Influence of Pileup and Noise on the Molière Radius

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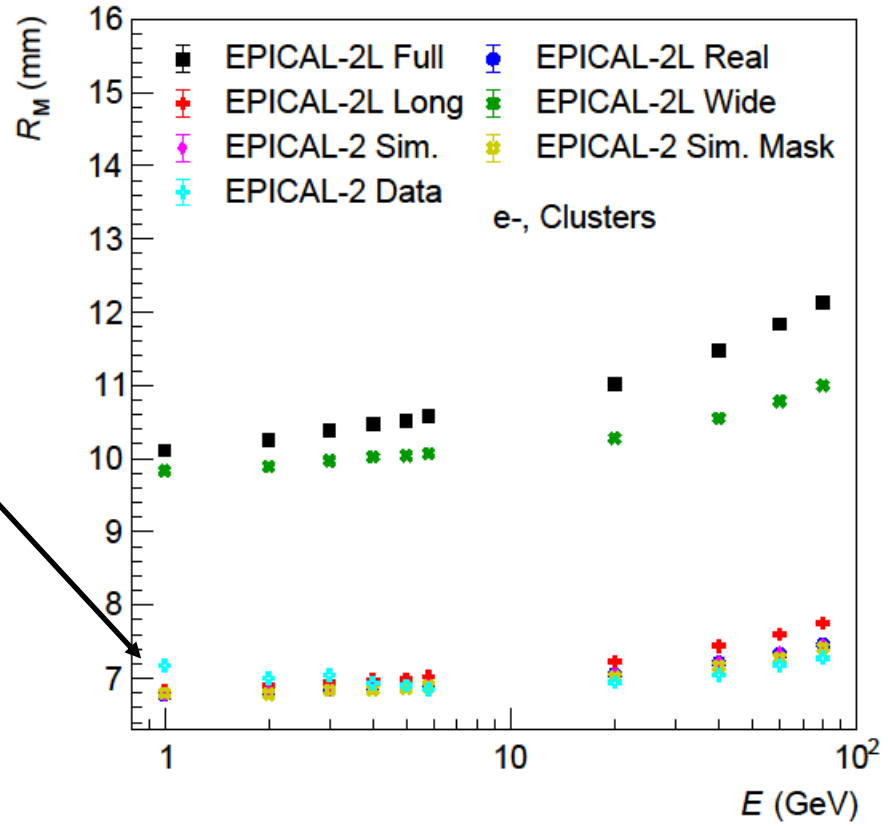
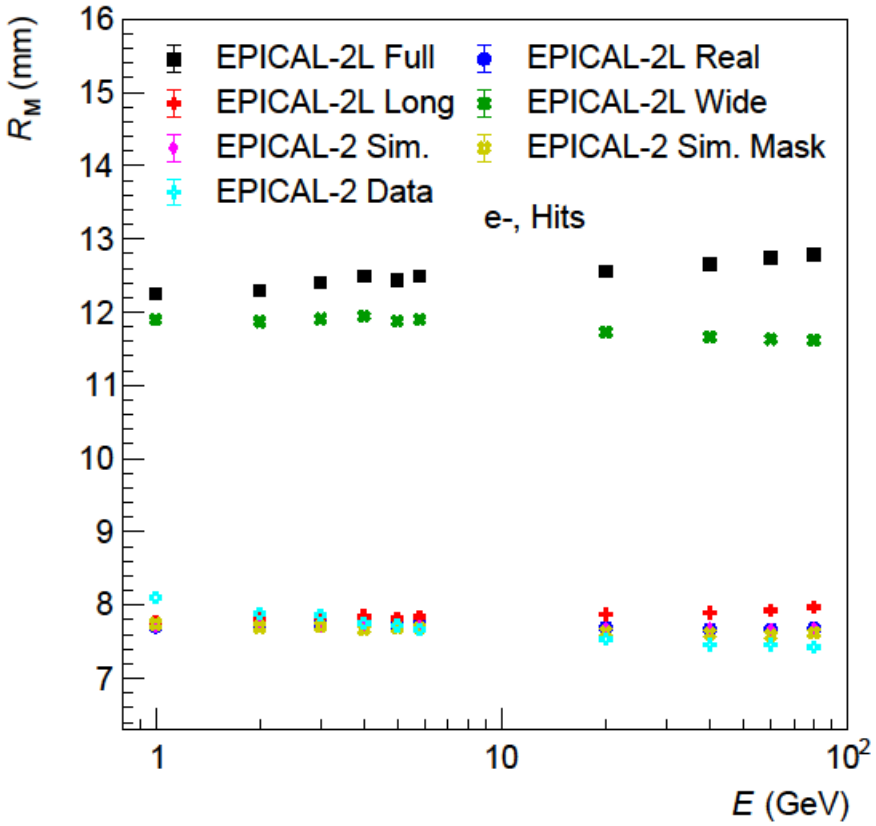
Reminder: Molière radius in simulation and data

- Simulation does not describe data at small *E*
- Maybe caused by pileup or noise?



