SLD Bs Mixing Review

Bs Mixing Using Ds + Tracks

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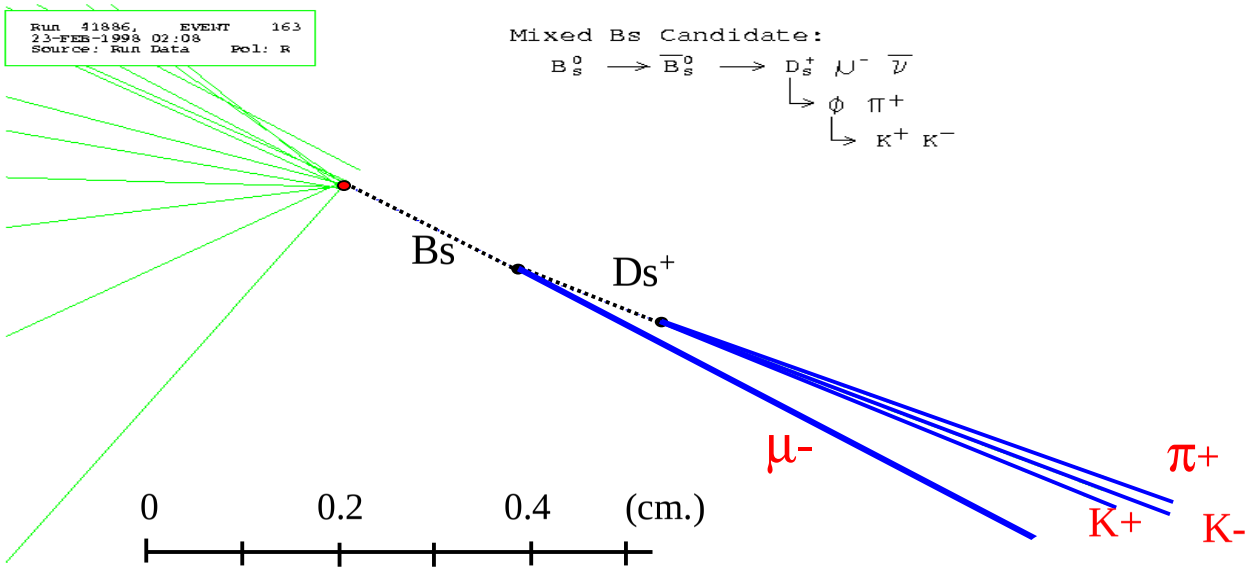
OUTLINE:

- Review of Ds+Tracks
- Ds selection using Neural Nets
- B vertex reconstruction
- Plan of action for the coming months

