

# Neutron Gun Set-up

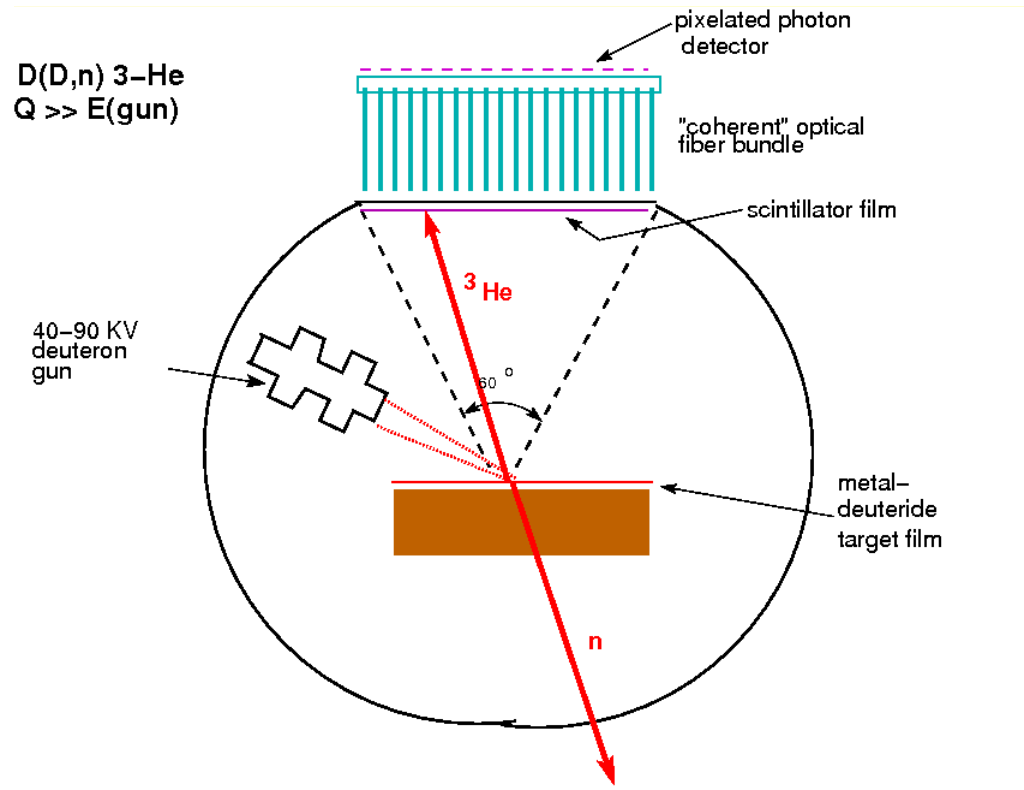
Work in progress

# Outline

Focalizing on the neutron gun set-up to start with. Today:

- Neutron-gun geometry and He detector configuration from docs
- Some ad-hoc configuration for neutron detectors
- Updated neutron detector support structure
- Plans and to do

# Neutron gun geometry-1



- HV fixed to 40 KV,

# A look at API 120 paper and docs

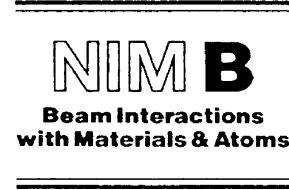


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## The API 120: A portable neutron generator for the associated particle technique

D.L. Chichester \*, M. Lemchak, J.D. Simpson

Geometry more clear (?), see later

According to NIM paper scintillator fiber detector for associated particle has both theta and phi readout:

very good angular and energy resolution even if TPC placed close to the gun at the expense of an increased readout channel count