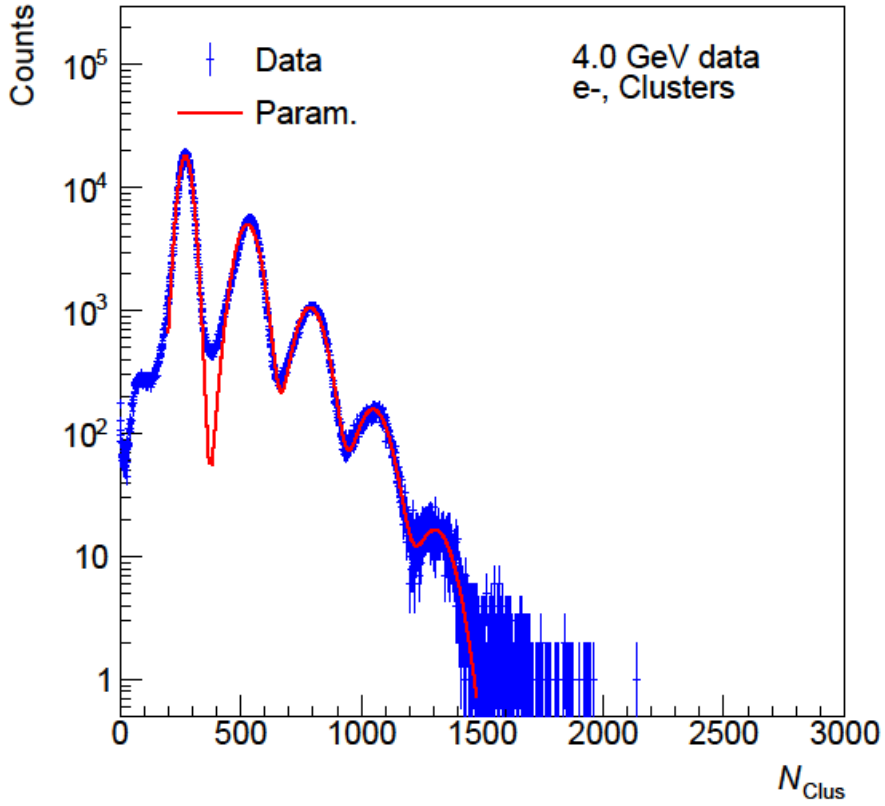


Checking the influence of pileup

- Estimated amount of pileup from a multi-Gaussian fit to the N_{Clus} distribution of unselected data
- Simulated corresponding amount of 2 and 3 electron events for each energy (assuming the low number of events with more than 3 electrons are negligible)

Simulated events:

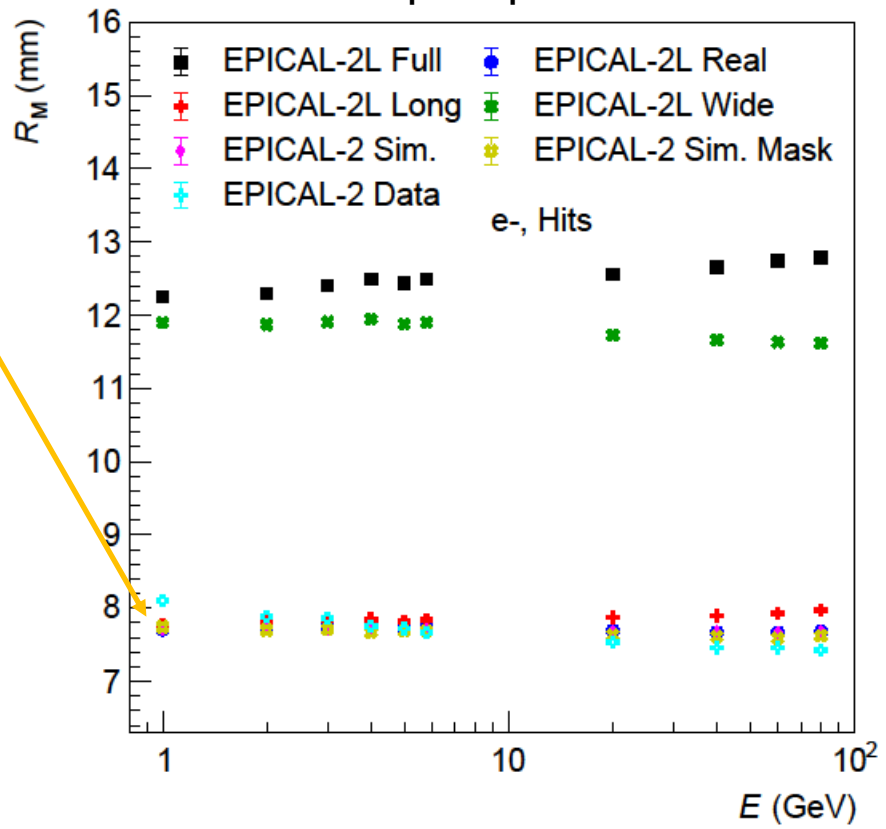
Energy (GeV)	1 el. evt.	2 el. evt.	3 el. evt.
1	20000	4250	669
2	20000	7969	2367
3	20000	7366	2035
4	20000	5473	1158
5	20000	2987	1157
5.8	20000	544	8