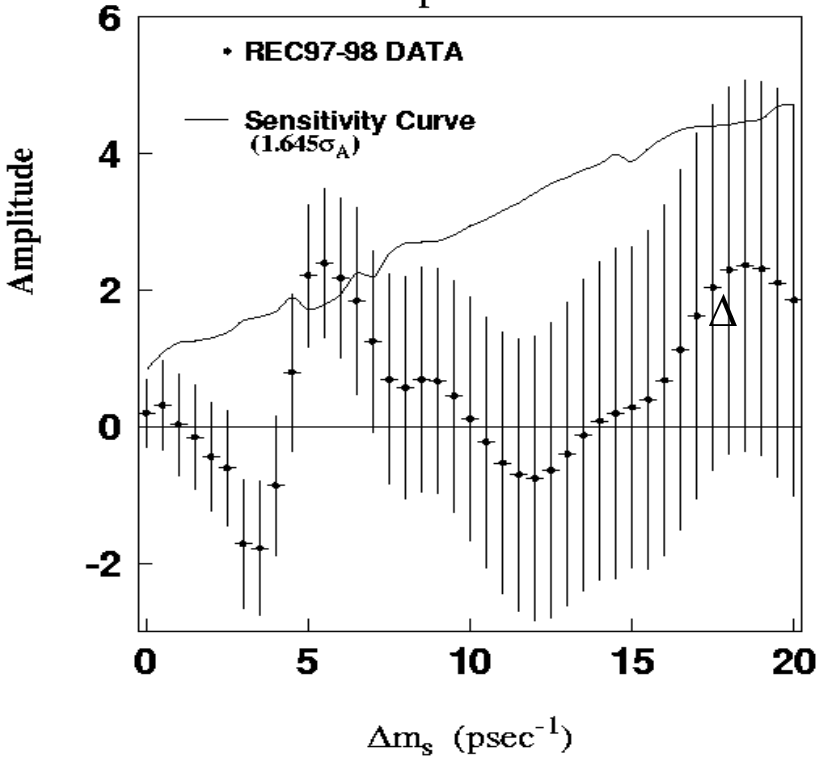
Ds+Track(s) Analysis



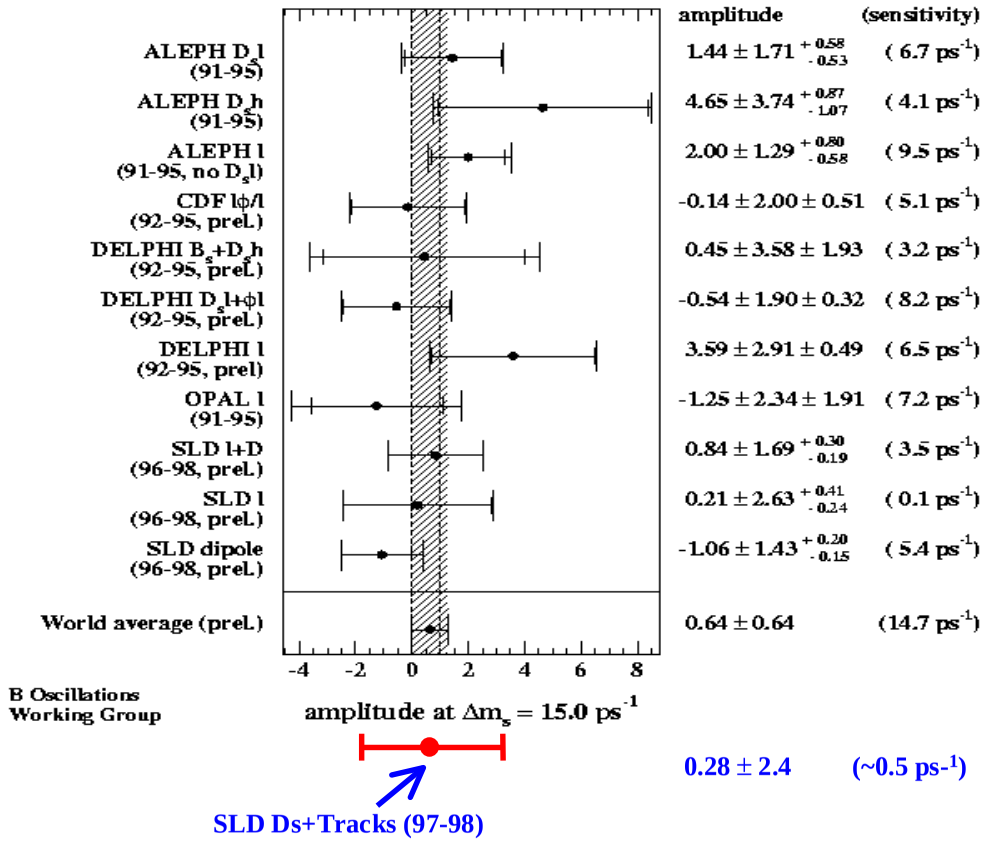
- Reconstruct Ds -->($\phi\pi$, K*K) to enhance purity and to tag the final state of the Bs
- Bs fraction >30%
- B decay length resolution ~50μm (60% core) !!!

Ds + TRACKS RESULTS (SUMMER 1999)

Amplitdue fit



Amplitdue at ΔMs=15ps^{-1}



Sensitivity can be improved by:

- Better resolution (B vtx and boost)
- Higher statistics/efficiency

What's new with the analysis?

- Using Neural Net to enhance the efficiency of Ds selection

  10(inputs) : 12(hidden nodes) : 1 (output)

  Inputs for $\phi\pi$ mode:

  M_{KK}, P_{tot}(Ds), K+ K- opening angle, Ds vtx prob, normalized Ds decay length (w.r.t. IP), ϕ helicity angle (in Ds rest frame), K+ helicity angle (in ϕ rest frame), and 3 CRID (CKID) codes.

  Inputs for K* K mode (required definite kaon from K*):

  $M_{K\pi}$(K*), K(from K*) π opening angle, Ds vtx prob, Normalized Ds decay length, ave. 3-D impact parameter of the Ds tracks, K* helicity angle (in Ds frame), K+(from direct Ds decay) helicity angle in K* frame, 2 CRID (CKID) for π and kaon(from direct Ds).

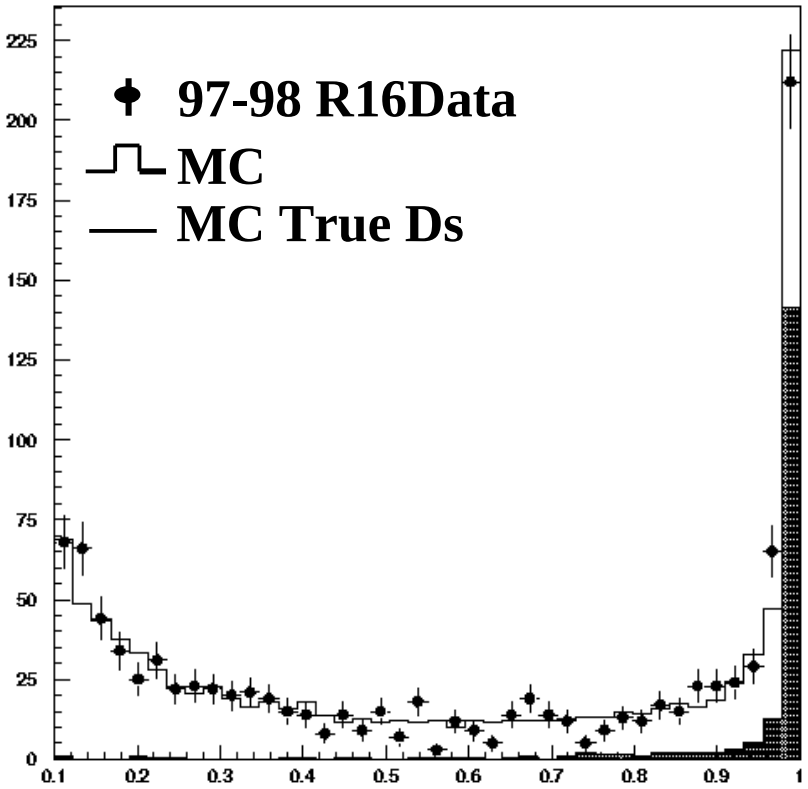
- Studied the feasibility of other Ds decay mode:

  Ds --> ϕ l ν, ϕ π π π, and K^0 K

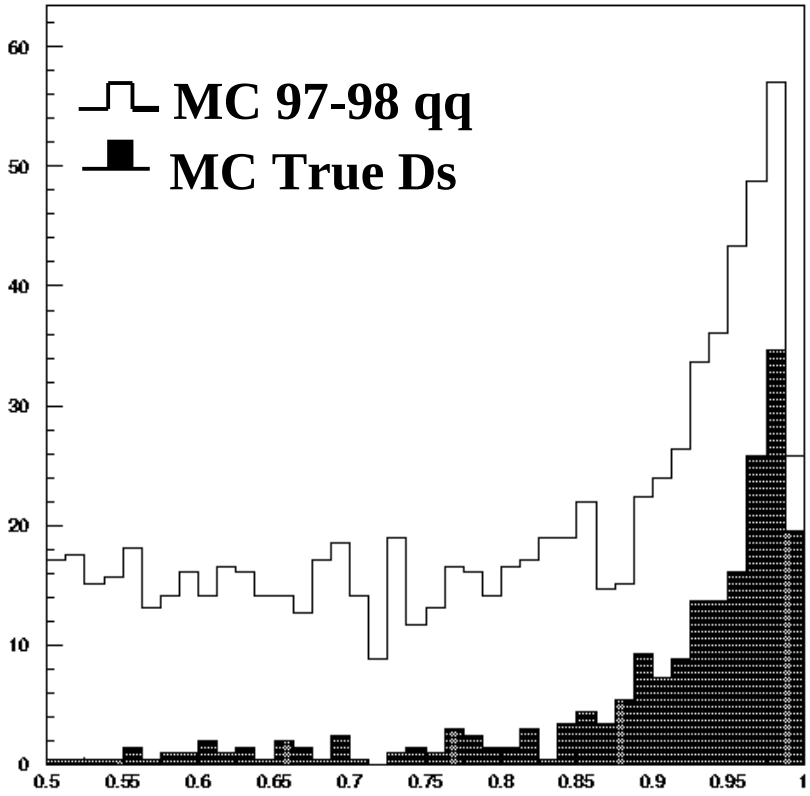
NEURAL NET OUTPUTS

- Using Stuttgart Neural Net package for the training

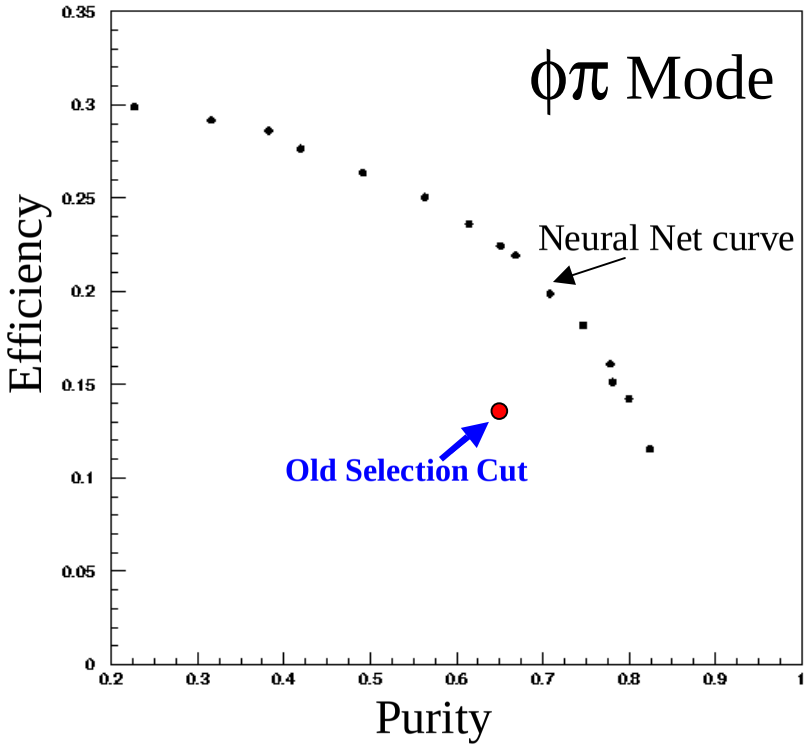
$\phi\pi$ Mode

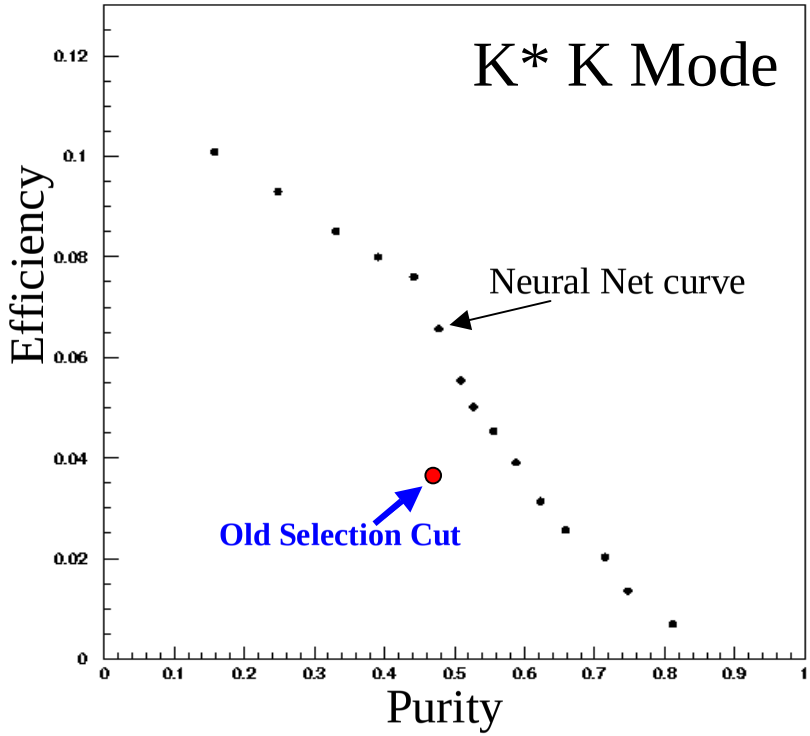