→ input for simulation

# Reaction kinematics and geometry

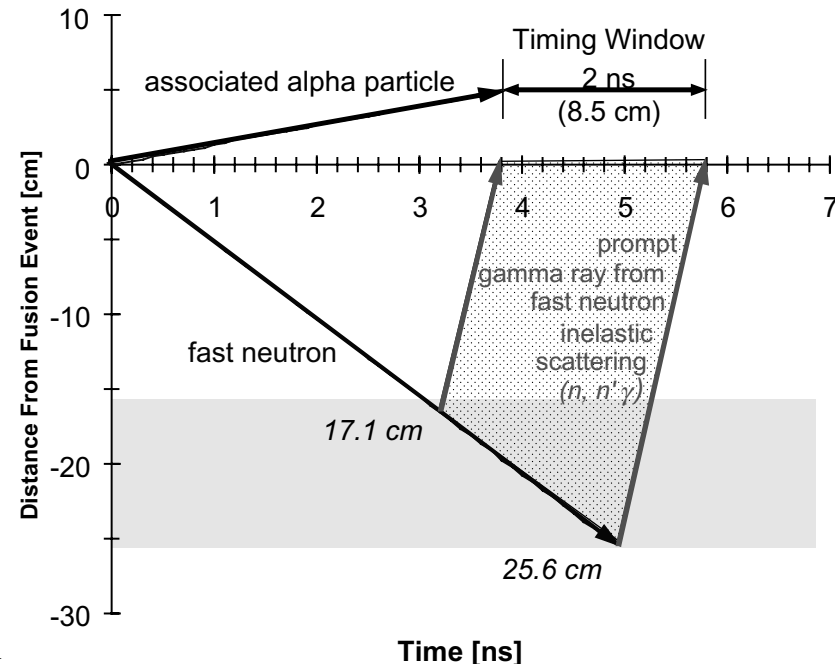
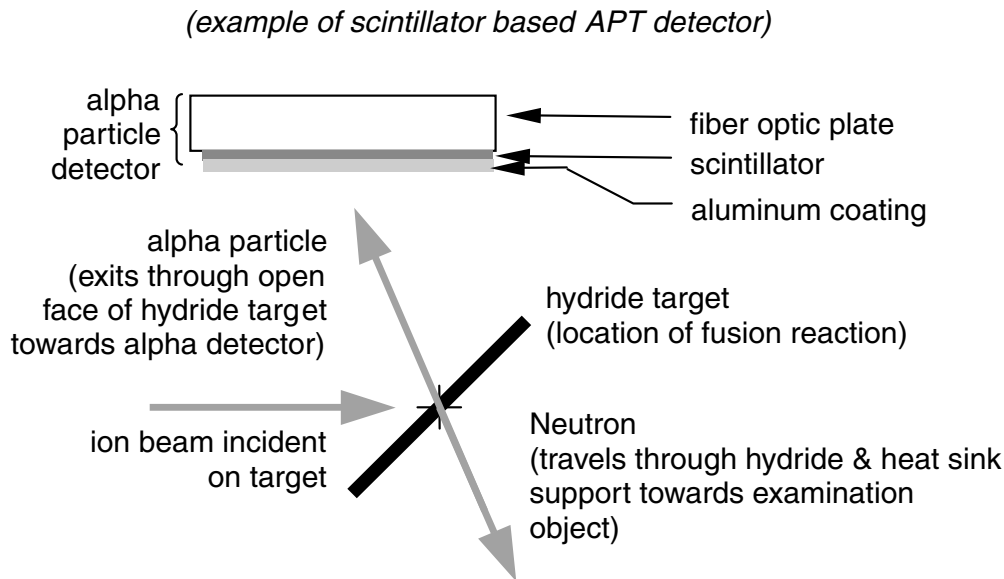


Fig. 1. Diagram of geometry involved in associated particle detection.

D-T reaction:  $v_n = 5.2 \text{ cm/ns}$   $v_\alpha = 1.3 \text{ cm/ns}$

D-D reaction:  $v_n = 2.2 \text{ cm/ns}$   $v_\alpha = 0.72 \text{ cm/ns}$

# XP85012

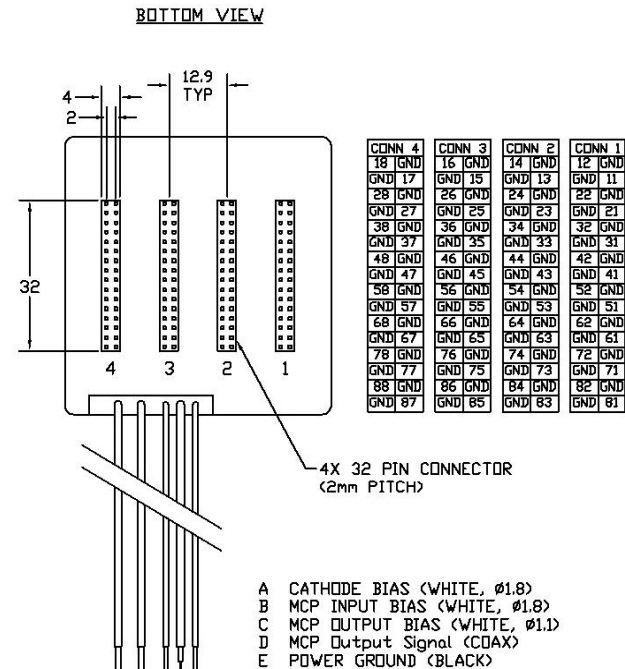
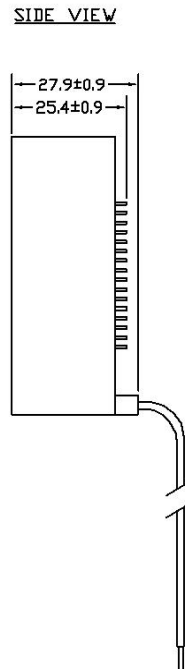
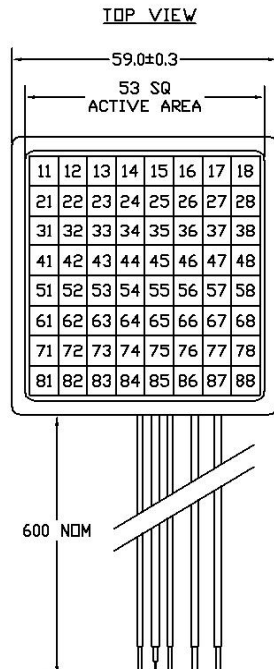


