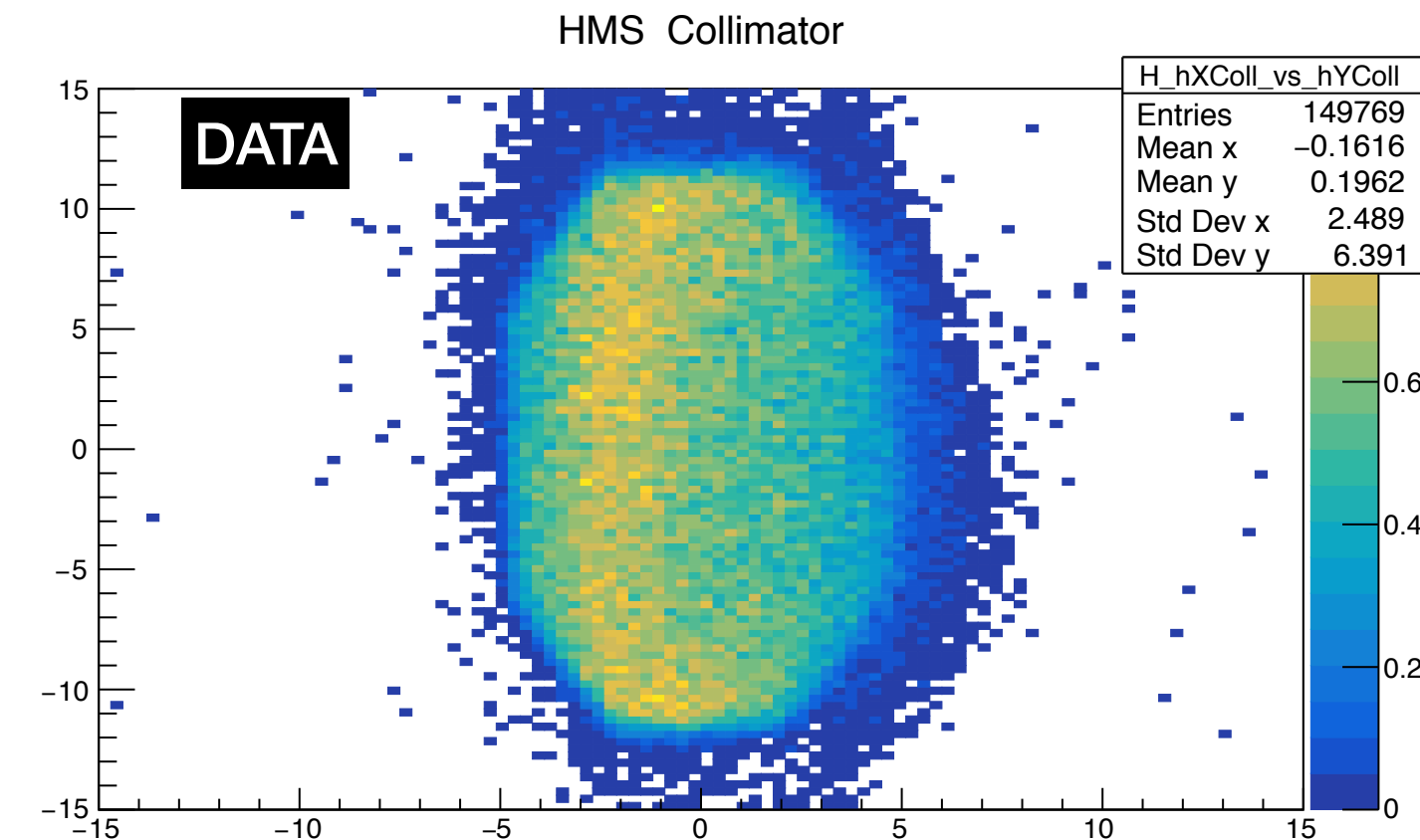
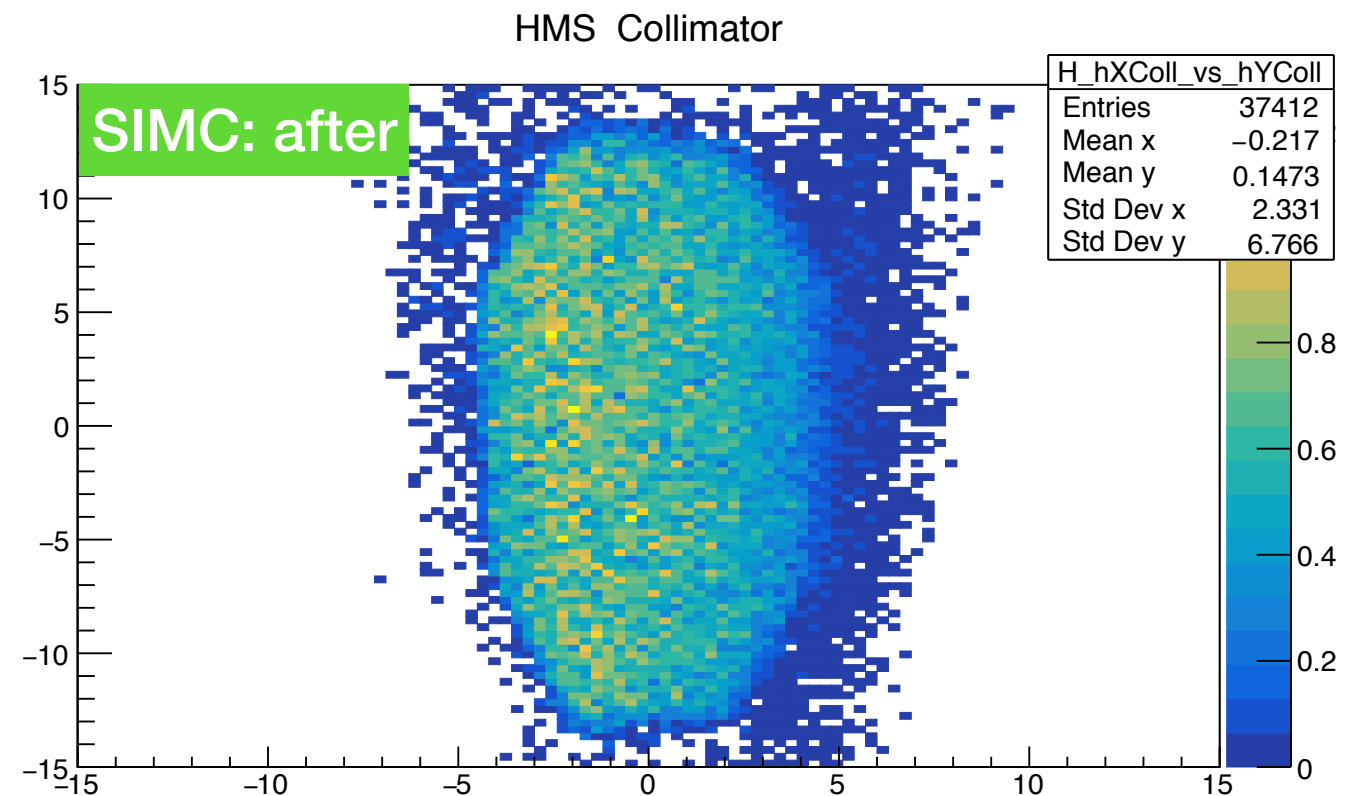
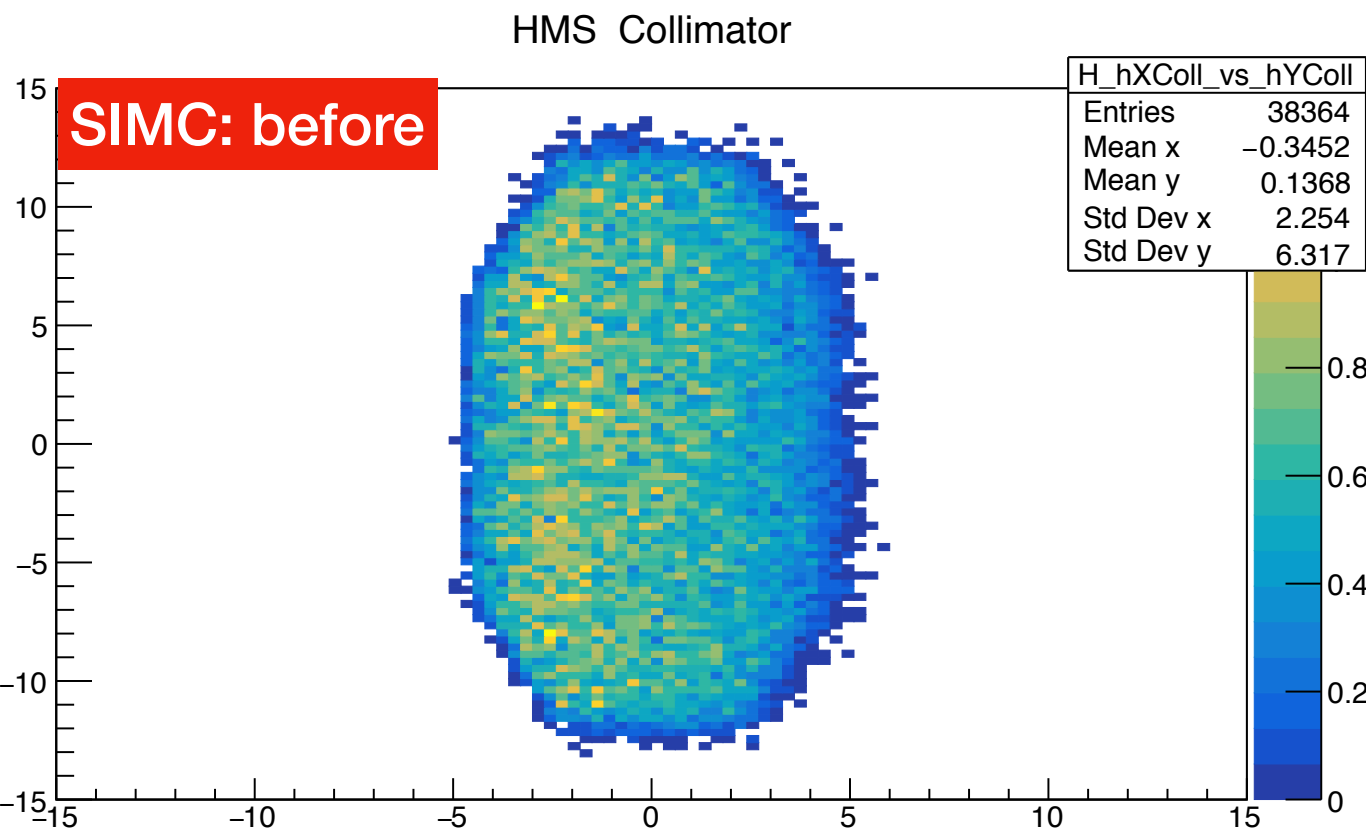


HMS Collimator / Missing Energy Cut Studies

May 23, 2019

HMS Collimator



Before simulating interactions
and energy loss at collimator.

After simulating interactions
and energy loss at collimator.

**SIMC energy loss at collimator
seems to agree well with data at
the collimator edges.**

DATA / SIMC Yield Ratios

The Data/SIMC yield ratios for the reconstructed quantities were plotted before and after simulating the energy loss at the HMS collimator. (**SEE NEXT SLIDE**)

The general cuts applied were:

$|\text{HMS Delta}| < 8 \%$

SHMS Delta: $(-10, 22) \%$

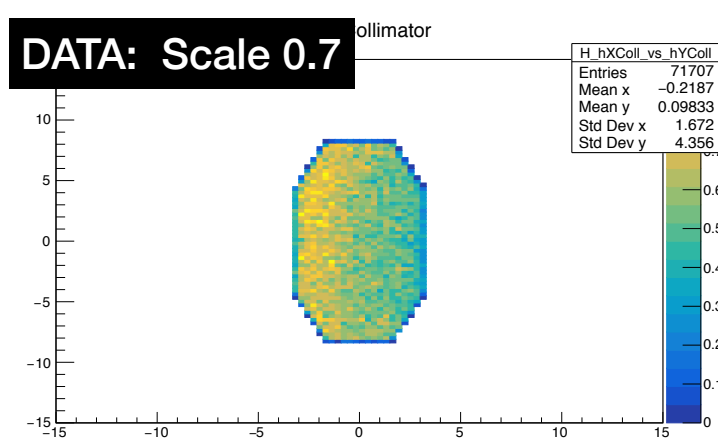
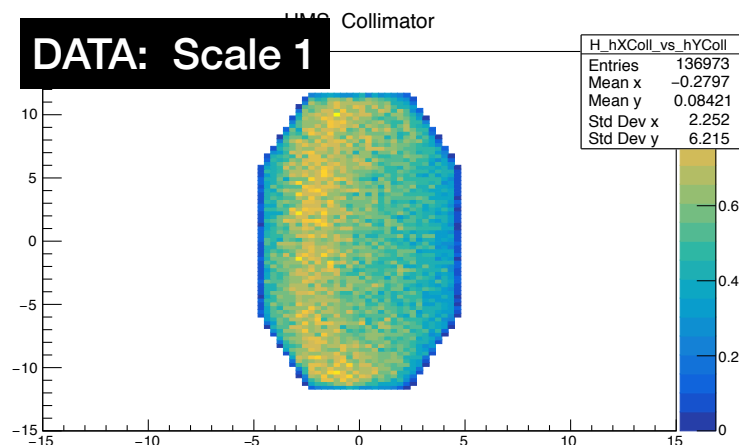
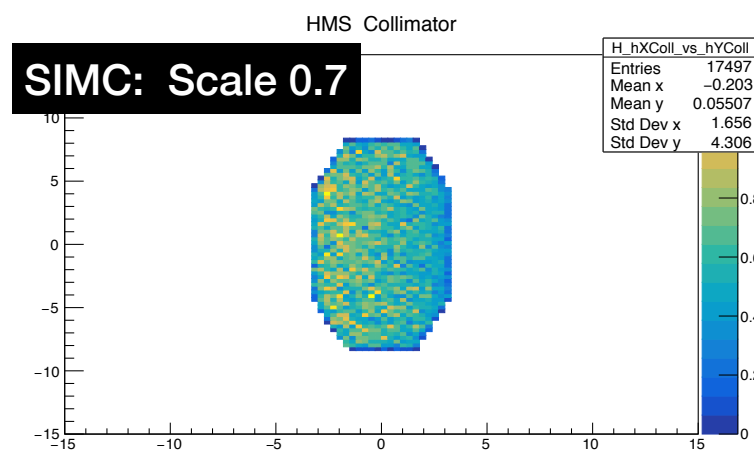
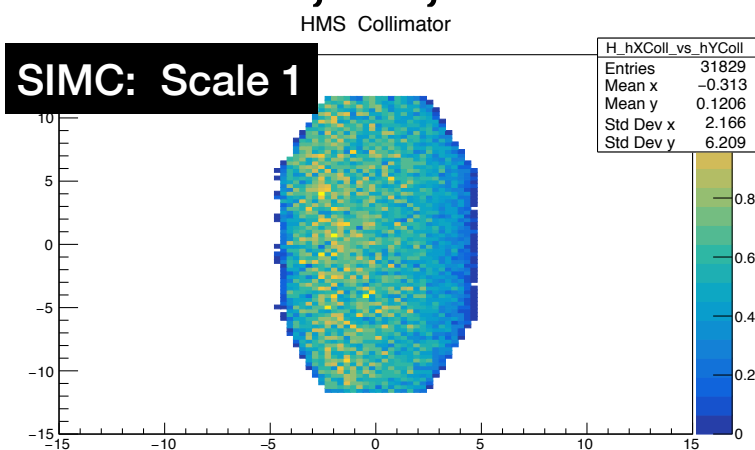
Inv. Mass W : $(0.85, 1.05)$

The scales on the **NEXT SLIDE** refer to the HMS Collimator Cuts made in Octagonal Shape;

No Scale --> No Collimator Cut

Scale 1 --> HMS Collimator Cut (Using Dimensions of Collimator)

Scale 0.95, 0.9, . . .----> HMS Collimator Cuts scaled. For example, $0.95 * \text{collimator dimensions}$

