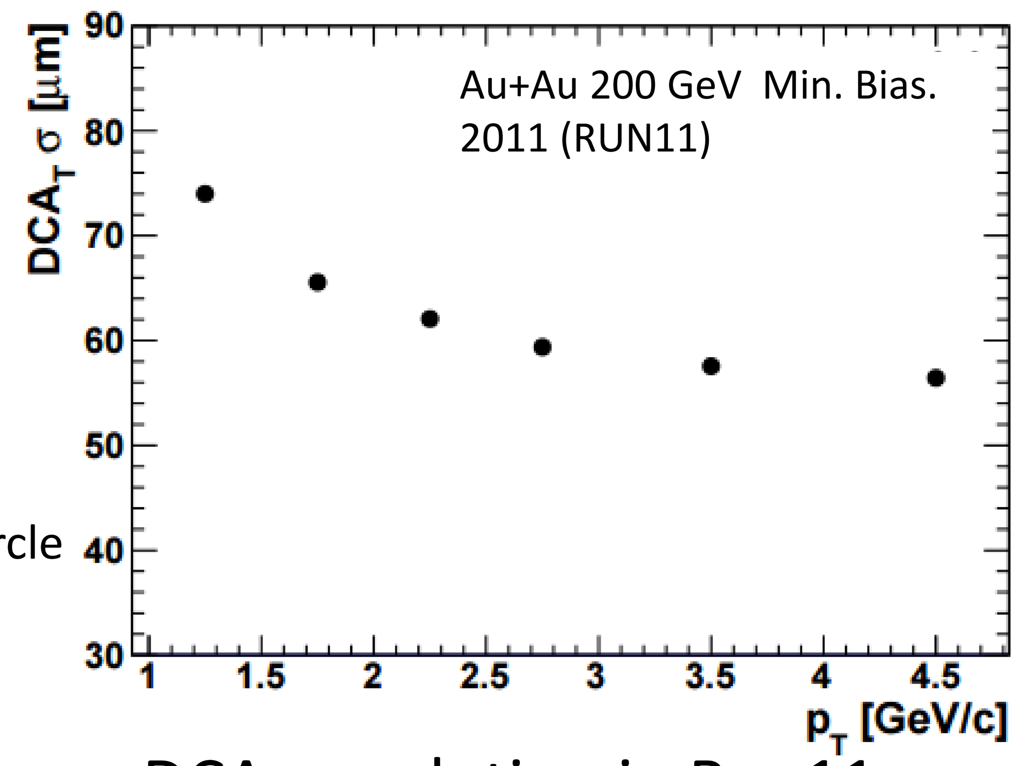


A schematic view of the VTX detector.

2. Distance of Closest Approach (DCA) measurement

- The lifetimes and kinematics for charm and bottom hadrons decaying to electrons are different.
- The VTX enables separation of their contributions with measurements of DCA.





