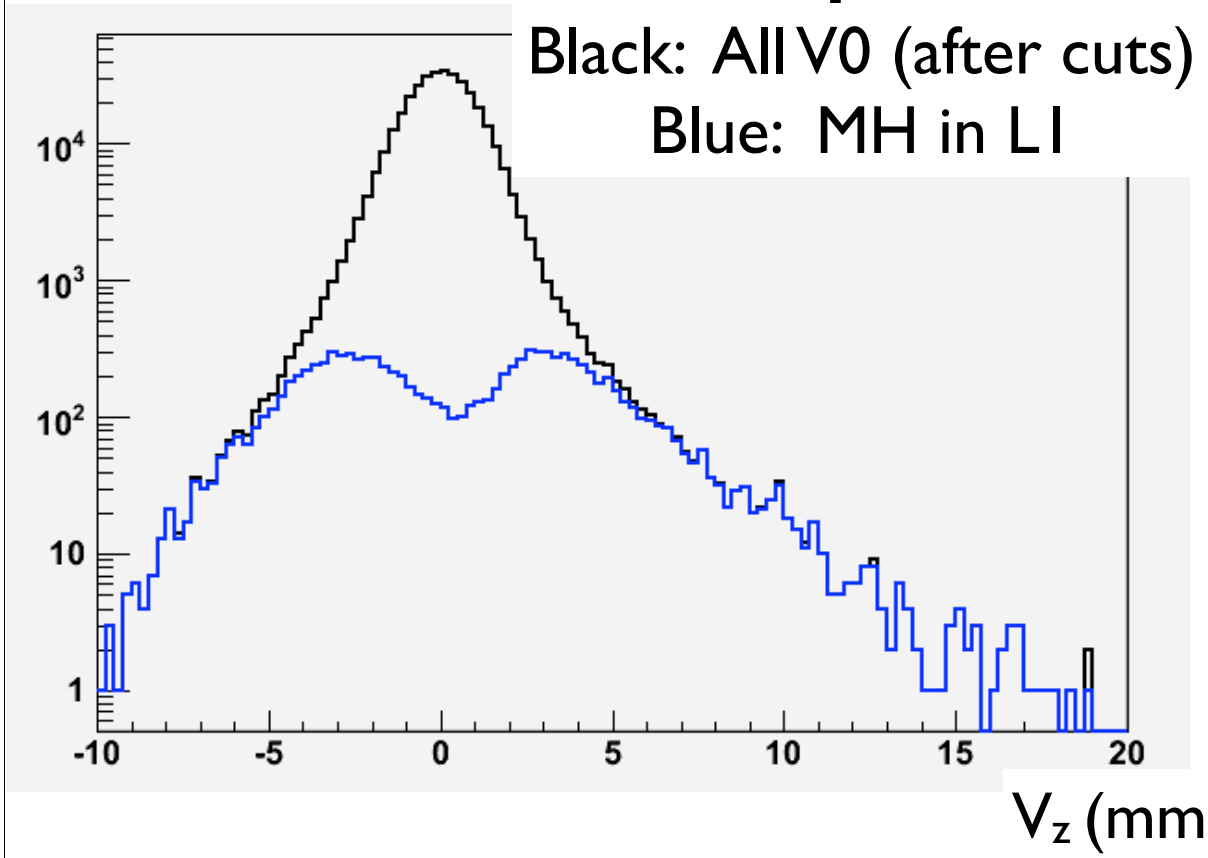
The problem...

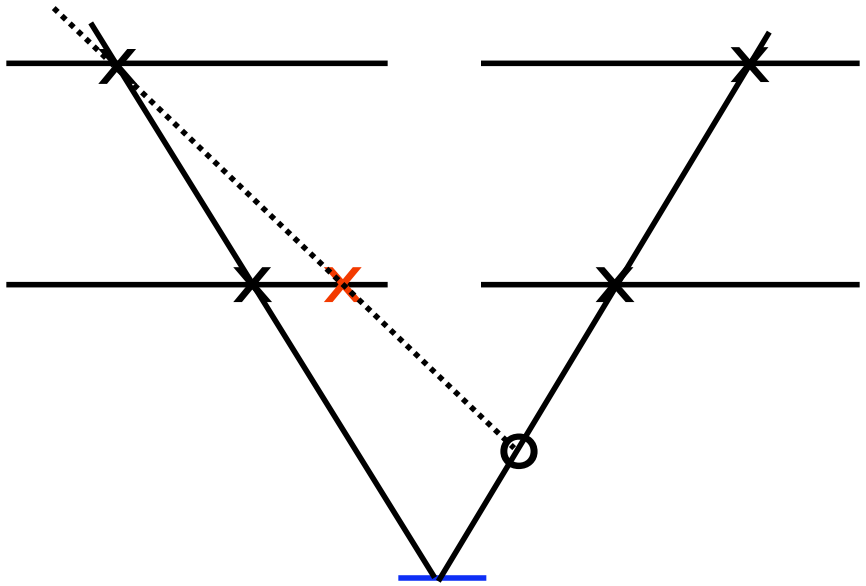


Base Cuts: Track χ^2 <20
190<M(e^+e^-)<210 MeV
V0 Momentum < 5.5GeV
Vertex χ^2<20
V_x<0.4 mm &&V_y<0.4 mm

vertex resolution is not good enough...the reach is destroyed

- the bulk of the problem comes from mishits in first layer (non-bend measurement)
- V0 with mishits in the other layers also have worse resolution, but 1) most mishits are in L1 and b) the resolution isn't as bad

