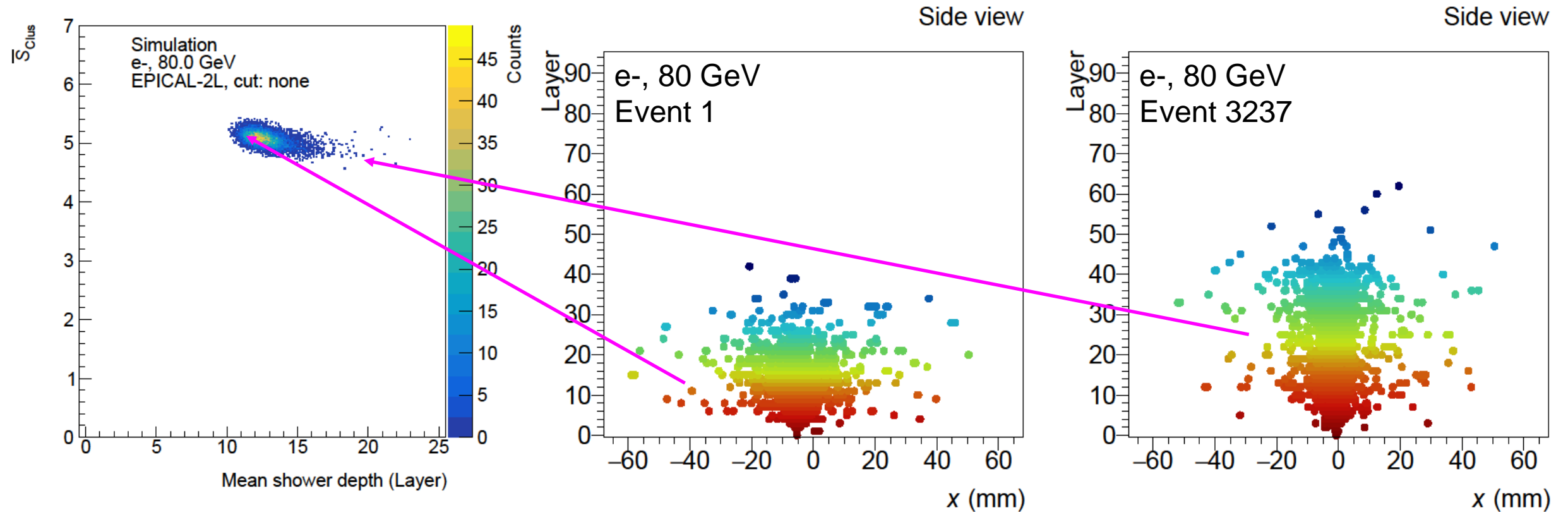


Elongated Events in the EPICAL-2

Johannes Keul



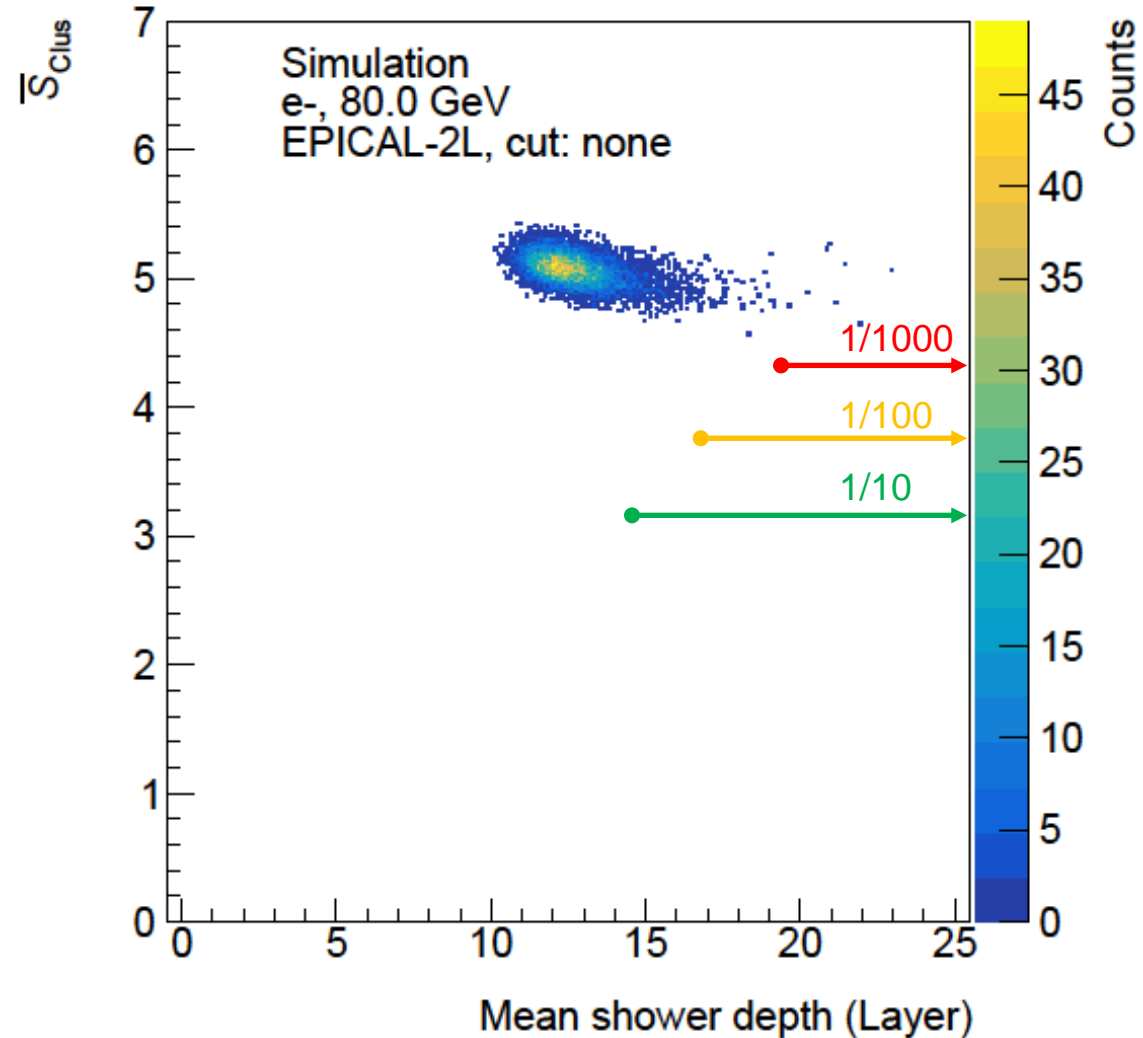
Reminder: Some events in simulation are strangely elongated



These elongated likely cause some of the strange observations like a difference in resolution between the Real and Normal detector geometries

