

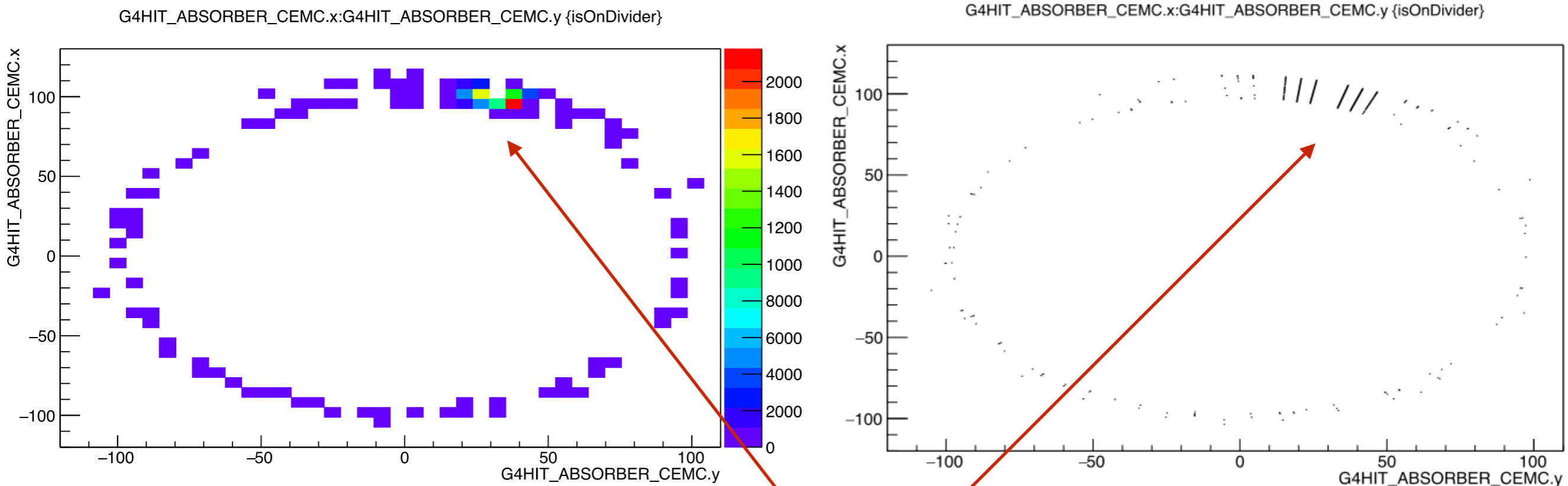
EMCal Divider Study

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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)