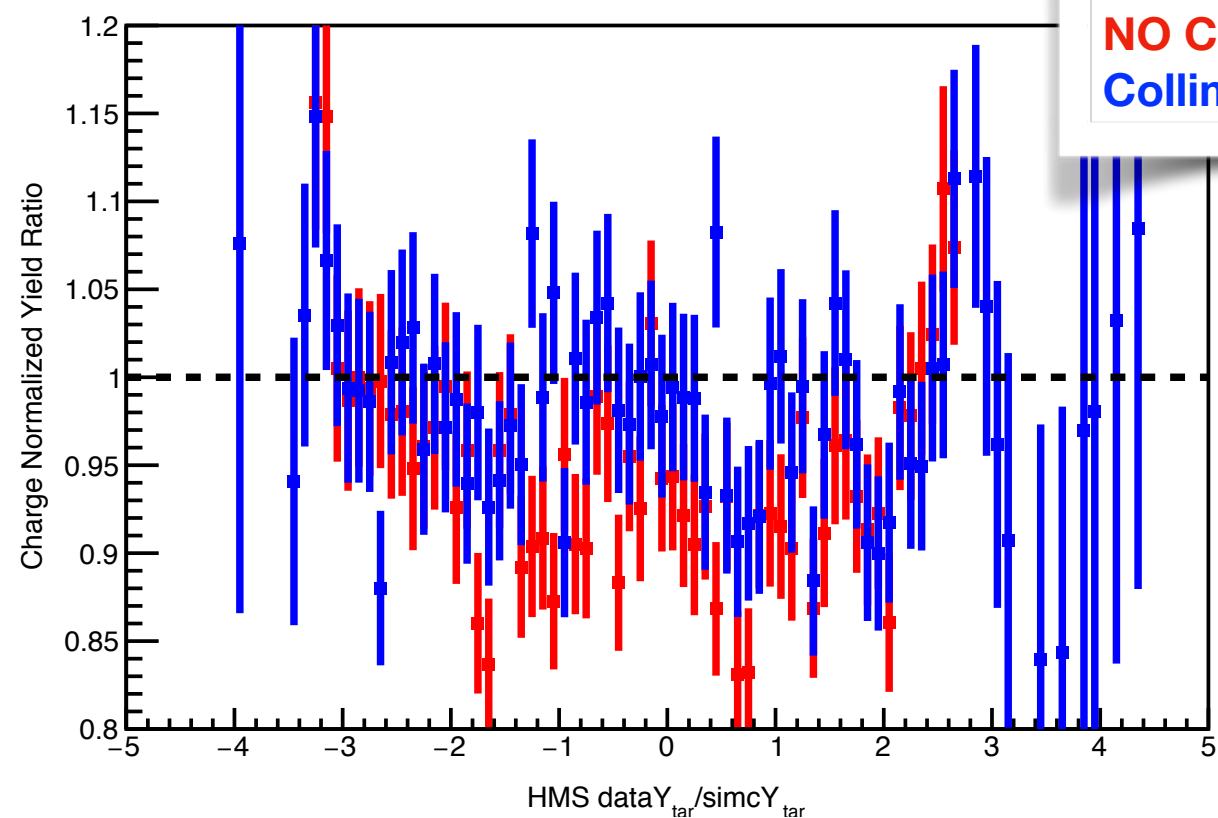


**Example of Collimator Cuts
made on both DATA and SIMC
for run 3288.**

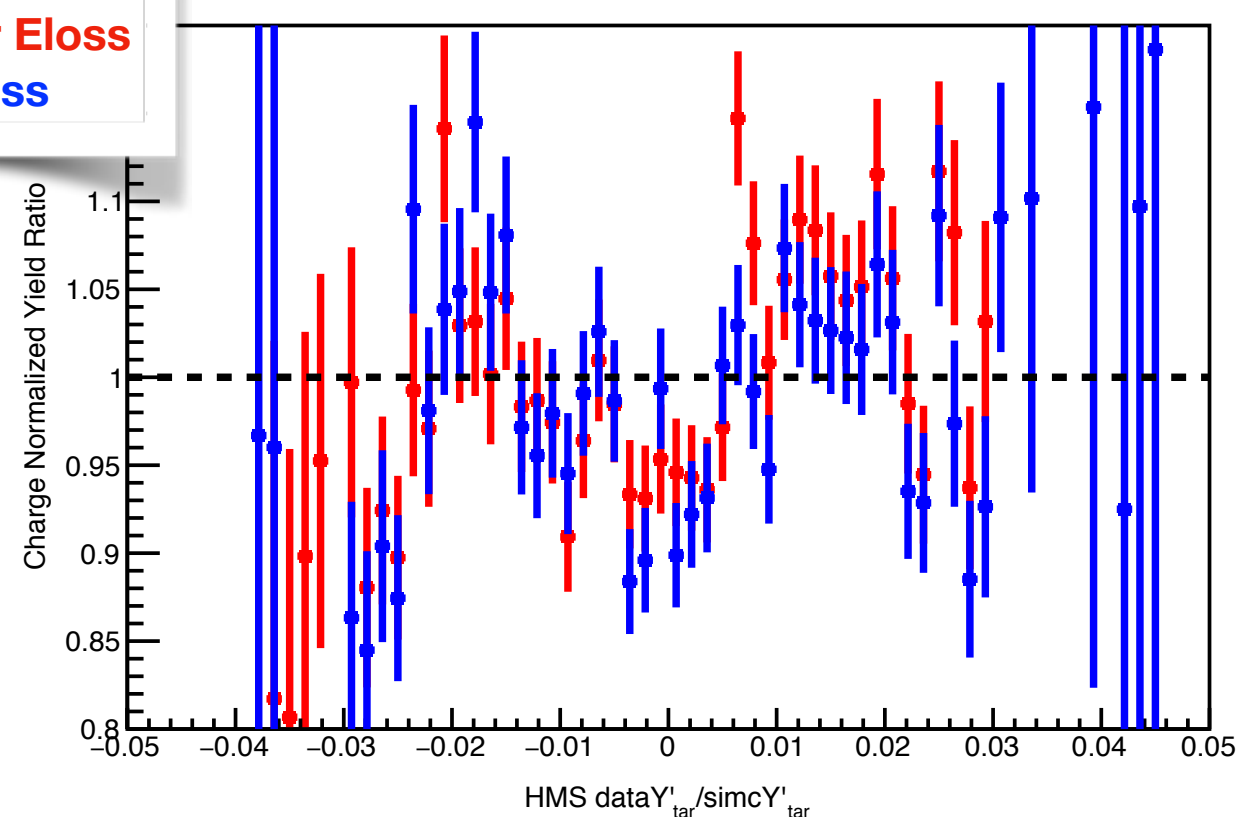
DATA / SIMC Yield Ratios

NO Collimator Cut

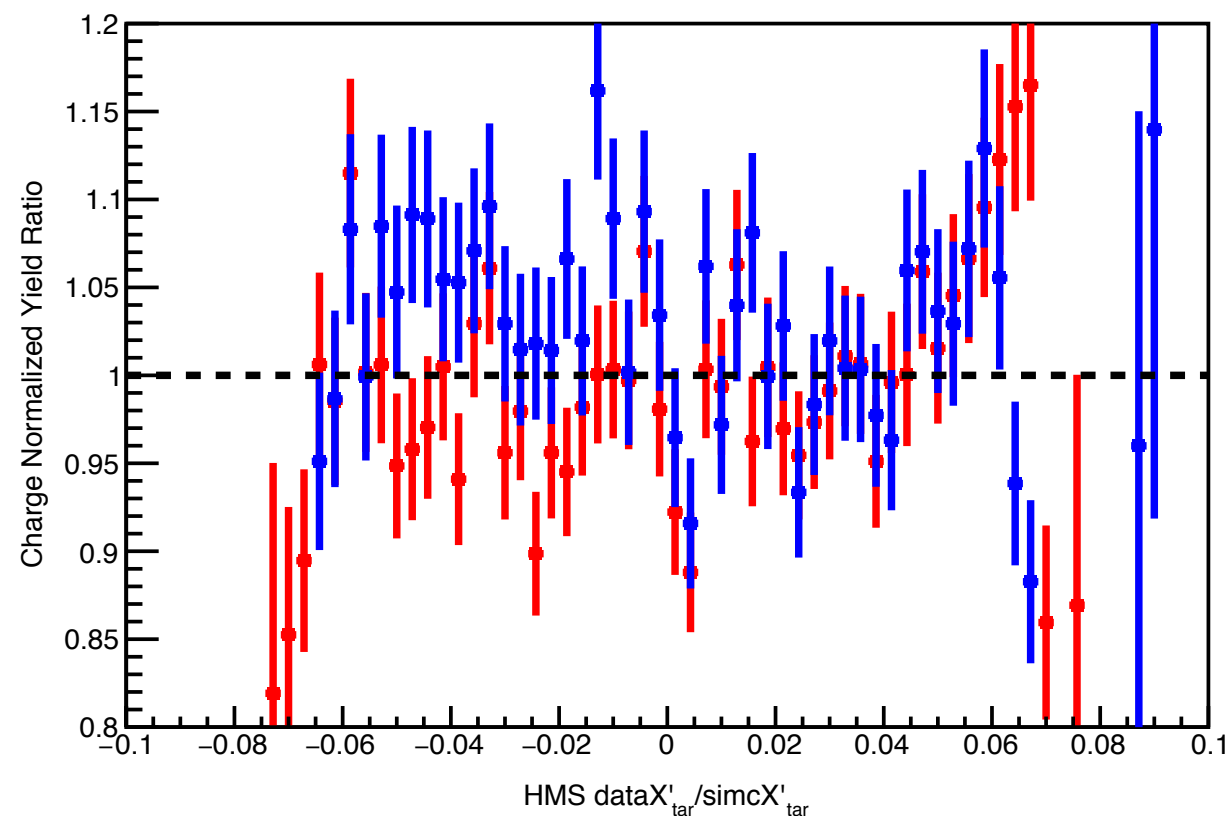
HMS Y_{tar} Yield Ratio



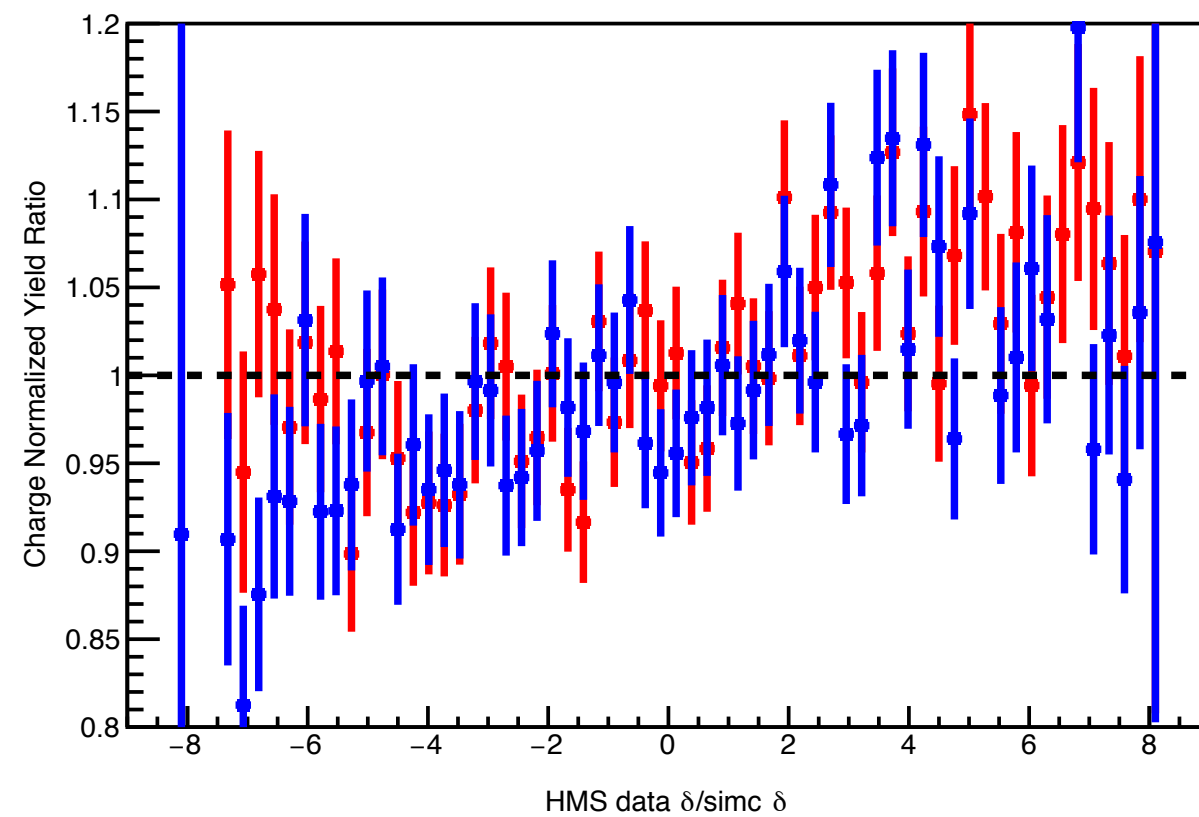
HMS Y'_{tar} Yield Ratio



HMS X'_{tar} Yield Ratio



