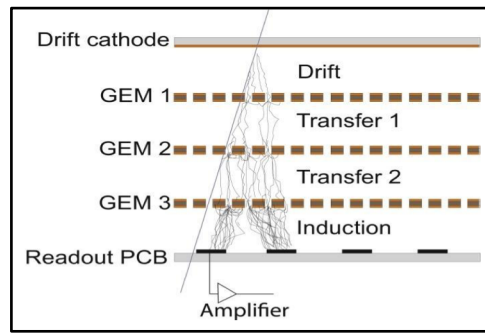# *Development of Machine Learning algorithms for Micro Pattern Gaseous Detectors*

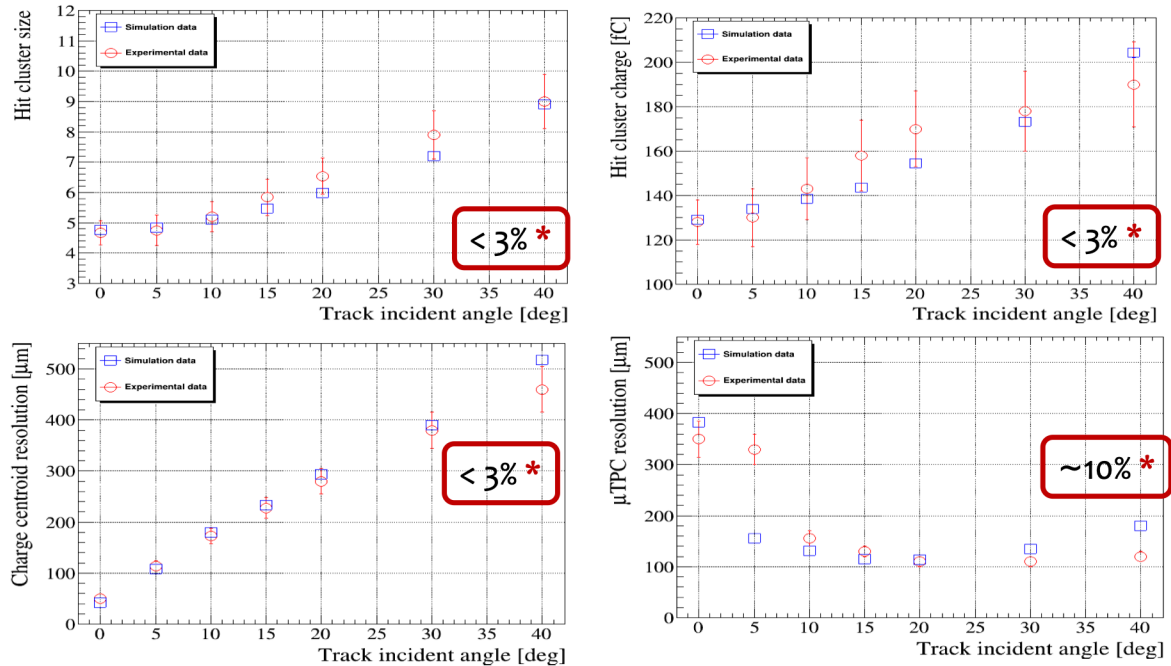*G. Cibinetto (INFN Ferrara)*

Simulation and ML development

For triple-GEM, we developed a parametric simulation which takes into account diffusion, transparency, gain, induction and readout electronics.

We tuned it to test beam data → both charge and time readout for CoG and uTPC cluster reconstruction.

Goal I: extend the simulation to other MPDG detectors.

Goal II: develop general purpose Machine Learning tracking algorithms.

Tuning to real data

Best result χ^2/NDF ~ 3 ← *gain tuning = 6.8* ← *diffusion tuning = 1.5*

* (experimental –simulated)/experimental
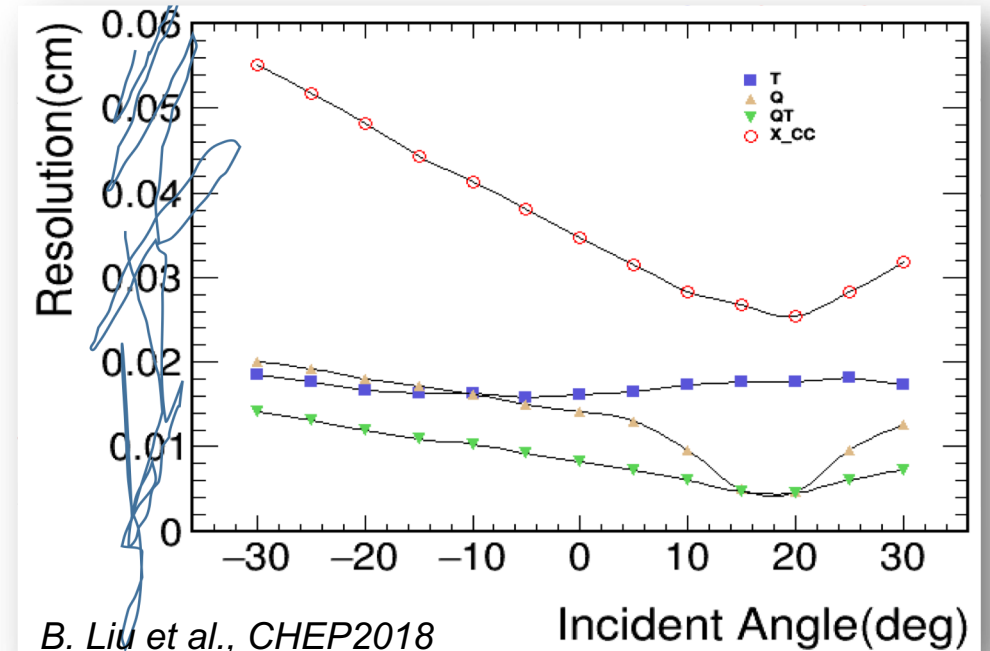
B. Liu et al., CHEP2018

Simulation and ML algorithms can be developed in the general framework

Task timeline and deliverables

- **Time line and task: 4 years**
  - First year: add uRWELL simulation. Cluster reconstruction GEM and uRWELL.
  - Second year: track finding
  - Third year: track cleaning and refinement
  - Forth year: application to Idea detector pre-shower and muon → optimization

- **Deliverables**
  1. A scientific paper and a poster describing the performed activity and the results.
  2. An open source software suite for training and testing ML algorithms on MPGDs.

  A deliverable for the simulation task can be added

Resources

- The group
    - INFN Bologna: main sub-task → porting and integration with IDEA general framework
    - INFN Ferrara: MPGD parametric simulation, uTPC development and ML algorithms
    - INFN Frascati Laboratory: responsible for uRWELL technology and test beam data
    - IHEP (Beijing): tracking and ML development

- Leading institute: INFN Ferrara (G. Cibinetto)

- Funding will be given to INFN as a single unit and then distributed among different groups.

	unit cost in kE
Post Doc Positions (4 years)	100
travel expenses (for 4 year)	40
consumables	10
Total	150

Numbers from the EoI → 50% manpower reduction is doable if we get external co-funding (e.g. INFN, University, …).

Matching funds: 300 kE, i.e. 50 PM for the entire project.