B physics status and plans

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University of Oklahoma

D0 collaboration meeting

B physics

Low Pt

- Sin 2β
- B- mixing
- Rare decays

focus

High Pt

- b-Tagging
- Top, Higgs
- Cross sections

Monte Carlo

Currently very limited MC statistics

MC generation starts from card file $\longrightarrow$ mc_runjob

This model does not work well for most B physics.
Branching ratios for specific decays ~ 10^{-6} so need to
enerate lots of MC

Using QQ (Cleo MC) to generate specific decay mode.
i.e. if Bd in event $B_d \longrightarrow$ J/Psi K_s

Can only ask for $b\bar{b}$ in card file, so not all events have a B_d,
also need P_T cuts, eta cuts etc.

Need unbiased way to remove unwanted events

MC Issues

Currently	Problems
Generate ~100,000 events	Getting events into SAM
Write them to disk	Needs lots of disk space
Strip off good events	Many steps done by hand
Process events	Time consuming
Put them into SAM	

Works for small samples ~ 1000 events

Dave Evans

Event Stripper (d0_mess)

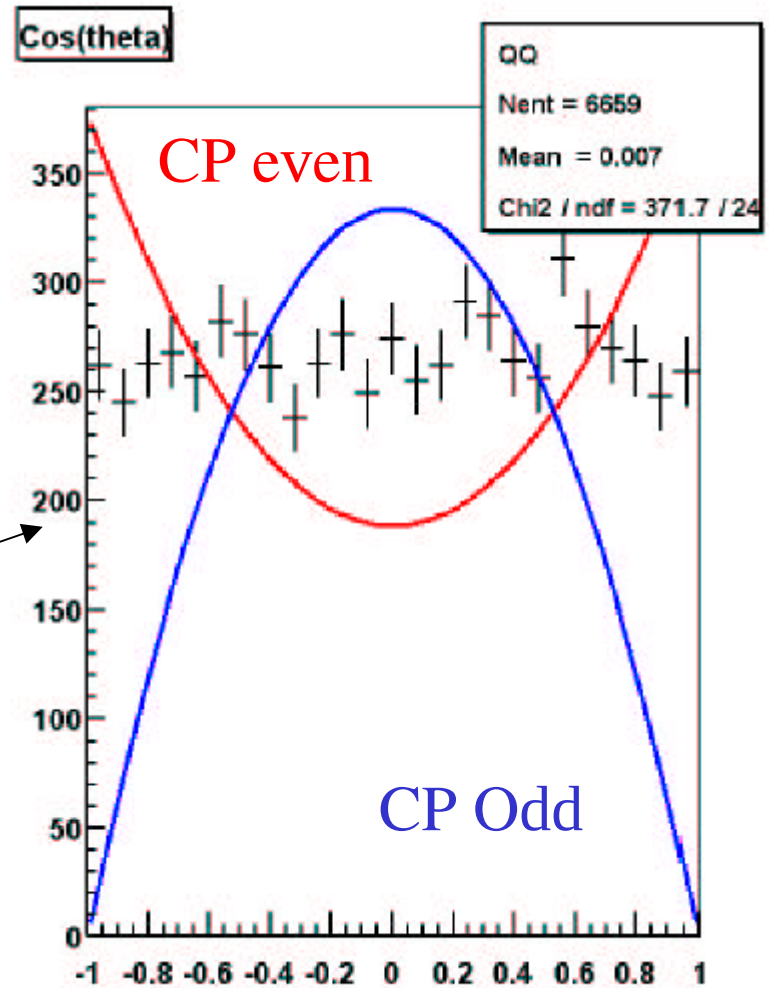
- Event stripper now being added into mc_runjob
- No need to run separate stripping step
- Event stripper controlled by RCP
- Metadata properly taken care of
- Available soon

QQ

- Another problem with MC is that QQ is becoming obsolete and does not correctly take into account correlations between decays

