STT
Physics Channel Benchmark

$$\bar{p}p \rightarrow \Psi(3770) \rightarrow D^+D^- \rightarrow K^-\pi^+\pi^+ \, K^+\pi^-\pi^-$$

Darmstadt, 13.12.2011   Marius C. Mertens

Outline

- Figures of merit

- Overview on the simulation procedure
- Overview on the analysis procedure

- Results of the analysis
- Preliminary results from the mixed events

- Summary

Figures of merit

For the exclusive reconstruction of the Channel

$$\bar{p}p \rightarrow \Psi(3770) \rightarrow D^+D^- \rightarrow K^-\pi^+\pi^+ \ K^+\pi^-\pi^-$$

the following properties* are to be determined:

- the resolution of the invariant **mass**
- the spatial resolution of the **secondary vertices**

*see http://www2.pv.infn.it/~boca/panda/comparisonTPC-STT/list.html

Simulation Overview

- Channel: $\bar{p}p \rightarrow \Psi(3770) \rightarrow D^+D^- \rightarrow K^-\pi^+\pi^+ \, K^+\pi^-\pi^-$

- Beam momentum: 6.5788 GeV/c

- Simulated data on the PandaGrid
  - *PandaRoot Grid version: nov11 (r.13755 / 13790)*
  - *run936cufix*

- Steps
  - *Simulation*
  - *Digitization*
  - *Reconstruction*
  - *PID*
  - ***Analysis***

Software experts, full data
sets available on the Grid

Analysis Overview

0: **Total count** of signal events as input

1: Events within **geometric acceptance** of the central tracker. All six MC signal tracks must touch the CT volume.

2: **Reconstructable events**. The reconstructed tracks are cleaned by positive MC PID information. After that they must contain (at least) two oppositely charged Kaons and two oppositely charged pairs of two Pions.

3: **Events hitting the STT**. All tracks to be processed should touch the STT volume. Tracks without at least one STT hit are discarded. After that the event must contain (at least) two oppositely charged Kaons and two oppositely charged pairs of two Pions.

4: **Events with D+ and D- candidates**. Same events as in (3)

5: **Events with D+ and D- candidates within 1.5 GeV mass window**

6: **Events surviving vertex fit**. (Best candidate with GlobalChi2 < 18)
    → Secondary vertex resolution

7: **Events with D+ and D- candidates within 0.5 GeV mass window**
    → Mass resolution

8: **Events with Psi candidates**. Same events as in (7)

9: ~~Events surviving 4C fit. (Best candidate with GlobalChi2 < 18)~~

Event Selection Process (STT)
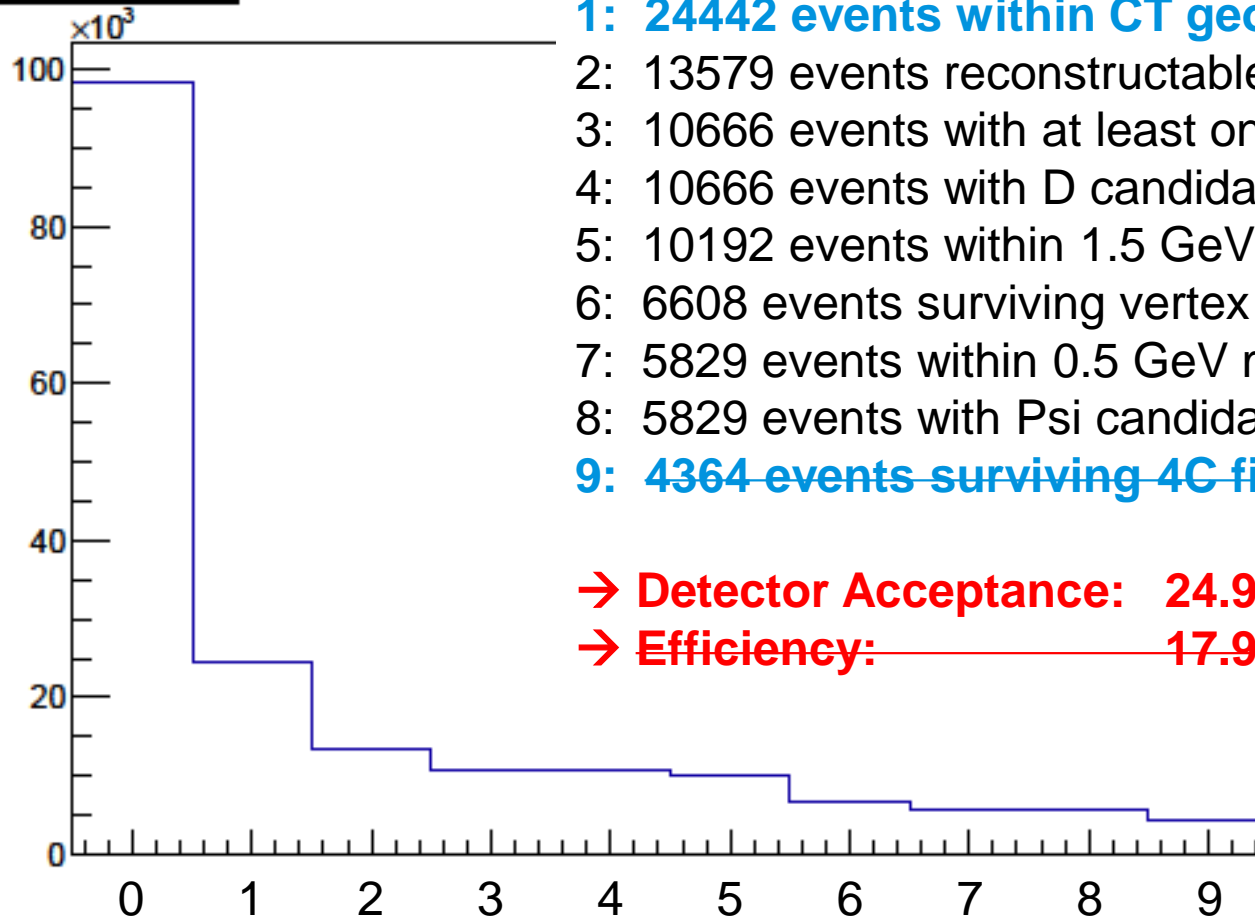
0: 98303 signal events total
1: 24442 events within CT geometric acceptance
2: 13579 events reconstructable by track finding
3: 10666 events with at least one STT hit
4: 10666 events with D candidates
5: 10192 events within 1.5 GeV mass window
6: 6608 events surviving vertex fit
7: 5829 events within 0.5 GeV mass window
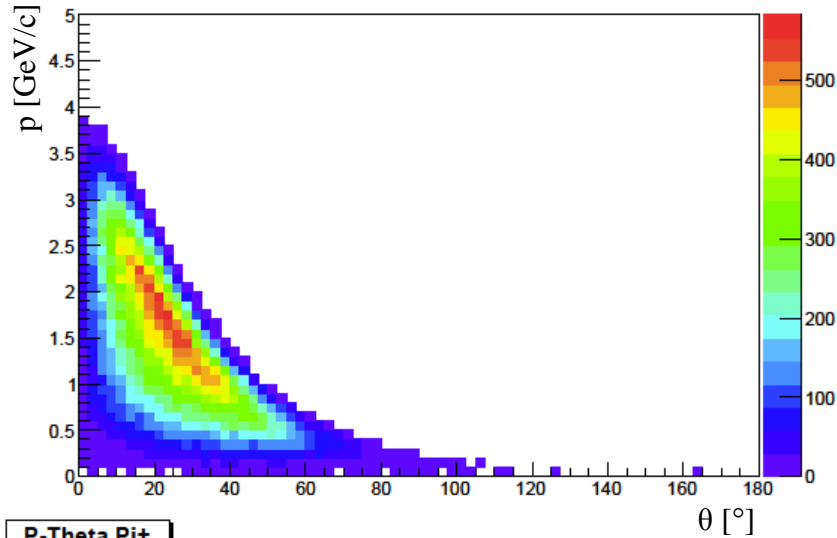8: 5829 events with Psi candidates
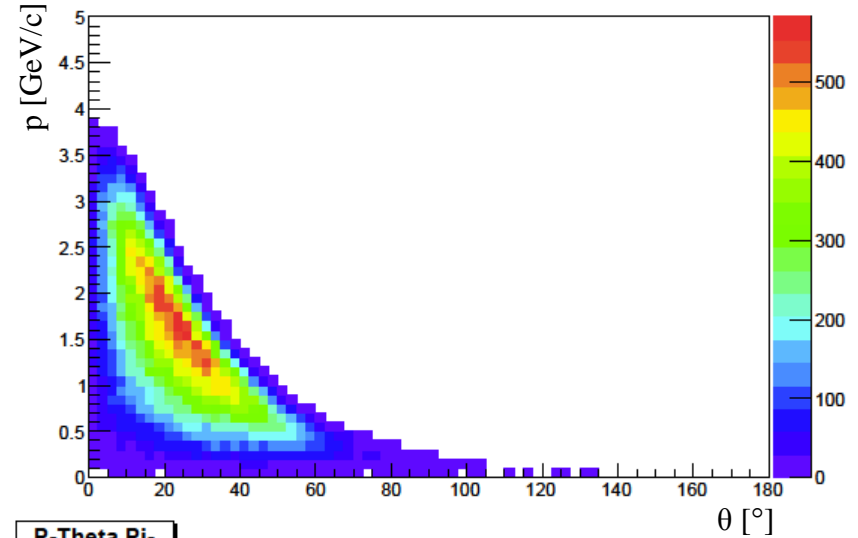**9: ~~4364 events surviving 4C fit~~**

