Pre-showering Layers

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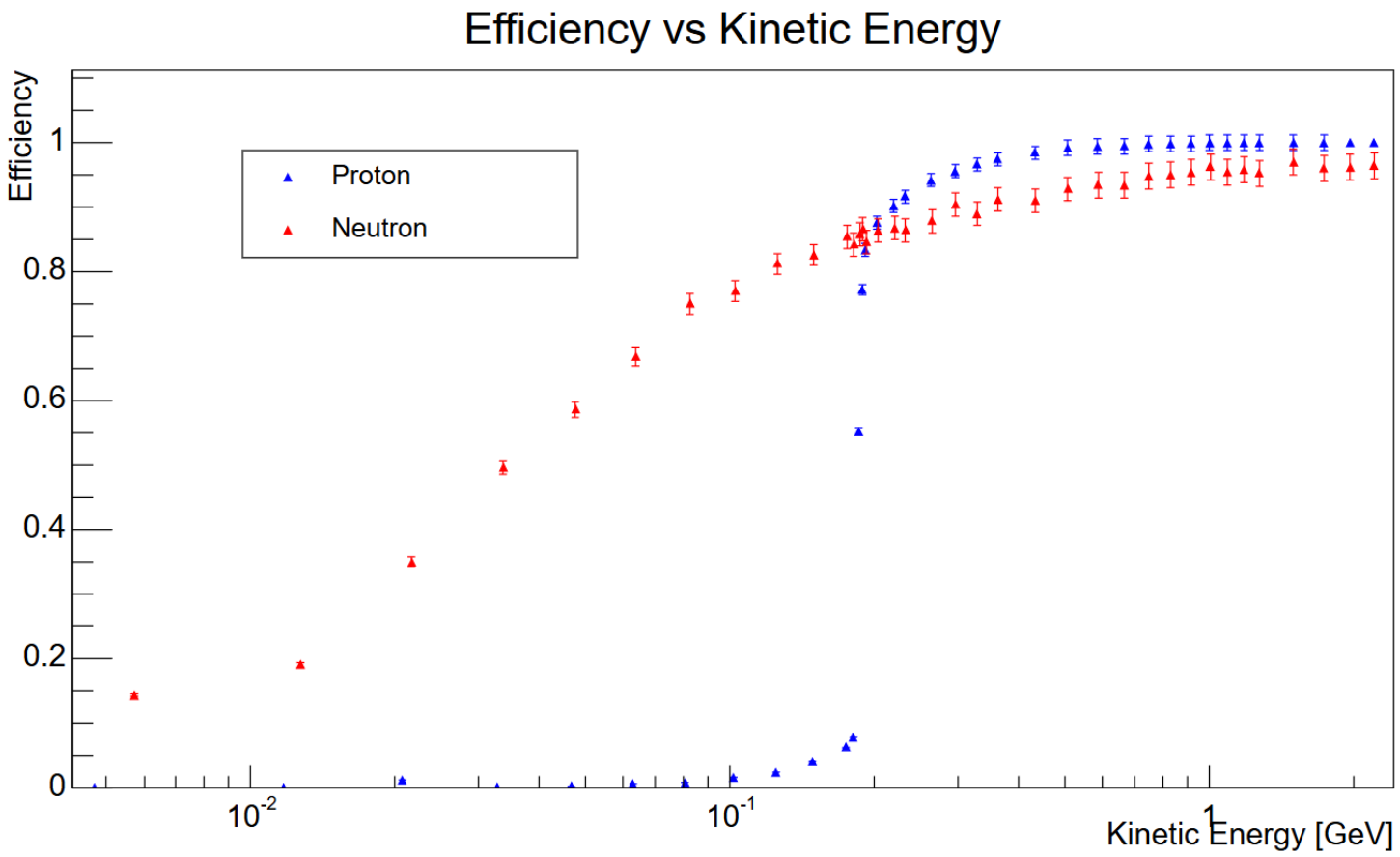
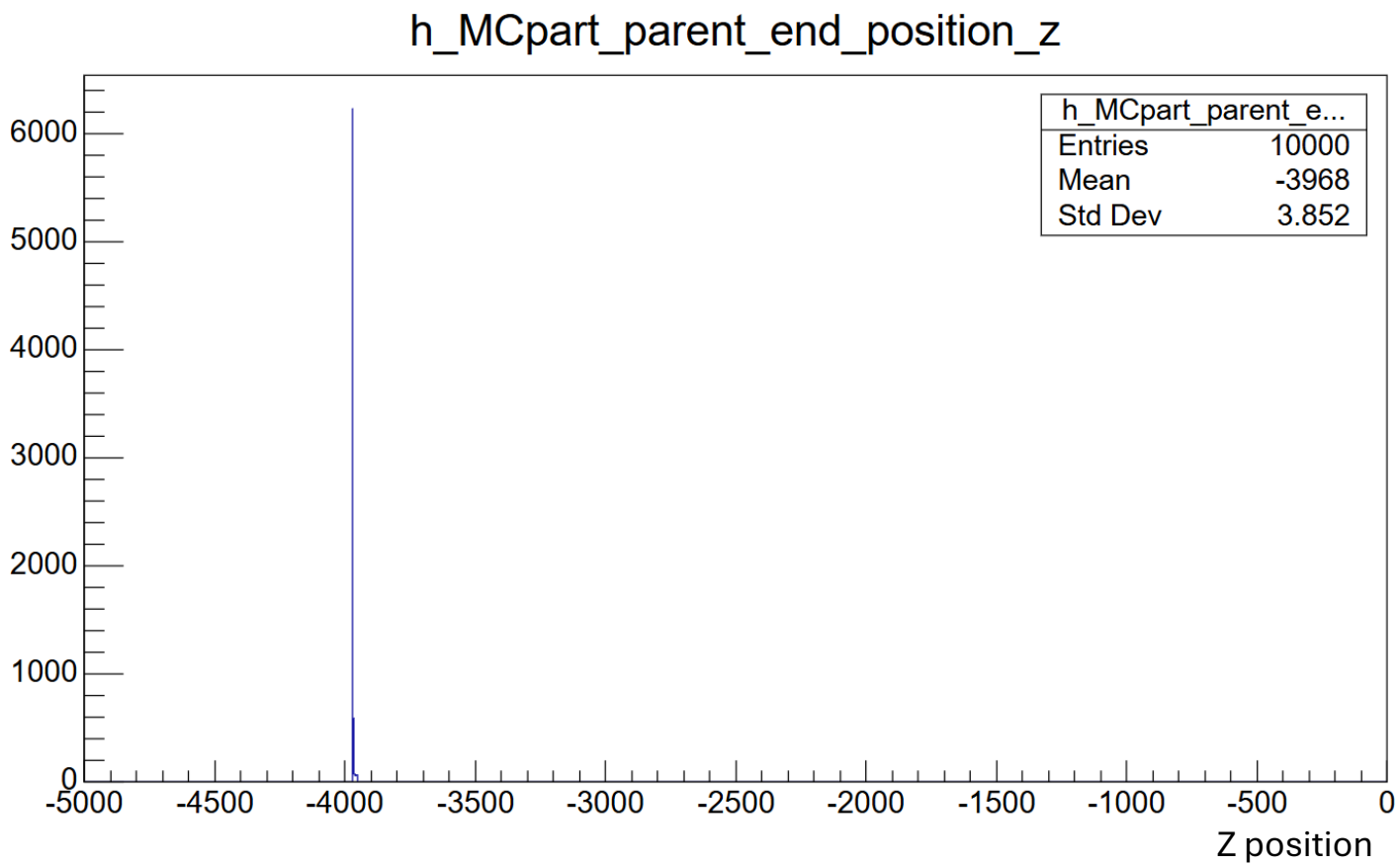
Abnormal efficiency