K* K Mode



Neural Net Results (efficiency vs purity)

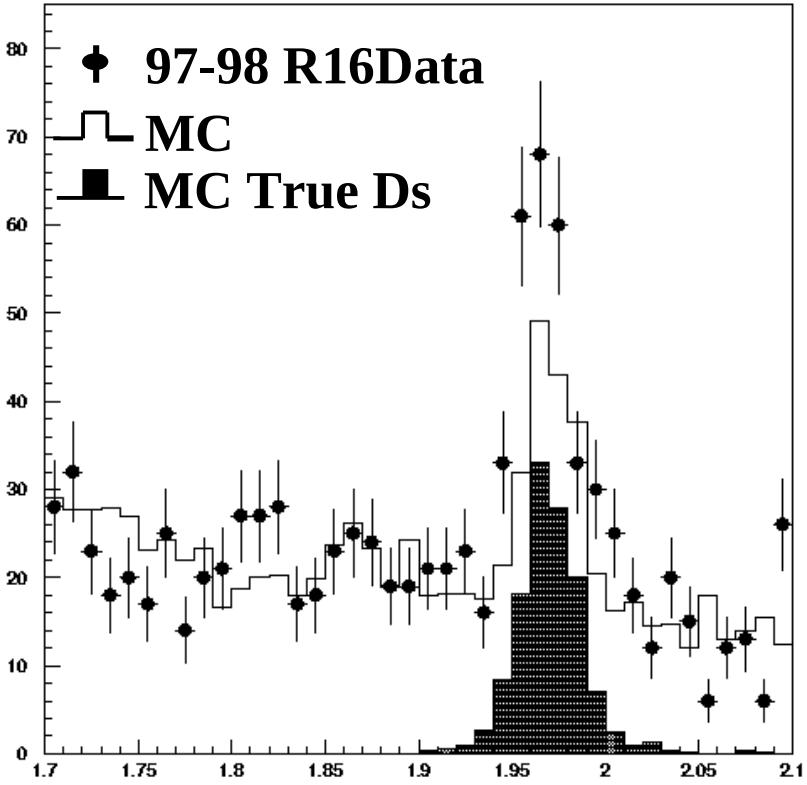




- Significant improvements in efficiency and purity
  Efficency improves (given the same purity)
  by ~50 % for both modes!!!

