

# GammaTPC: a new liquid argon time projection chamber based MeV gamma ray instrument

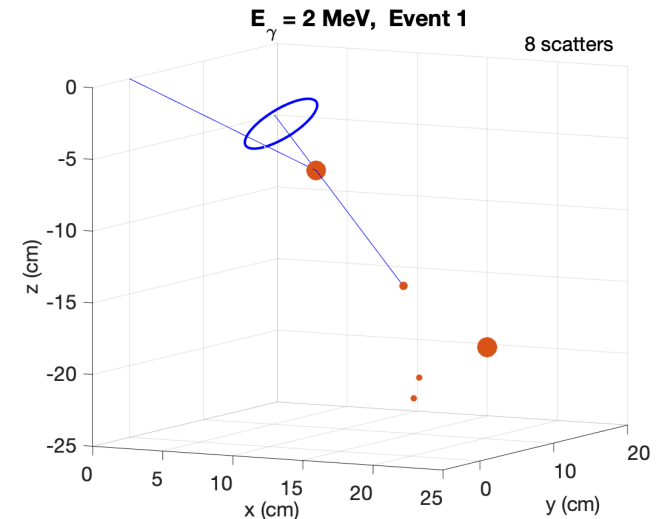
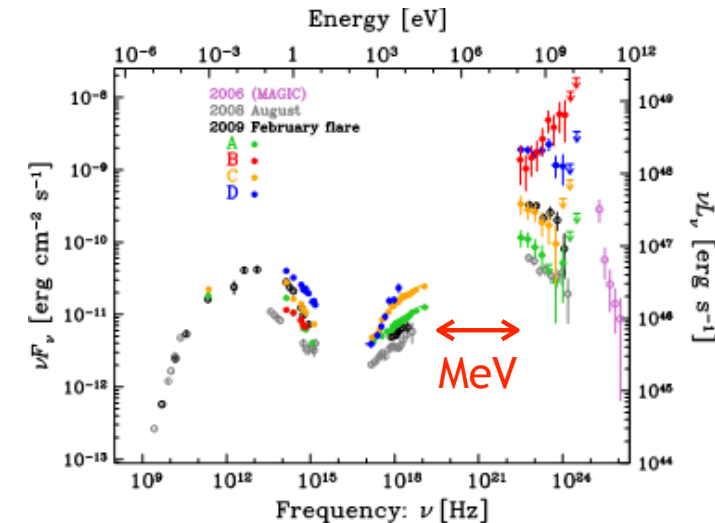
T. Shutt, SLAC

