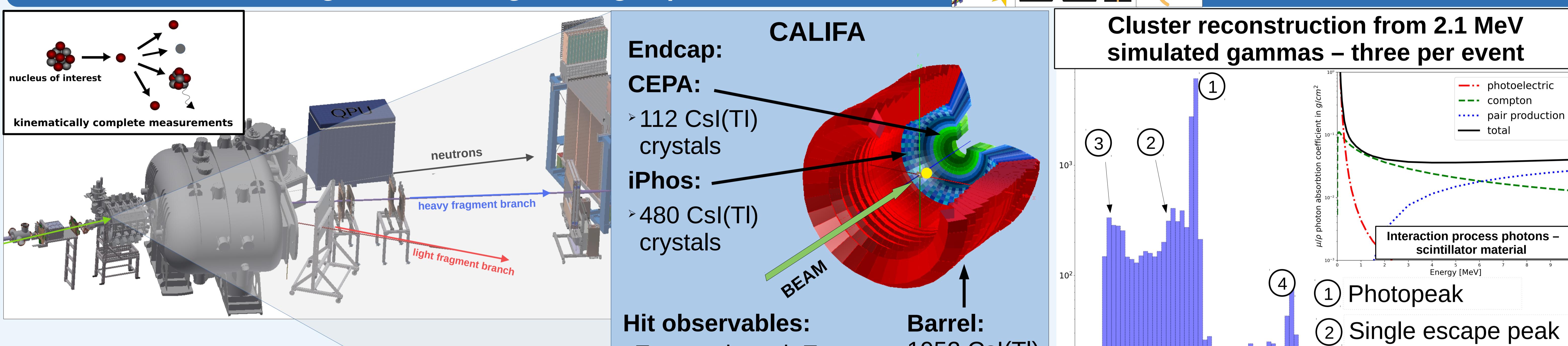
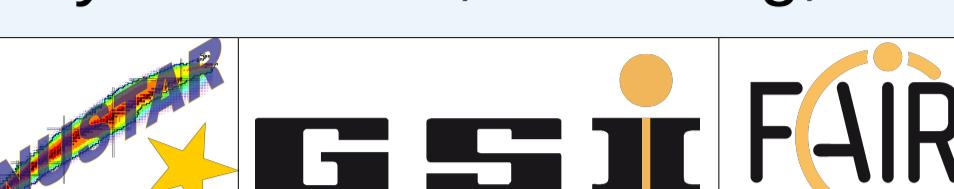


T. Jenegger, R. Gernhäuser for the R<sup>3</sup>B Collaboration  
supported by N. Hartman, L. Heinrich from the ORIGINS Data Science Laboratory - ODSL

TUM School of Natural Sciences, Physics Department, E62, Technical University of Munich, Garching, Germany