- Bs → J/Psi ϕ

- Transversity angle



Alberto Sánchez-Hernández

EvtGen

Developed by BaBar

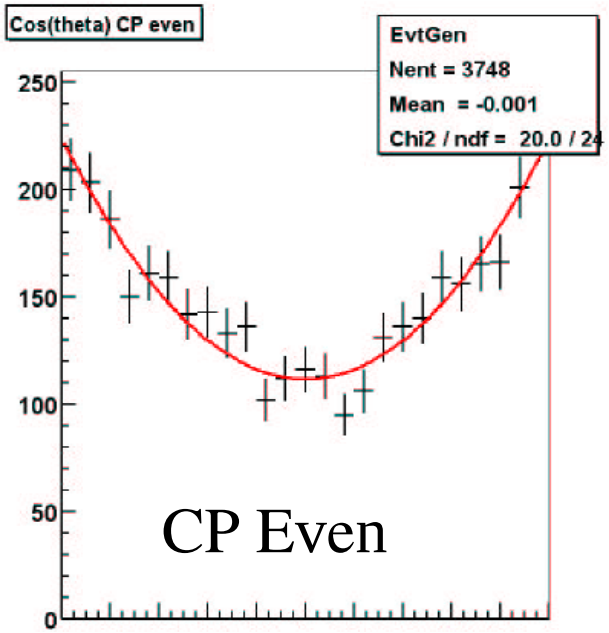
Better reproduces CLEO
ata

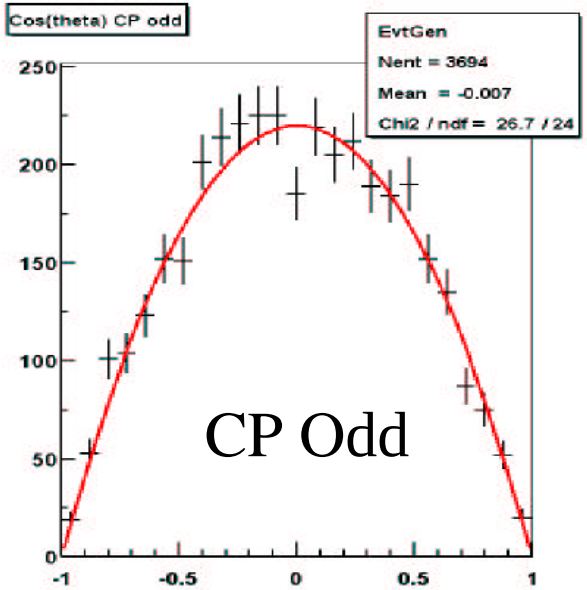
Written in C++

Being implemented at D0

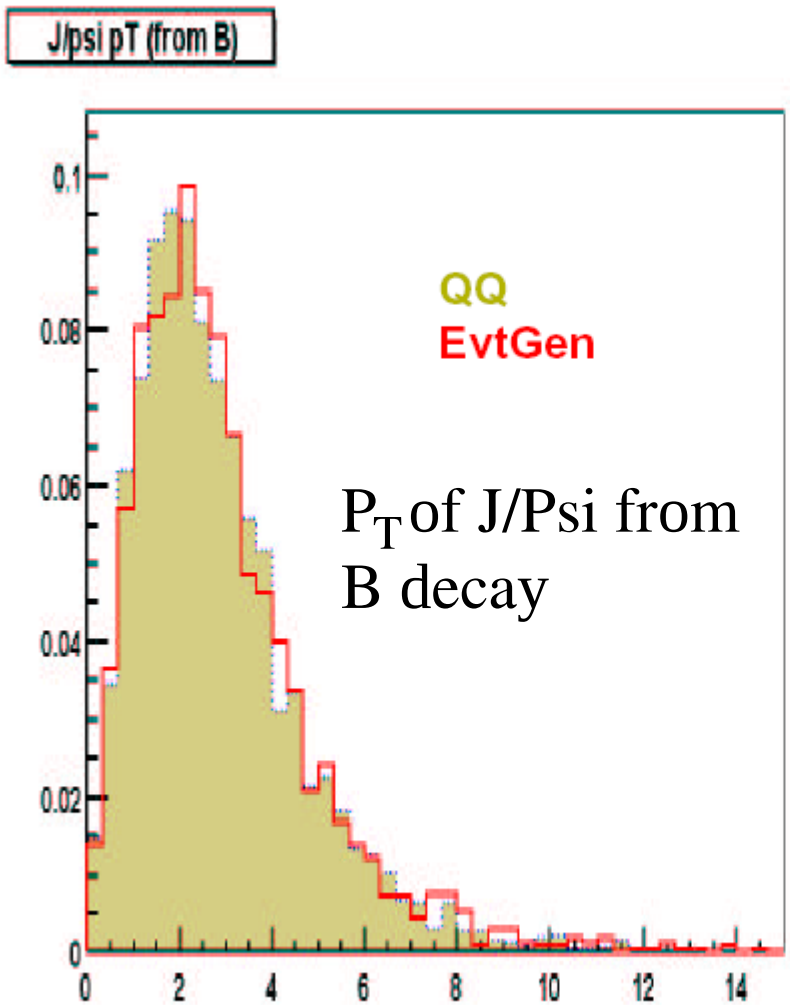
Correlations better
escribed

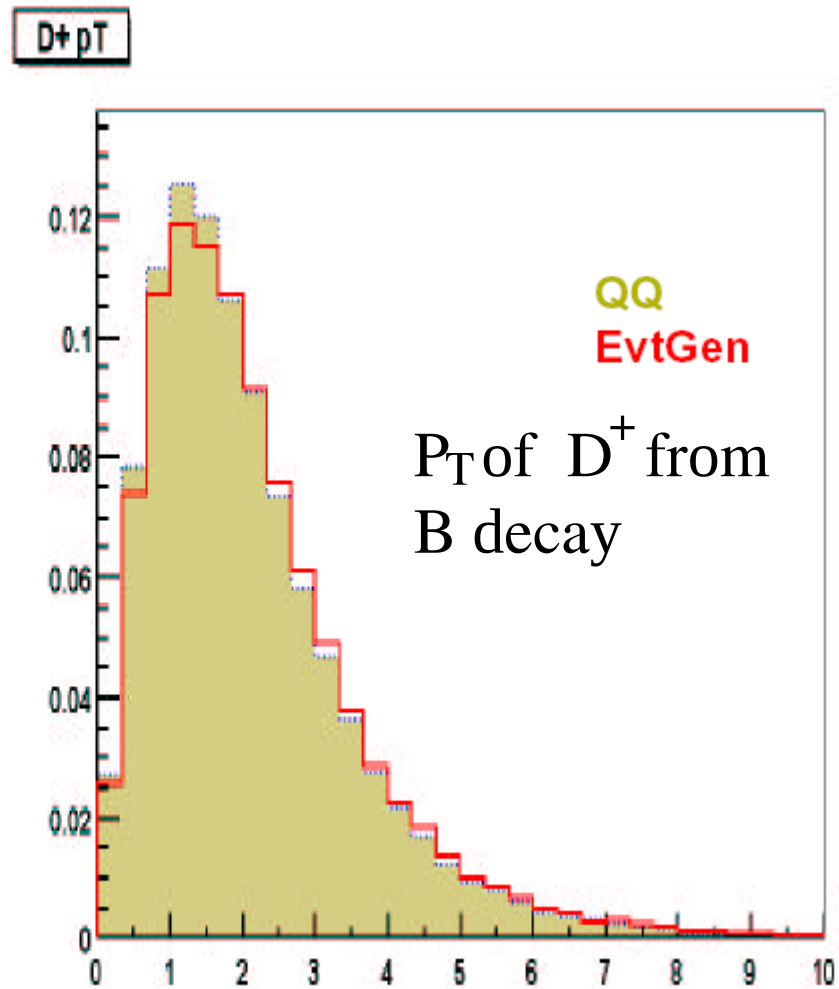
With d0_mess and EvtGen implemented, will be able to generate large samples
f events