V_z - V_y correlation with mishits



gross exaggeration

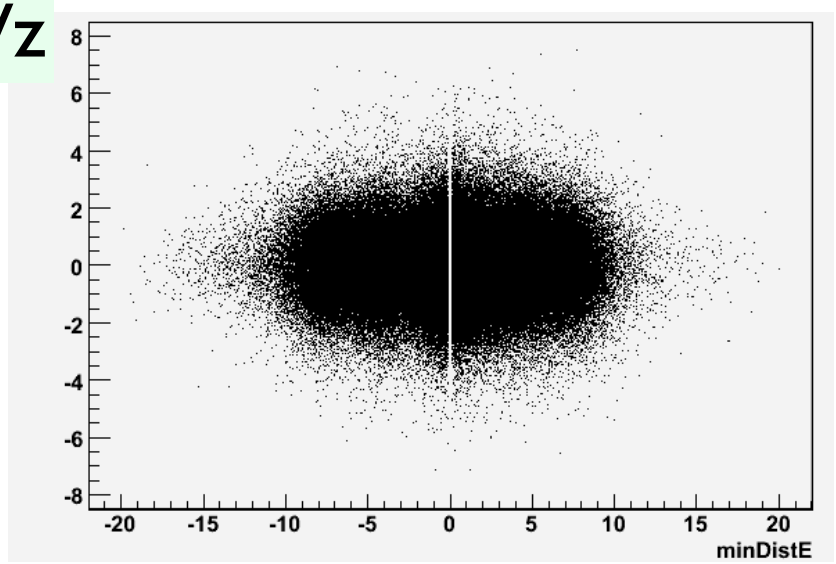
...taking a wrong hit from closer to the beam (where occupancy is high!) will pull vertex to higher Z.

Z-Vertex v L1 Cluster Isolation

minDist==the distance from the cluster on track to the closest other cluster in layer 1 (positive is towards the beam)

