



# ProtoDUNE PDS beam studies

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# ProtoDUNE PDS characterisation/performance

- Calibration and monitoring

- Multiple PEs plot, charge and max amplitude
- Gain vs applied bias voltage, SNR, calibration factor
- Crosstalk & afterpulses
- Time resolution
- Response stability overtime

- Cosmics

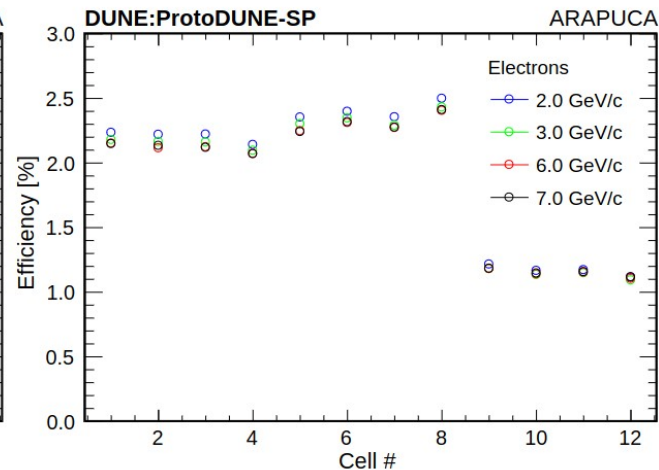
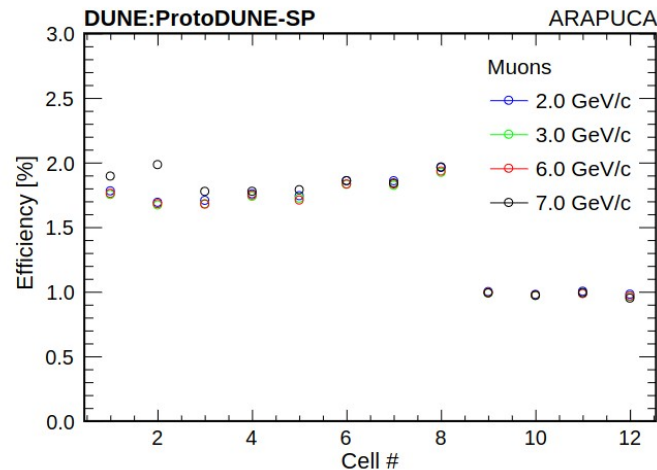
- Signal characteristics:
- Baseline, noise
- SPE: amplitude, rise, fall, etc
- Sensor efficiency (track, MC light estimate)
- Time resolution (distance, track)

- Beam

- Beam characteristics, particle types
- Optical properties (MC tuning)
- Sensors efficiency (MC light estimate)
- Time resolution (distance, track)

List not updated: Pulsed neutron source, rad. sources, Ion. laser.

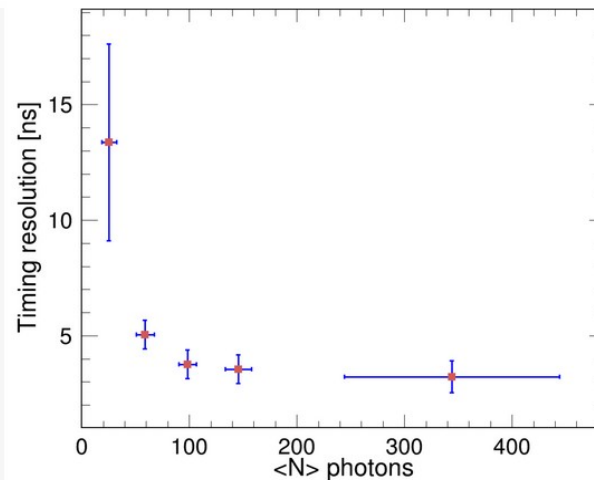
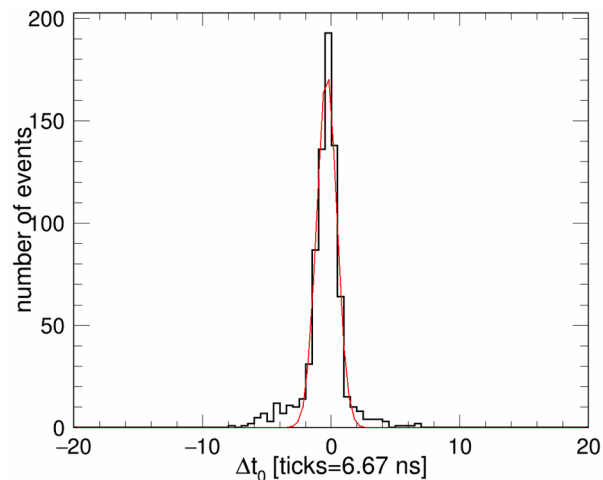
# Examples from pDUNE-SP



