

EbE Vertexing for Mixing

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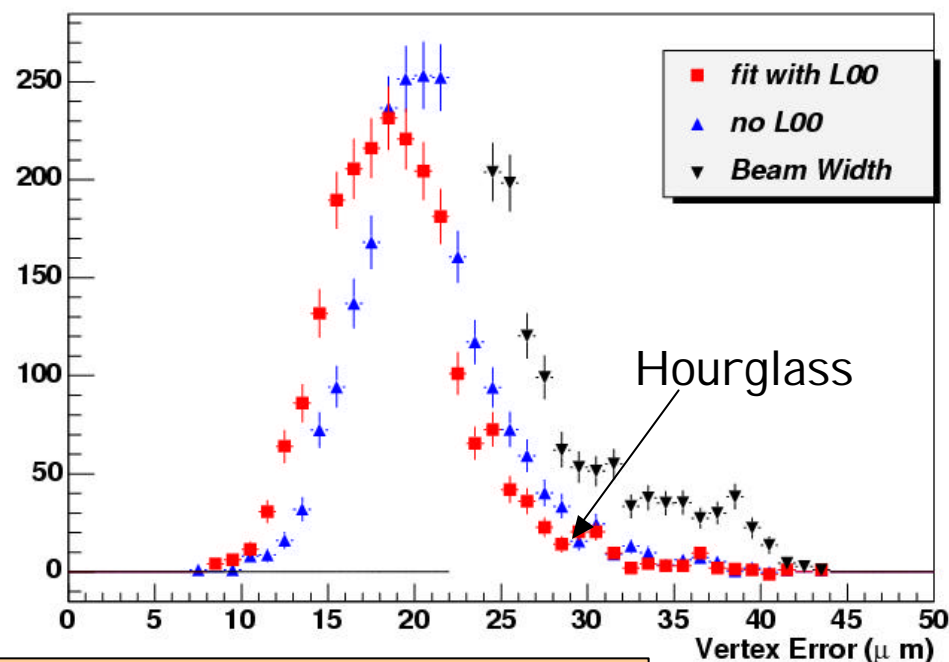
UPenn

Current status

EbE: iterative track selection/pruning algorithm to provide an unbiased estimate of the PV position on an Event-by-Event basis

- Hadronic analyses used a flat $\sim 25\mu\text{m}$ beamline!
- Possible improvements:
 - Move to "hourglass"
 - Move to EbE
 - EbE + Hourglass
 - One of the $\frac{1}{2}$ leptonic analyses used this

Error on Transverse Primary Vertex



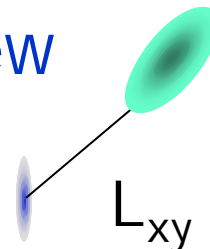
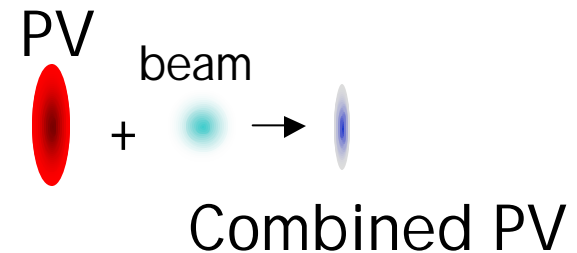
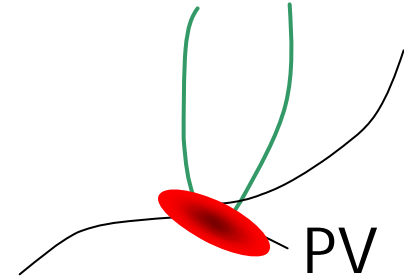
No matter what you choose, you need to understand your errors (pulls)

Decay L_{xy} Determination with EbE

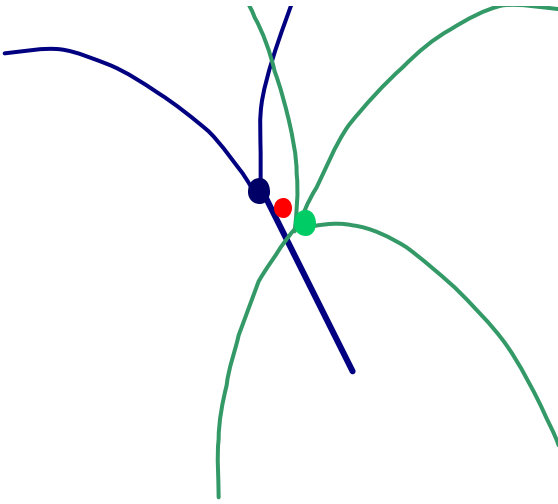
A 3 step process:

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

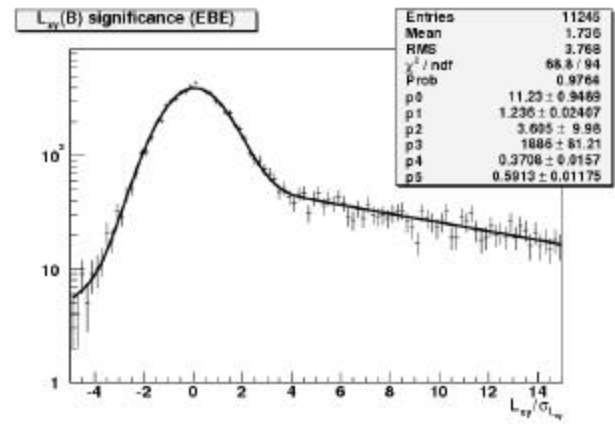
At each step, pulls of the new ingredient must be 1!!!



The tools to check the Pulls!



- Prompt peak
- **V**-truth
- **V1-V2**
- d_0/σ



$$L_{xy} := \vec{\Delta} \cdot \hat{P}_B$$

$$d_0^B := \left| \vec{\Delta} - \frac{P_B^2}{\vec{P}_B \cdot \vec{\Delta}} \vec{P}_B \right| \approx \vec{\Delta}^\perp \cdot \hat{P}_B$$

$$\sigma_{L_{xy}} = t \hat{\Delta} \Sigma_V^2 \hat{\Delta}$$

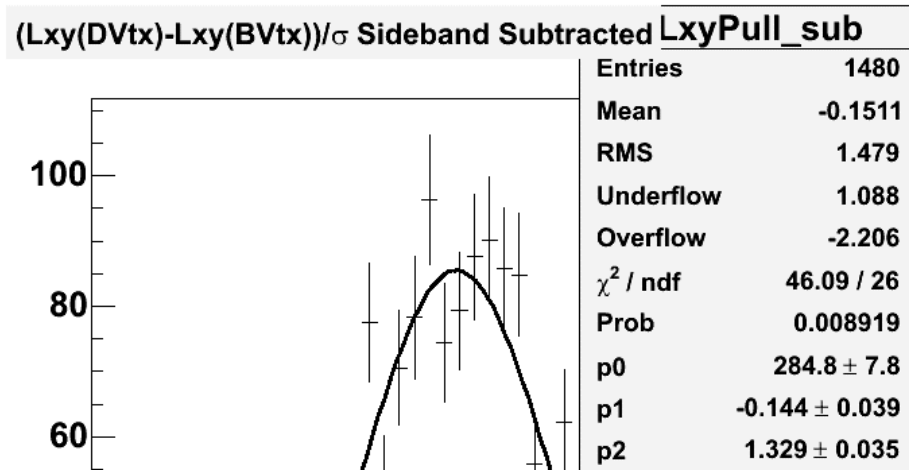
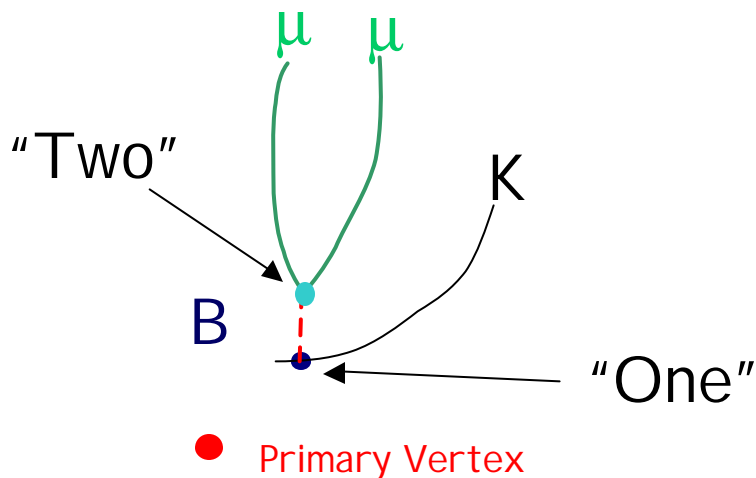
$$\sigma_{d_0^B} = t \hat{\Delta}^\perp \Sigma_V^2 \hat{\Delta}^\perp$$

$\hat{\Delta} = (x, y) \Rightarrow \hat{\Delta}^\perp = (y, -x)$

One more tool for the SV

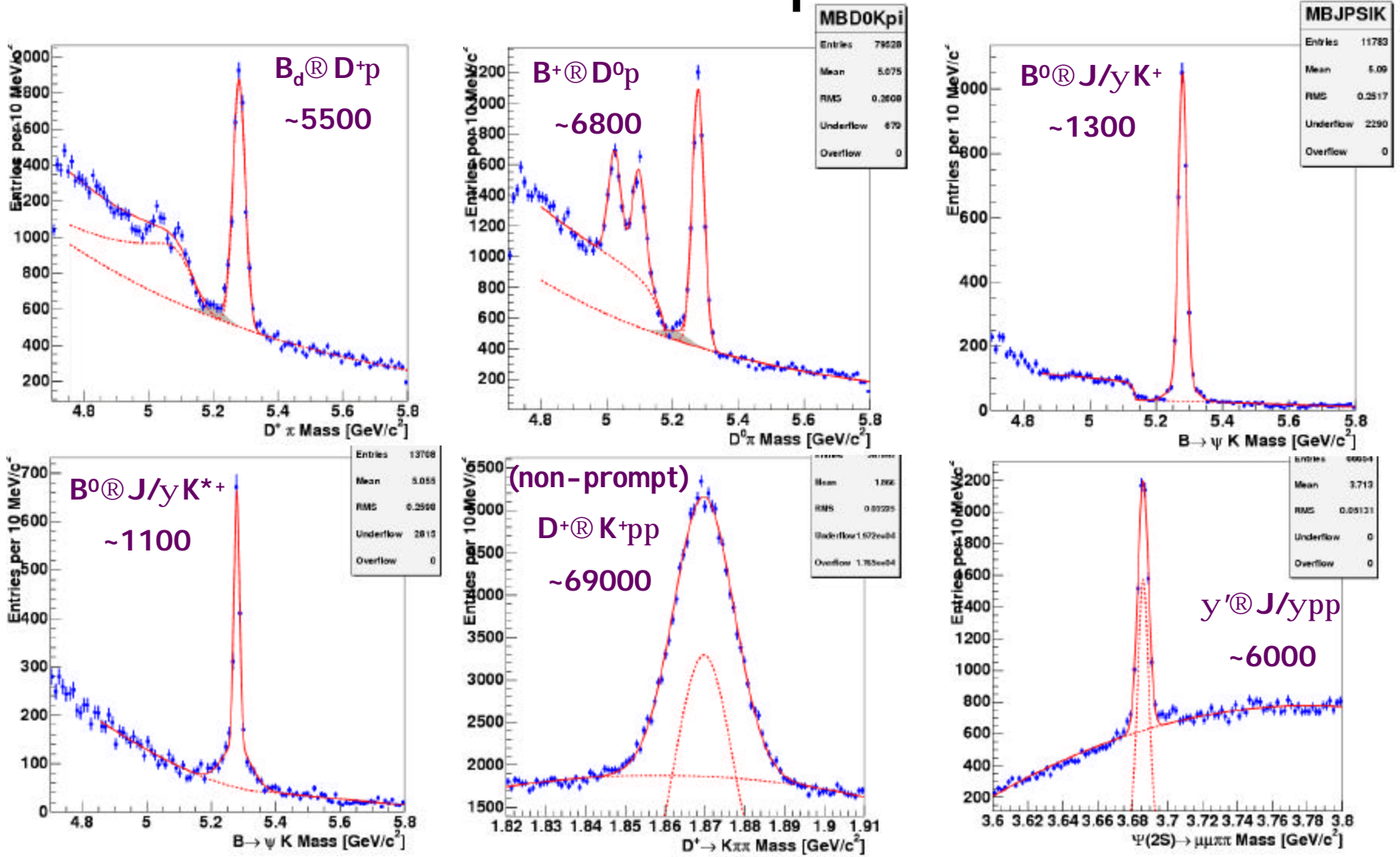
Example: $B \rightarrow \psi K^+$

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



Tracks' d_0 can be used as cross-check

The samples



~15000 fully reco'd B, ~69000 Fully reco'd D+, ~6000 fully reco'd ψ' (re-running)

Montecarlo: mostly BGEN (basically all of the above+B_s), using Pythia if possible

Technicalities (contd.)

