

Reach Estimates for Jeopardy

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U.S. DEPARTMENT OF
ENERGY

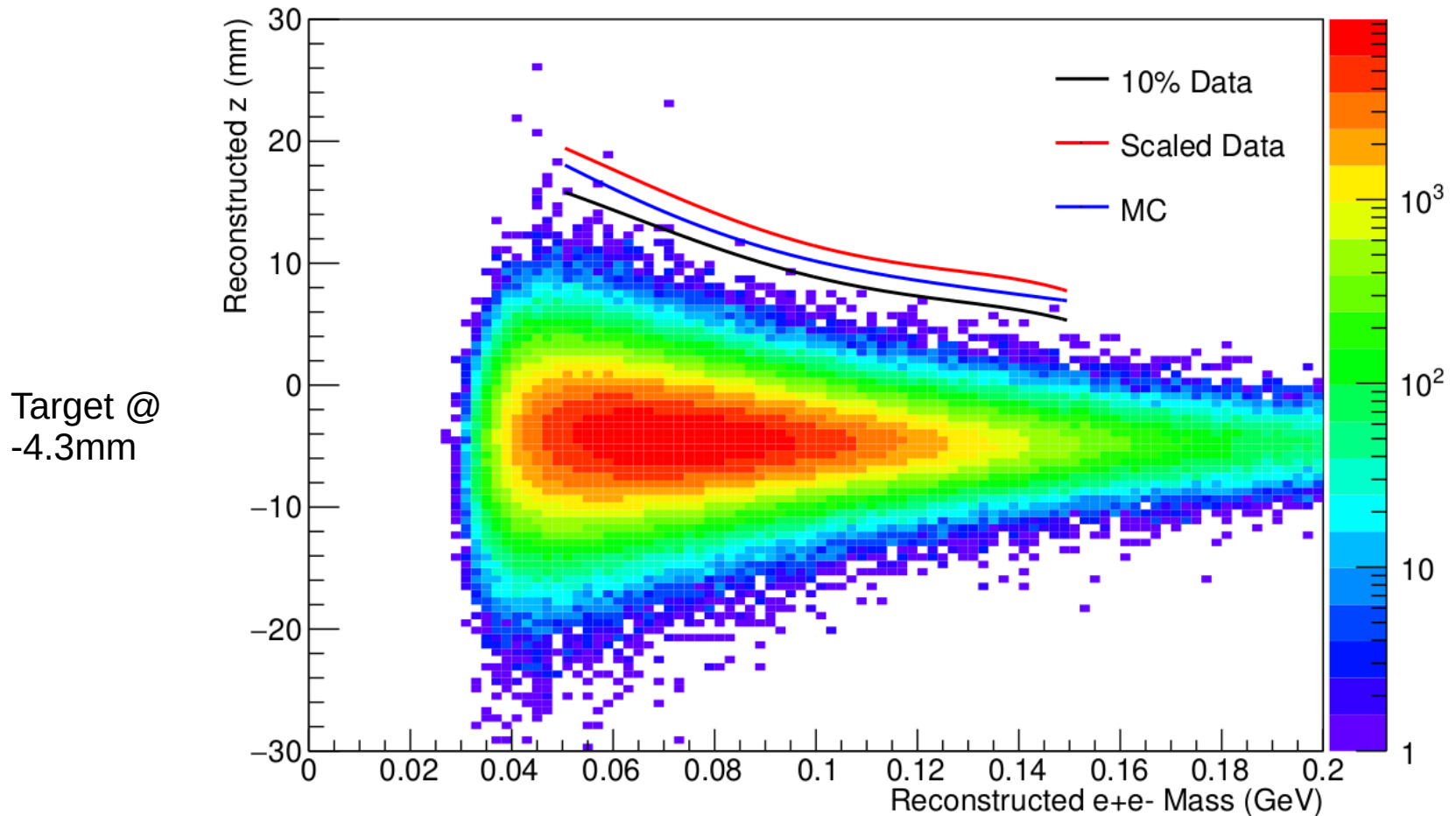
Stanford
University

SLAC NATIONAL
ACCELERATOR
LABORATORY

- Want to focus mostly on the zcuts being used
 - Can quickly change if people can agree
 - What did Matt G do for the estimates he made in 2017?
- Go over how Matt G and I think we are roughly agreeing with his 2017 estimates
- What needs to be done to make estimates for more than just 4.55 GeV?

