EbE Vertexing for Mixing

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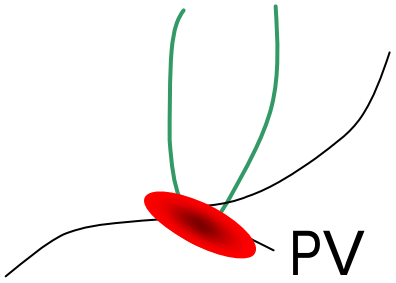
For the LBLB group

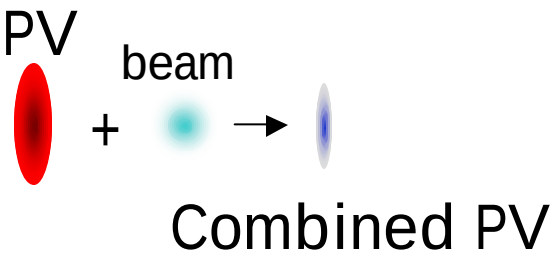
Decay L_{xy} Determination

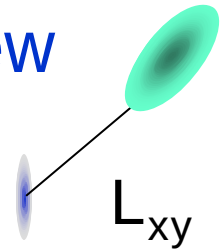
A 3 step process:

1. Determine vertex from tracks in the event (~25μm-ish)
2. Apply beamline constraint (~25μm-ish)
3. Compute secondary vertex position

At each step, pulls of the new ingredient must be 1!!!

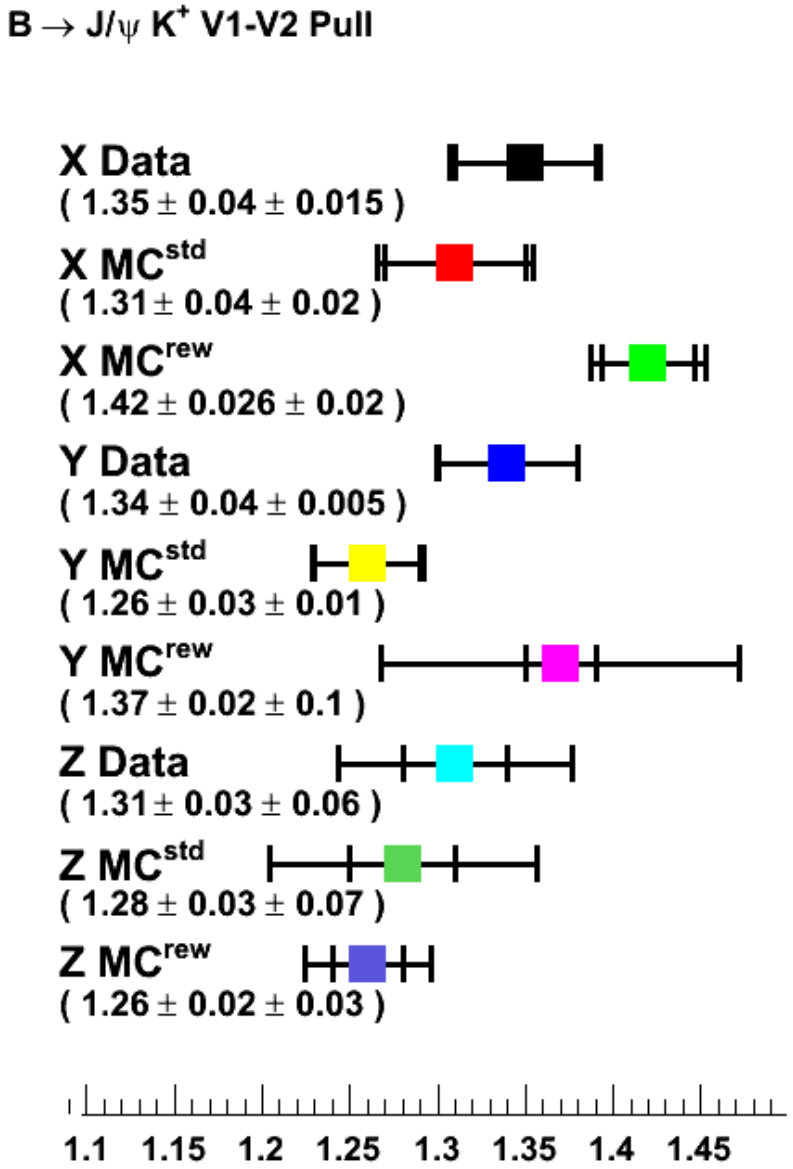






PV Scale Factor (no beam constr.)