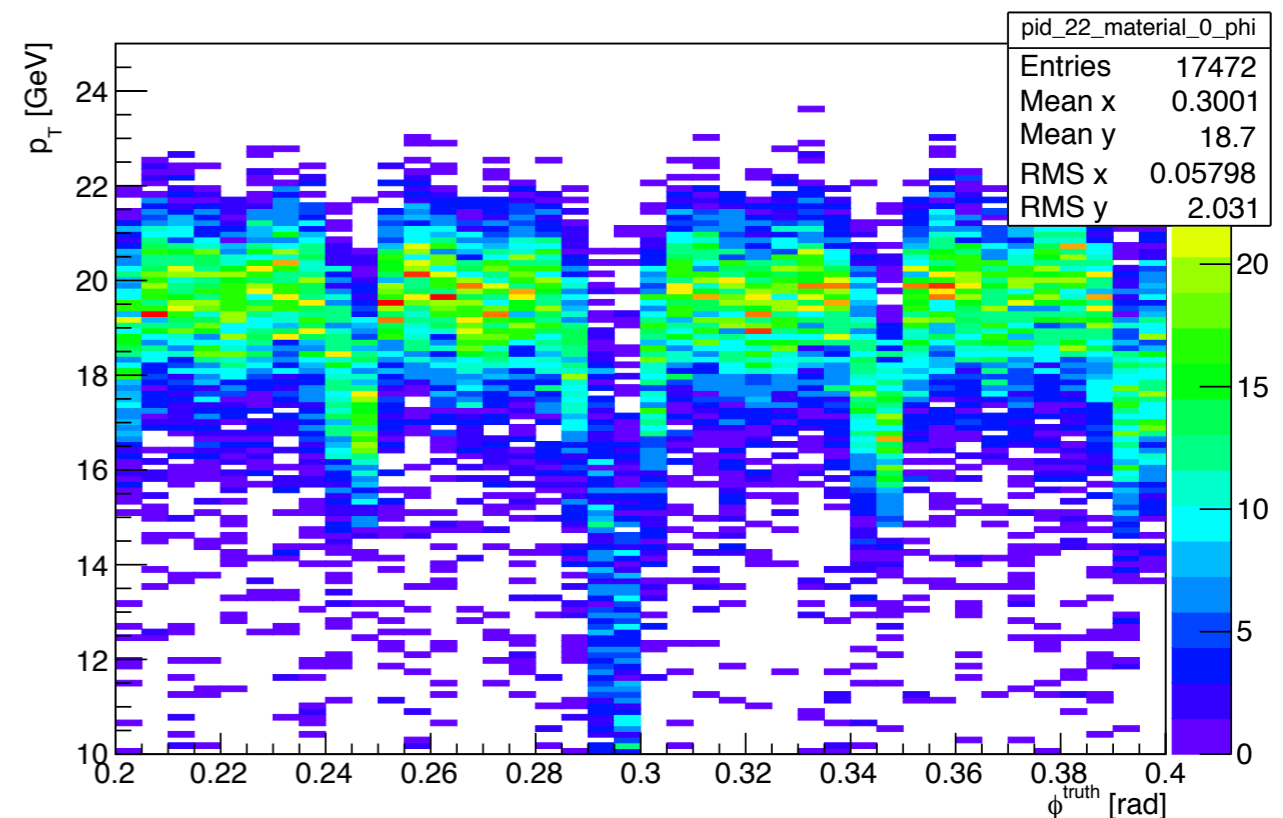
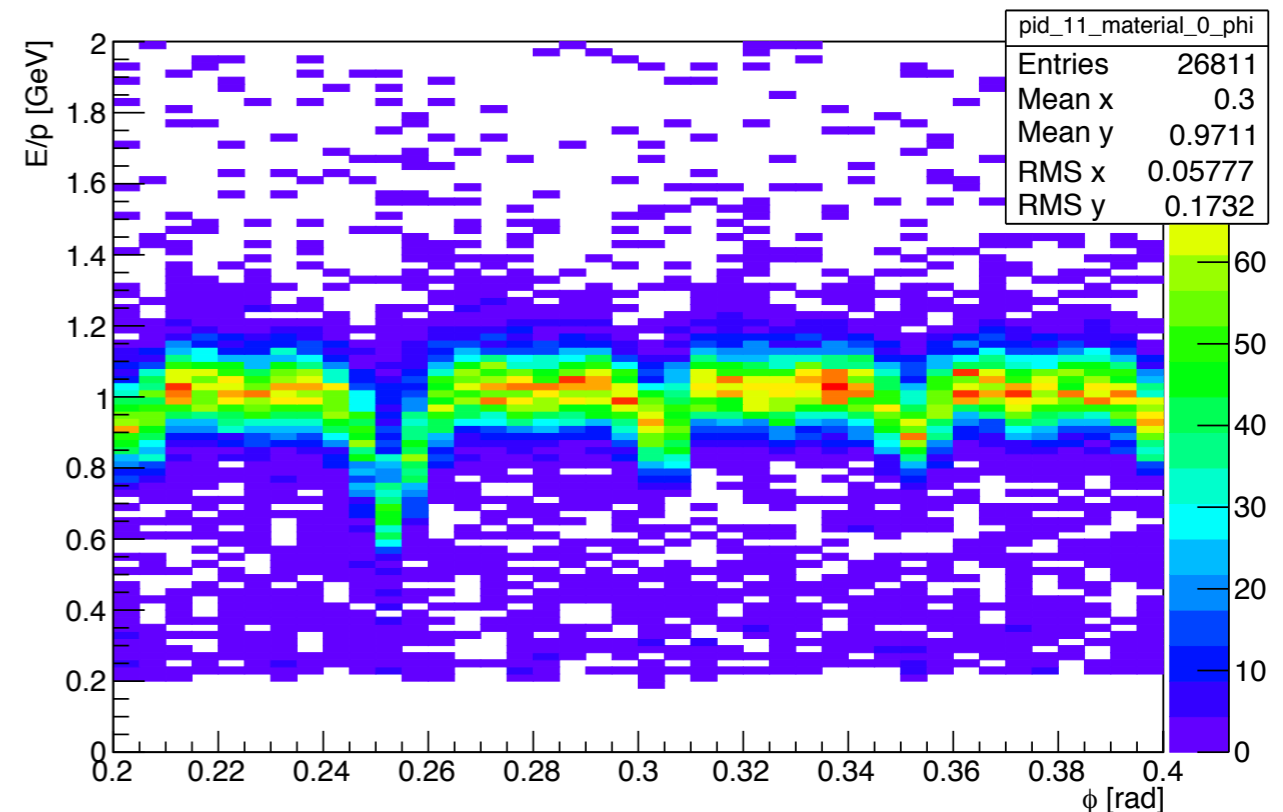
Example DSTReader Plots Showing Divider Hits



