

EMCal Divider Study

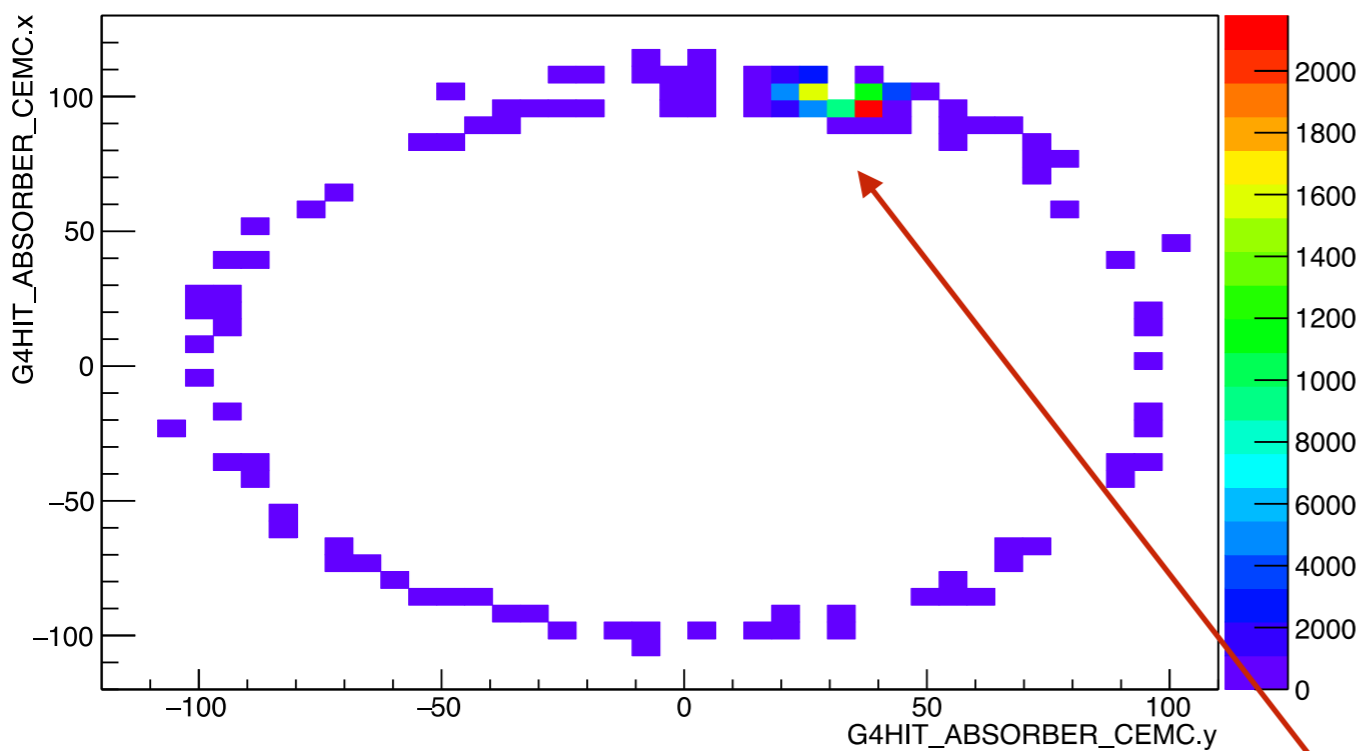
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11/15/17

Overview

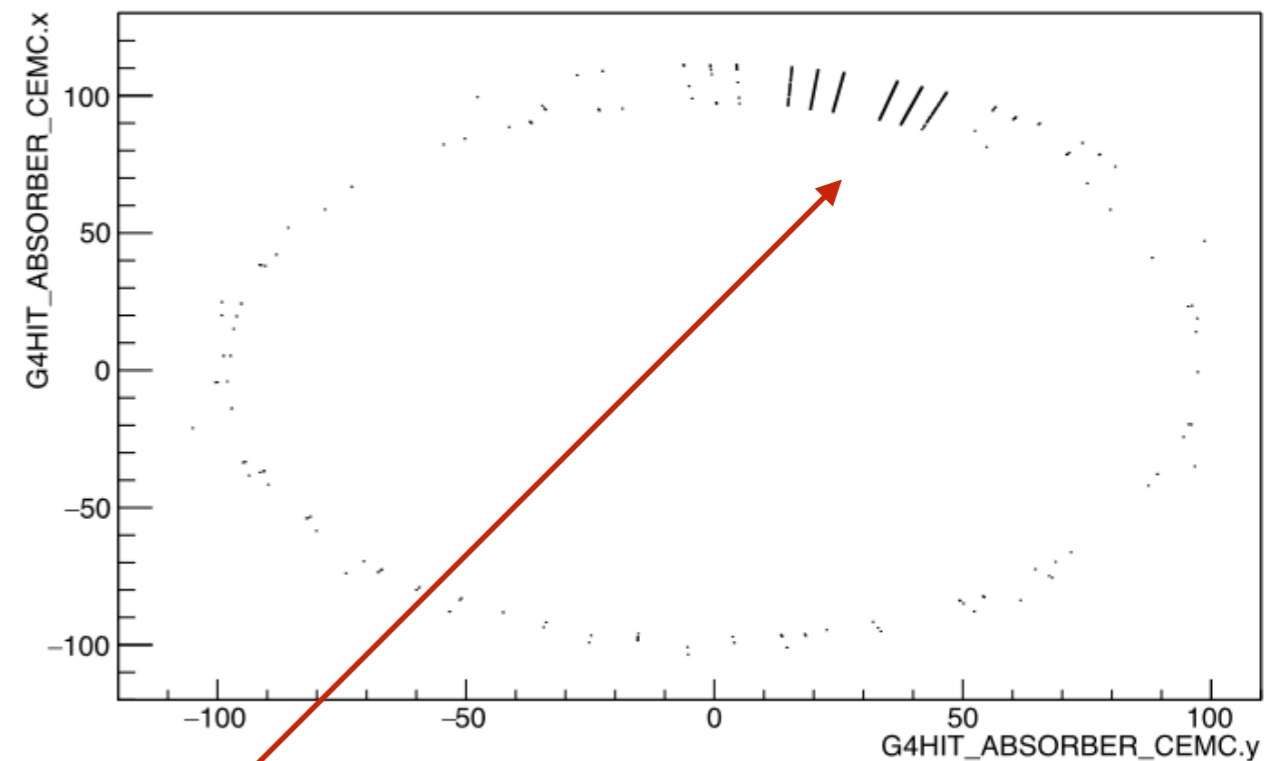
- Reminder: Last few weeks Jin submitted pull requests which allows us to adjust divider width and material in simulation
- Performed single particle simulations with various divider materials
- Simulation setup:
 - Electrons or positrons at 5 GeV, photons at 20 GeV in p_T
 - $0.4 < \eta < 0.5$
 - $0.2 < \phi < 0.4$ (1 sector)