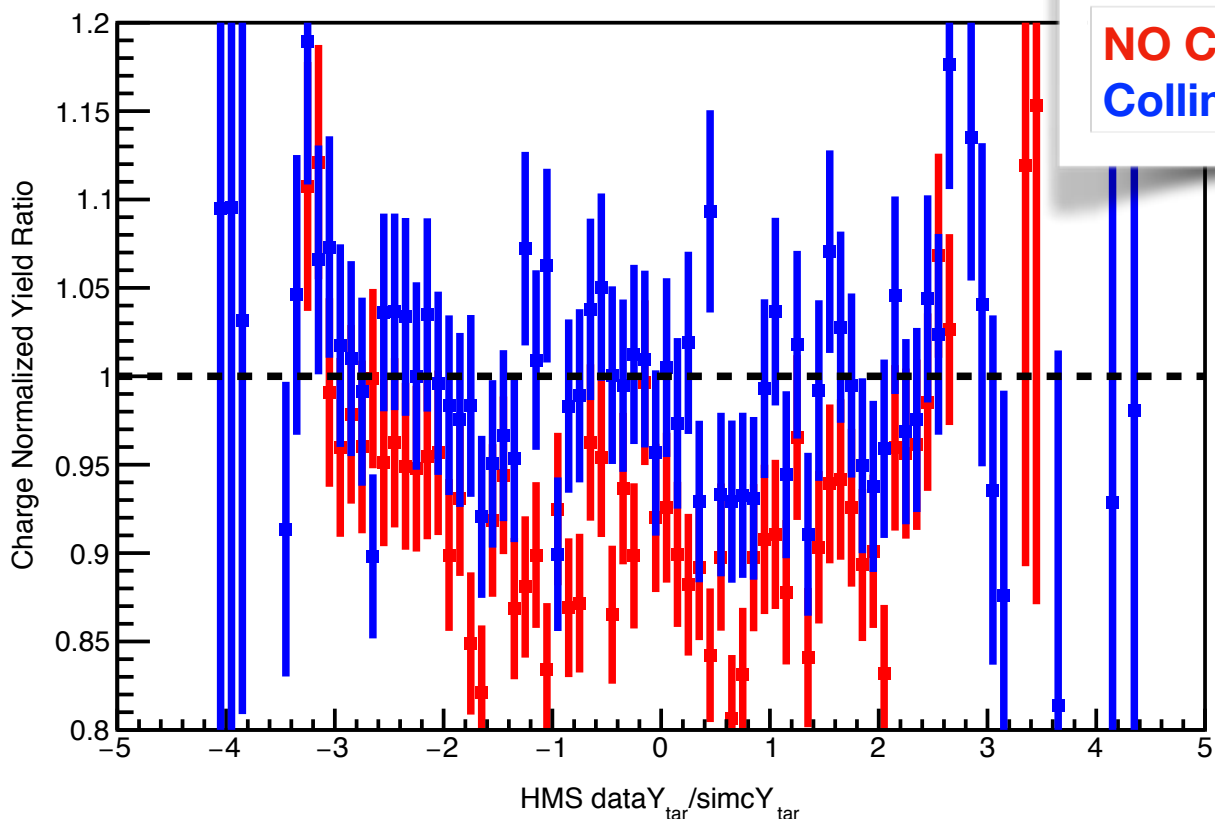
HMS Delta Yield Ratio



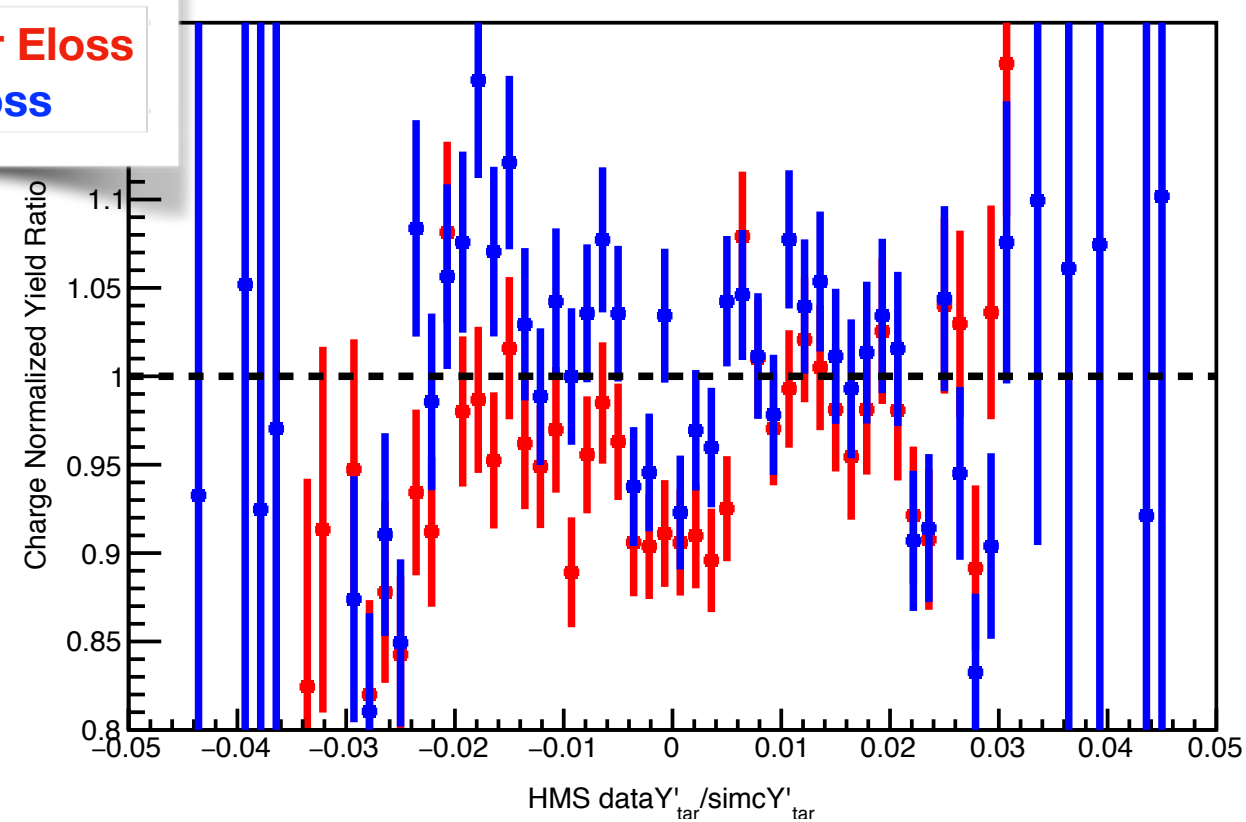
DATA / SIMC Yield Ratios

Collimator Cut: Scale 1

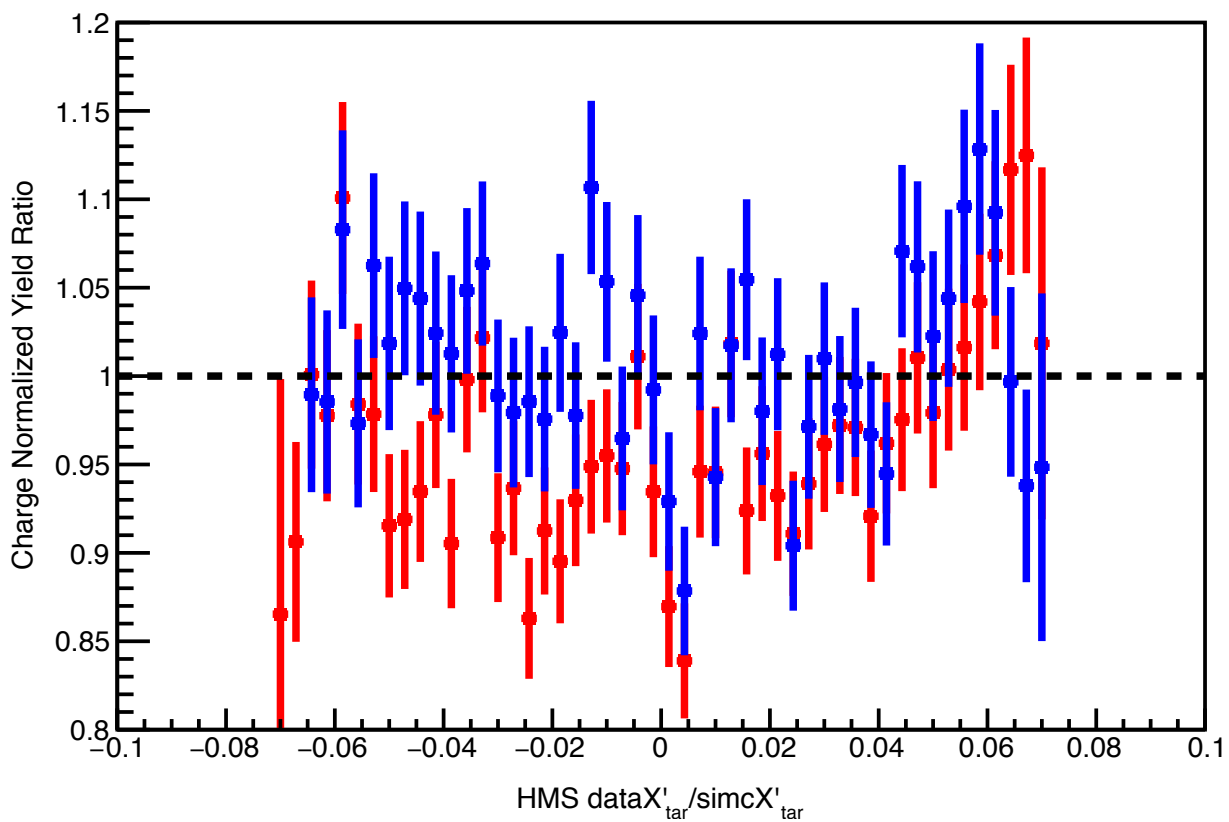
HMS Y_{tar} Yield Ratio



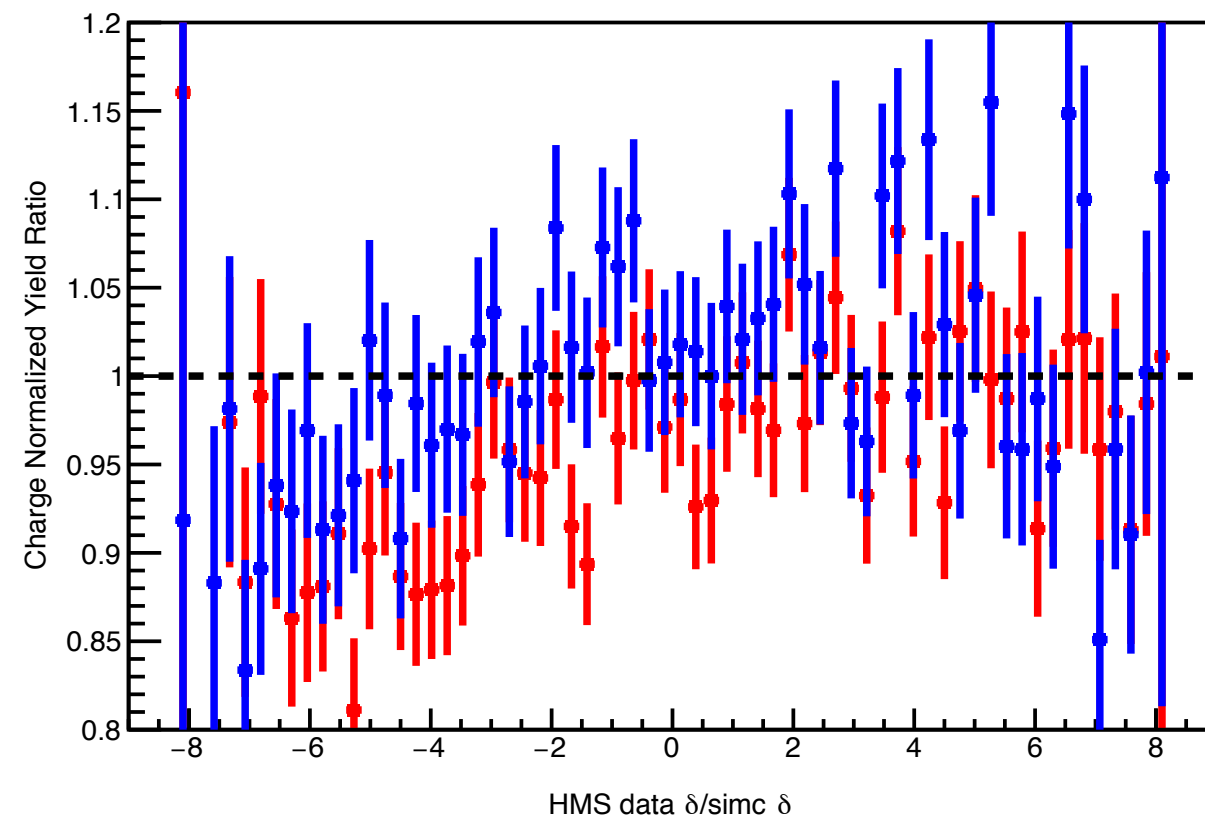
HMS Y'_{tar} Yield Ratio



HMS X'_{tar} Yield Ratio



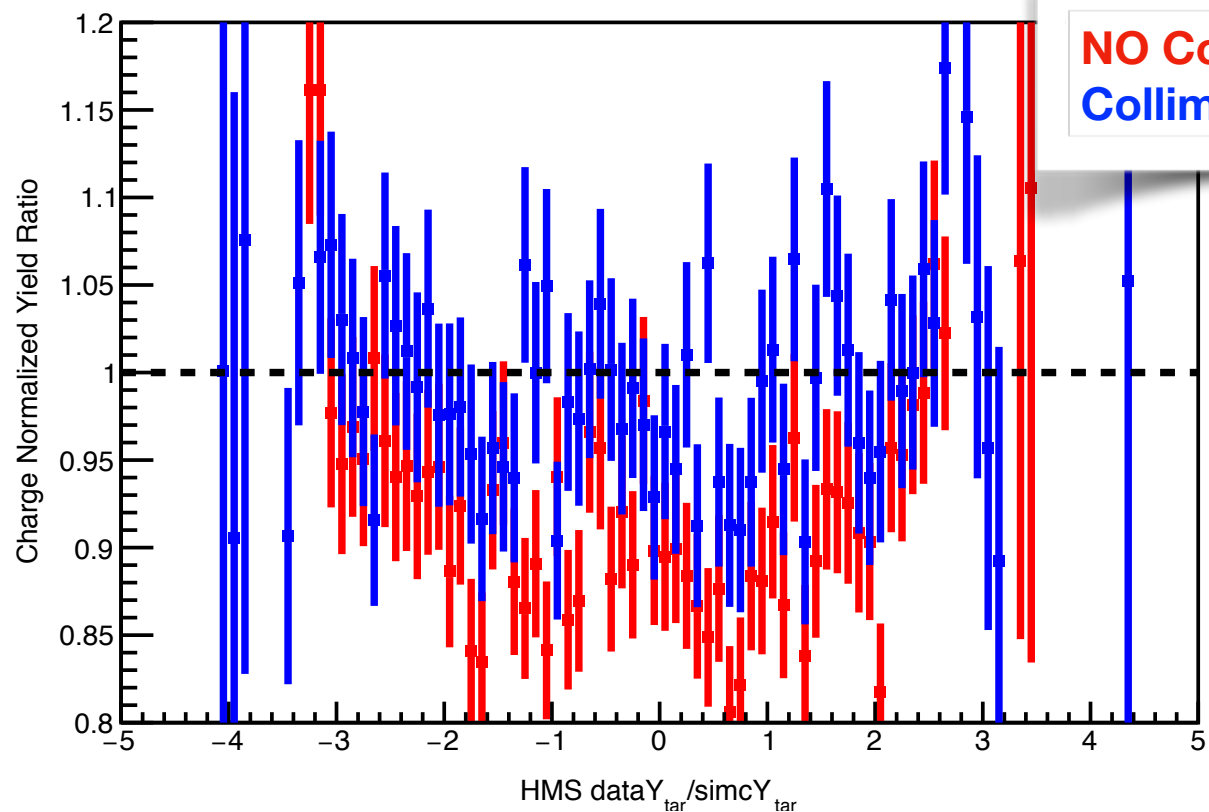
HMS Delta Yield Ratio



