

GEANT4 simulation of calorimeter and preshower in test beam

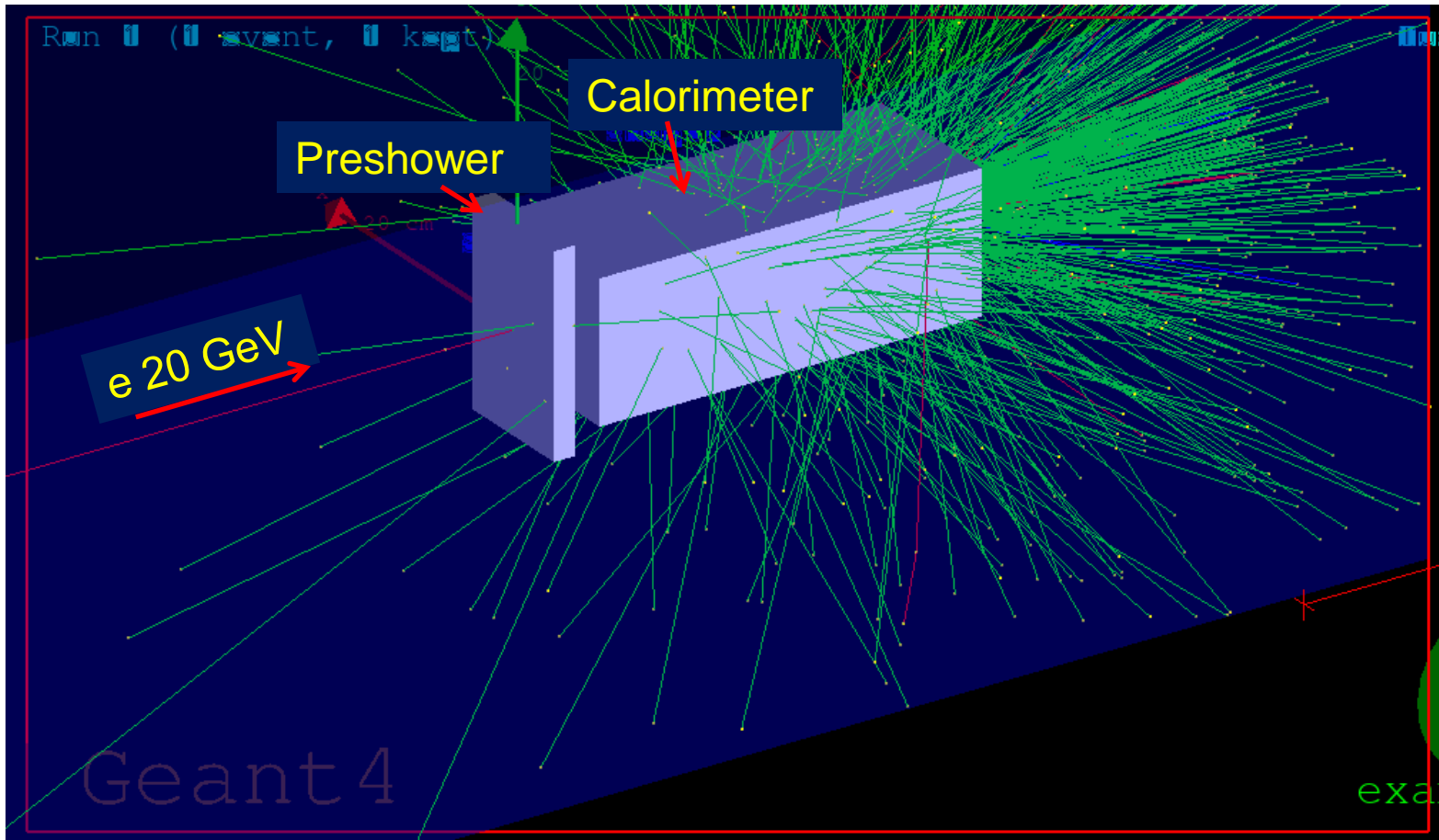
S.Ilinykh¹, V.O.Tikhomirov^{1,2}

¹National Research Nuclear University “MEPhI”

²P.N.Lebedev Physical Institute of the Russian Academy of Sciences


TRD meeting, 4.05.2022

Single event display



- GEANT version 10 (technical problem with using of last version 11)
- Default physics lists
- Preshower: 85x135x5 mm of Pb + 85x135x10 mm scintillator
- Calorimeter: 105x95x265 mm of lead glass

New compared to April 27 presentation: parameters of lead glass were described in wrong way. Old results concerning to lead glass calorimeter simulation are disallowed.

- Our calorimeter block are from OPAL experiment
- Opal paper: lead glass Schott type SF57, but without detail specification
- WA89 paper: the same type of lead glass with specification 
- Take these parameters for our GEANT simulation

