Performance Comparison

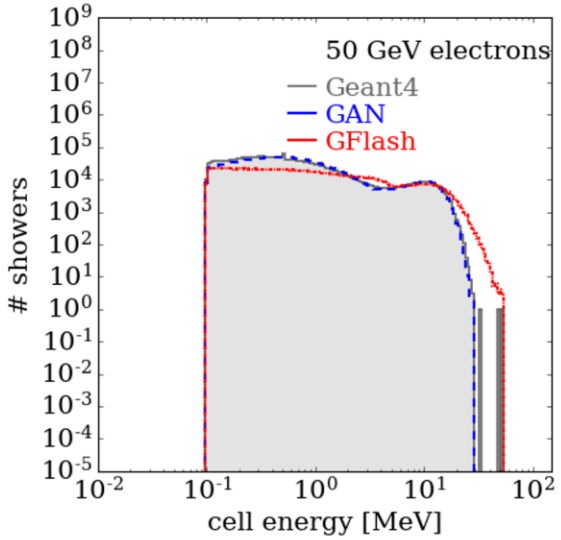
GEANT4, GFLASH, GAN

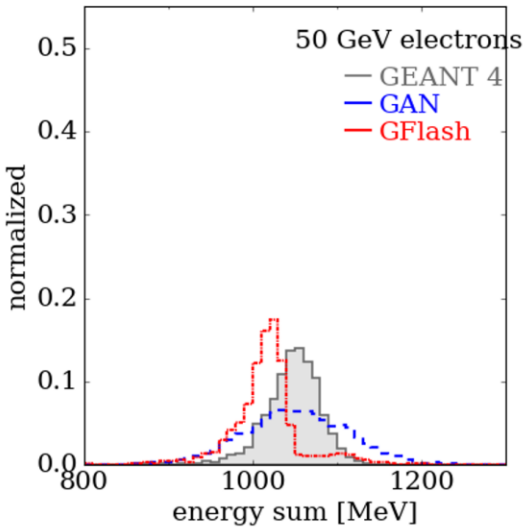
Comparison of all Differential Distributions between Geant4, GFlash and the GAN Network

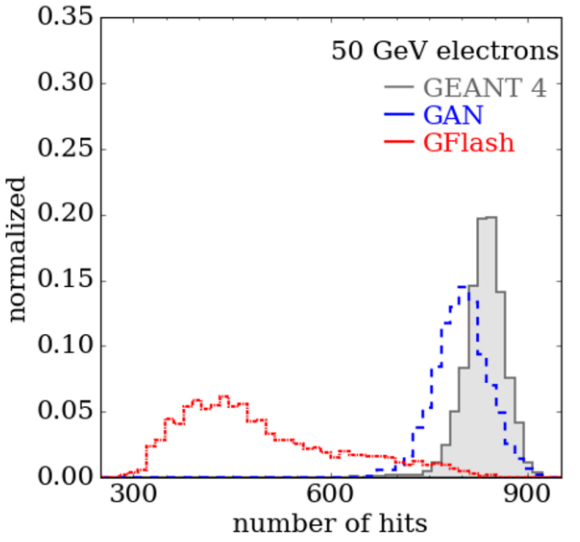
3200 showers
50 GeV electrons
Cut at 0.1 MeV

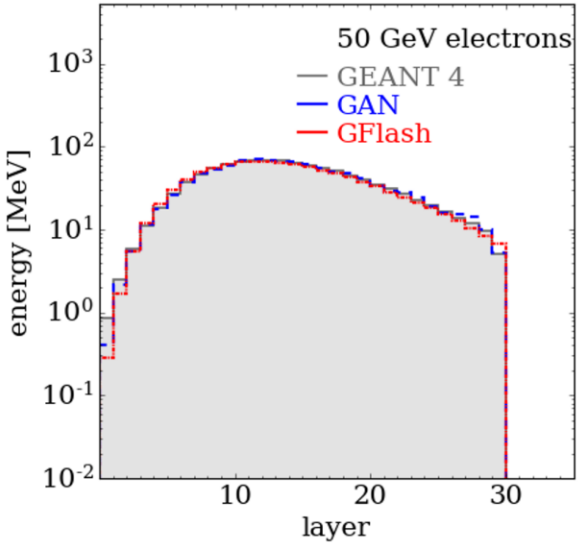
Shape: 30x30x30
Absorber thickness = 5.5mm
Sensitive thickness = 0.12mm