Reconstruction:

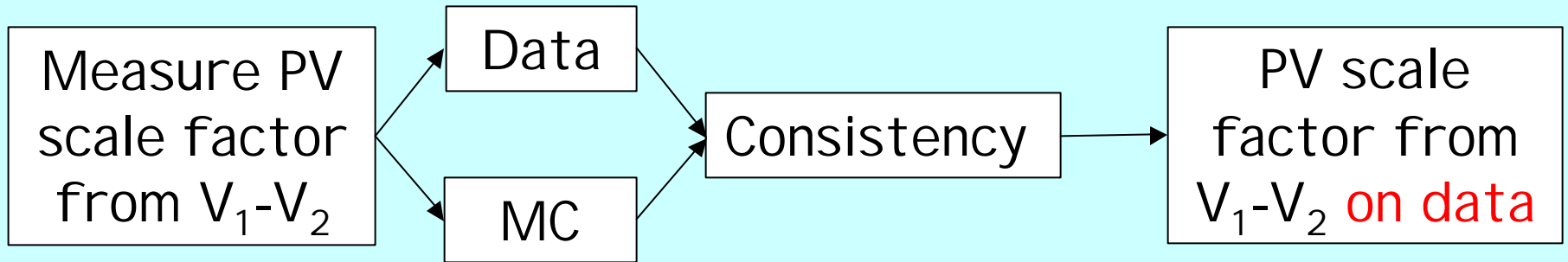
- Based on the $\sim 350\text{pb}^{-1}$ dataset/ 5.x production
- 6.1.0 CharmMods with CTVMFT "fix" (does not really affect results though)
- Standard tracking requirements (COT+3Si)
- **Tight** selection cuts to improve S/B

Montecarlo:

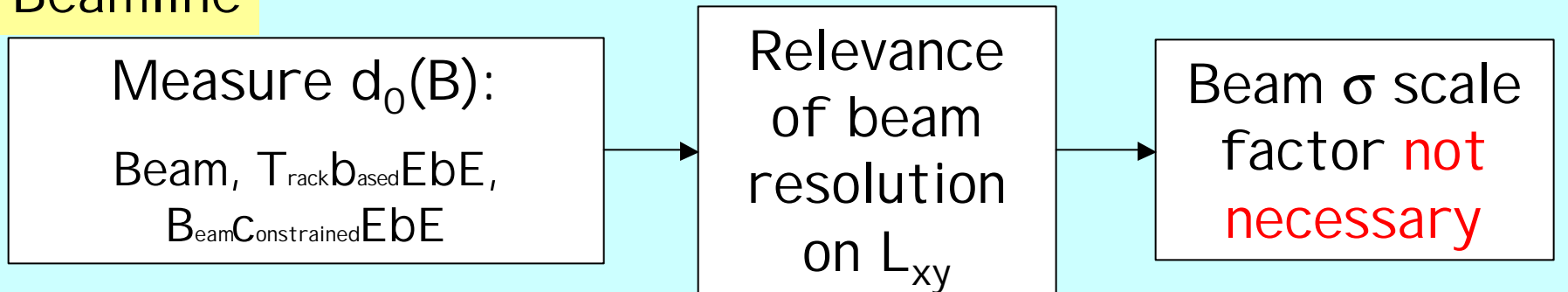
- Using the standard BMC tools plus:
- Stephanie's L00 reweighting
- Kludge (CharmMods/DCalcPrimVertModule) to generate PV based on data histograms for BGEN

Plan

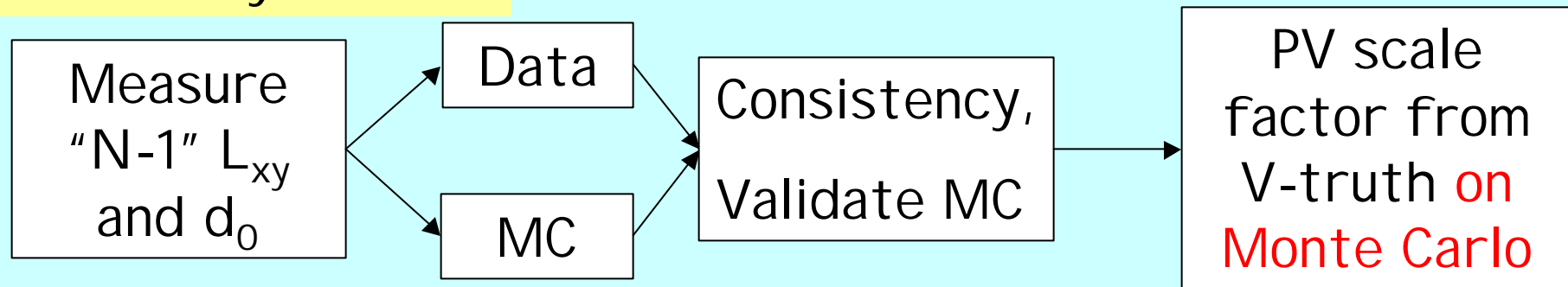
Primary Vertex



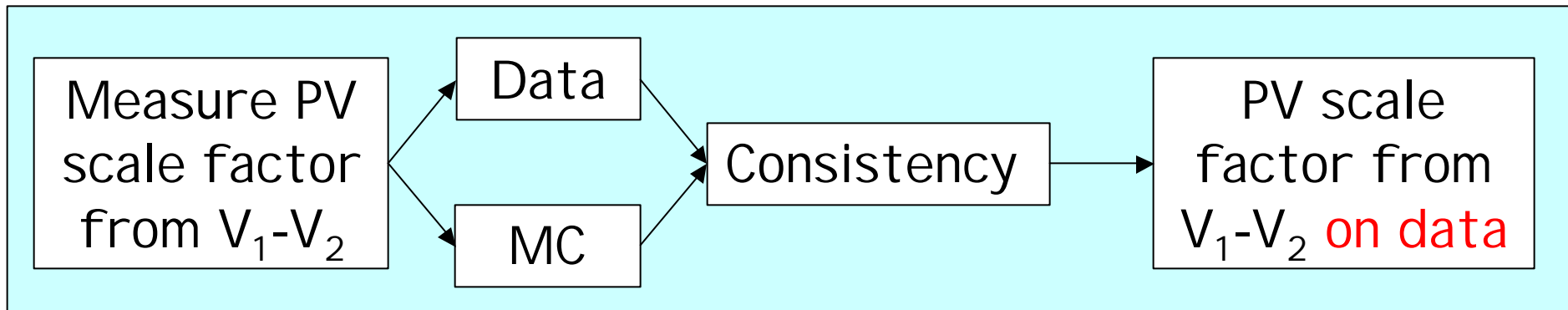
Beamline



Secondary Vertex



Primary Vertex



PV Scale Factor (no beam constr.)

- Can be probed directly on data using V_1-V_2
- Consistent picture in data: $O(1.38)$
- Monte Carlo after L00 re-weighting shows similar numbers (bottom right)
- Measured systematics from fit model and across samples [effect is $O(5\%)$]


V1-V2 Pull

B \rightarrow D⁰ π^+ X Data 
($1.4 \pm 0.02 \pm 0.05$)

B \rightarrow D⁺ π^+ X Data 
($1.39 \pm 0.02 \pm 0.02$)

B \rightarrow J/ ψ K⁺ X Data 
($1.38 \pm 0.03 \pm 0.02$)

B \rightarrow J/ ψ K⁺ X Data 
($1.32 \pm 0.03 \pm 0.02$)

ψ^* \rightarrow J/ ψ $\pi\pi$ X Data 
($1.34 \pm 0.02 \pm 0.02$)



Pull fit:

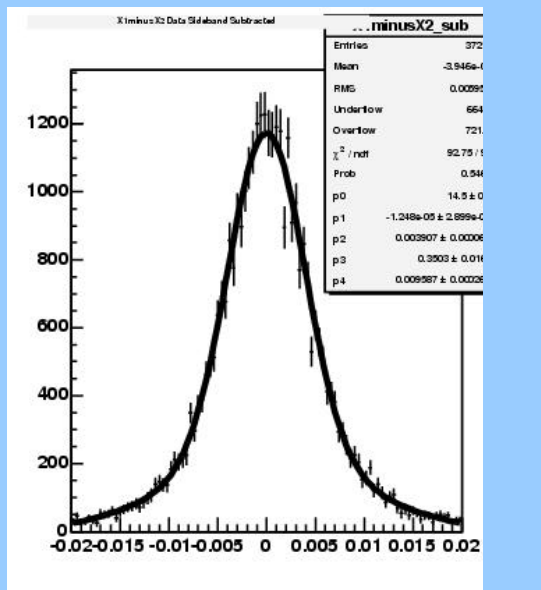
Reference:

• Gauss ($\pm 2\sigma$)


Model Syst.:

• Bigauss


• GaussExp



B \rightarrow J/ ψ K⁺ X Data 
($1.38 \pm 0.03 \pm 0.02$)

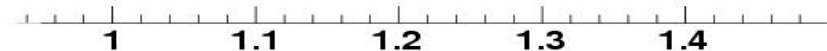
B \rightarrow J/ ψ K⁺ X MC^{rew} 
($1.38 \pm 0.03 \pm 0.02$)

B \rightarrow J/ ψ K⁺ Y Data 
($1.38 \pm 0.03 \pm 0.02$)

B \rightarrow J/ ψ K⁺ Y MC^{rew} 
($1.36 \pm 0.02 \pm 0.02$)

B \rightarrow J/ ψ K⁺ Z Data 
($1.39 \pm 0.03 \pm 0.08$)

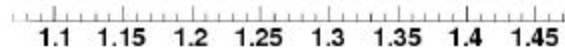
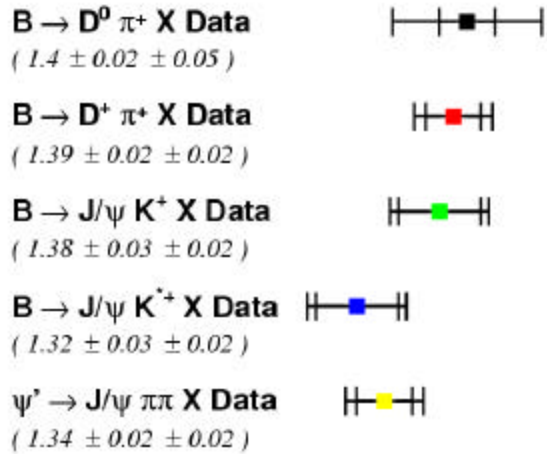
B \rightarrow J/ ψ K⁺ Z MC^{rew} 
($1.28 \pm 0.02 \pm 0.03$)



PV scale factor: other plots (X, Y, Z)

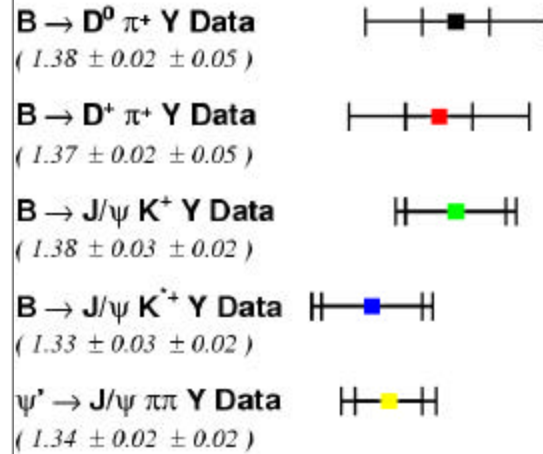
X

V1-V2 Pull



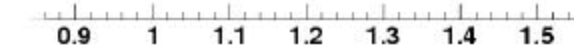
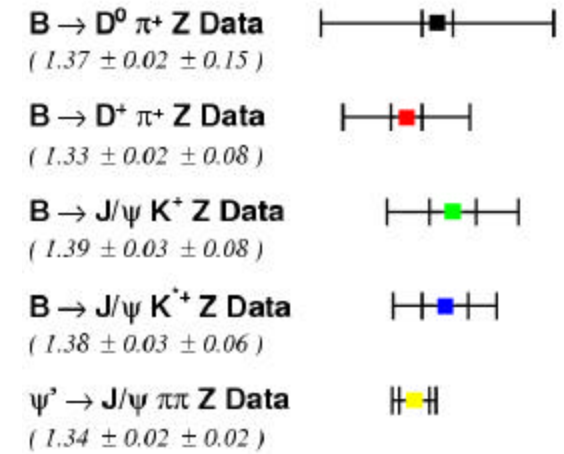
Y

V2 Pull



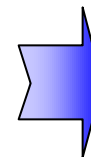
Z

-V2 Pull



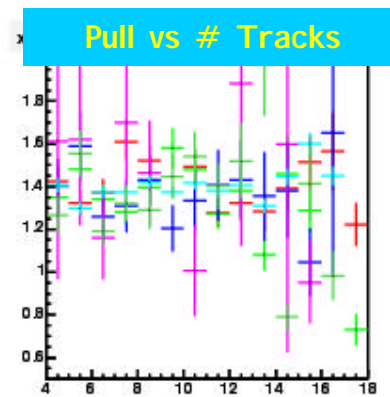
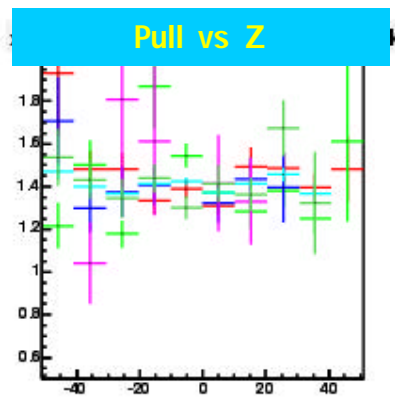
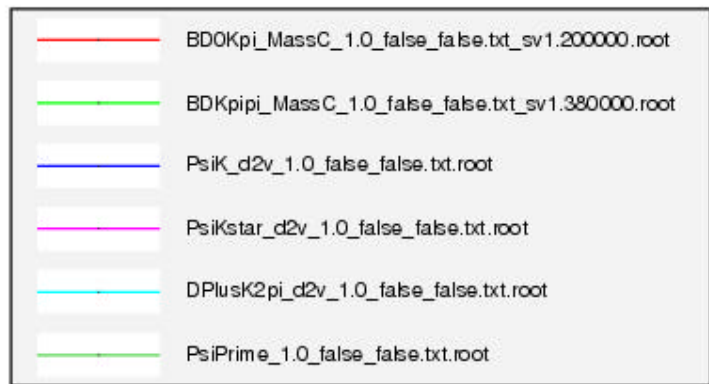
Pull uncertainty is dominated by:

- Variability among samples
- Systematic uncertainty from fit model

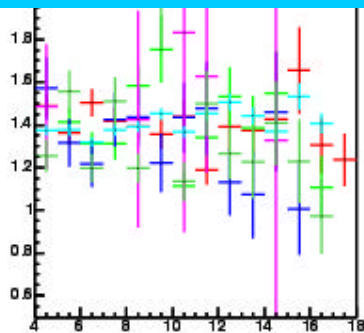


5% Uncertainty

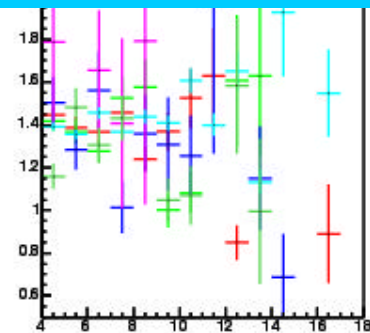
PV scale factor dependencies (X)



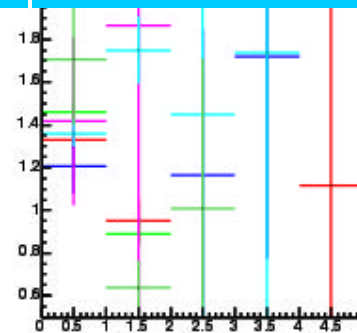
Pull vs # tracks w. z hits



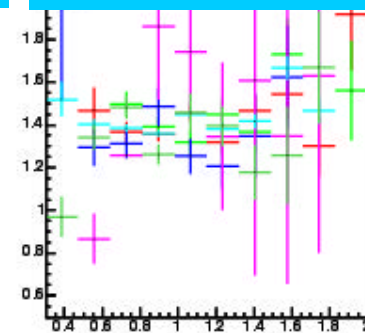
Pull vs # tracks w.LOO hits



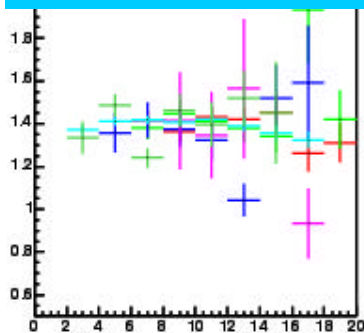
Pull vs # Tracks Pt>2



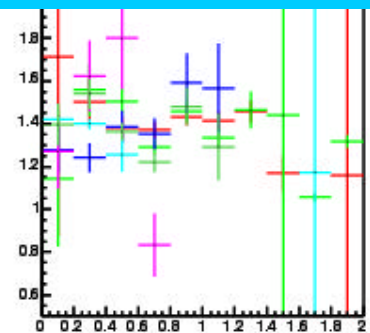
Pull vs Tracks <Pt>



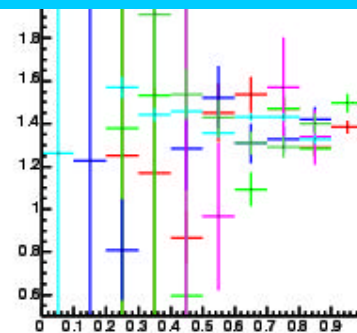
Pull vs Pt B candidate



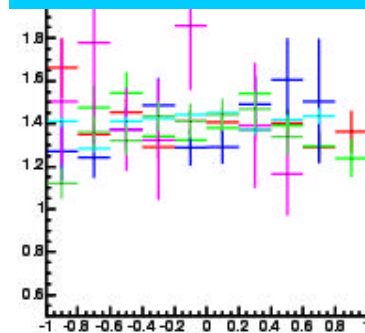
Pull vs DR_{max} B candidate



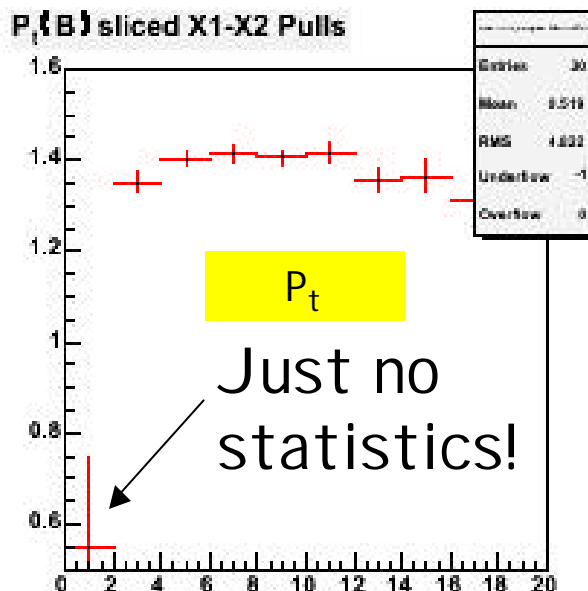
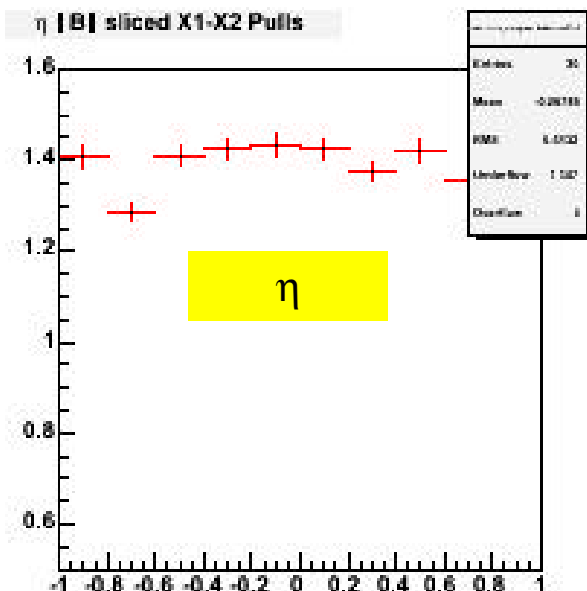
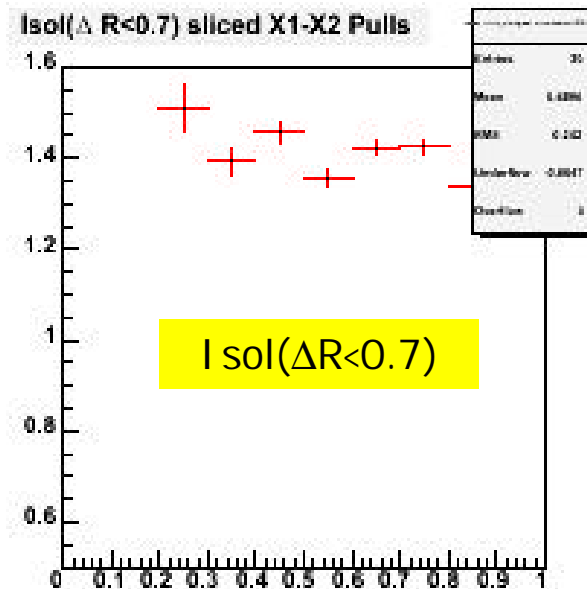
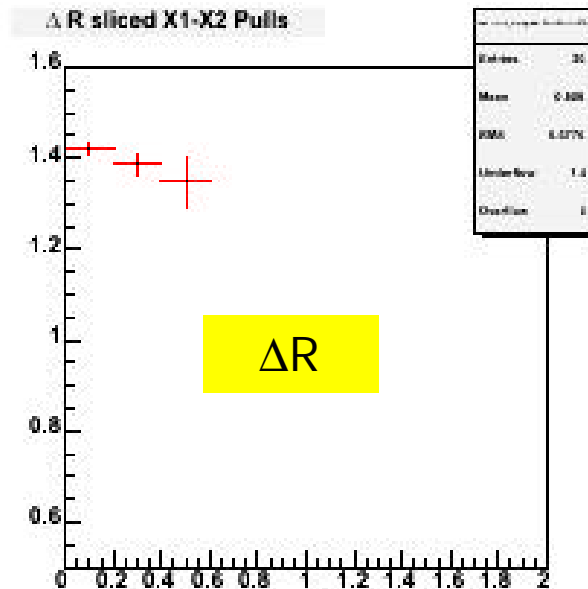
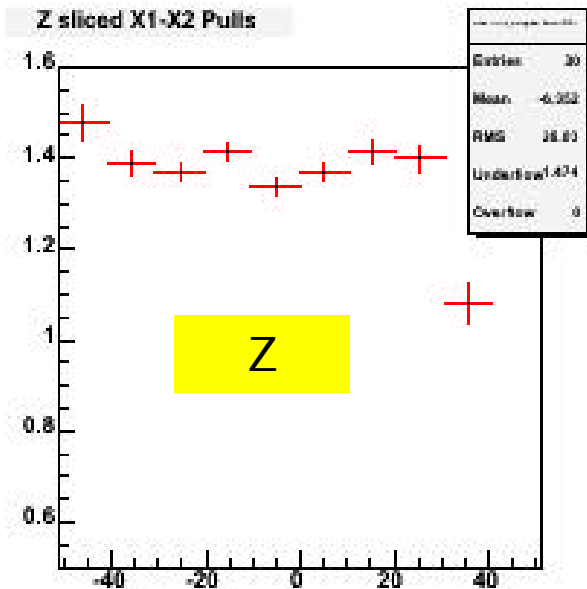
Pull vs Isol. B candidate



Pull vs h B candidate



PV scale factor: details (à la CDF7500)



Non-statistical
fluctuations
dominated by fit
model!

Conclusions on PV

- Scale factor **measured on data**
- Stable (within 5%):
 - Among samples
 - No evidence of dependencies
- We can move to the next step!

Beamline

Measure $d_0(B)$:

Beam, T_{rack} based EbE,
BeamConstrained EbE

Relevance
of beam
resolution
on L_{xy}

Beam σ scale
factor **not
necessary**

$d_0(B)$: properties and limitations

Three possible ways of measuring PV:

- 1) Beamline
- 2) Track based Primary Vertex (TBPV)
- 3) TBPV constrained to beamline ("EbE")

What enters in $\sigma(d_0)$:

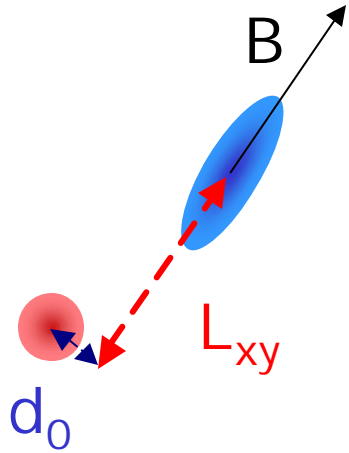
- a) Beam (1,3)
- b) Secondary vertex (1,2,3)
- c) TBPV (2,3)

☹ None of (1,2,3) probes only one piece!

☹ Regime (relative contribution of a,b,c) differs between (1,2,3) but **also** between L_{xy} and d_0 !

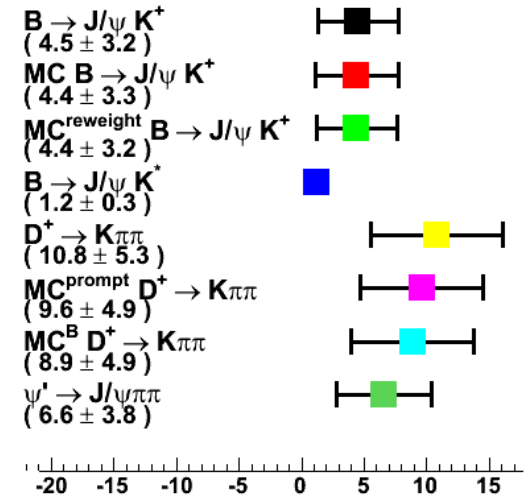
Let's see what happens in a real case...

Limit to the d_0 / L_{xy} analogy

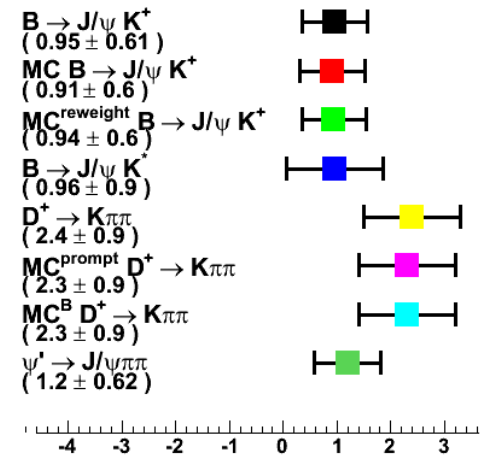


SV resolution ellipsoid is elongated and “seen from” different angles by d_0 and L_{xy} !