- Scale factor in data is O(1.38)
- Montecarlo after L00 reweighting shows consistent numbers
- Systematics from fit model and across samples available [effect is O(10%)]
- Pull after beamline constraint?
  - Apply beam constraint
  - Look at d0 of fully reco'd candidates WRT EbE vertex
  - Affected by:
    - EbE (PV + beam)
    - Secondary Vertex



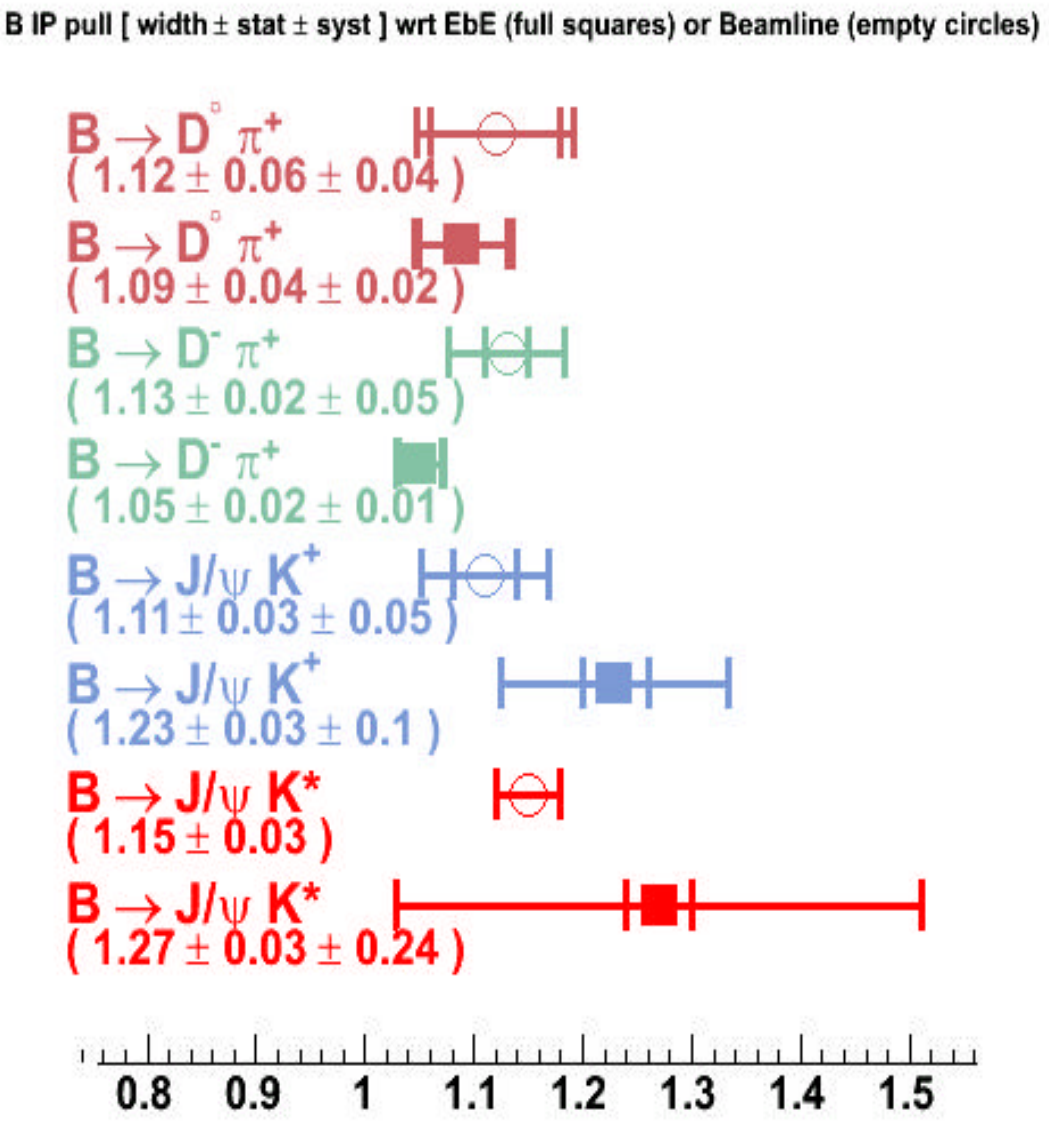
Beamline Constraint

Impact Parameter Pull w.r.t. beamline/beamline constrained EbE:

- d_0^{beam} shows ~10-15% deviation from 1
- d_0^{EbE} Shows O(20%) deviation

- Where do these come from?

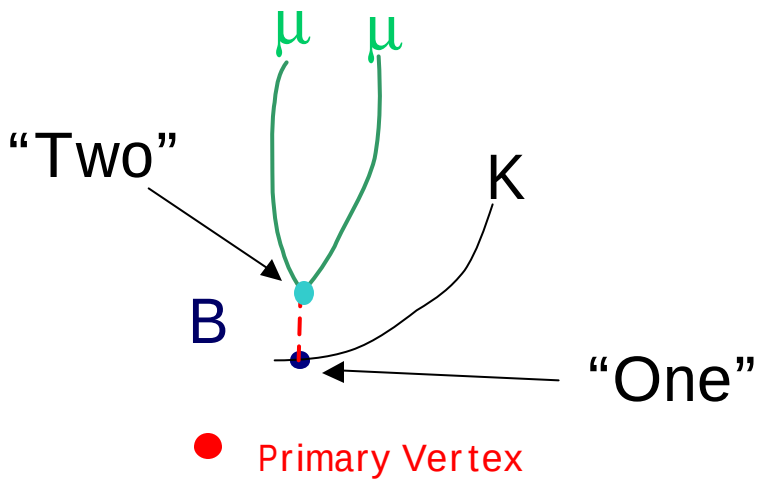
1. Beamline [constraint]
2. Secondary Vertex res.