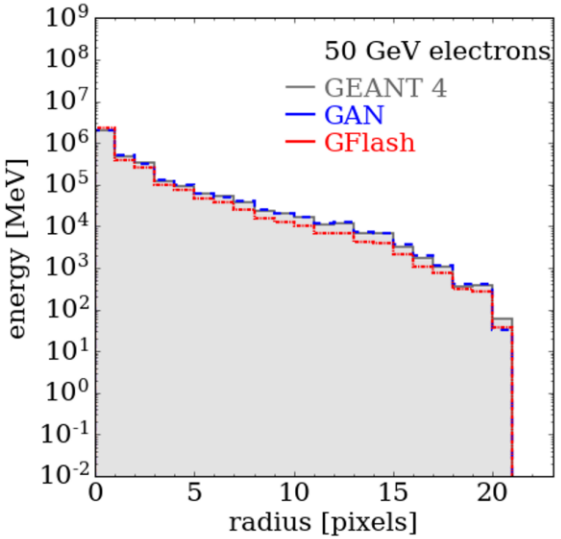
GFlash:
Step size = 0.001 * X_0

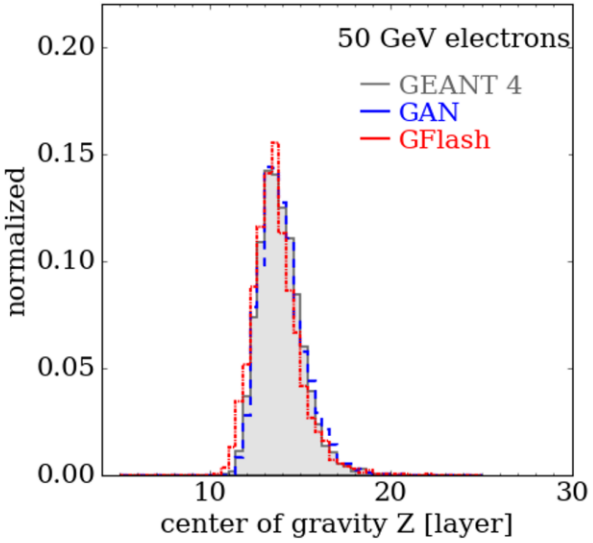












Area Difference

Geant4 & Gflash	Area Difference for each differential Distribution						
Energy [GeV]	**Total E**	**Cell E**	**Occupancy**	**C. o. Gravity**	**Radial E**	**Logitudinal E**	**ø Area Difference**
20	0.507	0.297	0.999	0.088	0.072	0.031	0.332
50	0.504	0.152	0.907	0.092	0.077	0.022	0.292
80	0.461	0.100	0.889	0.110	0.078	0.021	0.277
ø Area Difference for each Distribution	0.490	0.183	0.932	0.096	0.076	0.025	**0.300**

Table 1: Area Difference of 20, 50 and 80 GeV electron showers for six differential distributions between Geant4 and GFlash.

Factor: 2.24

Geant4 & GAN	Area Difference for each differential Distribution						
Energy [GeV]	**Total E**	**Cell E**	**Occupancy**	**C. o. Gravity**	**Radial E**	**Logitudinal E**	**ø Area Difference**
20	0.311	0.087	0.195	0.032	0.056	0.034	0.119
50	0.313	0.070	0.425	0.033	0.037	0.017	0.149
80	0.363	0.060	0.311	0.034	0.022	0.012	0.134
ø Area Difference for each Distribution	0.329	0.072	0.310	0.033	0.038	0.021	**0.134**

Table 2: Area Difference of 20, 50 and 80 GeV electron showers for six differential distributions between Geant4 and the GAN network.

Computing Time

Model	Energy [GeV]	Computing Time on CPU [ms / shower]	Computing Time on GPU [ms / shower]
GAN	10 - 100	80.774 ± 1.171	5.579 ± 0.0041
GFlash*	10 - 100	149.969	-
Geant4	10 - 100	709,789	-

$2\ t_{GAN,\ CPU} = t_{GF}$

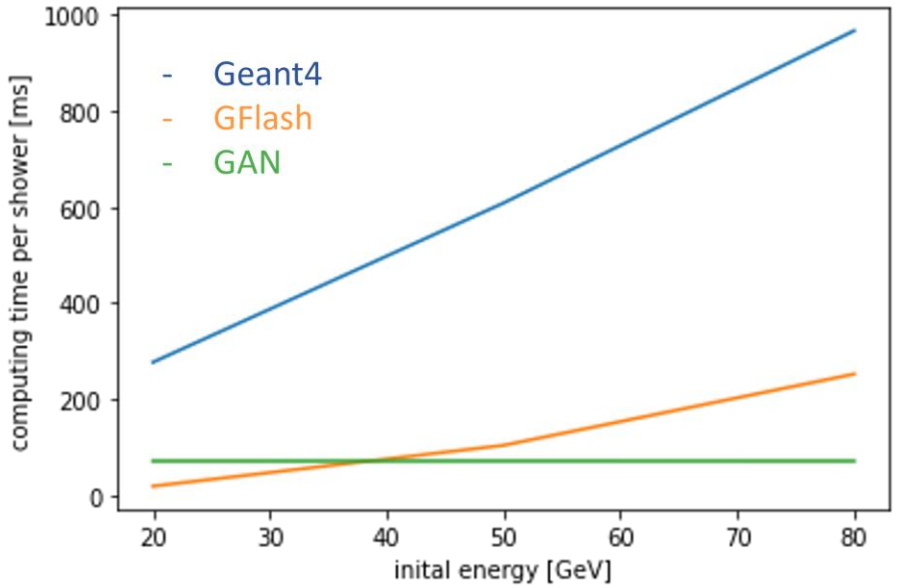
$27\ t_{GAN,\ GPU} = t_{GF}$

$9\ t_{GAN,\ CPU} = t_{G4}$

$127\ t_{GAN,\ GPU} = t_{G4}$

*step size is set to $0.001 * X_0$

Computing t for various electron energies



GFlash Computing t for various step sizes