‘D’ Vertex error ellipsoid
 ▸ **anisotropy** (mean±RMS)



‘D’ Vertex error scale [in ϵ 100 μ m units] (mean±RMS)



	Not Beam Constrained		Beam Constrained	
	σ_{d0}	σ_{Lxy}	σ_{d0}	σ_{Lxy}
PV	23	27	17	17
SV	12	36	12	36
Sum	27	45	21	43

d_0 and L_{xy} probe **different regimes** of σ_{PV}/σ_{SV} : d_0 dominated by PV, L_{xy} dominated by SV

Back to d_0 : Comparison among samples and with MC

Track based EbE

Beamline

EbE (with beam constr.)

$B \rightarrow D^0 \pi^+$
($0.98 \pm 0.015 \pm 0.01$)

$B \rightarrow D^- \pi^+$
($1.06 \pm 0.015 \pm 0.016$)

$B \rightarrow J/\psi K^+$
($1.05 \pm 0.02 \pm 0.03$)

$B \rightarrow J/\psi K^*$
($1.12 \pm 0.03 \pm 0.02$)

$MC^{\text{reweight}} B \rightarrow J/\psi K^*$
($1.05 \pm 0.02 \pm 0.02$)

$\psi' \rightarrow J/\psi \pi\pi$
($1.15 \pm 0.01 \pm 0.02$)

$MC^{\text{reweight}} \psi' \rightarrow J/\psi \pi\pi$
($0.99 \pm 0.03 \pm 0.02$)

$B \rightarrow D^0 \pi^+$
($1.17 \pm 0.02 \pm 0.02$)

$B \rightarrow D^- \pi^+$
($1.15 \pm 0.02 \pm 0.02$)

$B \rightarrow J/\psi K^+$
($1.15 \pm 0.02 \pm 0.02$)

$MC^{\text{reweight}} B \rightarrow J/\psi K^*$
($1.04 \pm 0.02 \pm 0.03$)

$B \rightarrow J/\psi K^*$
($1.09 \pm 0.03 \pm 0.02$)

$MC^{\text{reweight}} B \rightarrow J/\psi K^*$
($0.97 \pm 0.02 \pm 0.02$)

$\psi' \rightarrow J/\psi \pi\pi$
($1.22 \pm 0.02 \pm 0.02$)

$MC^{\text{reweight}} \psi' \rightarrow J/\psi \pi\pi$
($1.03 \pm 0.03 \pm 0.02$)

$B \rightarrow D^0 \pi^+$
($1.13 \pm 0.02 \pm 0.02$)

$B \rightarrow D^- \pi^+$
($1.13 \pm 0.02 \pm 0.02$)

$B \rightarrow J/\psi K^+$
($1.23 \pm 0.03 \pm 0.05$)

$B \rightarrow J/\psi K^*$
($1.19 \pm 0.03 \pm 0.02$)

$\psi' \rightarrow J/\psi \pi\pi$
($1.23 \pm 0.02 \pm 0.02$)



SV



Beamline and SV



Beamline and SV

Source of deviations from 1

Evidences of underestimate of **beamline** and **SV** errors!

Why blow-up on the beamline does not concern L_{xy}

Why 30%?

- Back-of-the-envelope calculations:
 - Typical 'long run'
 - Initial and final luminosities
 - On-line (SVT) beam width measurement confirms estimate
 - Tested on single run

Why it is of marginal relevance:

- Using 'average beam width' attenuates the effect: 30%→20%:

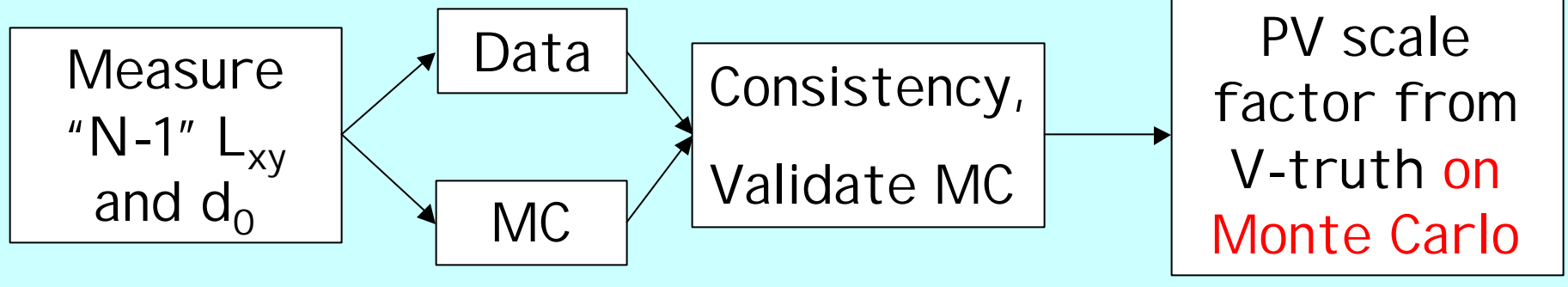
	σ [μm]	Pull [%]
L_{xy}	+0.5	+2%
d_0	+2	+6%

Other sources not investigated, however: not much of a concern for L_{xy} , relevant for d_0

Bottom line

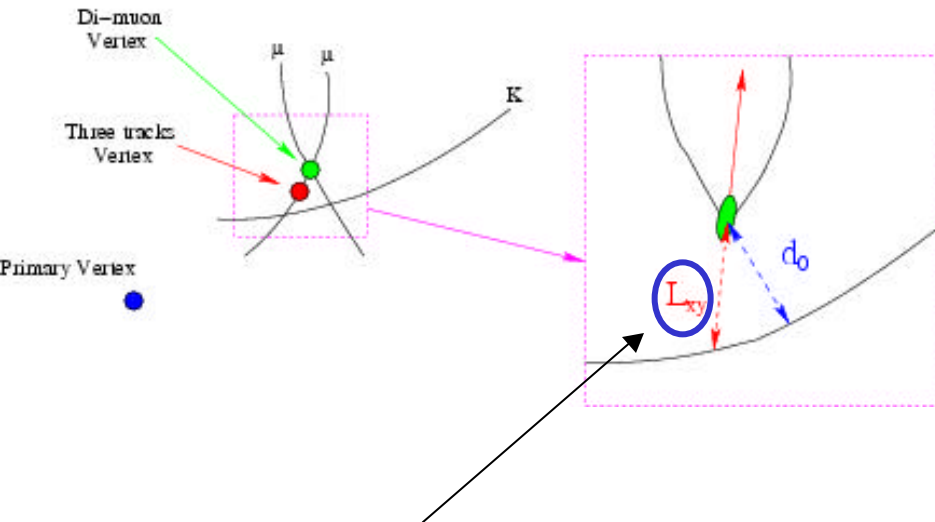
- d_0 pulls show effect of non unitarity of:
 - Beamline pulls
 - Secondary vertex pulls
- Restoring beamline pulls' unitarity is of **marginal** (2%) relevance for L_{xy}
- Let's move on to the secondary vertex!

Secondary Vertex



"N-1" L_{xy} : data and MC

$B \rightarrow D L_{xy}$ pull [width \pm stat \pm syst]



- Computed L_{xy} pulls for the various samples
- Compared to MC evaluation
- **Pretty good agreement!**
- MC seems to account for (possible) inter-sample variations and absolute scale of pulls!

$B \rightarrow J/\psi K^+$
($1.21 \pm 0.02 \pm 0.02$)



MC^{reweight} $B \rightarrow J/\psi K^+$
($1.22 \pm 0.02 \pm 0.04$)



$B \rightarrow J/\psi K^+$
($1.19 \pm 0.03 \pm 0.01$)



MC^{reweight} $B \rightarrow J/\psi K^+$
($1.02 \pm 0.03 \pm 0.03$)



$D^+ \rightarrow K\pi\pi$
($1.117 \pm 0.005 \pm 0.02$)



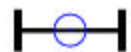
MC^{rew. prompt} $D^+ \rightarrow K\pi\pi$
($1.14 \pm 0.002 \pm 0.03$)



$\psi' \rightarrow J/\psi\pi\pi$
($0.98 \pm 0.015 \pm 0.01$)



MC^{reweight} $\psi' \rightarrow J/\psi\pi\pi$
($1.03 \pm 0.05 \pm 0.02$)



Dependencies

Look for evidence of dependencies on geometry, kinematics etc:

- Pick a suitable set of variables:

Z of SV

$\Delta\phi$ single track-rest of vertex

Pt of SV

Pt of single track

Combined Pt of tracks in SV

η of SV

Ct of SV

#tracks with L_{00} hits in SV

L_{xy} of SV

#tracks with stereo hits in SV

ϕ of SV

Combined Pt of tracks in SV ($\Delta\phi < 0.3$)

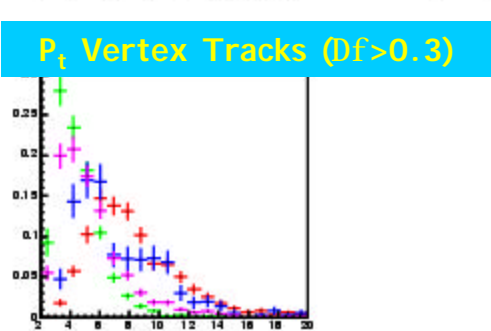
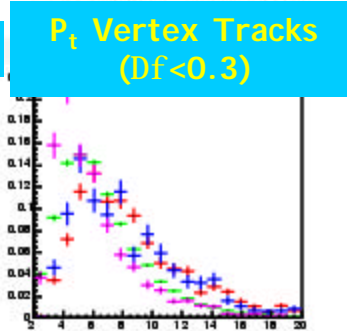
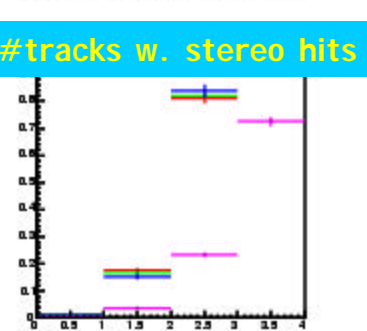
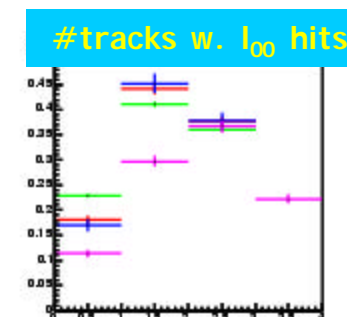
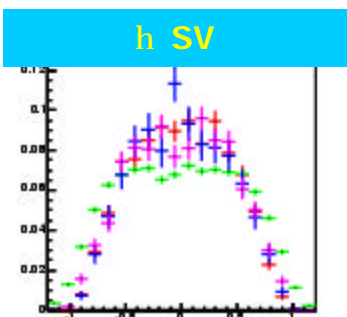
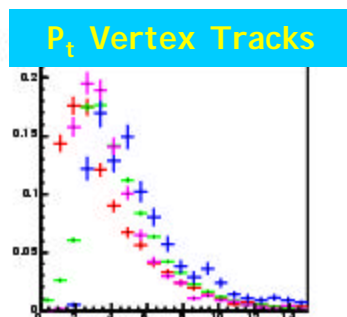
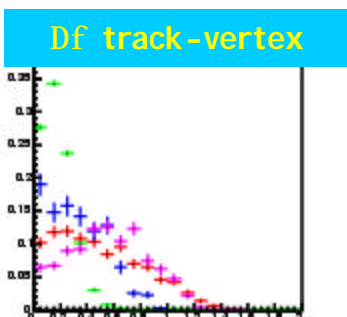
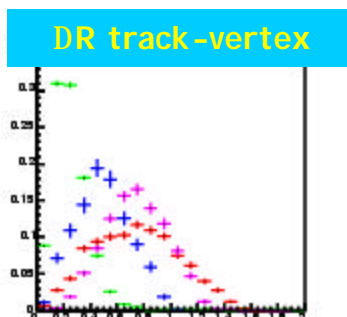
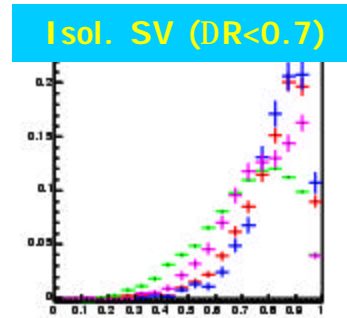
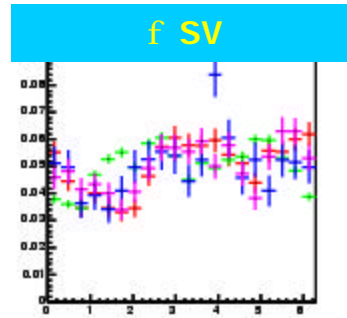
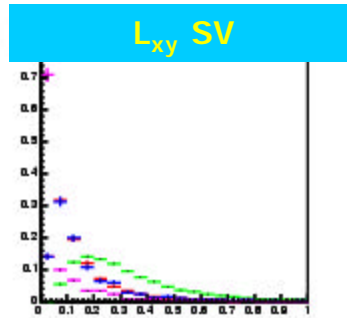
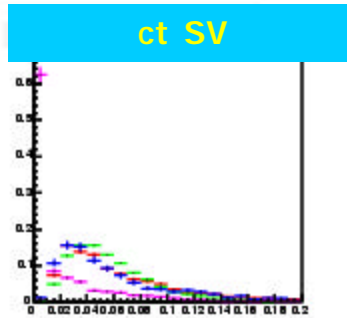
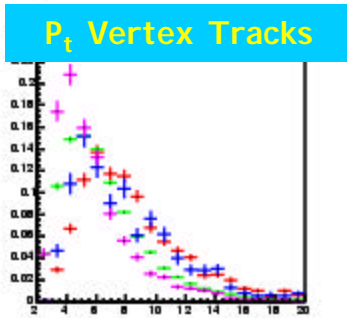
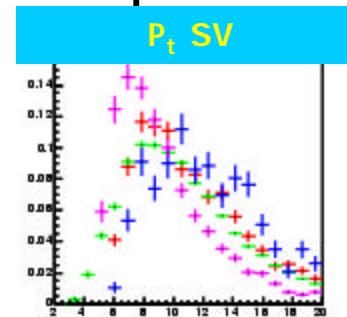
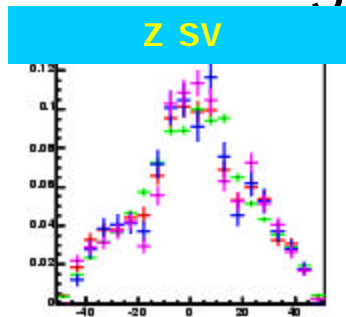
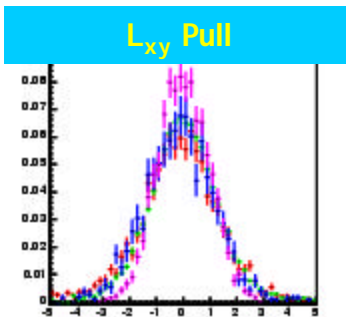
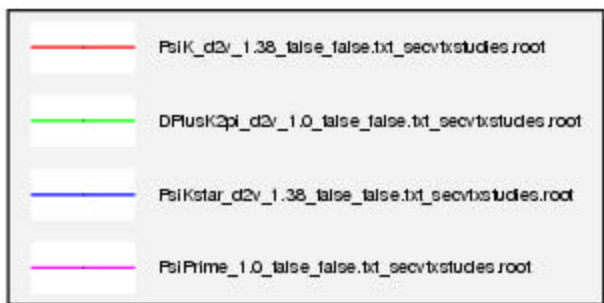
Isolation of candidate B ($\Delta R < 0.7$)