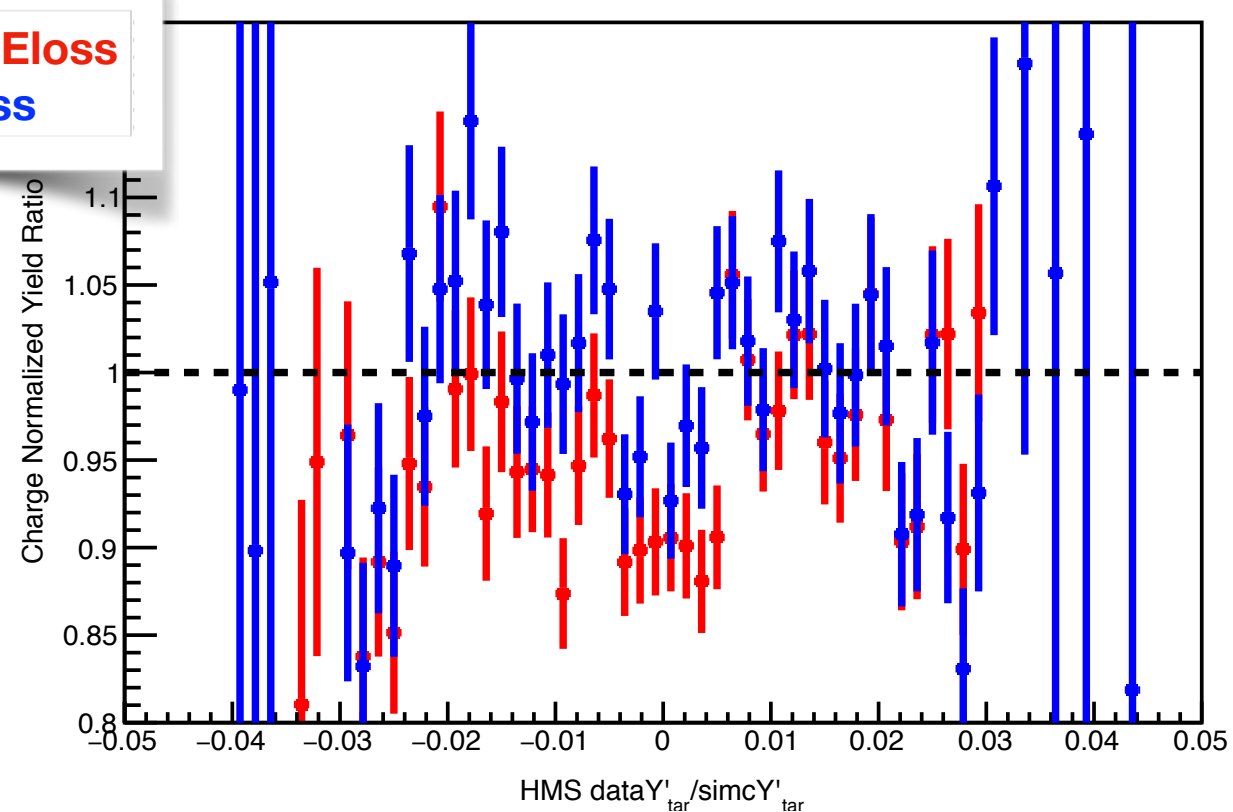
DATA / SIMC Yield Ratios

Collimator Cut: Scale 0.95

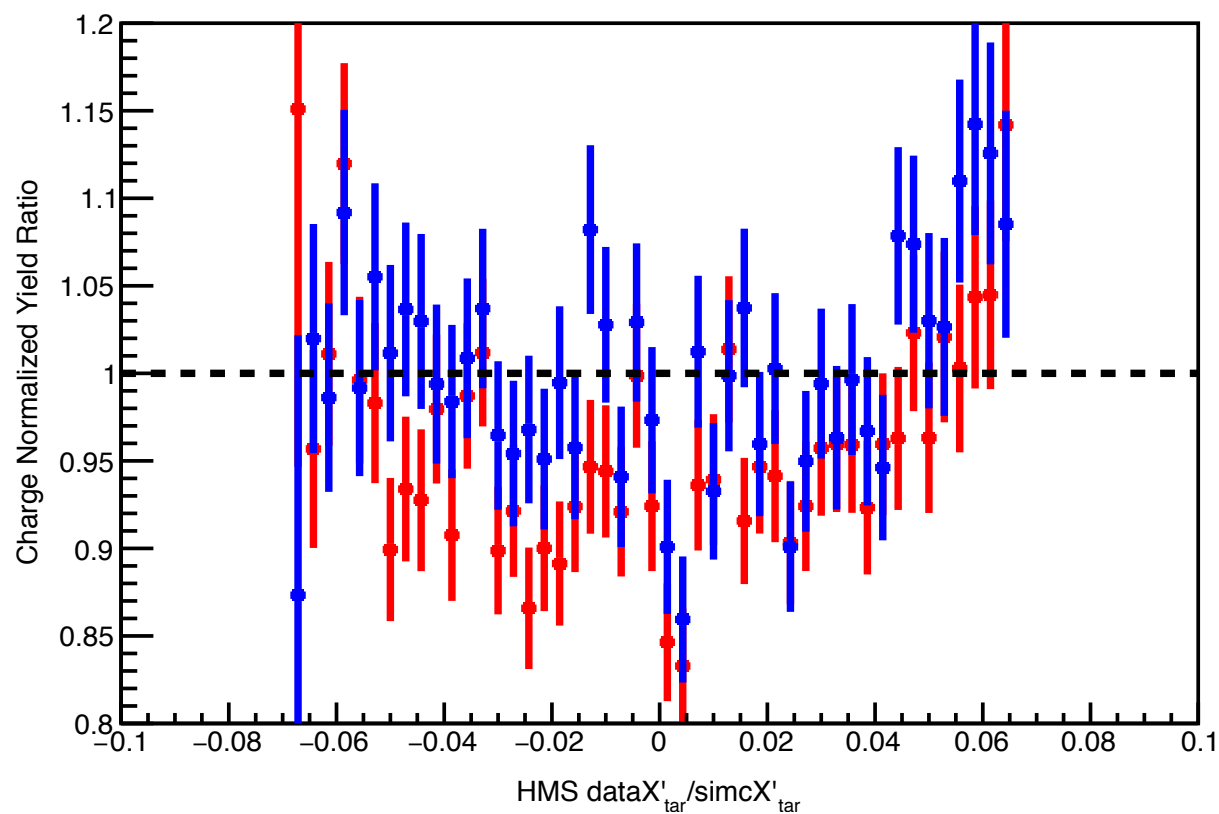
HMS Y_{tar} Yield Ratio



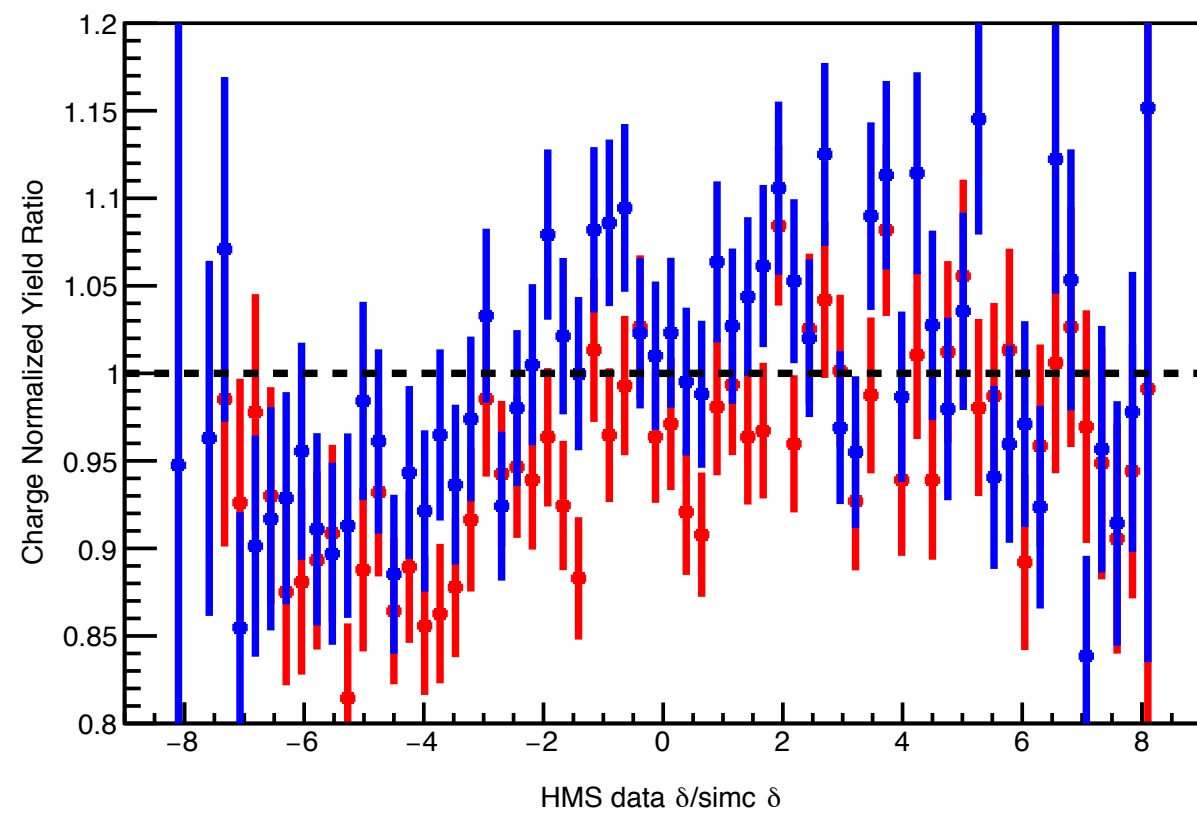
HMS Y'_{tar} Yield Ratio



HMS X'_{tar} Yield Ratio



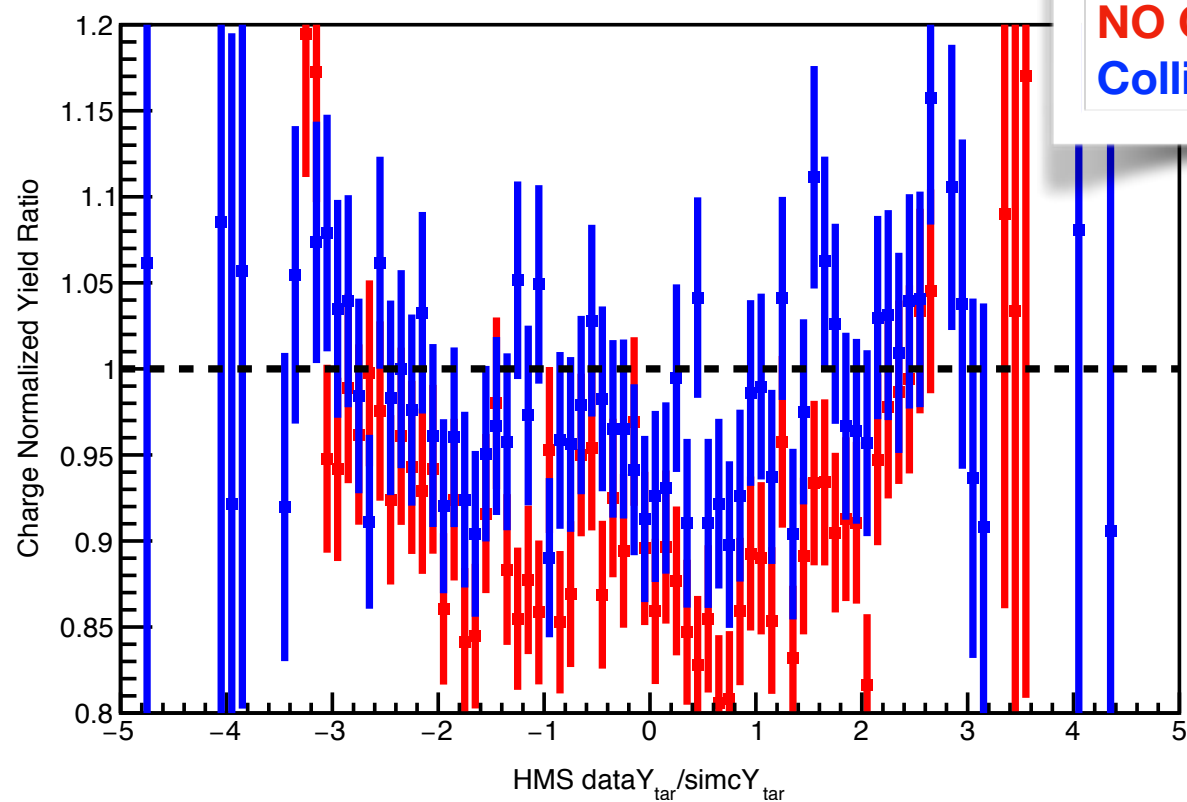
HMS Delta Yield Ratio



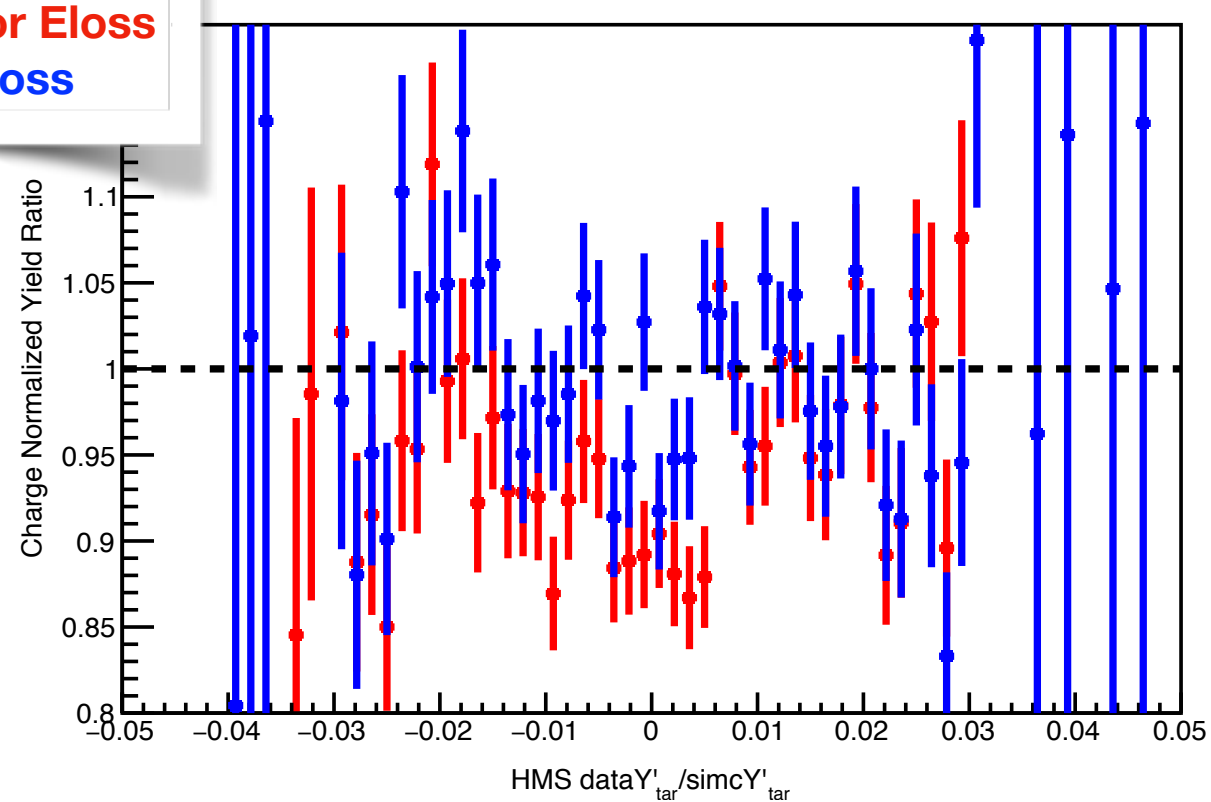