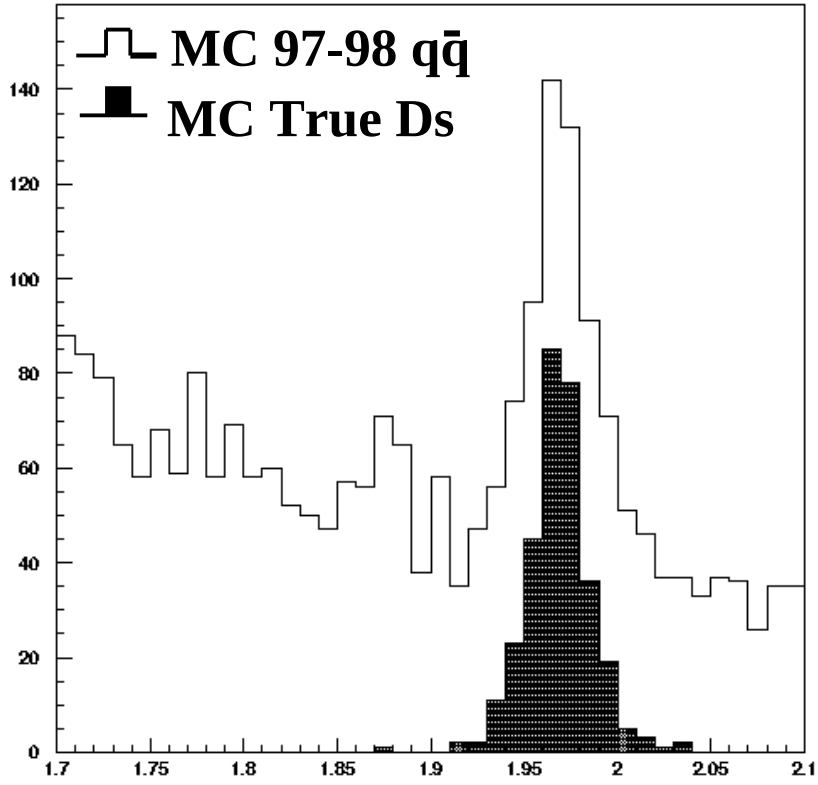
Ds Invariant Mass Plots

$\phi\pi$ Mode (NN>0.95)



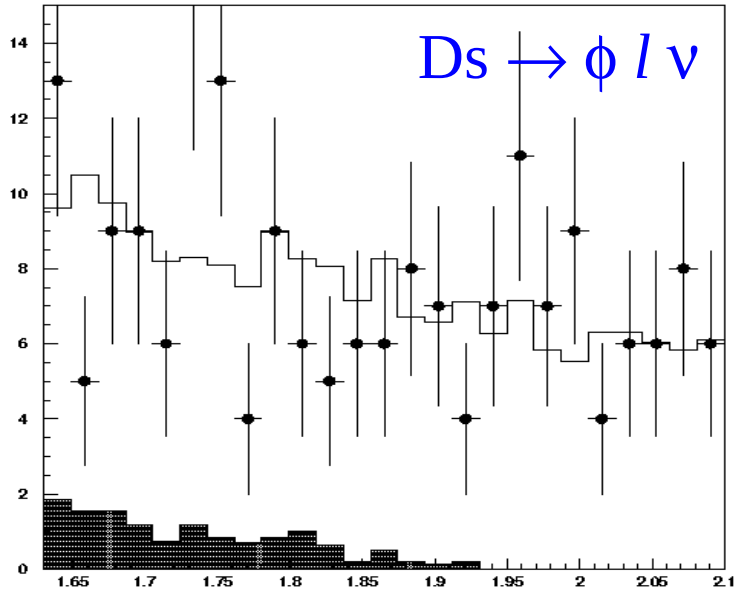
$M_{kk\pi}$ (GeV)

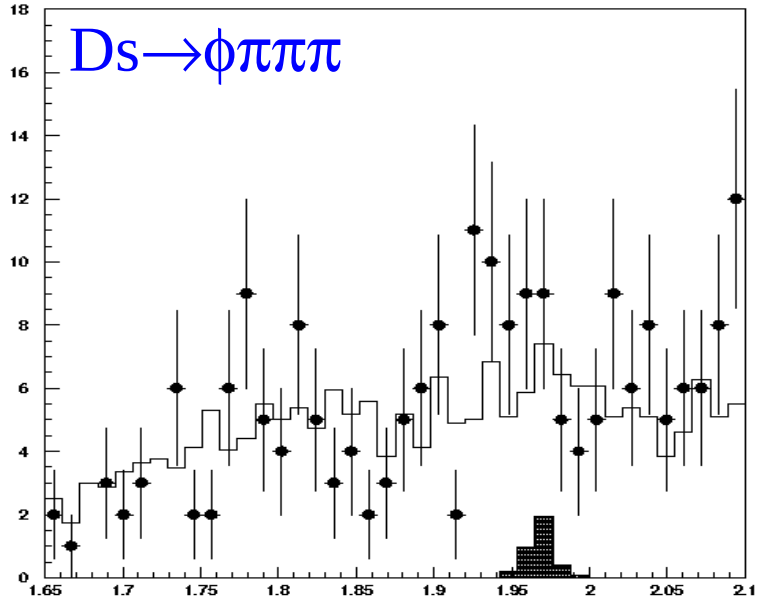
K* K Mode (NN>0.9)