→ **Detector Acceptance: 24.9 %**
→ ~~**Efficiency: 17.9 %**~~

P- θ Distribution (Input Events, Analysis Step 0)
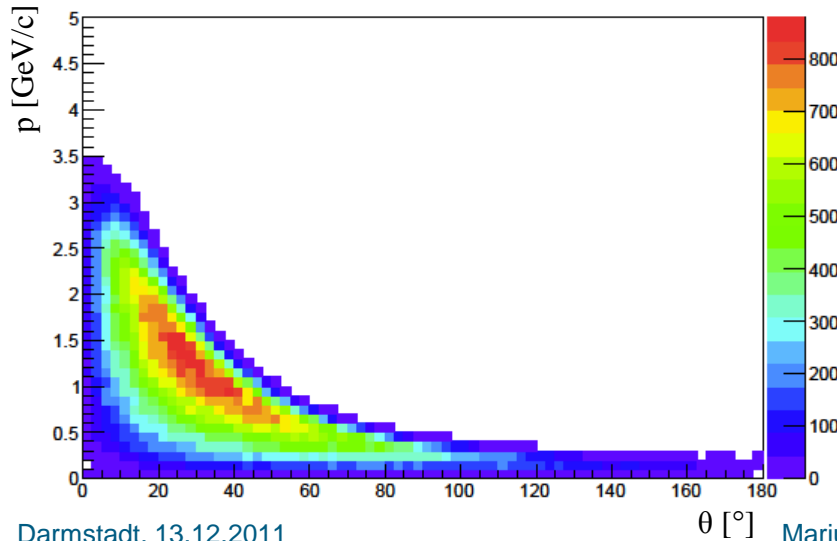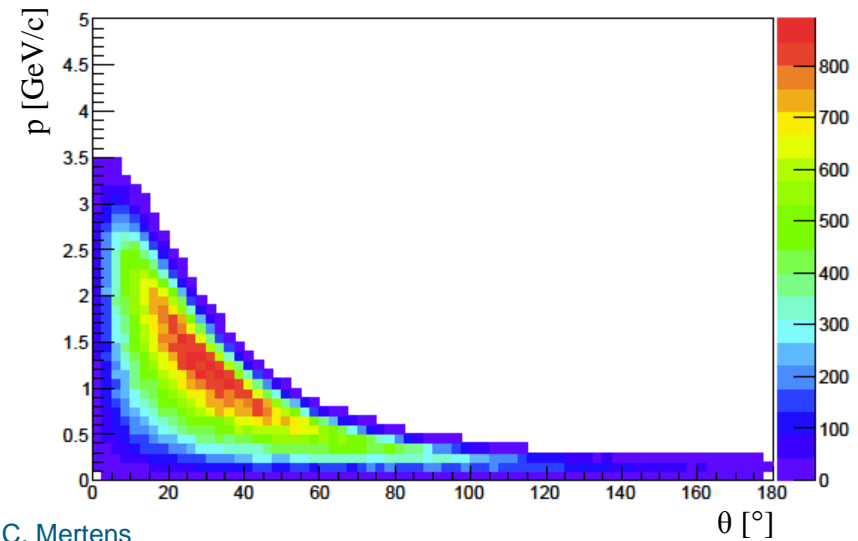
θ-φ Geometrical Acceptance (Analysis Step 1)