DATA / SIMC Yield Ratios

Collimator Cut: Scale 0.90

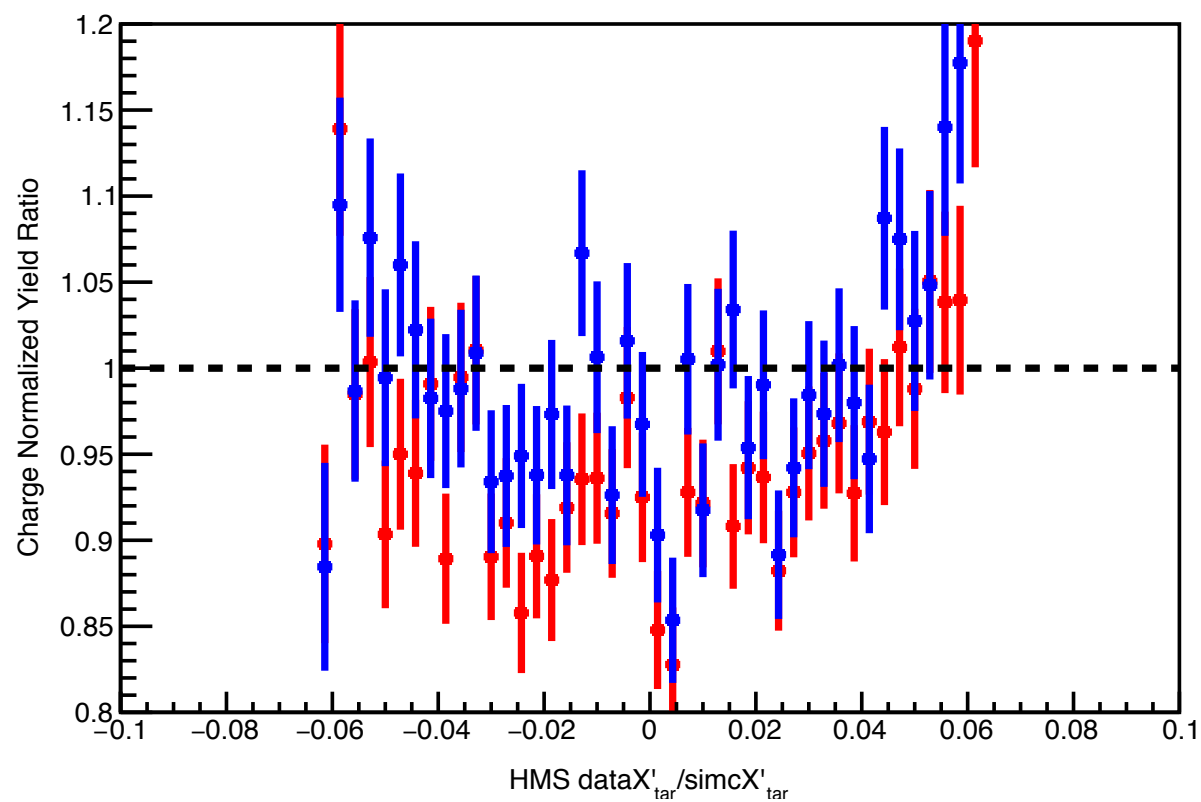
HMS Y_{tar} Yield Ratio



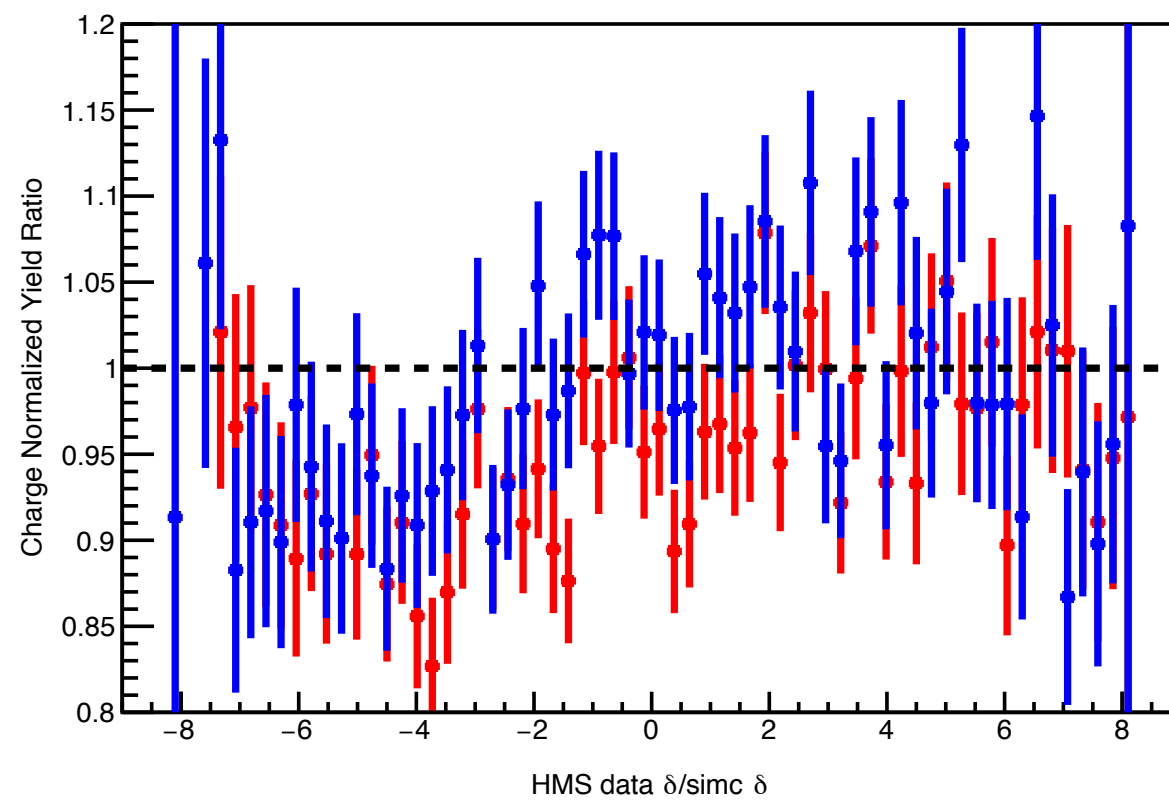
HMS Y'_{tar} Yield Ratio



HMS X'_{tar} Yield Ratio

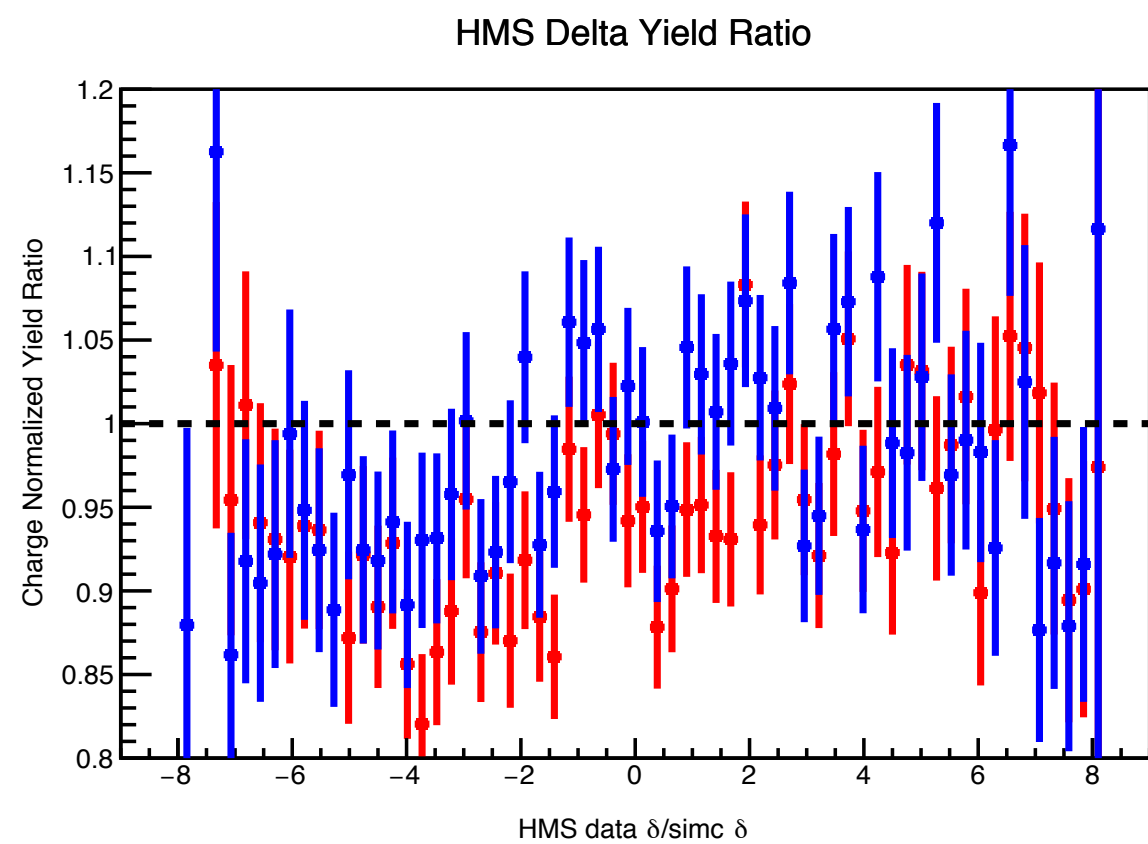
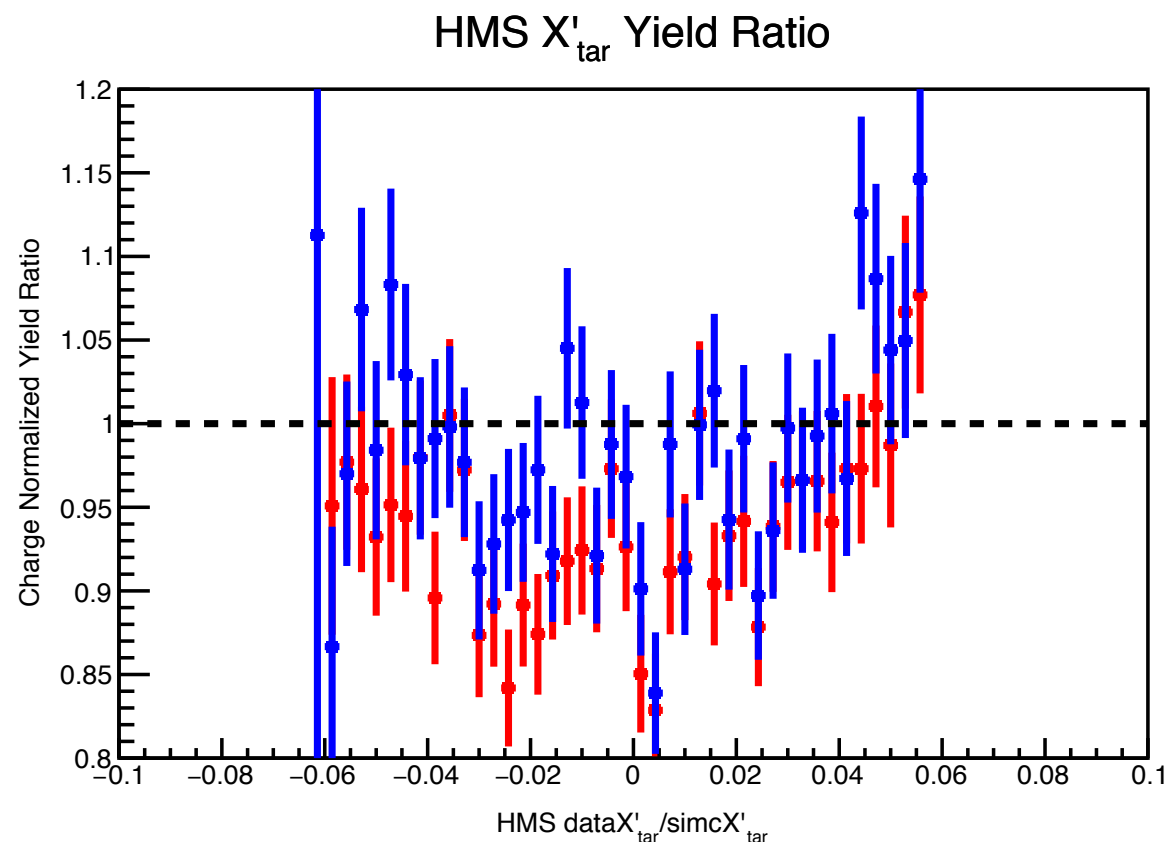
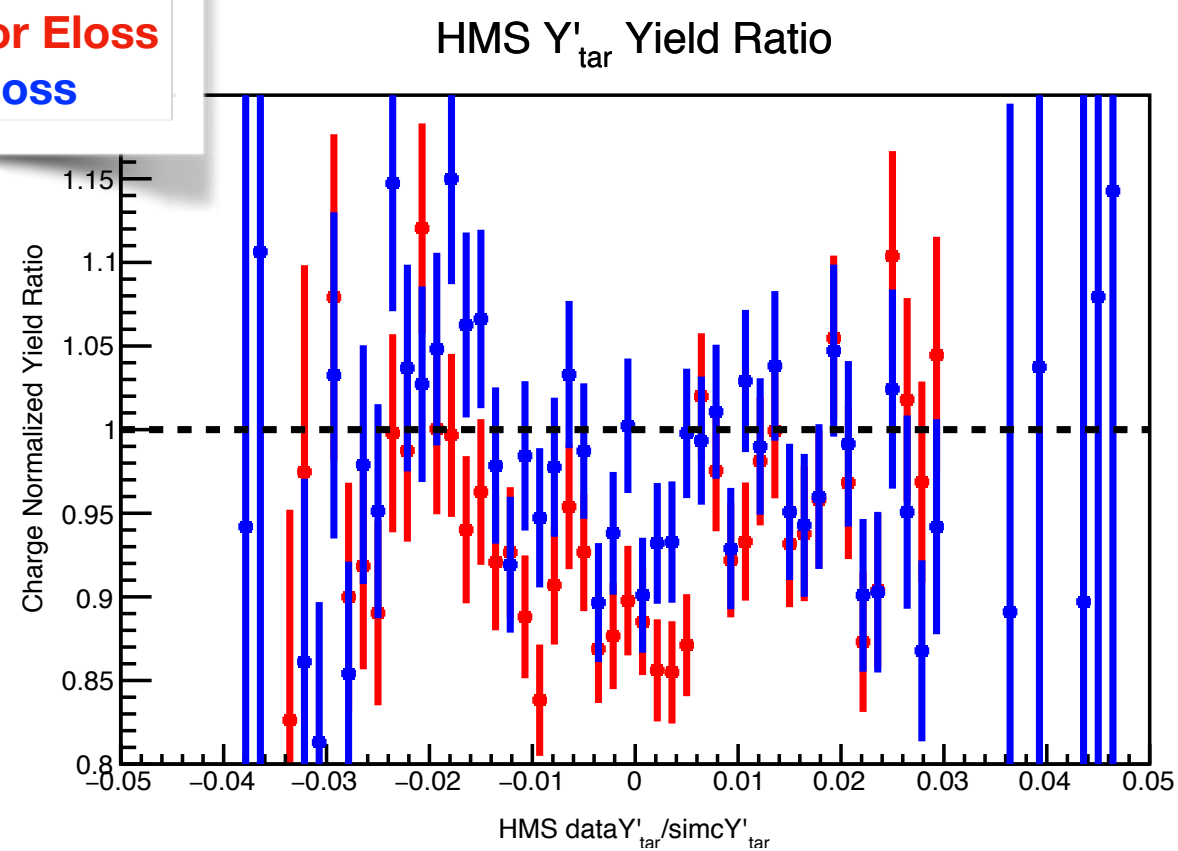
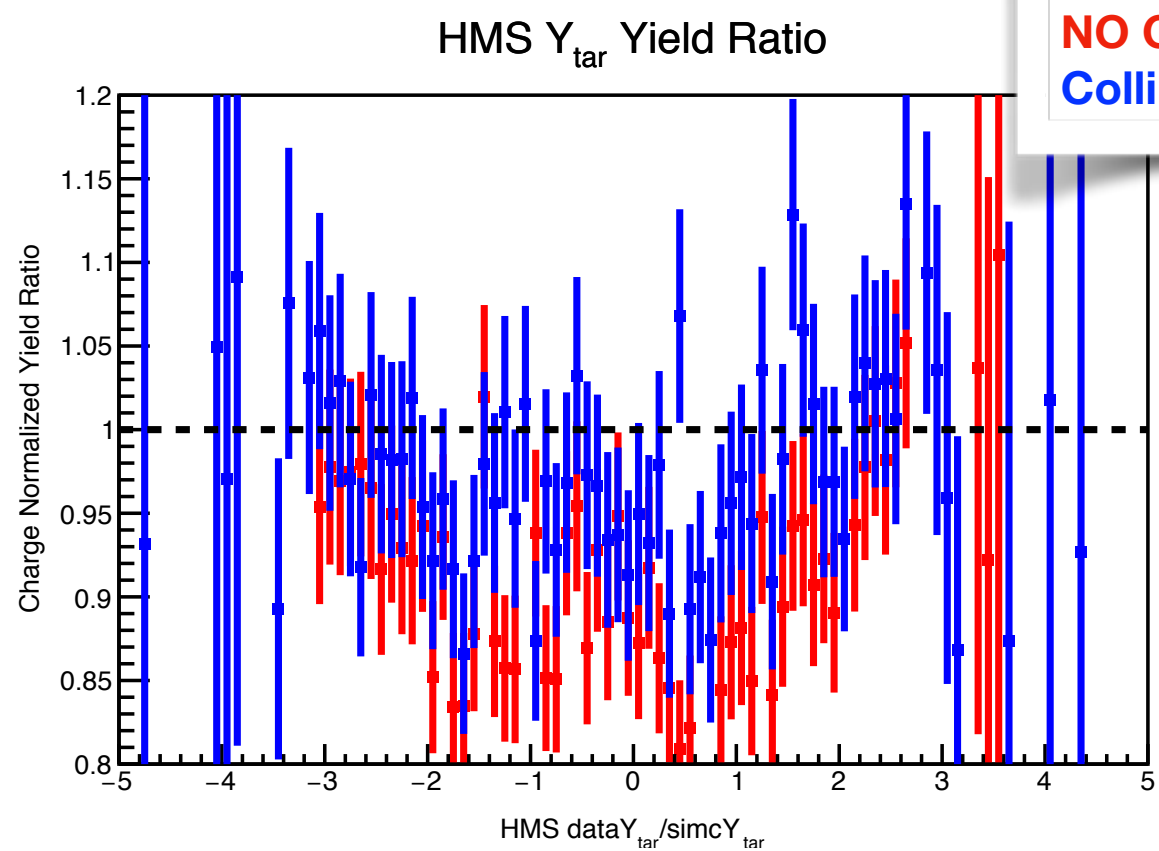