- Beam

Sensors efficiency  
(MC light estimate)

Time resolution  
(distance, track)

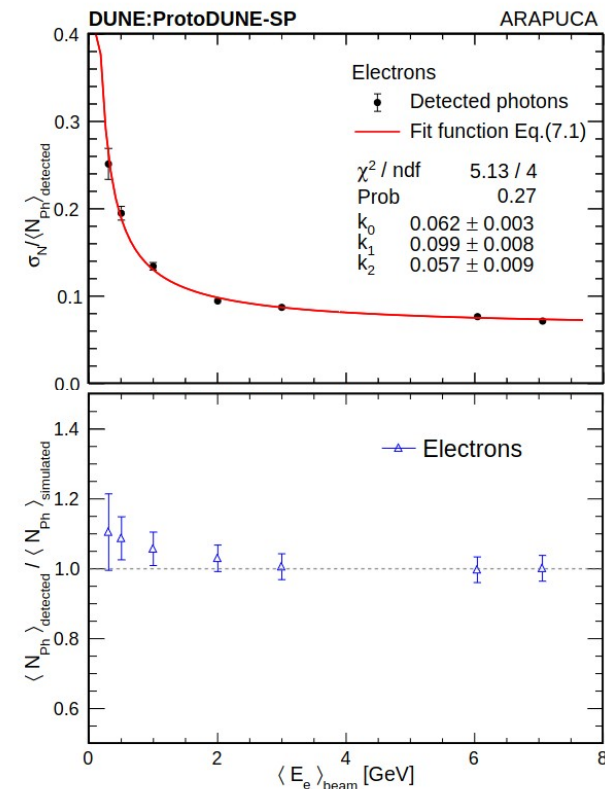
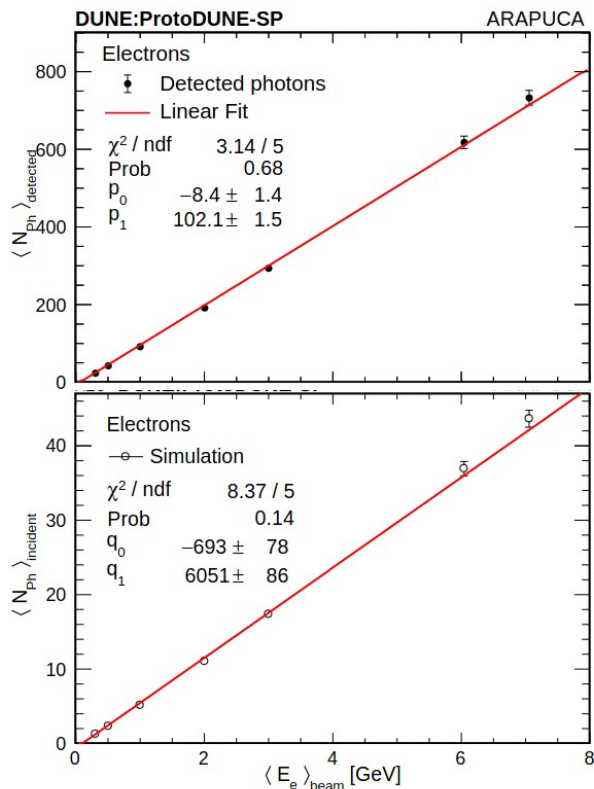