## CALIFA – Detection of gammas and light charged particles @ R<sup>3</sup>B

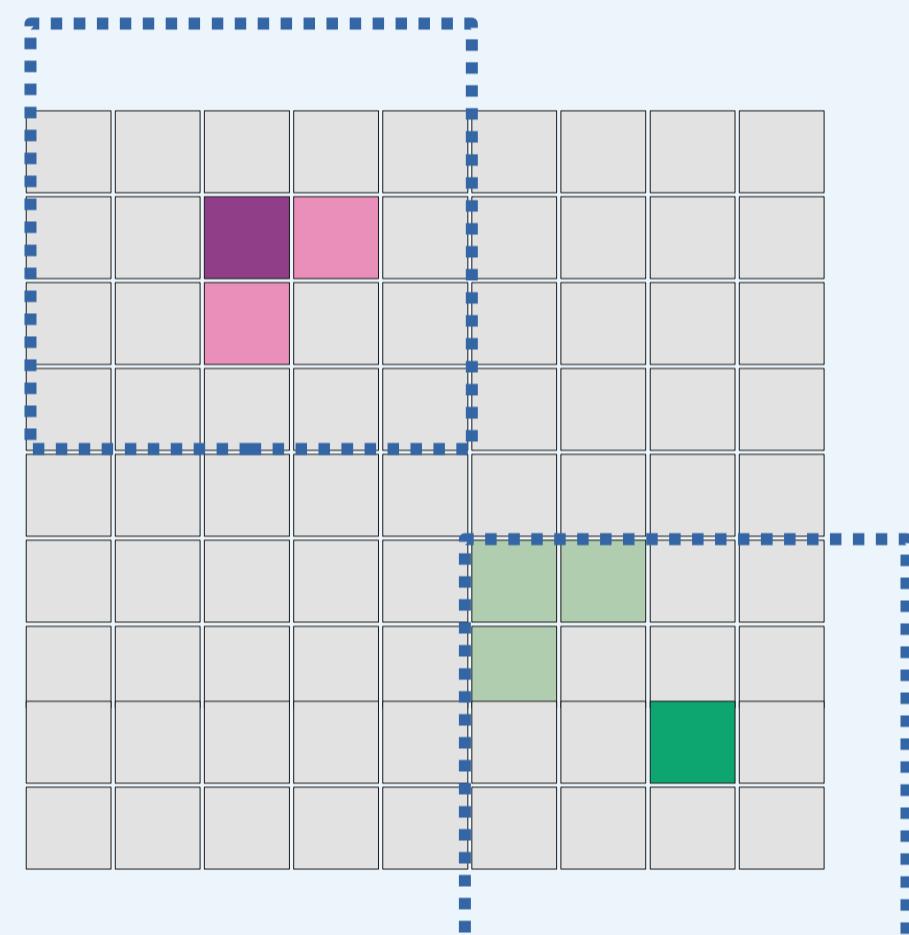


## R<sup>3</sup>B - Reactions with Relativistic Radioactive Beams

- Studies of exotic nuclei far from stability
- Focus: nuclear structure and reaction dynamics