$$0.2 < \phi < 0.4$$

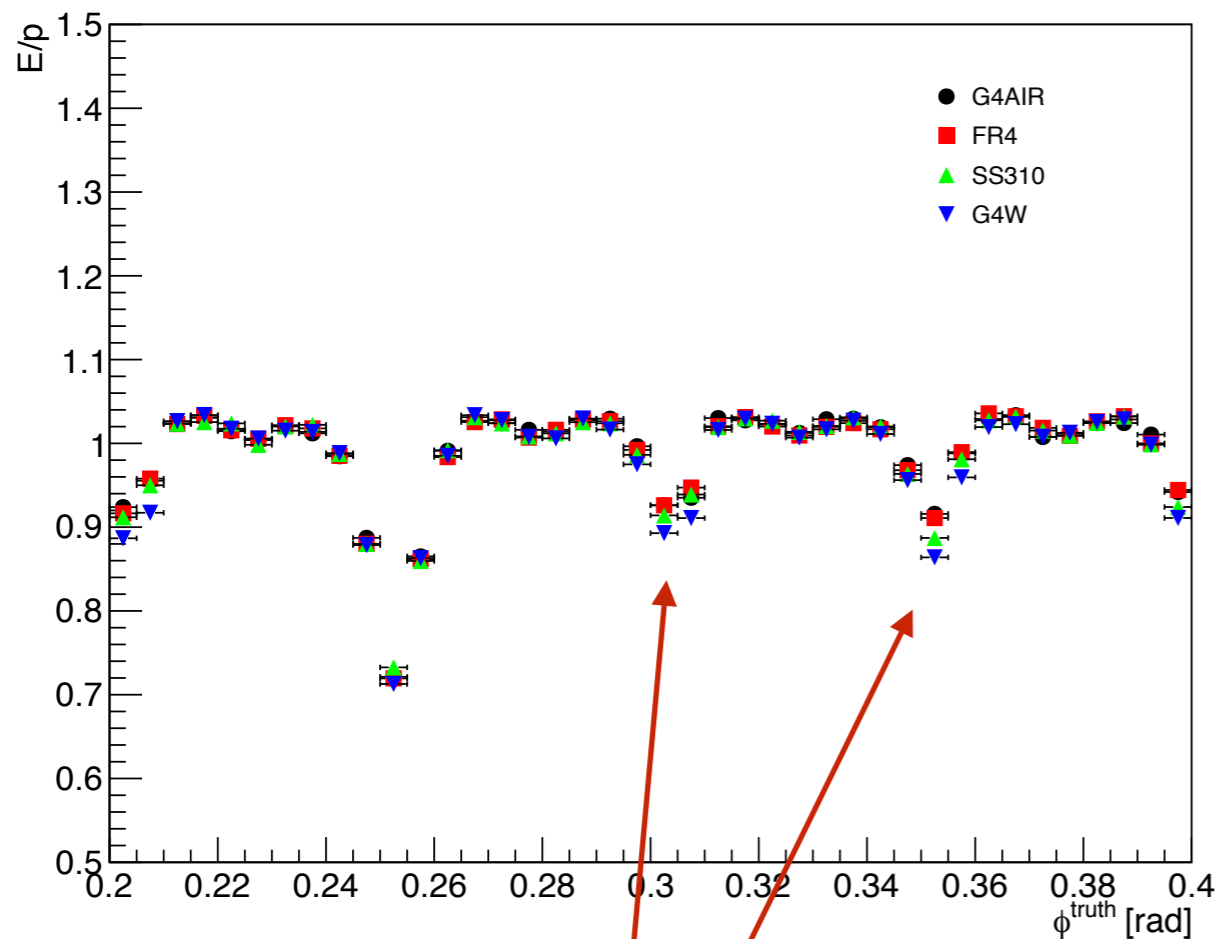
Example Energy Response

- Example energy response for 5 GeV electrons (top) or 20 GeV photons (bottom) in G4AIR
- 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)