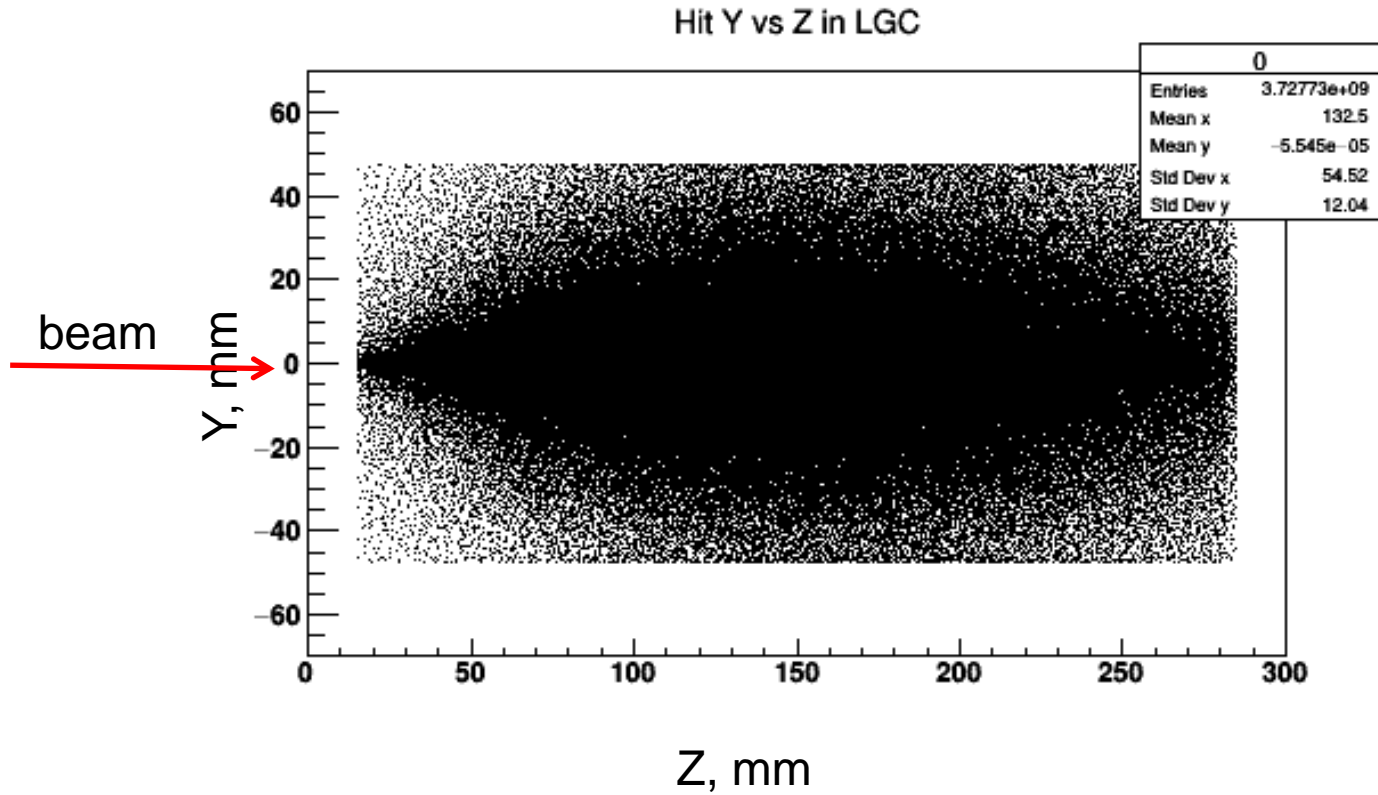
Parameter of Lead Glass

Chemical composition (wt%)

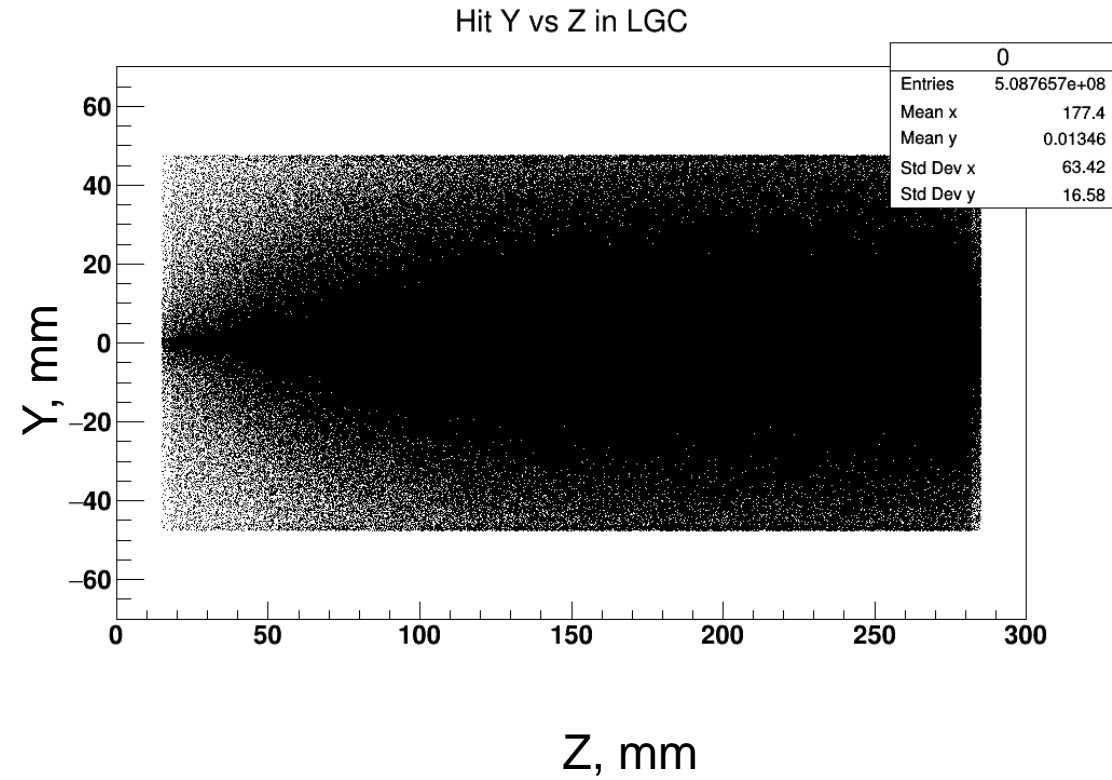
SiO ₂	27.3
PbO	70.9
K ₂ O	0.9
Na ₂ O	0.6
Sb ₂ O ₃	0.3
Radiation length (cm)	1.7
Refractive index	1.8
Density (g/cm ₃)	5.2
Critical energy (MeV)	12.6
Molière unit (X ₀)	1.7