Combined Pt of tracks in SV ($\Delta\phi > 0.3$)

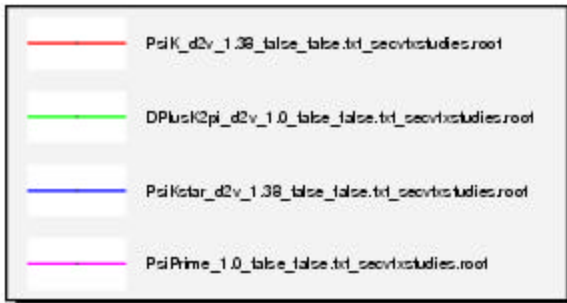
ΔR single track-rest of vertex

- Compare how various samples probe them
- Check pull vs variables

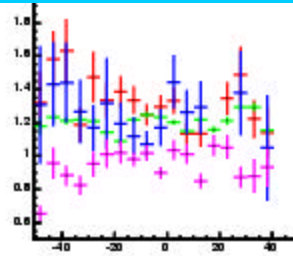
How different are distributions among samples?



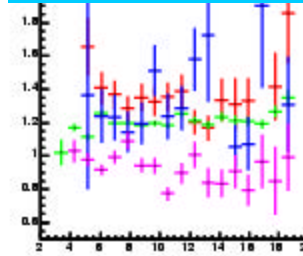
Dependencies? Pulls



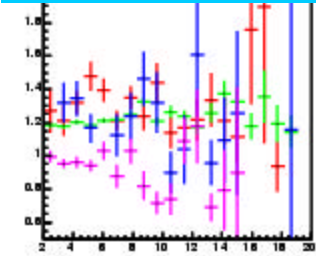
Z SV



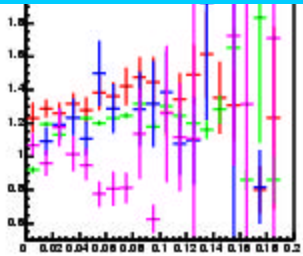
P_t SV



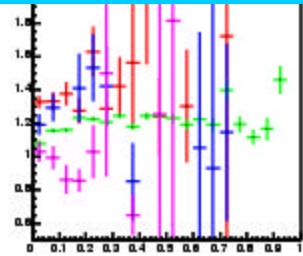
P_t Vertex Tracks



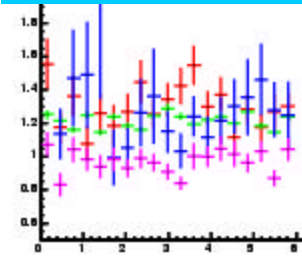
ct SV



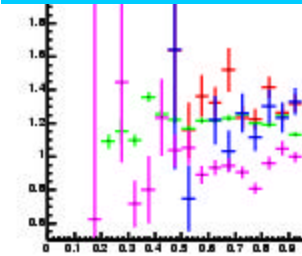
L_{xy} SV



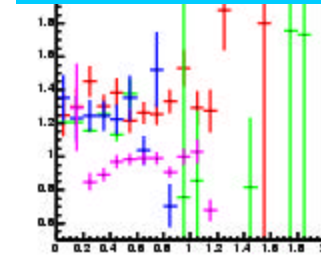
f SV



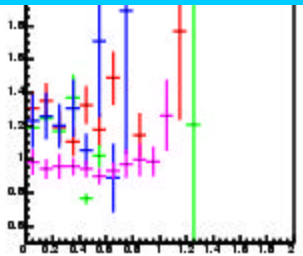
Isol. SV (DR<0.7)



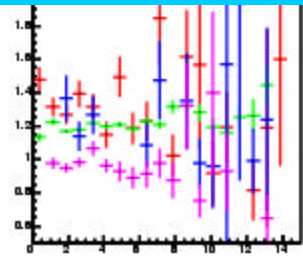
DR track-vertex



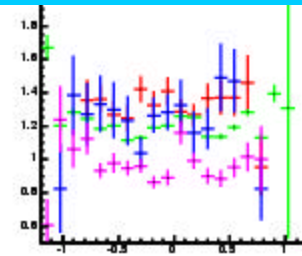
Df track-vertex



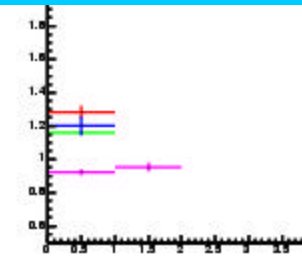
P_t Vertex Tracks



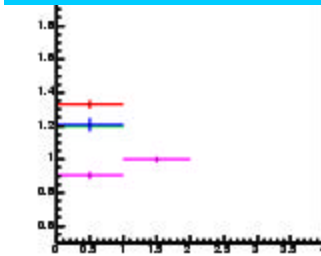
h SV



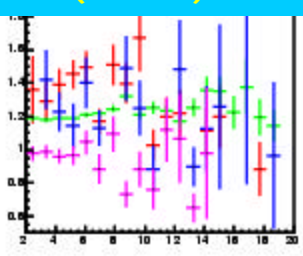
#tracks w. I₀₀ hits



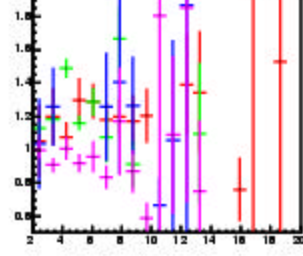
#tracks w. stereo hits



P_t Vertex Tracks (Df<0.3)



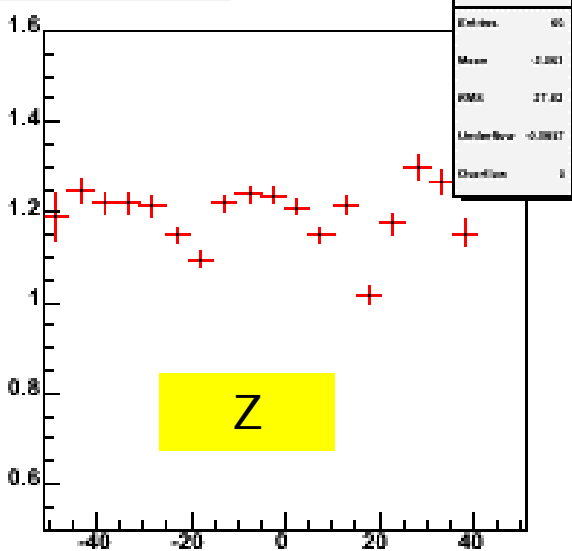
P_t Vertex Tracks (Df>0.3)



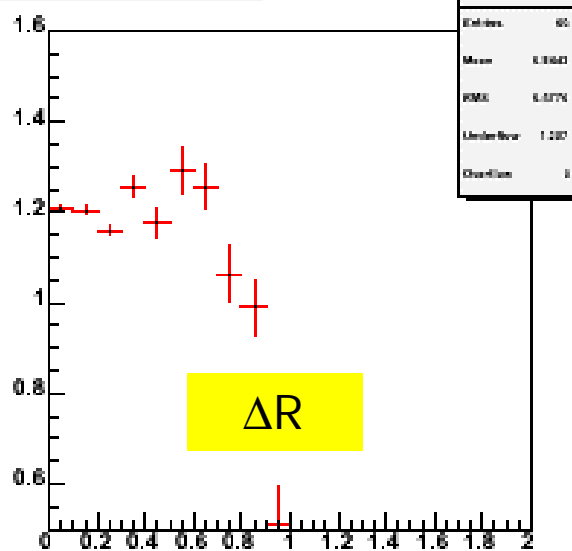
Just an overview: most interesting repeated next...

SV scale factor: details (à la CDF7500)

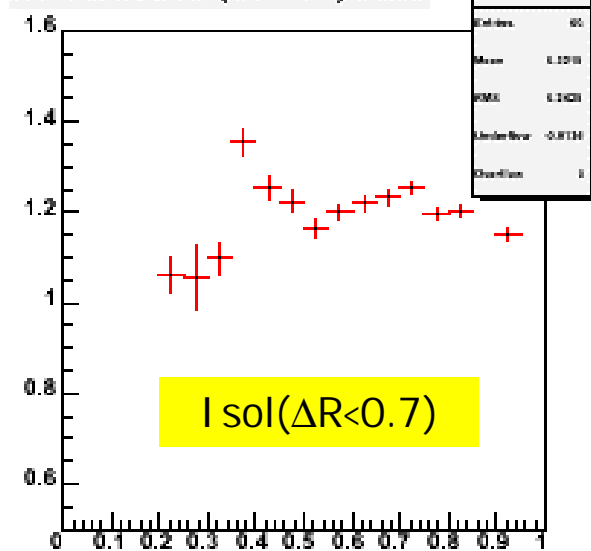
Sec. Vtx Z sliced



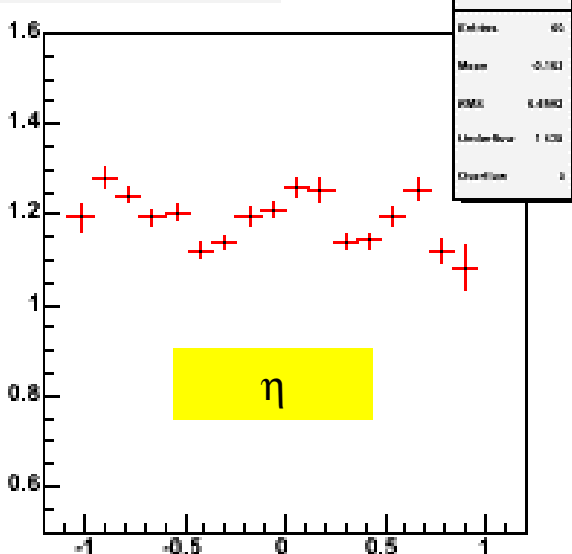
Sec. Vtx ΔR sliced



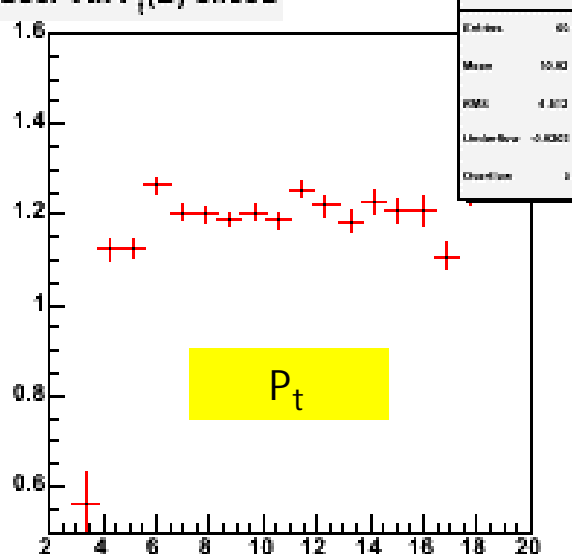
Sec. Vtx Isolation($\Delta R < 0.7$) sliced



Sec. Vtx η |D| sliced



Sec. Vtx $P_t(B)$ sliced

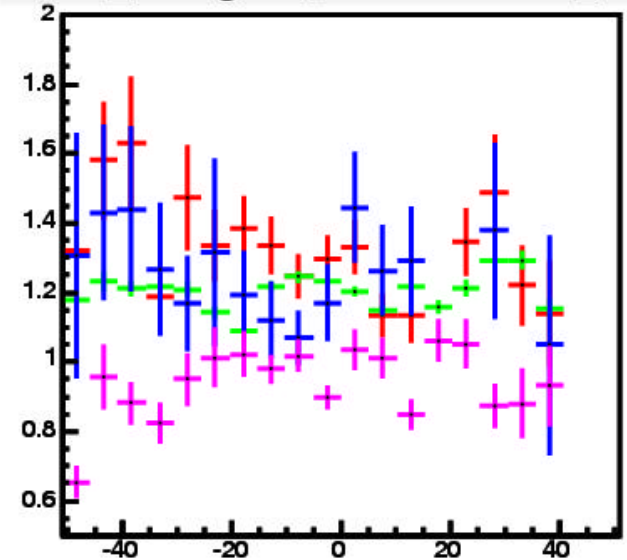


Non-statistical
fluctuations
dominated by fit
model!