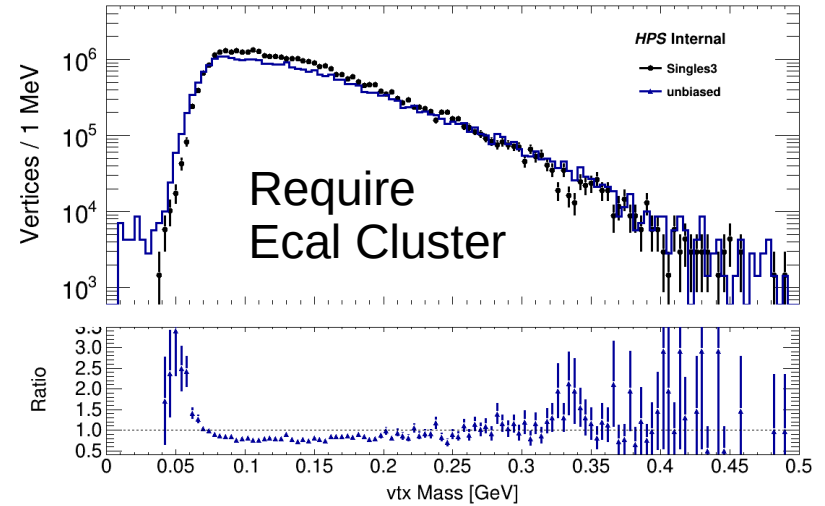
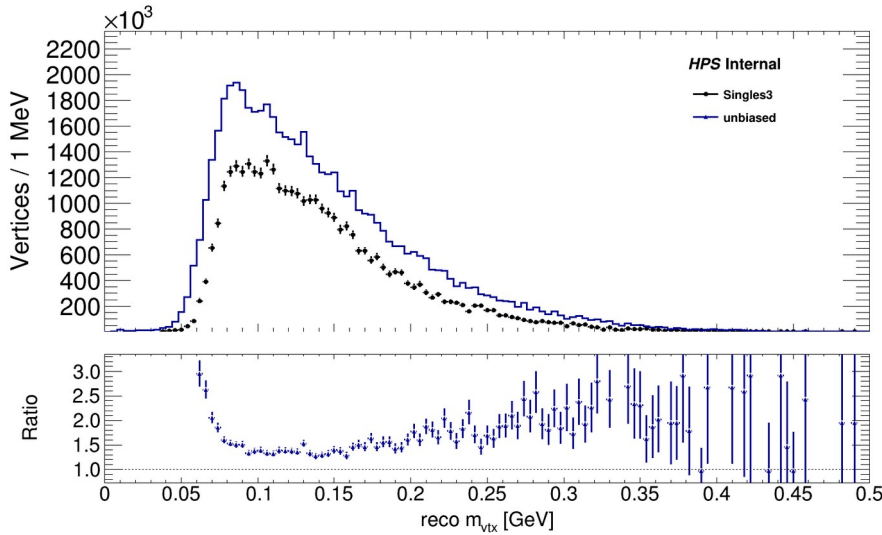
Zcuts for 2016 Analysis