Snowmass CPM, CF7 breakout

10/6/2020

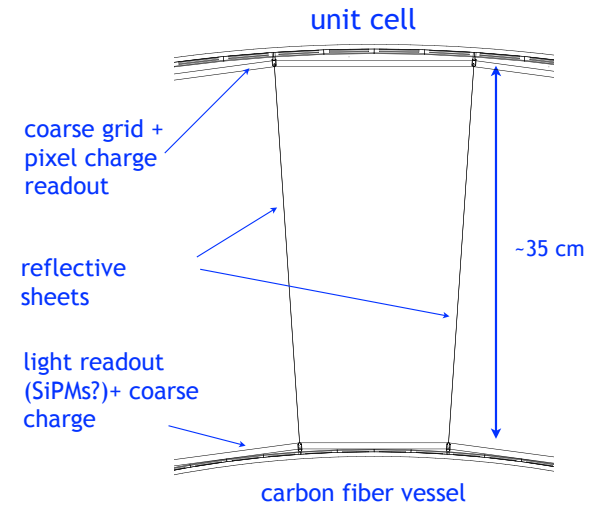
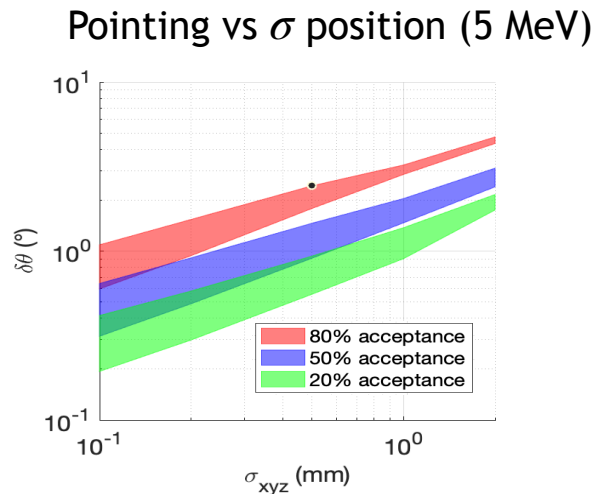
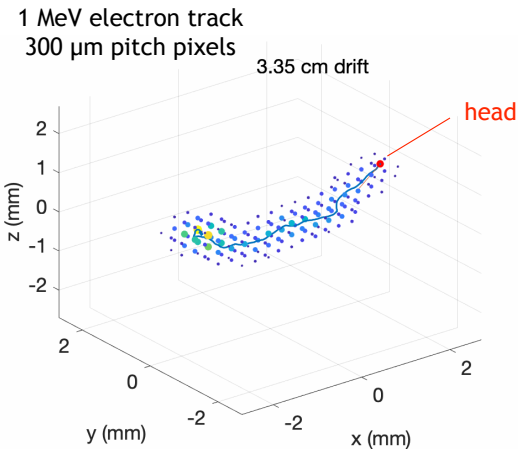
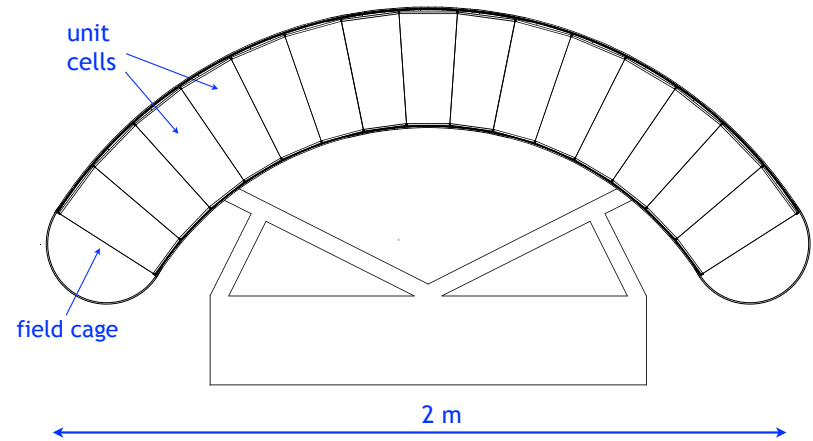
# Why a liquid Ar TPC Compton Camera?

- Exciting, largely unexplored energy window with significant discovery potential.
- Large area instrument excellent for multi-messenger
- Challenge: fine grained read out of large mass
- Time Projection Chamber (TPC)
  - Uniform active volume: *High fidelity event reconstruction, background rejection*
  - 3D readout with 2D instrumentation: large mass with modest power and channel count
- Liquid Ar - optimal target



# GammaTPC

- Design very much in progress
- Multi-level trigger
  - Handle high rate with  $\sim 200 \mu\text{s}$  drift
  - Reduce power: grids turn on after light signal
- Pixel readout
  - Coarse grid trigger allows true pixel readout
  - Requires development of new true power-off state



# Prospects

- Initial studies look promising
  - Pointing on degree scale or better, depending on E
  - Energy resolution  $\sim 2\%$  fwhm  $\Delta E/E$  at 1 MeV
  - Effective area / actual area appears high
- Significant issues to be address, including:
  - Pixel readout, extreme low power electronics
  - Liquid noble handling in space
- Leverages 20+ years liquid noble development for DM and  $\nu$
- Appears worth pursuing as successor to mature Si technology