QQ vs EvtGen

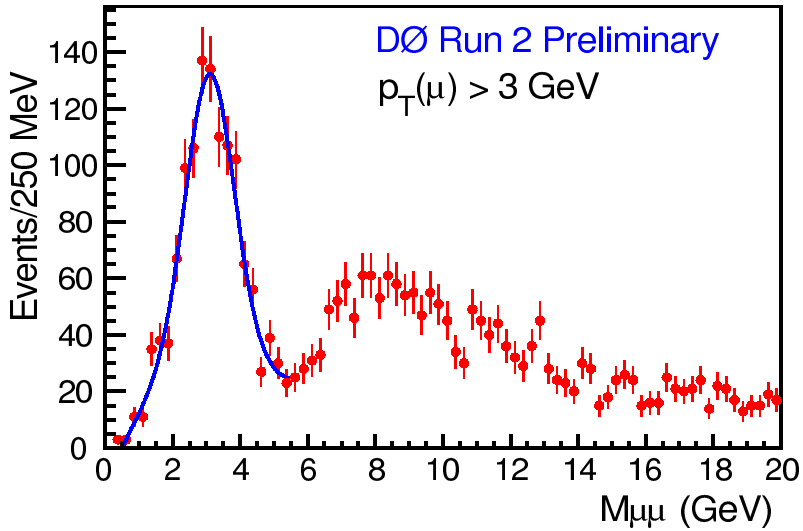


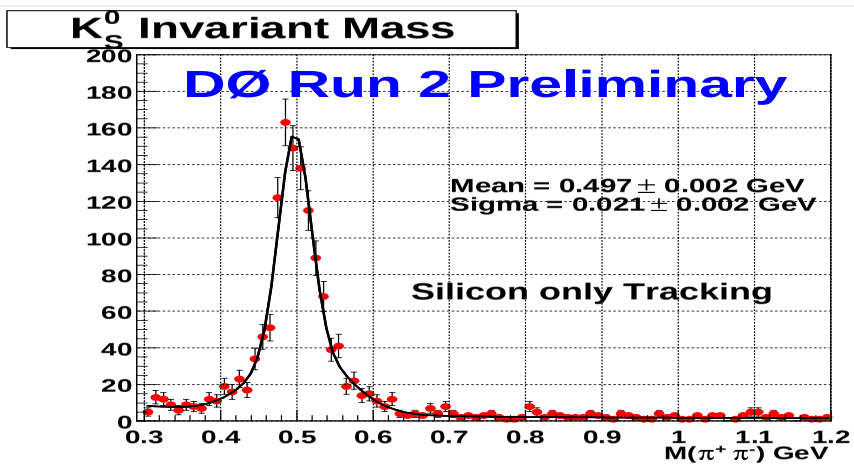


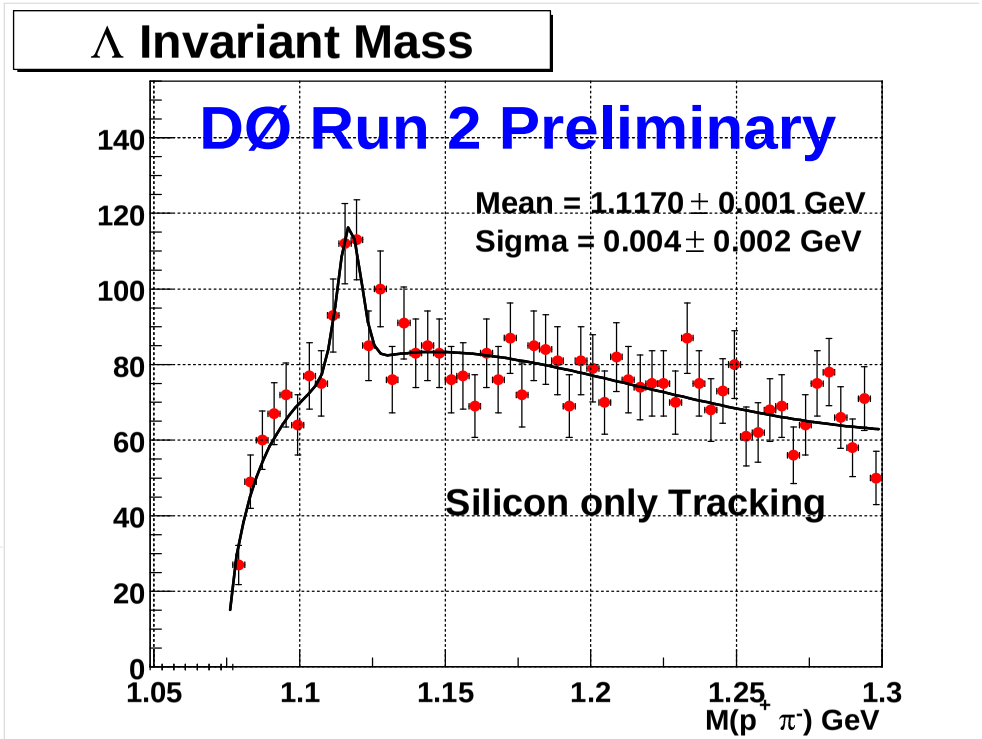
J/Ψ and D^+ from B mesons

Alberto Sánchez-Hernández

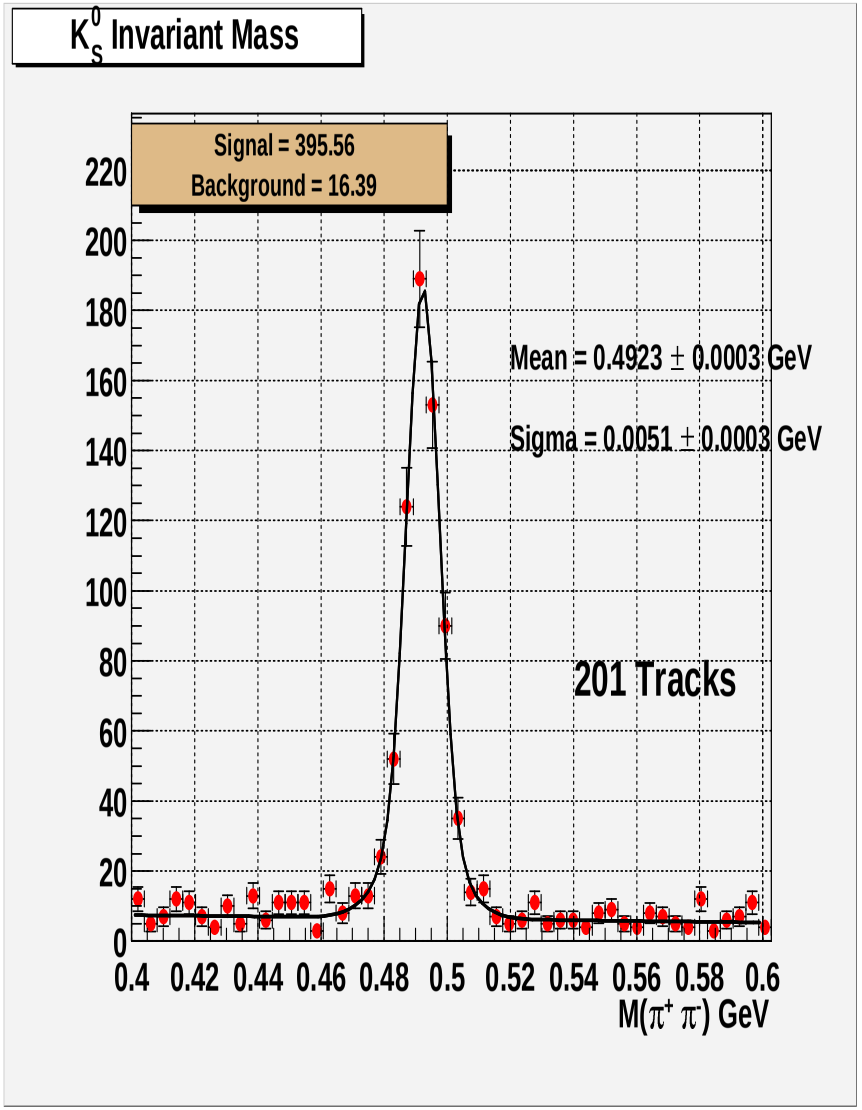