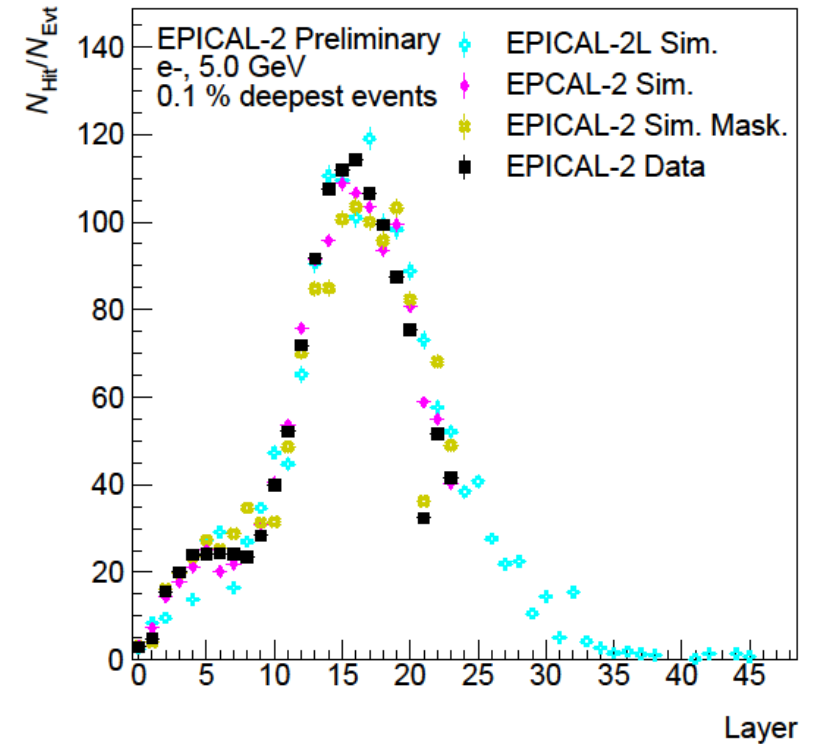
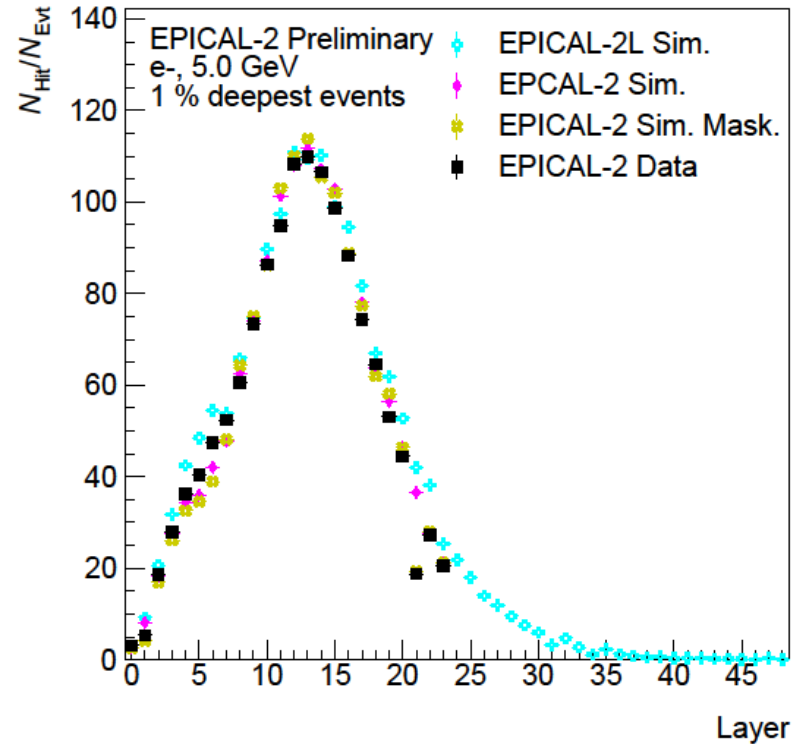
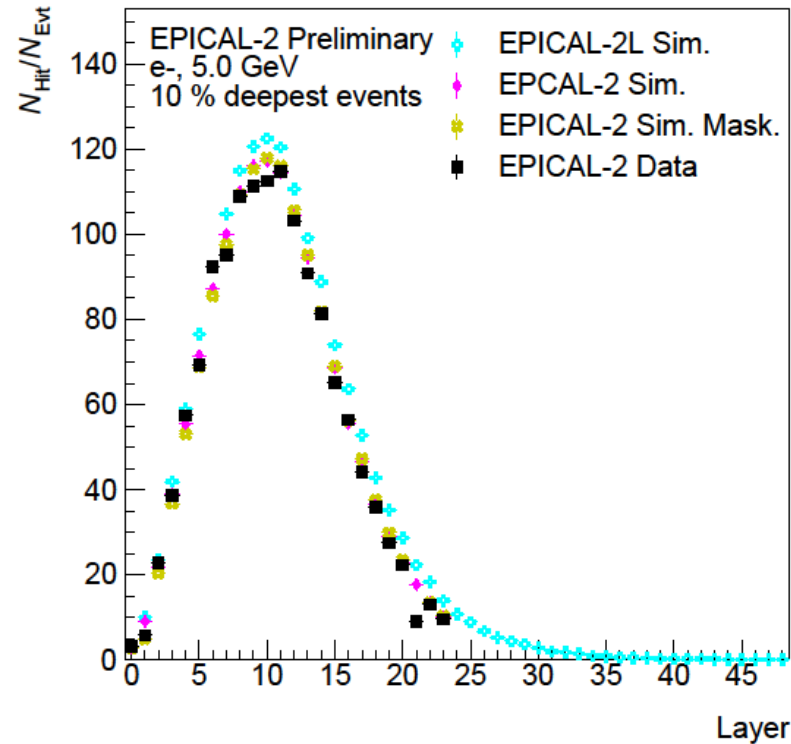
Taking a look at deep events