# ProtoDUNE PDS Beam Studies

- PDS calorimetric energy reconstruction
- Combined charge+light calorimetry
- Michel electrons (LE calorimetry)

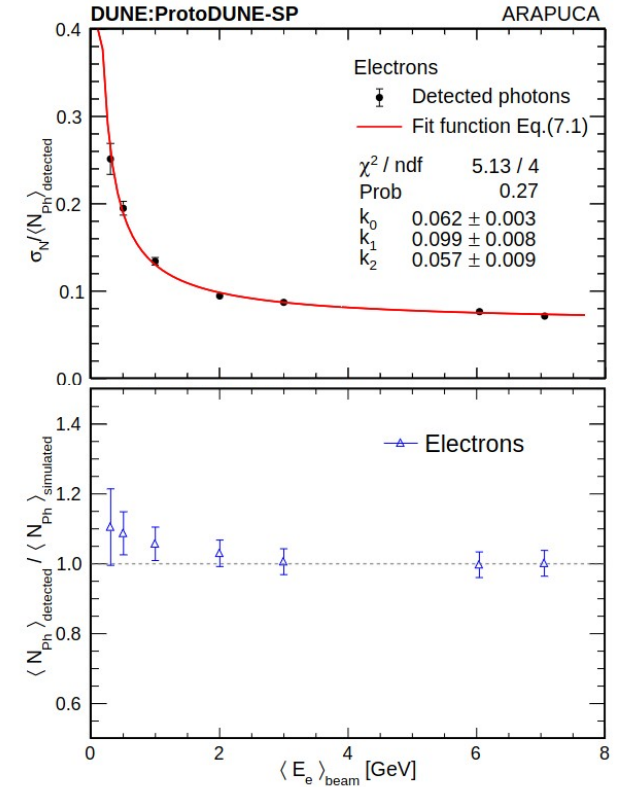
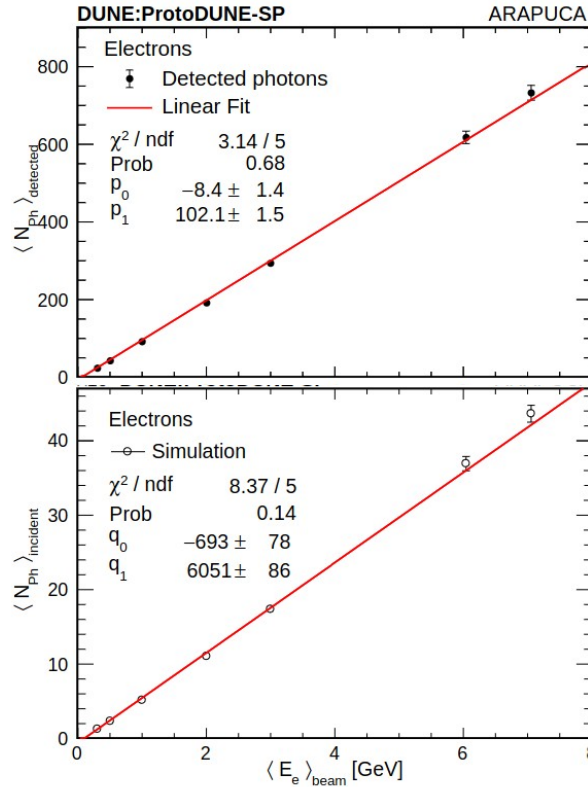
# ProtoDUNE PDS Beam Studies