Example DSTReader Plots Showing Divider Hits

G4HIT_ABSORBER_CEMC.x:G4HIT_ABSORBER_CEMC.y {isOnDivider}



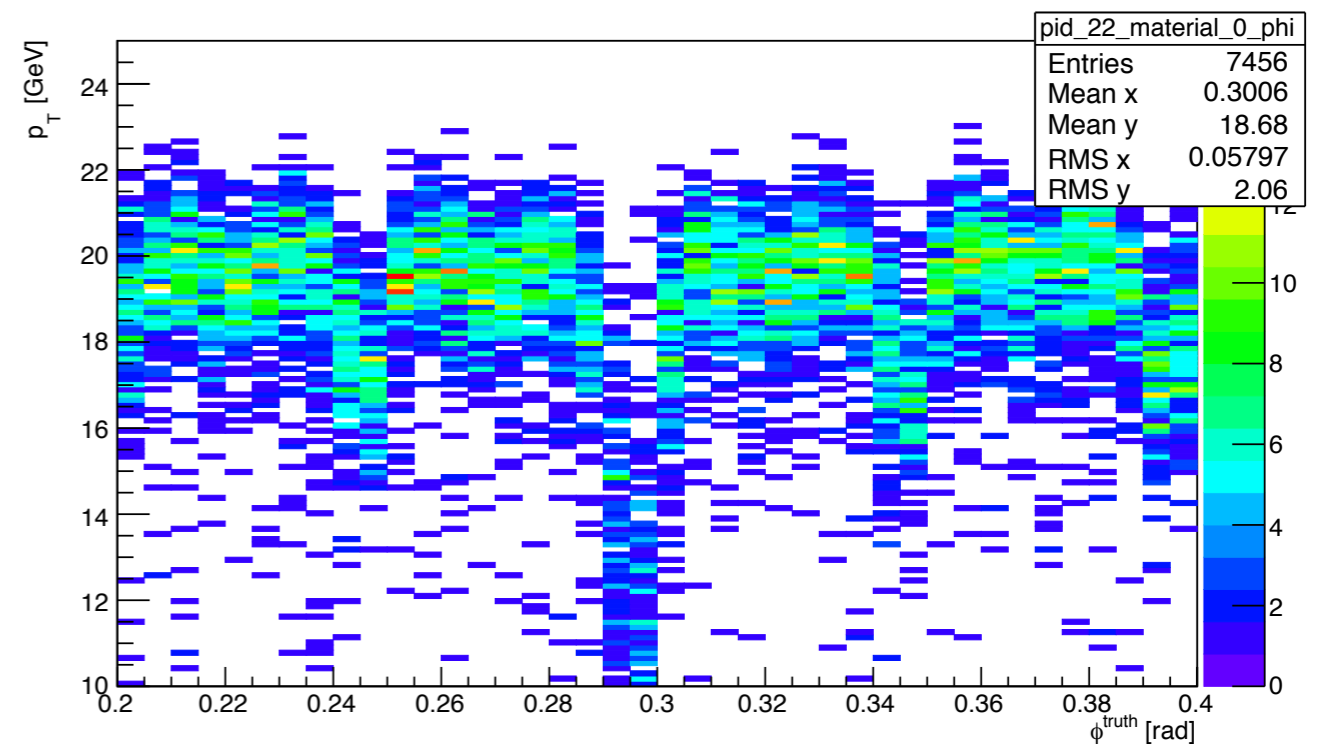
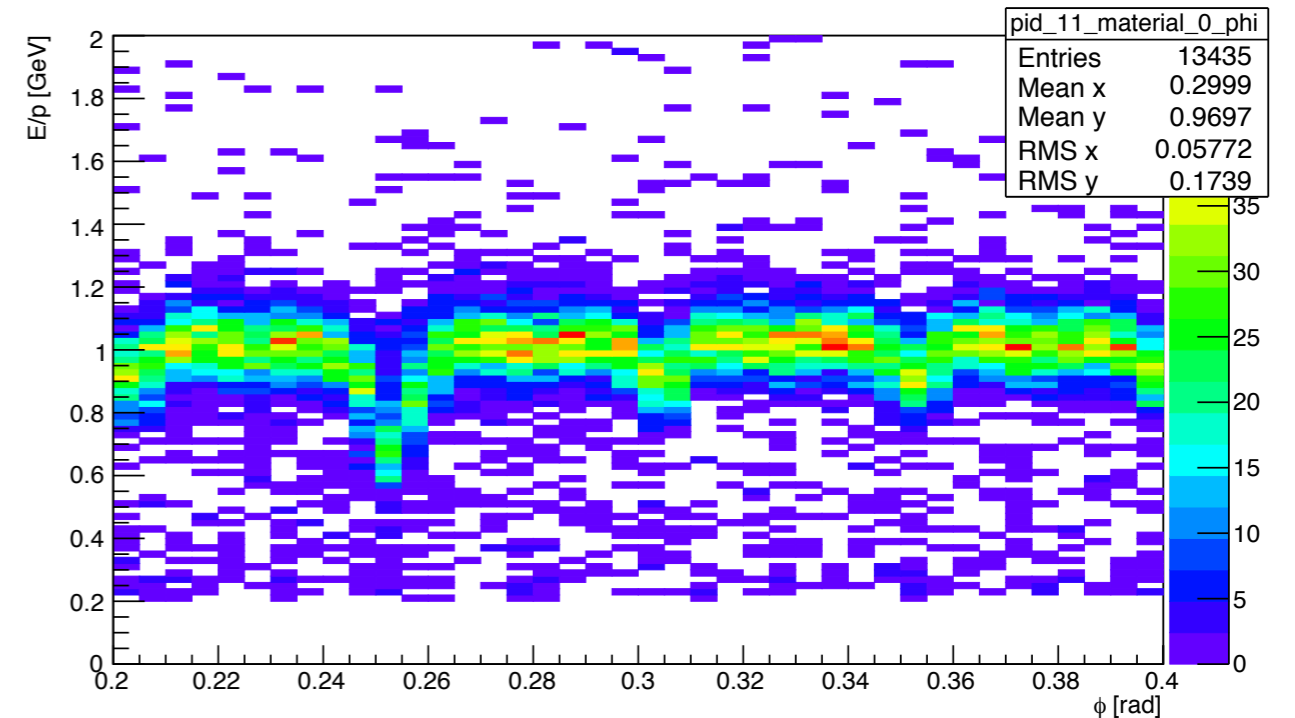
G4HIT_ABSORBER_CEMC.x:G4HIT_ABSORBER_CEMC.y {isOnDivider}