## Photon Detector

25 $\mu$ m MCP-PMT  
8x8 Anode  
53 mm Square



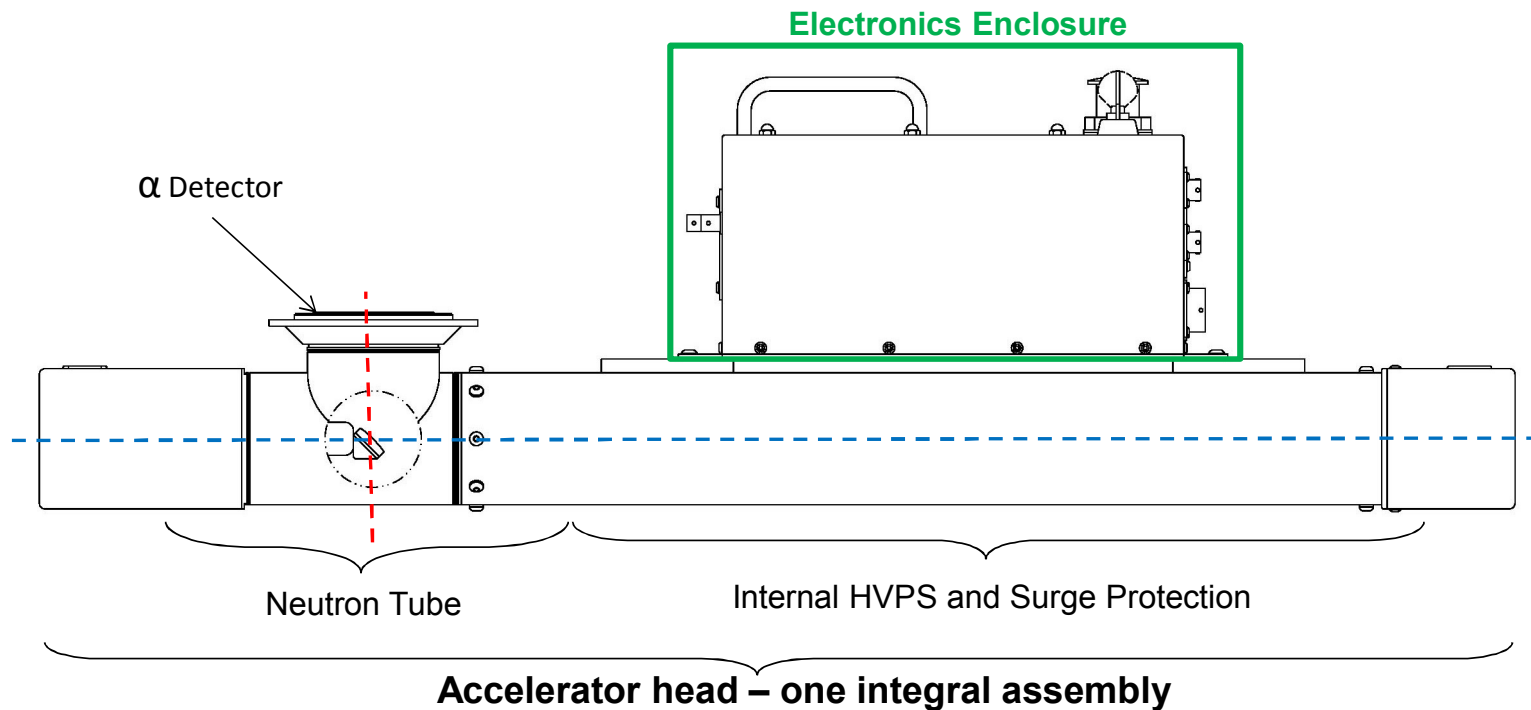
XP85012/A1



Mass: ~128g

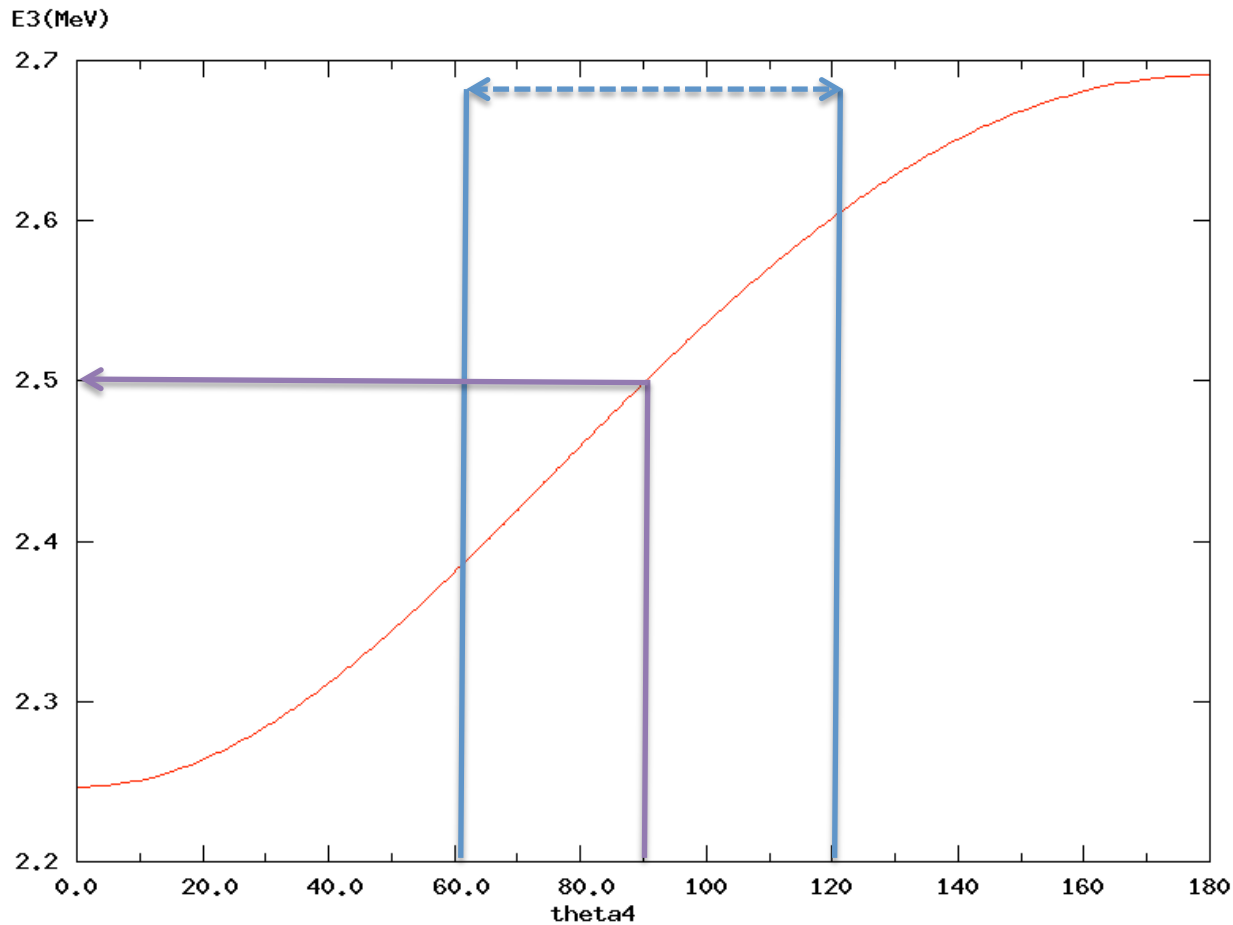
# Neutron gun geometry-2

- Generator Axis
- Target Plane



Take associate particle b/w  $60^\circ$  and  $120^\circ$  (?)  