Theta-Phi Acceptance K+
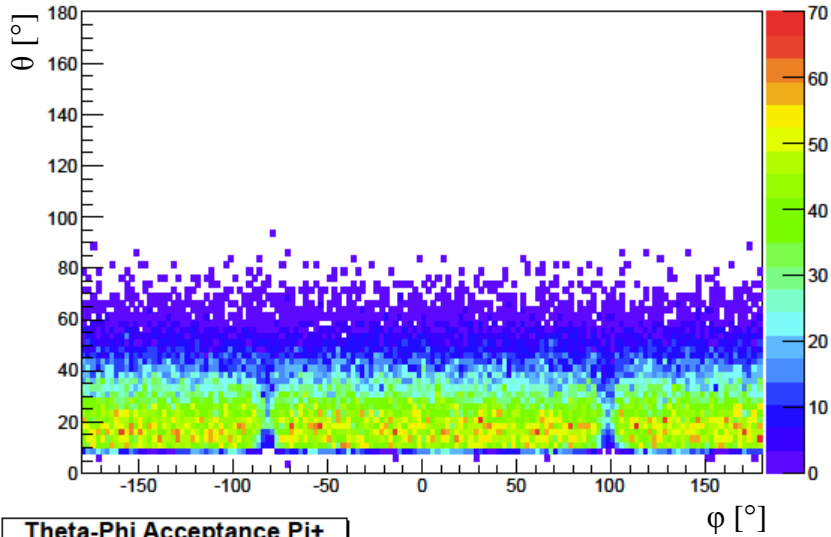
Theta-Phi Acceptance K-
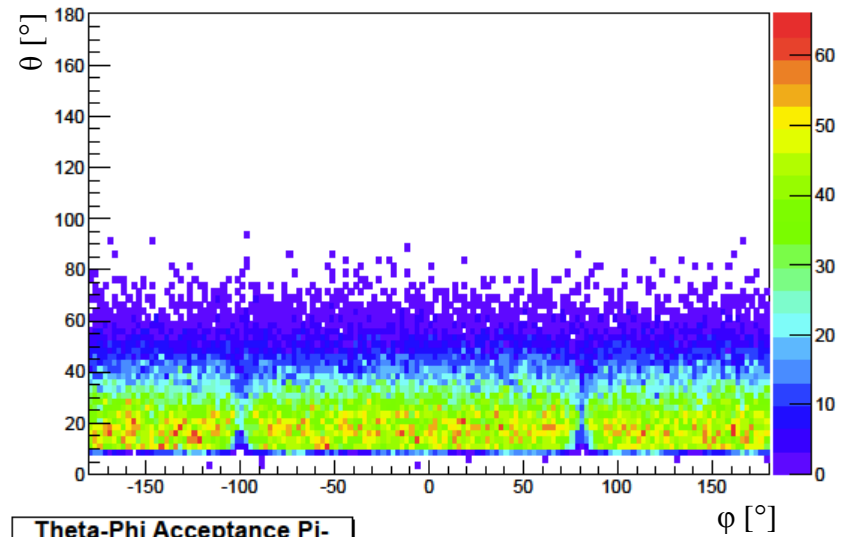
Theta-Phi Acceptance Pi+
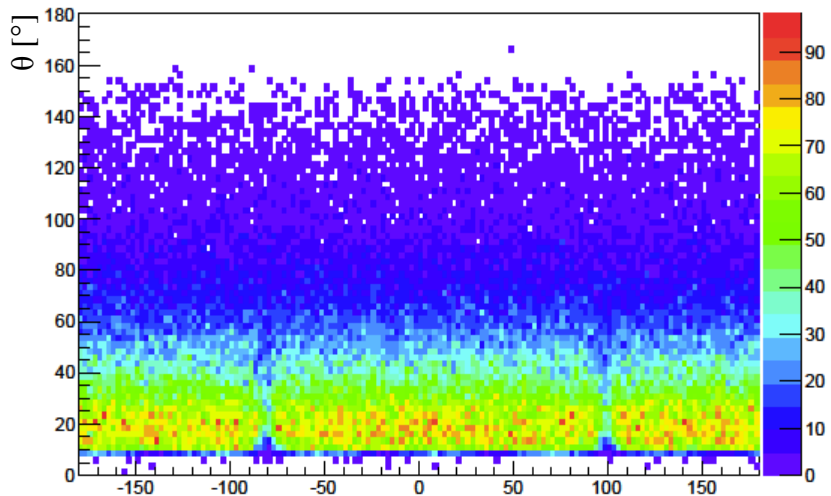
Theta-Phi Acceptance Pi-
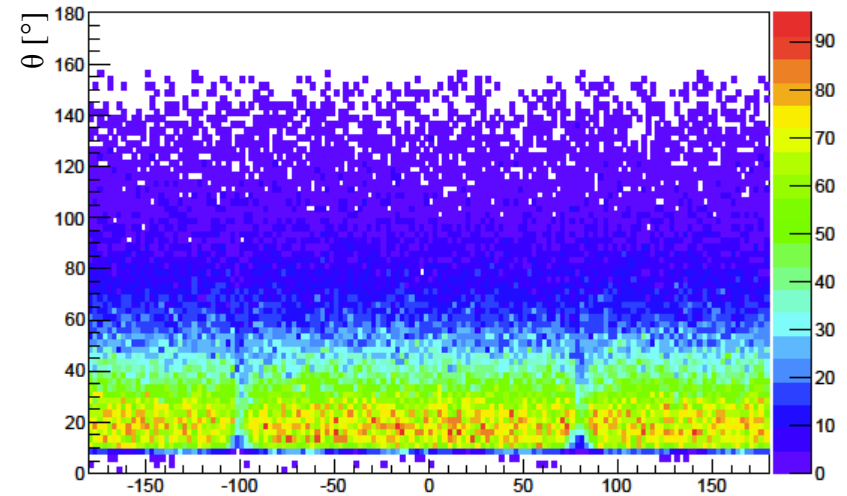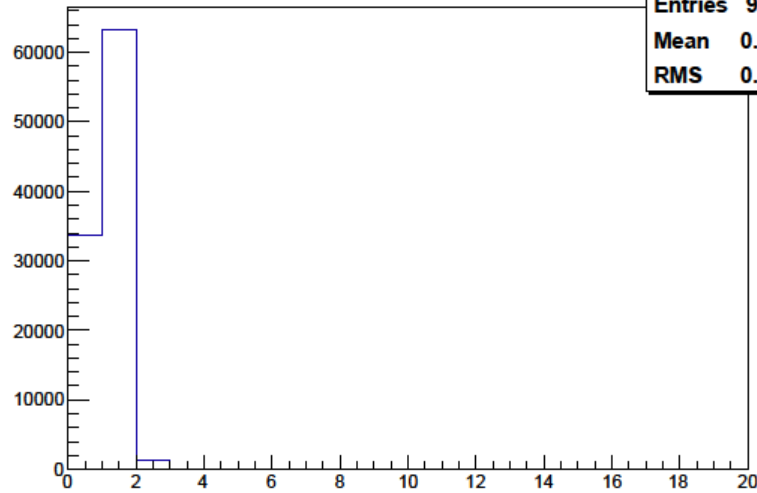