Shower profile in calorimeter

e



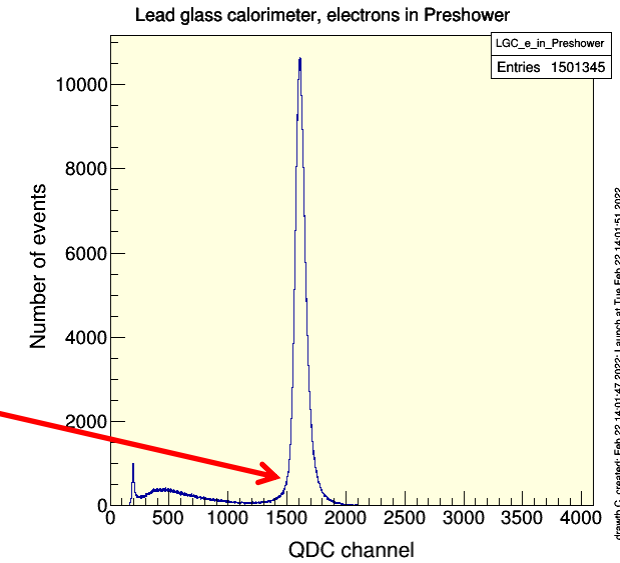
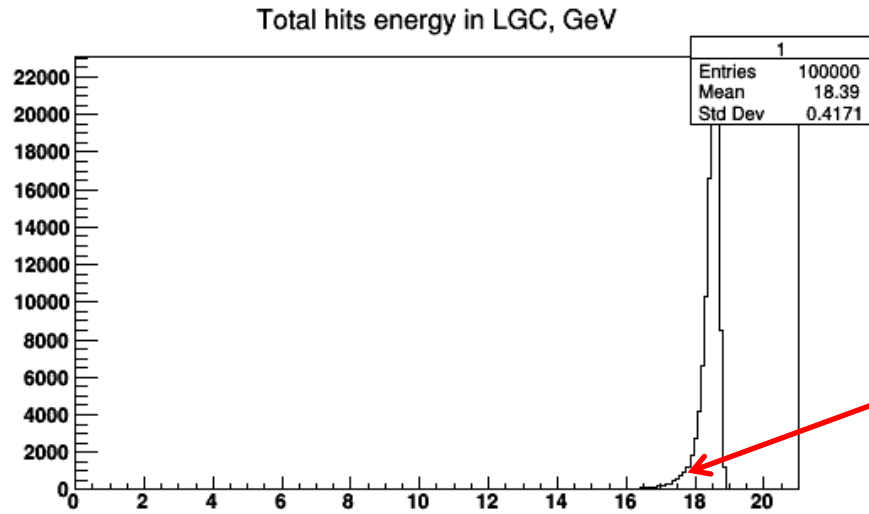
$\pi\pi$



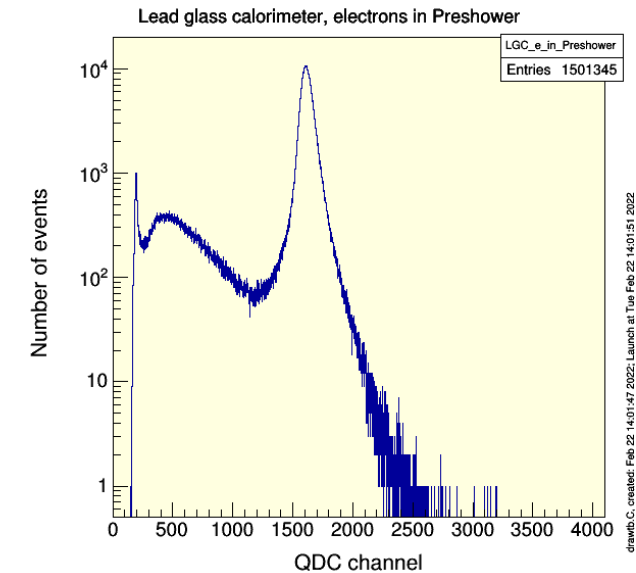
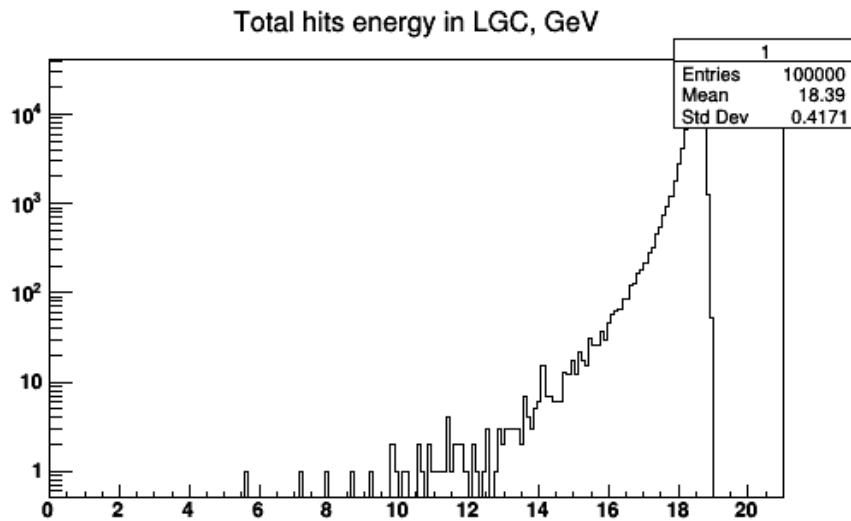
GEANT4