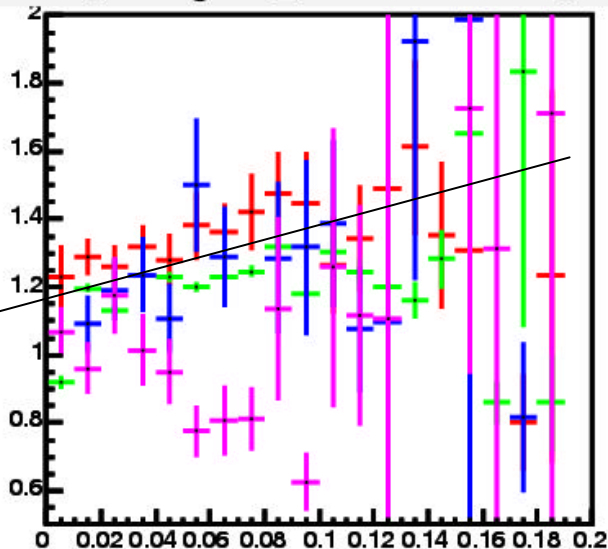
Selected Plots

- We expect some variation as a function of Z (for instance, because of detector structure)
- Ct dependence?
- All variations well within $\pm 10\%$ when integrated over kinematics

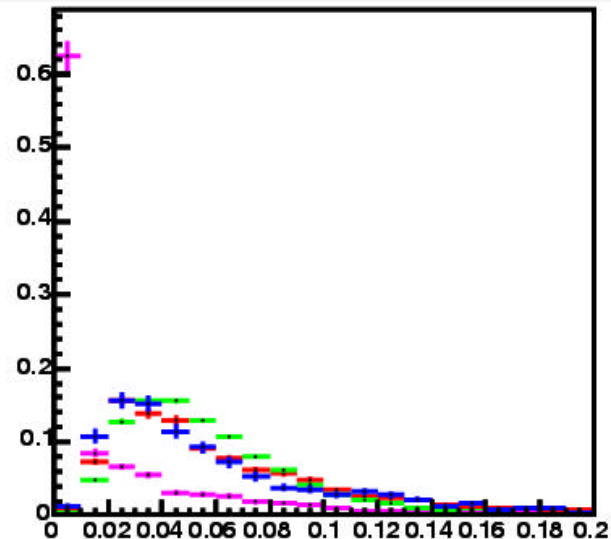
xslice_histogram_SecVtxZslices_stack



xslice_histogram_SecVtxCtslices_stack

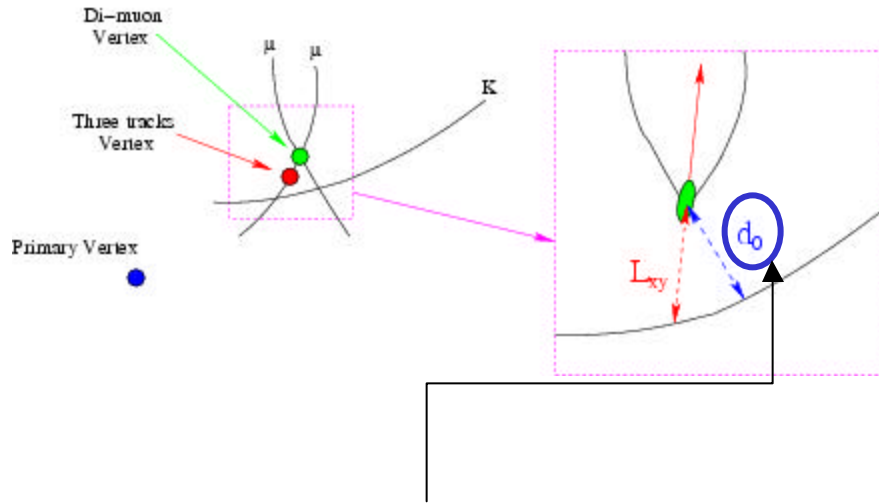


distribution_histogram_SecVtxCtslices_sub_stack



"N-1" d_0 : a cross check!

B pion d_0 WRT D vertex pull [width \pm stat \pm syst]



- Compute also d_0 pulls for the various samples
- Compare to MC evaluation
- Pretty good agreement here as well!
- Good job with the realistic simulation+reweighting!

B \rightarrow J/ ψ K⁺
(1.02 \pm 0.02)



MC^{reweight} B \rightarrow J/ ψ K⁺
(1.13 \pm 0.02 \pm 0.07)



B \rightarrow J/ ψ K^{*}
(1.04 \pm 0.03 \pm 0.04)



MC^{reweight} B \rightarrow J/ ψ K^{*}
(0.92 \pm 0.02 \pm 0.02)



D⁺ \rightarrow K $\pi\pi$
(1.03 \pm 0.005 \pm 0.02)



MC^{rew. prompt} D⁺ \rightarrow K $\pi\pi$
(1.09 \pm 0.002 \pm 0.03)



ψ' \rightarrow J/ $\psi\pi\pi$
(0.92 \pm 0.013)



MC^{reweight} ψ' \rightarrow J/ $\psi\pi\pi$
(0.97 \pm 0.04 \pm 0.01)



SV scale factor from MC


Now that we know to what extent we can rely on MC, let's look at reconstructed-truth!

$SV_{\text{reco}} - SV_{\text{truth}}$: X


$SV_{\text{reco}} - SV_{\text{truth}}$: Y

$SV_{\text{reco}} - SV_{\text{truth}}$: Z


MC^{reweight} $B \rightarrow D^0 \pi^+$
(1.16 ± 0.02 ± 0.15)




MC^{reweight} $B \rightarrow D^- \pi^+$
(1.18 ± 0.02 ± 0.2)



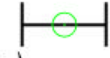
MC^{reweight} $B \rightarrow J/\psi K^+$
(1.28 ± 0.03 ± 0.01)




MC^{reweight} $B \rightarrow J/\psi K^*$
(1.21 ± 0.03 ± 0.01)




MC^{rew. prompt} $D^+ \rightarrow K\pi\pi$
(1.11 ± 0.01 ± 0.1)




MC^{reweight} $\psi' \rightarrow J/\psi \pi\pi$
(1.14 ± 0.03 ± 0.01)




MC^{reweight} $B_s \rightarrow D_s \pi$
(1.24 ± 0.01 ± 0.05)





MC^{reweight} $B \rightarrow D^0 \pi^+$
(1.21 ± 0.02 ± 0.2)




MC^{reweight} $B \rightarrow D^- \pi^+$
(1.22 ± 0.02 ± 0.2)




MC^{reweight} $B \rightarrow J/\psi K^+$
(1.22 ± 0.03 ± 0.01)




MC^{reweight} $B \rightarrow J/\psi K^*$
(1.21 ± 0.03 ± 0.01)




MC^{rew. prompt} $D^+ \rightarrow K\pi\pi$
(1.12 ± 0.01 ± 0.1)




MC^{reweight} $\psi' \rightarrow J/\psi \pi\pi$
(1.2 ± 0.03 ± 0.05)




MC^{reweight} $B_s \rightarrow D_s \pi$
(1.21 ± 0.01 ± 0.07)



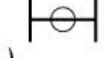

MC^{reweight} $B \rightarrow D^0 \pi^+$
(1.15 ± 0.02 ± 0.1)




MC^{reweight} $B \rightarrow D^- \pi^+$
(1.13 ± 0.02 ± 0.15)




MC^{reweight} $B \rightarrow J/\psi K^+$
(1.15 ± 0.03 ± 0.05)




MC^{reweight} $B \rightarrow J/\psi K^*$
(1.12 ± 0.02 ± 0.01)




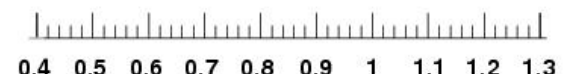
MC^{rew. prompt} $D^+ \rightarrow K\pi\pi$
(1.16 ± 0.01 ± 0.01)



MC^{reweight} $\psi' \rightarrow J/\psi \pi\pi$
(1.08 ± 0.03 ± 0.01)



MC^{reweight} $B_s \rightarrow D_s \pi$
(1.16 ± 0.01 ± 0.02)

SV scale factor from MC

...projected along P_t , and broken down into PV and SV contribution:

$L_{xy}^{reco} - L_{xy}^{truth}$

$MC^{reweight} B \rightarrow D^0 \pi^+$
($1.14 \pm 0.01 \pm 0.04$)

$MC^{reweight} B \rightarrow D^- \pi^+$
($1.12 \pm 0.02 \pm 0.11$)

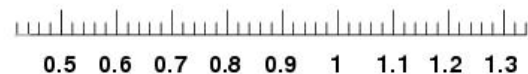
$MC^{reweight} B \rightarrow J/\psi K^+$
($1.12 \pm 0.03 \pm 0.05$)

$MC^{reweight} B \rightarrow J/\psi K^*$
($1.15 \pm 0.03 \pm 0.01$)

$MC^{rew. prompt} D^+ \rightarrow K\pi\pi$
($1.16 \pm 0.01 \pm 0.15$)

$MC^{reweight} \psi' \rightarrow J/\psi \pi\pi$
($1.14 \pm 0.02 \pm 0.01$)

$MC^{reweight} B_s \rightarrow D_s \pi$
($1.17 \pm 0.01 \pm 0.03$)



$L_{xy}^{reco} - L_{xy}^{truth}$: PV

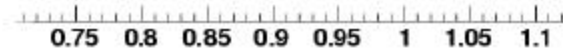
$MC^{reweight} B \rightarrow D^0 \pi^+$
($1.04 \pm 0.02 \pm 0.07$)

$MC^{reweight} B \rightarrow D^- \pi^+$
($1.03 \pm 0.02 \pm 0.01$)

$MC^{reweight} B \rightarrow J/\psi K^+$
($1.01 \pm 0.02 \pm 0.01$)

$MC^{reweight} B \rightarrow J/\psi K^*$
($1.02 \pm 0.02 \pm 0.02$)

$MC^{reweight} B_s \rightarrow D_s \pi$
($1.02 \pm 0.01 \pm 0.01$)



$L_{xy}^{reco} - L_{xy}^{truth}$: SV

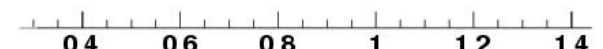
$MC^{reweight} B \rightarrow D^0 \pi^+$
($1.2 \pm 0.02 \pm 0.2$)

$MC^{reweight} B \rightarrow D^- \pi^+$
($1.19 \pm 0.02 \pm 0.02$)

$MC^{reweight} B \rightarrow J/\psi K^+$
($1.24 \pm 0.03 \pm 0.01$)

$MC^{reweight} B \rightarrow J/\psi K^*$
($1.14 \pm 0.02 \pm 0.01$)

$MC^{reweight} B_s \rightarrow D_s \pi$
($1.22 \pm 0.01 \pm 0.01$)



• Amazingly stable and consistent with X, Y and Z!