2.5 MeV neutron energy at  $90^\circ$

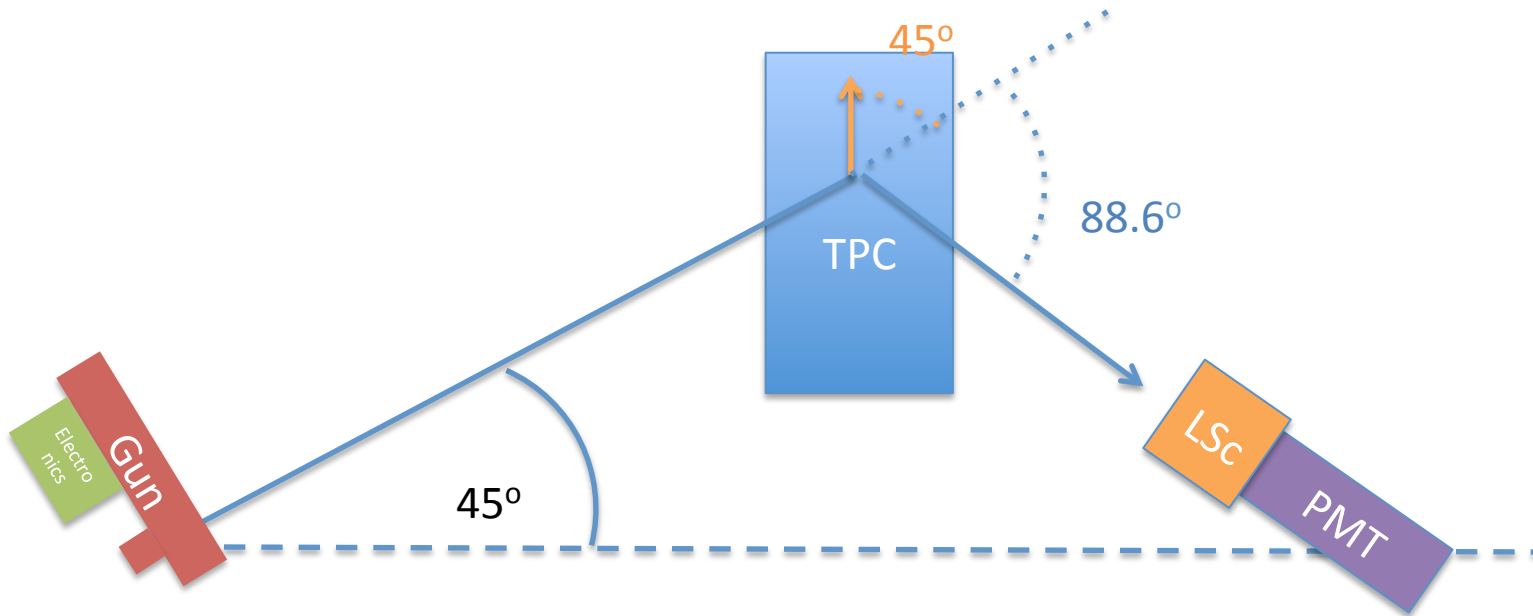
# Neutron Energy ( $E_3$ ) vs $^3\text{He}$ angle ( $\theta_4$ )



- Tagged neutron in the range of  $^3\text{He}$  recoil angle b/w  $60^\circ$  and  $120^\circ$
- Assume  $90^\circ$  in the following

