

# Overview: ongoing work on protoDUNE dual phase in LArSoft

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March 8<sup>th</sup>, 2017 / ProtoDUNE reconstruction meeting

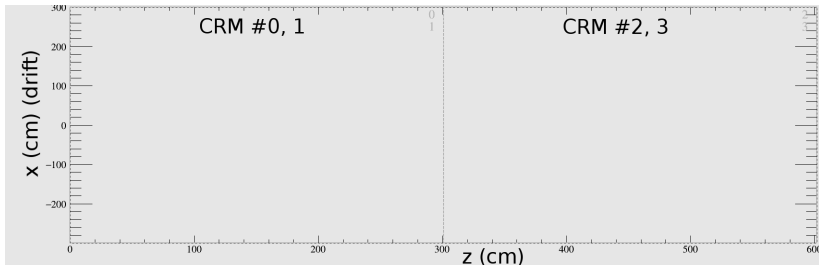
**ETH** zürich

- Motivation:
  - Goal: full simulation and reconstruction chain for the protoDUNE-DP
  - Many people are joining our efforts on implementing the dual phase in LArSoft → **important to coordinate our work**
  
- Content:
  - Overview and description of the ongoing activities
  - List of activities that are just getting started
  - List with open tasks (everyone is invited to get involved)

# Overview: Ongoing activities

1. Geometry (Balint Radics, ETH Zurich)
  2. Hit shaping & fitting (Christoph Alt, ETH Zurich)
  3. Shower reconstruction (Andrea Scarpelli, APC Paris)
  4. Track reconstruction (Christoph Alt, ETH Zurich)
- + much help and assistance from Robert, Dorota, Slavic and Gianluca!

## existing protoDUNE dp geometry in LArSoft:



- Four  $3 \times 3 \text{ m}^2$  CRM's, 6 meter drift
- .fcl's for sim & reco in: `srcs/dunetpc/fcl/protodunedp/`

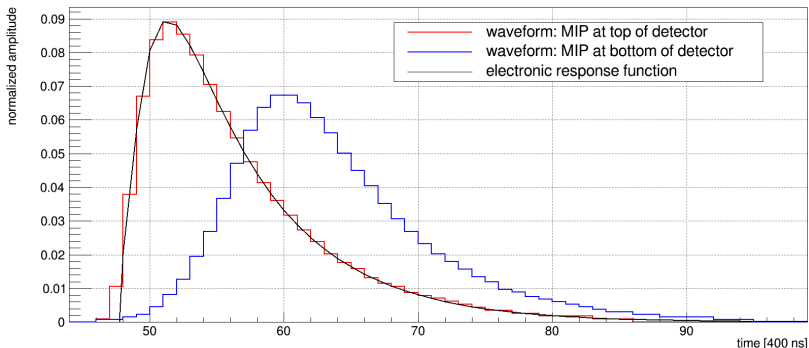
### 1. Geometry (Balint Radics, ongoing):

- rotate existing protoDUNE dp geometry to obtain drift in y (thanks to Gianluca Petrillo for getting started with this!)
- adapt charge projection to rotated geometry
- add crucial materials (field cage, beam window and beam plug)

## 2. Hit shaping & fitting (Christoph Alt, ongoing):

- add noise based on  $3 \times 1 \times 1$  measurements
- implement electronic response function for dual phase
- fit raw waveforms and validate clustering/tracking algorithms

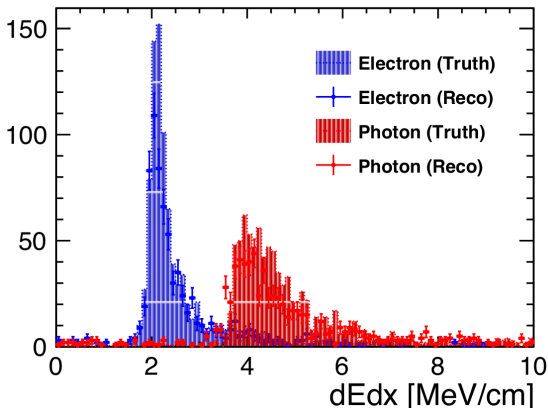
### Preliminary: electronic response function for dual phase



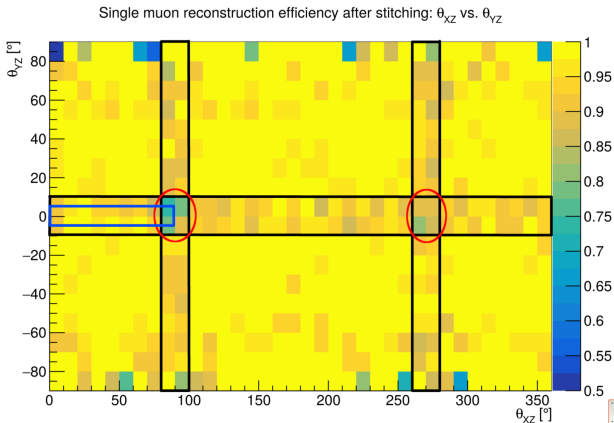
### 3. Shower reconstruction (Andrea Scarpelli, ongoing):

- calorimetric shower reconstruction
- electron/gamma separation

first results on  $e^-/\gamma$  separation:  $dE/dx$  for the first 2.5cm of the shower



4. Track reconstruction (Christoph Alt, ongoing):
- muon reconstruction efficiency & track splitting
  - Overall efficiency: 97.2%



more info:

<https://indico.fnal.gov/getFile.py/access?contribId=4&sessionId=2&resId=0&materialId=slides&confId=13770>

## Just getting started:

- 5. Cosmics simulation      Kai Loo, Univ. of Jyväskylä
  
- 6. 3x1x1 with LArSoft      Kevin Fusshoeller, ETH Zurich
  
- 7. Light sim/reco      Andrea Scarpelli, APC Paris  
Alessandra Tonazzo, APC Paris  
Clara Cuesta, CIEMAT  
Chiara Lastoria, CIEMAT  
Ana Gollego, CIEMAT  
Jose Alfonso, CIEMAT
  
- 8. Low energy reco      Clara Cuesta, CIEMAT  
Chiara Lastoria, CIEMAT  
Ana Gollego, CIEMAT  
Jose Alfonso, CIEMAT



## Examples for open tasks:

- reading beam simulation files into LArSoft (a tool for this is available for single phase already)
- simulate charge smearing in the gas phase
- electric field maps for improved charge drift simulation

Everyone is welcome!