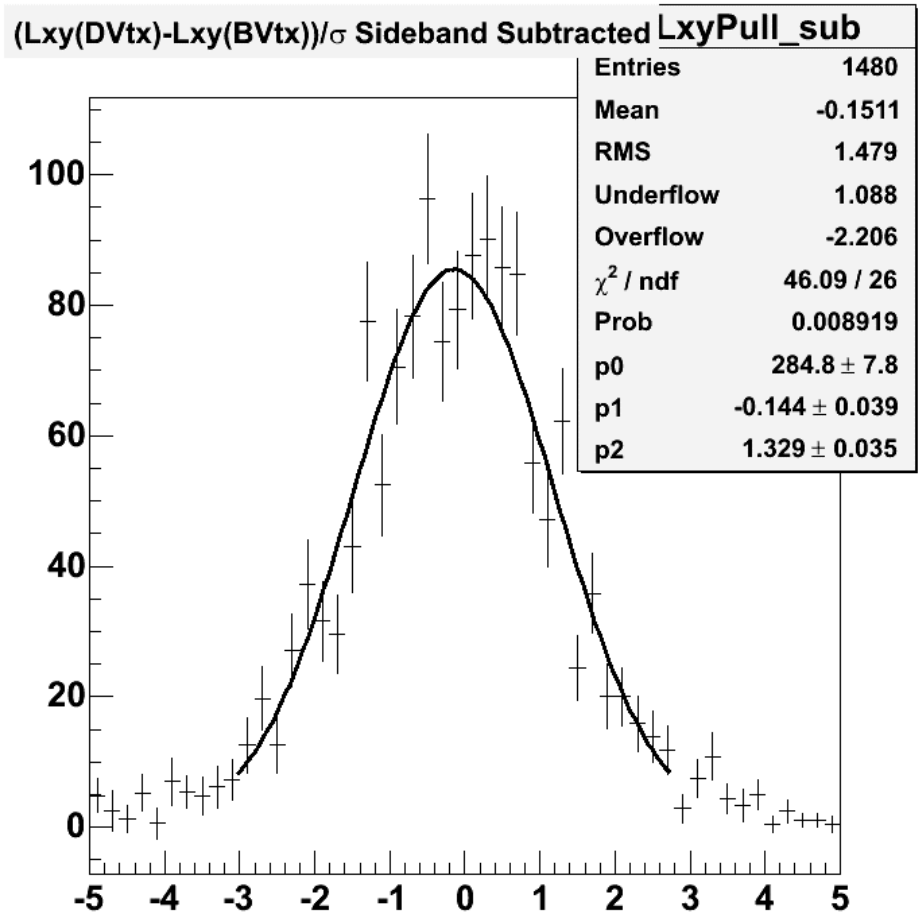


Secondary Vertex Scale factor from B decays

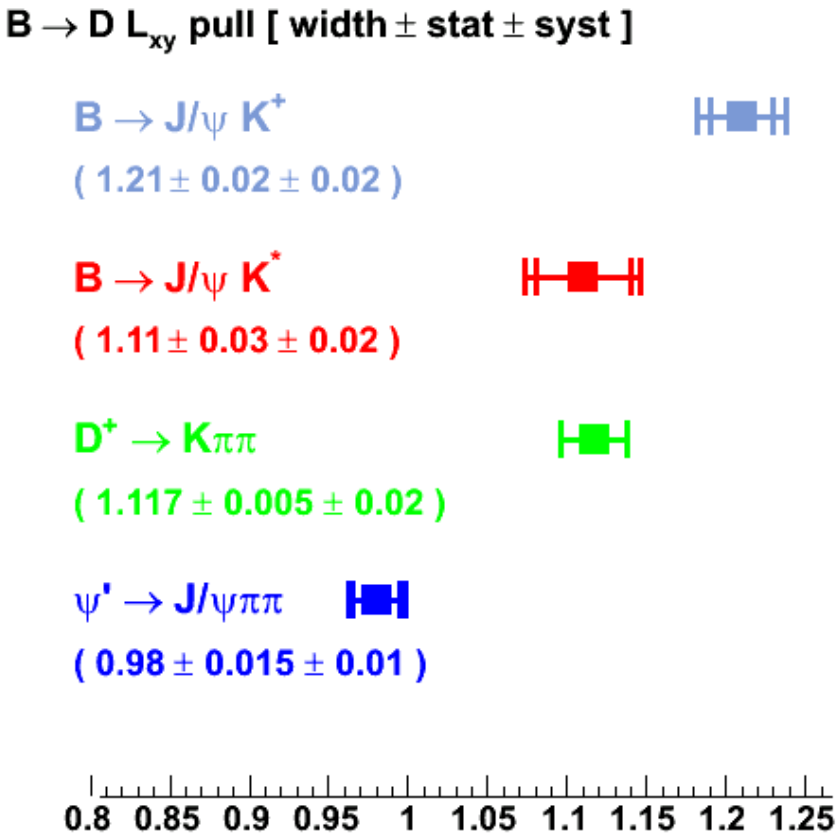
Example: $B \rightarrow \psi K^+$

- Fit ψ to a single vertex
- "point" ψ back to K
- Measure L_{xy} wrt B vertex
- Pull is a proxy for a "seconday vertex" pull!





The SV scale factor problem



- Re-analyzed all samples
- Fixed a couple of bugs…
- Pull grows as a function of lifetime?
- No clear dependency on any other variable spotted
- How does this compare to montecarlo?