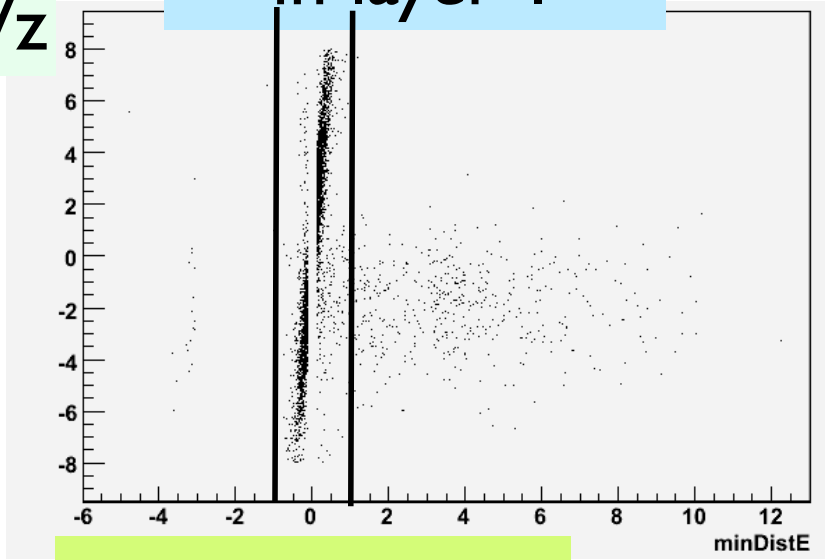
0 mishits

Vz



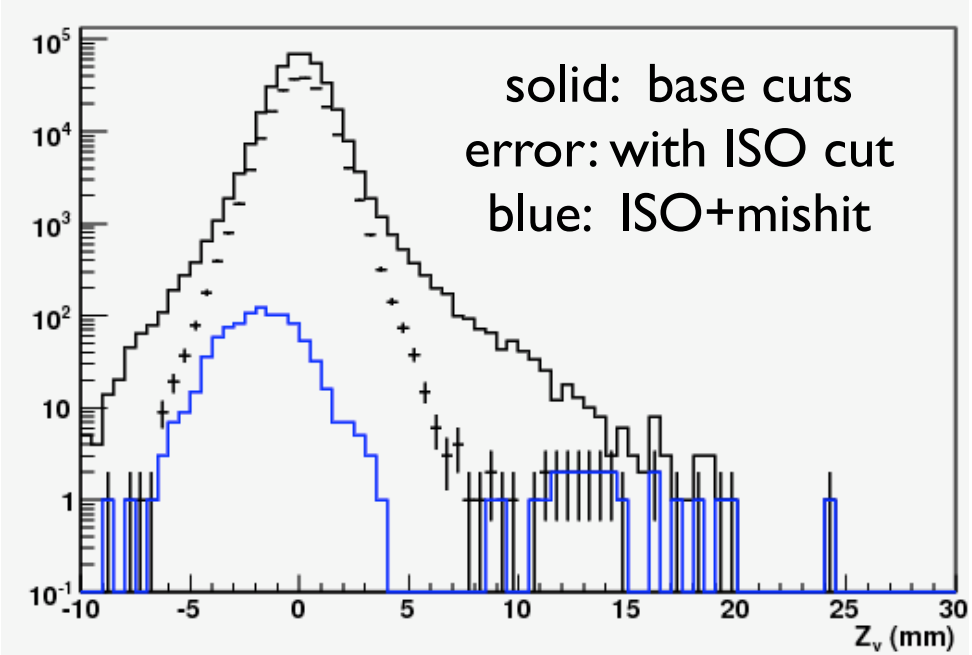
electron mishit in layer 1

Vz



cut at +/- 1mm?

Resolution after ISO cut...

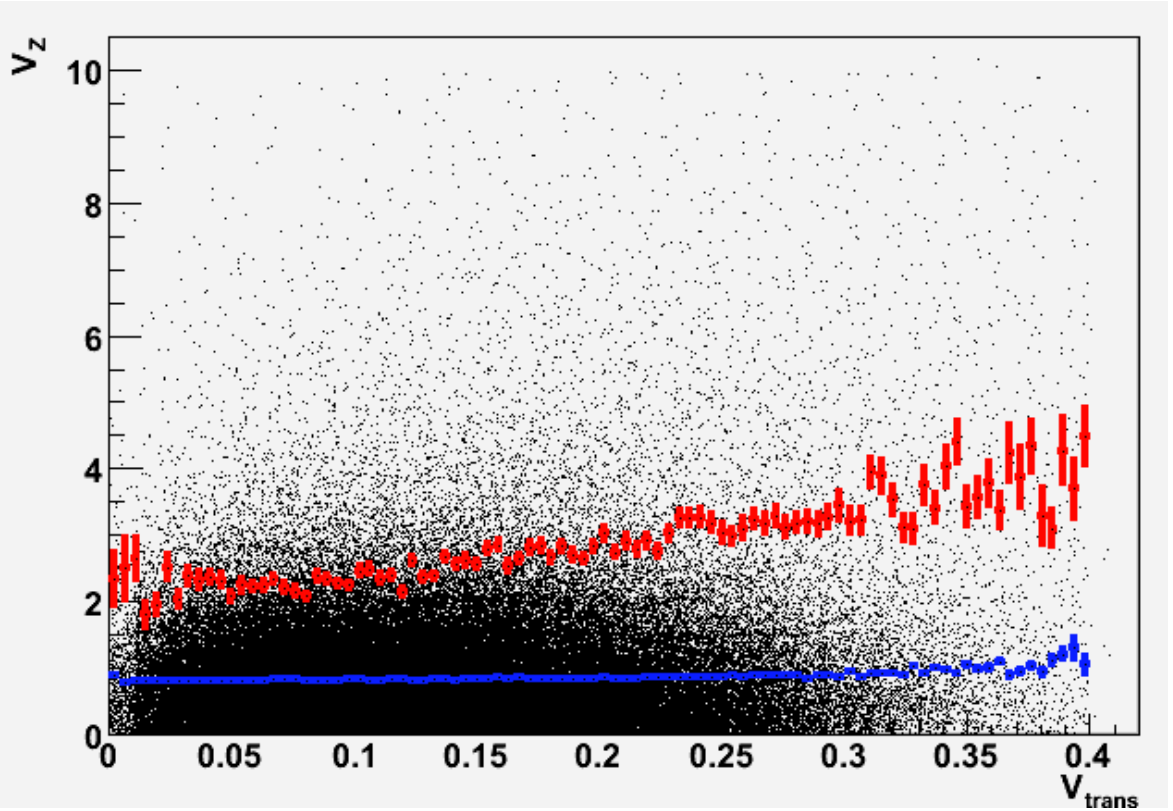


Cutting at minDist>1mm for both e^+ and e^- cleans things up considerably...but at a cost of ~50% efficiency