HMS Delta Yield Ratio



DATA / SIMC Yield Ratios

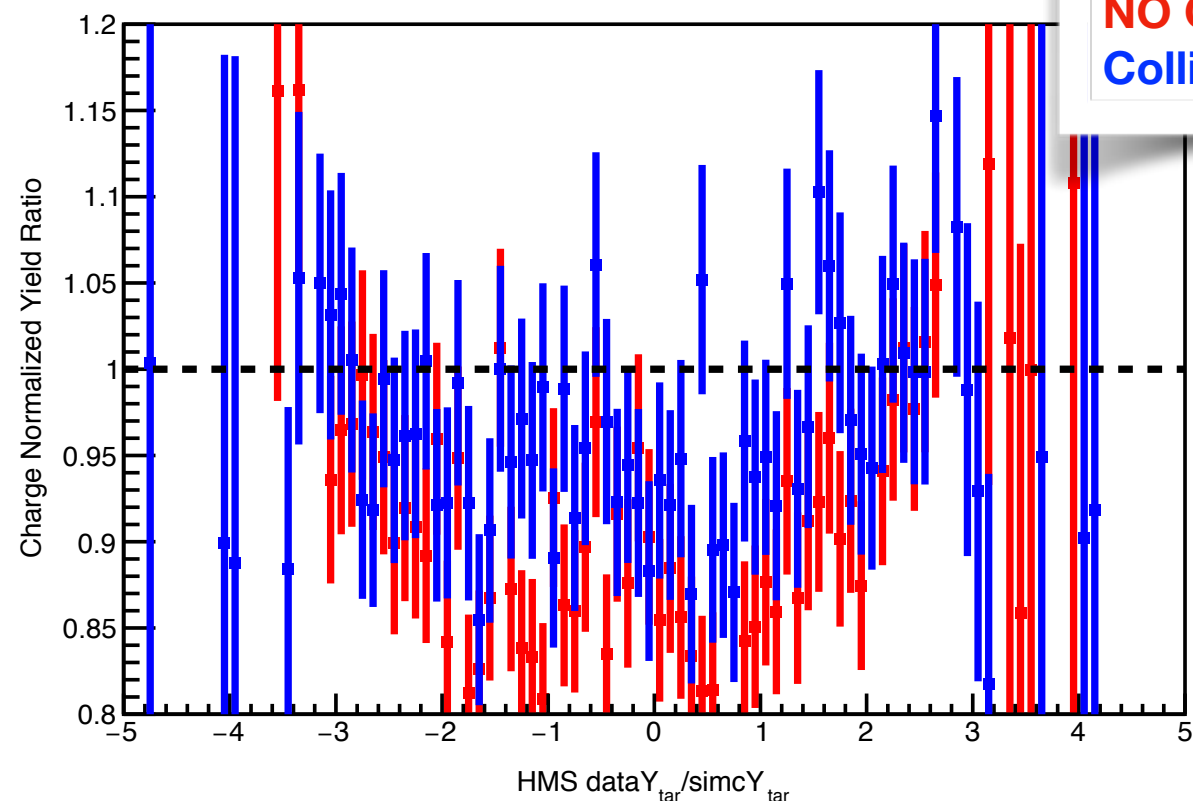
Collimator Cut: Scale 0.85



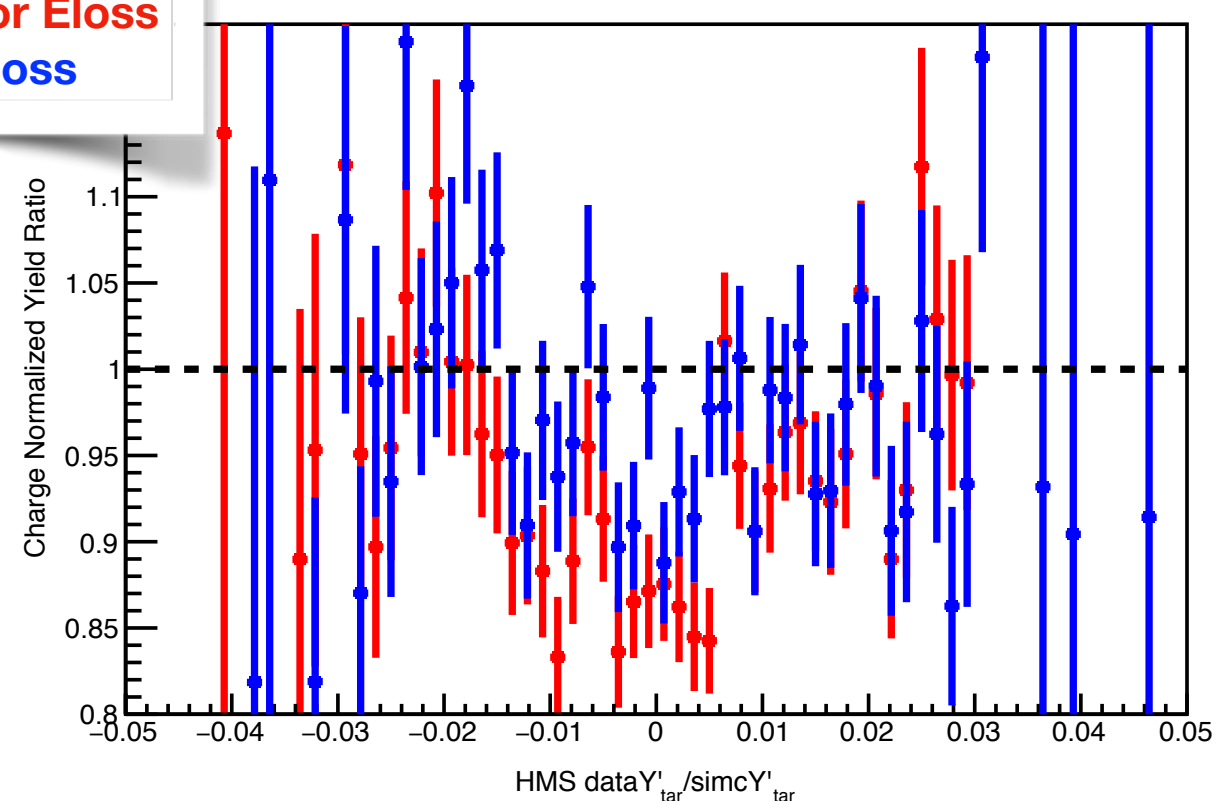
DATA / SIMC Yield Ratios

Collimator Cut: Scale 0.80

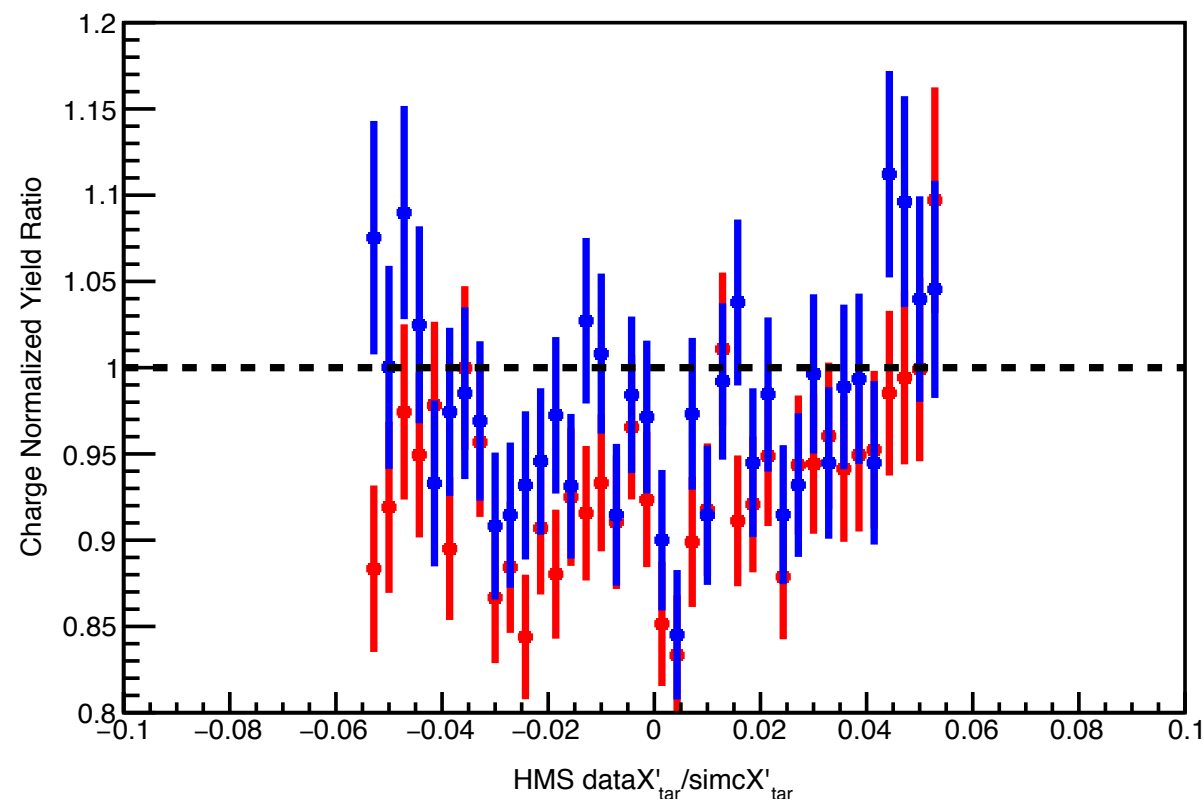
HMS Y_{tar} Yield Ratio



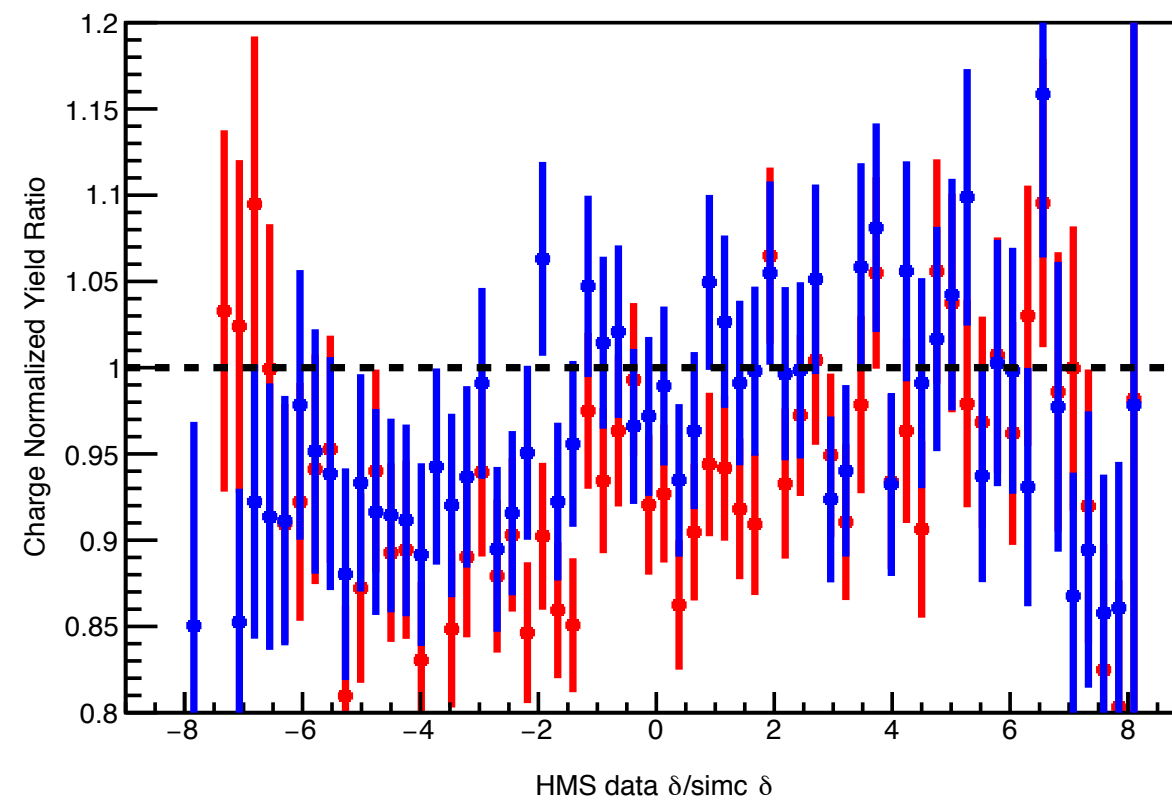
HMS Y'_{tar} Yield Ratio



HMS X'_{tar} Yield Ratio



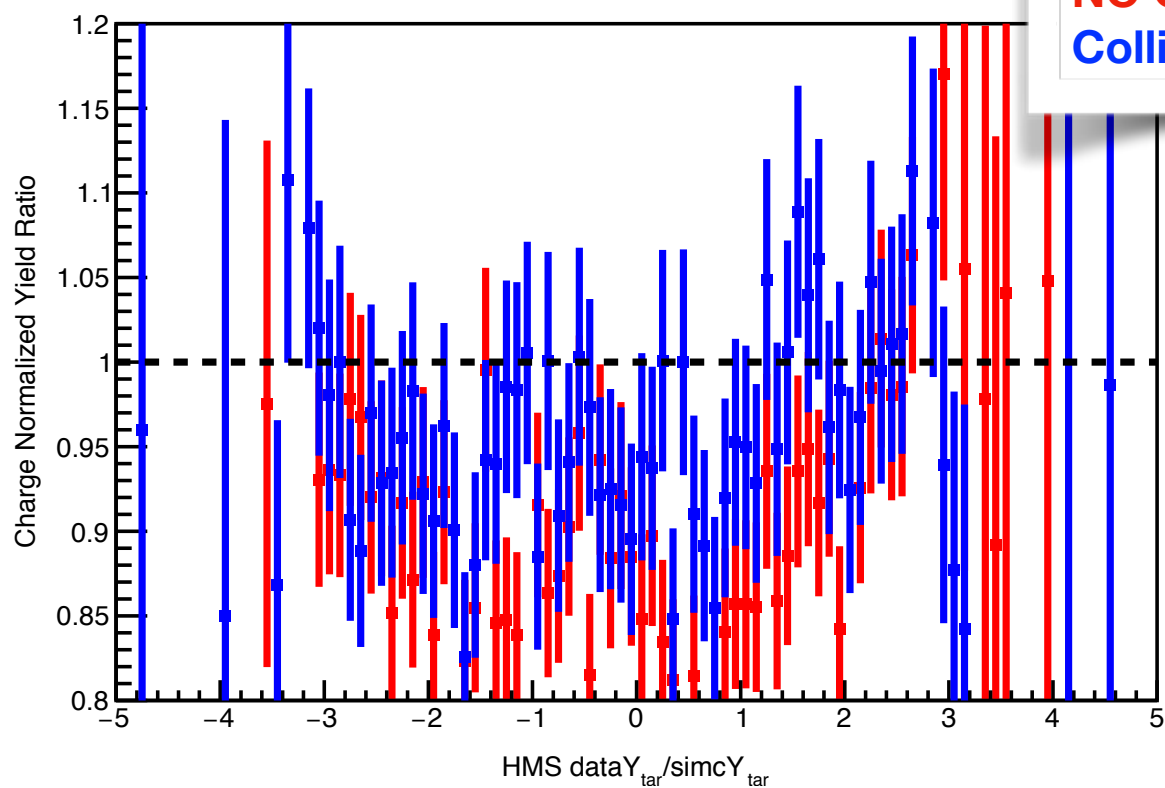
HMS Delta Yield Ratio



