Photon Conversions for Phase2/First Physics

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▶ Detector visualization

▶ Bottomonium analyses

■ Measure η_b, χ_{b0} mass and width via $\Upsilon(3S) \to \gamma\eta_b(nS)$ and $\Upsilon(3S) \to \gamma\chi_{b0}(1P)$

■ Disentangle overlapping photon lines

● Measurement of BF $\Upsilon(3S) \to \gamma\chi_{b1,2}(1P) \to \gamma\Upsilon(1S)$

● Discovery of $\Upsilon(1D)$ states via $\Upsilon(1D) \to \gamma\chi_{bJ}(1P)$
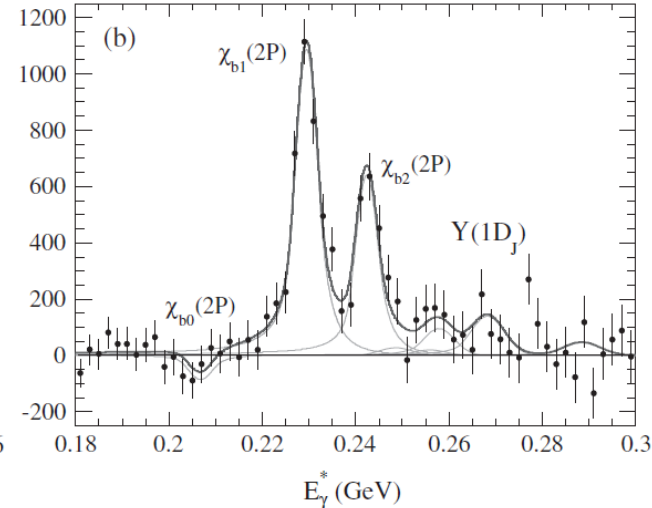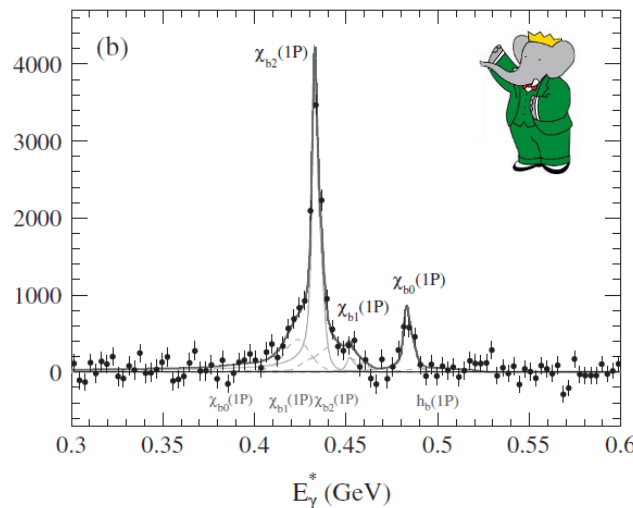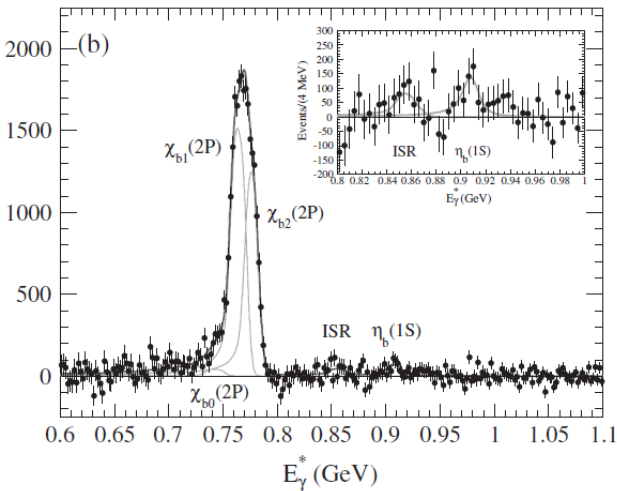
Analysis – Introductory Comments

► V0Finder implemented in basf2

  ■ Combine track pairs mainly for K_S, but also get Λ and $\gamma \to$ e+e-

  ■ Optimized for K_S: all tracks are fit as pions, K_S mass within beampipe, etc.