Final Selection 10% Data L1L1

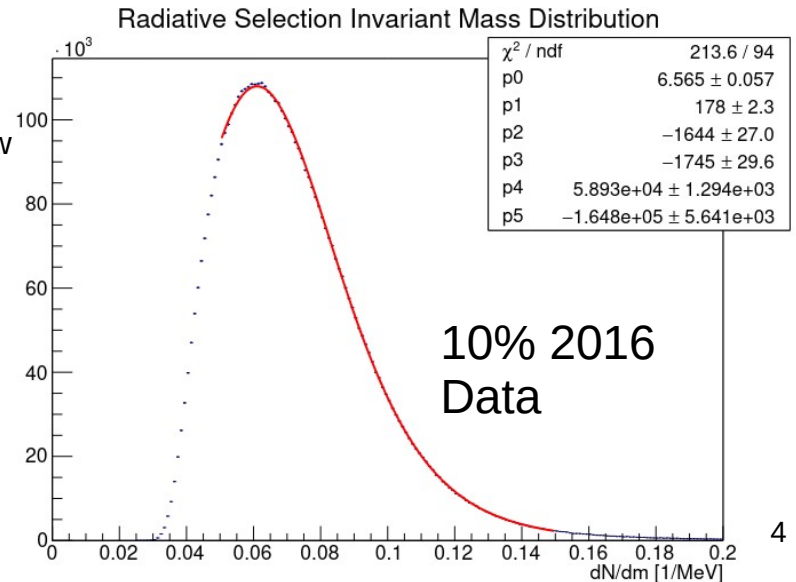


- Fresh from recent draft of 2016 note sent to review committee

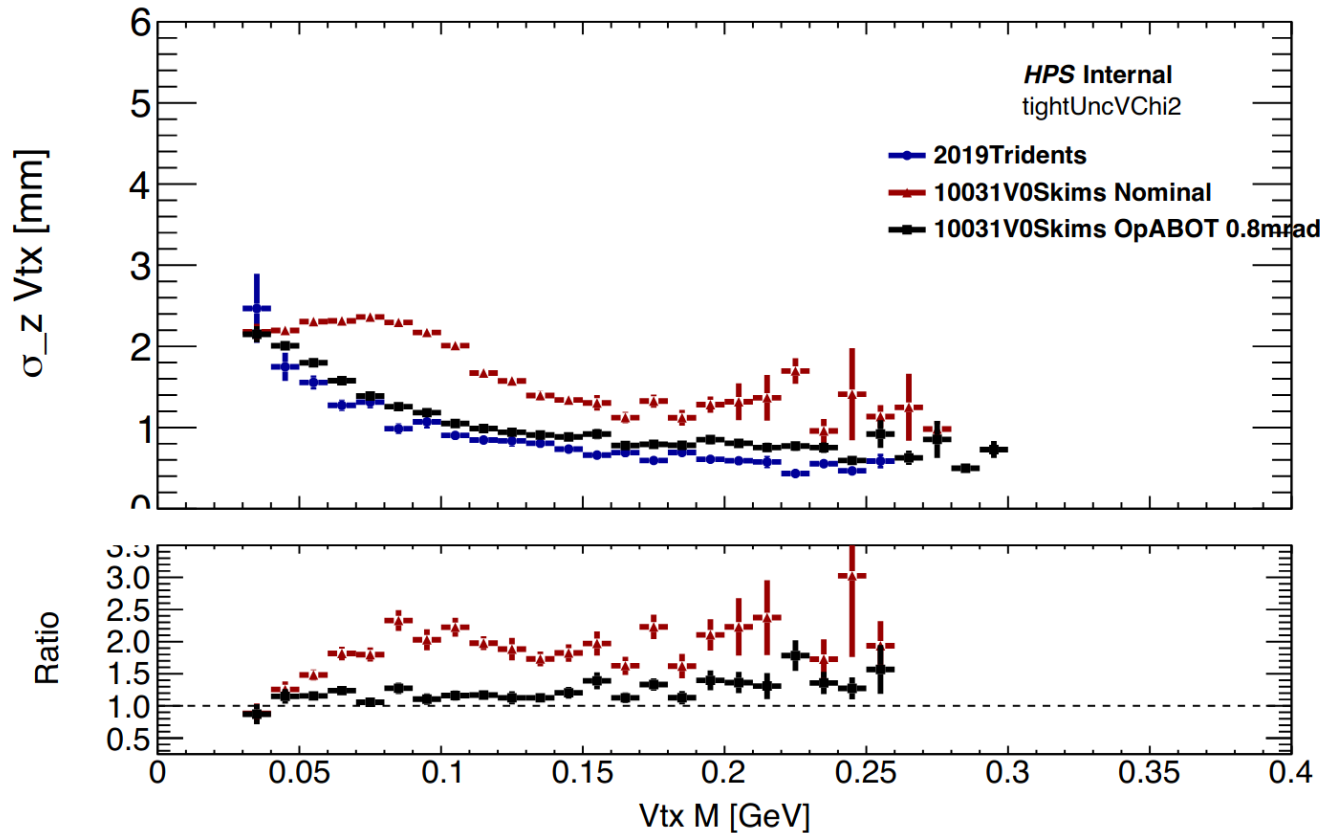
Tritrig Invariant Mass Distribution



- Using 2019 pass0b tritrig+beam MC in the rest of the slides to follow
 - Normalized to 125 1/pb
 - Singles3 trigger
 - Minimum pair momentum is 2 GeV from MG
- Ratio of accepted rates appears to be only ~ 2 (compare m in 219 with $2*m$ in 2019)