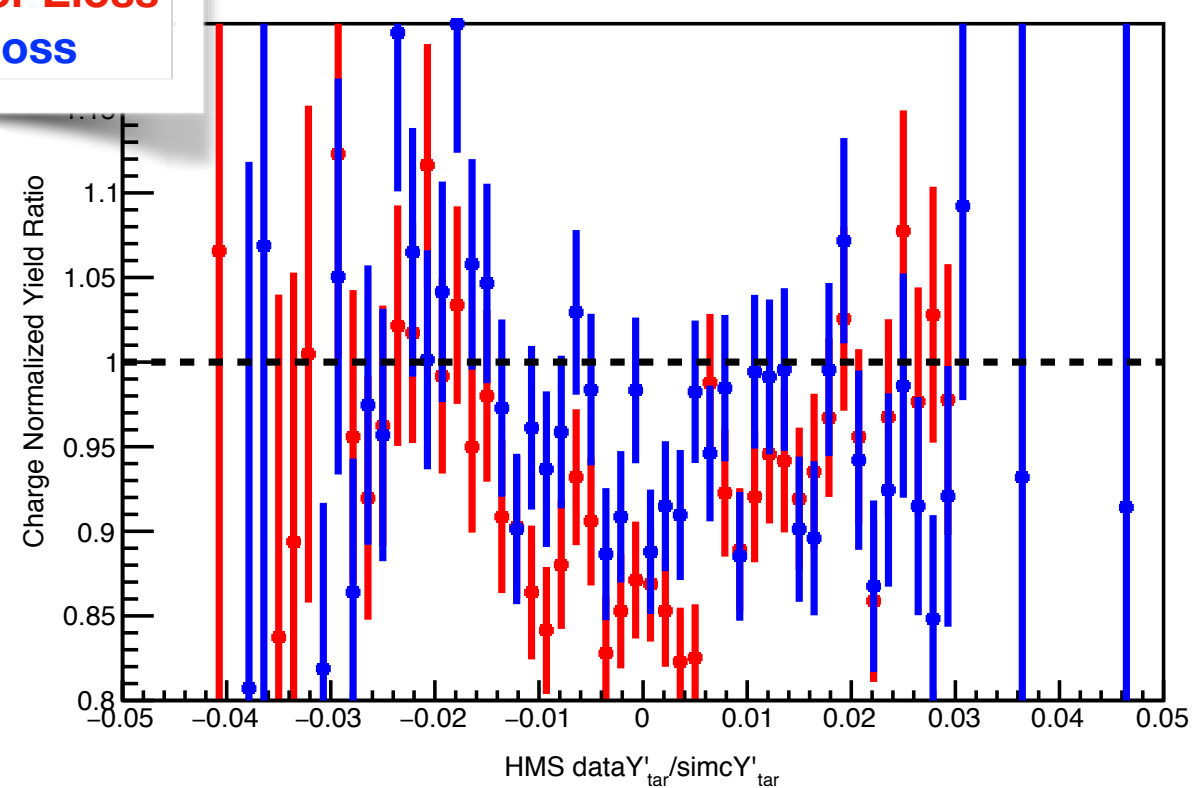
DATA / SIMC Yield Ratios

Collimator Cut: Scale 0.75

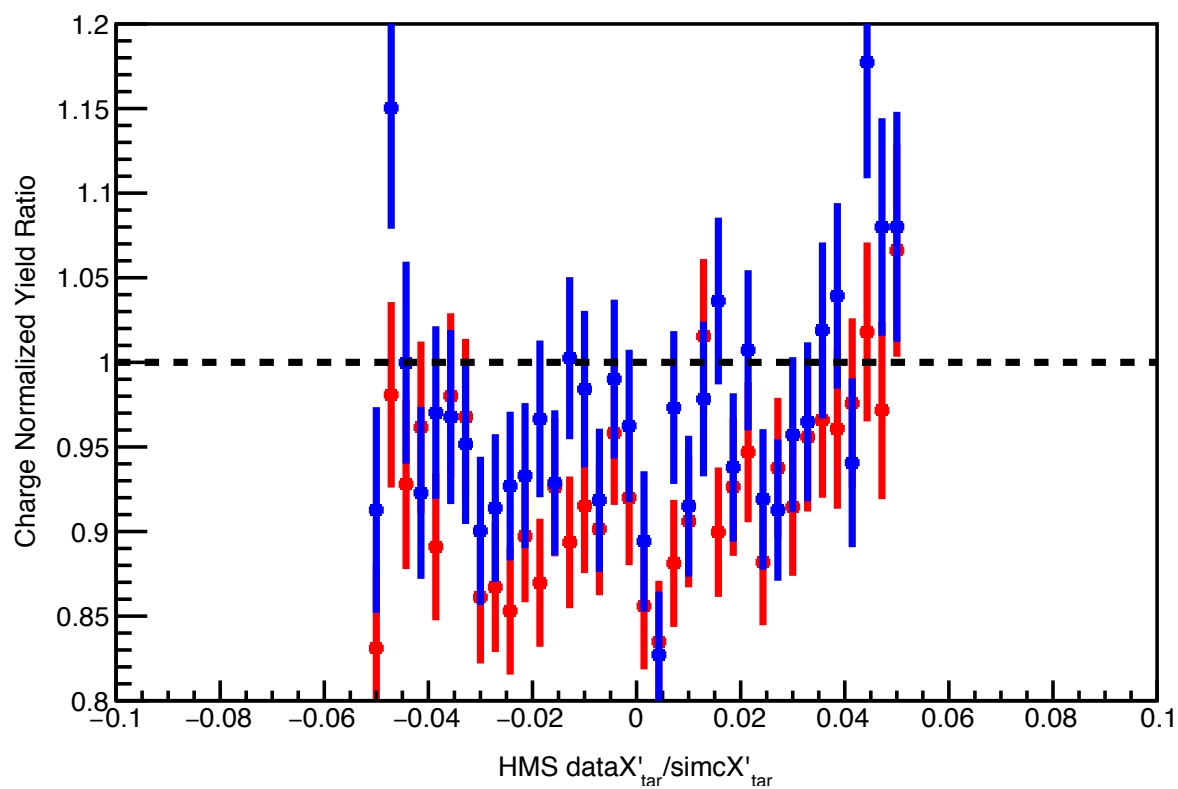
HMS Y_{tar} Yield Ratio



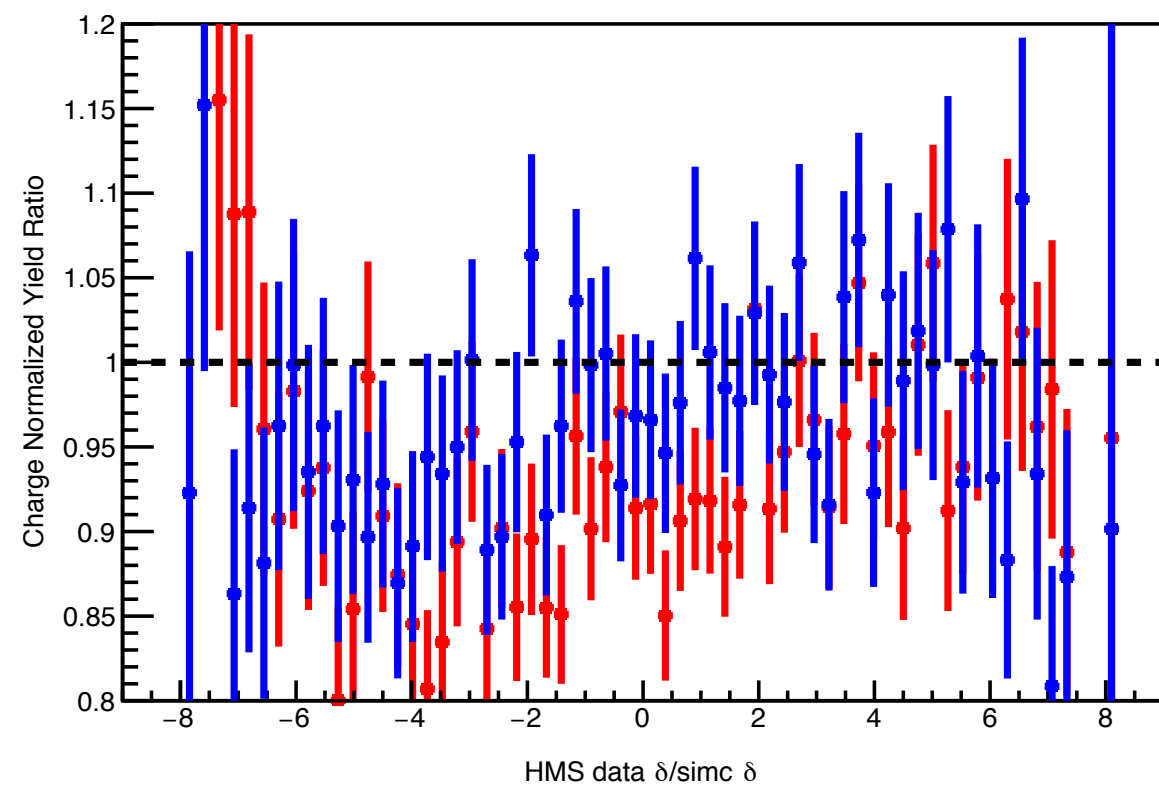
HMS Y'_{tar} Yield Ratio



HMS X'_{tar} Yield Ratio

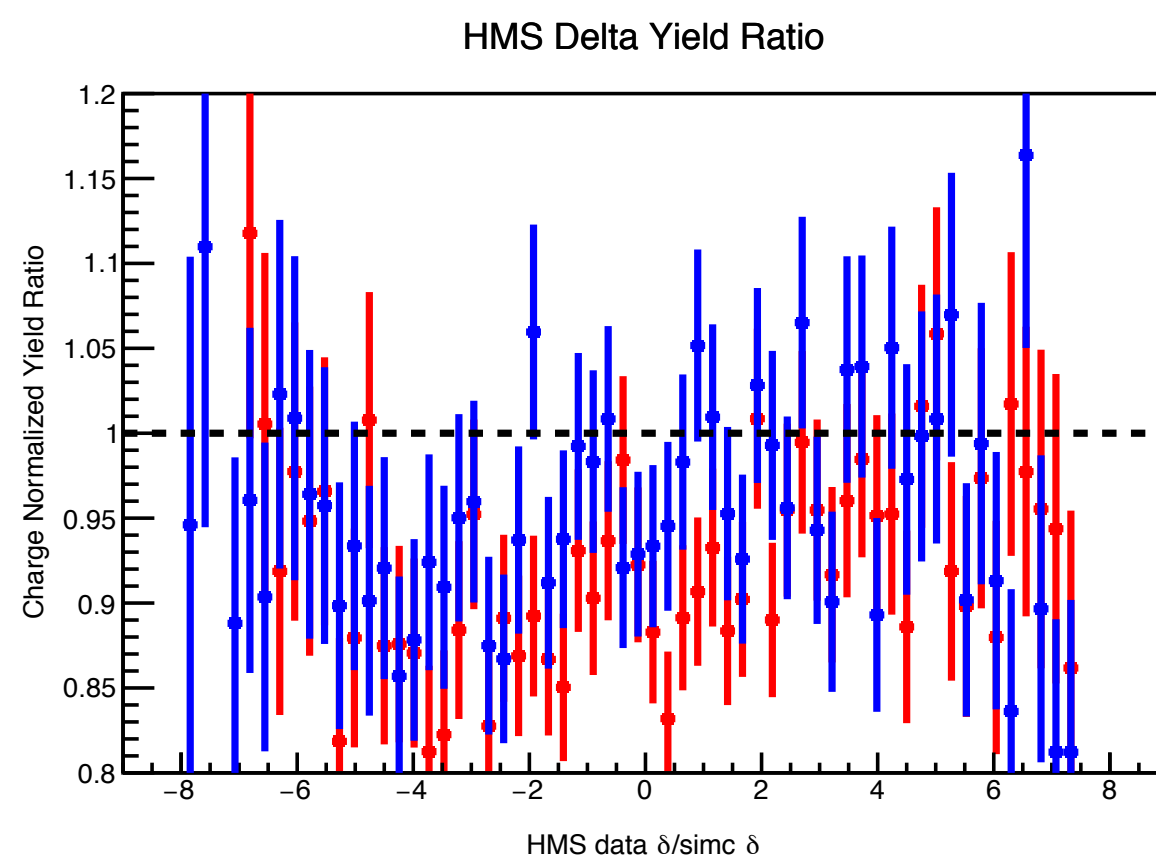
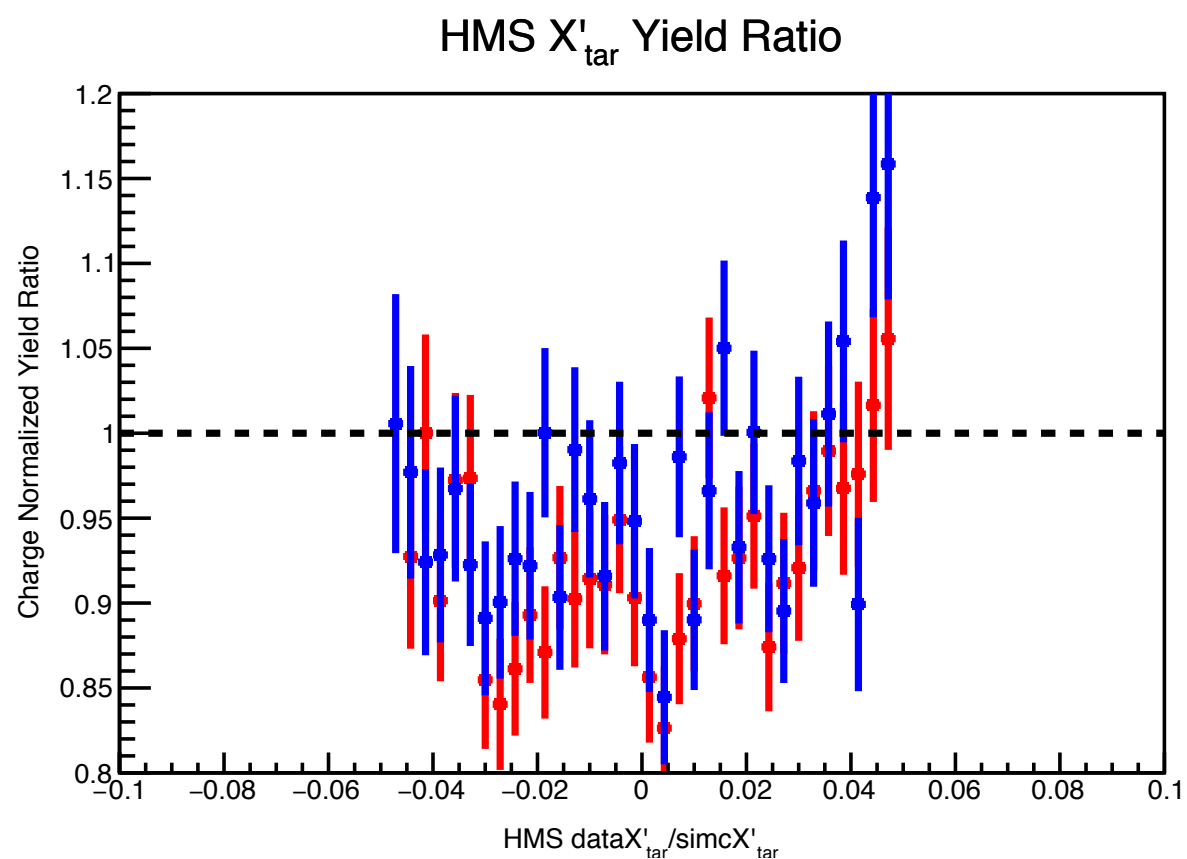
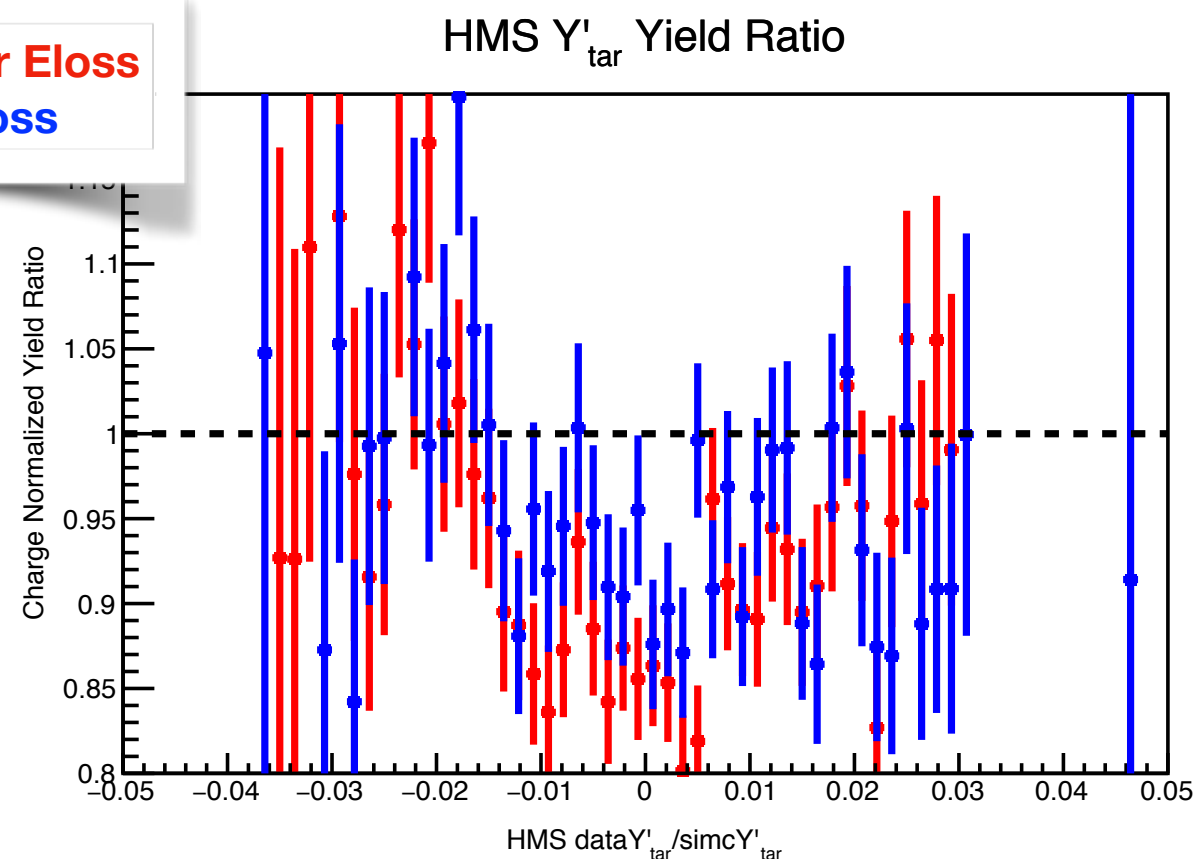
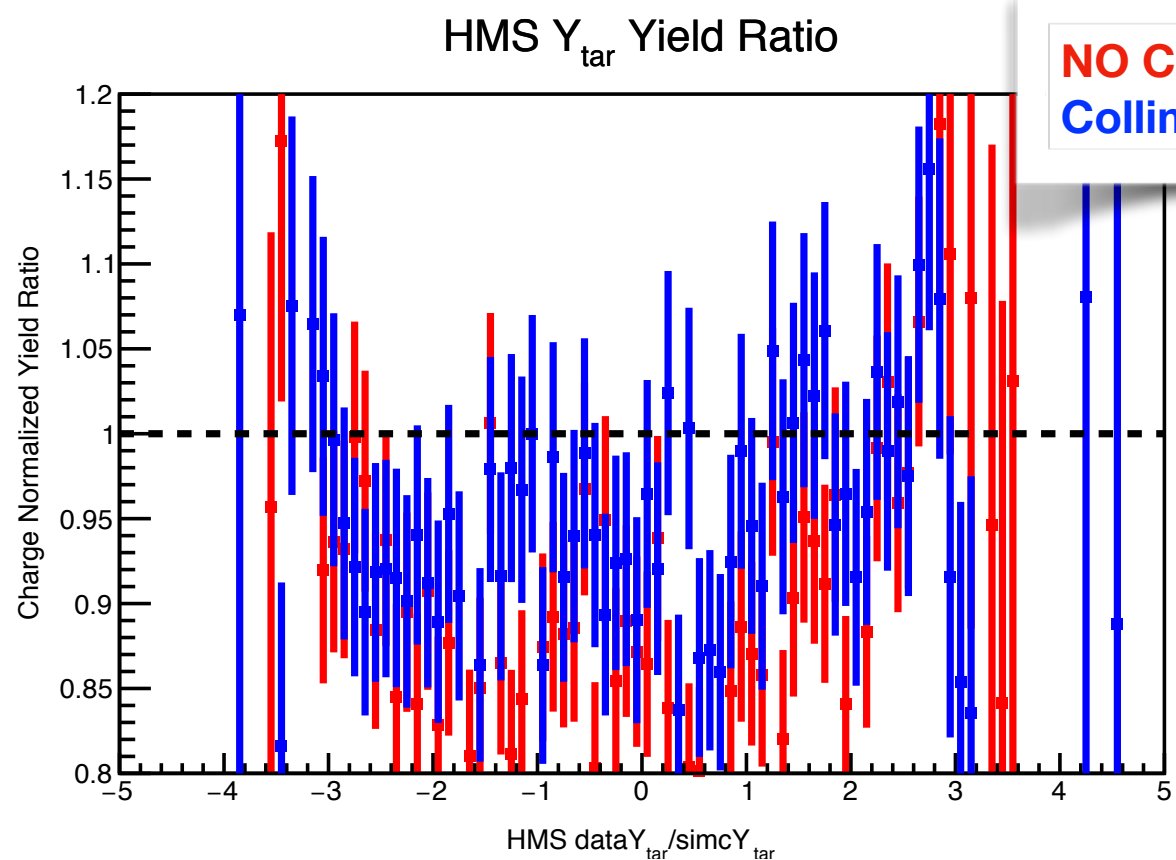