► Modifications

  ■ Removed K_S mass requirement and loosened chi2 (V0Finder in tracking)

  ■ Use electron mass when building K_S (ParticleLoader in analysis)

  ■ Add V0 vertex information from mdst through to NtupleMaker

► MC generation

  ■ 3M events each in Phase 2 and Phase 3, build-07-03 with modifications

  ■ $\Upsilon(3S) \to$ 66% $\gamma\chi_{b2}(2P)$, 33% $\gamma\chi_{b0}(1P)$

    ● $\chi_{b2}(2P) \to$ 50% $\gamma\Upsilon(1S)$, 50% $\gamma\Upsilon(2S)$

    ● $\chi_{b0}(1P) \to$ 100% $\gamma\Upsilon(1S)$

      ◆ $\Upsilon(1,2S) \to$ 100% $\mu^+\mu^-$

► **The following is PRELIMINARY**
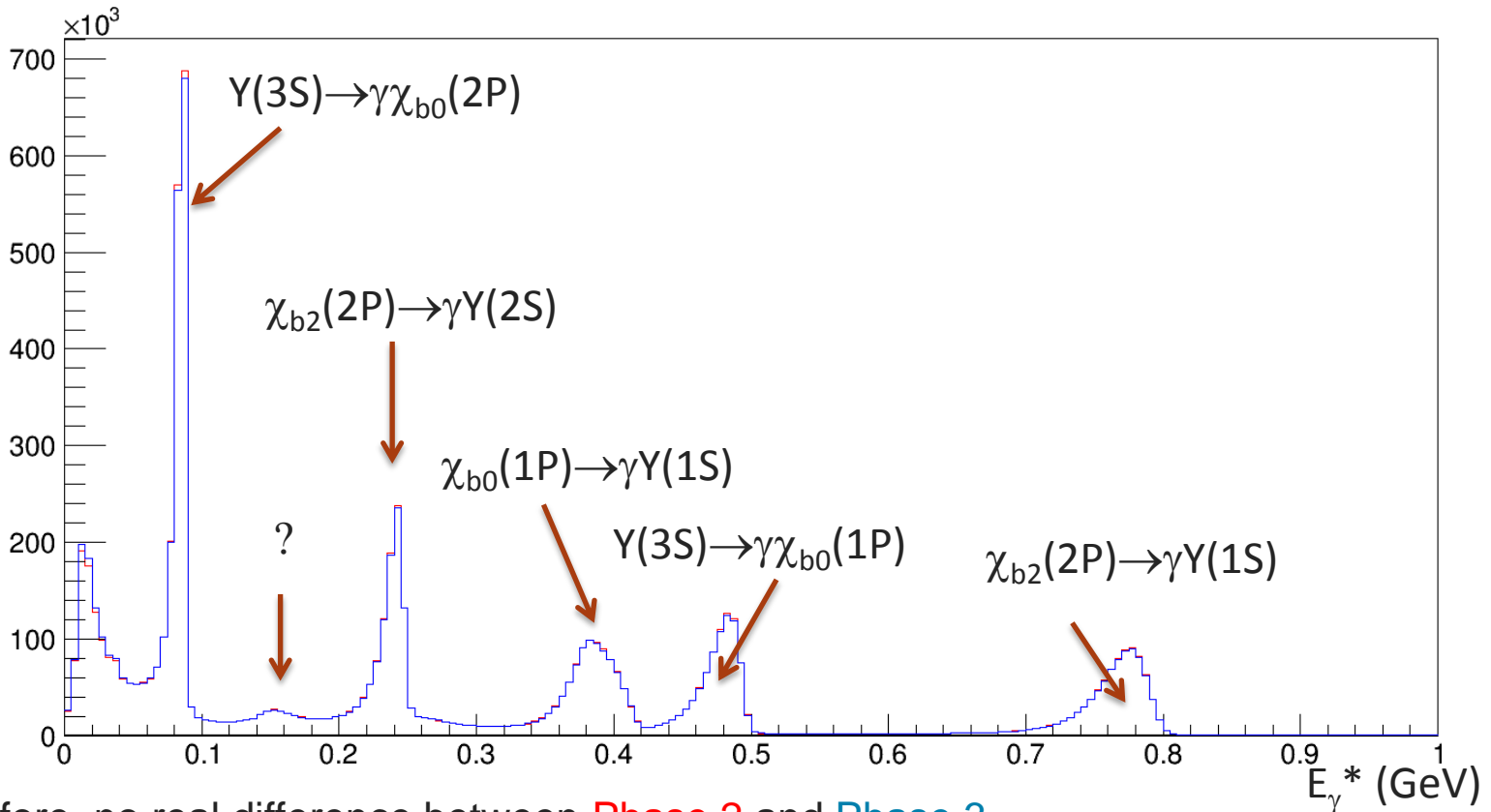
- As before, no real difference between Phase 2 and Phase 3
- One unaccounted feature
- Doppler-broadening in $\chi_{b0}(1P) \rightarrow \gamma Y(1S)$ lineshape
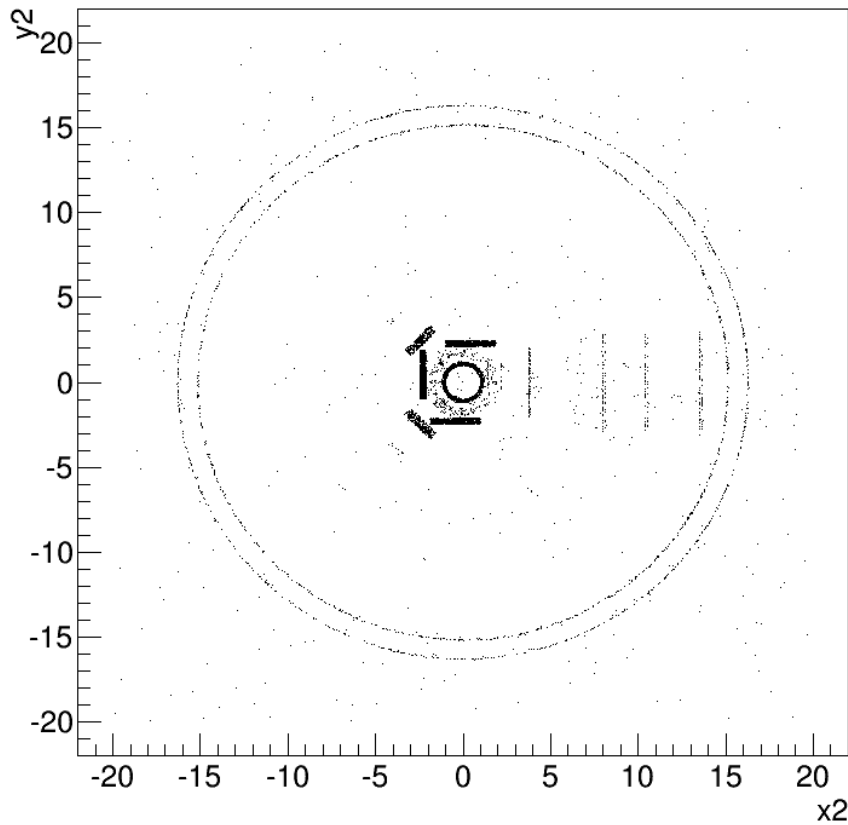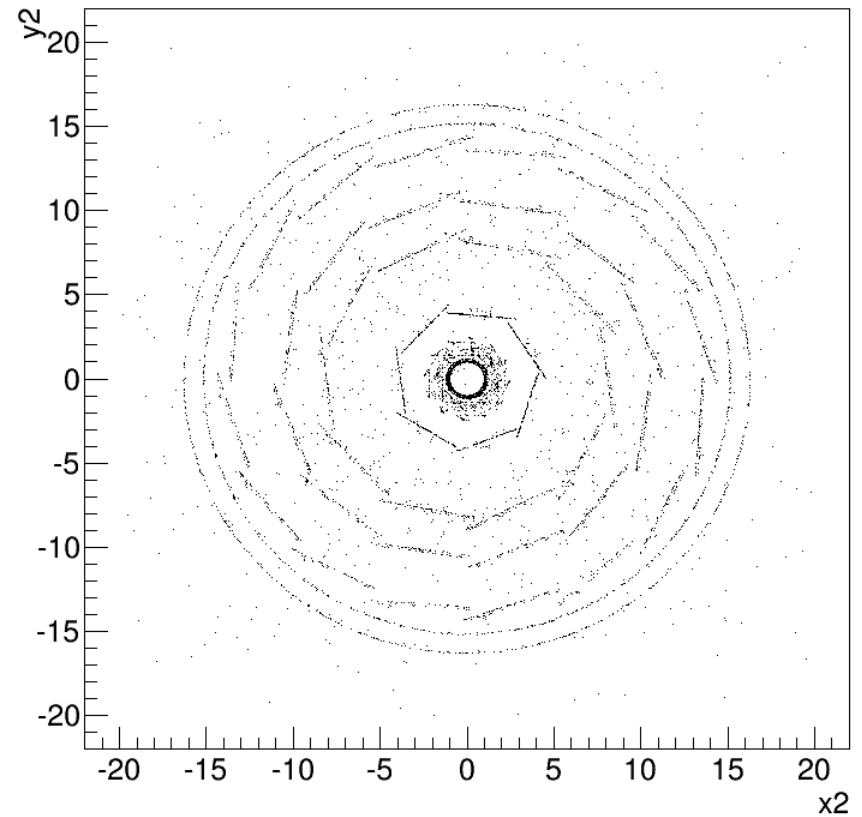- To do: estimate efficiency, resolution, "real" MC