Selecting the 1/10, 1/100, and 1/1000 of the events with the largest mean shower depth



Taking a look at deep events: longitudinal profile

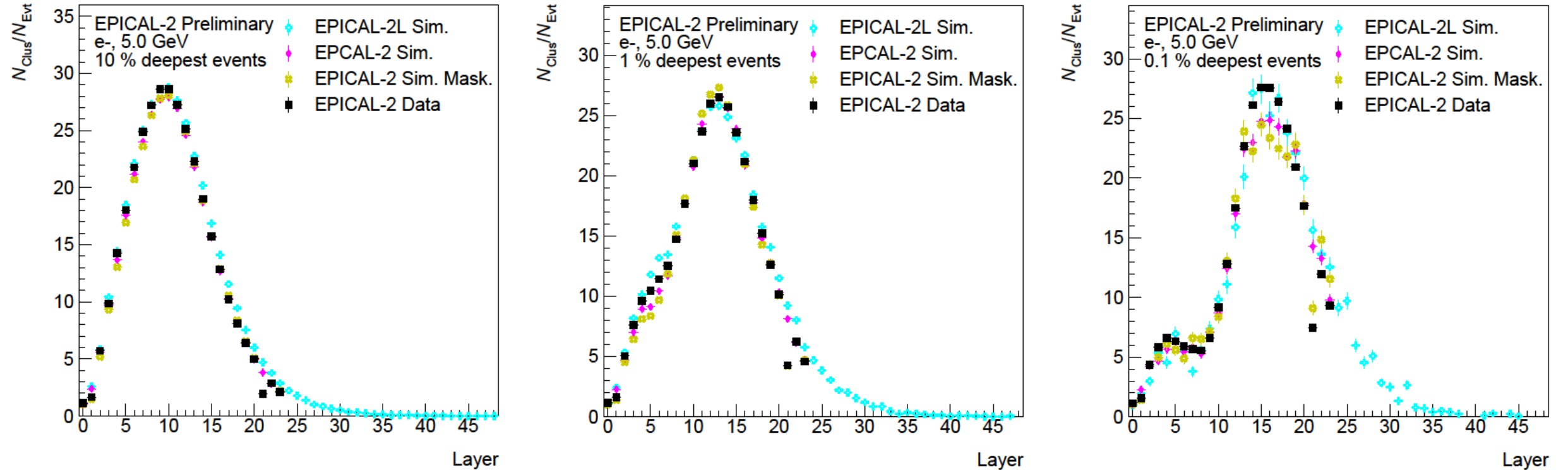
Hits



- For the 0.1% sample, a plateau at small layers is observed in both simulation and data