HMS Delta Yield Ratio



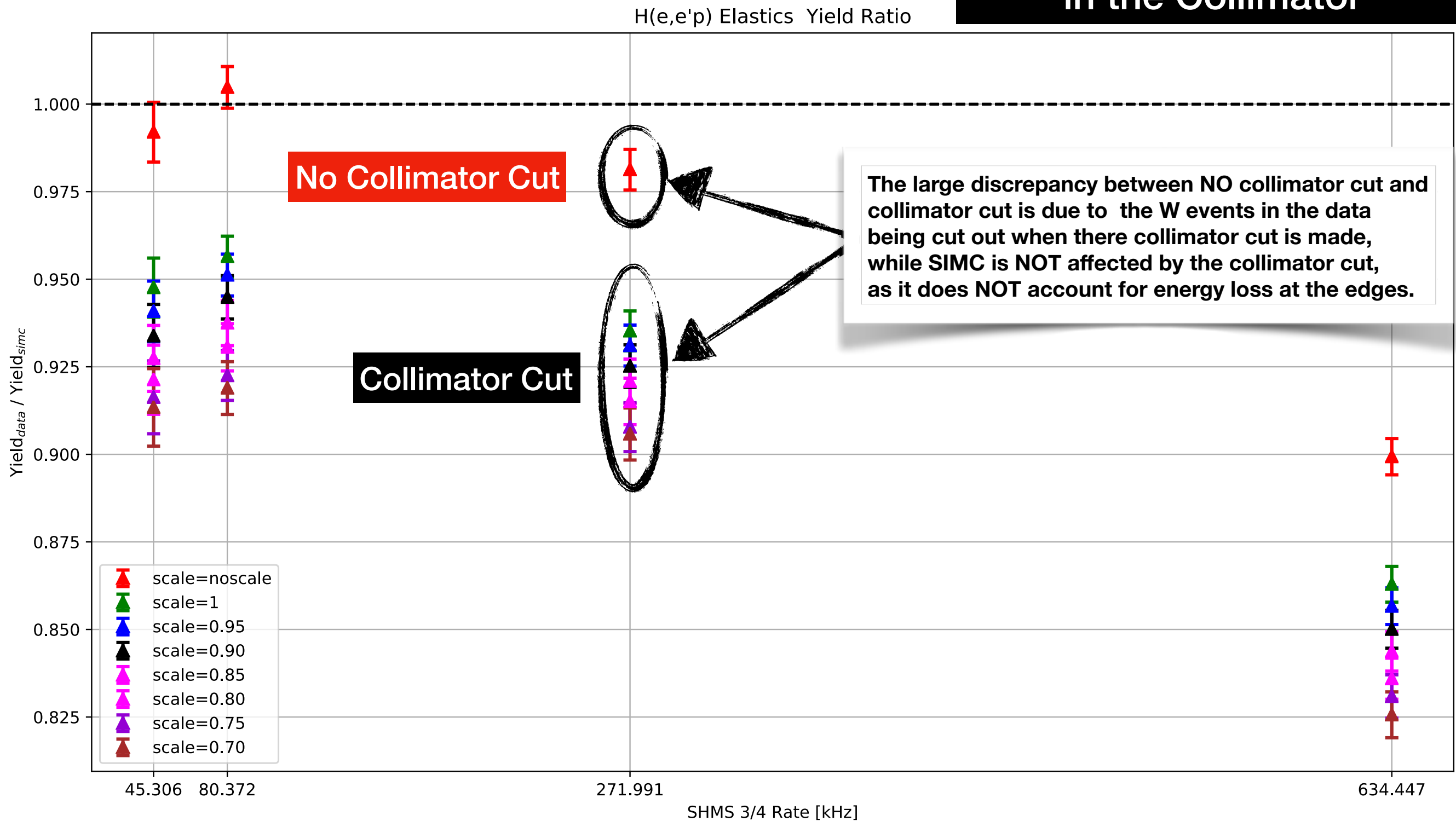
DATA / SIMC Yield Ratios

Collimator Cut: Scale 0.70



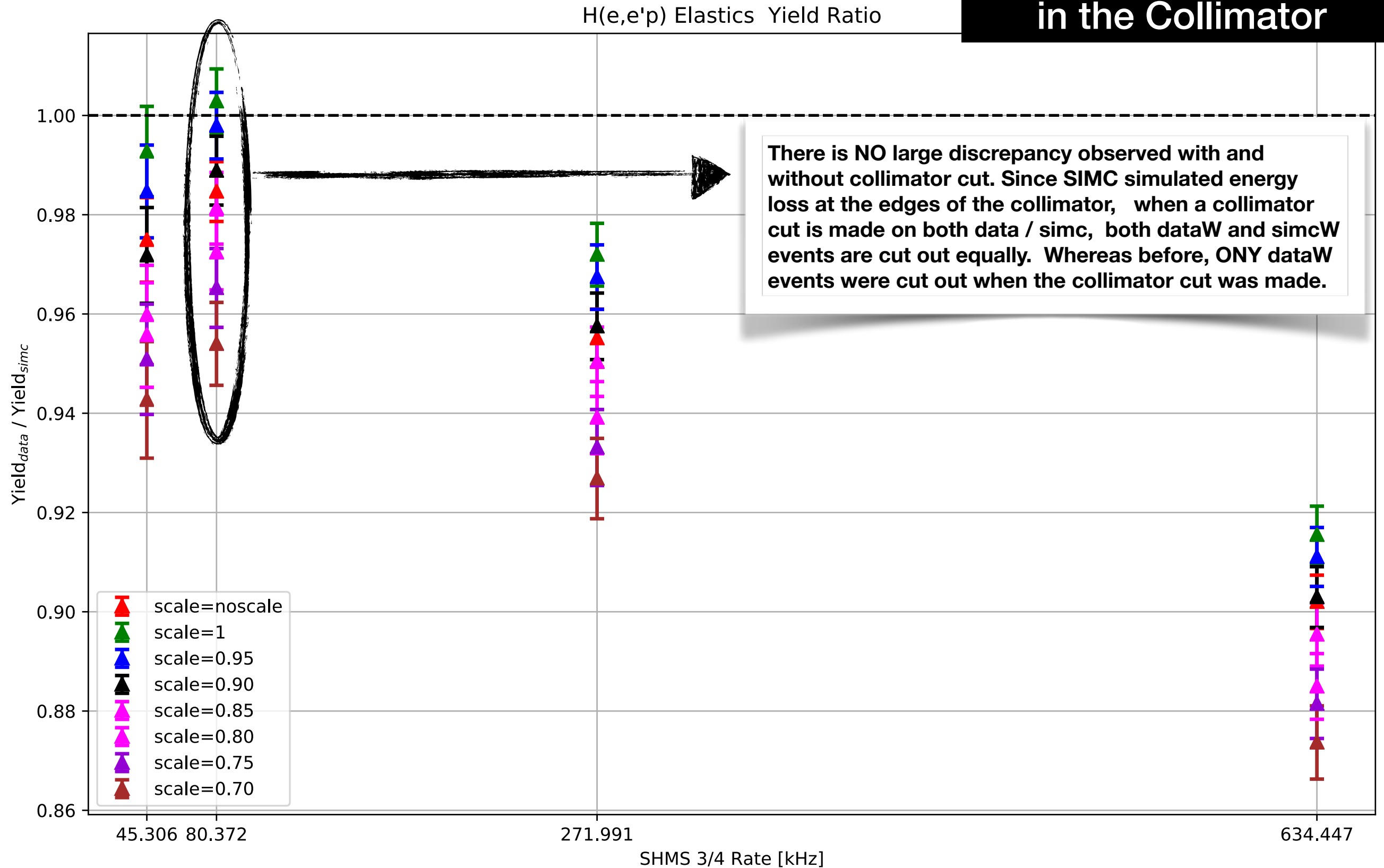
DATA / SIMC Yield Ratio

**NO Energy Loss Simulated
in the Collimator**



DATA / SIMC Yield Ratio

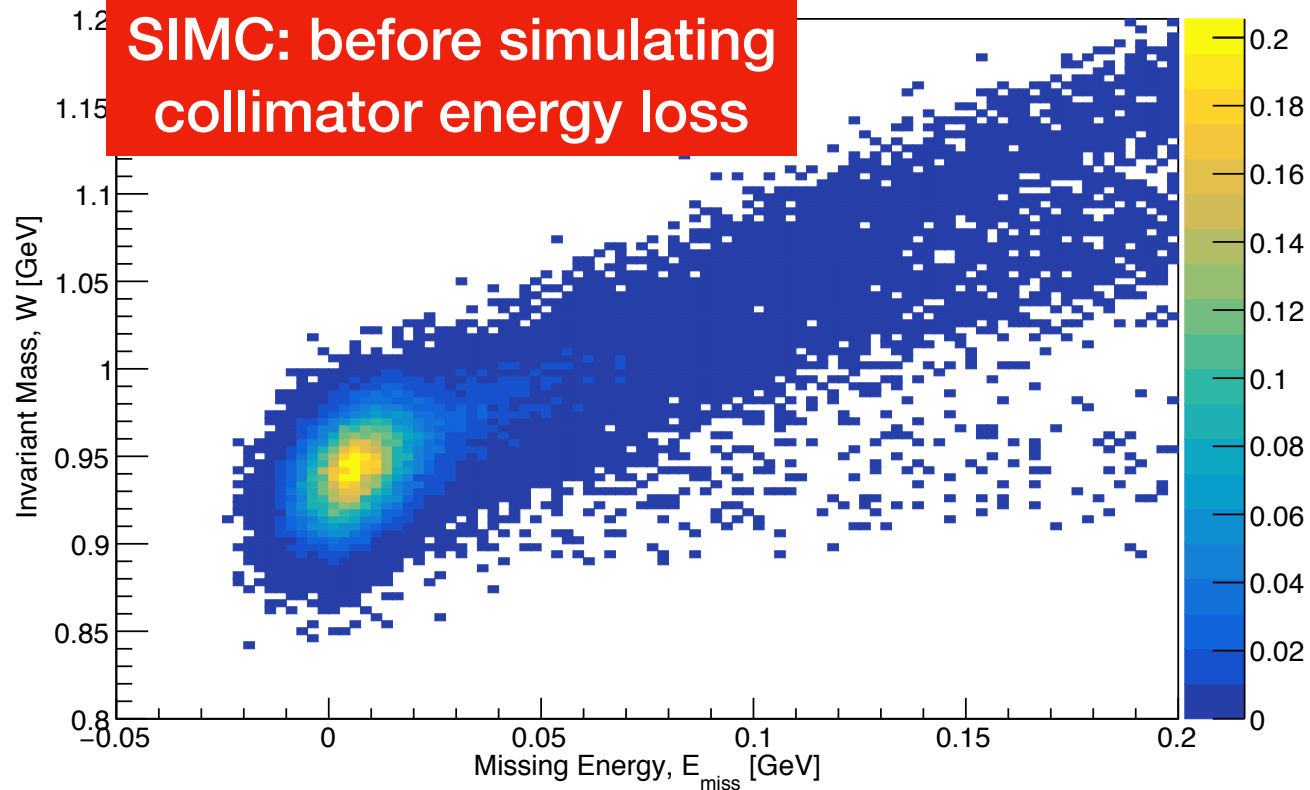
Energy Loss Simulated
in the Collimator



Missing Energy Cut Study

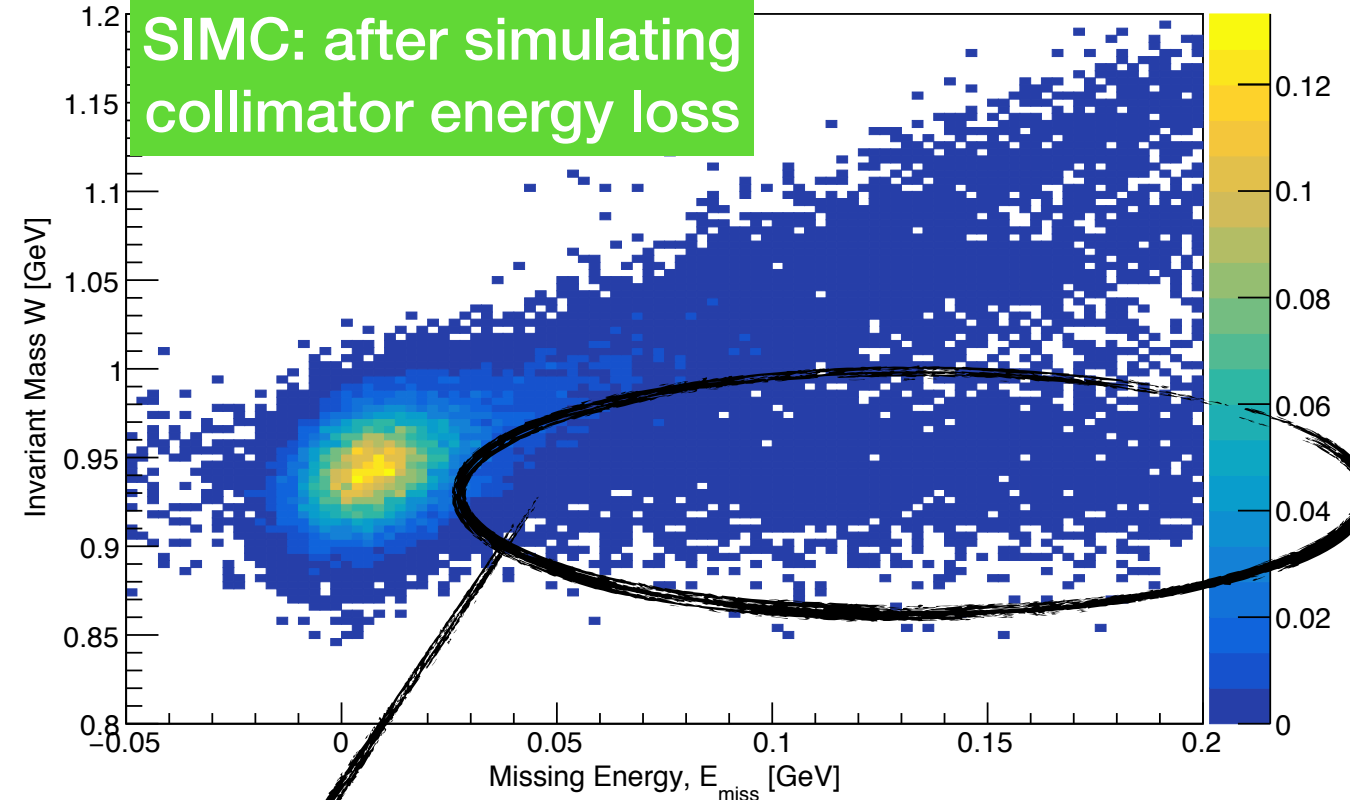
W:Em {Weight*(abs(h_delta)<8.&&e_delta>-10&&e_delta<22.)}

**SIMC: before simulating
collimator energy loss**



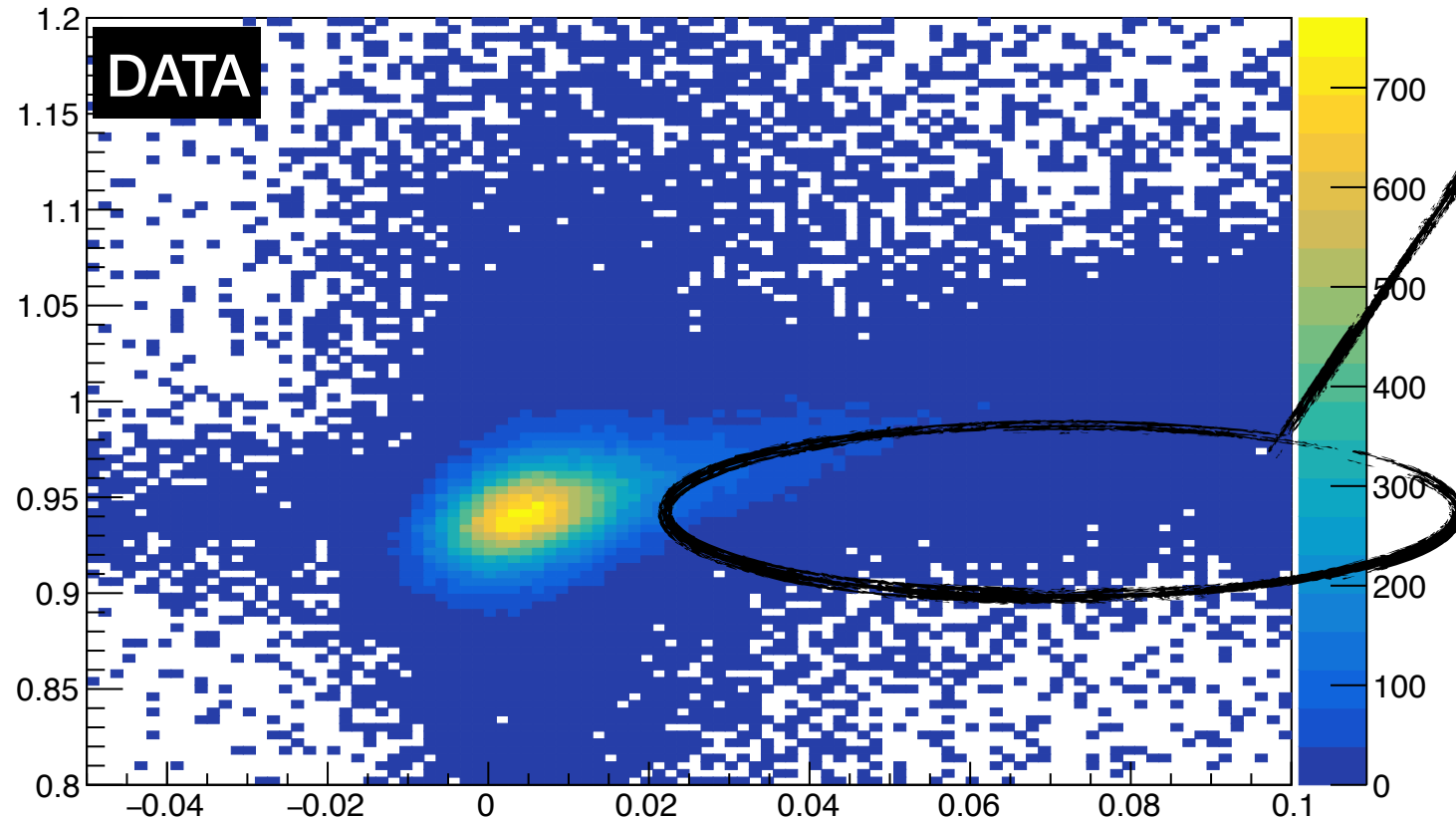
W:Em {Weight*(abs(h_delta)<8.&&e_delta>-10&&e_delta<22.)}

**SIMC: after simulating
collimator energy loss**



P.kin.primary.W:H.kin.secondary.emiss {abs(H.gtr.dp)<8.&&P.gtr.dp>-10&&P.gtr.dp<22.}

DATA

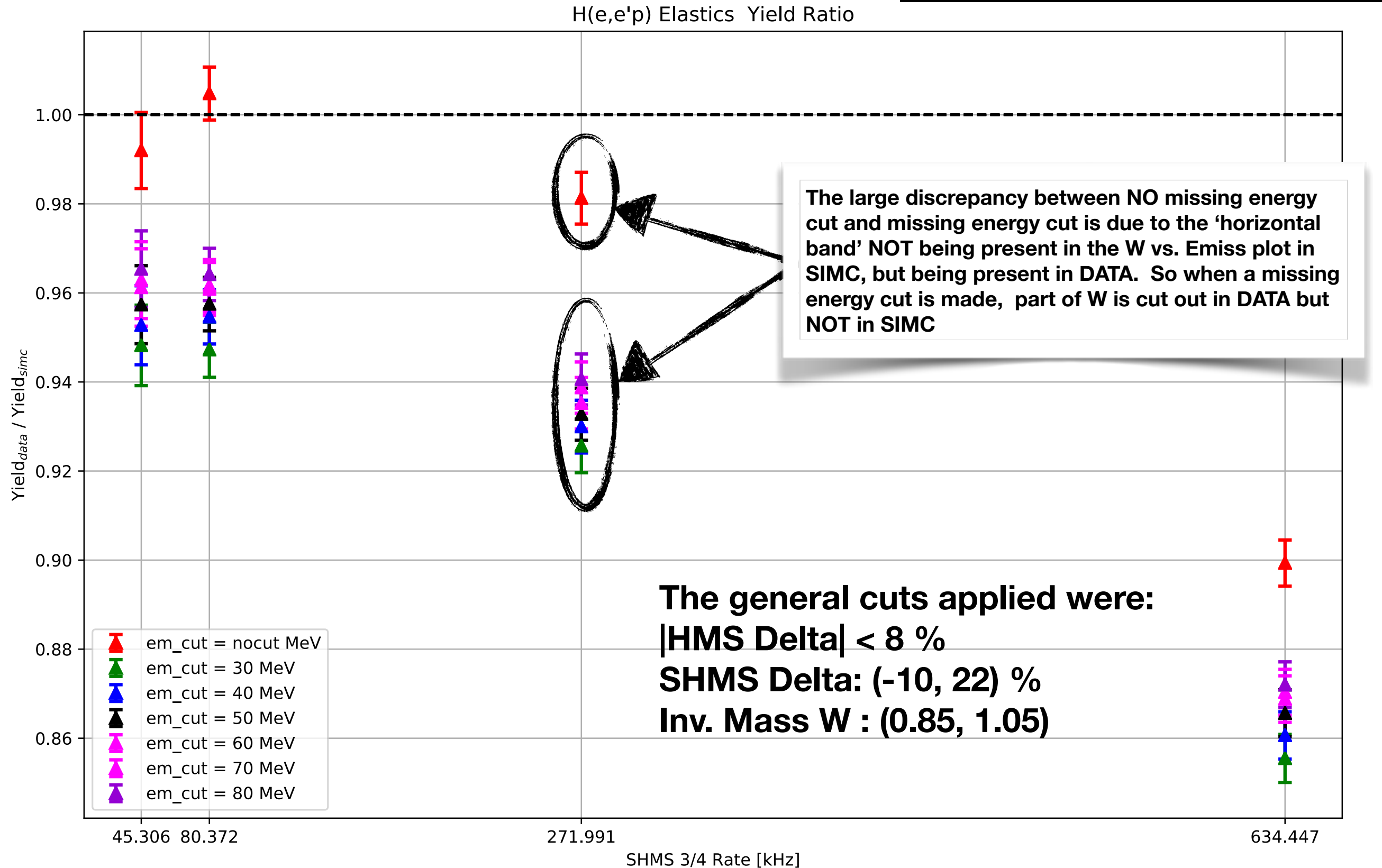


After simulating energy loss in collimator, horizontal band shows up in the W vs. E_{miss} plot. This indicates that SIMC is properly simulating $H(e,e'p)$ protons that interacted and lost energy (hence large missing energy), but still form a coincidence trigger so that W is reconstructed at the proton mass.

This solves the “Missing Energy Cut” problem, so now, when a missing energy cut is made in simc, W events are also cut out in SIMC, whereas before, the W event would remain intact resulting in a smaller (dataY / simcY) yield ratio than expected.

Missing Energy Cut Studies

**NO Energy Loss Simulated
in the Collimator**



Missing Energy Cut Studies

Energy Loss Simulated
in the Collimator

H(e,e'p) Elastics Yield Ratio