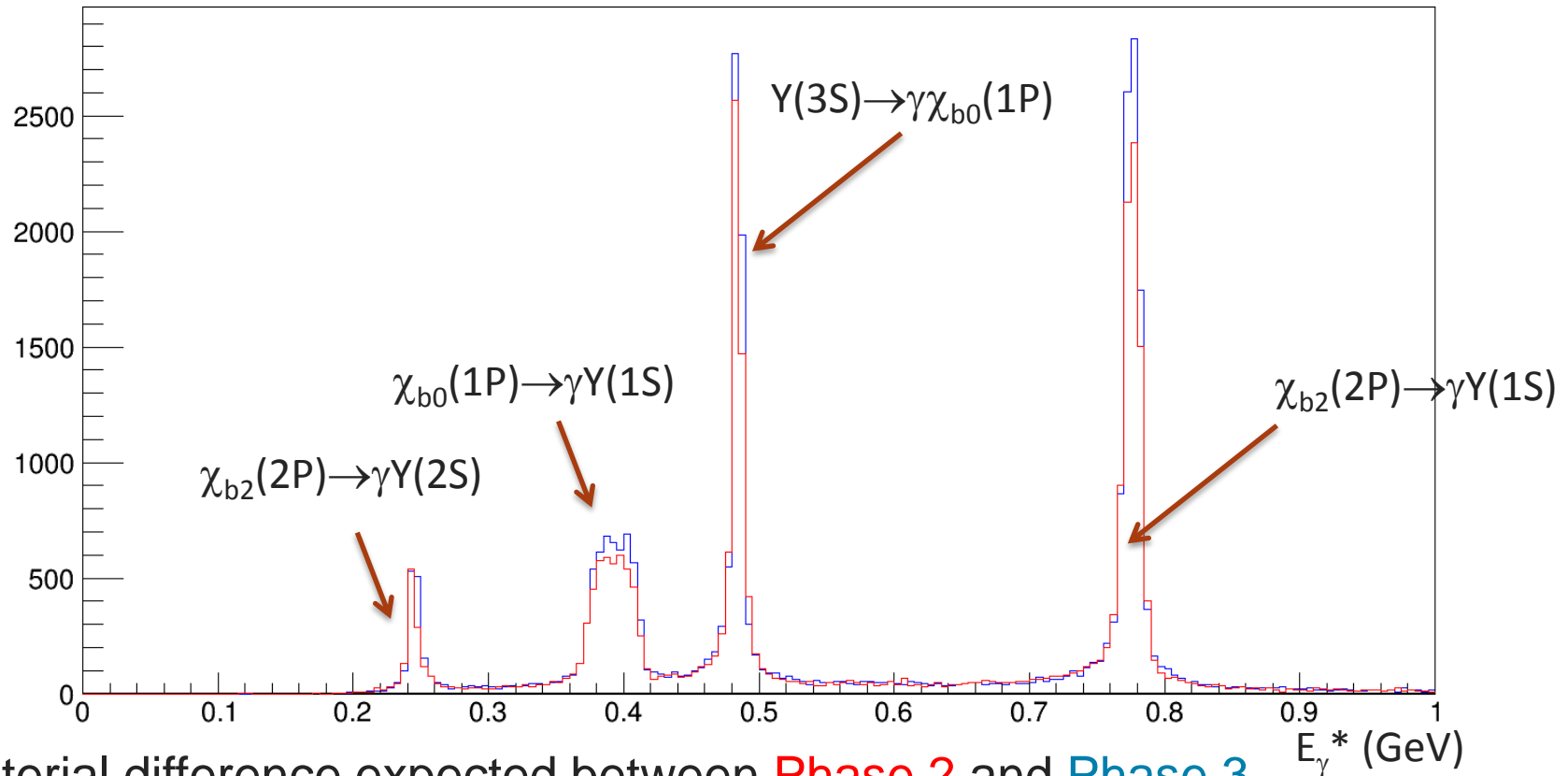
- ▶ Material difference expected between Phase 2 and Phase 3
- ▶ Good resolution but extremely low efficiency
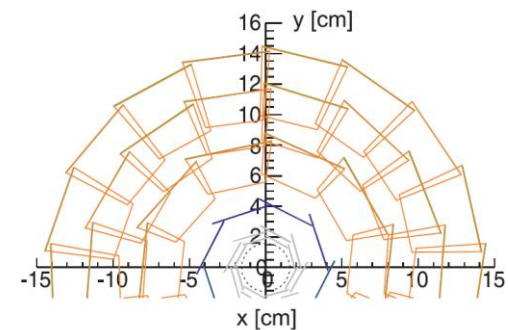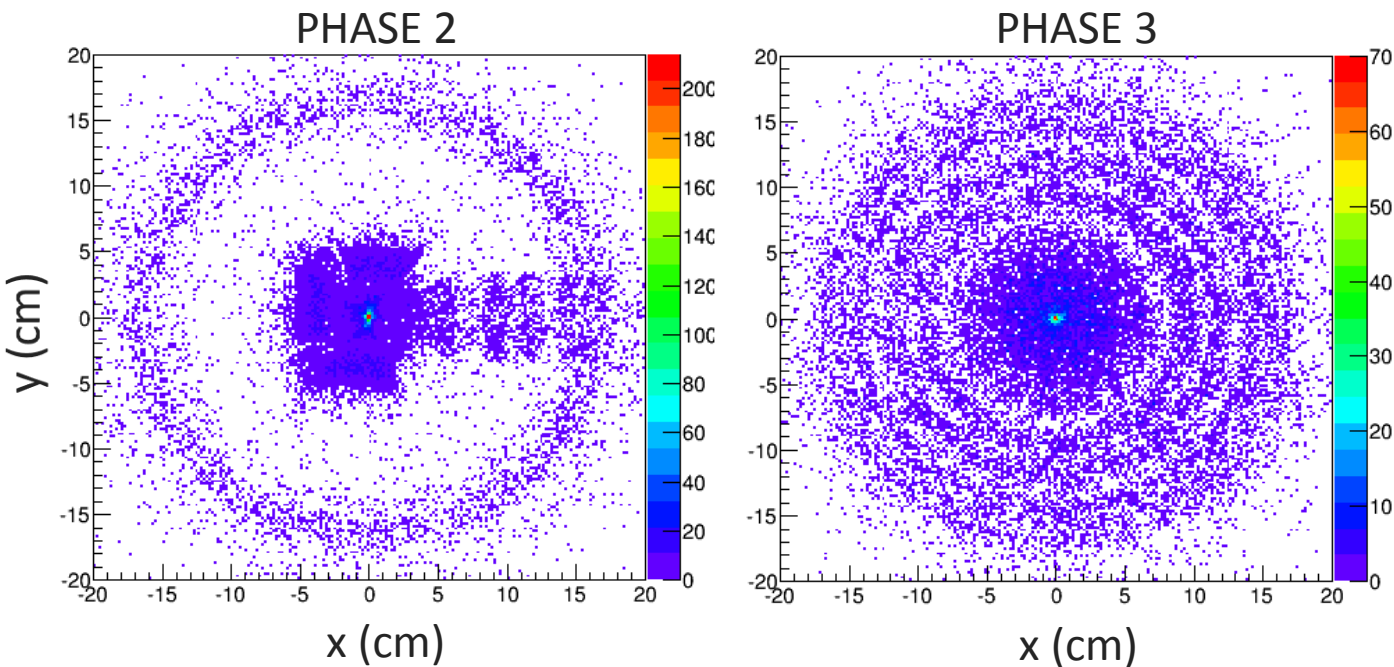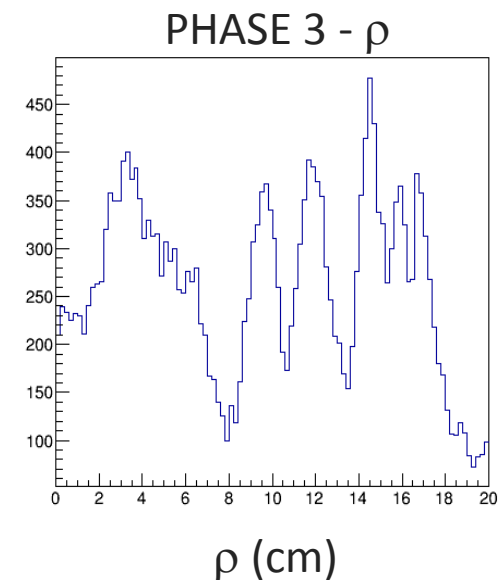- ▶ Doppler broadening effects present