$$0.2 < \phi < 0.4$$

Example Energy Response

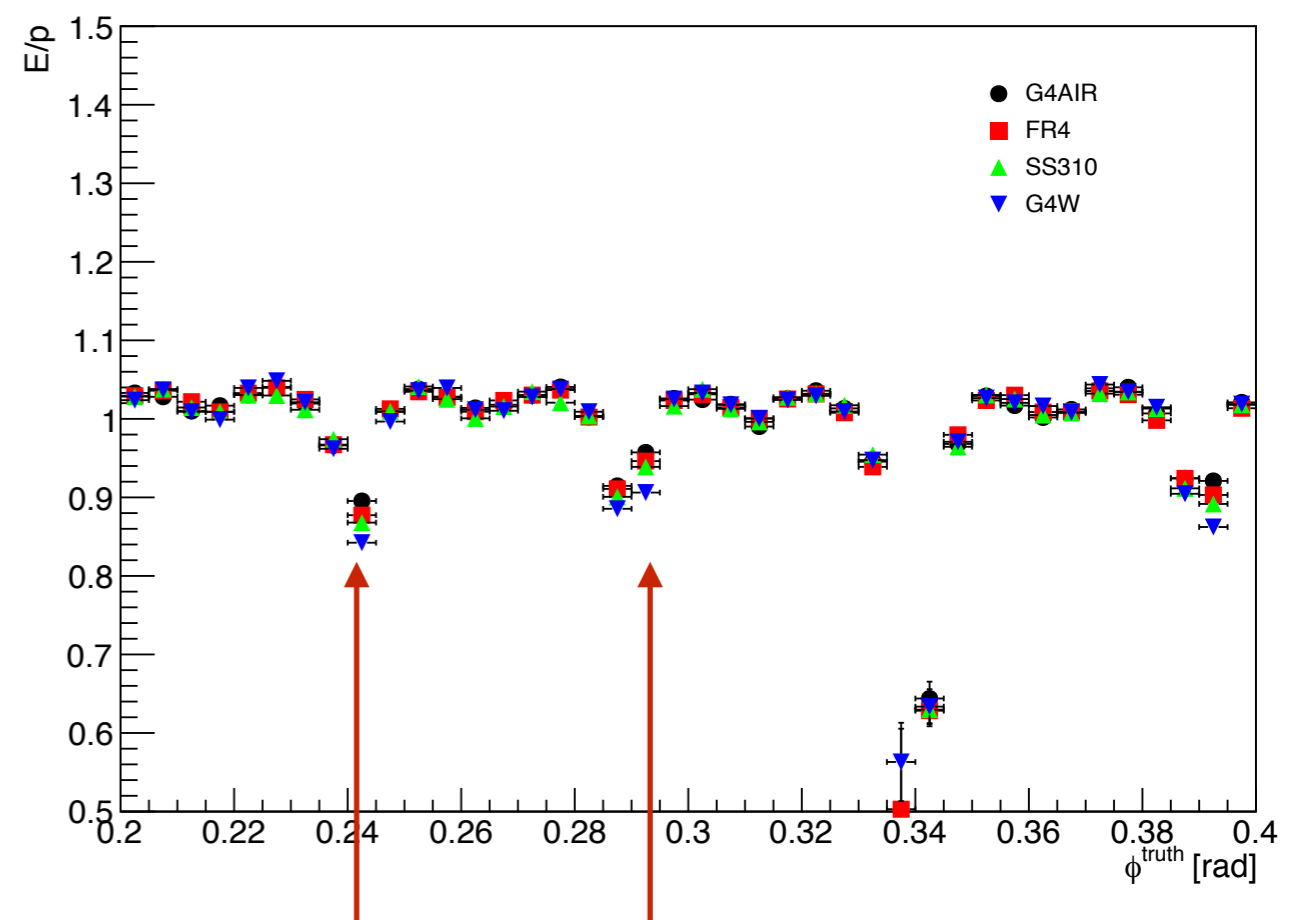
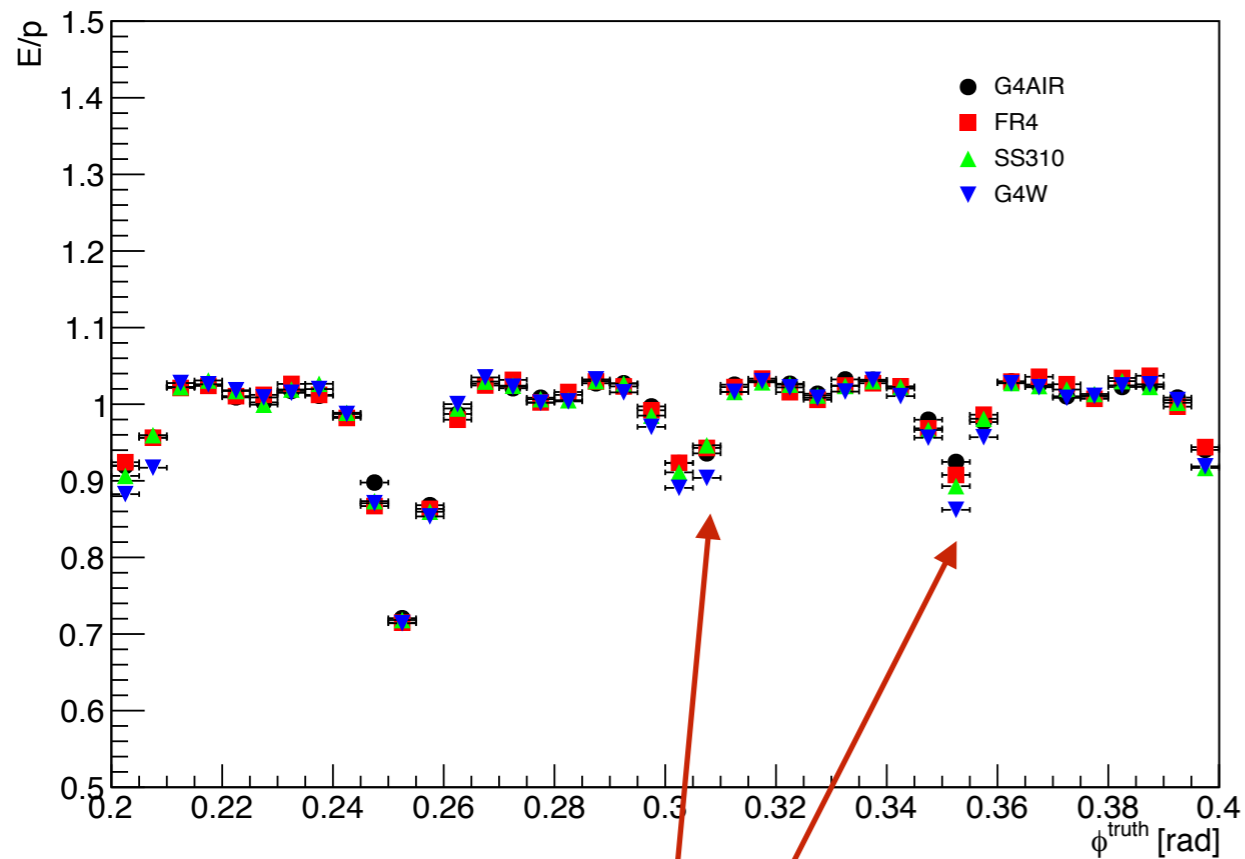
- Example energy response for 5 GeV electrons (top) or 20 GeV photons (bottom) in G4AIR
 - Photons suffer a bit from statistics
- This is without the position dependent energy recalibration
- Fit each slice with a Gaussian and plot the mean energy responses as a function of particle and divider material (G4AIR, FR4, SS310, G4W)