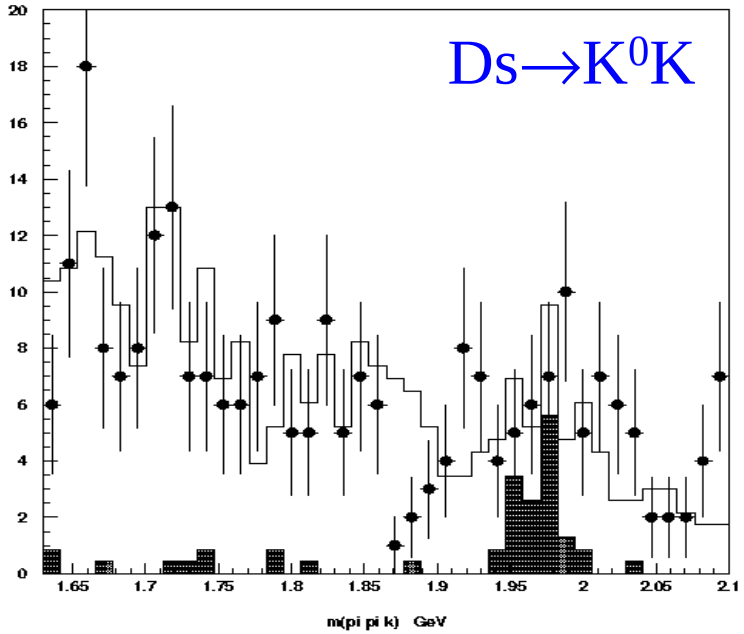


$M_{k\pi k}$ (GeV)

Other Ds Decay Modes



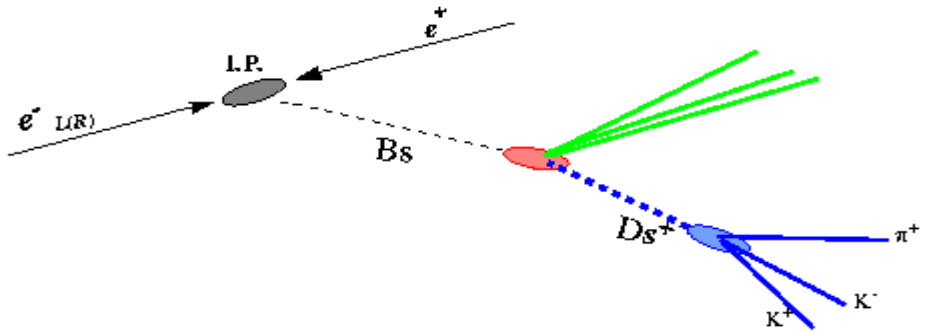




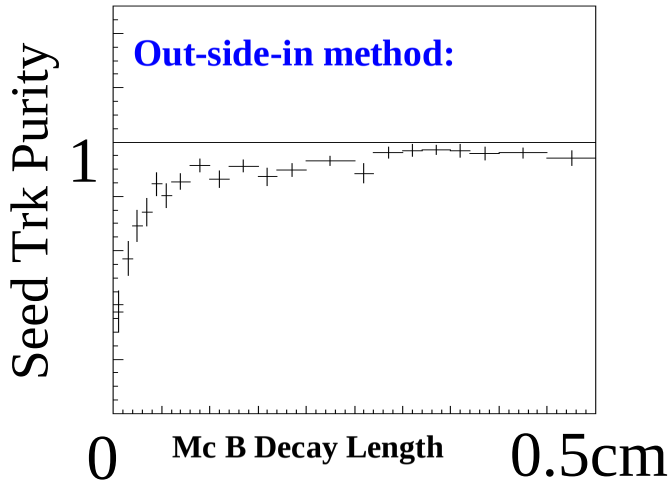
- These modes are fairly messy and probably will not contribute much to the analysis.

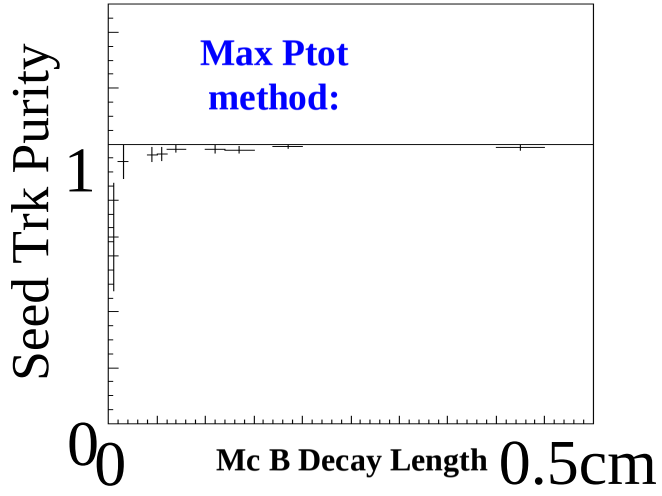
- Put these modes on hold for now

Can We Further Improve the Decay Length Resolution?