J/Psi Ks finding

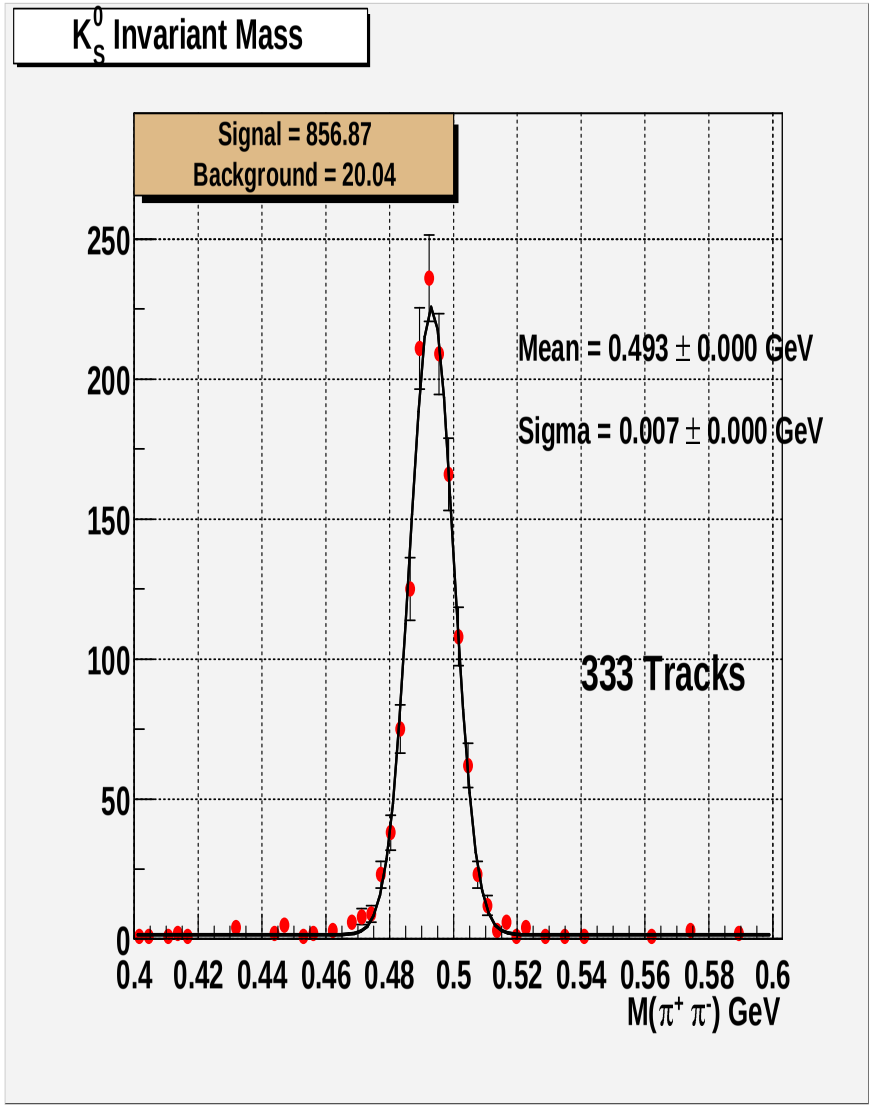




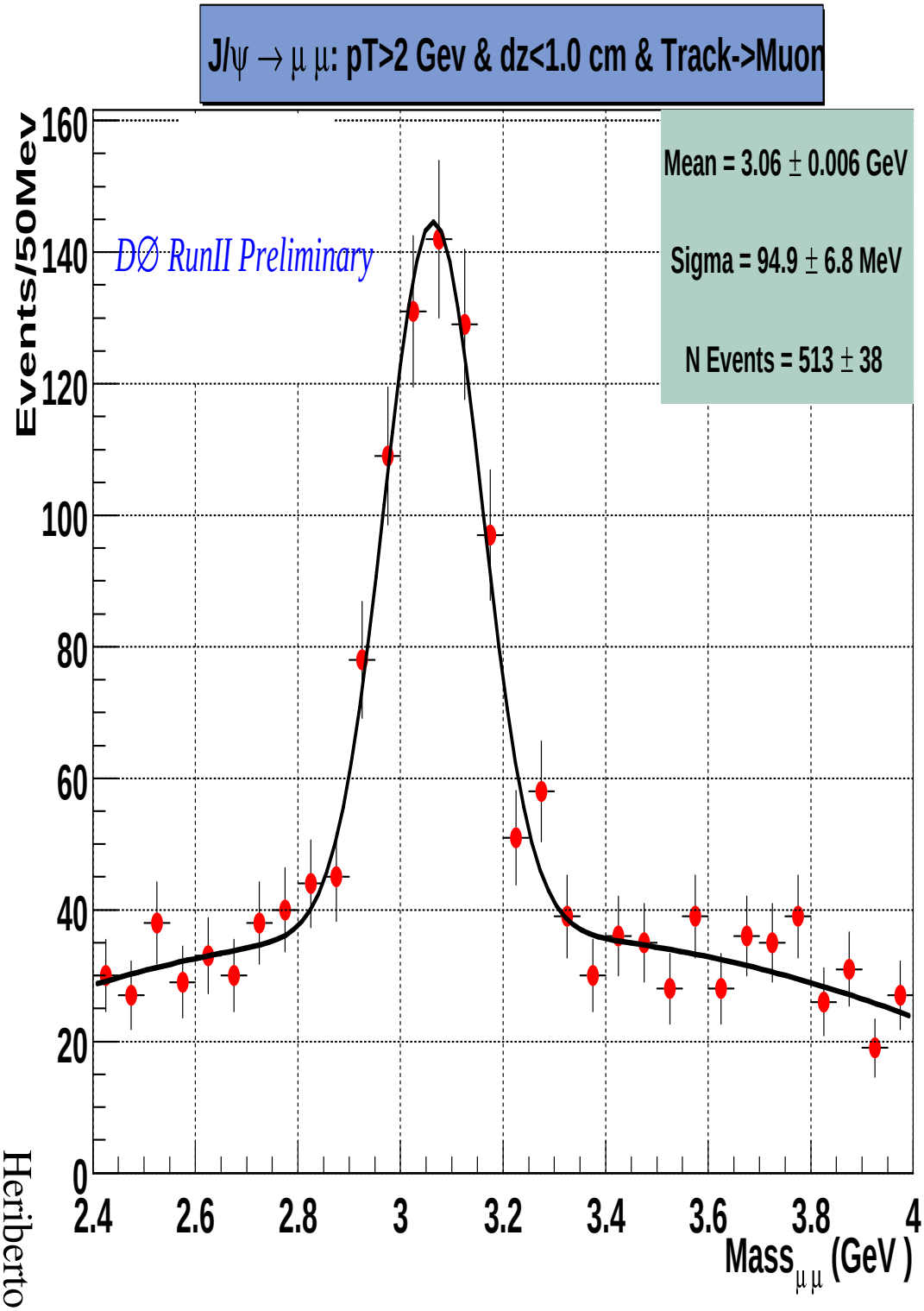


Kshorts with full tracking





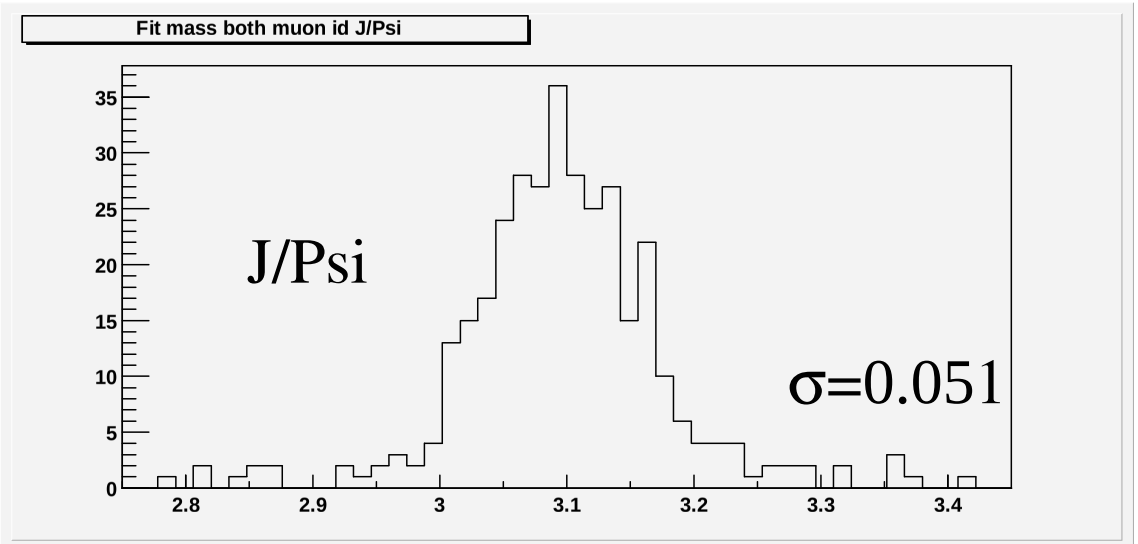
Ariel Schwartzman