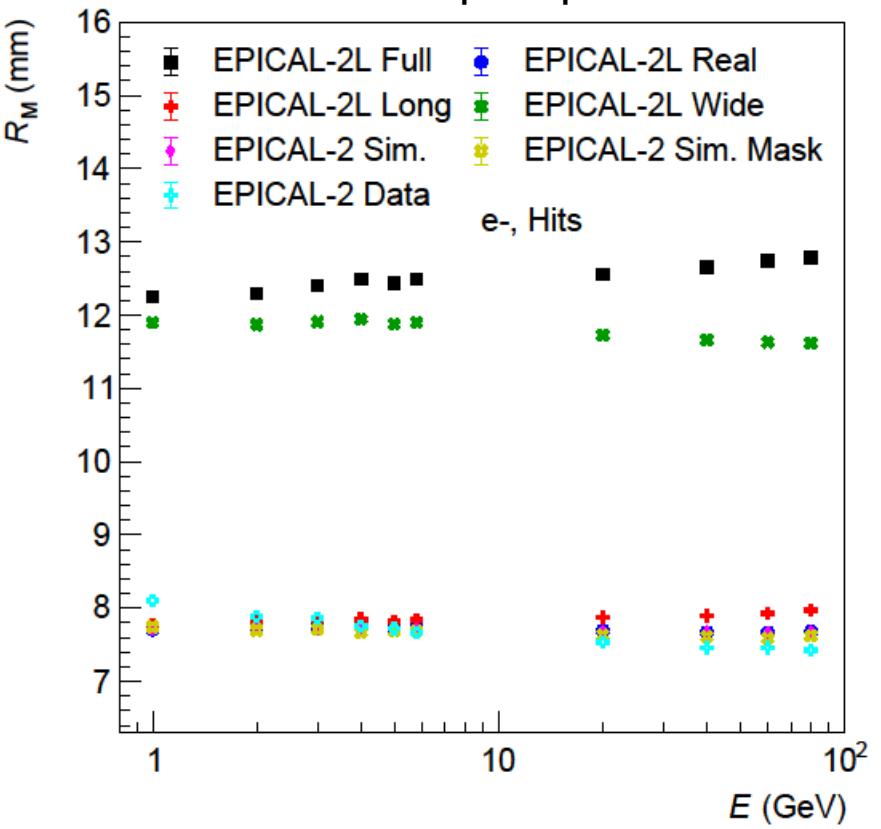
Checking the influence of pileup

- Used dataset with pileup for EPICAL-2 Sim. Mask
- ➢ Pileup makes no difference

With pileup



Without pileup



Checking the influence of noise

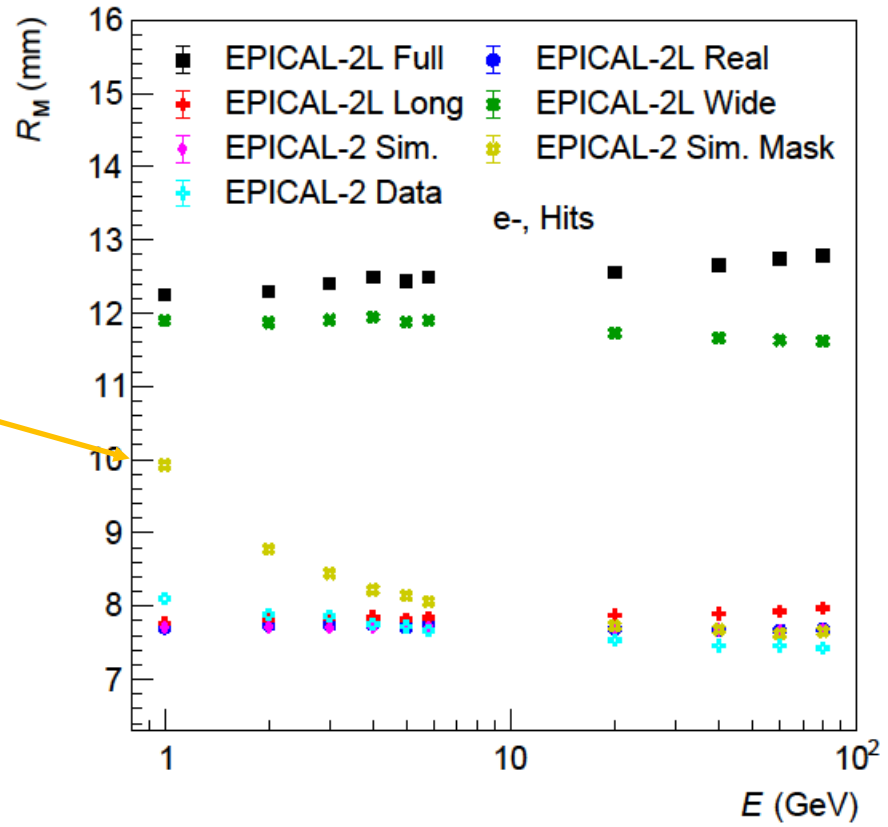
Noising the simulation:

- Loop over every pixel in every event
- Check if the pixel is masked or has a hit
- If not: decide based on a random number roll if the pixel fires

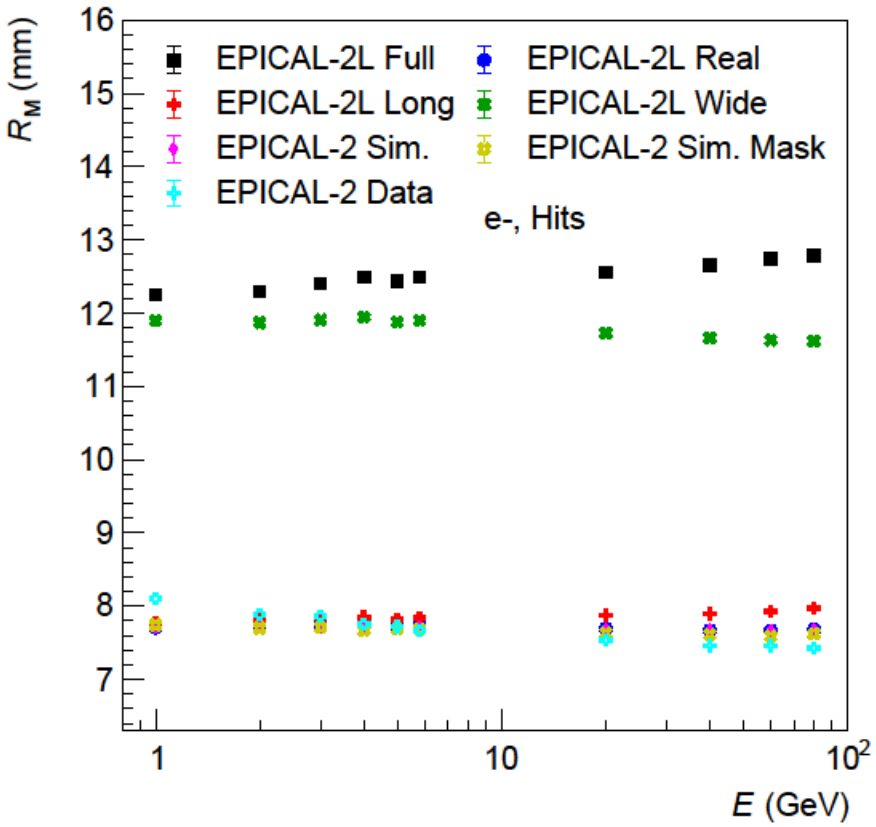
Checking the influence of noise

- Testing with a very high amount of noise:
  1/1M pixel readouts
  (unrealistically high)
- The Molière radius in the noised simulation is higher for small *E*