DCA_T resolution in Run11

3. electron DCA distribution

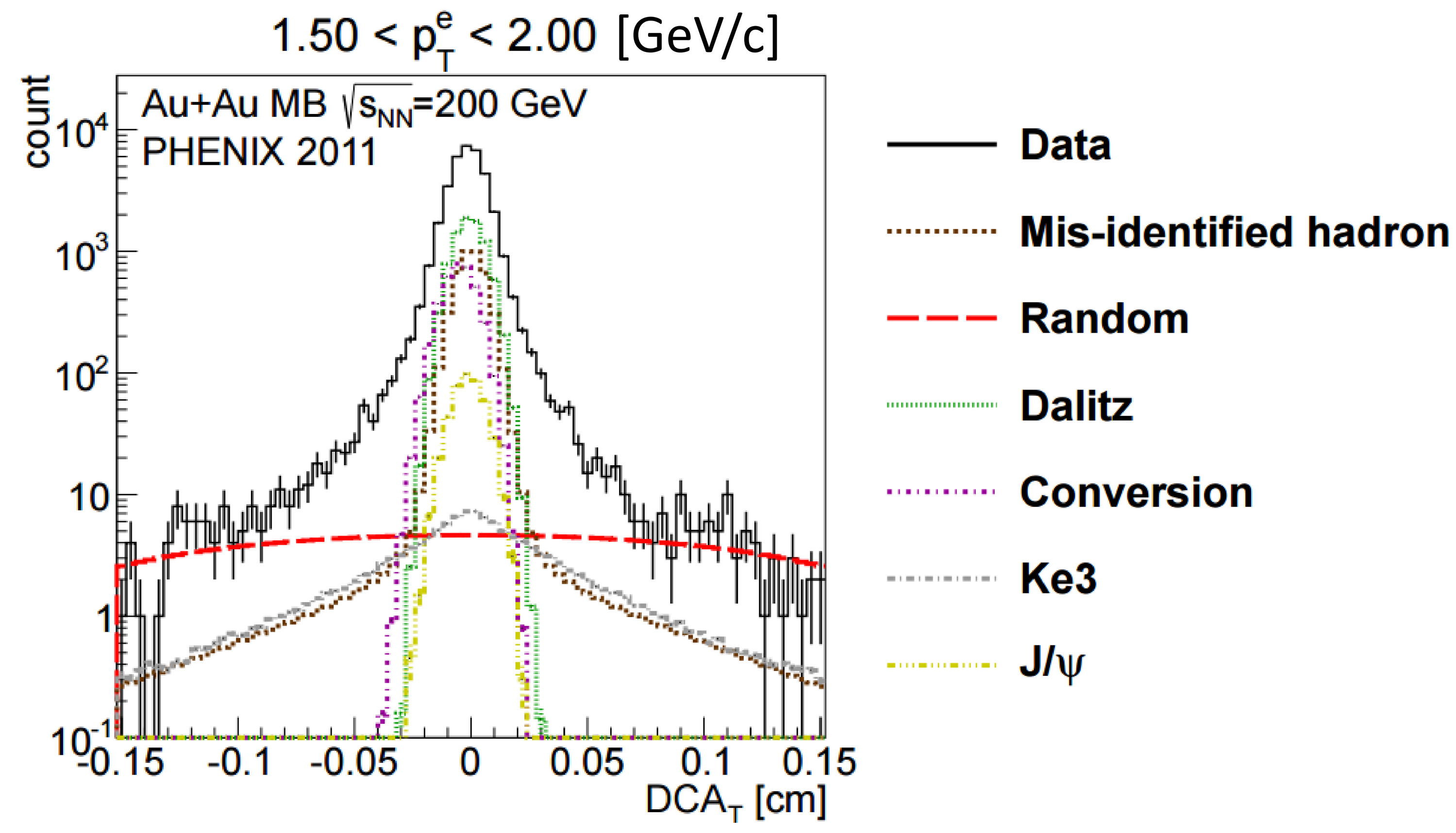
The sample of candidate electron tracks contains contributions of ...

(**signal**) electrons from charm and bottom hadron

+

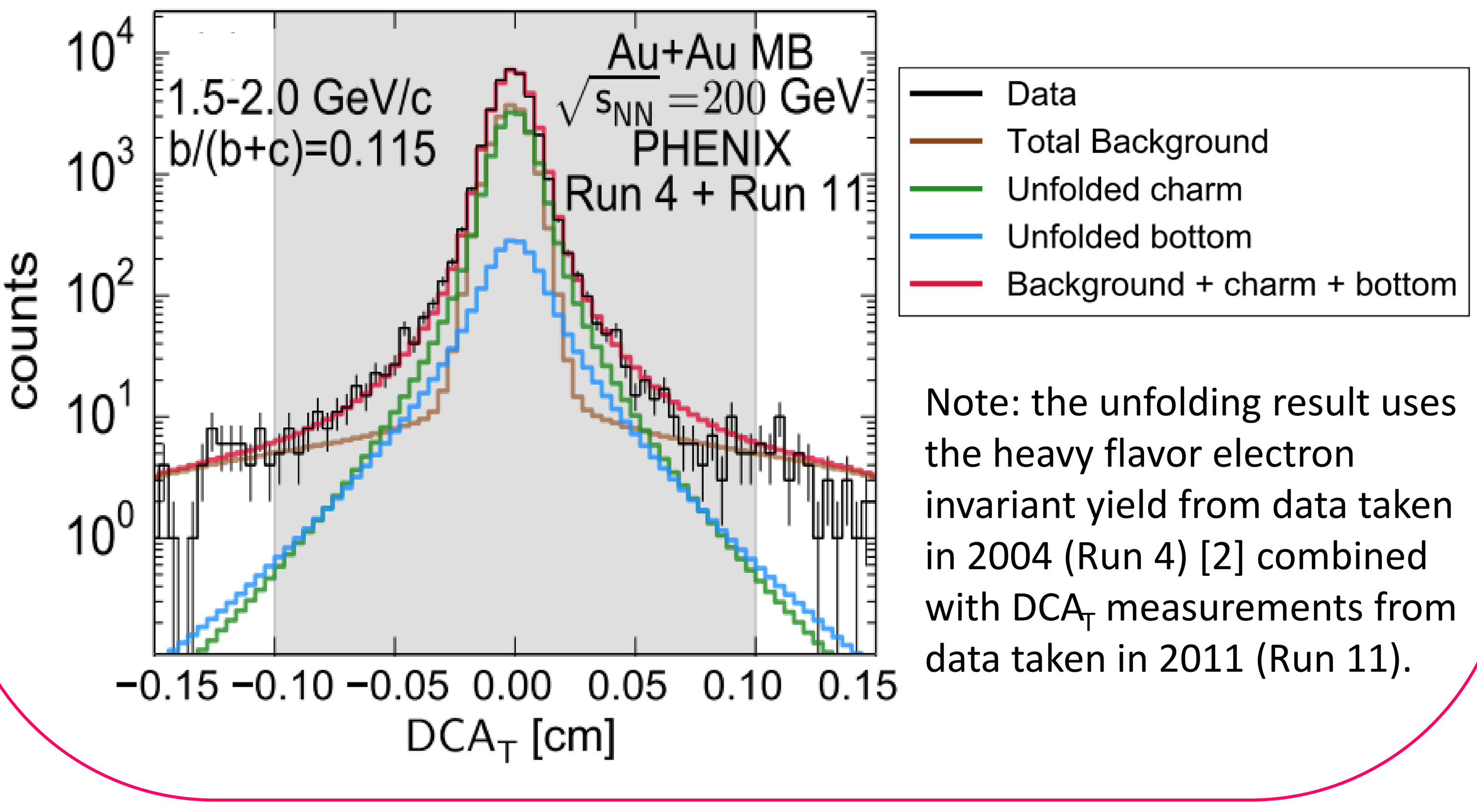
(**background**)