PHASE 2

PHASE 3
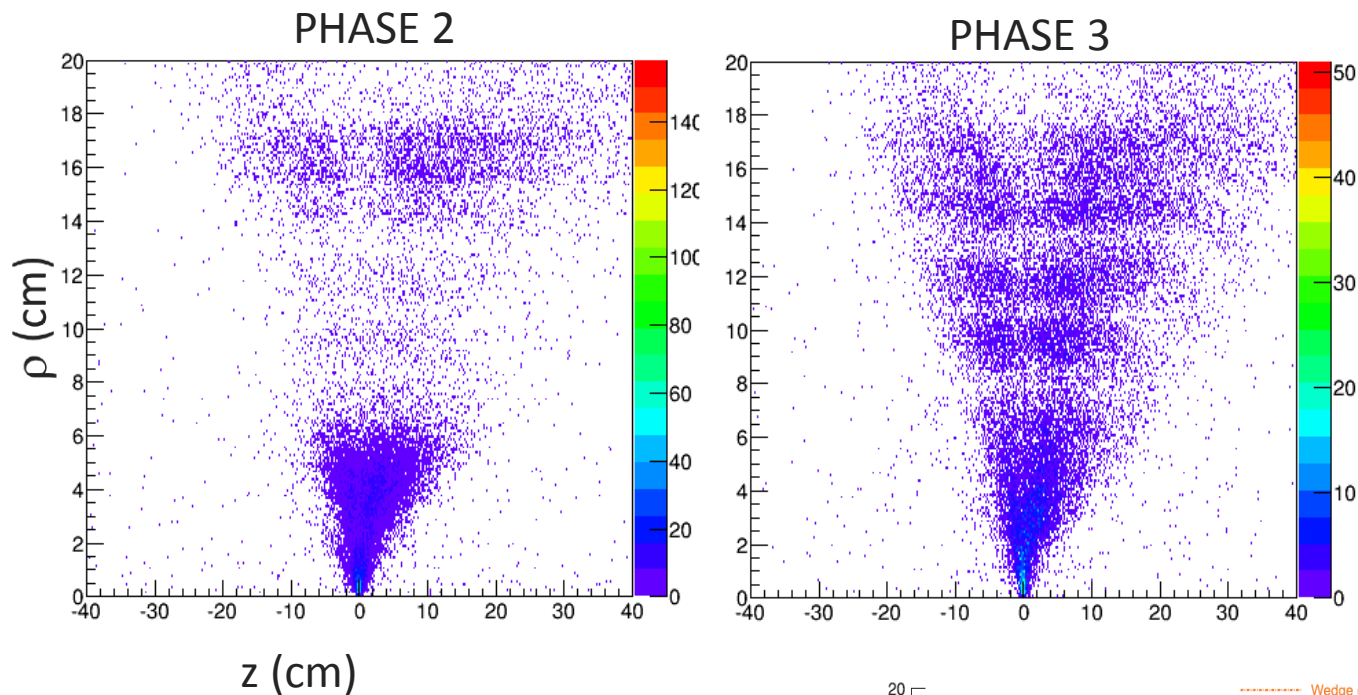
Analysis – Converted Photons Reconstructed Vertices