With noise



Without noise

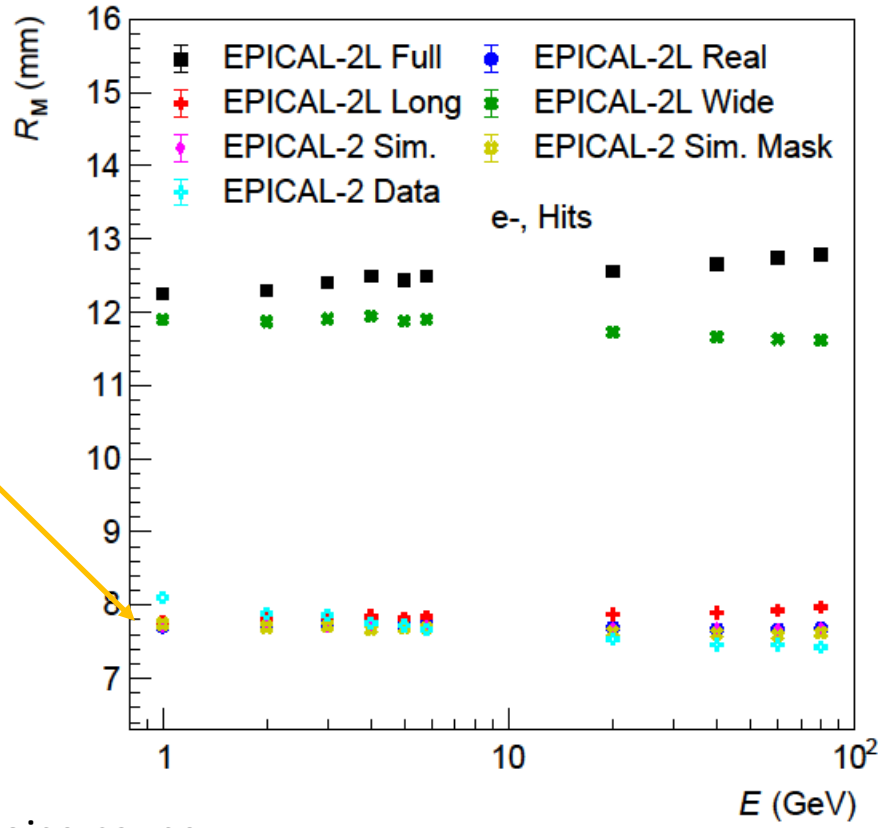


Checking the influence of noise

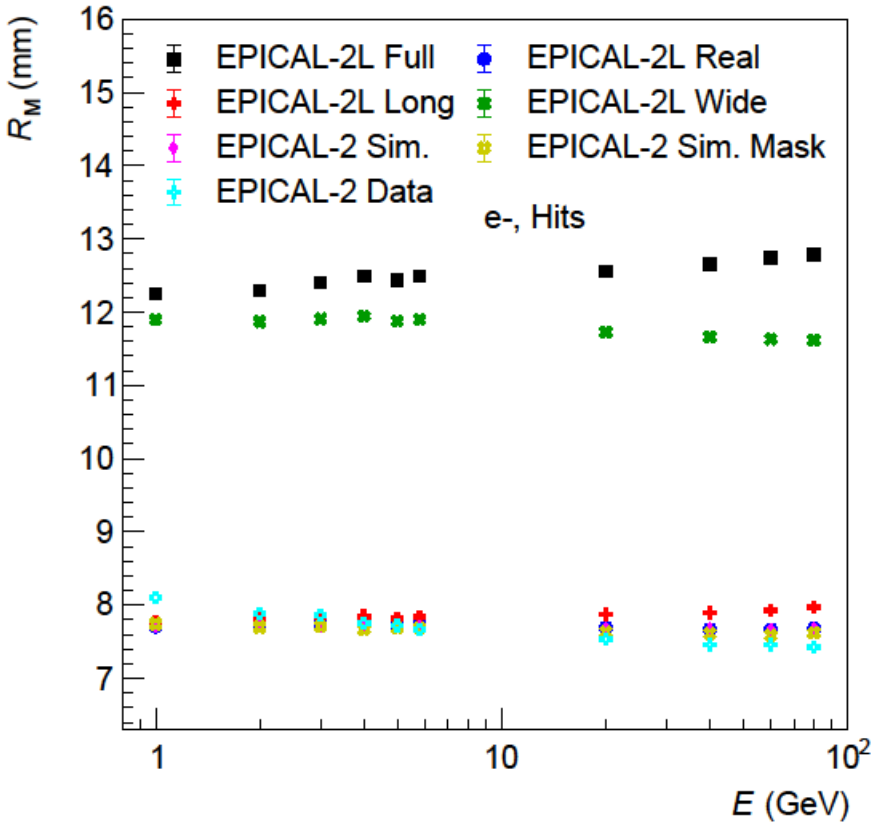
- Testing with a realistic amount of noise:
  1/1B pixel readouts (real noise in the EPICAL-2 might even be lower, estimated from pedestal runs: 1/9B)