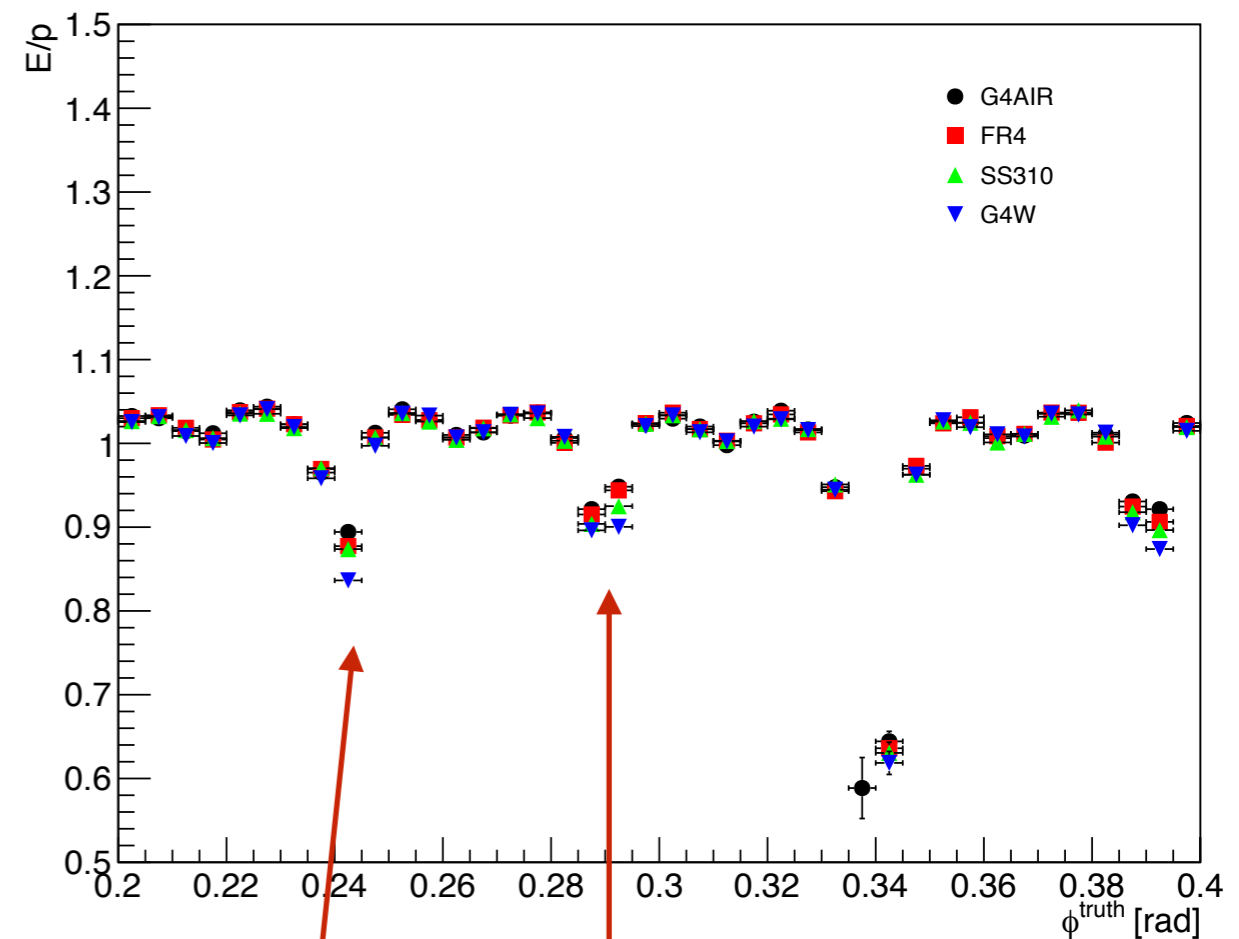


Energy Responses as a Function of Material

Electron



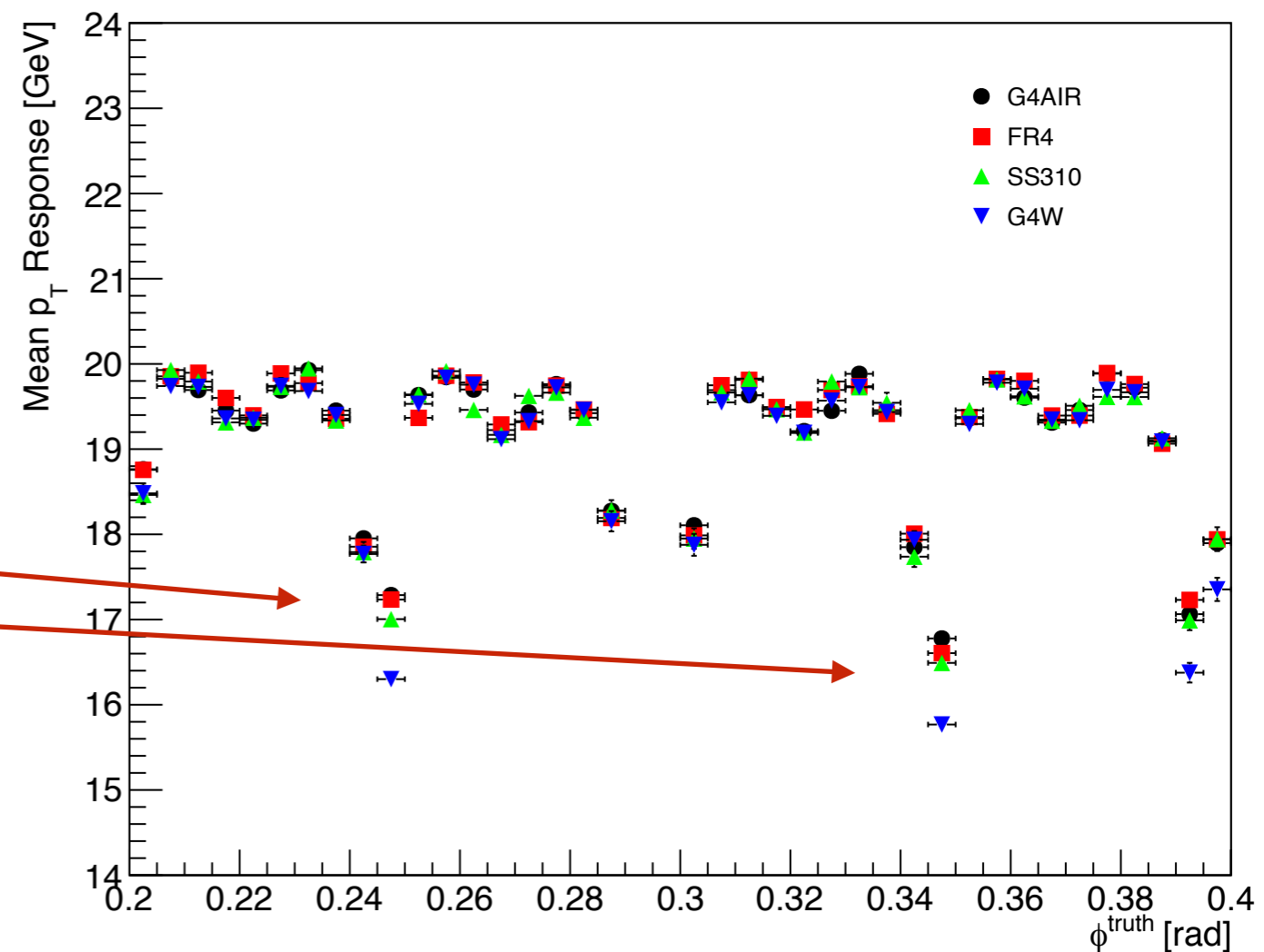
Positron



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

Photon Response

- Clear material dependence in the photon response
- Significant drop off when using G4W
- AIR, FR4, and SS410 are all reasonably similar