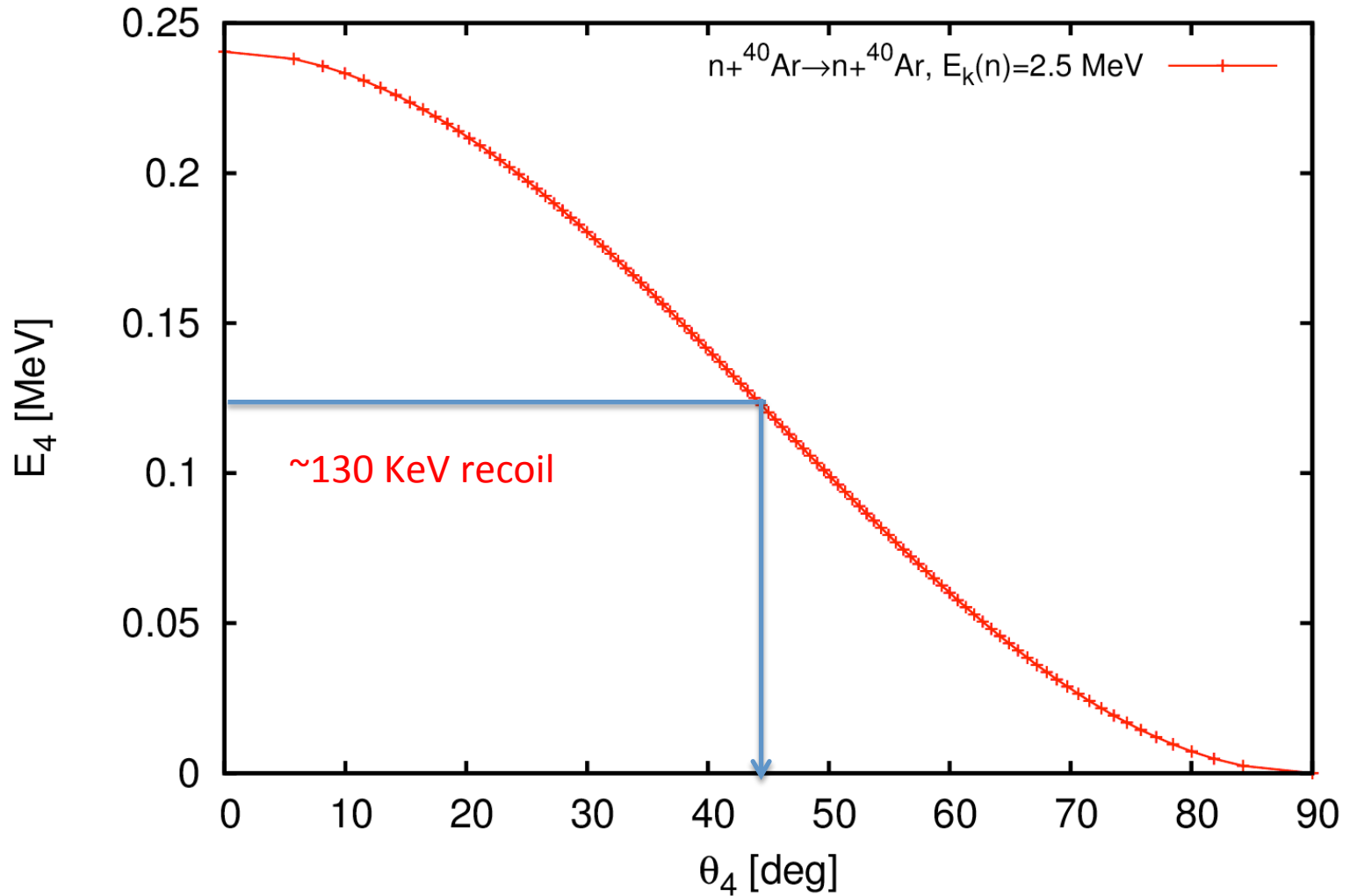


# Geometry (parallel recoil)

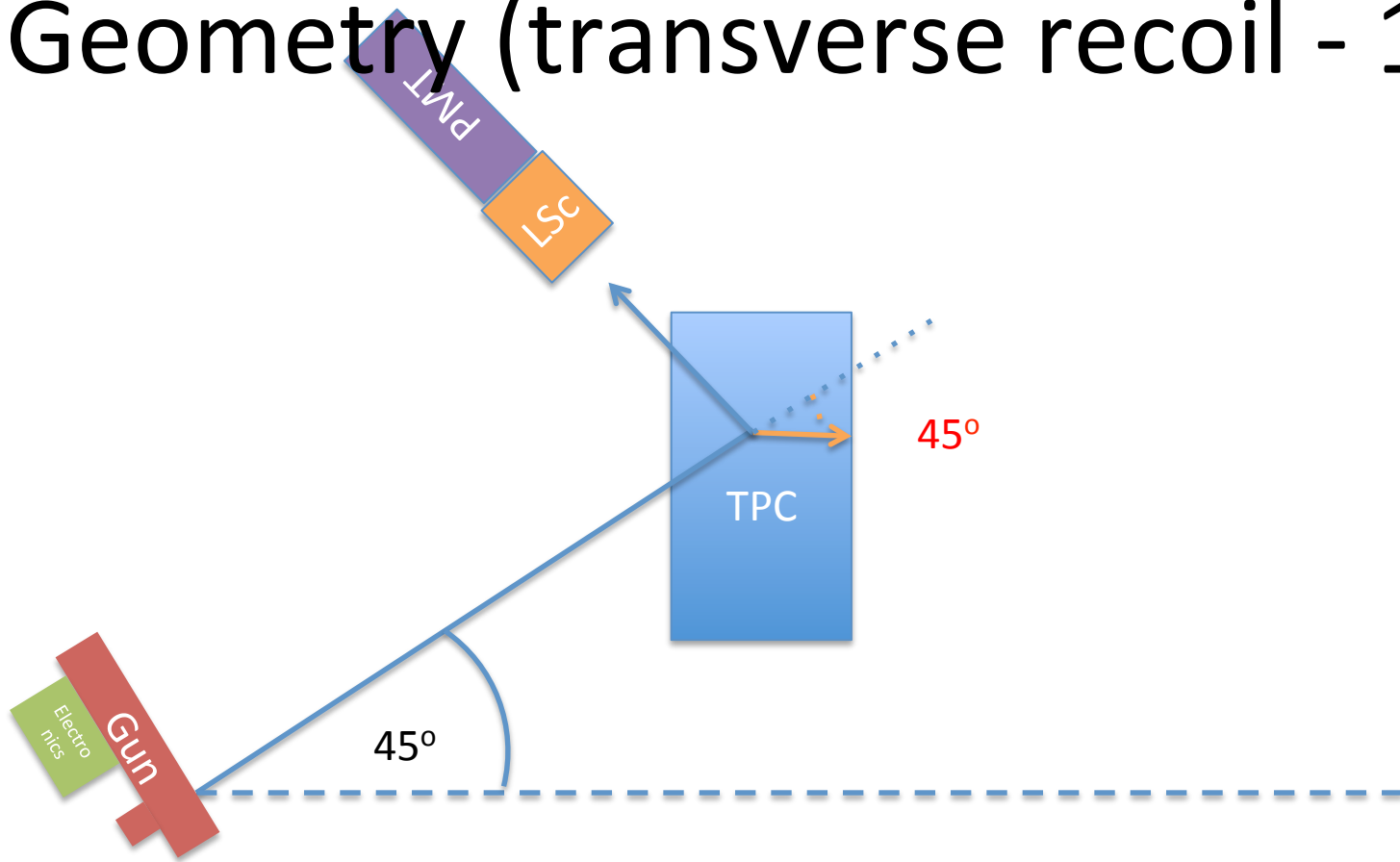


- Assuming the gun inclined by 45° , parallel recoil ( $\theta_R = 0^\circ$ ) require 45° degree  $^{40}\text{Ar}$  scattering from the neutron beam line corresponding to 88.6° neutron scattering