Track Multiplicities (in Analysis Step 3)
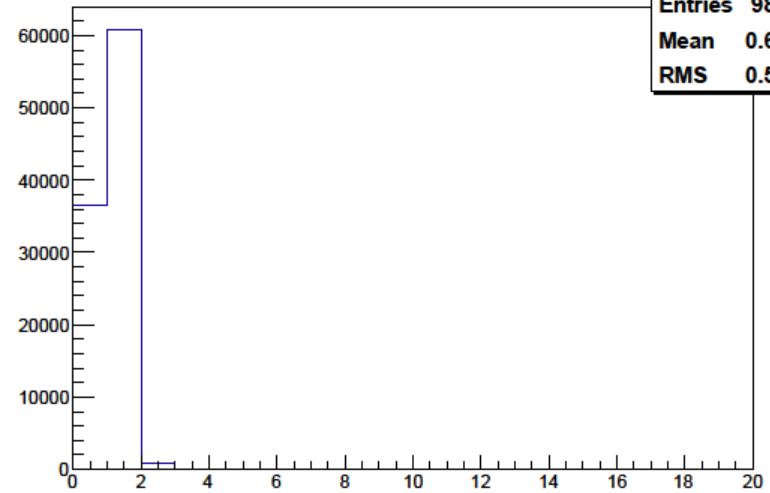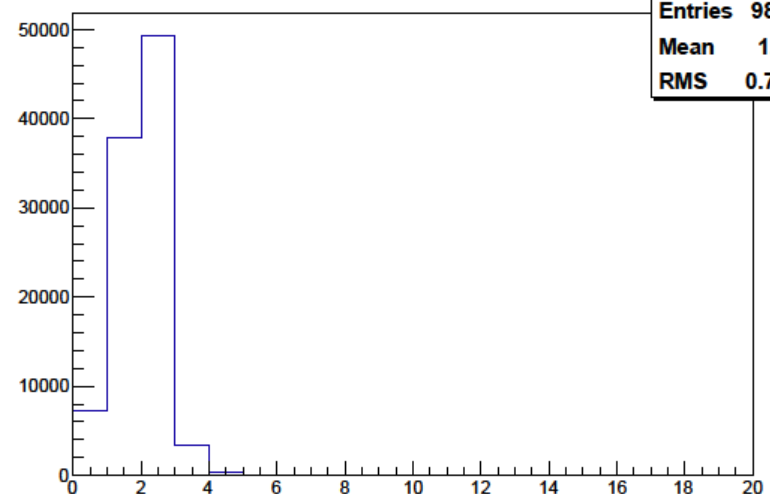
Raw D Meson Masses
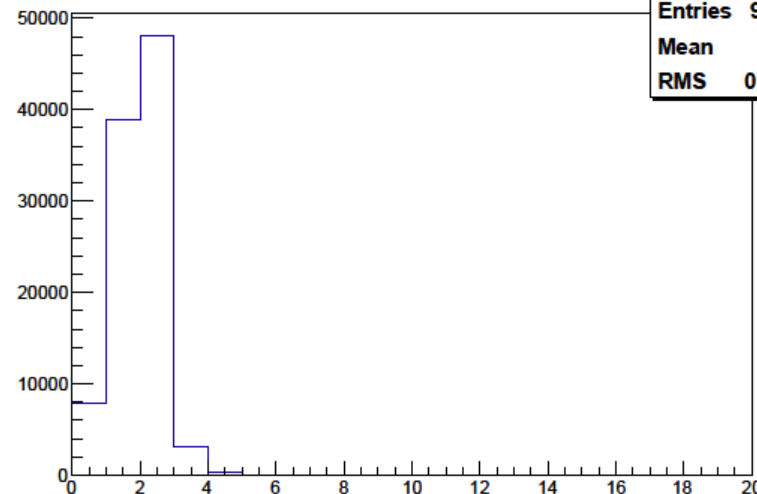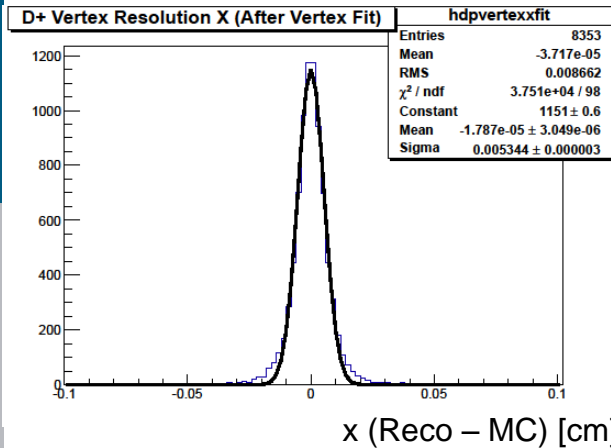
D-Meson Vertex Fit