VzCut	f(loose)	f(tight)	f_MH(tight)
>5.00 mm	0.0082304	0.0004756	0.2526316
>7.50 mm	0.0026183	0.0001452	0.8275862
>10.00 mm	0.0009812	0.0001151	0.9565217
>12.50 mm	0.0003354	0.0000801	1.0000000
>15.00 mm	0.0001352	0.0000350	1.0000000
>17.50 mm	0.0000501	0.0000200	1.0000000
>20.00 mm	0.0000050	0.0000050	1.0000000

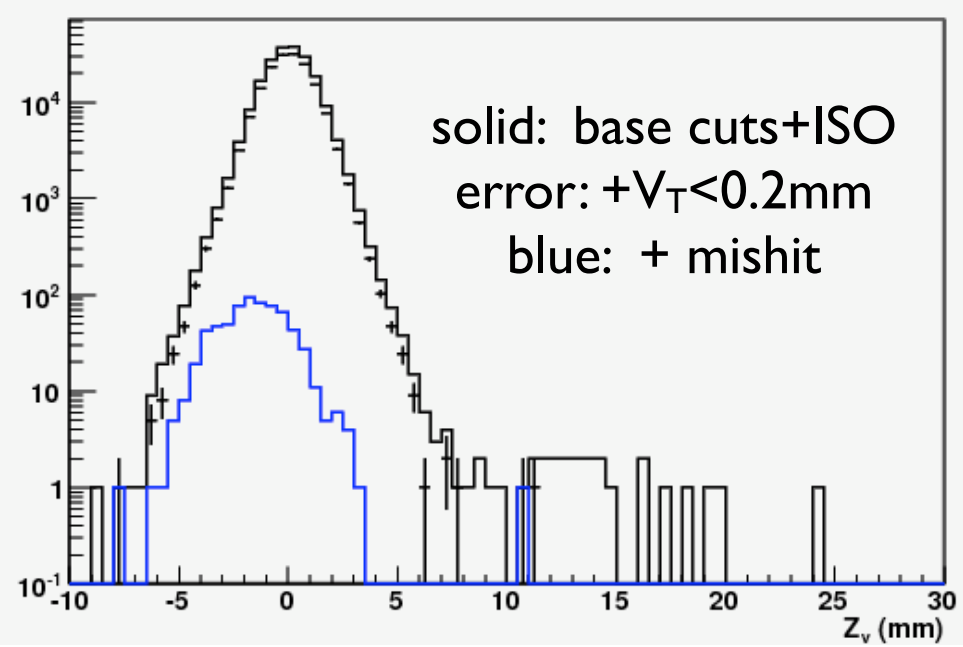
One more thing...

Current cut is Vx ,Vy<0.4mm...there is more to be gained though.



A brutal cut would be V_T<0.2mm...note that this near the expected V_T for a A' decaying at 2cm!

...tighter cut on V_T



Tighter cut on V_T cleans it up even more, but is inelegant...rather have a V- and P-constrained fit

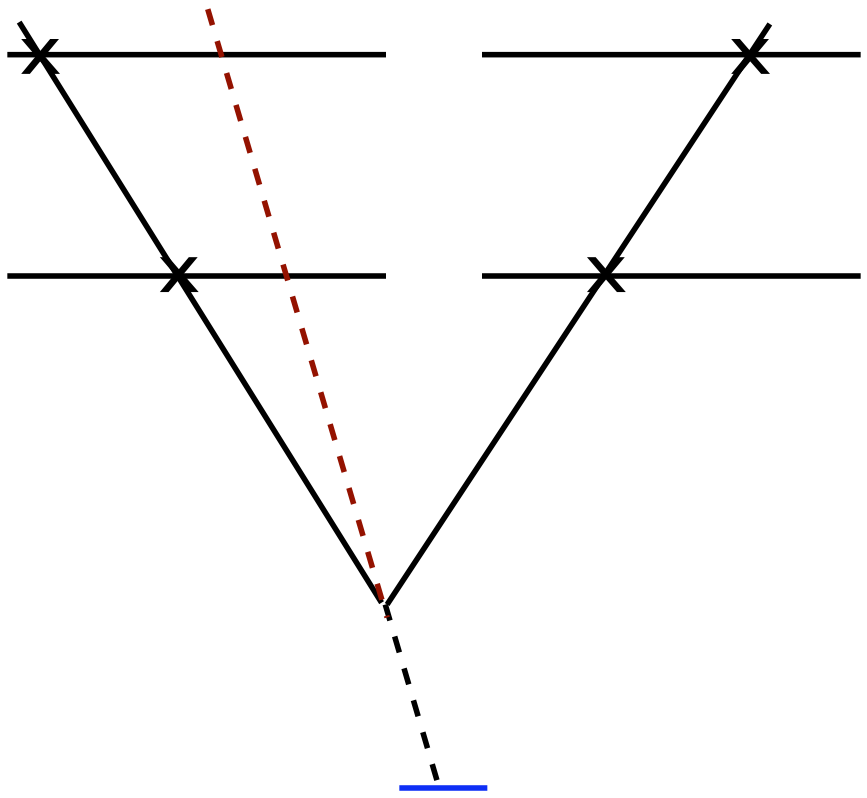
minVtxX	f(loose)	f(tight)	f_MH(tight)
>5.00 mm	0.0005707	0.0002343	0.0256410
>7.50 mm	0.0001742	0.0000180	0.3333333
>10.00 mm	0.0001382	0.0000120	0.5000000
>12.50 mm	0.0000961	0.0000000	0.0000000
>15.00 mm	0.0000420	0.0000000	0.0000000
>17.50 mm	0.0000240	0.0000000	0.0000000
>20.00 mm	0.0000060	0.0000000	0.0000000