➢ Noise makes no difference

With noise



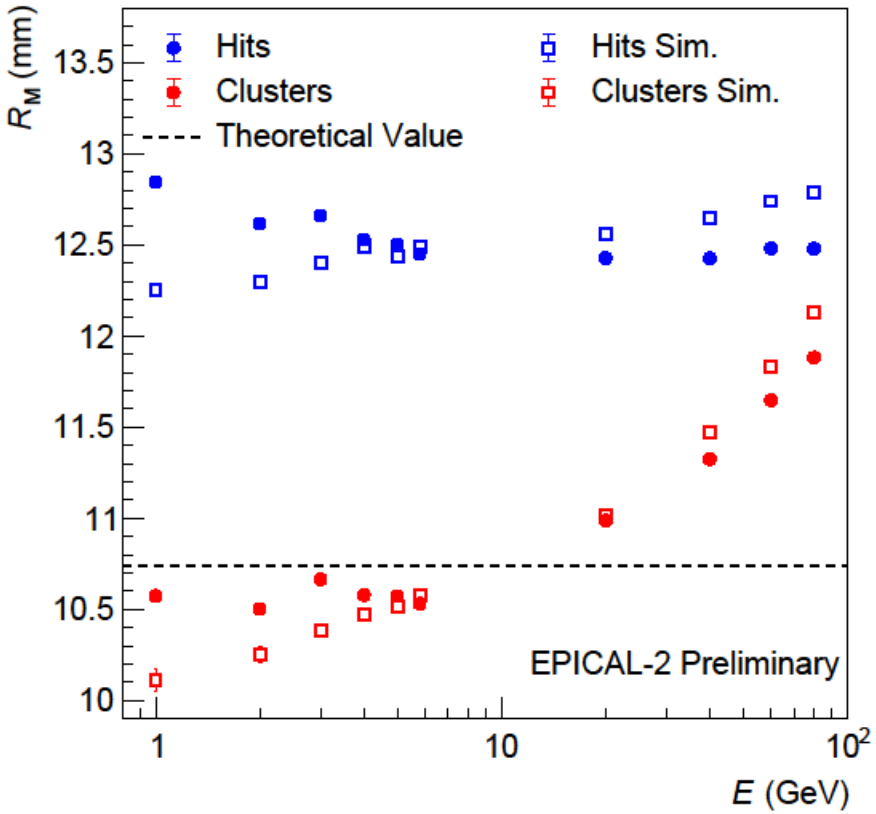
Without noise



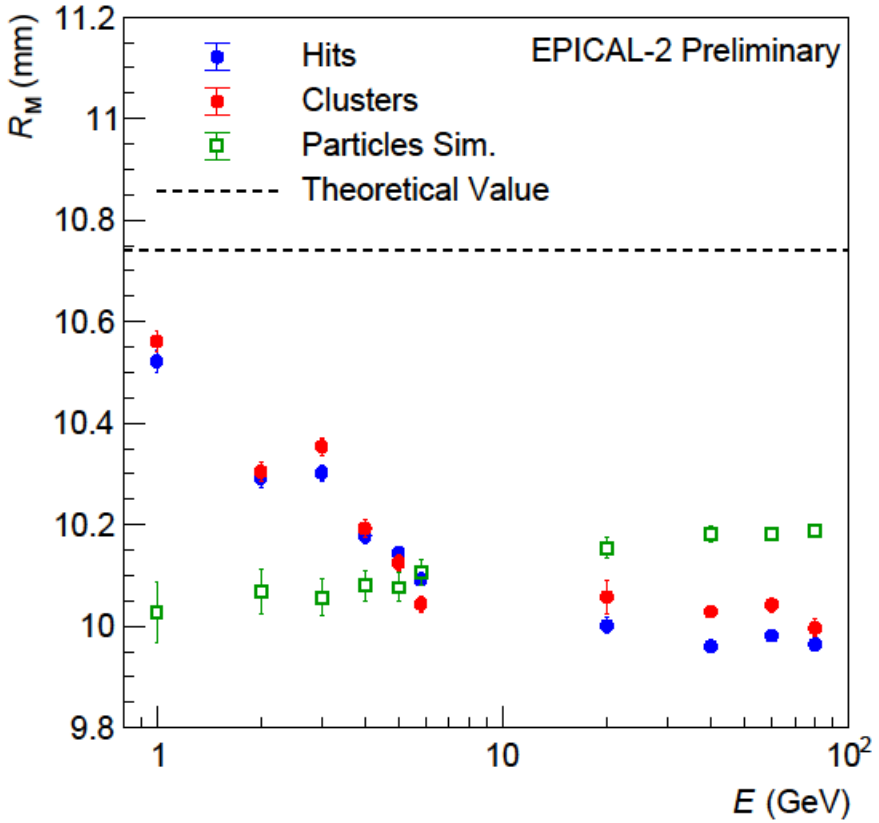
➢ Conclusion: neither pileup nor noise cause the difference between data and sim.

Which Molière radius plots do we want to show in the Paper?

Geometric corrections with EPICAL-2L Sim.