χ^2 distribution of the vertex fits to the D-mesons. For each event, the candidates with the best $\chi^2 < 18$ are selected (one D^+, one D^-)
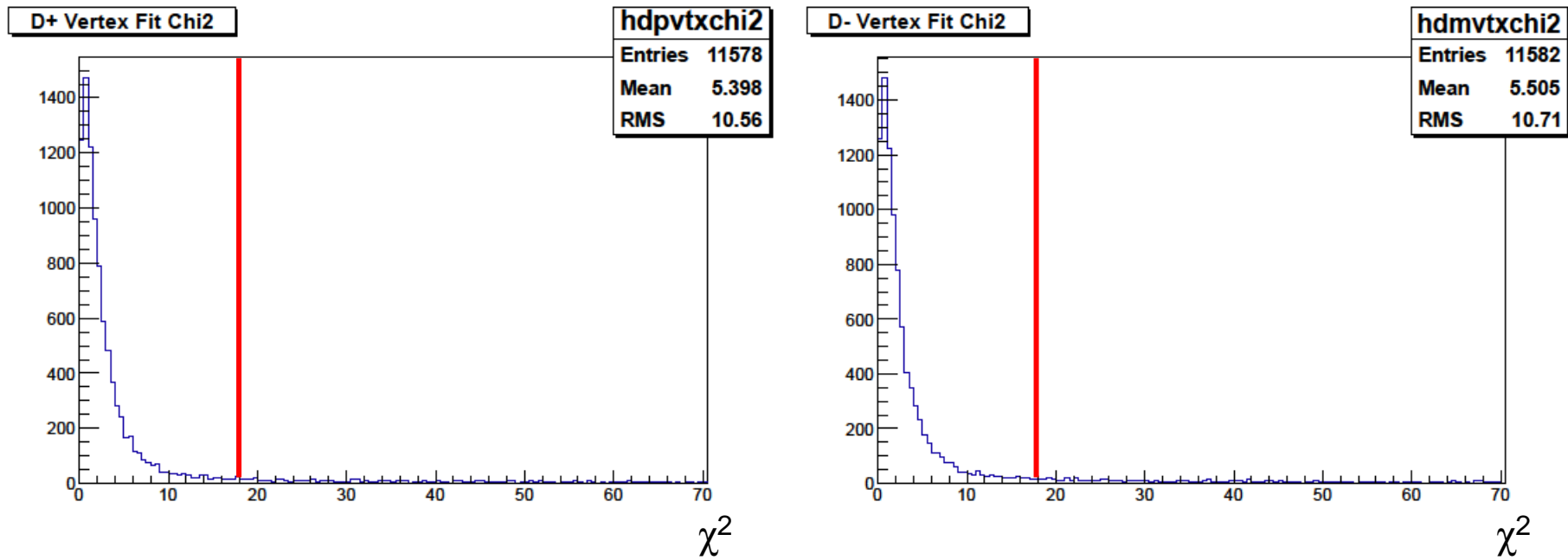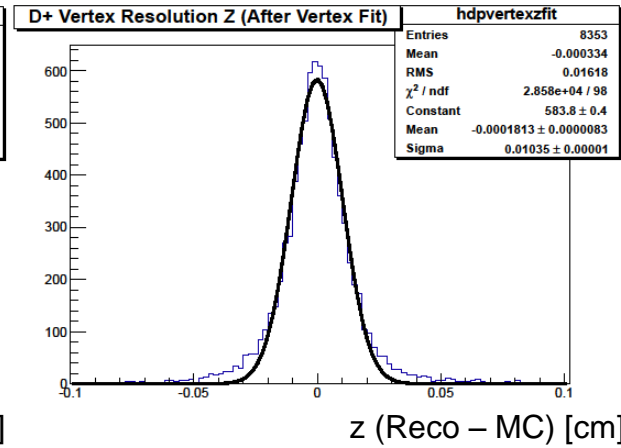
D-Meson Vertex Resolution (after Vertex Fit)
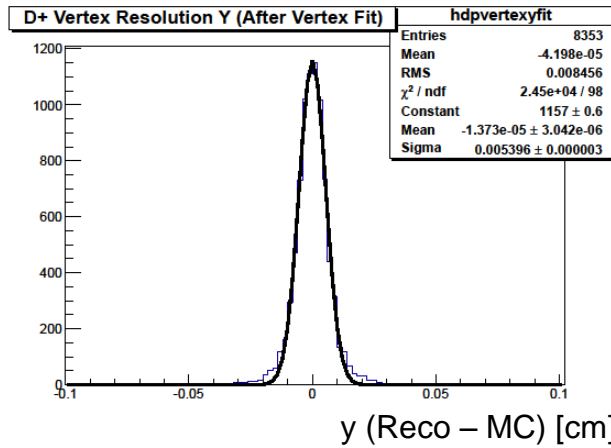