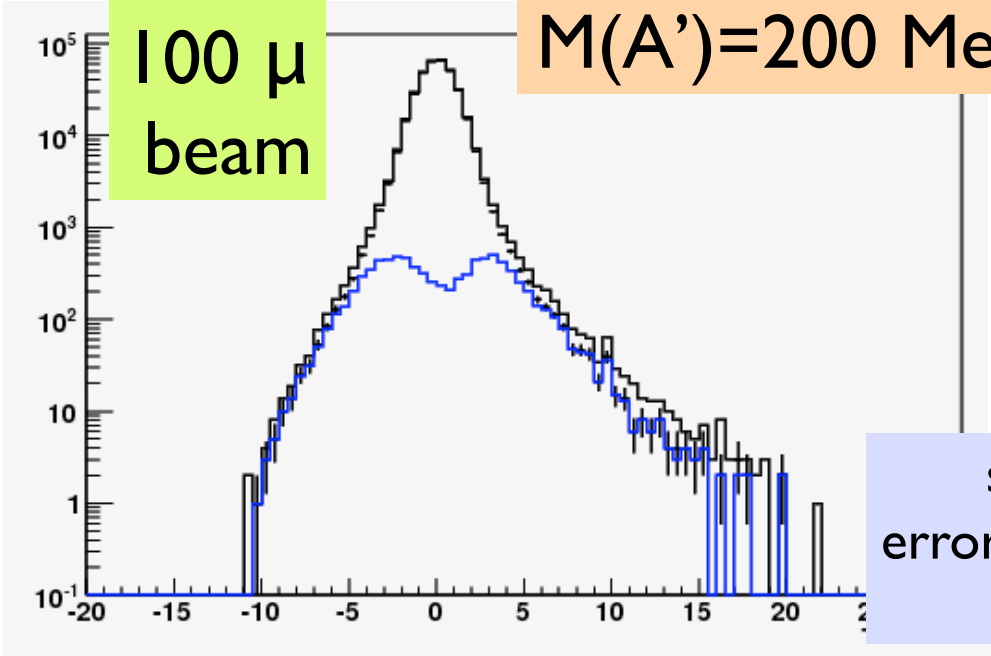
nAp(Loose): 196153 nAp(Tight): 163548; Ap efficiency (relative): 0.833778

Note: total A' reco efficiency after all cuts is ~25% (does not include geometric acceptance)

Beamspot constrained vertex

I fudged a constrained fit
by feeding a third "track"
with errors the size
of the beam spot. The direction
of the track is taken from the
reconstructed V0 momentum
and given 0 uncertainty....





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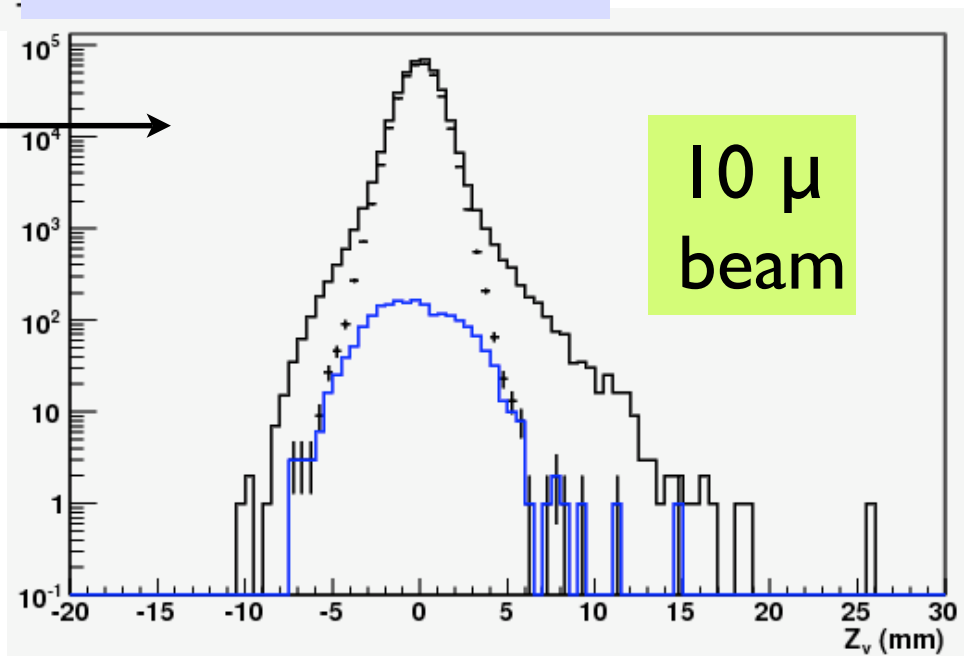
Unc Vertex χ^2<20
V_x<0.4 mm &&V_y<0.4 mm