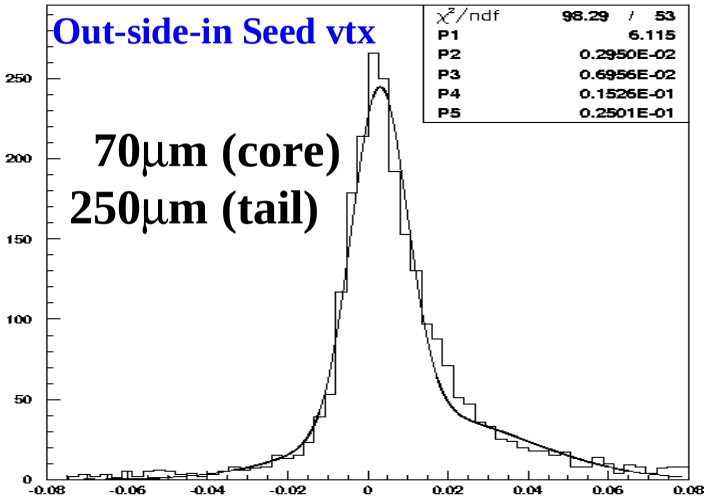


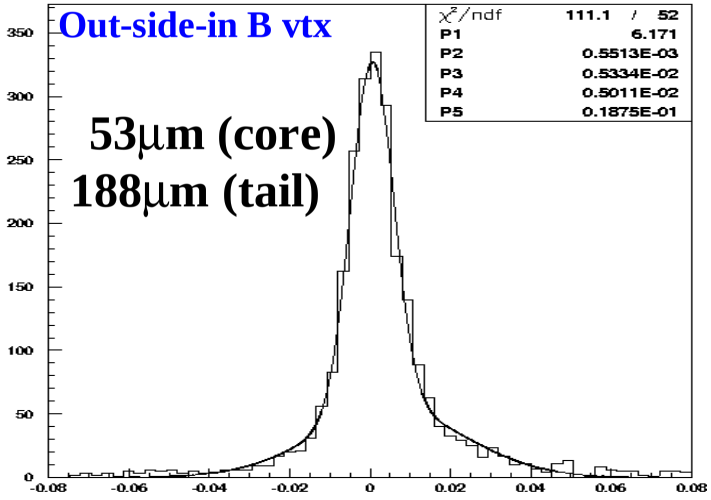
- Current algorithm selects seed vtx by fitting all trks in the hemisphere individually with the "virtual" Ds trk, the vtx furtherst from the IP (upstream of Ds) is selected as the seed vtx for track attachments --> seed vtx resolution of ~ 70μm
- Pick the highest momentum trk (with 3-D impact param > 3σ) in the hemisphere as the the seed trk gives a seed vtx resolution of ~ 57 μm