Corrections on particle level with EPICAL-2L Sim. + particle info

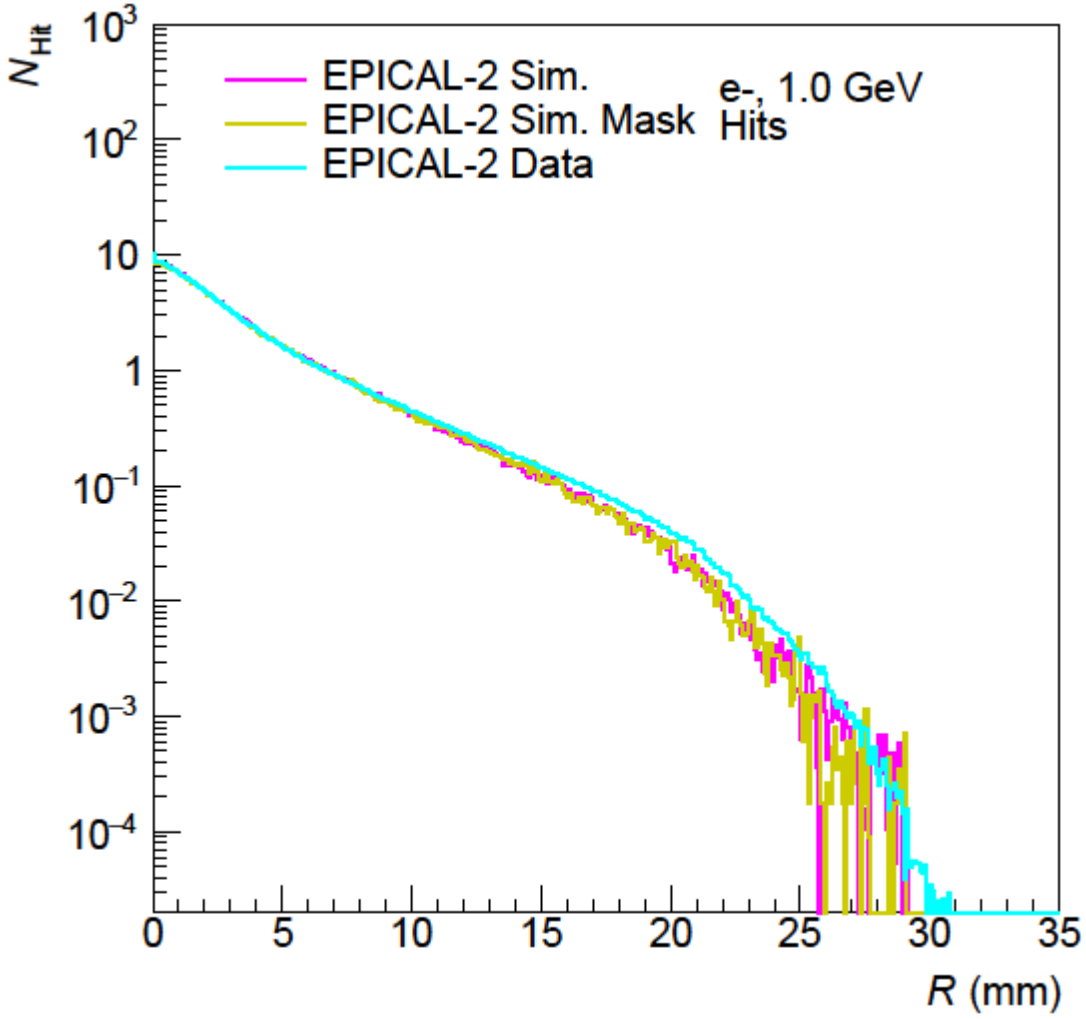


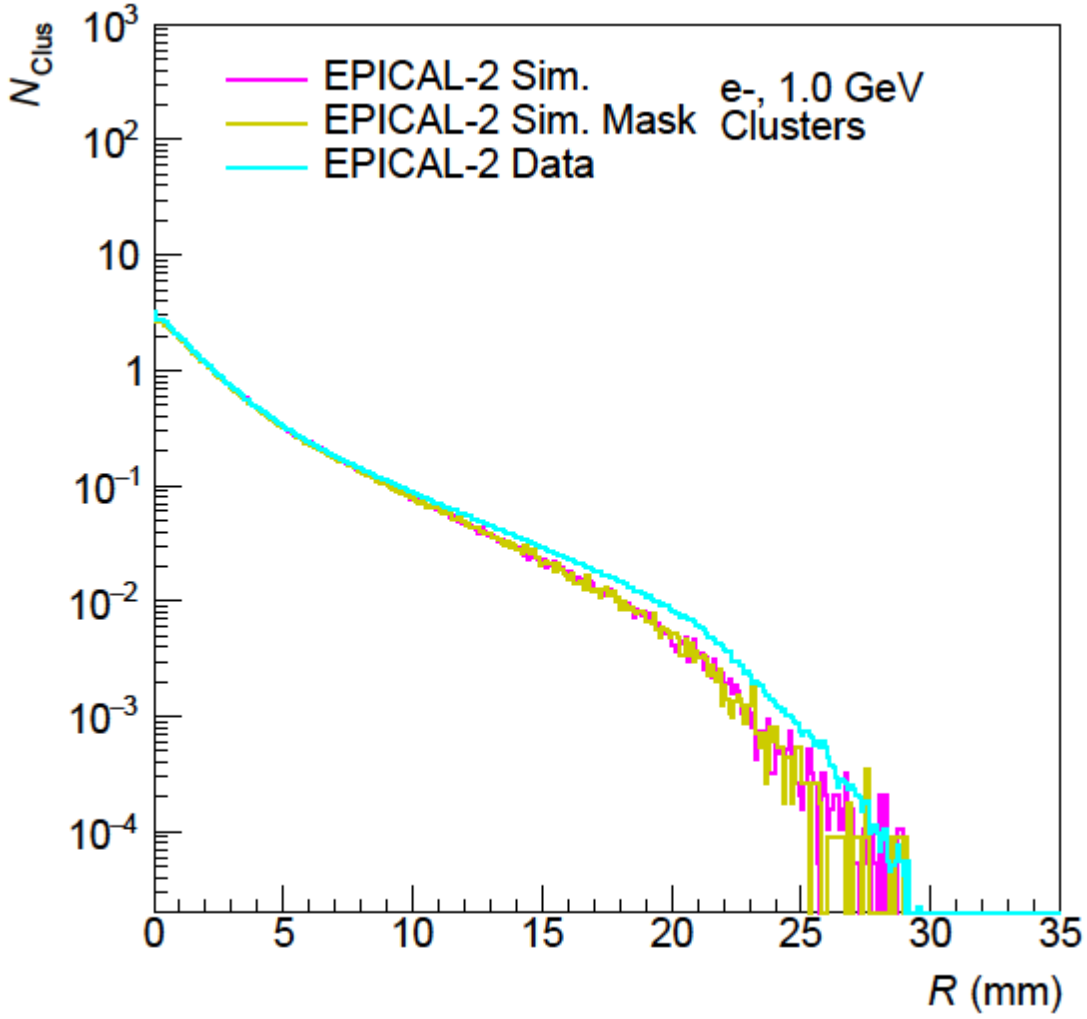
Outlook

- Set up a GEANT4 Simulation to study the Moliere radius with access to the full energy deposit of a shower