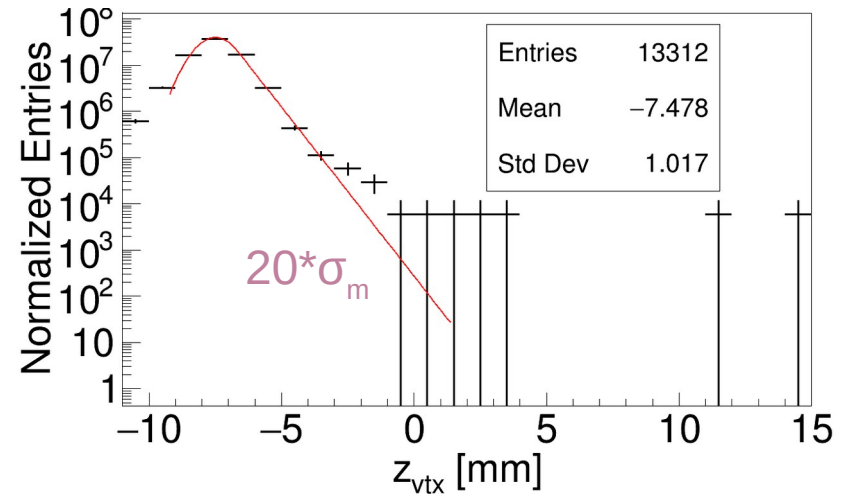
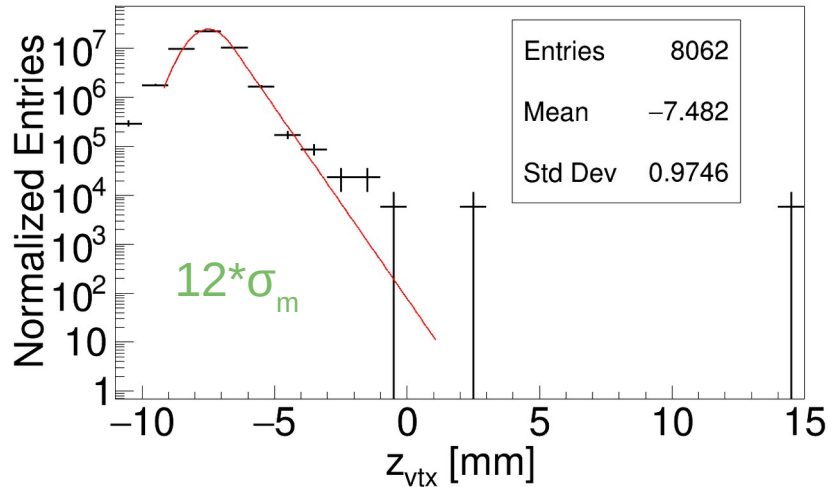
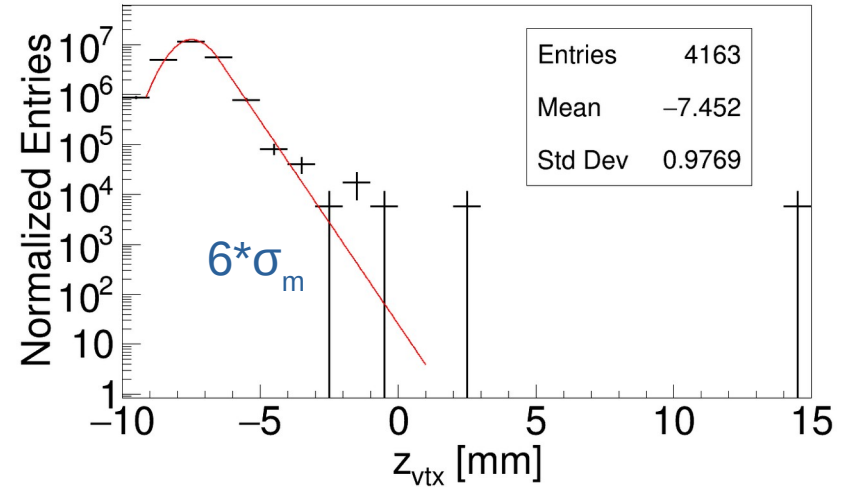
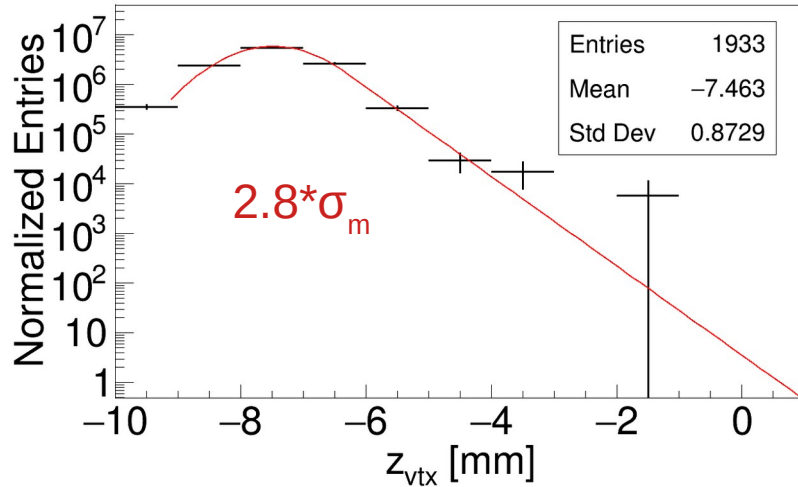