solid: base cuts
error: constrained χ^2 cut
blue: mishit L1

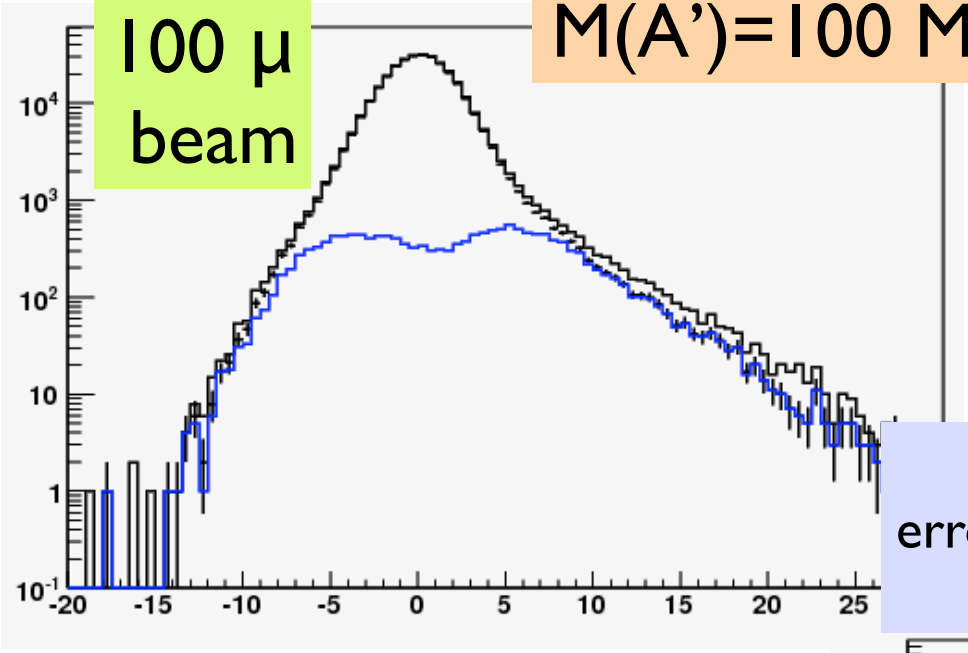
minVtxX	f(loose)	f(tight)	f_MH(tight)
>5.00 mm	0.0228950	0.0000931	0.8965517
>7.50 mm	0.0130060	0.0000193	1.0000000
>10.00 mm	0.0084052	0.0000064	1.0000000
>12.50 mm	0.0060125	0.0000032	1.0000000
>15.00 mm	0.0045358	0.0000000	0.0000000



Reco efficiency ~65%

100 μ beam

M(A')=100 MeV



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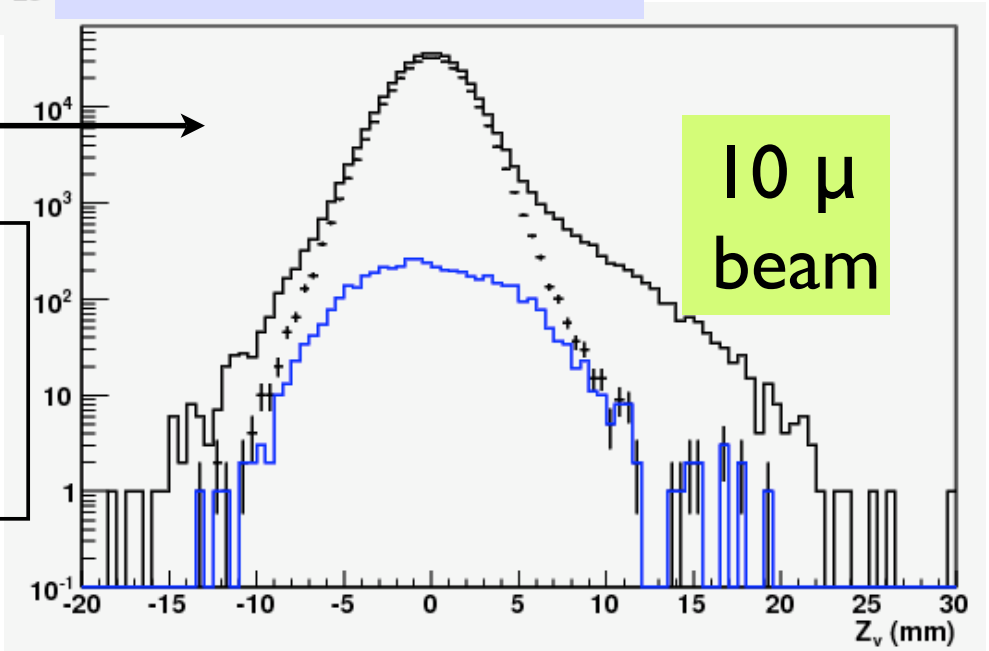
Unc Vertex χ^2<20
V_x<0.4 mm &&V_y<0.4 mm