Energy Responses as a Function of Material

Electron

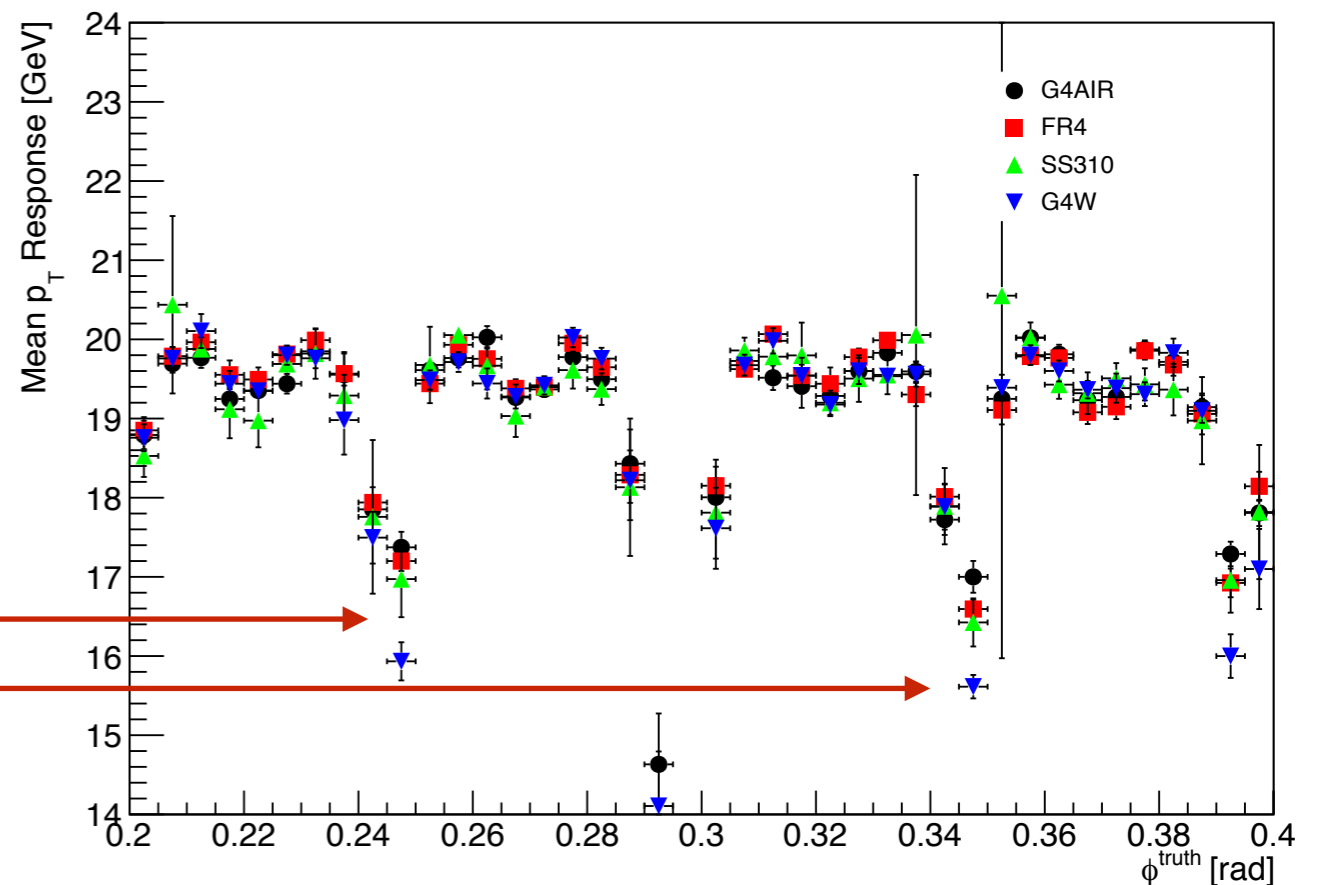
Positron



- There is some indication of a material dependence in between blocks, but it appears to be small

Photon Response

- Even with limited statistics can see some material dependence at block boundaries
- Statistics are lacking though
- Running more simulations but I believe that the electron/positron responses tell us what we would like to know