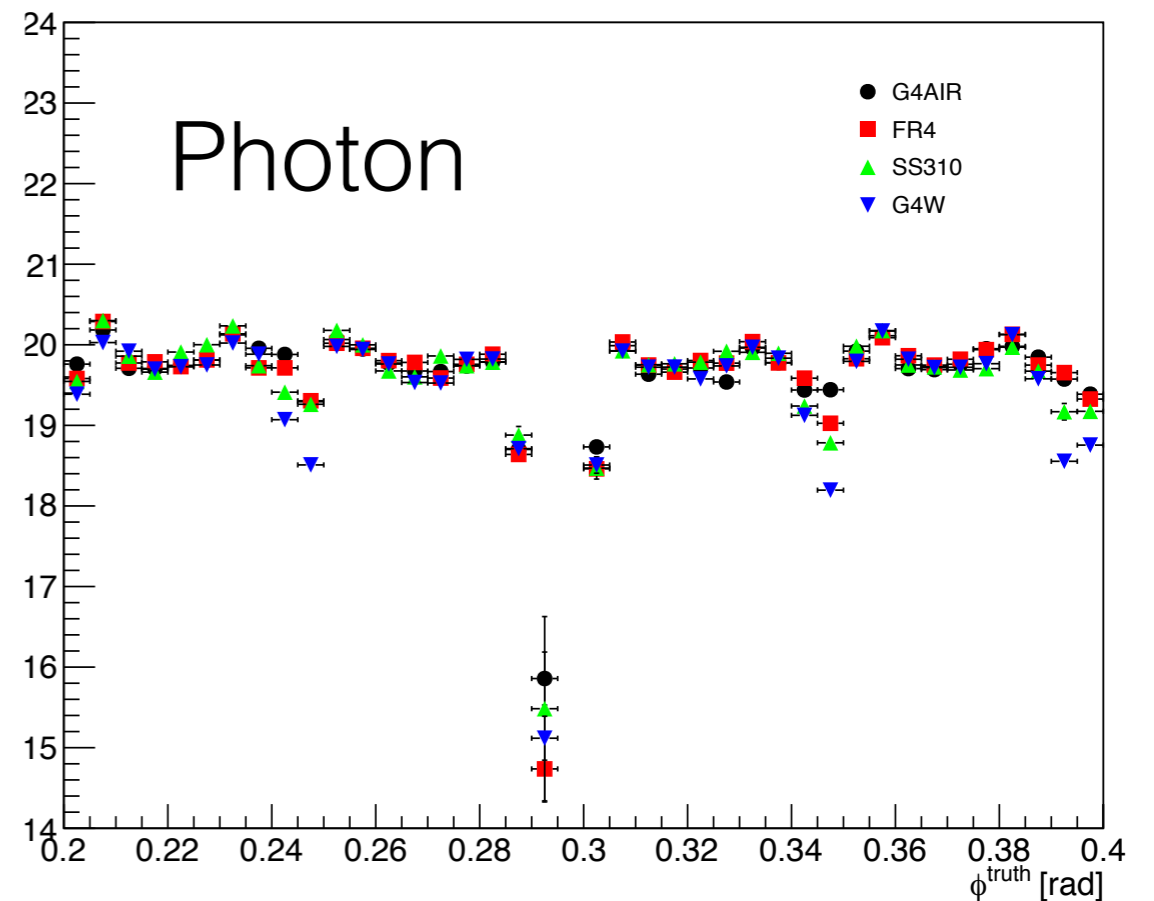
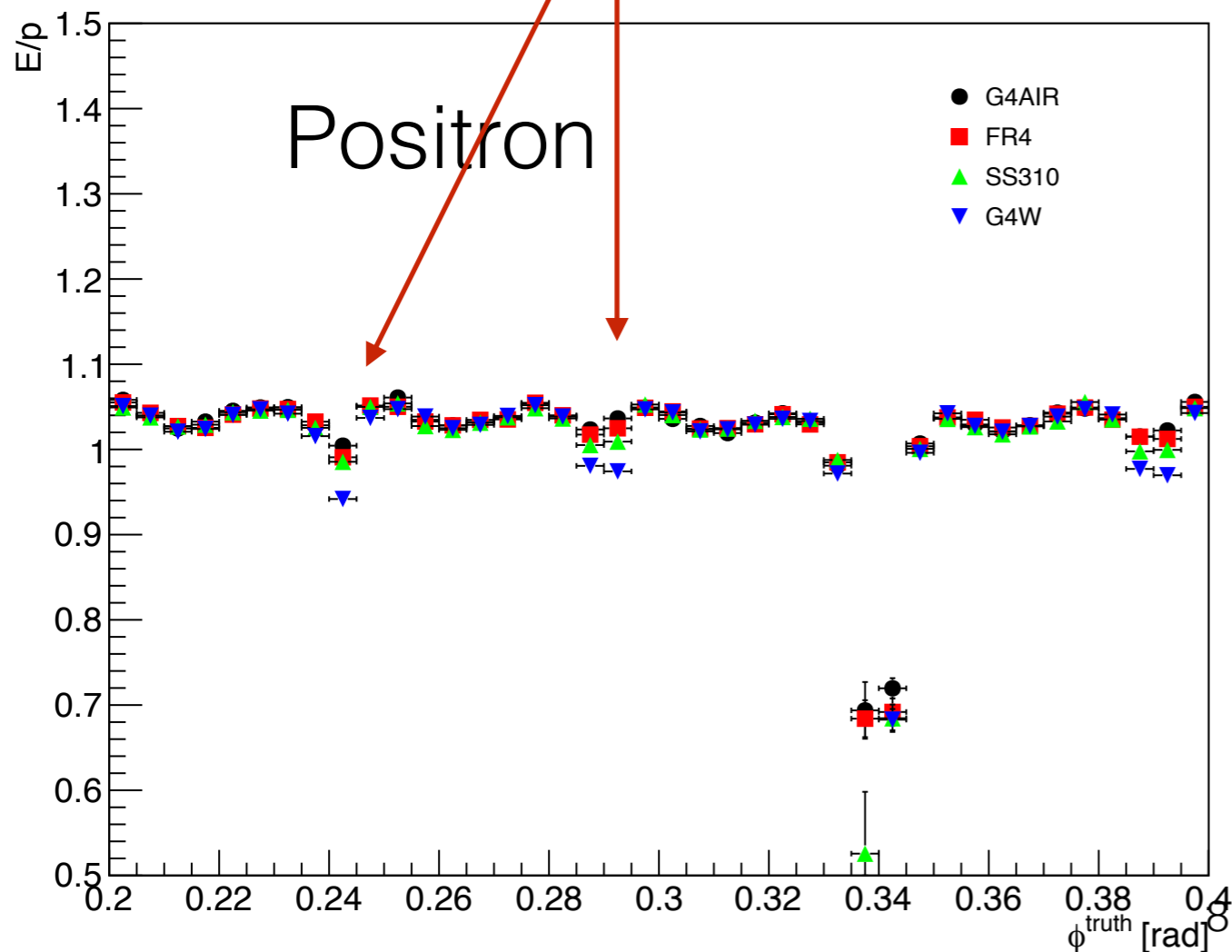