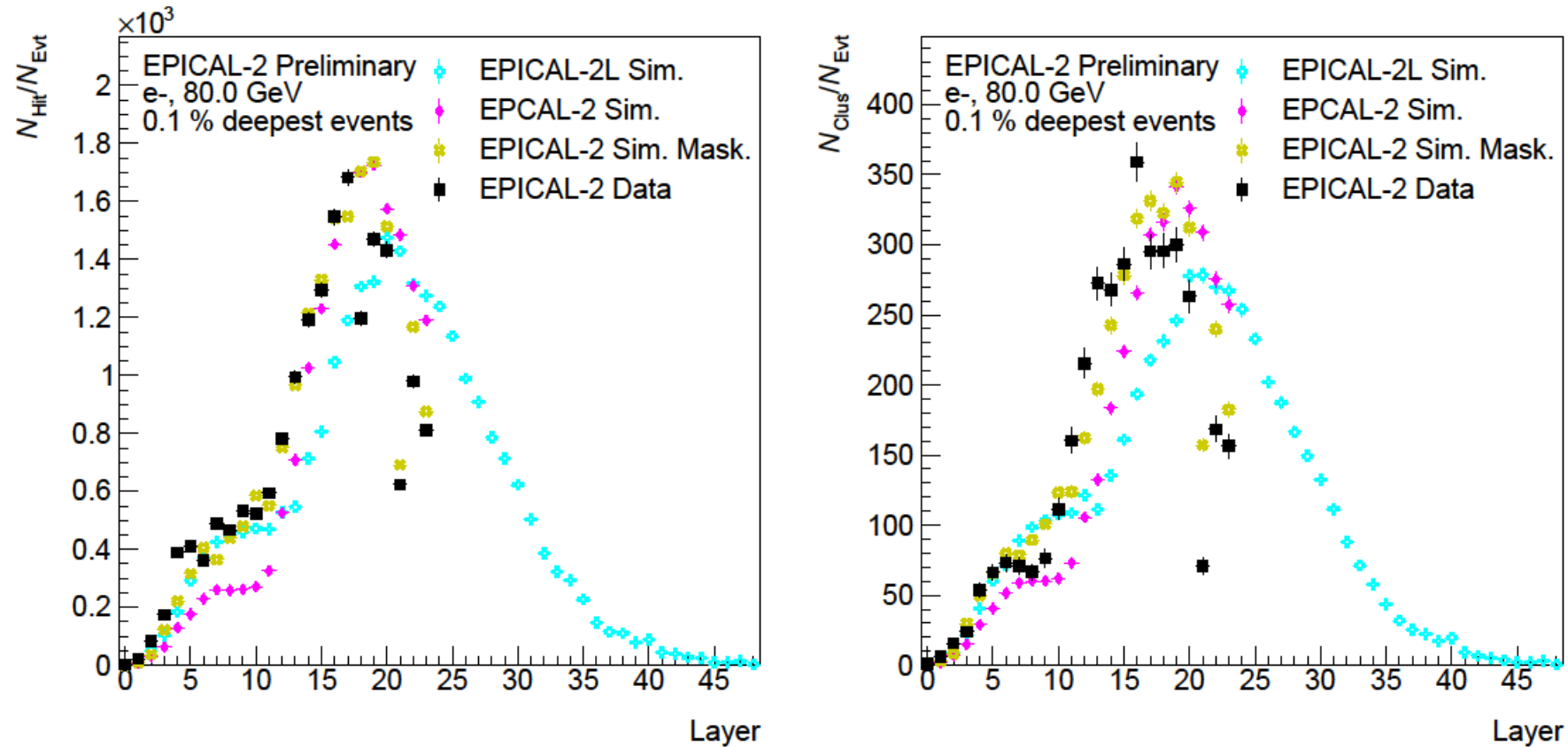
Taking a look at deep events: longitudinal profile