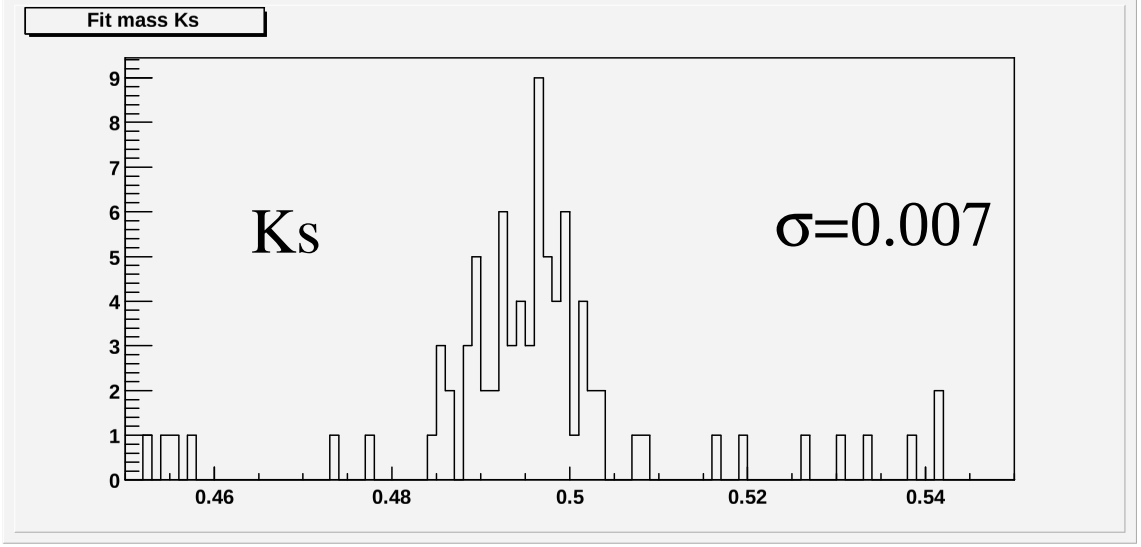


Heriberto Castilla

MC

Mass resolution





- Resolutions ~ what we expect
- Need full tracking for most B physics analyses
- When tracks found, they are “good”. J/Psi-Ks have expected mass and width