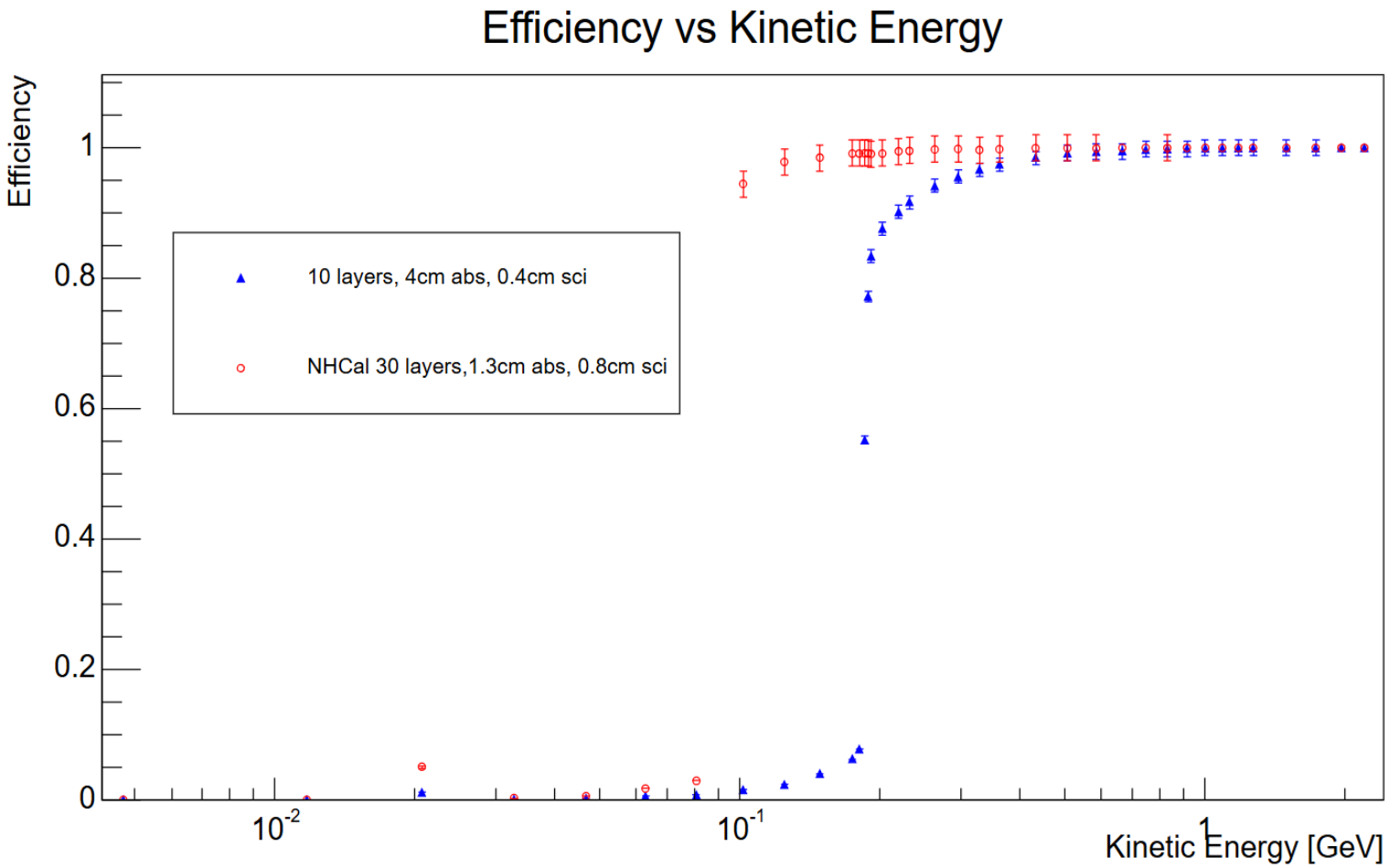
- Backward Hcal only in this simulation.
- Efficiency of Neutron grows gradually
- Efficiency of Proton has a sharp jump at around 200MeV Kinetic Energy.