- PDS energy reconstruction
  - Independent measurement



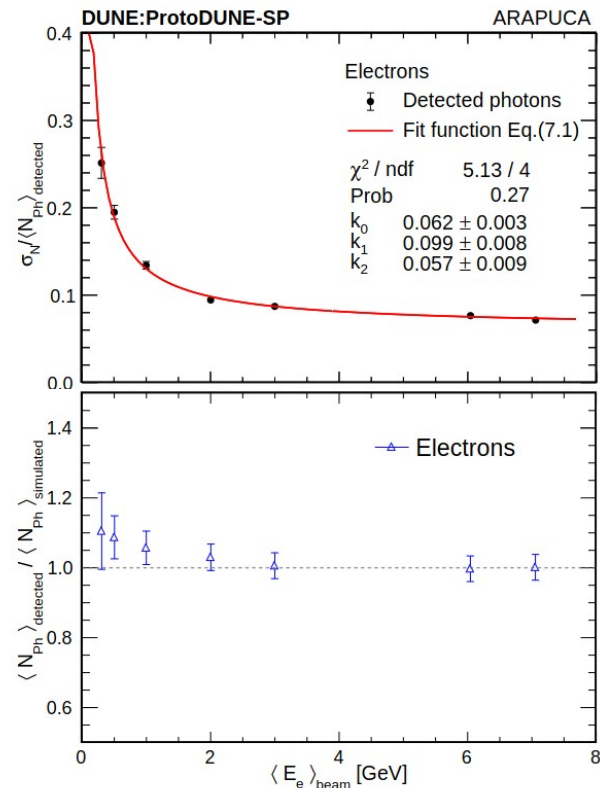
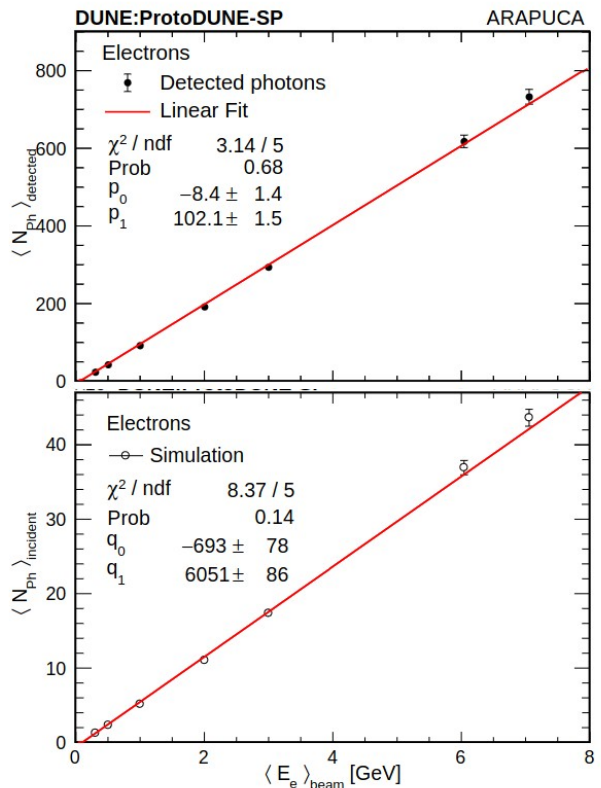
# ProtoDUNE PDS Beam Studies

- PDS energy reconstruction
  - Independent measurement
- Light + charge calorimetry
  - Anti-correlation understanding
  - Resolution improvement
  - No recombination correction



# ProtoDUNE PDS Beam Studies

- PDS energy reconstruction
  - Independent measurement
- Light + charge calorimetry
  - Anti-correlation understanding
  - Resolution improvement
  - No recombination correction
- Michel electrons
  - Physics (Oscillation and SNB)
  - Low energy range (<60MeV)
  - Energy & time information?



# ProtoDUNE PDS Beam Studies

- PDS calorimetric energy reconstruction
- Combined charge+light calorimetry
  - Michel electrons (LE calorimetry)
- Areas/opportunities where PDS info can help improve Physics?
  - Neutron interaction studies?
    - Inelastic (n-p interactions,  $\gamma$  de-excitation), elastic (LE p), capture ( $\gamma$ )
  - Low energy point-like deposits?