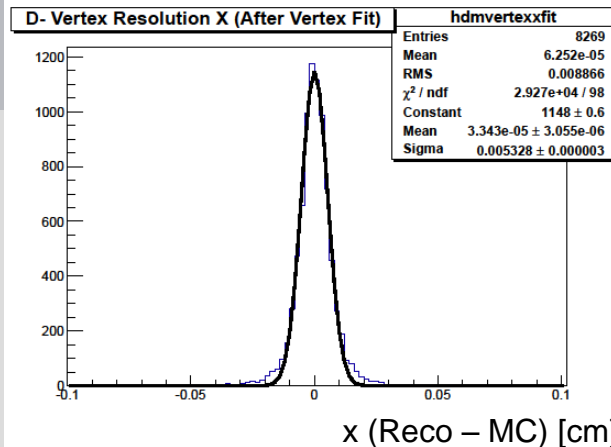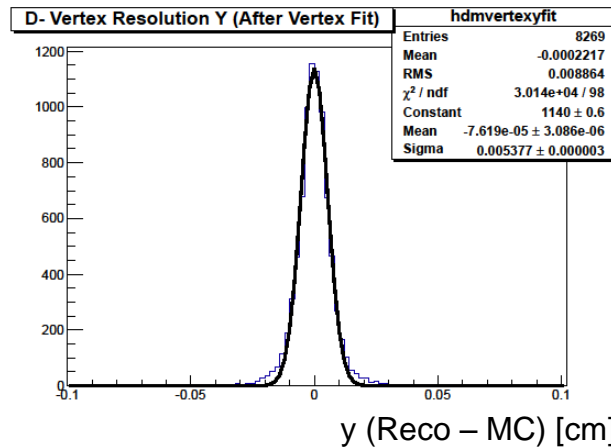$\sigma_x = (53.44 \pm 0.03)\ \mu m$ $\sigma_y = (53.96 \pm 0.03)\ \mu m$ $\sigma_z = (103.5 \pm 0.1)\ \mu m$
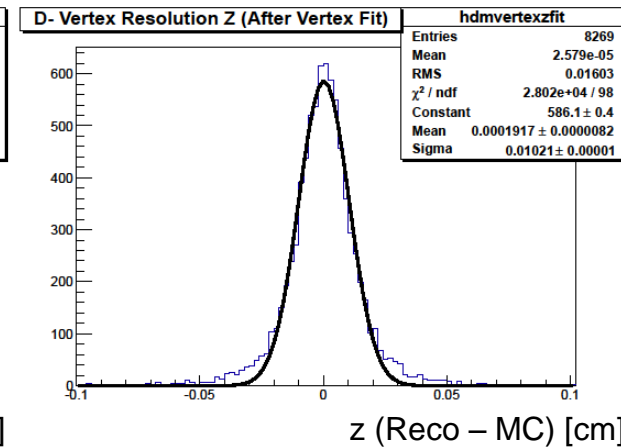
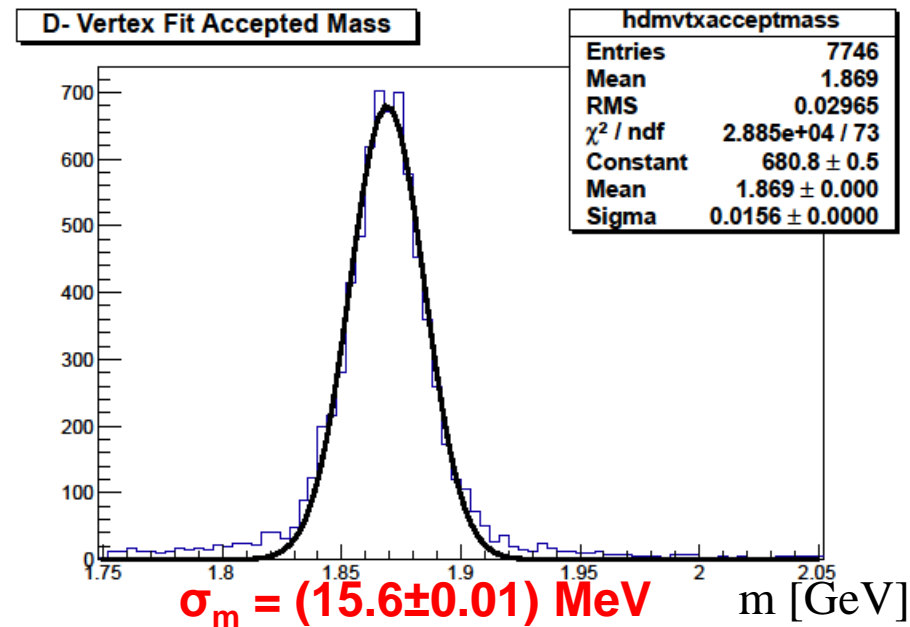$\sigma_x = (53.28 \pm 0.03)\ \mu m$ $\sigma_y = (53.77 \pm 0.03)\ \mu m$ $\sigma_z = (102.1 \pm 0.1)\ \mu m$