# $^{40}\text{Ar}$ recoil T vs $^{40}\text{Ar}$ recoil angle

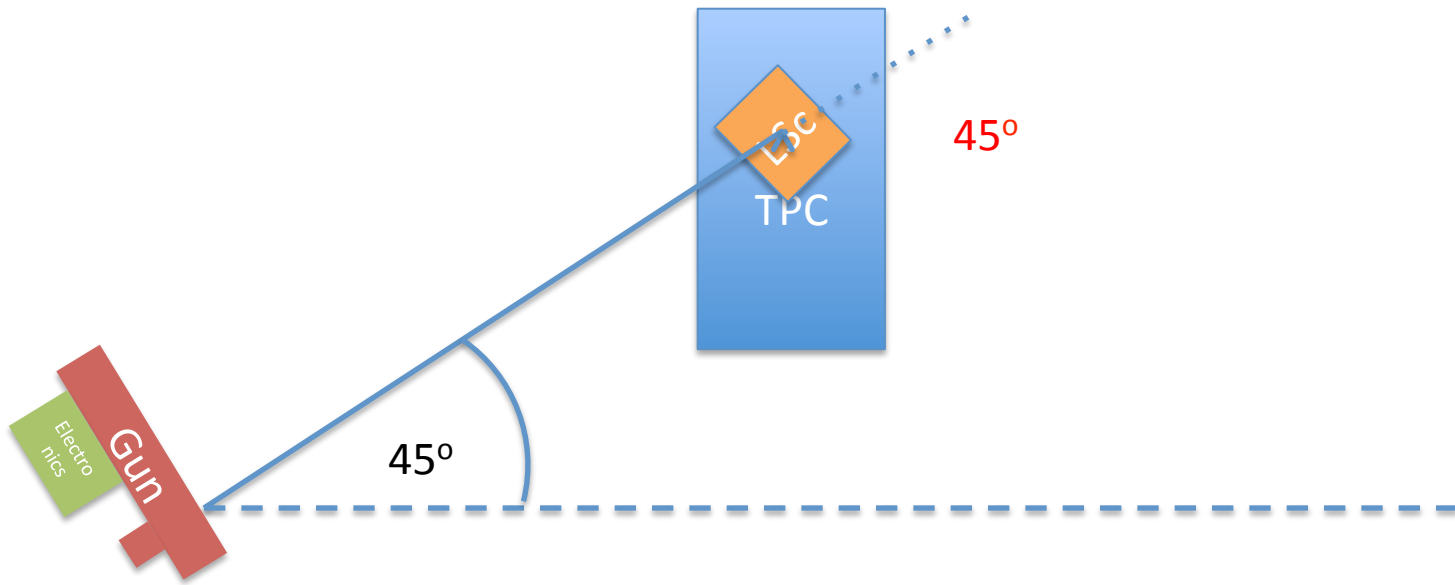


# Geometry (transverse recoil - 1)



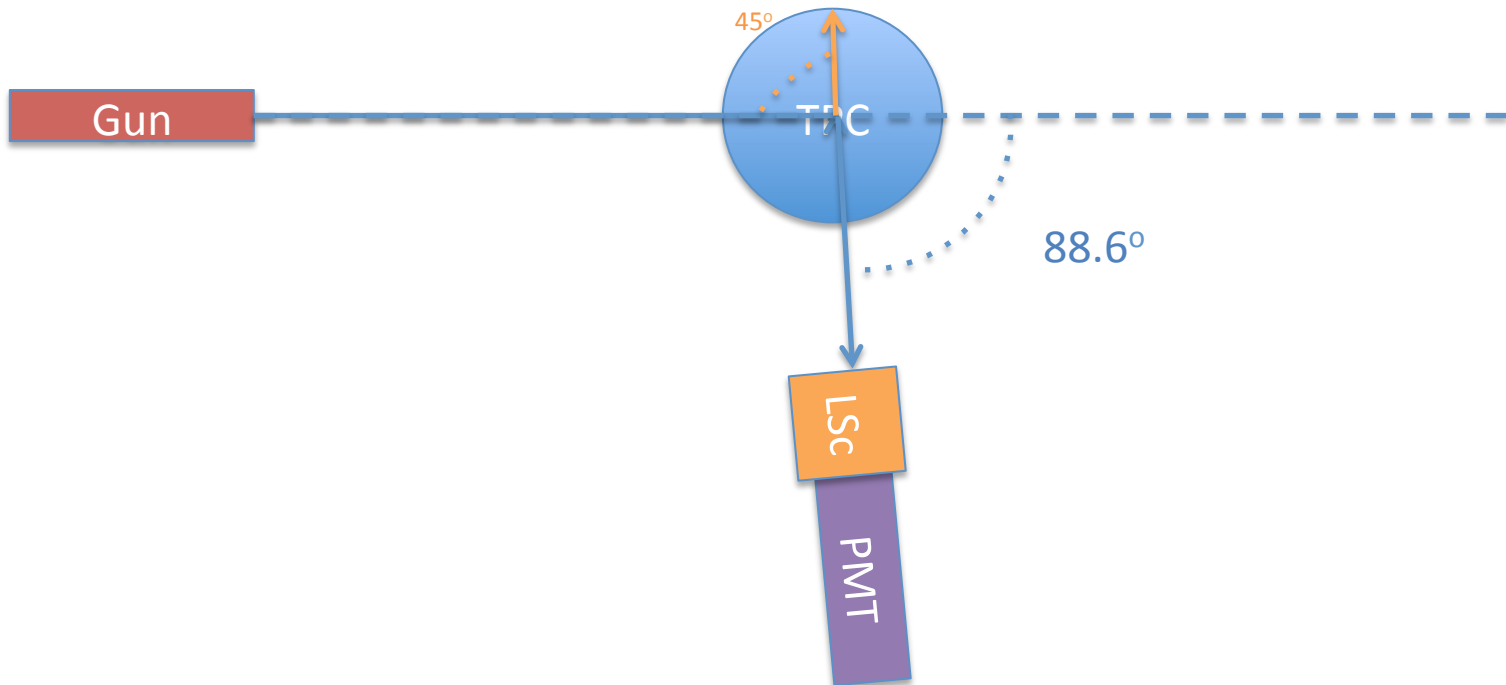
- Inconvenient set-up...