Proton Behavior



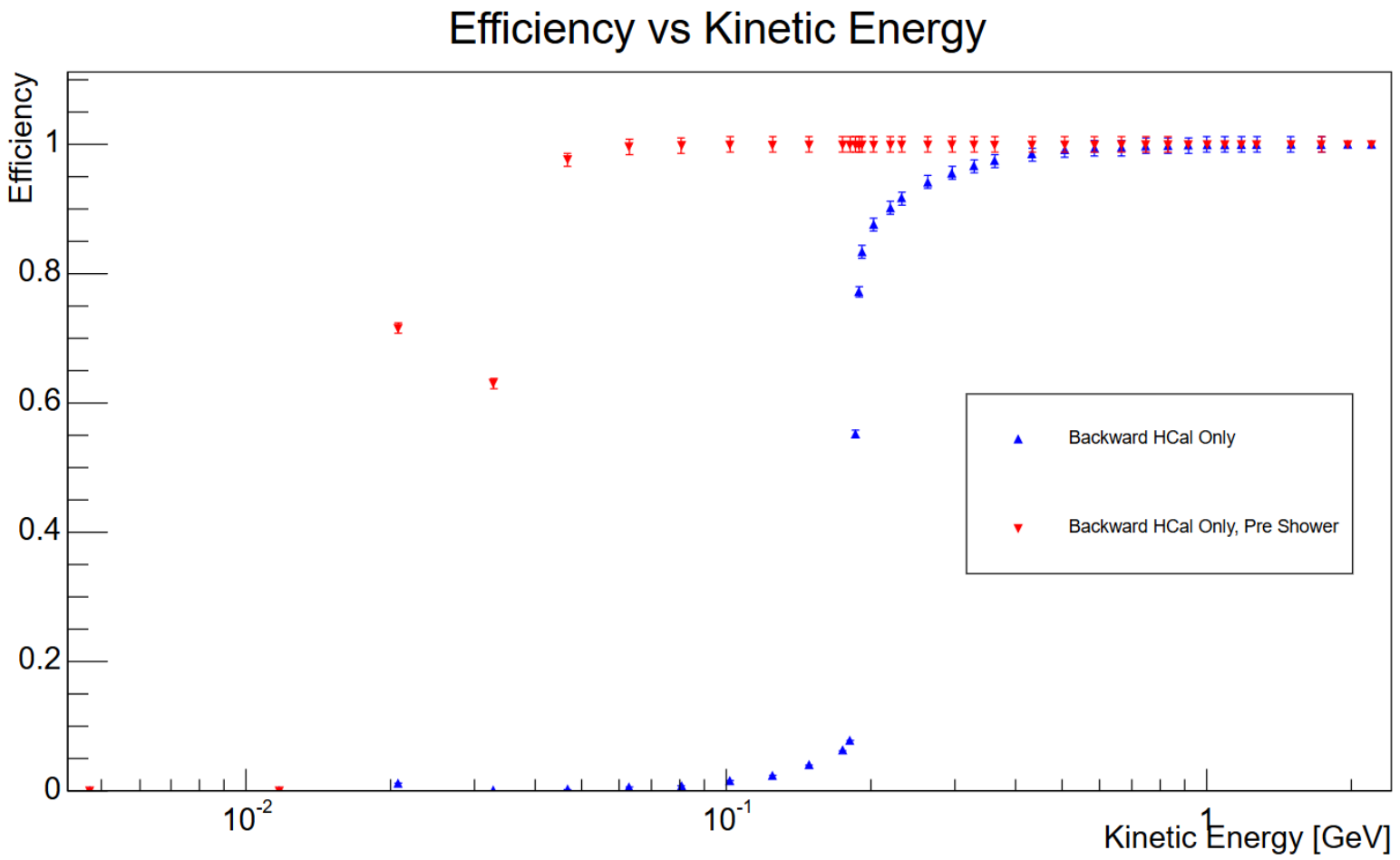
- 180MeV Proton in this simulation (just below the energy threshold).
- Protons from the gun stopped in the first layer of absorber, before the first layer of scintillator.