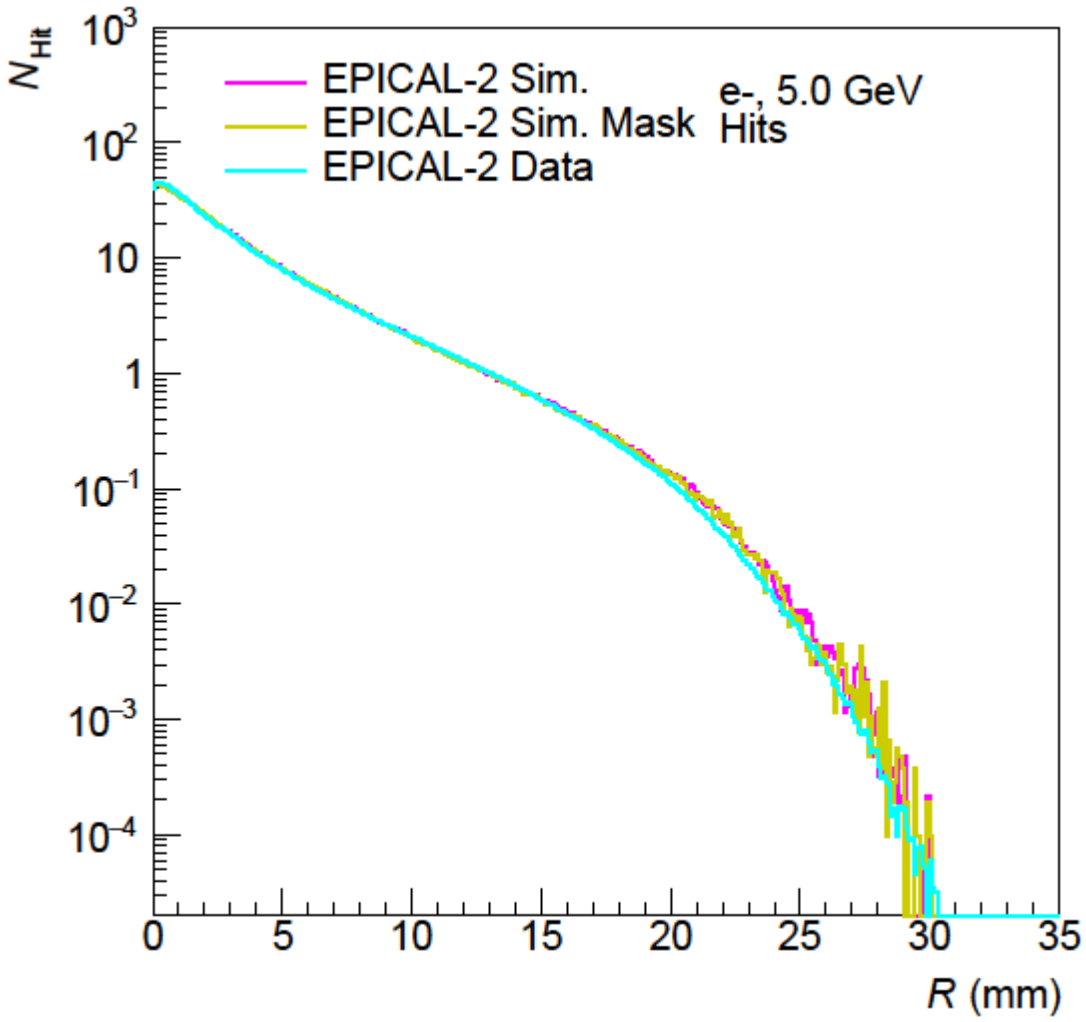
Backup

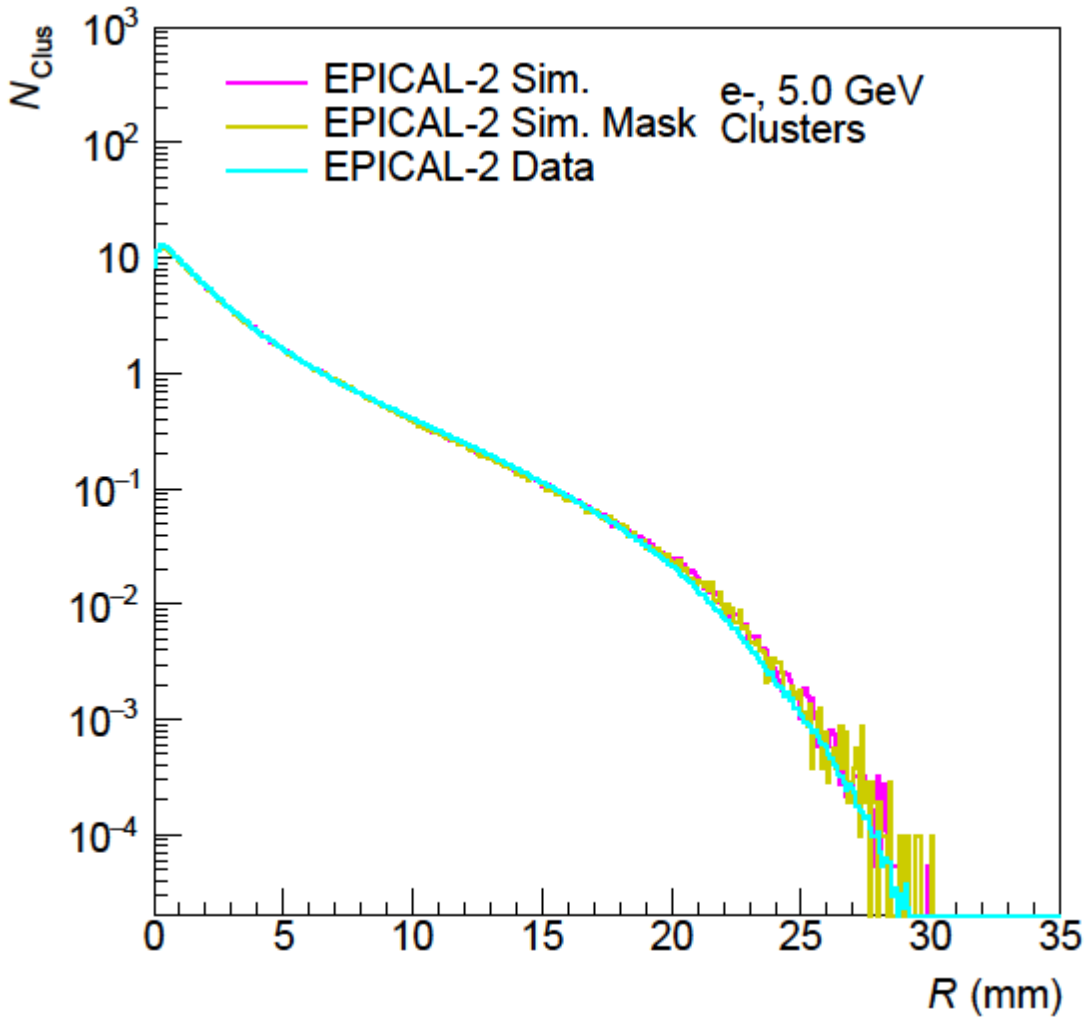
Lateral number of hit and cluster distributions