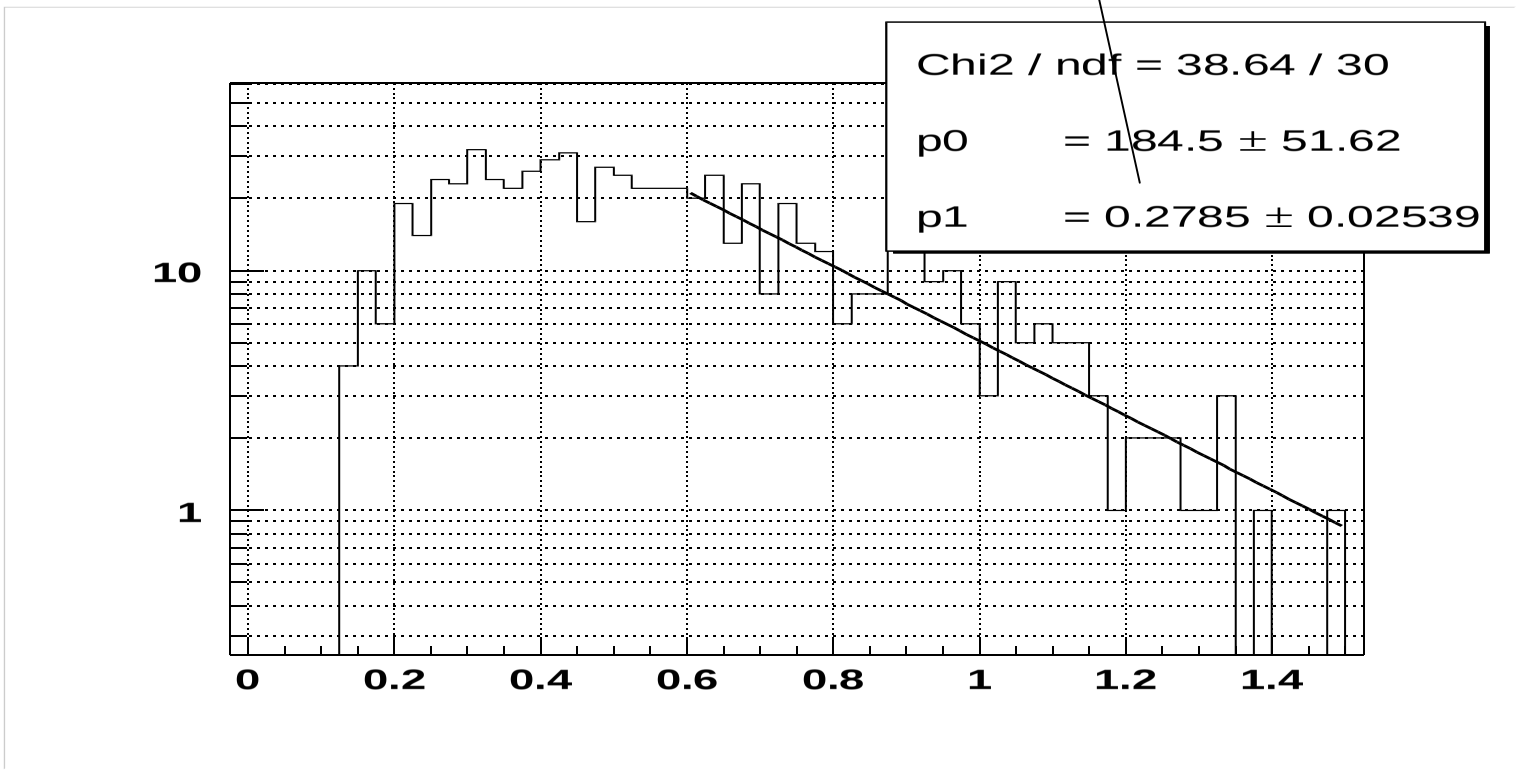
- Issue has been low efficiency

Ks “lifetime” from SMT only tracking

PDG:$c\tau$=2.68 cm

L_{xy} M(Ks)/P_T

cm



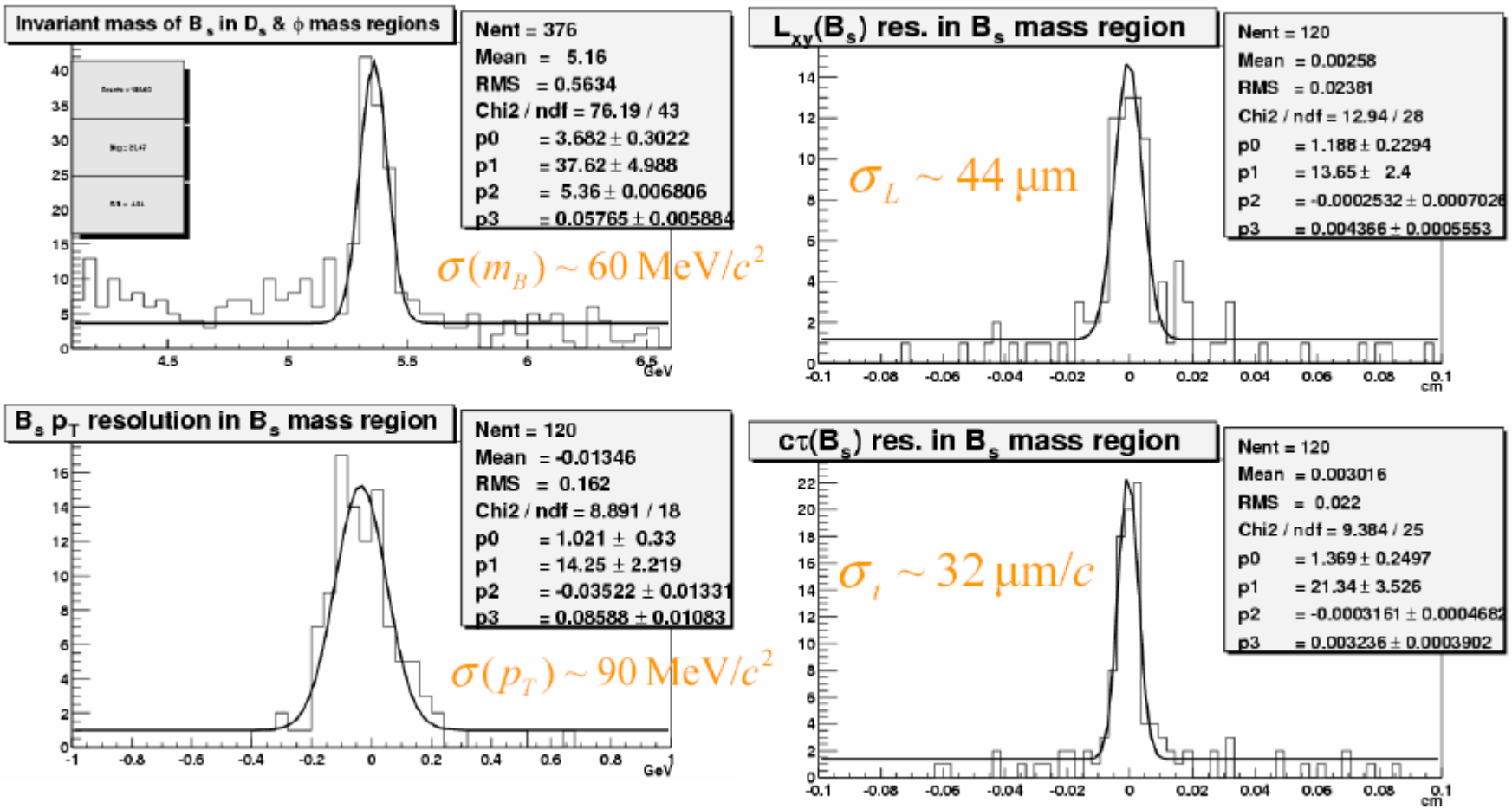
Ariel Schwartzman

Bs Decays

$Bs \rightarrow Ds\ \pi$

$\hookrightarrow \phi\ \pi$

$\hookrightarrow K\ K$



Using Vertex constrained fits

σ_t =100 fs