1) Misidentified hadrons
2) High-multiplicity background (Random VTX hits)
3) Photonic electrons (Dalitz + Conversion)
4) Kaon decay electrons
5) Heavy-quarkonia decay electrons



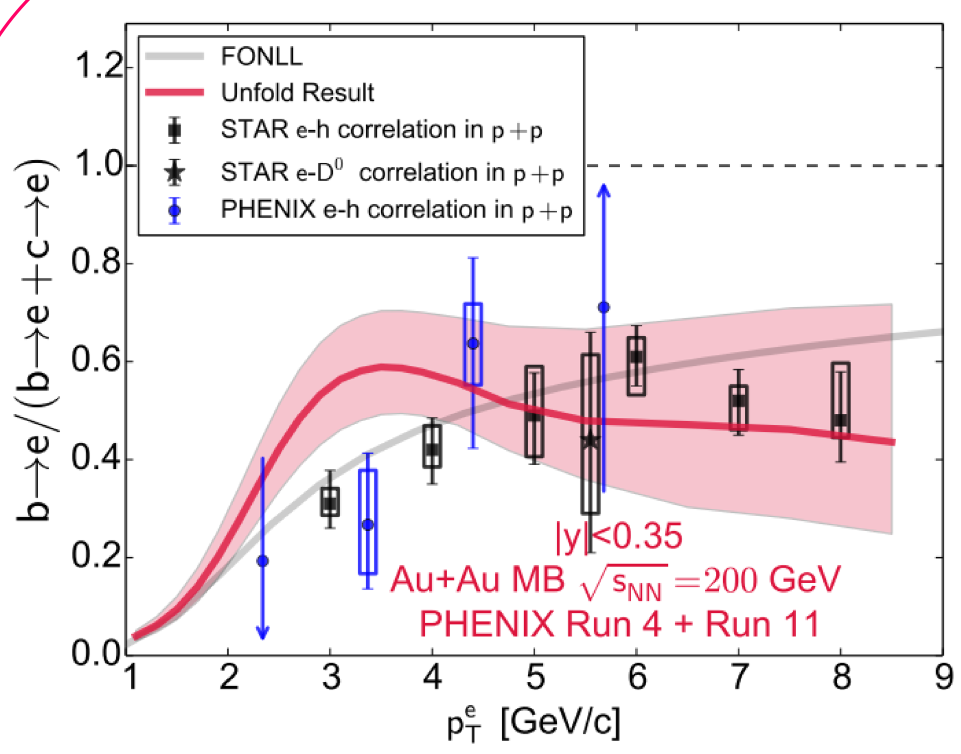
DCA_T distributions for electrons in MB Au+Au at $\sqrt{s_{NN}} = 200$ GeV with background components.