Vertex Z Resolution



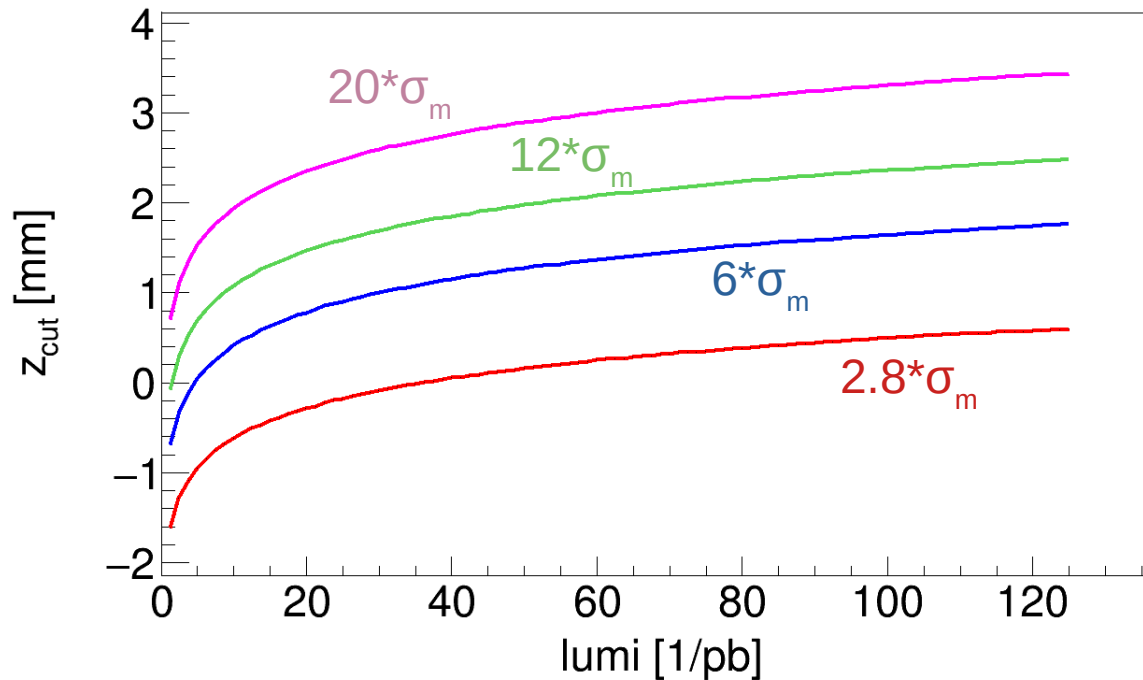
- Using MC vtx Z resolution from 2019Tridents
 - Thanks to PF for this plot
 - Fit the blue points with a polynomial, won't bore you with those details