▶ Inner detector V0 vertices (X:Y plot, no cut in z here)
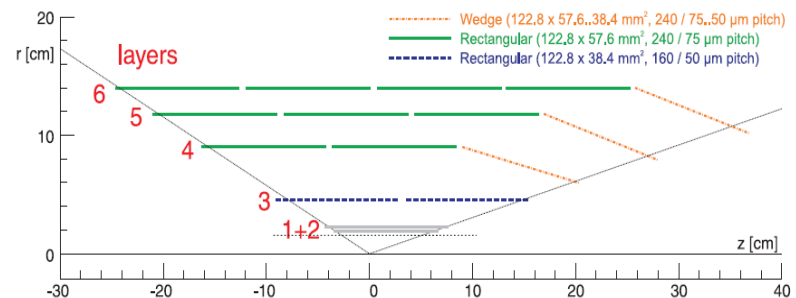
PHASE 2

PHASE 3

PHASE 3 - ρ

x (cm)

x (cm)

ρ (cm)

▶ SVD and Phase 2 detectors where expected

▶ No resolution of VXD or beampipe
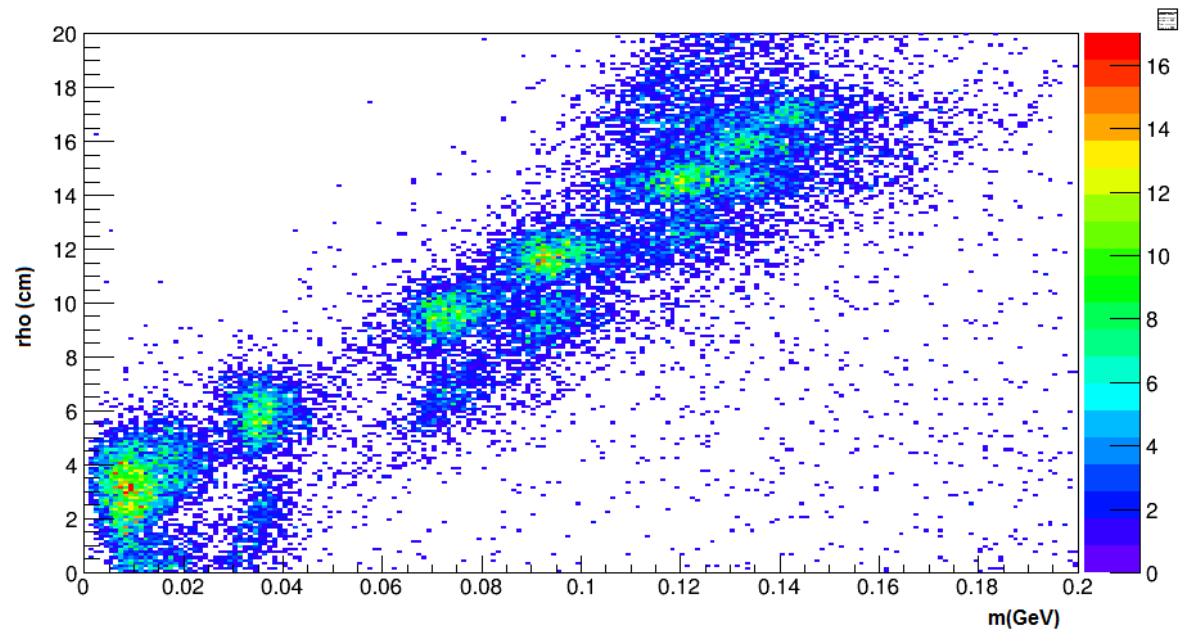
Analysis – Converted Photons Vertices in ρ and z

PHASE 2

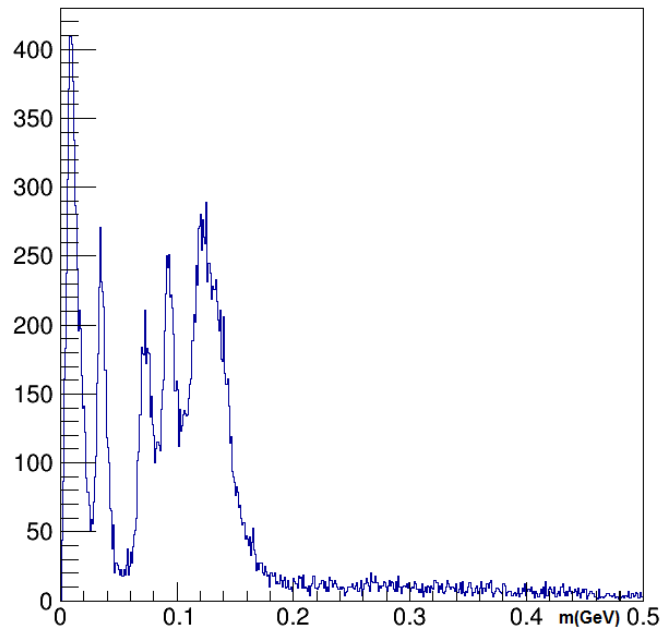PHASE 3

z (cm)