After subtracting those backgrounds, the remaining charm and bottom components are extracted by an unfolding method.
(also see the poster by **D. McGlinchey**)

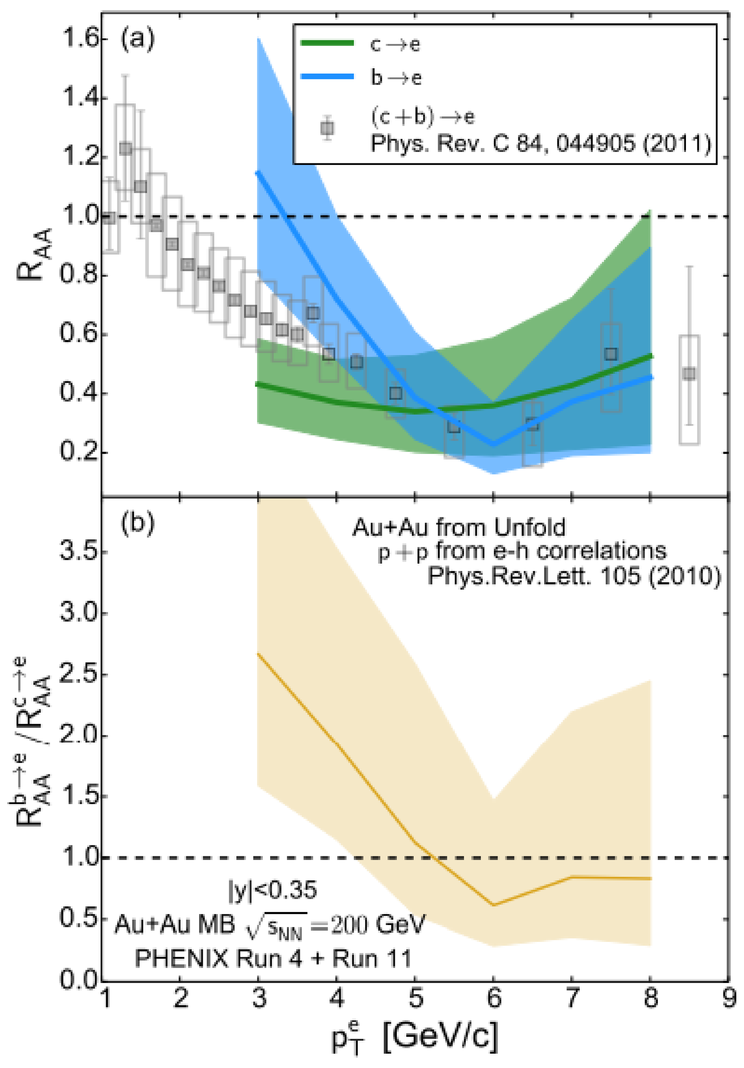


Note: the unfolding result uses the heavy flavor electron invariant yield from data taken in 2004 (Run 4) [2] combined with DCA_T measurements from data taken in 2011 (Run 11).

4. Results



The bottom electron fraction compared to measurements in p+p collisions at $\sqrt{s_{NN}}$ = 200 GeV from PHENIX [3] and STAR [4]. Also shown are the central values for FONLL [5] for p+p collisions at $\sqrt{s_{NN}}$ = 200 GeV.



(a) The R_{AA} for c → e, b → e and combined heavy flavor [2] as a function of electron p_T. STAR p+p data [4] is used for the denominator of $R_{AA}^{c\to e}$ and $R_{AA}^{b\to e}$.
(b) The ratio $R_{AA}^{b\to e}/R_{AA}^{c\to e}$

5. Conclusions

-We find electrons from bottom hadron decays are less suppressed than those from charm hadron decays in the range 3 < p_T GeV/c < 4.
-Bottom electron fractions are similar in Au+Au and p+p for p_T> 4GeV/c within the large uncertainties.

References

[1] A. Adare et al. (PHENIX collaboration), arXiv:1509.04662 (2015).
[2] A. Adare et al. (PHENIX Collaboration), Phys. Rev. C 84, 044905 (2011).
[3] A. Adare et al. (PHENIX Collaboration), Phys. Rev. Lett. 103, 082002 (2009).
[4] M. M. Aggarwal et al. (STAR Collaboration), Phys. Rev. Lett. 105, 202301 (2010).
[5] M. Cacciari, P. Nason, and R. Vogt. Phys. Rev. Lett. 95, 122001 (2005).

Also see posters by
T. Hachiya, (B-> J/psi with the VTX)
K. Nagashima (Run 14 VTX analysis)