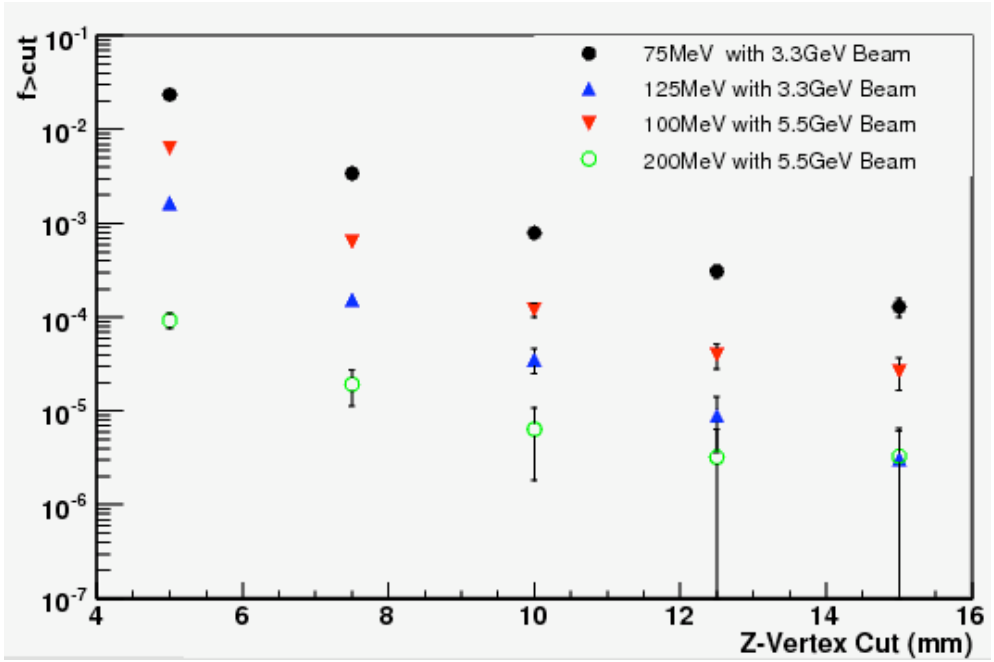
solid: base cuts
error: constrained χ^2 cut
blue: mishit L1

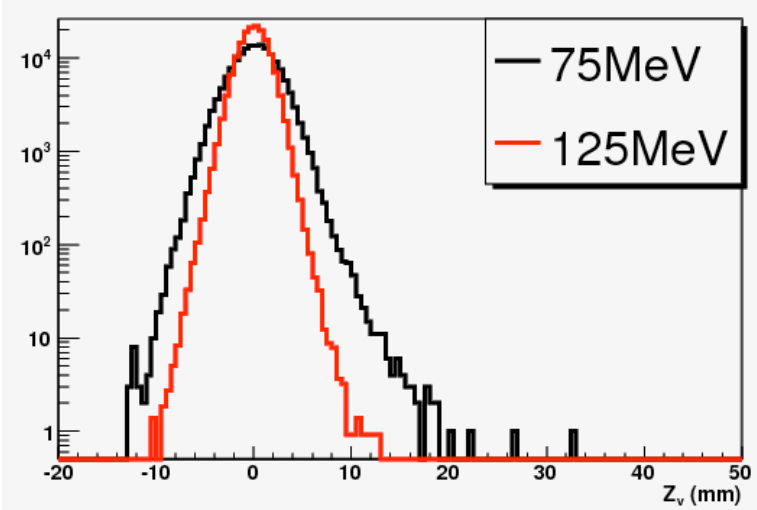
minVtxX	f(loose)	f(tight)	f_MH(tight)
>5.00 mm	0.0254551	0.0063594	0.2565582
>7.50 mm	0.0103269	0.0006306	0.6984127
>10.00 mm	0.0047069	0.0001201	0.9722222
>12.50 mm	0.0019927	0.0000400	1.0000000
>15.00 mm	0.0007854	0.0000267	1.0000000
>17.50 mm	0.0002553	0.0000100	1.0000000
>20.00 mm	0.0000722	0.0000000	0.0000000