Electron signal in calorimeter

Data 2021

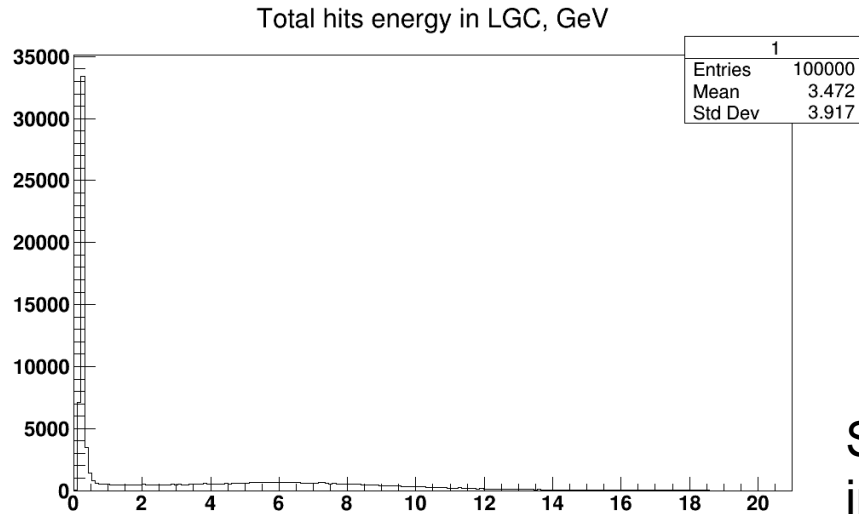


Peak asymmetry seems different

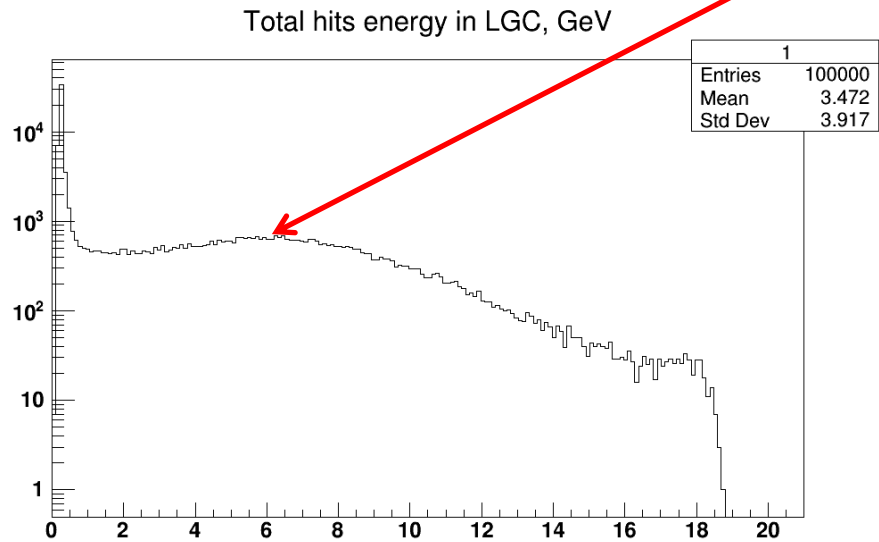


Pion signal in calorimeter

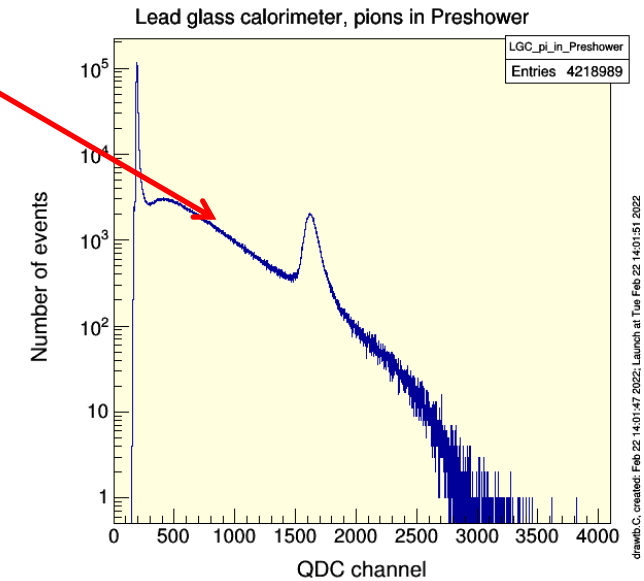
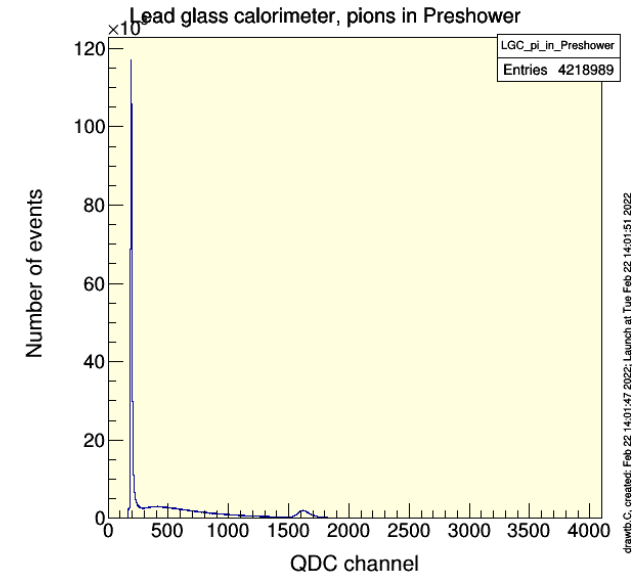
GEANT4