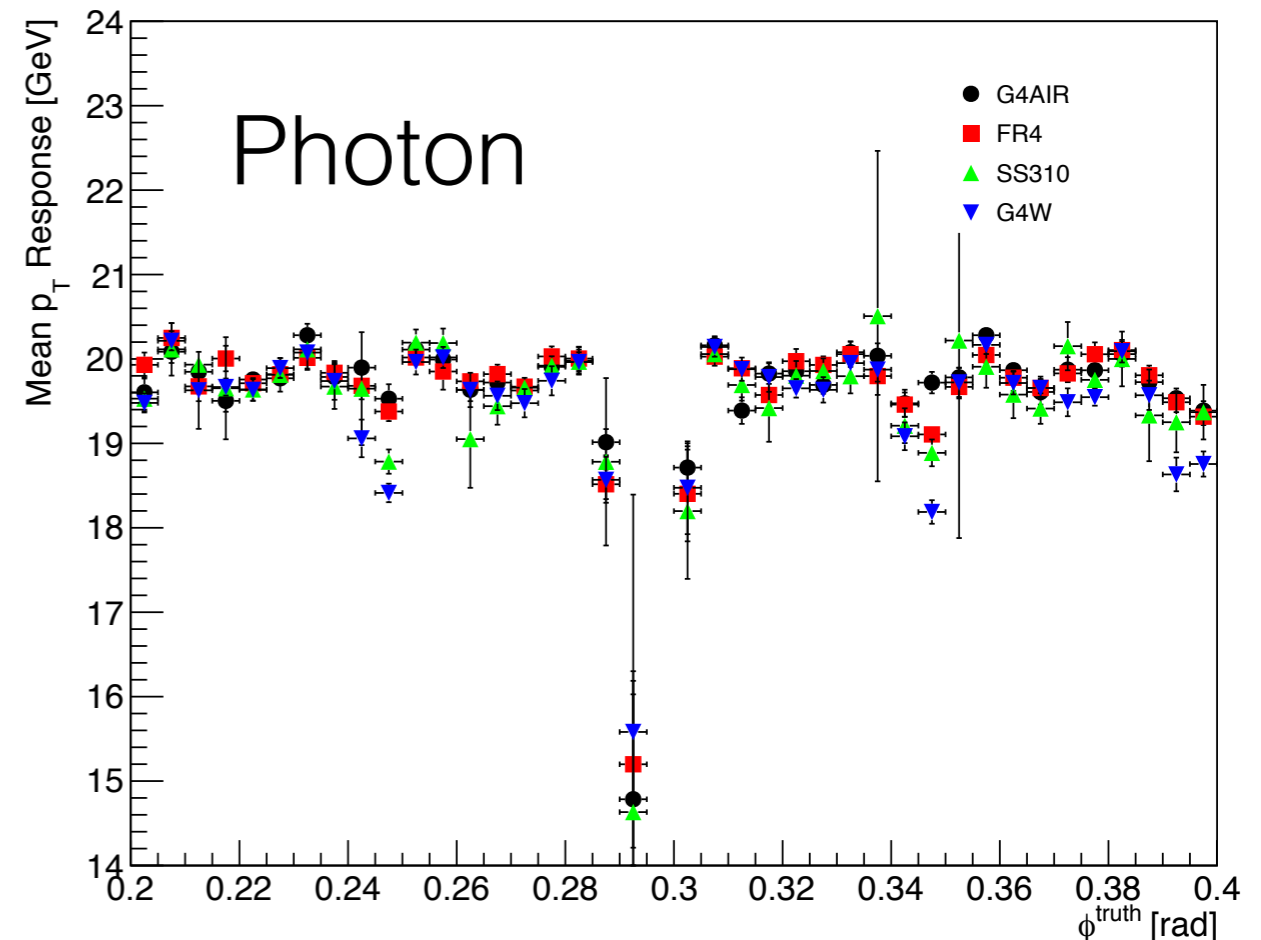
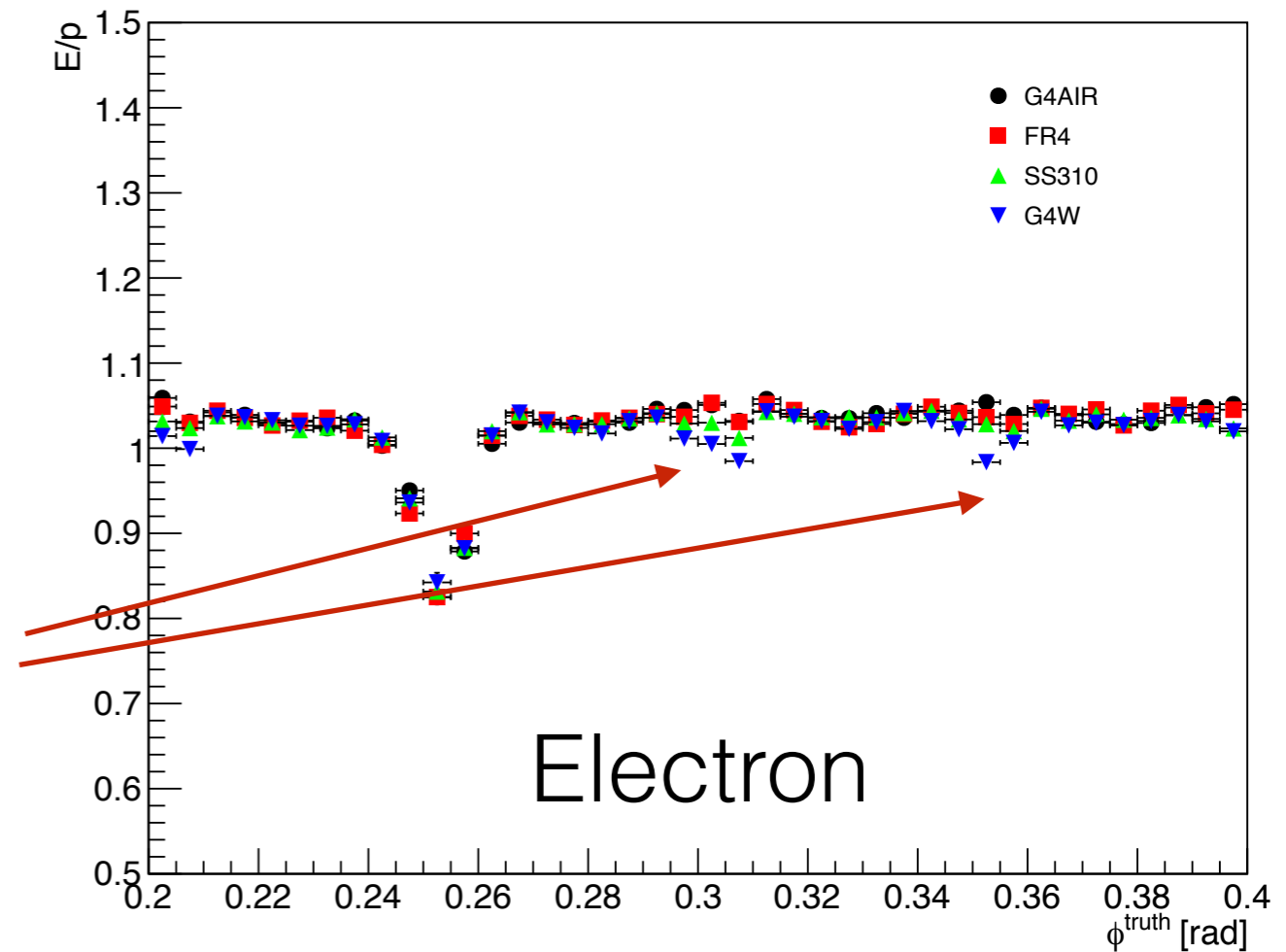