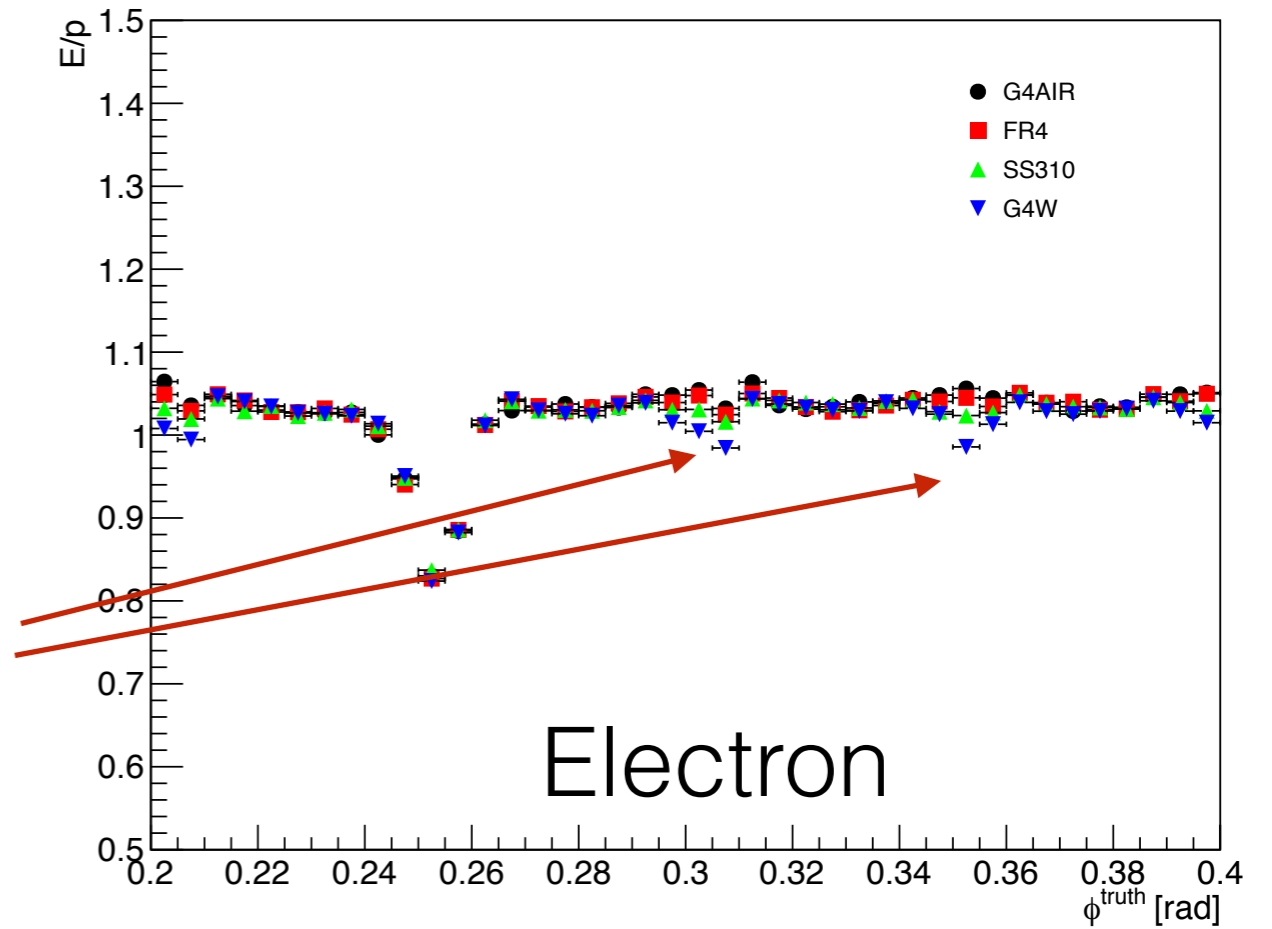