D-Meson Mass Resolution (after Vertex Fit)

σ_m = (16.48±0.01) MeV

σ_m = (15.6±0.01) MeV

Preliminary Mixing Results from just now…

Nice Events

hniceevents	
Entries	121490
Mean	1.32
RMS	2.215

72500 Input Events
2.2% Total Reconstructed
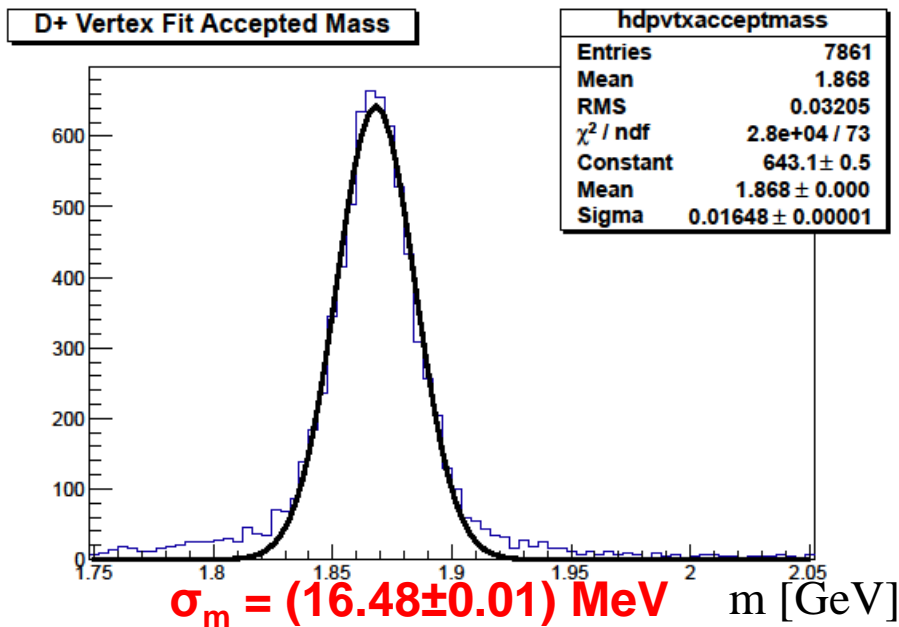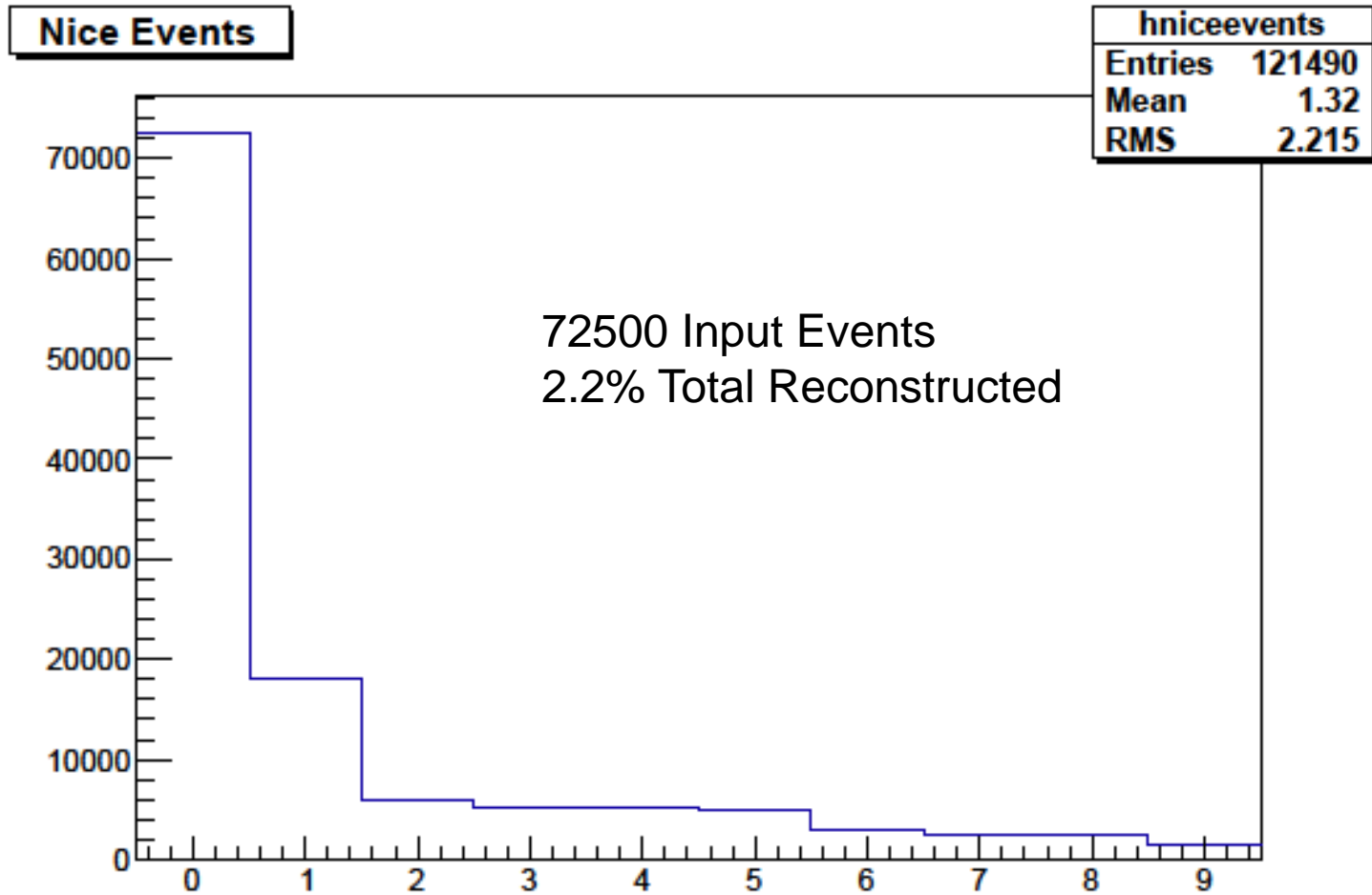
Preliminary Mixing Results from just now…

D+ Vertex Fit Accepted Mass
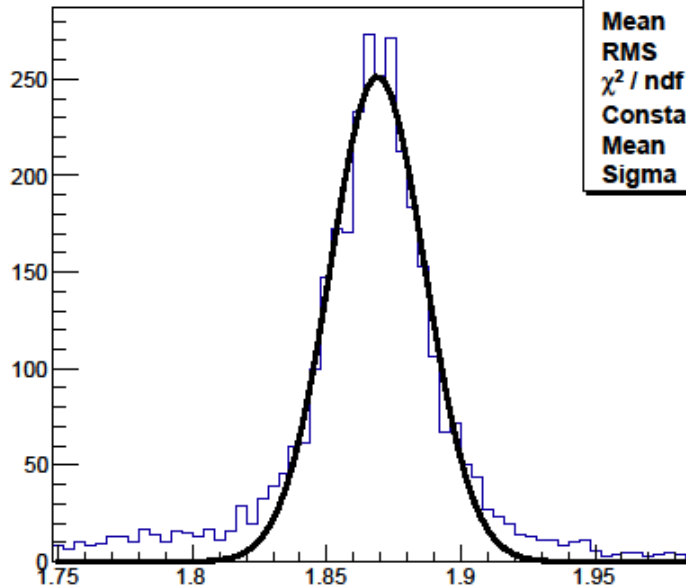
hdpvtxacceptmass	
Entries	3504
Mean	1.869
RMS	0.038
χ^2 / ndf	1.062e+04 / 73
Constant	251.7 ± 0.5
Mean	1.869 ± 0.000
Sigma	0.01759 ± 0.00004