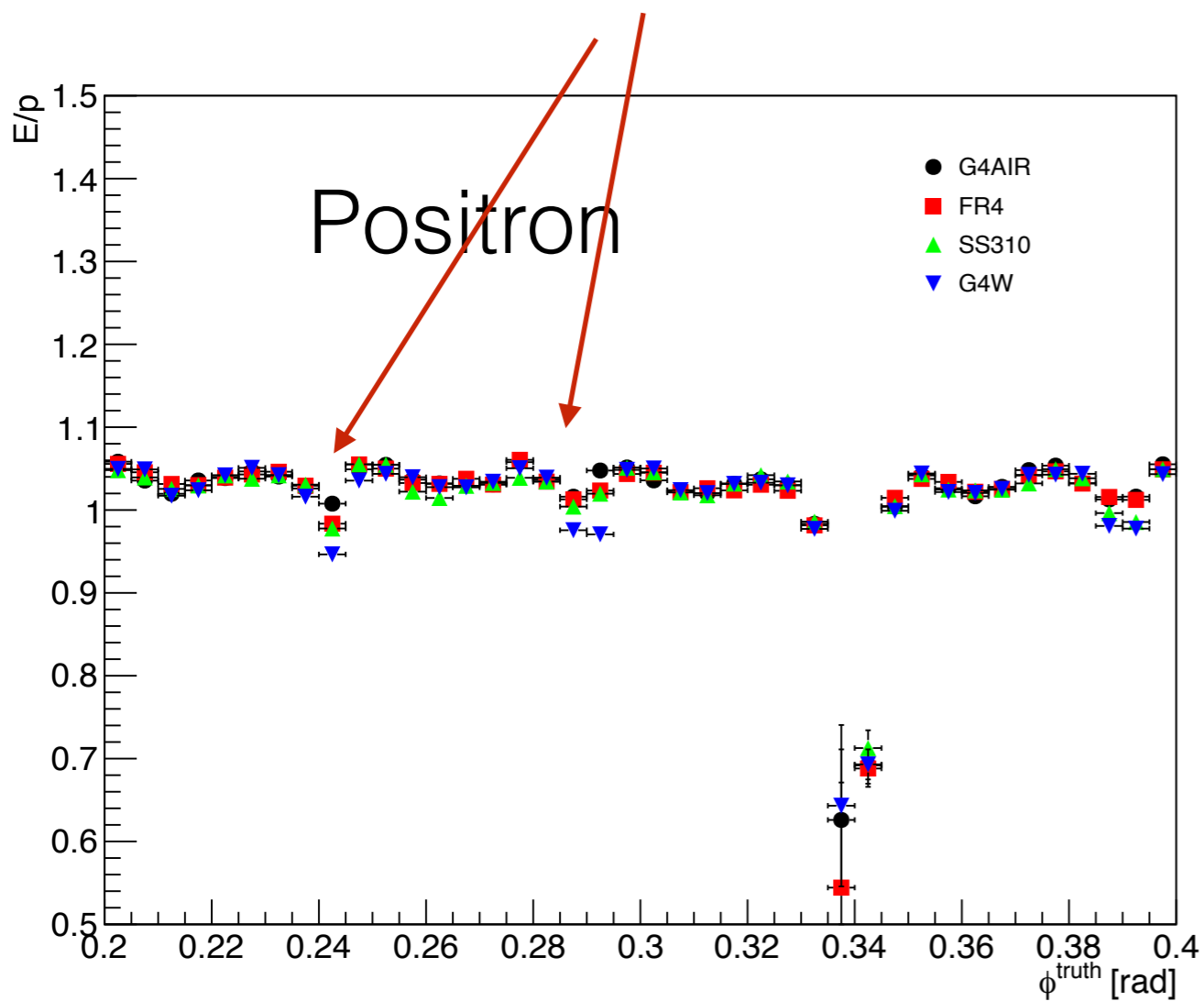