Geometry change



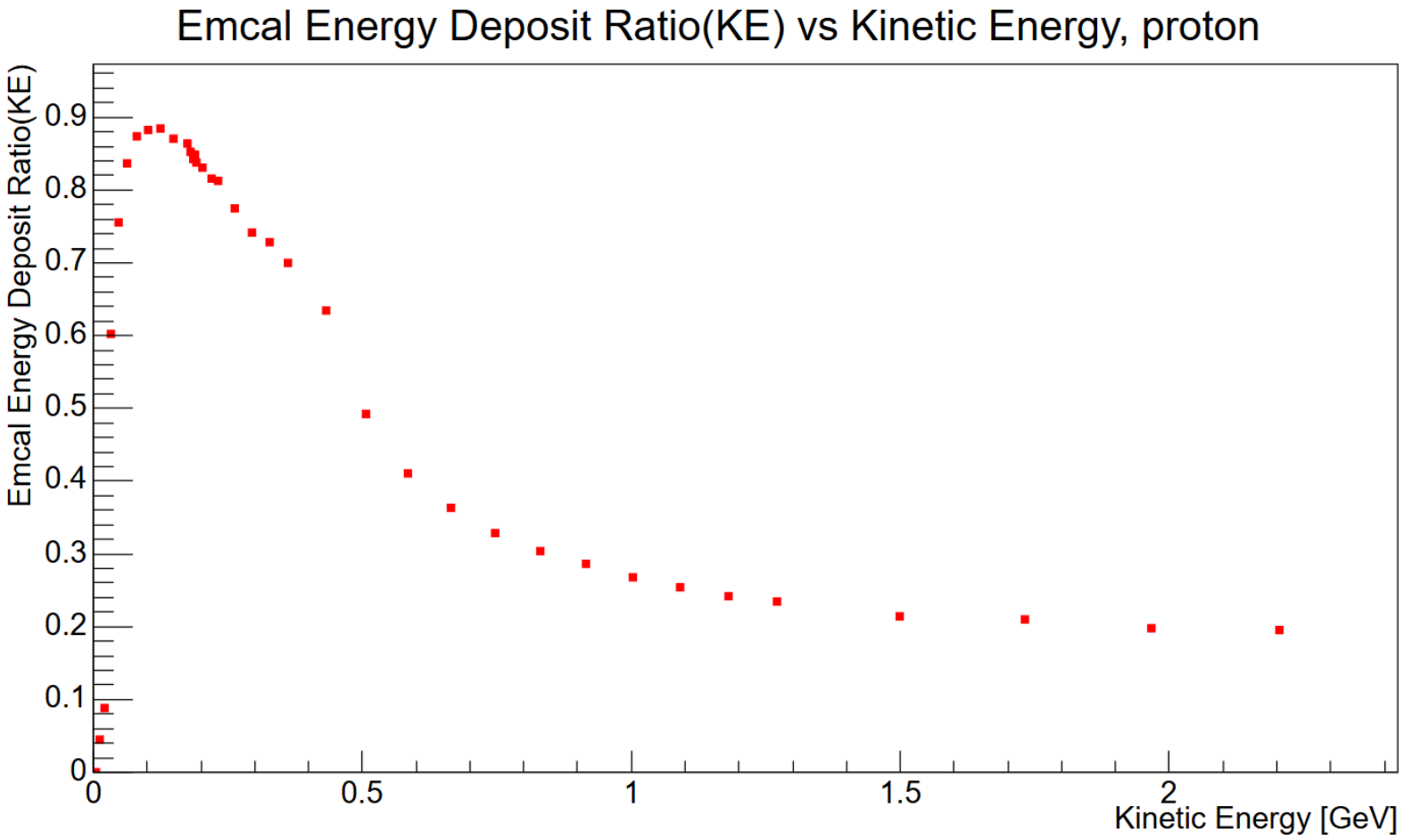
- New geometry of Hcal marked in red, based on the suggestion for neutron efficiency
- Energy threshold for proton efficiency shifted.