• Variations well within 10%

SV Pull Strategy

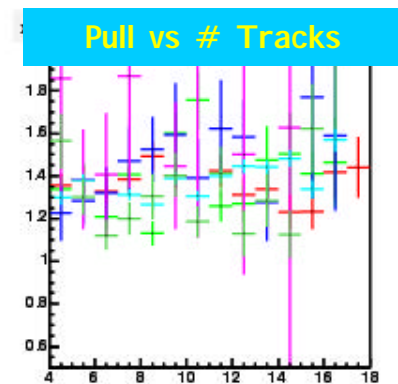
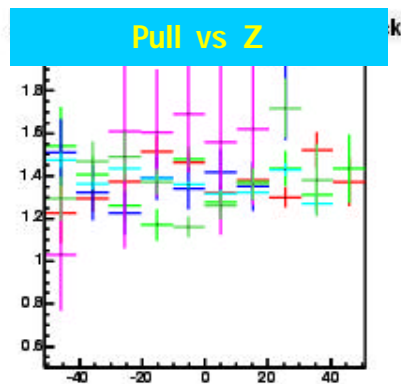
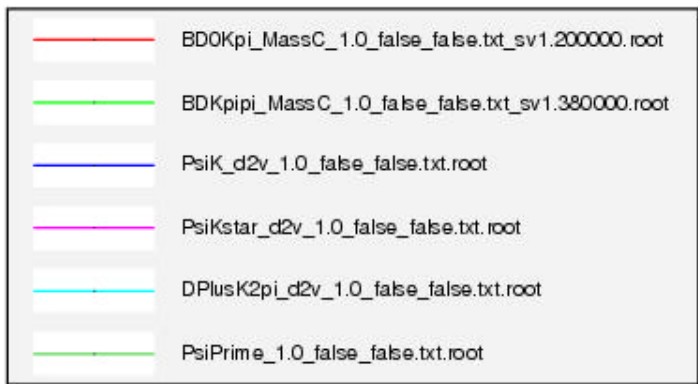
- “N-1” d_0 and L_{xy} **validate** monte-carlo
- **Dependencies** studied in “N-1” d_0/L_{xy} are **mostly due to choice of variables** (to be confirmed by last bullet!)
- **MC** predicts a **SV scale factor** of **$1.2 \pm 10\%$**
- **Before blessing**: dependencies of MC scale factor

Conclusions

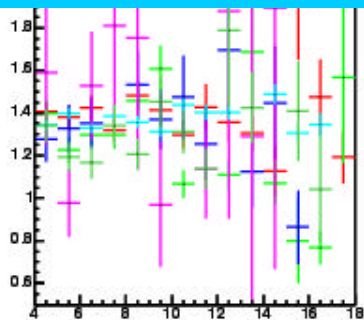
- I identified a procedure to determine all the relevant scale factors
- Three scale factors:
 - PV: $1.38 \pm 5\%$ (based solely on **data!**)
 - Beamline: 1.0 (not really, but not relevant for L_{xy})
 - SV: $1.2 \pm 10\%$ (**from MC**, **after validation**)
- Systematics mostly from inter-sample variation/neglected dependancies
- Re-running through all the samples to finalize numbers, stabilize statistics etc.

Backup

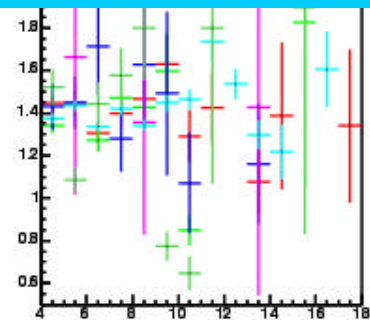
PV scale factor dependencies (Y)



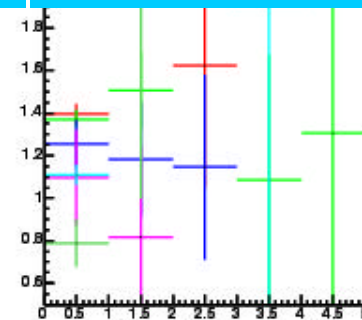
Pull vs # tracks w. z hits



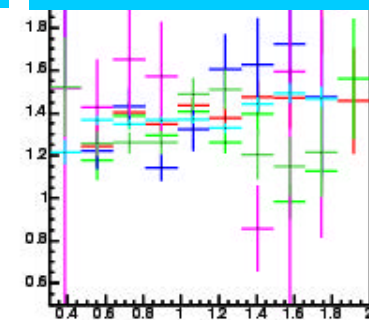
Pull vs # tracks w. LOO hits



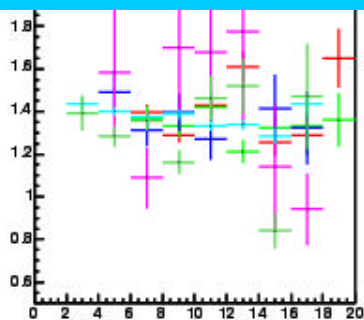
Pull vs # Tracks Pt>2



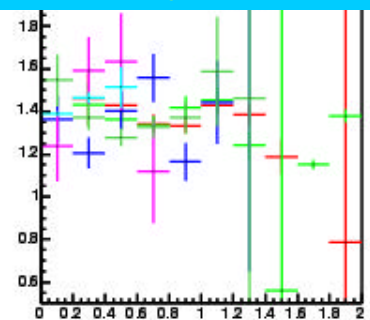
Pull vs Tracks <Pt>



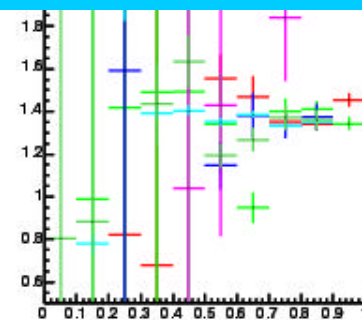
Pull vs Pt B candidate



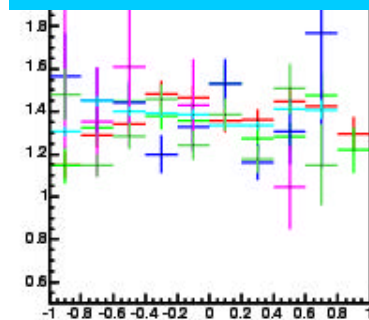
Pull vs DR_{max} B candidate



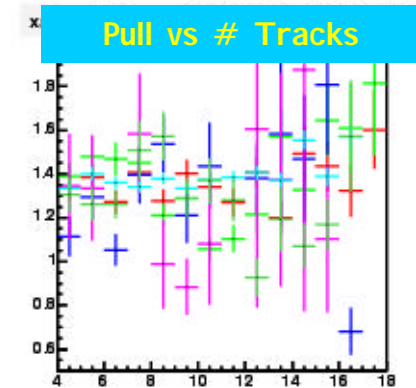
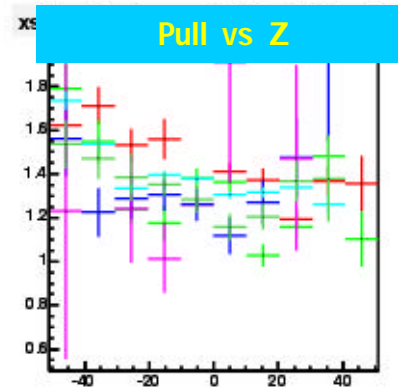
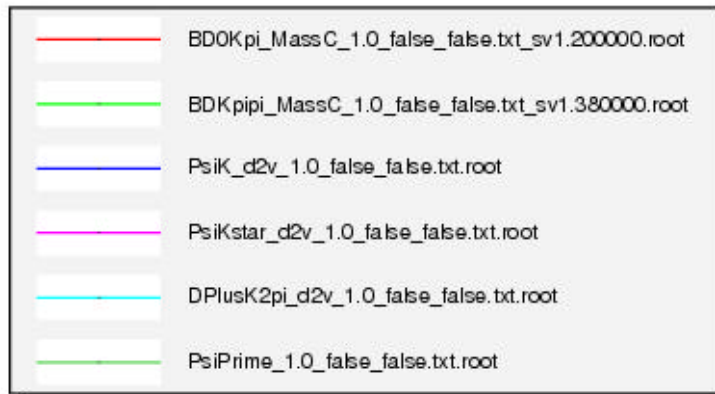
Pull vs Isol. B candidate



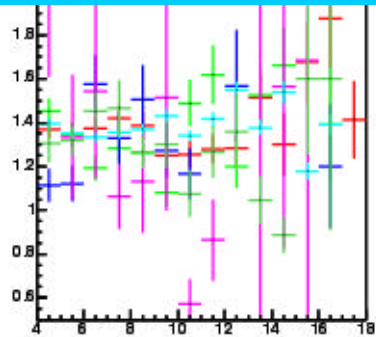
Pull vs h B candidate



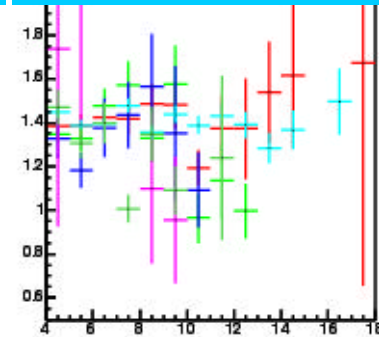
PV scale factor dependencies (Z)