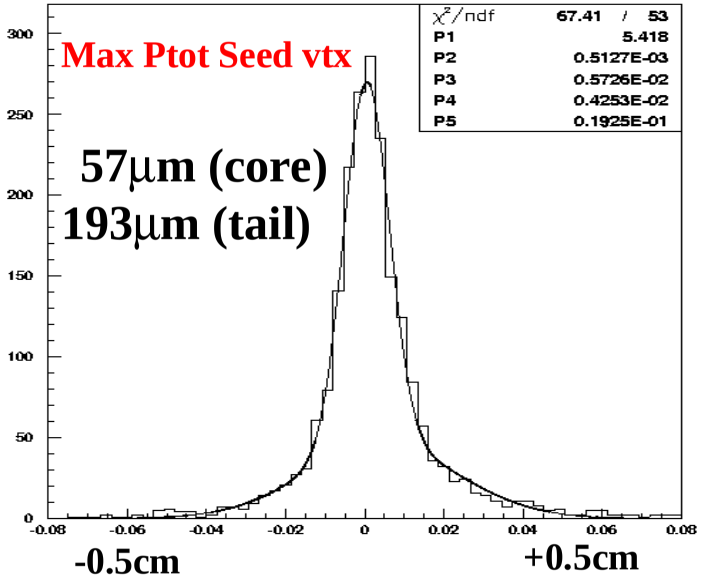


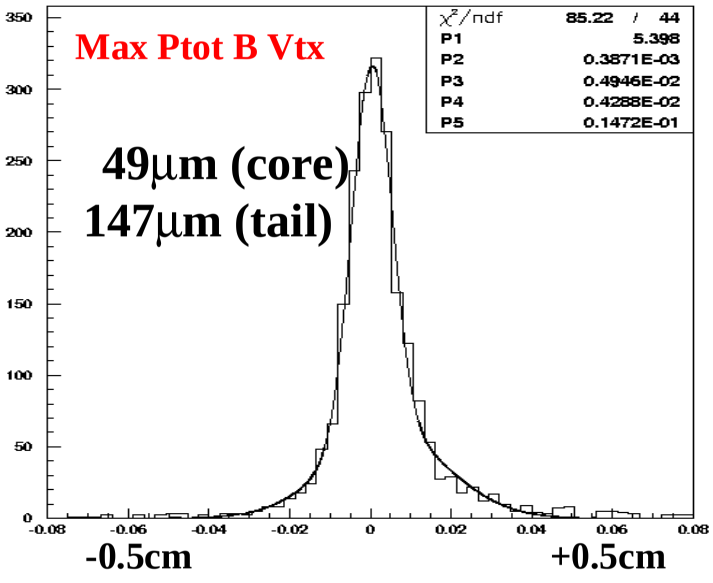


Decay Length and Seed Vtx Resolutions

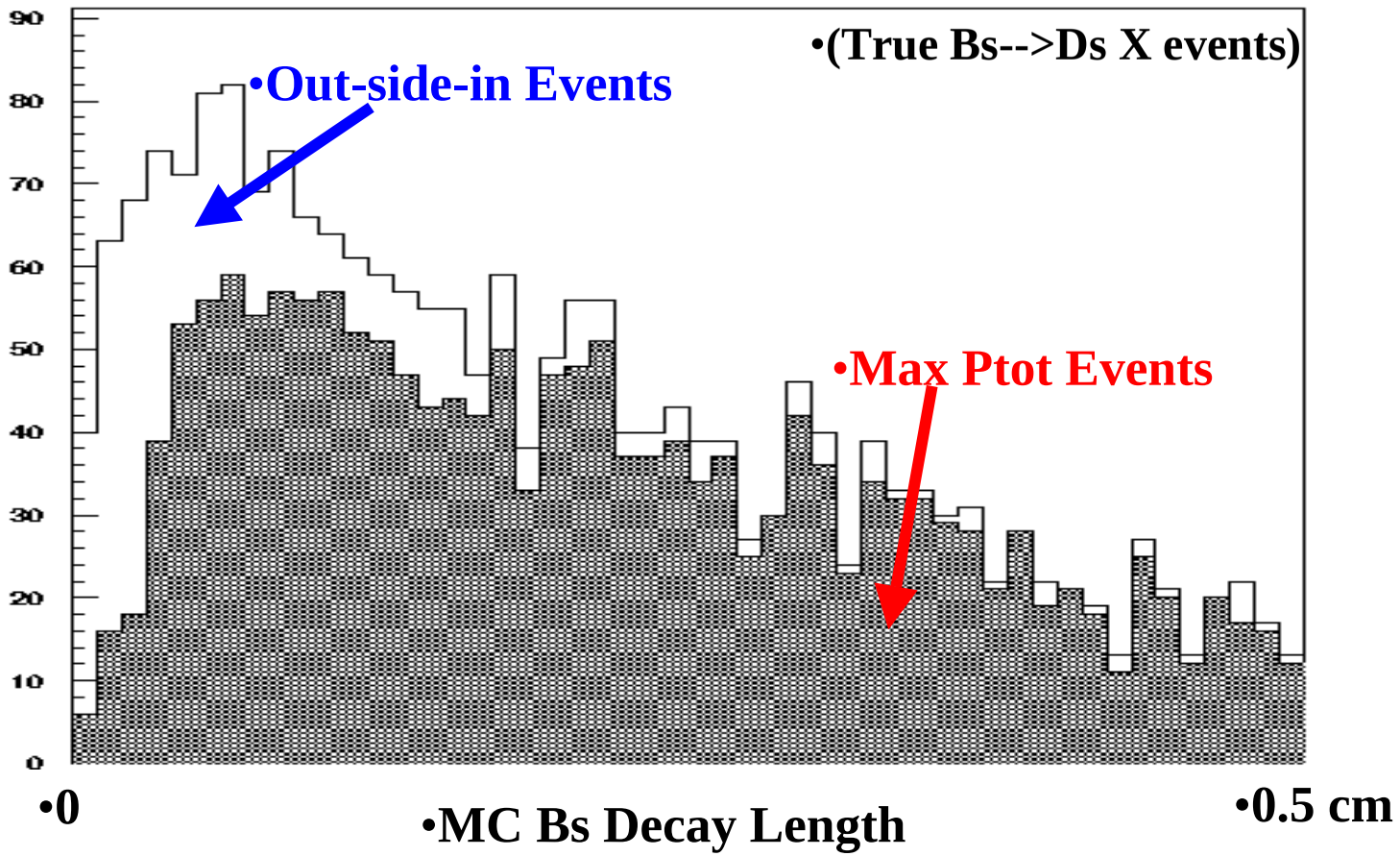








Looks good but ……..



- Max Ptot method improves resolution but has lower efficiency at short decay length
- Combining both techniques may be the way to go

PLAN OF ACTION FOR THE NEXT FEW MONTHS

- **Optimize NN cuts for $\phi\pi$ and K*K (base on Moser's formula)**
- **Incorporate new boost routine from D. Dong (expect significant improvements**
- **Include "kitchen sink" intial state tagging routine**
- **Study VXD alone vectors (improve B vtx charge purity)**
- **Study the enhancement from Bs $\rightarrow$ Ds $l\,\nu$ events**
- **Freeze all development work by mid-April and move on to finalize the data amplitude fit.**
- **Combine the result with the other SLD mixing analyses.**