Pre-showering layer included



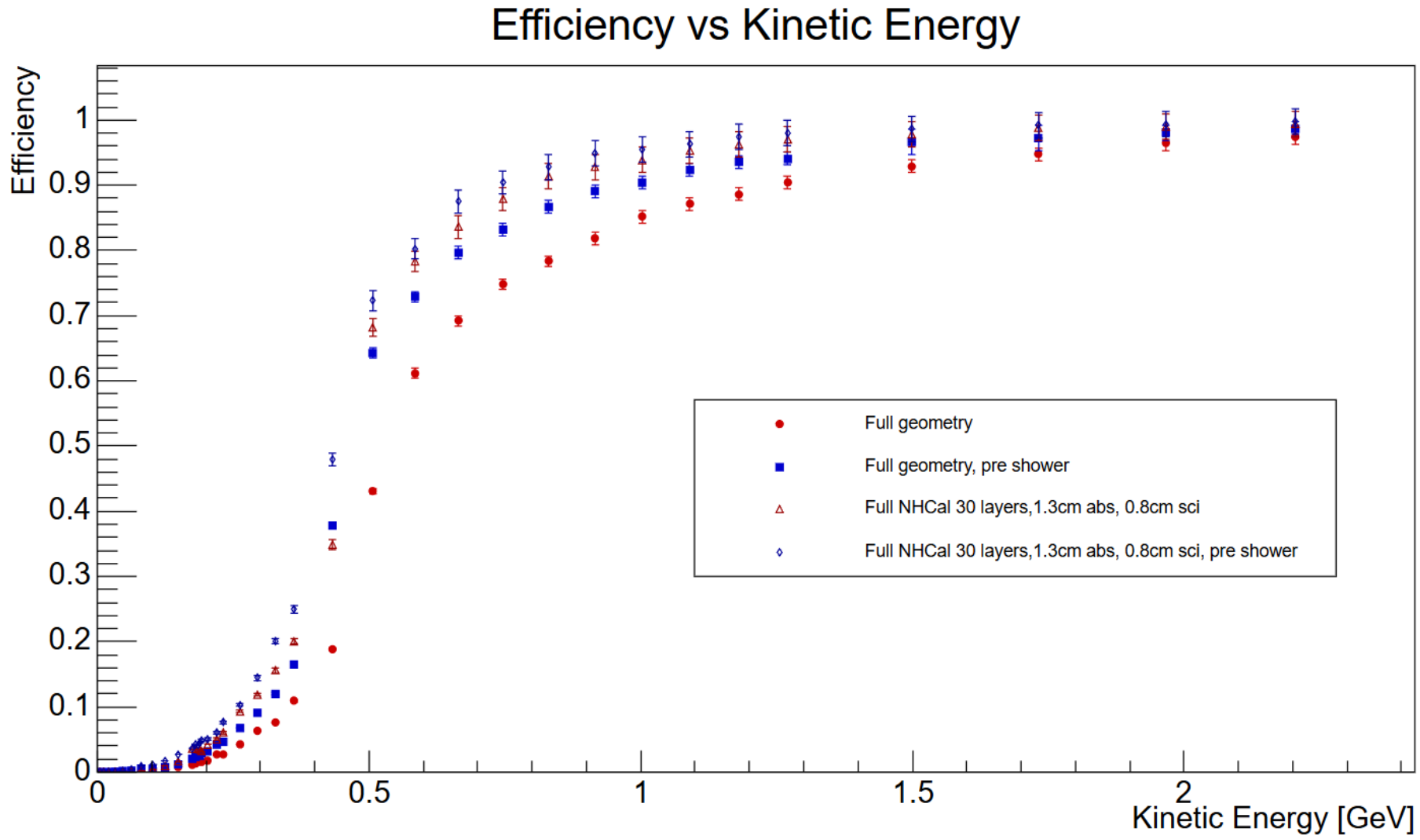
- Pre-showering layer means add one scintillator layers before our default Hcal detector.
- Layer thickness the same as the scintillator thickness in detector.
- Efficiency improve significantly