Reco efficiency ~65%



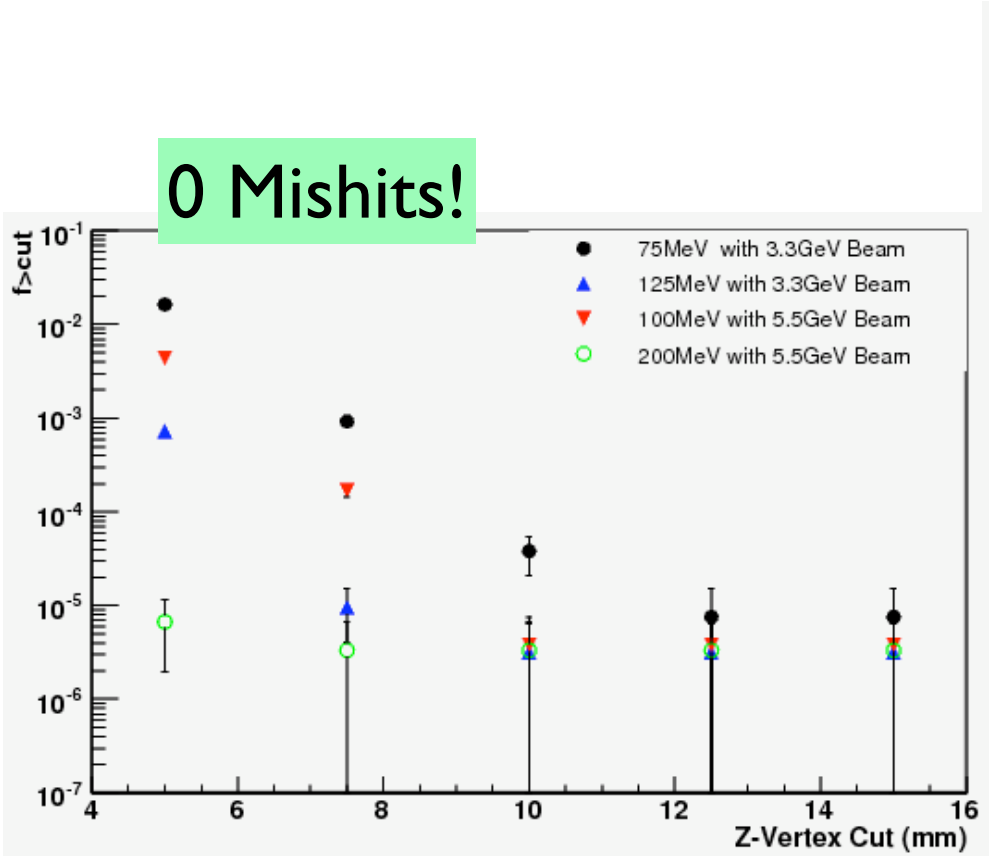
Energy/Mass Dependence...

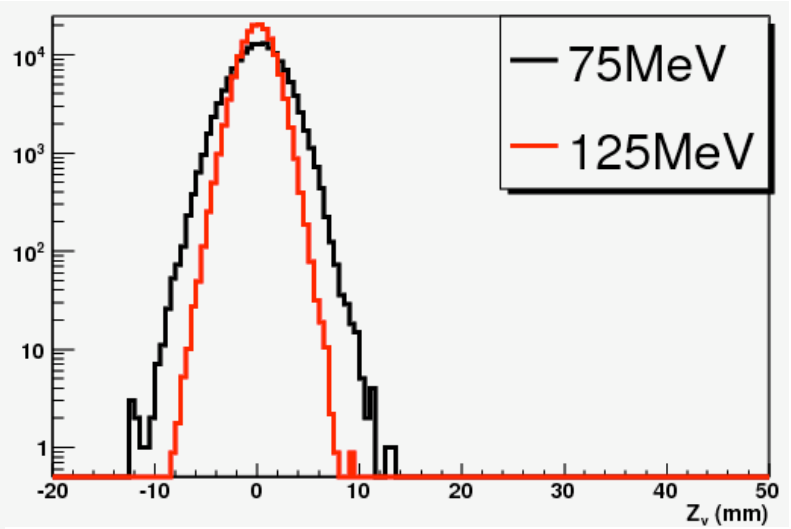




After cut on the constrained vertex, we still have some work to do...lower masses are still too dirty

Energy/Mass Dependence...





There does look like there is room to do better, if we can clean up the mishits.

Next steps...

- The biggest problem is from mishits in the first layer of Si...the pointing resolution from the subsequent layers is not good enough to resolve nearby hits. How do we solve this?
  - Adding an additional "hit" at the beamspot helps quite a bit...how small do we need the beam to be?
  - move planes 1 and 2 (x-y 90^{o} stereo) closer
  - add an additional x-y plane in between 1 and 2
- I'm looking at these solutions now...hopefully by Friday I'll have some answers