Conclusions

- There is a slight response difference between the 4 materials
 - Looks to be an 8% effect at worse from G4AIR-G4W, 3-4% effect at best
 - Difference between G4AIR and SS310 is at most 3%.
Difference between SS310 and FR4 is at most 2%
 - Note also that the position dependent correction makes this difference smaller (see backups)
- I am running more statistics for the photons, but based on the electrons/positrons the effect appears to be a few percent

Responses with Position Recalibration

Responses after position recalibration show some material dependence in block boundaries



Example energy deposition in the divider per event [GeV]

G4AIR

150 * 0 *
 * 151 * 3.555e-06 *
 * 152 * 3.497e-05 *
 * 153 * 2.453e-06 *
 * 154 * 2.955e-06 *
 * 155 * 3.763e-06 *
 * 156 * 0 *
 * 157 * 7.596e-07 *
 * 158 * 9.346e-08 *
 * 159 * 4.315e-06 *
 * 160 * 1.395e-05 *
 * 161 * 7.346e-07 *
 * 162 * 1.380e-06 *
 * 163 * 2.131e-05 *
 * 164 * 2.610e-06 *
 * 165 * 7.224e-07 *
 * 166 * 4.837e-08 *
 * 167 * 1.454e-05 *
 * 168 * 2.716e-06 *
 * 169 * 1.931e-05 *
 * 170 * 3.390e-05 *
 * 171 * 8.596e-07 *
 * 172 * 1.401e-07 *
 * 173 * 8.666e-07 *
 * 174 * 1.030e-07 *

G4W

* 125 * 0.0292929 *
 * 126 * 0.0197231 *
 * 127 * 0.0018729 *
 * 128 * 0.0119231 *
 * 129 * 0.0091332 *
 * 130 * 0.0155842 *
 * 131 * 0.0442088 *
 * 132 * 0.0130847 *
 * 133 * 0.0028971 *
 * 134 * 0.0008931 *
 * 135 * 0.1326771 *
 * 136 * 0.0824766 *
 * 137 * 0.0202192 *
 * 138 * 0.0019179 *
 * 139 * 0.0171066 *
 * 140 * 0.4943101 *
 * 141 * 0.0048306 *
 * 142 * 0.1614126 *
 * 143 * 0.0982819 *
 * 144 * 0.0028162 *
 * 145 * 0.0060702 *
 * 146 * 0.0498763 *
 * 147 * 0.0436497 *
 * 148 * 0.0482307 *
 * 149 * 0.0059679 *

SS310

* 125 * 0.0010117 *
 * 126 * 0.0032261 *
 * 127 * 0.0001611 *
 * 128 * 0.0012504 *
 * 129 * 0.0128772 *
 * 130 * 0.0033219 *
 * 131 * 0.0037478 *
 * 132 * 0.0041433 *
 * 133 * 0.0007457 *
 * 134 * 0.0049096 *
 * 135 * 0.0041540 *
 * 136 * 0.0093805 *
 * 137 * 0.1239463 *
 * 138 * 0.0023412 *
 * 139 * 0.0095213 *
 * 140 * 0.0031895 *
 * 141 * 0.0005670 *
 * 142 * 0.0415706 *
 * 143 * 0.0005033 *
 * 144 * 0.0043380 *
 * 145 * 0.0561623 *
 * 146 * 0.0003318 *
 * 147 * 0.0052560 *
 * 148 * 0.0031761 *
 * 149 * 0.0050752 *

FR4

* 125 * 0.0007321 *
 * 126 * 0 *
 * 127 * 0.0006566 *
 * 128 * 0.0011789 *
 * 129 * 0.0019222 *
 * 130 * 0.0020956 *
 * 131 * 0.0248396 *
 * 132 * 0.0023547 *
 * 133 * 0.0362140 *
 * 134 * 0.0004648 *
 * 135 * 0.0418466 *
 * 136 * 0.0011482 *
 * 137 * 0.0312298 *
 * 138 * 0.0259616 *
 * 139 * 0.0006351 *
 * 140 * 0.0005105 *
 * 141 * 0.0002837 *
 * 142 * 0.0013796 *
 * 143 * 7.863e-05 *
 * 144 * 0.0004807 *
 * 145 * 0.0002420 *
 * 146 * 0.0119910 *
 * 147 * 0.0382477 *
 * 148 * 0.0297400 *
 * 149 * 0 *