Full geometry, proton

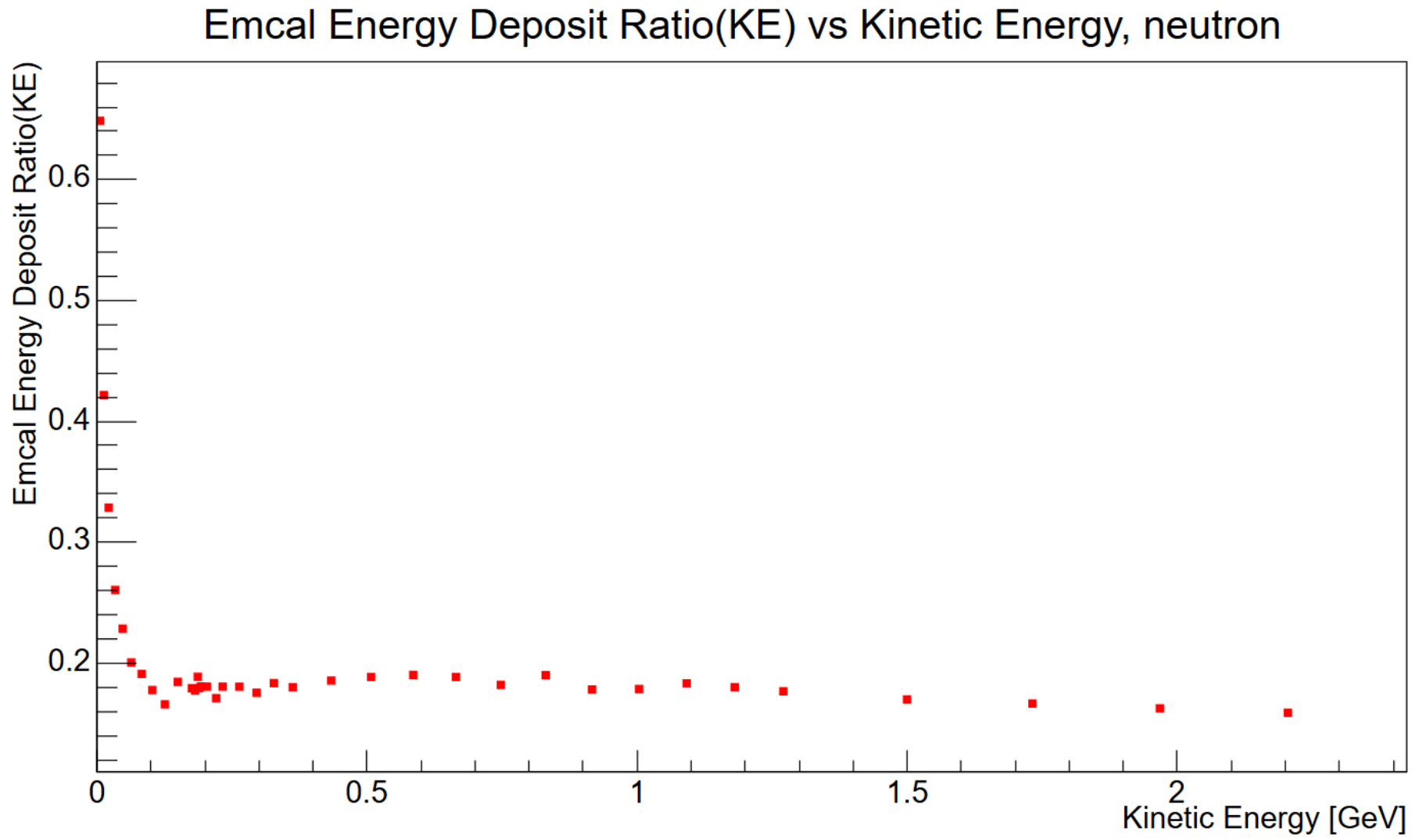


- Proton from the gun hit Emcal before hit Hcal
- Almost all its energy is deposited in the Emcal for low energy proton.