Shape in the region with pions interacting in calorimeter seems different



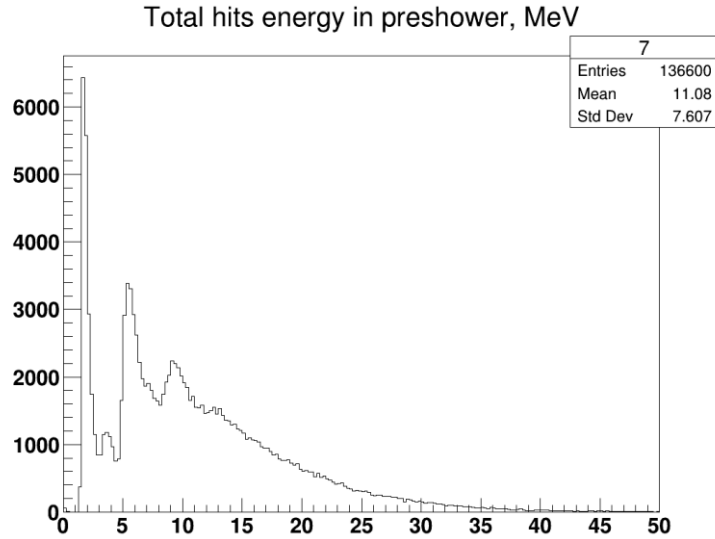
Data 2021



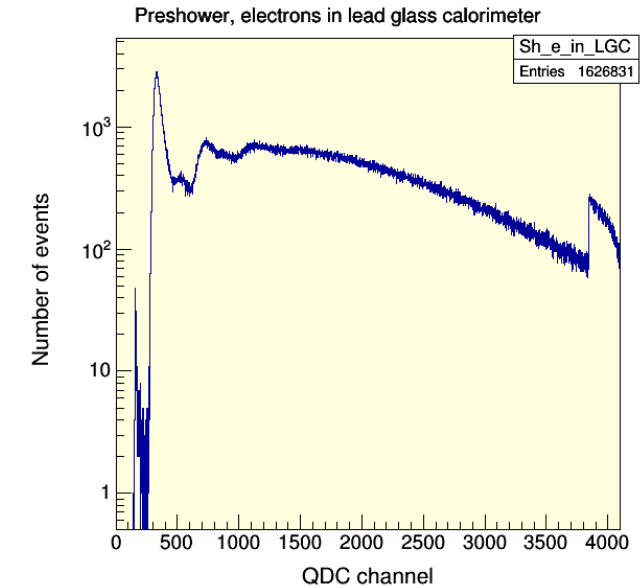
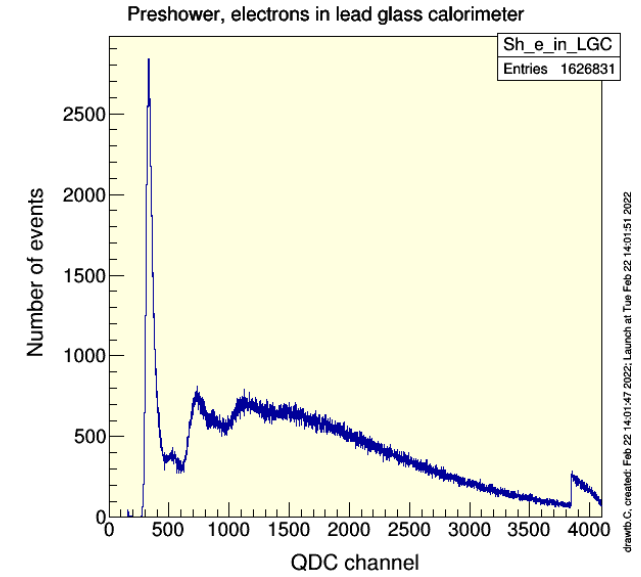
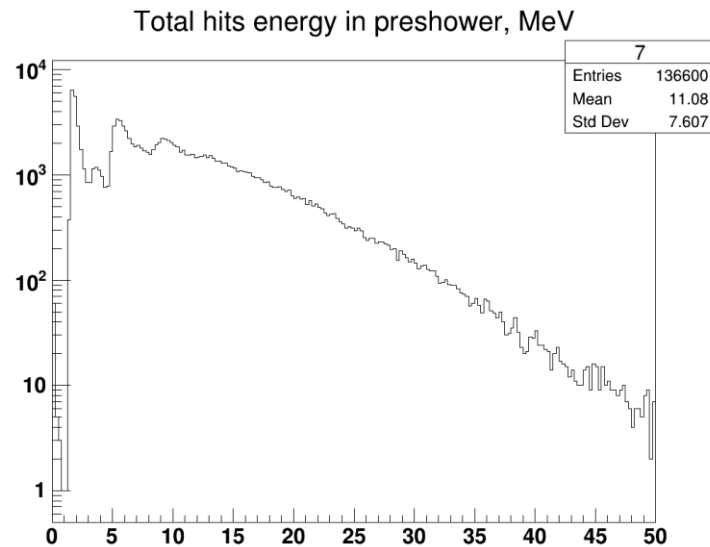
GEANT4

Electron signal in preshower

Data 2021

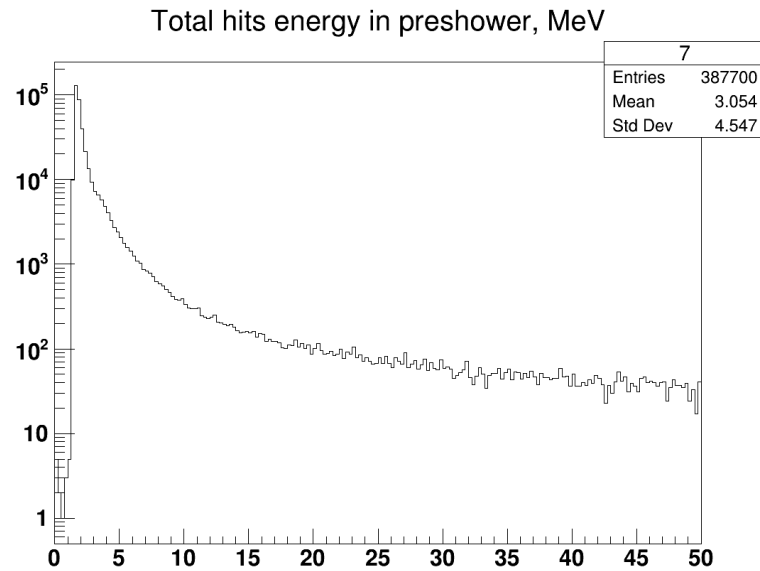
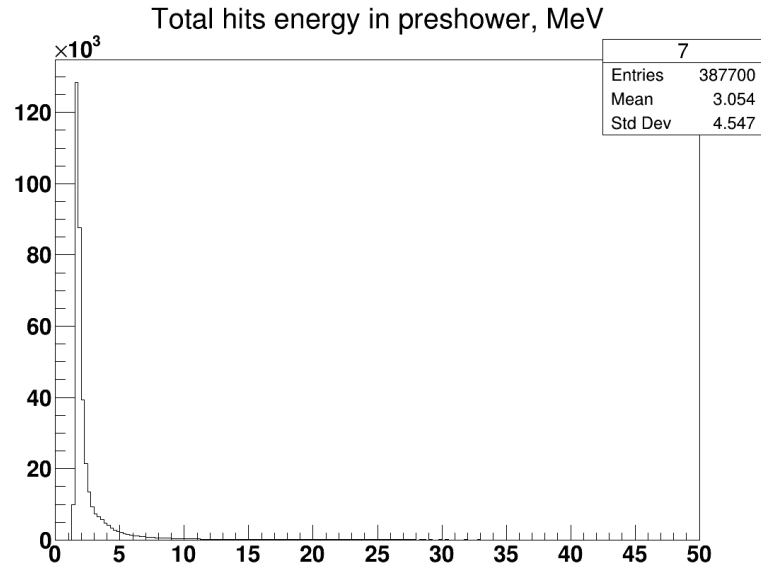