## Constant Geometry Method (CGM)

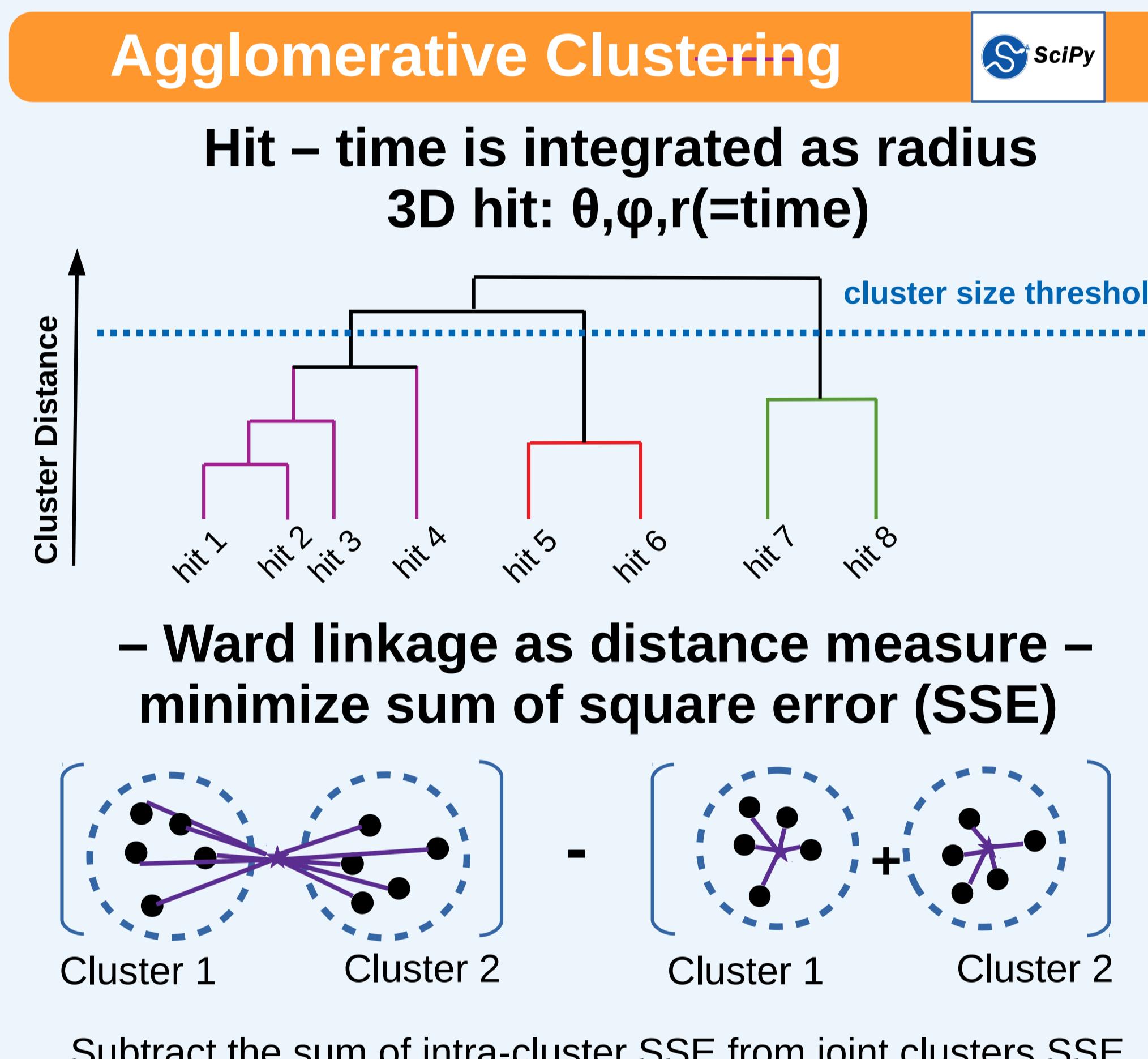