Clusters



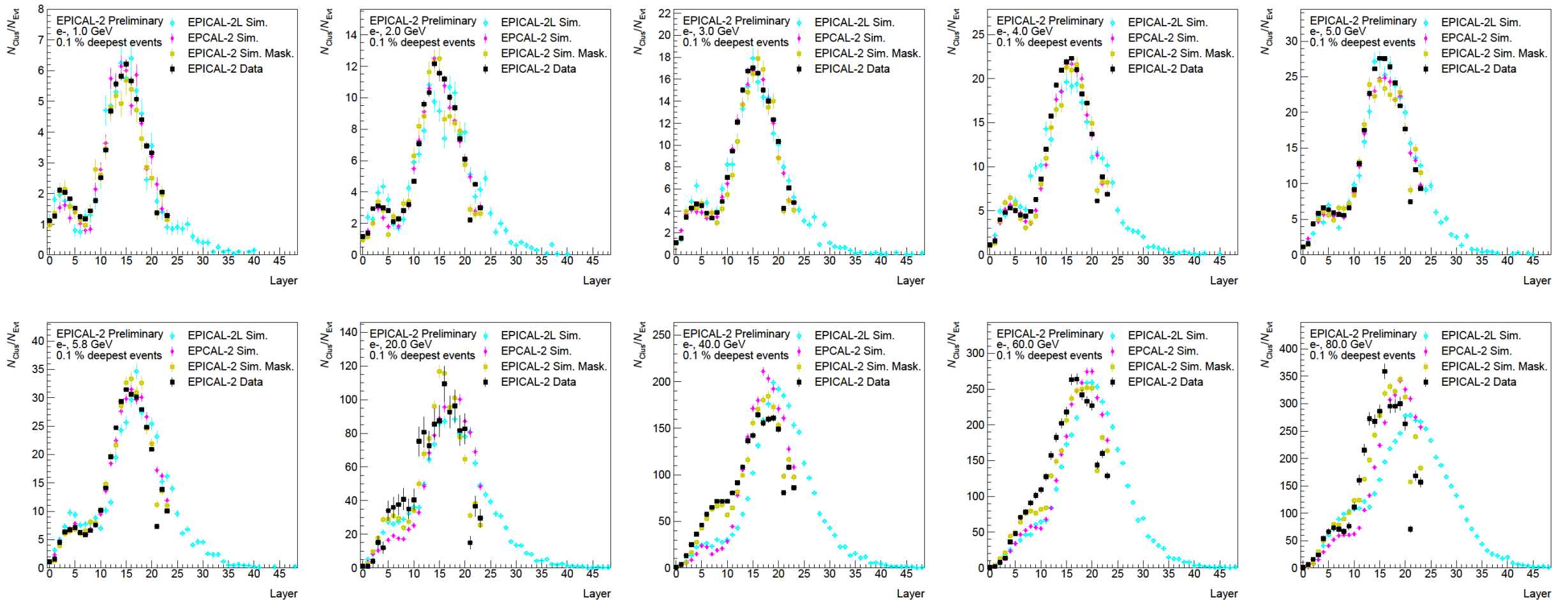
- For the 0.1% sample for clusters, the longitudinal profile shows a double peak, this feature is present in both simulation and data

Taking a look at deep events: longitudinal profile, SPS



- For SPS, as soon as the event selection is applied (Sim. Mask and Data), the effect is suppressed.
- The event selection is designed to filter out (hadron) events with late shower development, therefore also filtering out electron events with late showers