Seems similar...

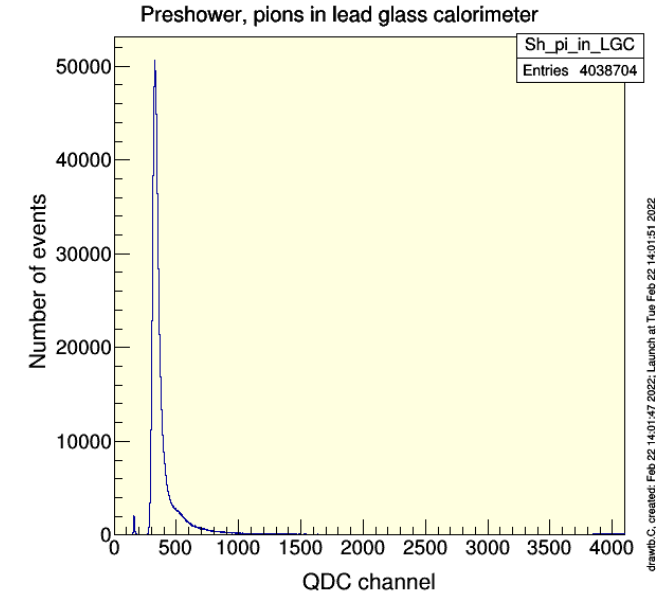


Pion signal in preshower

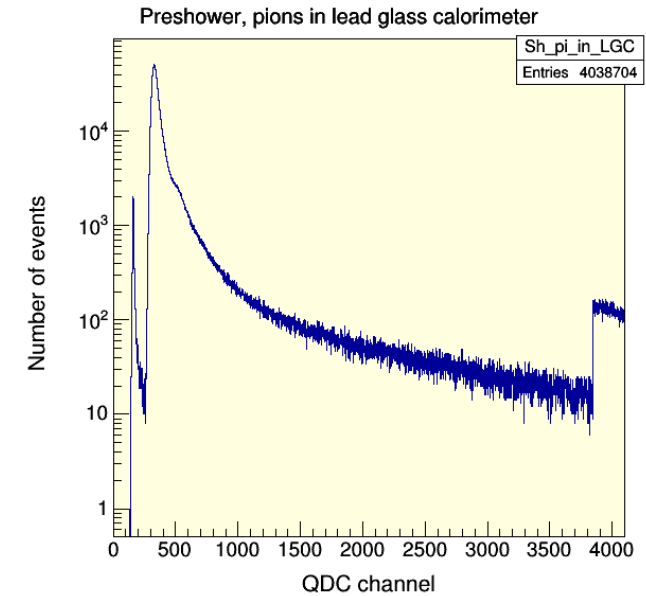
GEANT4



Data 2021



Seems similar...

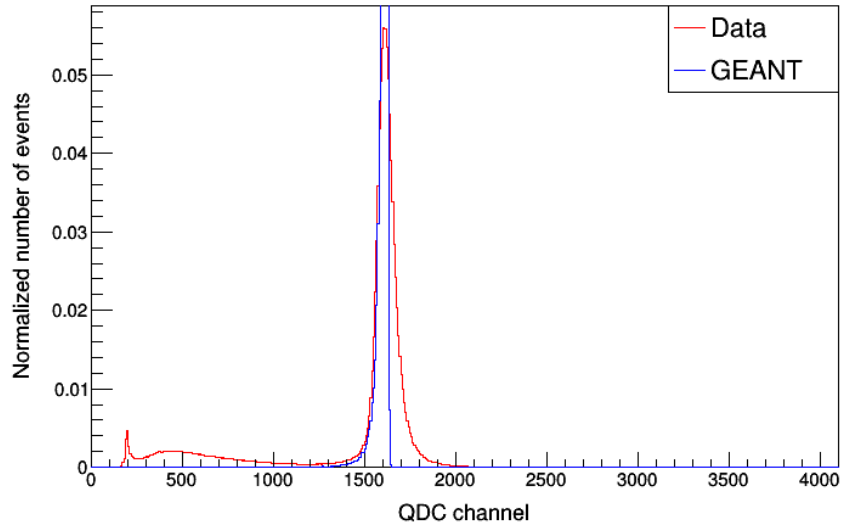


- New: energy depositions in preshower and calorimeter are converted to QDC counts to compare with experiment data