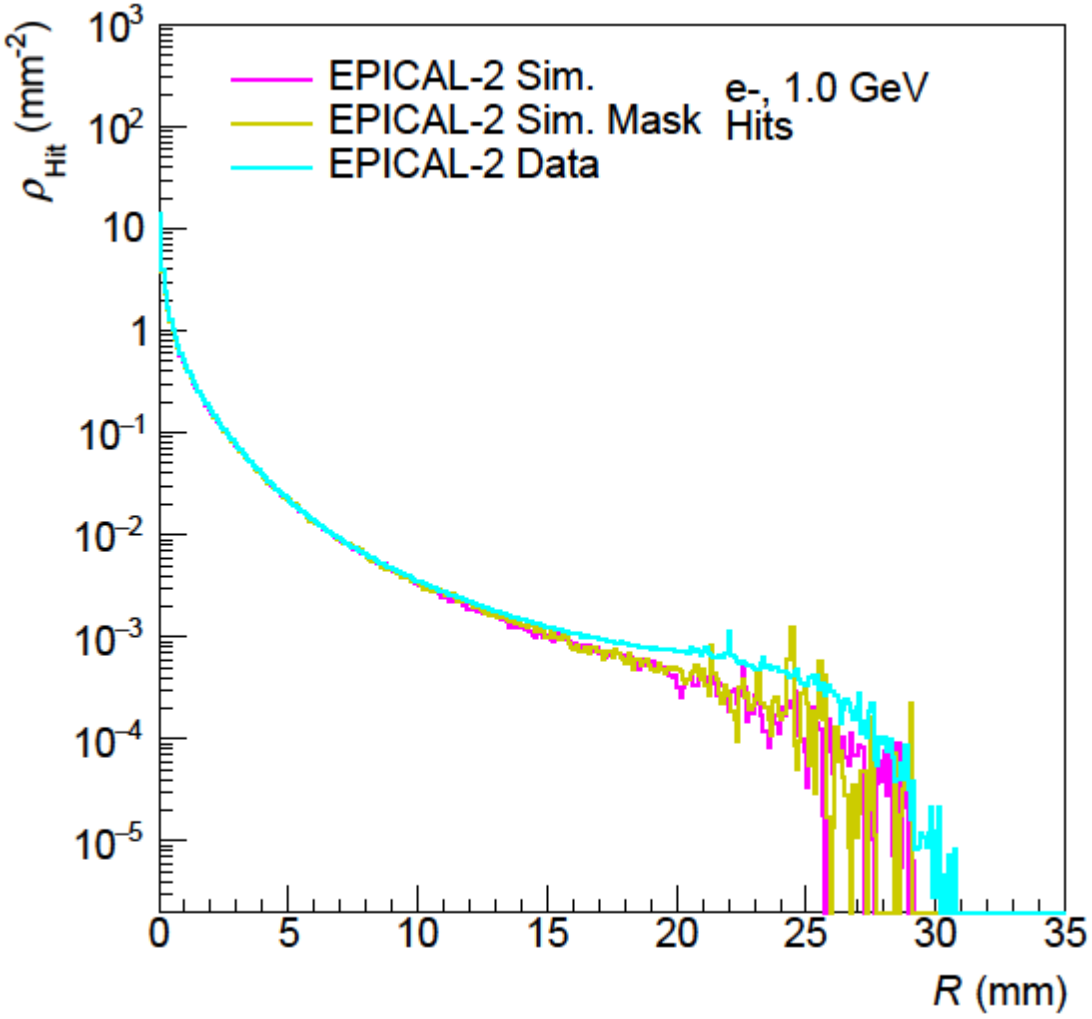


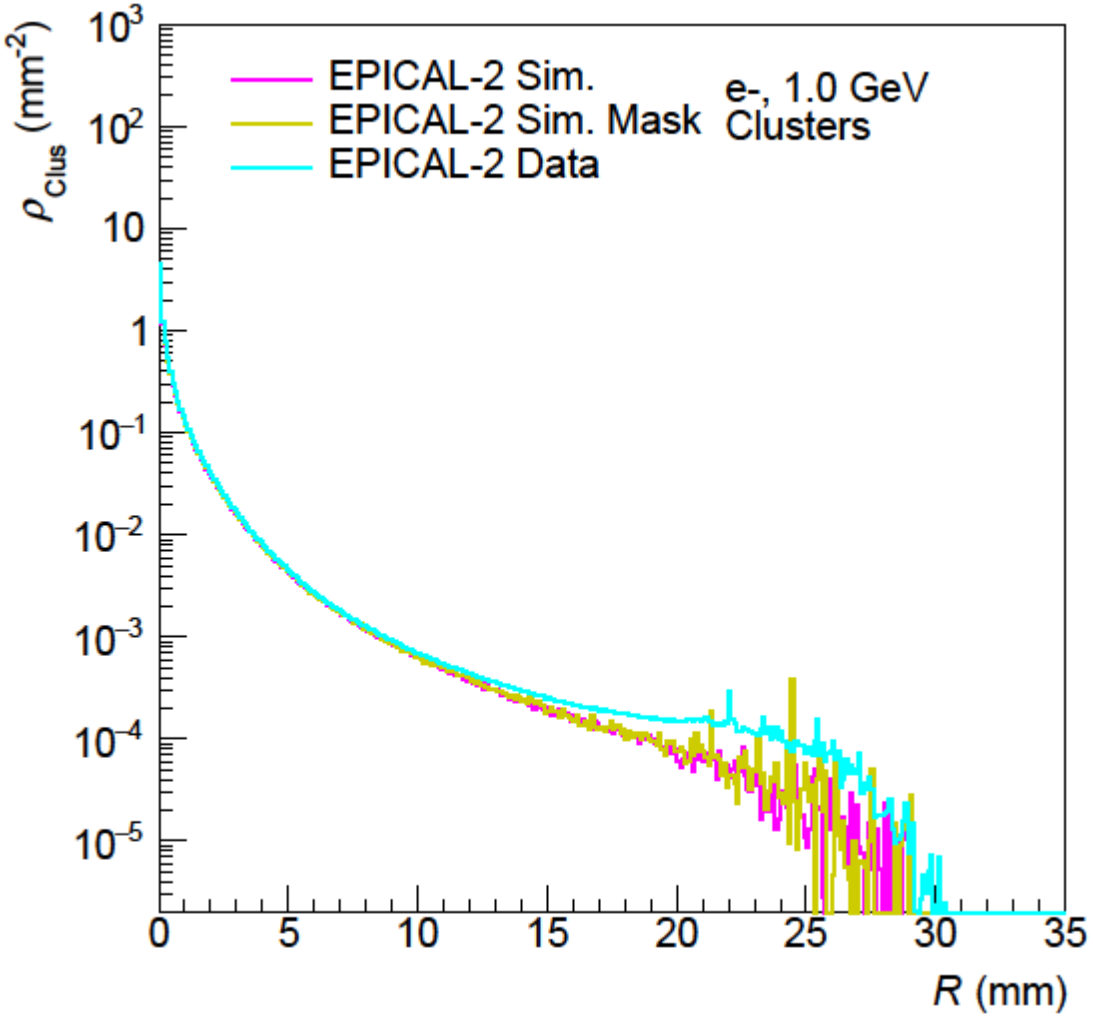
Lateral number of hit and cluster distributions





Lateral hit and cluster density distributions





Lateral hit and cluster density distributions