layers

► Similar plots in ρ and z
► Wedge pieces visible

► Invariant mass distribution does not peak at zero
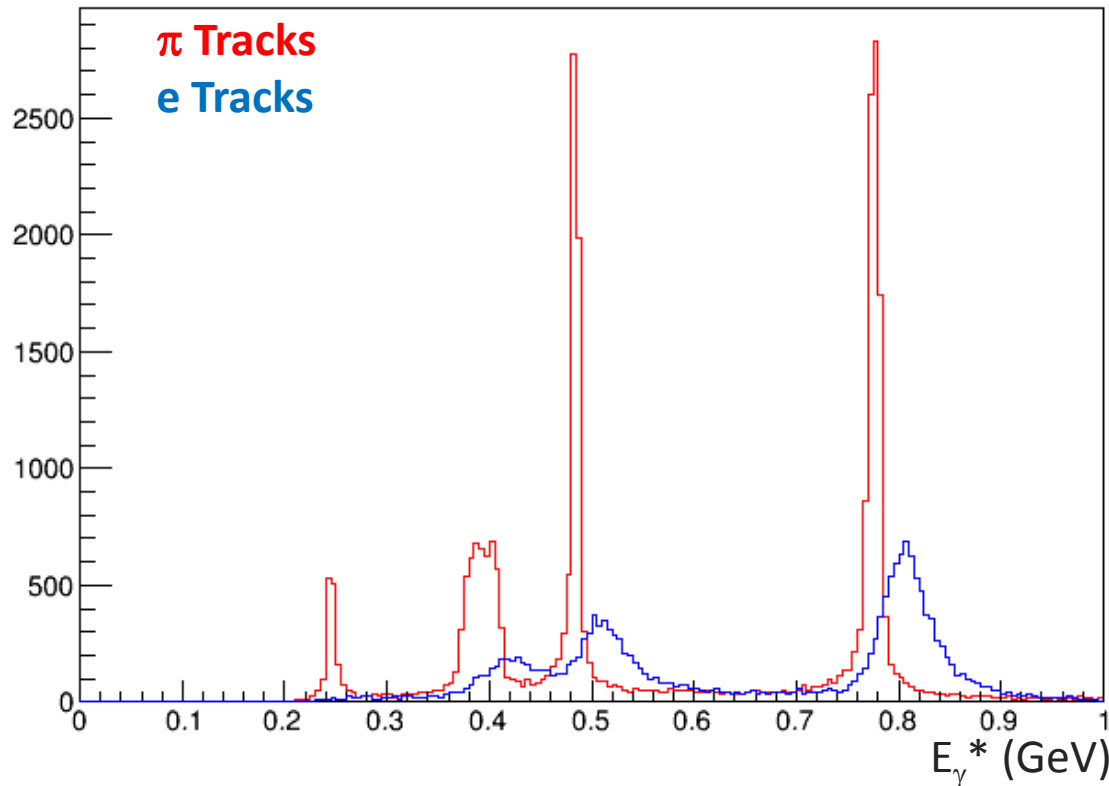

Signal MC converted photon mass

► Directly correlated with vertex position

Analysis – Converted Photons
e- Track Hypothesis: Work In Progress

► Attempted to use electron particle hypothesis from Genfit level

■ Fewer conversions, energy/resolution shift → not yet understood

■ (I possibly/probably did something wrong here, do not take seriously yet)

Analysis Conclusions: To Do List

► More work needed

- ▪ Improved conversion finder (electron tracks, better finding algorithm?)
- ▪ …
- ▪ Calculate efficiencies (esp. for low energy/momentum)
- ▪ Expected resolution
- ▪ …
- ▪ Correct Phase 2 geometry material
- ▪ Effects of more material
- ▪ …