D- Vertex Fit Accepted Mass
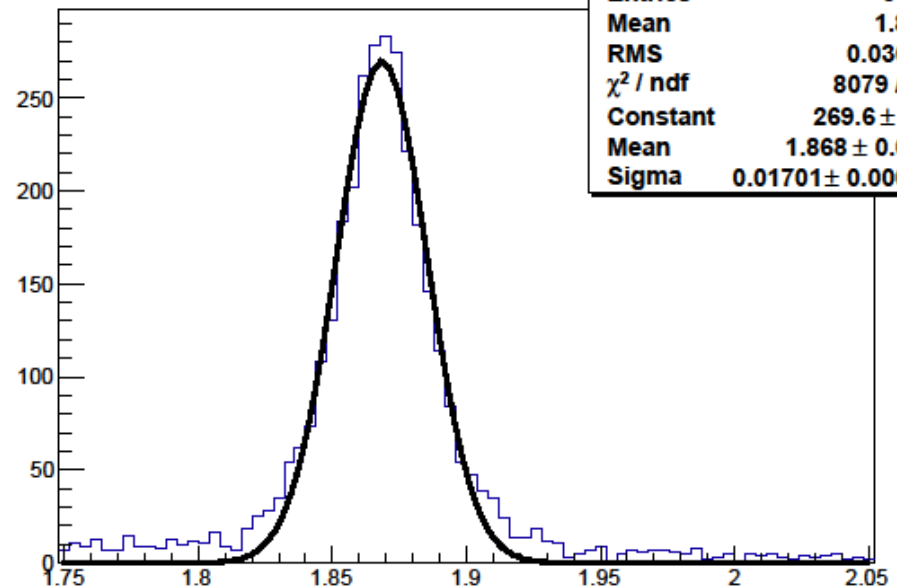
hdmvtxacceptmass	
Entries	3550
Mean	1.869
RMS	0.03679
χ^2 / ndf	8079 / 73
Constant	269.6 ± 0.5
Mean	1.868 ± 0.000
Sigma	0.01701 ± 0.00004

Mass Resolution: 17.3 MeV

Preliminary Mixing Results from just now…
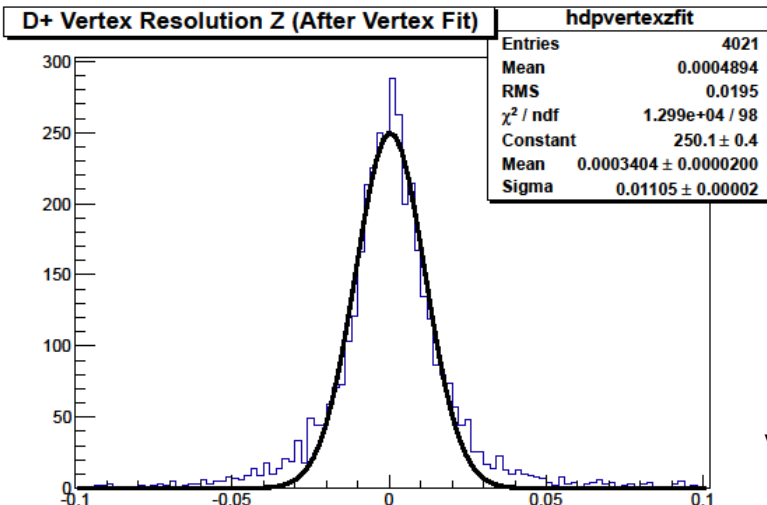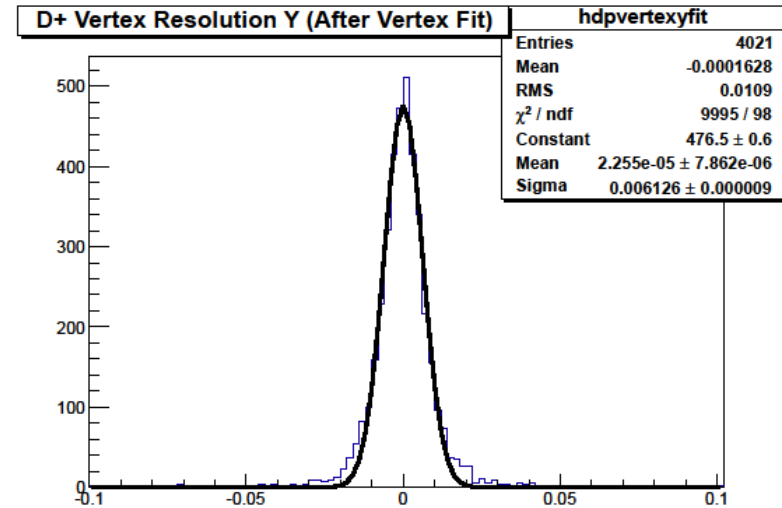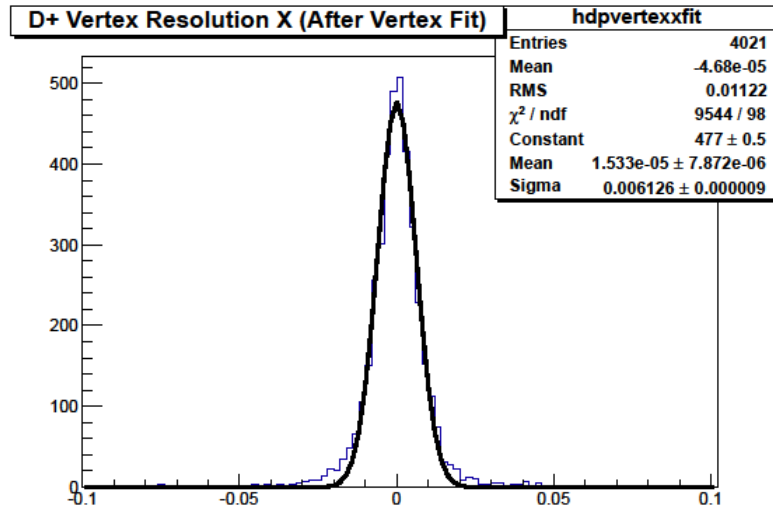
Vertex Resolution (xy): 60.9 µm

Vertex Resolution (z): 108.7 µm

Summary of the Results

Property	Performance
Acceptance	24.9 %
~~Efficiency~~	~~17.9 %~~
~~Total Reconstructed~~	~~4.4 %~~
Vertex Resolution (xy)	53.6 µm
Vertex Resolution (z)	102.8 µm
Mass Resolution	16.0 MeV

Remarks:

- Good results, consistent with previous analyses
- Already the raw data have good resolution
- Pure signal, so „fit cuts" still somewhat arbitrary

Personal remark:

- The time has come to improve our analysis tools…

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Thank you for your attention

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