Vertex Z Distribution Fits



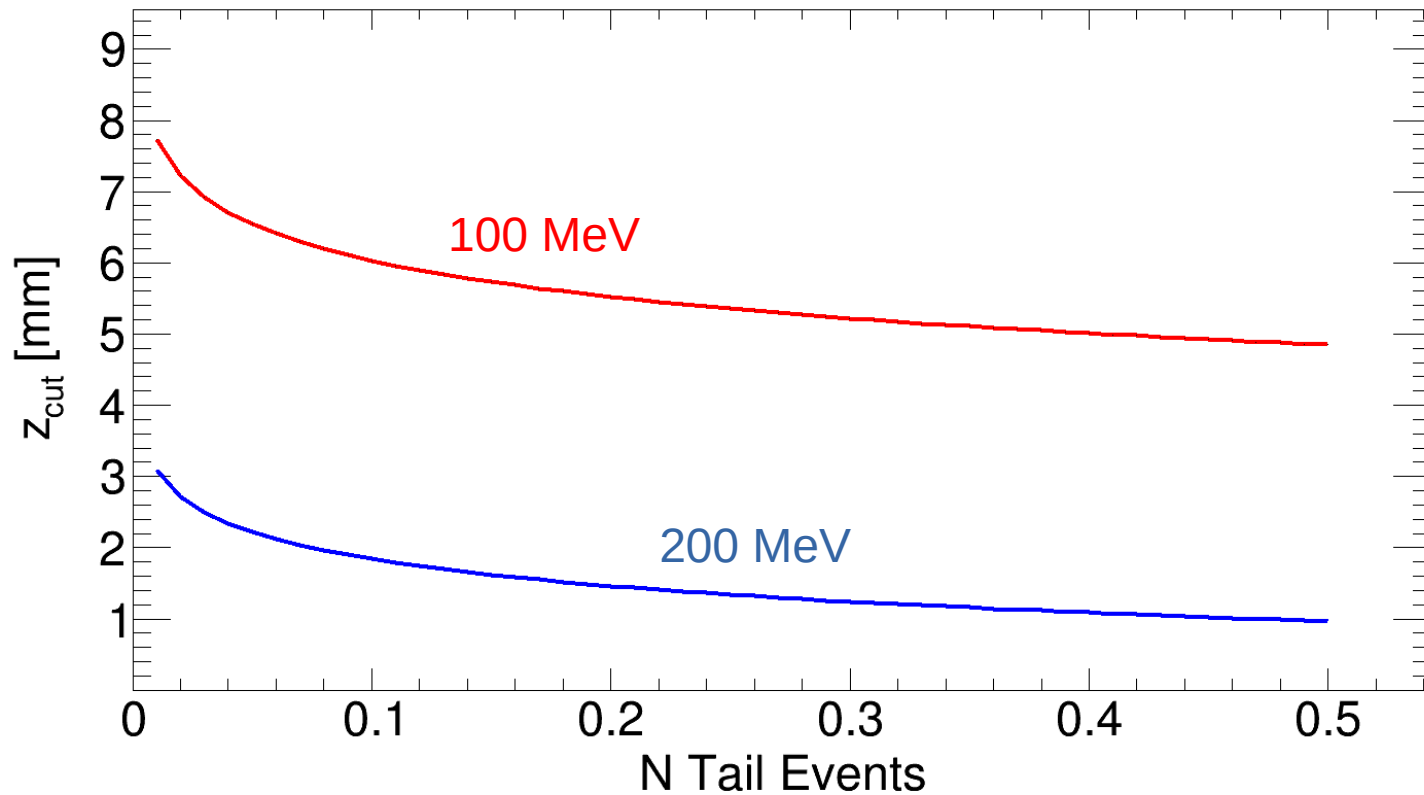
- Fits using different widow sizes in mass centered around 150 MeV