Conclusions

- There is a slight response difference between the 4 materials
 - Looks to be an ~7% 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)

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

G4W

SS310

FR4

150 * 0 *	* 125 * 0.0292929 *	* 125 * 0.0010117 *	* 125 * 0.0007321 *
* 151 * 3.555e-06 *	* 126 * 0.0197231 *	* 126 * 0.0032261 *	* 126 * 0 *
* 152 * 3.497e-05 *	* 127 * 0.0018729 *	* 127 * 0.0001611 *	* 127 * 0.0006566 *
* 153 * 2.453e-06 *	* 128 * 0.0119231 *	* 128 * 0.0012504 *	* 128 * 0.0011789 *
* 154 * 2.955e-06 *	* 129 * 0.0091332 *	* 129 * 0.0128772 *	* 129 * 0.0019222 *
* 155 * 3.763e-06 *	* 130 * 0.0155842 *	* 130 * 0.0033219 *	* 130 * 0.0020956 *
* 156 * 0 *	* 131 * 0.0442088 *	* 131 * 0.0037478 *	* 131 * 0.0248396 *
* 157 * 7.596e-07 *	* 132 * 0.0130847 *	* 132 * 0.0041433 *	* 132 * 0.0023547 *
* 158 * 9.346e-08 *	* 133 * 0.0028971 *	* 133 * 0.0007457 *	* 133 * 0.0362140 *
* 159 * 4.315e-06 *	* 134 * 0.0008931 *	* 134 * 0.0049096 *	* 134 * 0.0004648 *
* 160 * 1.395e-05 *	* 135 * 0.1326771 *	* 135 * 0.0041540 *	* 135 * 0.0418466 *
* 161 * 7.346e-07 *	* 136 * 0.0824766 *	* 136 * 0.0093805 *	* 136 * 0.0011482 *
* 162 * 1.380e-06 *	* 137 * 0.0202192 *	* 137 * 0.1239463 *	* 137 * 0.0312298 *
* 163 * 2.131e-05 *	* 138 * 0.0019179 *	* 138 * 0.0023412 *	* 138 * 0.0259616 *
* 164 * 2.610e-06 *	* 139 * 0.0171066 *	* 139 * 0.0095213 *	* 139 * 0.0006351 *
* 165 * 7.224e-07 *	* 140 * 0.4943101 *	* 140 * 0.0031895 *	* 140 * 0.0005105 *
* 166 * 4.837e-08 *	* 141 * 0.0048306 *	* 141 * 0.0005670 *	* 141 * 0.0002837 *
* 167 * 1.454e-05 *	* 142 * 0.1614126 *	* 142 * 0.0415706 *	* 142 * 0.0013796 *
* 168 * 2.716e-06 *	* 143 * 0.0982819 *	* 143 * 0.0005033 *	* 143 * 7.863e-05 *
* 169 * 1.931e-05 *	* 144 * 0.0028162 *	* 144 * 0.0043380 *	* 144 * 0.0004807 *
* 170 * 3.390e-05 *	* 145 * 0.0060702 *	* 145 * 0.0561623 *	* 145 * 0.0002420 *
* 171 * 8.596e-07 *	* 146 * 0.0498763 *	* 146 * 0.0003318 *	* 146 * 0.0119910 *
* 172 * 1.401e-07 *	* 147 * 0.0436497 *	* 147 * 0.0052560 *	* 147 * 0.0382477 *
* 173 * 8.666e-07 *	* 148 * 0.0482307 *	* 148 * 0.0031761 *	* 148 * 0.0297400 *
* 174 * 1.030e-07 *	* 149 * 0.0059679 *	* 149 * 0.0050752 *	* 149 * 0 *