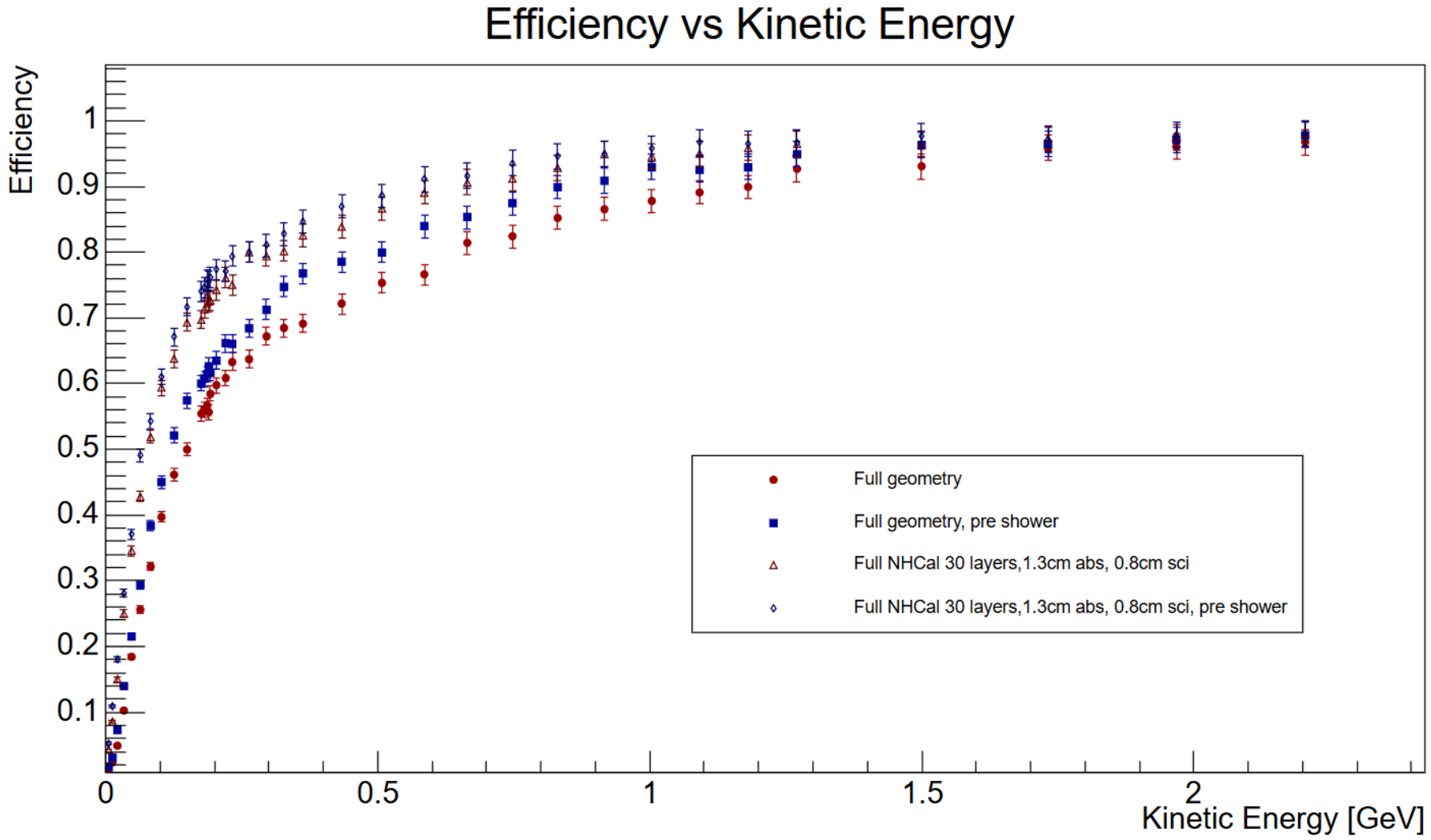
Full geometry, proton



Full geometry, neutron



Full geometry, neutron



Conclusion

- Pre-showering layers can significantly improve our detector's efficiency of proton detection.
- The efficiency shows a dependence on the ratio of absorber and scintillator, so my next plan is trying to change the thickness of the pre-showering scintillator layers and see what difference can be made.
- The energy level of proton in our real study is also important, because that will determine whether the energy threshold of efficiency in my study is worthy to pay attention.
- Instead of using a particle gun, using a pythia event to see how different setup works in more realistic situation.