Vertex Z Resolution



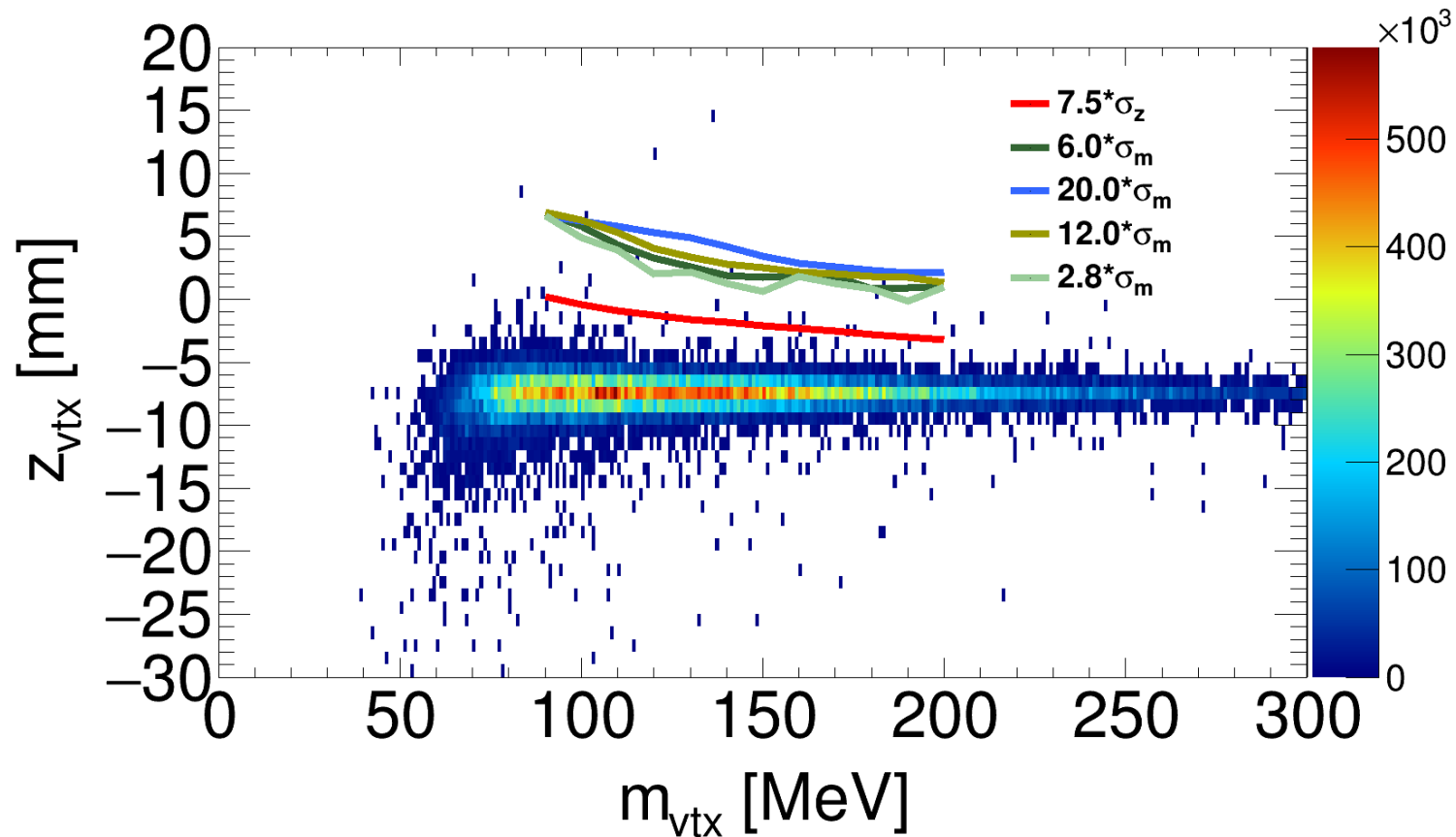
- Studied using the method used in 2015 and 2016 analysis notes applied to 2019 MC
 - Scale the rate and recompute the 0.5 tail event interval
- Expected relative rate between 2016 and 2019 is roughly: (Ignoring change in acceptance)
 - $(6.610\text{E}+08 \text{ pb} * 125 \text{ 1/pb}) / (1.416\text{e}6 \text{ nb} * 11000 \text{ 1/nb}) = 5.3$