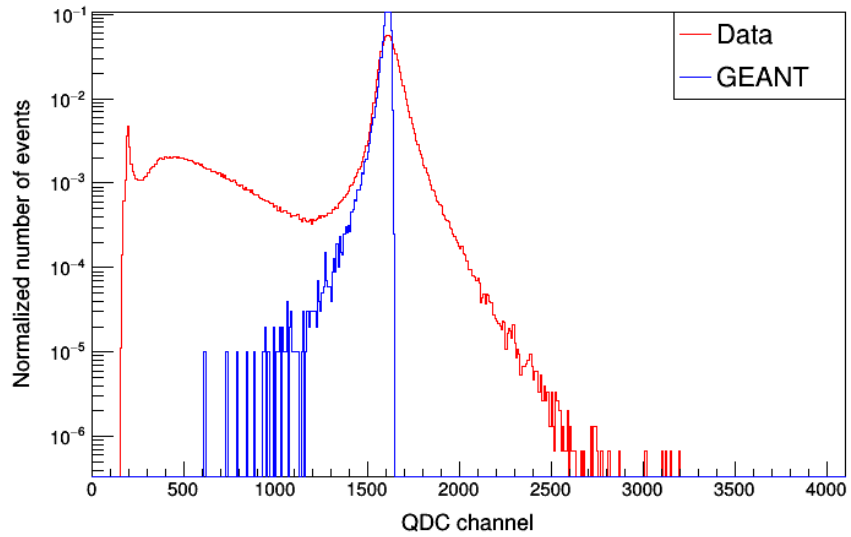
Calorimeter

e

Electron_in_calorimeter

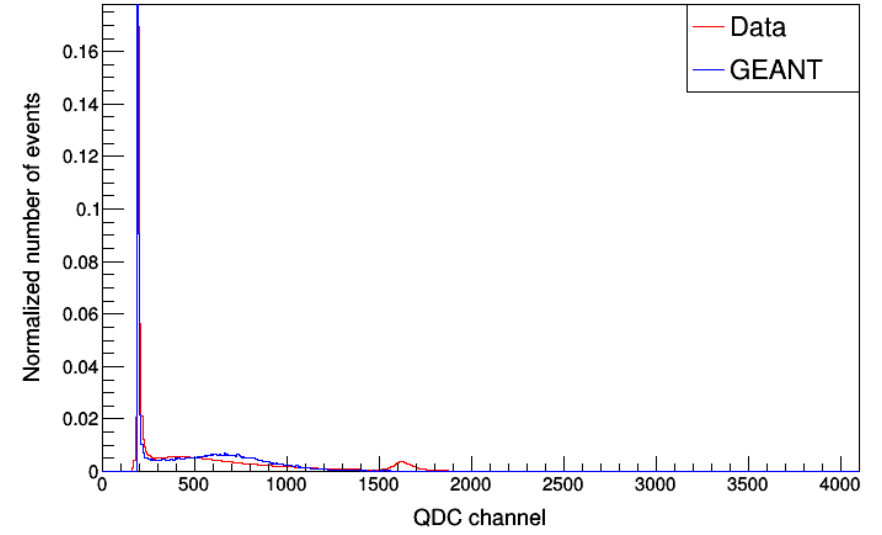


Electron_in_calorimeter

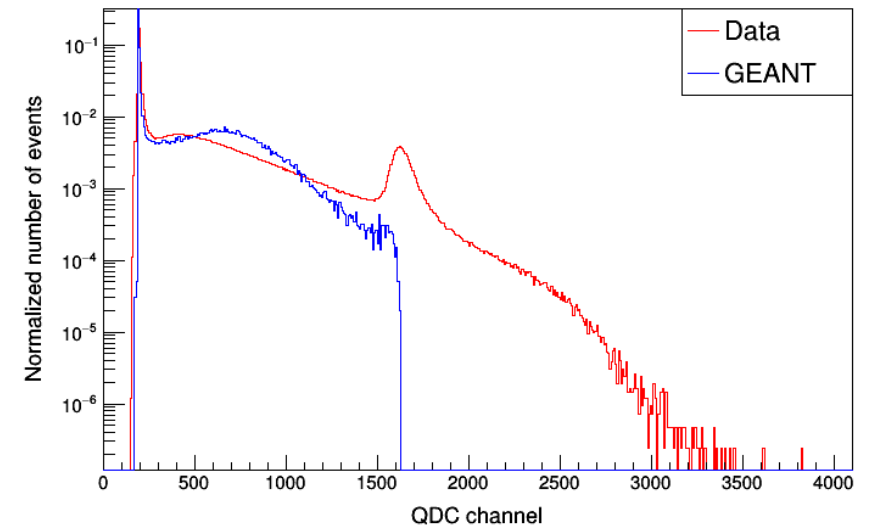


π

Pion_in_calorimeter



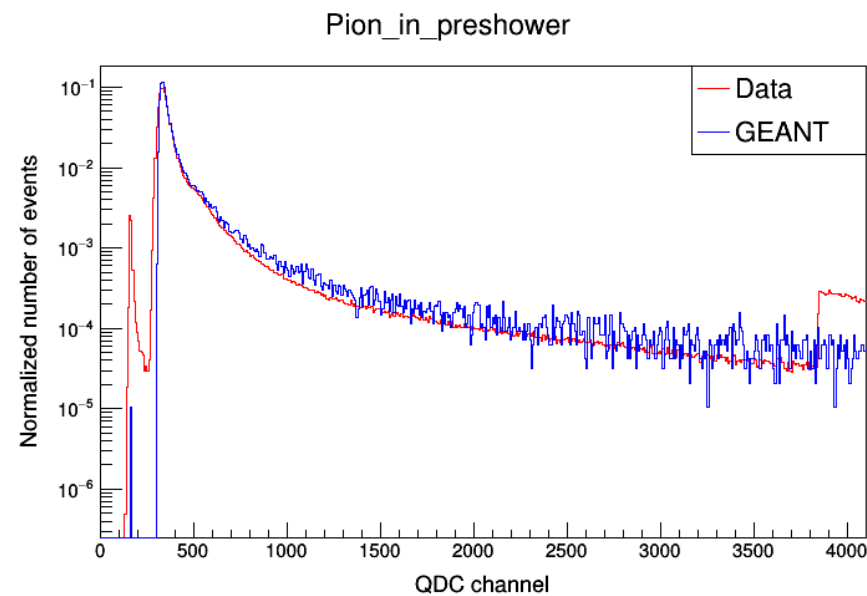
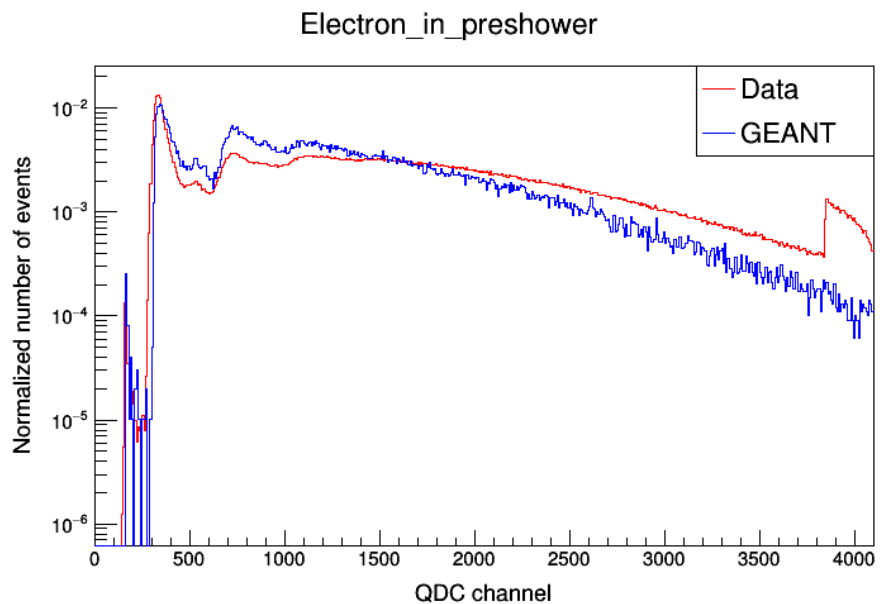
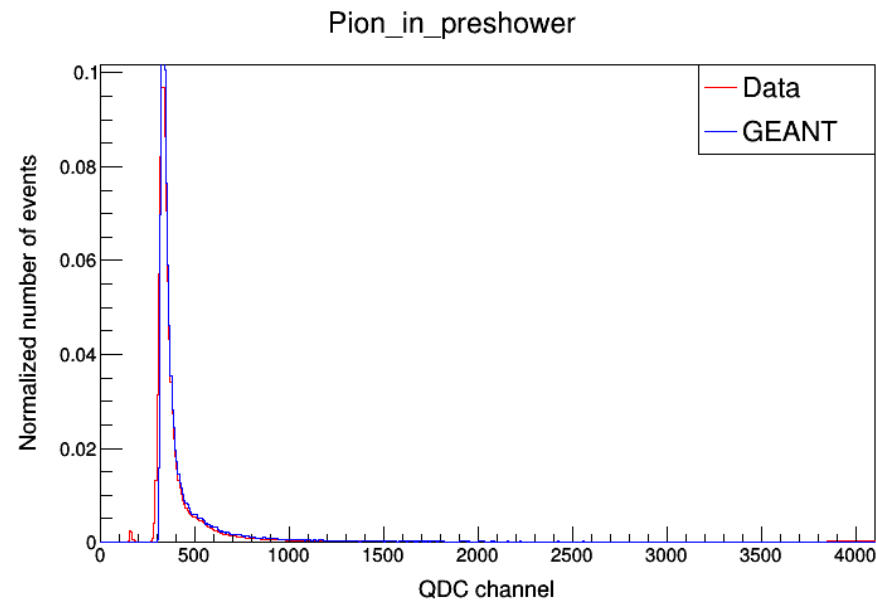