Bs mixing

Asymmetry ~ $\cos(\Delta M_s\, t)$

$$Sig(\Delta m_s) = \sqrt{\frac{ND^2\varepsilon}{2}} e^{-(\Delta m_s \sigma_t)^2/2} \sqrt{\frac{S}{S+B}}$$

$Xs = \Delta M_s/\Gamma$

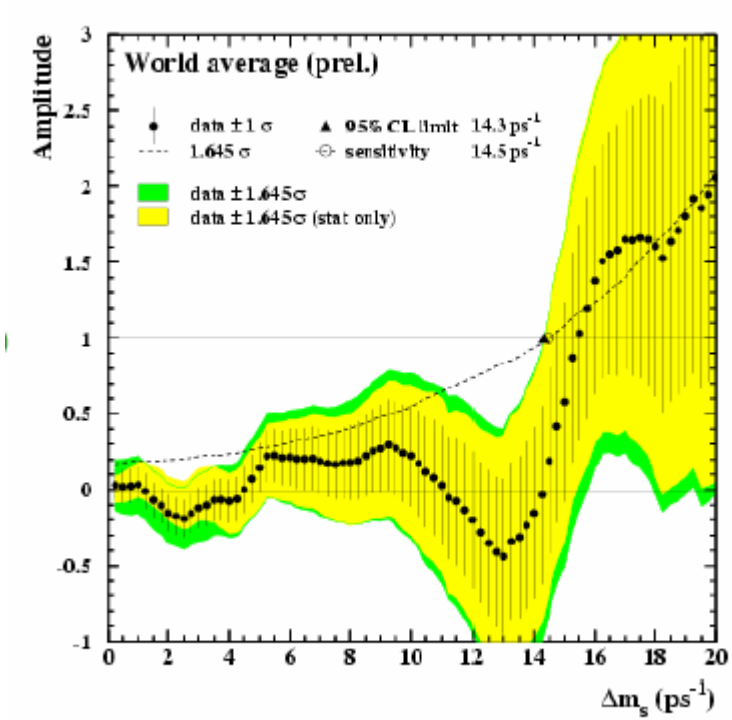
N correctly tagged Events	σ_T	Xs reach
3000	0.1 ps	30
6000	0.1 ps	30
8000	0.045 ps	60
6000	0.075 ps	40
8000	0.06 ps	50