Vertex Z Resolution



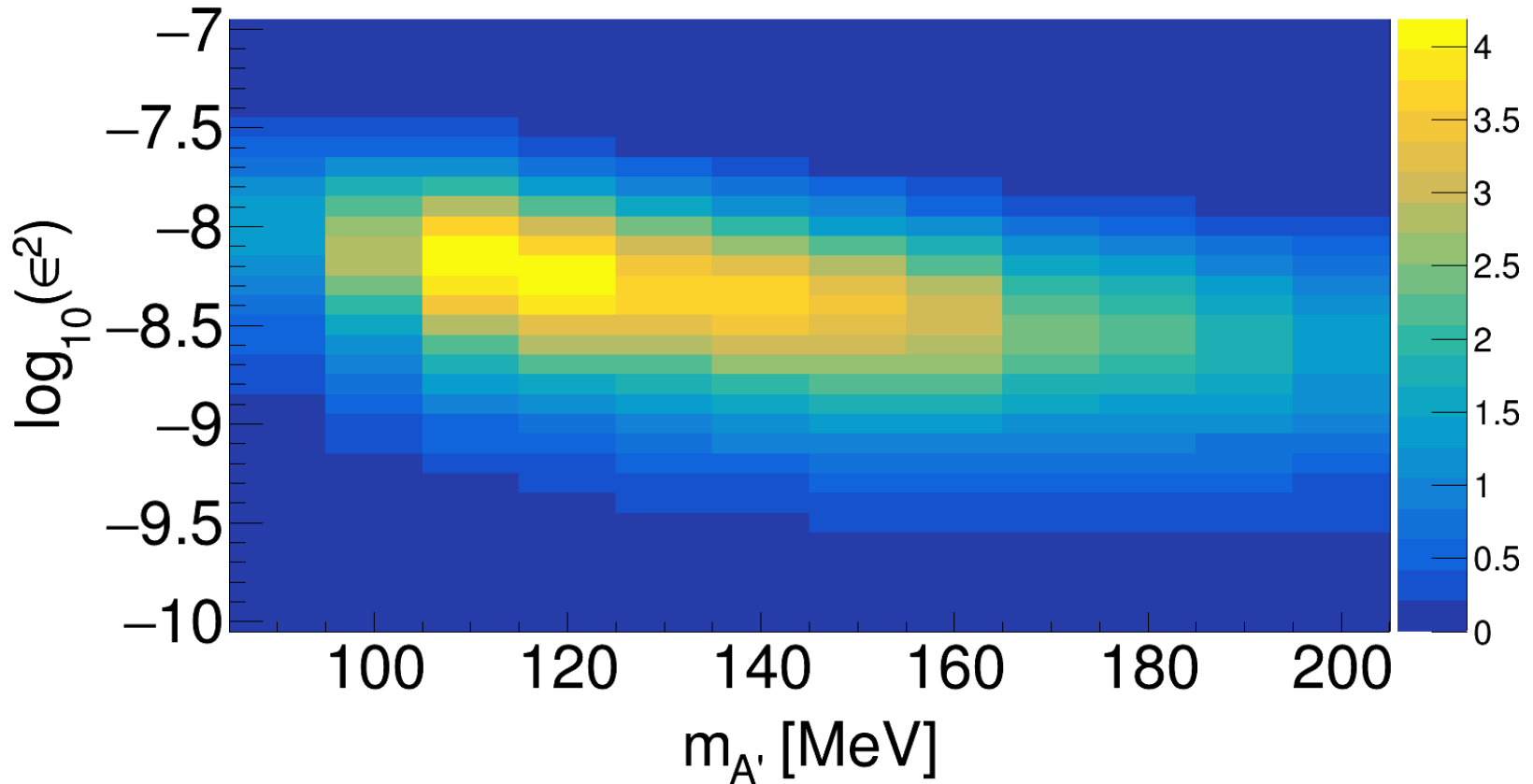
- Studied using the method used in 2015 and 2016 analysis notes applied to 2019 MC
 - Varying the 0.5 event constraint on the tail integral
- We see that the change in zcut given the rough arbitrariness of choosing 0.5 events is roughly one vertex resolution, so this matters roughly the same amount as lumi scaling

Comparison of Zcuts



- Zcuts taken from different procedures based on normal fits and via calibration of $N \cdot \sigma_z$ via “scaling” 2016 zcuts

Expected Signal Rate



- If we follow a reasonable rough scaling procedure to compare 2016 zcuts to 2019, $z_{\text{cut}} = N \cdot \sigma_z$ agrees by calibrating $N = 7.5$
- Peak is about 4.2 events

Reconciling with 2017 Estimate

- Still trying to iron out number, but planning to scale up background rate used in calculating the signal rate because of inconsistencies between data and MC rates
 - This is roughly a factor of 2 so we see about 5 events in the max
 - How does this compare?
- Matt G reported a max signal rate of about 20 events
 - This was for about 250 1/pb so we only expect 10 based on this
 - Matt G said he mistakenly used 100% selection efficiency when he generated the max number of 20, should be roughly 50%

What still needs to happen?

- The $N=7.5$ calibration is a bit conservative, we could consider going down to about 7.0 to be less conservative
 - We can discuss this number a bit using the plots provided
- Decide on scaling factor we should increase rate by since we see a higher rate in data than MC
- Get contour plots onto Omar's style of exclusion plot
 - Want to have a few lumis above the 2019 lumi
 - Should we consider making using the 3.0 expected signal event contour to be a little conservative?