Taking a look at deep events: longitudinal profile

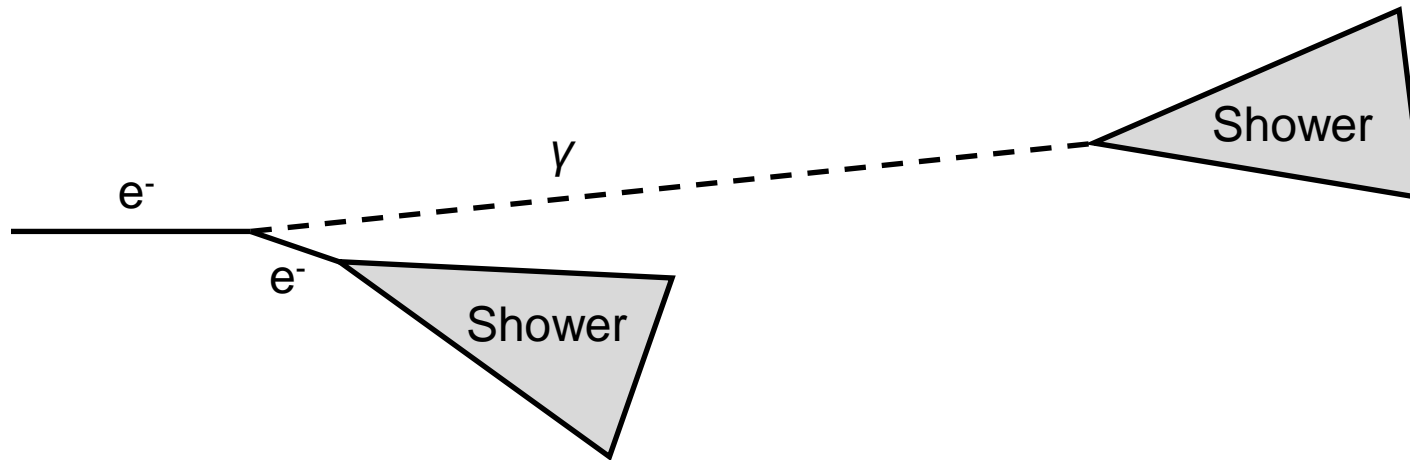


- Plateau or double peak is observed in simulation at all energies
- Plateau or double peak is observed in data at DESY energies and is suppressed (by the event selection) at SPS energies

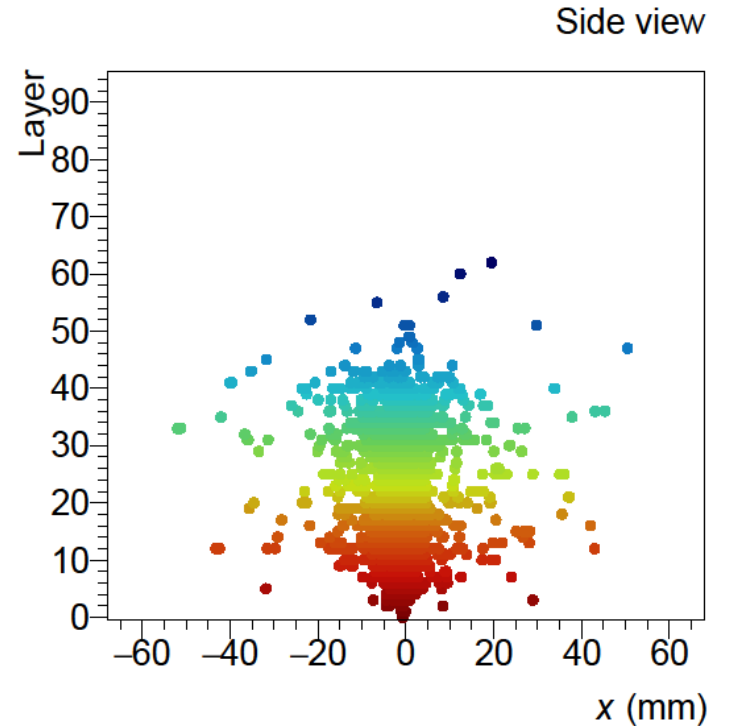
Conclusion

- In a small fraction (1/1000) of events, something strange happens, which results in the shower penetrating deeper than usual
- These deep events are likely **not** a simulation-only phenomenon. They really exist.

Possible explanation of the deep events (speculation)



- In some cases, a significant part of the primary electron's energy is transferred to a single bremsstrahlung photon
- This photon can travel quite far in the detector without interacting: mean free path for photons is approximately 1.5 layers
- Chance of a photon traveling through a certain number of layers:
 - 6 layers: 6.25%
 - 12 layers: 0.4%
 - 18 layers: 0.025%



I didn't find a theoretical formula to calculate the probability yet, still searching...