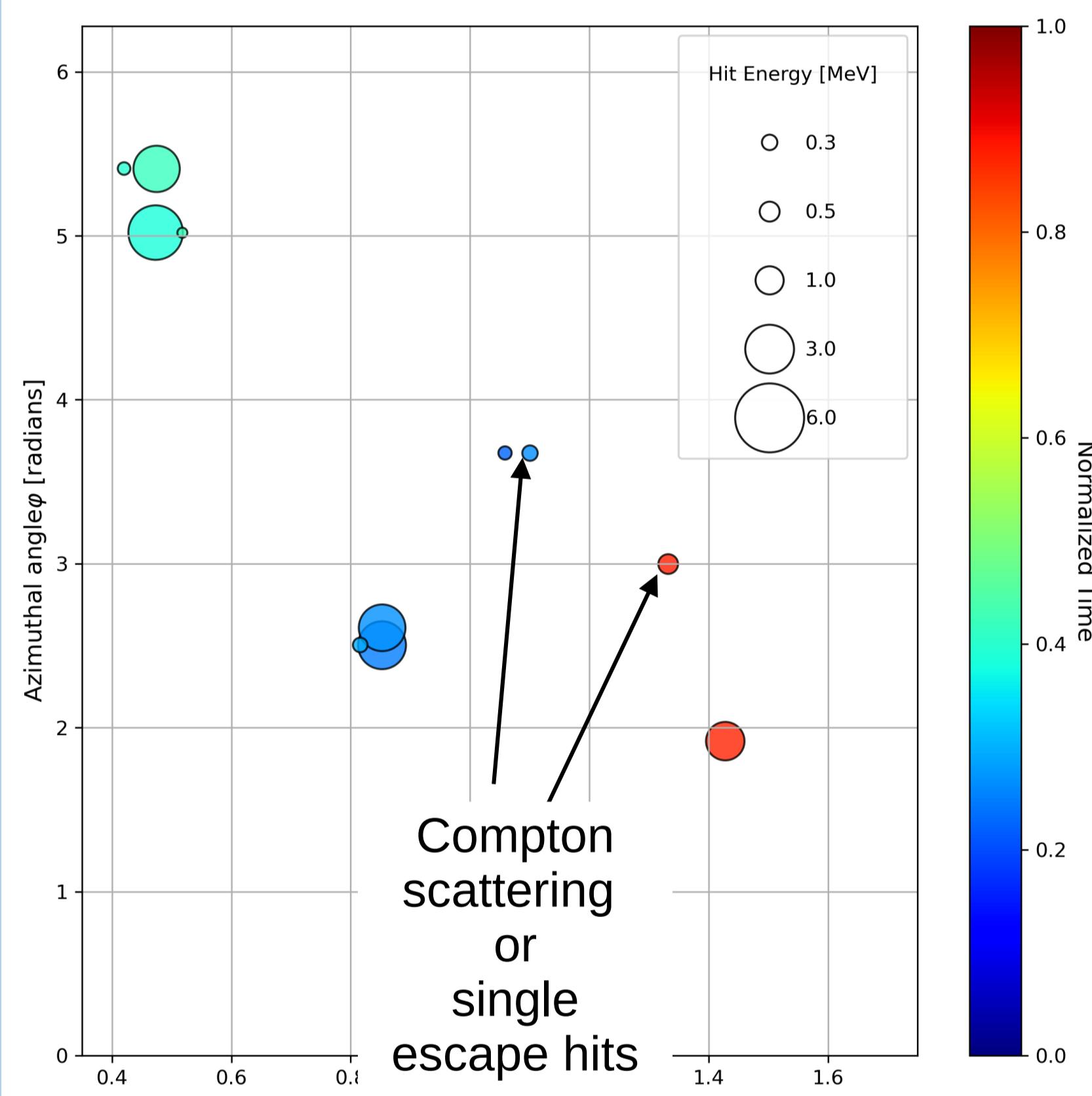
User defines shape and size of cluster:



and set energy threshold for single crystals

- |         |
|---------|
| 3.1 MeV |
| 2.2 MeV |
| 2. MeV  |
| 1.5 MeV |
| 0.7 MeV |
| 0.5 MeV |
| 0.3 MeV |
- Sort the hit list by energy:
1. Create cluster centered around first hit
  2. Loop over all hits in list
  - if hit inside cluster add it and remove it from the list
  3. Do this procedure until list is empty

## Simulated CALIFA event with three true clusters

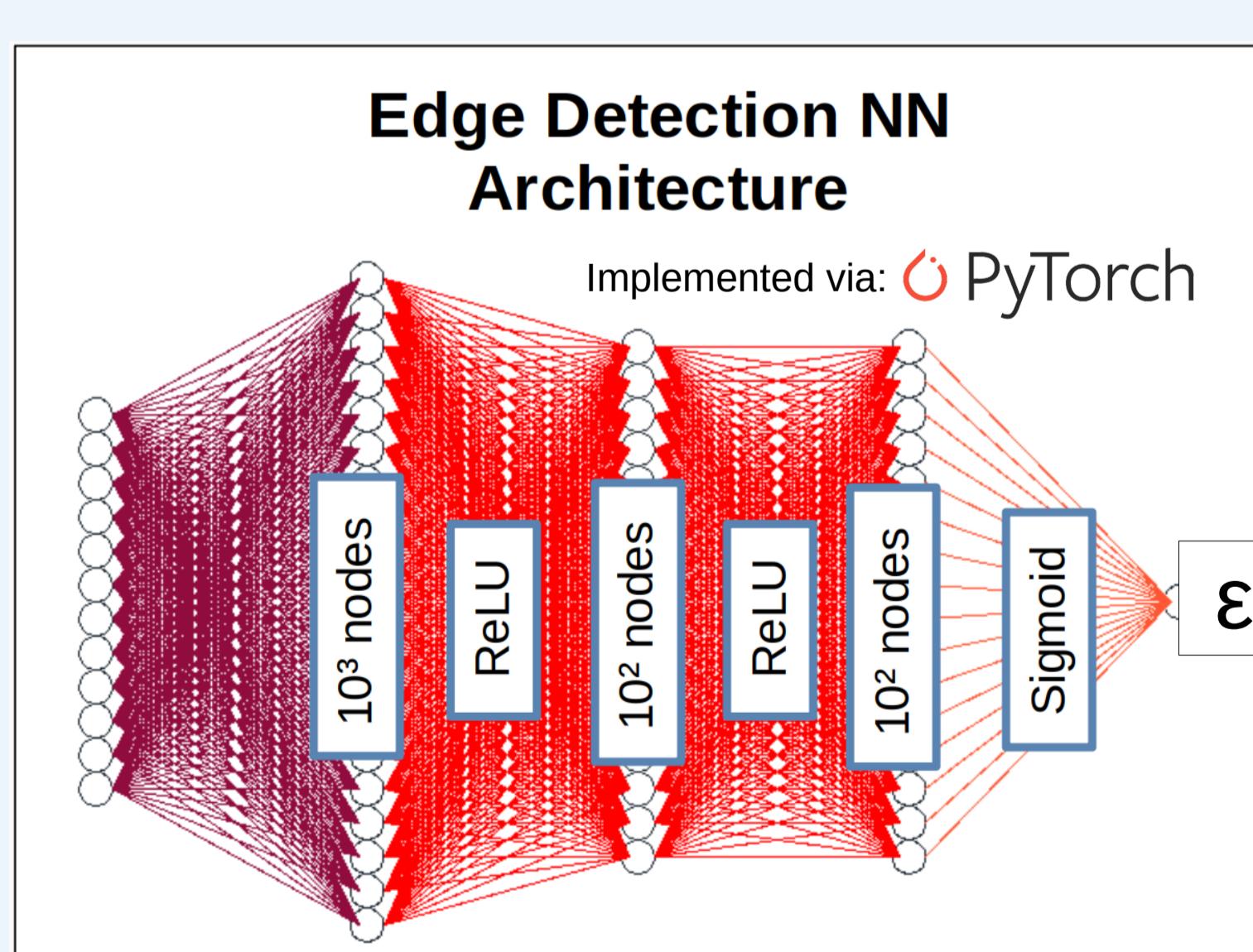


## Edge Detection Neural Network

### Pairwise hit comparison (i, j)

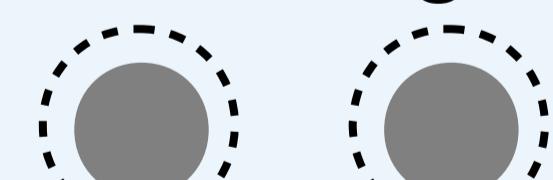
12 input features:

$$E_{ij}, \theta_{ij}, \phi_{ij}, t_{ij}, \Delta E_{ij}, \Delta \theta_{ij}, \Delta \phi_{ij}, \Delta t_{ij}$$

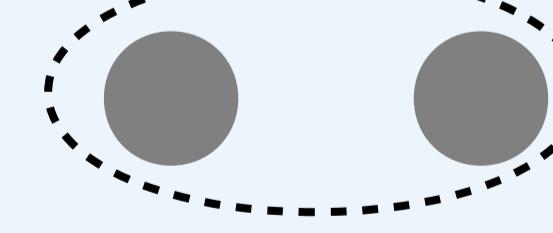


Single node output layer with score  $\varepsilon$  within [0, 1]

If  $\varepsilon < \text{merge cut}$



elif  $\varepsilon > \text{merge cut}$



### Various Edge Detection NN models analyzed:

- Edge model without time information
- Edge Model with time information
- R3B + Edge (without time)  
Data preclustered via Standard R3B Clustering → input into the Edge model
- Aggro + Edge (with time)  
Data preclustered via Agglomerative Clustering → input into the Edge model

## RESULTS