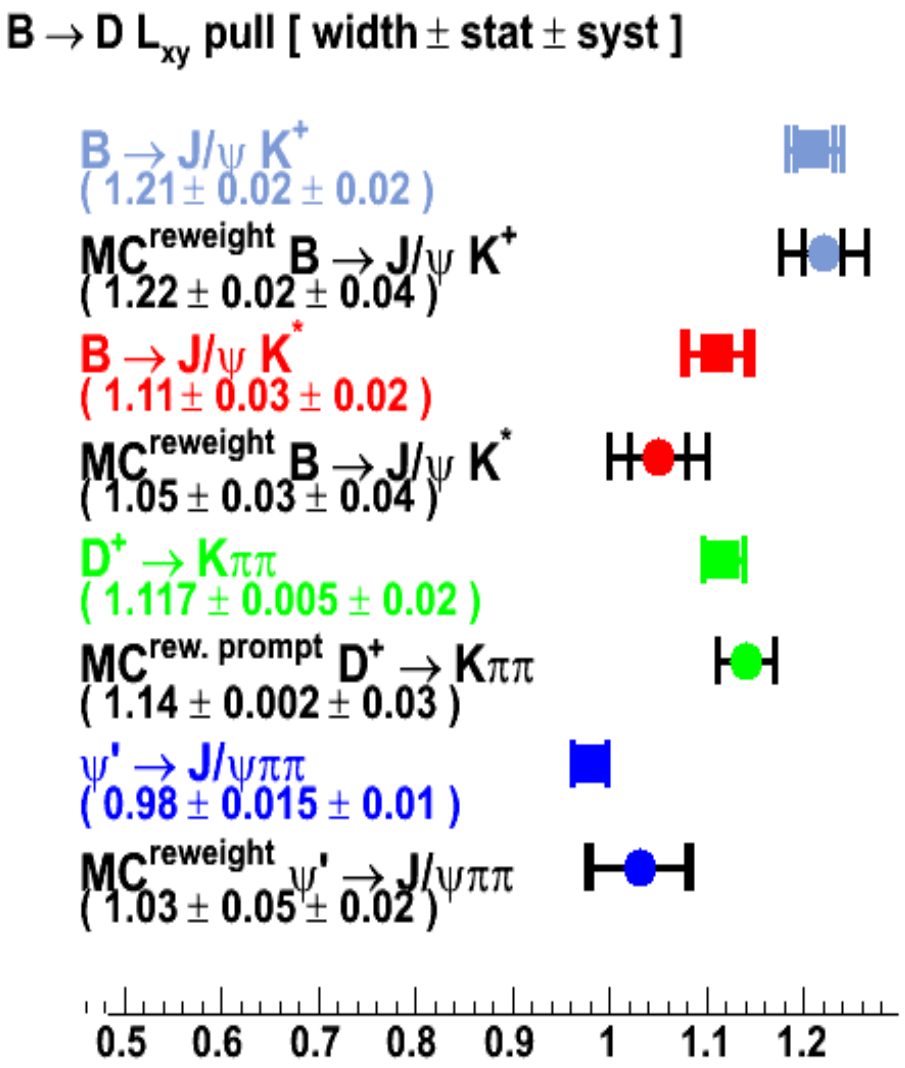
Montecarlo

We compare/complement data with:

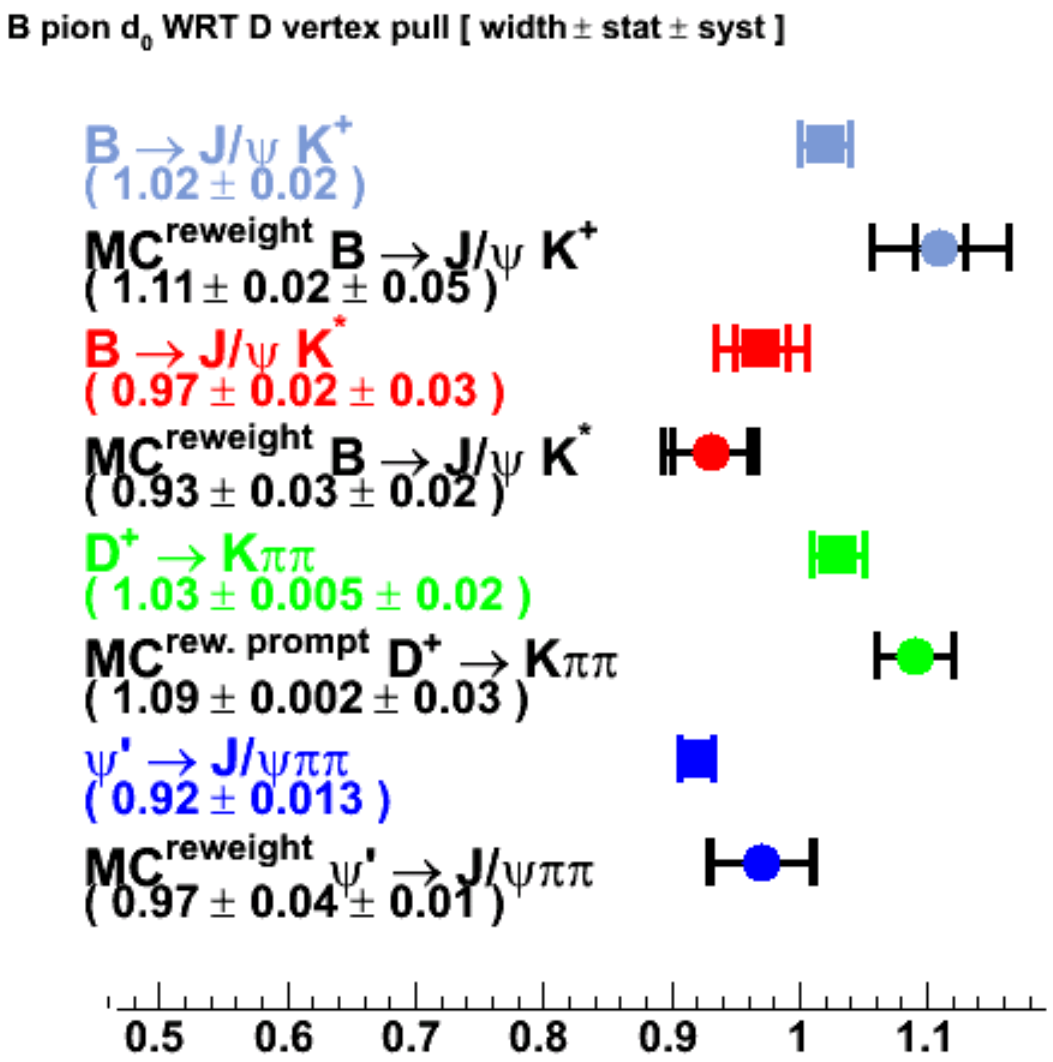
- Toy montecarlo to study pull of fixed kinematics vs L_{xy}
- Several samples:
  - As many of the modes we study on data as possible
    - ψ, ψK^+, ψK^*, D^+
  - Pythia (preferable to evaluate the PV pulls)
  - Bgen (suitable for most SV studies)

L00 Reweighting on SV

- L00 reweighting has a larger effect on SV than PV
- Effect consistently reproduces our 'problem' on Montecarlo!!!
- If we find consistency with data, we can dissect the MC and get another tool to investigate the problem!
- In the short term we can just use MC to assess the scale factor, with a systematic uncertainty of few %!
- We can confirm this looking at the impact parameter, rather than L_{xy}



Cross check: 'B' pion IP



Picture is consistent with what we see on L_{xy} !!!

Bottomline

- SV scale factor depends on mode (kinematics/topology)
- Montecarlo reproduces the behavior

➢ We can measure the appropriate scale factor comparing measured-truth

Conclusions

- We now have a way of assessing all the scale factors involved [O(10-20%) different from 1]
- Aart's measurement of the beamline 'growth' with time needs to be incorporated as well [O(10-15%) effect]
- Putting all together should allow us to obtain a consistent picture with a reasonable systematic [O(10%)]
- Plan is to verify this and document everything!