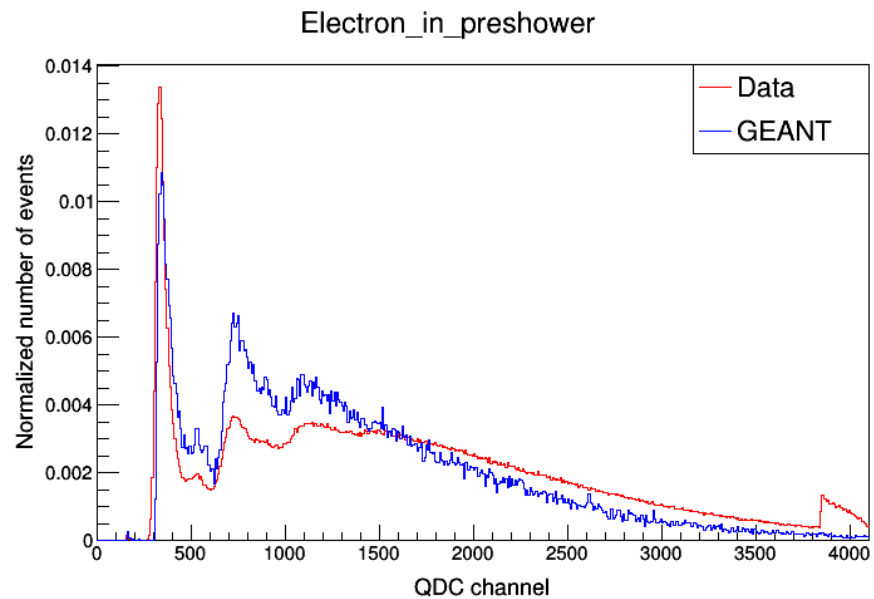
Pion_in_calorimeter



e

Preshower

$\pi\pi$



- Next steps:

Check GEANT physics lists, production and tracking cuts etc.

Smear conversion of energy deposition to QDC taking into account that in reality we register scintillator light in preshower and Cherenkov light in calorimeter.