Current Limit $\Delta M_s > \sim 14\ ps^{-1}$

Bump at 17 ps^{-1}

SM: 13 $ps^{-1} < \Delta m_s < 21\ ps^{-1}$

(20 < Xs < 31)



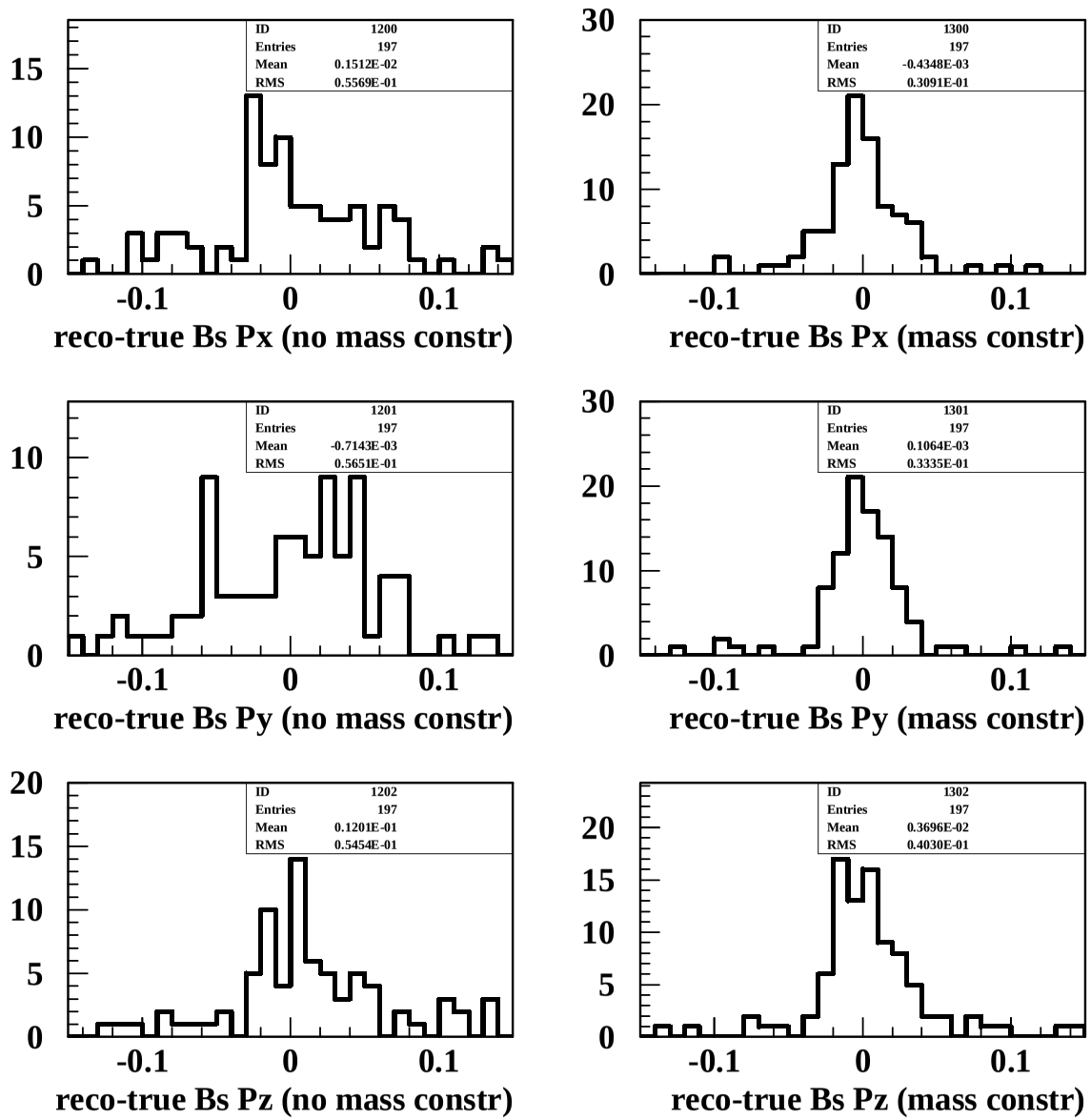
Semileptonic modes: Xs < 30

Implementing Kinematic fits

- Small Improvements in proper time resolution gives a large affect in Xs reach
- Sherry Towers has started looking into implementing constrained vertex fitting package
- Preliminary

Effect of constraints on momentum

Bs momentum resolution (with and w/o mass constraints)



Sherry Towers

Constrained fit results

- ~ 25% decrease in proper time resolution
- Results encouraging
- Needs more study

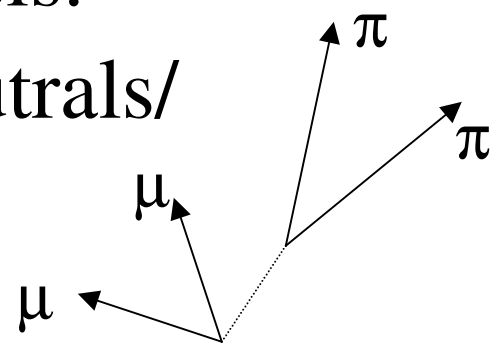
Triggers

- Low Pt dilepton triggers ideal for B physics

- For hadronic modes, only 1 lepton so need to implement additional requirement on event.
- Currently studying how best to implement hadronic trigger

Vertexing tracks

- Most physics groups can directly use output of reco_analyze for physics analysis.
- We need to vertex tracks/form neutrals/ vertex them etc.
- Time consuming
- Thanks to vertexing group, code now exists to vertex directly from root-tuples. Easier and faster method



Conclusions

- Getting underlying tools in place to do B physics (MC, vertexing in root, constrained fits, triggers etc.)
- Very important to have highly efficient tracking, studies underway to try to improve Ks finding efficiency
- Looking forward to track trigger and improved tracking efficiency.