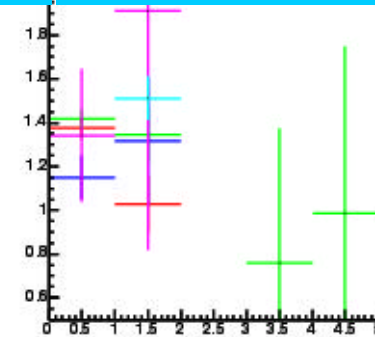
Pull vs # tracks w. z hits



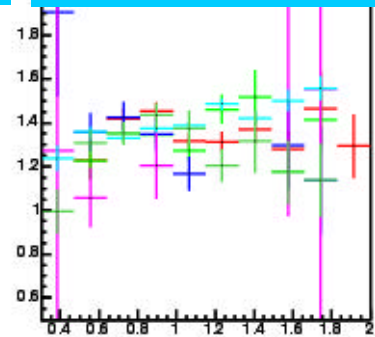
Pull vs # tracks w. LOO hits



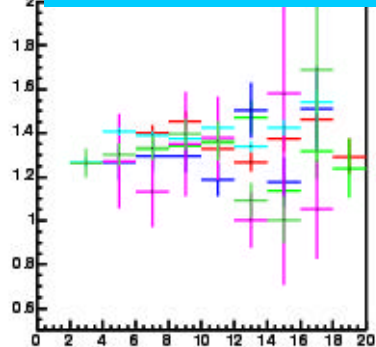
Pull vs # Tracks Pt>2



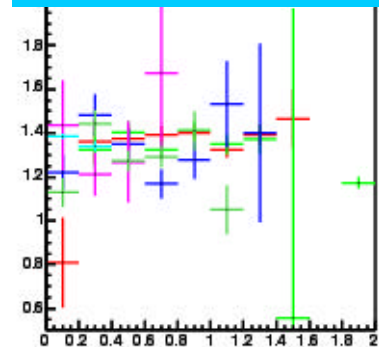
Pull vs Tracks <Pt>



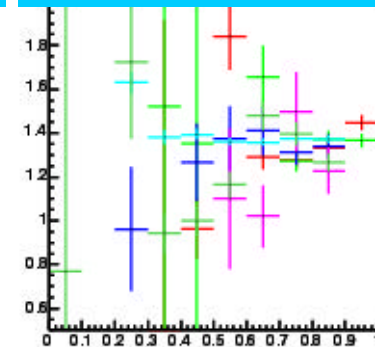
Pull vs Pt B candidate



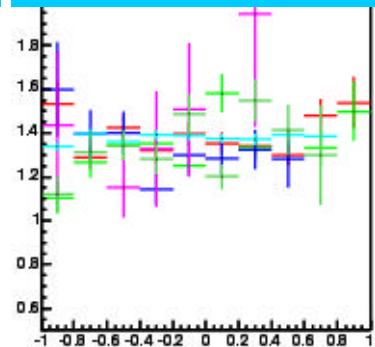
Pull vs DR_{max} B candidate



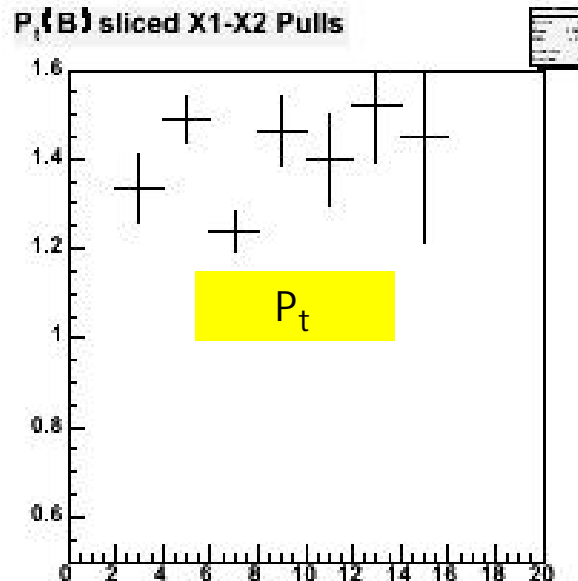
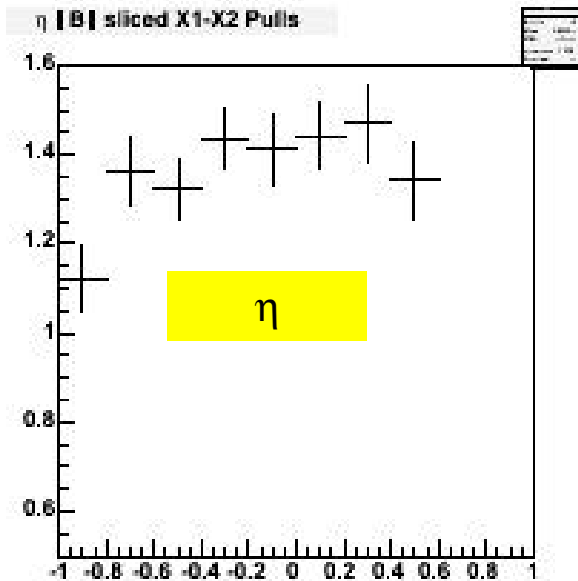
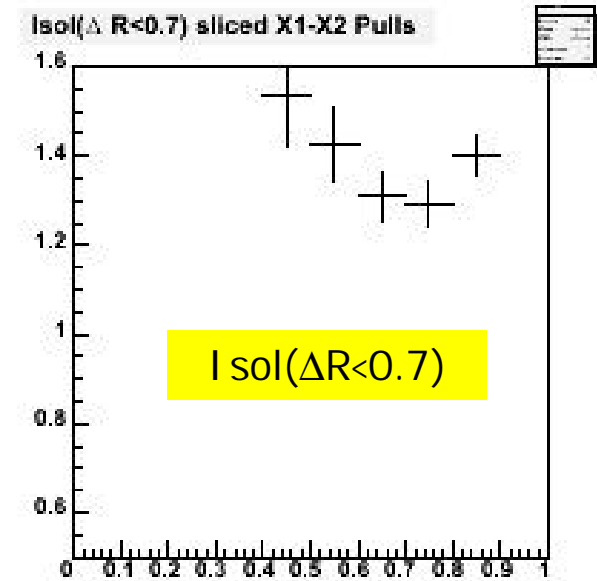
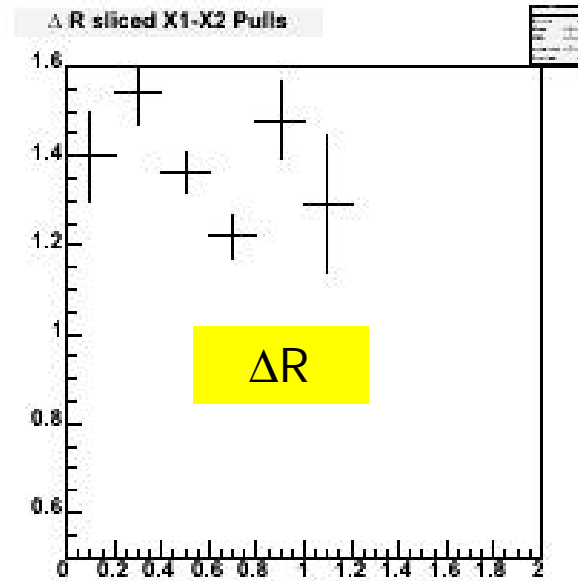
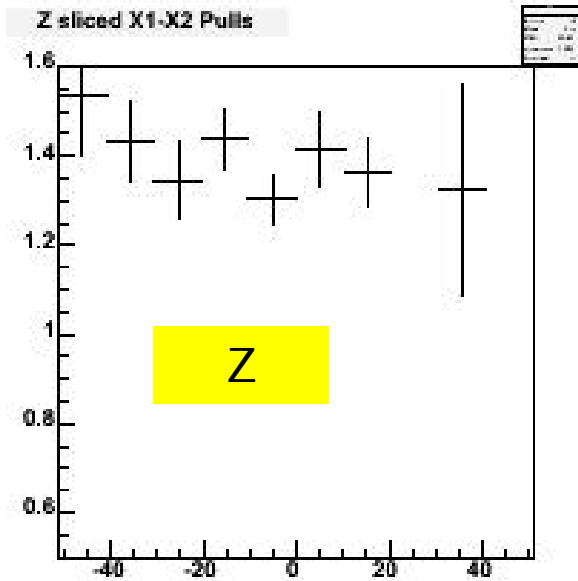
Pull vs Isol. B candidate



Pull vs h B candidate



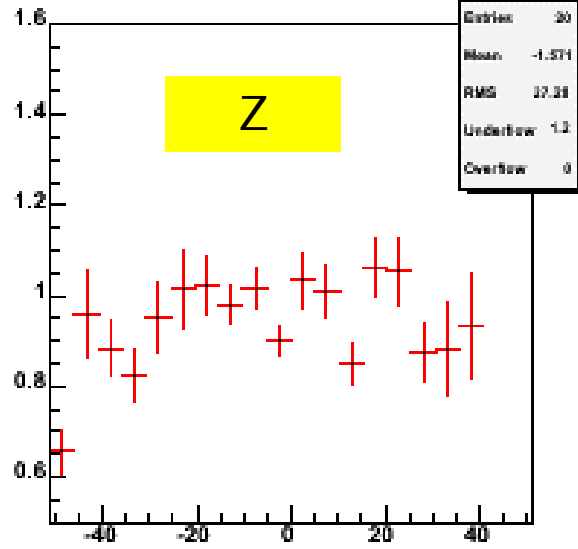
PV scale factor for ψ' : details (à la CDF7500)



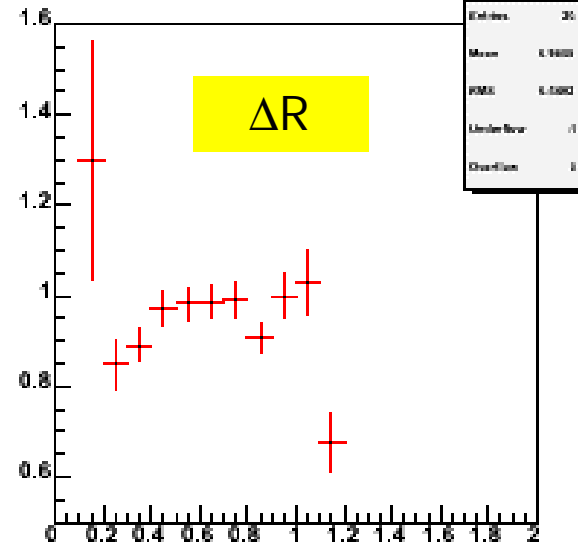
Non-statistical fluctuations dominated by fit model!

SV scale factor for ψ' : details (à la CDF7500)

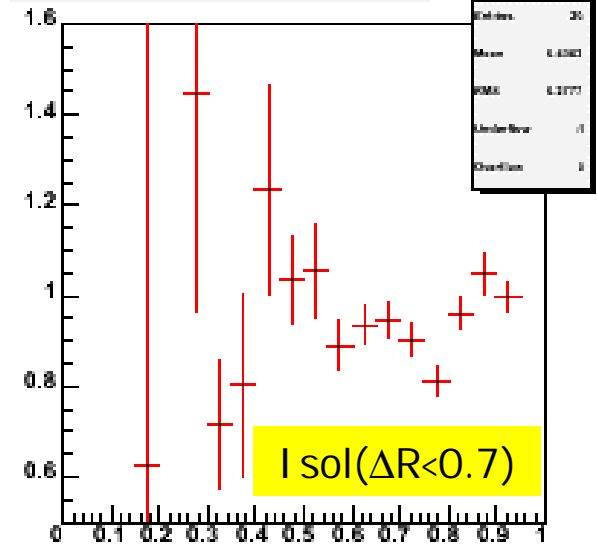
Sec. Vtx Z sliced



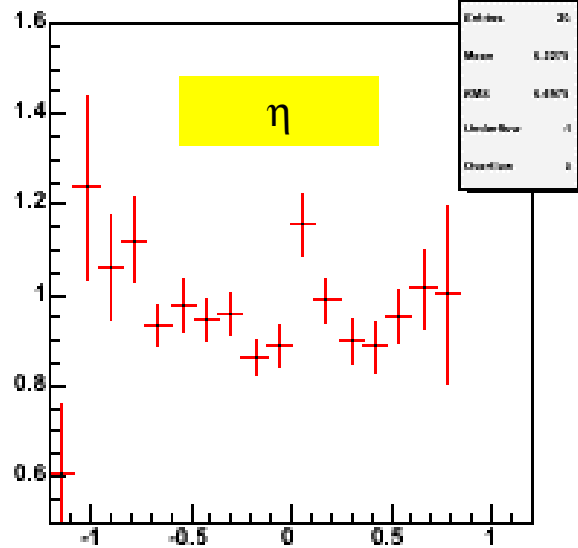
Sec. Vtx ΔR sliced



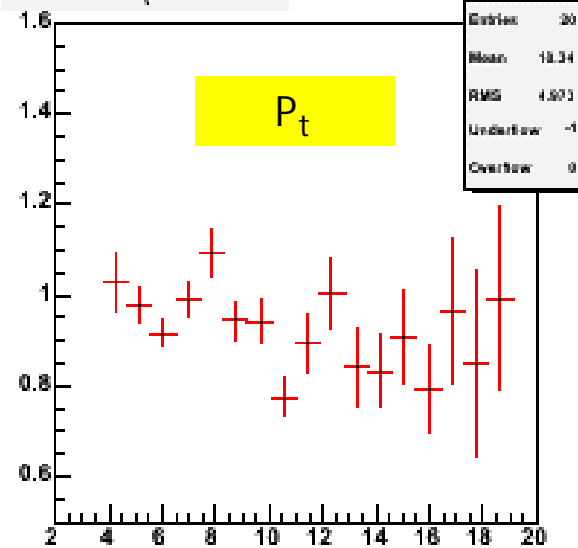
Sec. Vtx Isolation($\Delta R < 0.7$) sliced



Sec. Vtx η |D| sliced



Sec. Vtx $P_t(B)$ sliced



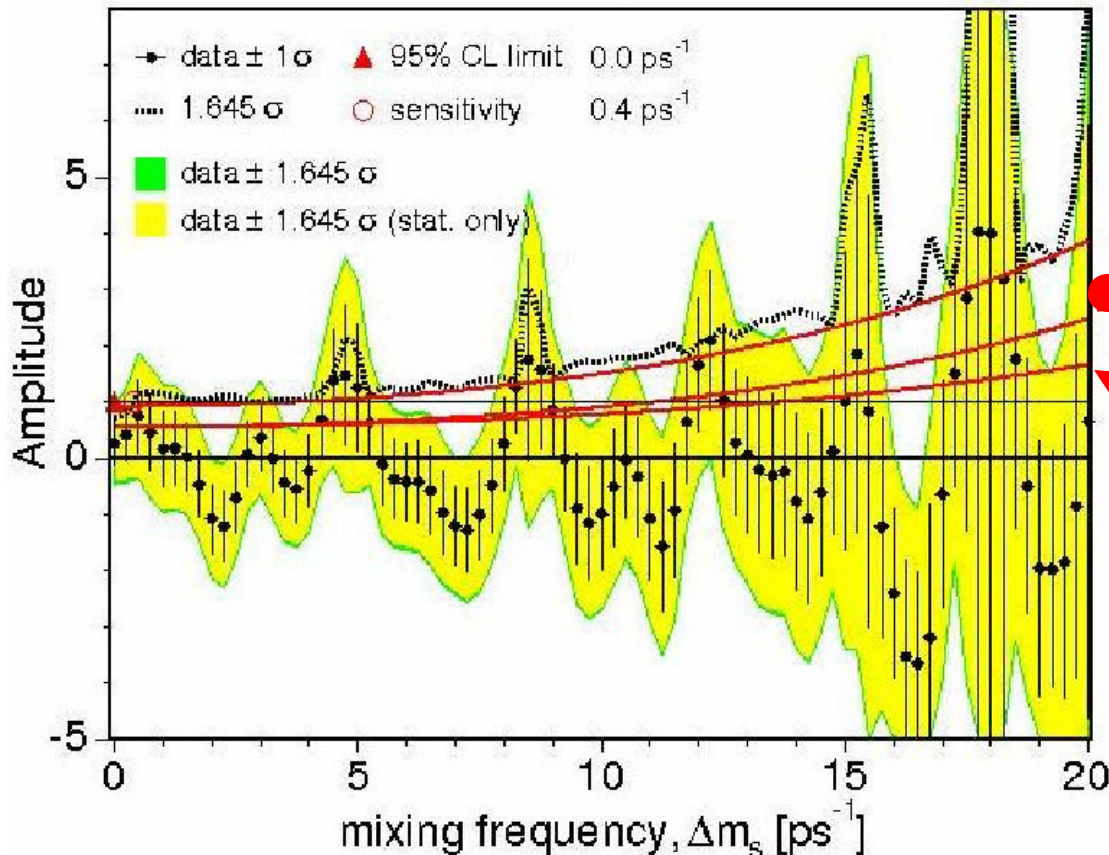
Non-statistical fluctuations dominated by fit model!

What do we gain?

Euphemism

1. 15-20% In vertex resolution!
2. Better control of systematics (hard to evaluate)
3. Correct EbE resolution (it is not clear that it is correct now)

Hadronic Analysis CDF II



•Red arrow is the effect of 1. **Only**

•Point 2. Affects mostly the green area (tiny ?)

•Point 3. Has an effect qualitatively similar to 1., but hard to evaluate

Hadronic analysis systematics

source	selected Δm_s scan points				
	0.0	5.0	10.0	15.0	20.0
$B_s \rightarrow D_s K$ level	0.019	0.024	0.030	0.037	0.047
dilution scale factors	0.143	0.168	0.205	0.254	0.314
dilution templates	0.119	0.147	0.178	0.211	0.246
fraction of Λ_b	0.014	0.009	0.009	0.011	0.012
Punzi term for σ_{ct}	0.009	0.008	0.022	0.033	0.030
dilution of $B \rightarrow DX$	0.025	0.001	0.000	0.000	0.001
σ_{ct} scale factor	0.000	0.024	0.061	0.090	0.144
usage of L00 in bias curve	0.001	0.001	0.001	0.001	0.001
B_s lifetime uncertainty	0.001	0.001	0.001	0.001	0.001
reweighted p_t spectrum	0.001	0.001	0.001	0.001	0.001
non-Gaussian tails in ct resol.	0.001	0.027	0.052	0.078	0.104
neglect B^0 in fit	0.039	0.036	0.033	0.031	0.028
effect of $\Delta\Gamma/\Gamma = 0.2$	0.028	0.028	0.028	0.028	0.028
Total systematic	0.195	0.232	0.289	0.357	0.443
Statistical	0.393	1.129	1.010	2.652	5.281