# Geometry (transverse recoil - 2)



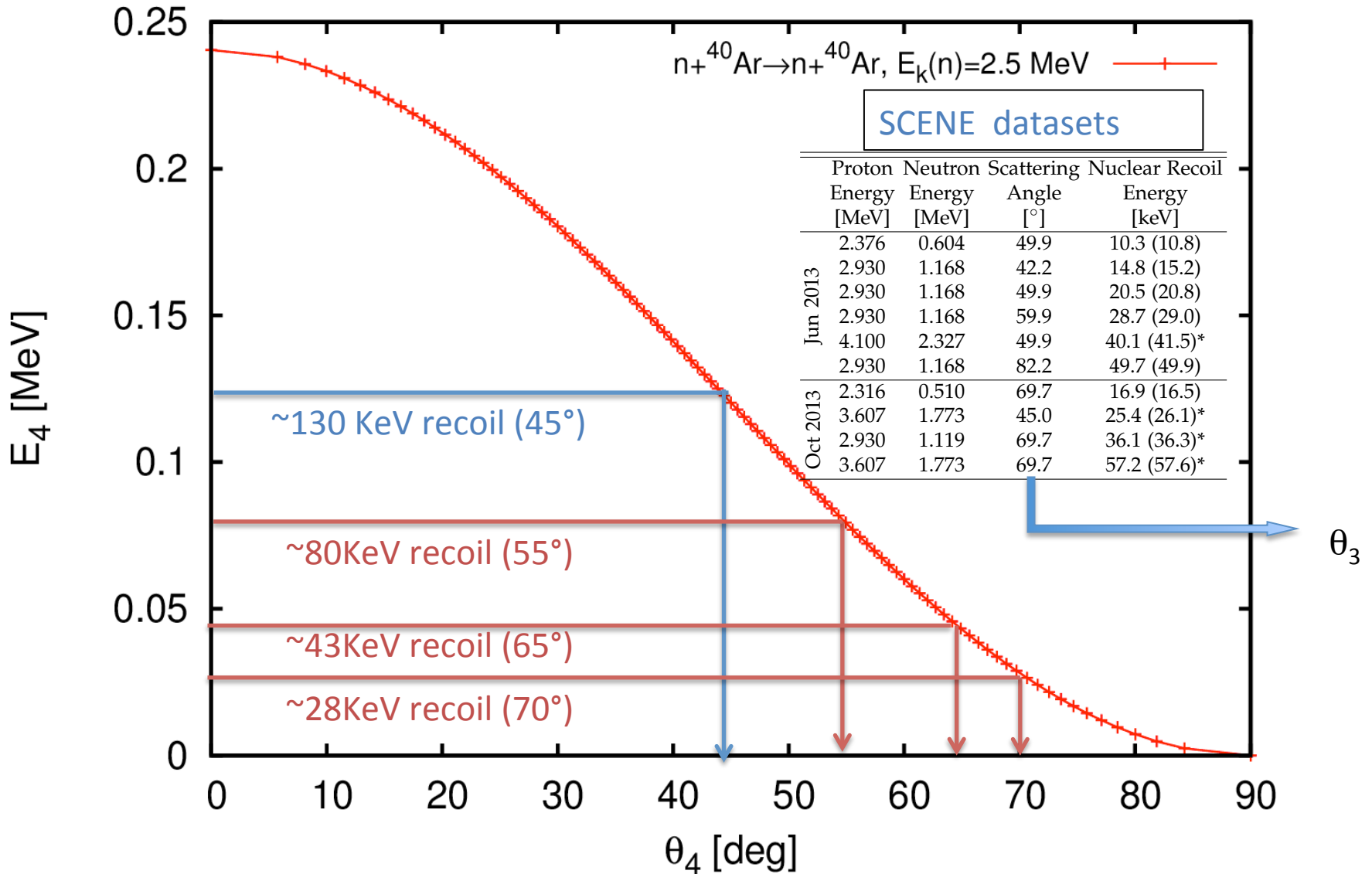
- Better one

# Geometry (transverse recoil – top view)

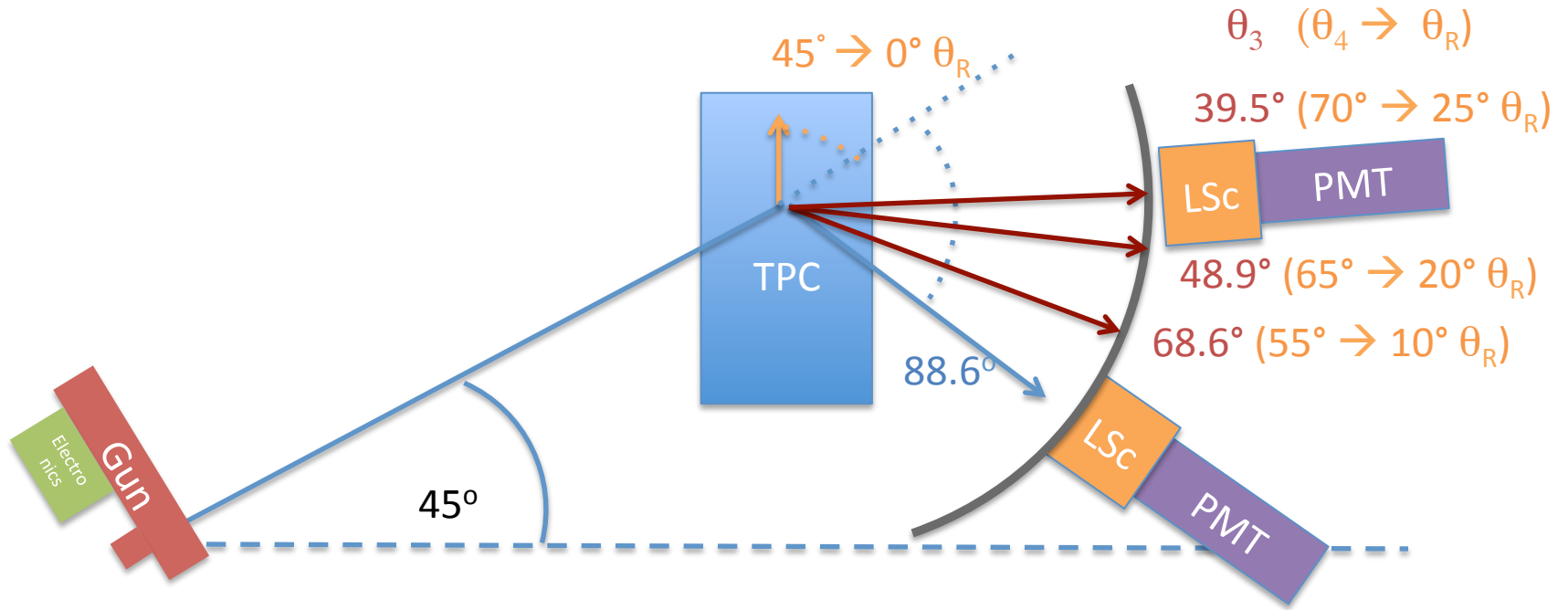


- Viewing from above

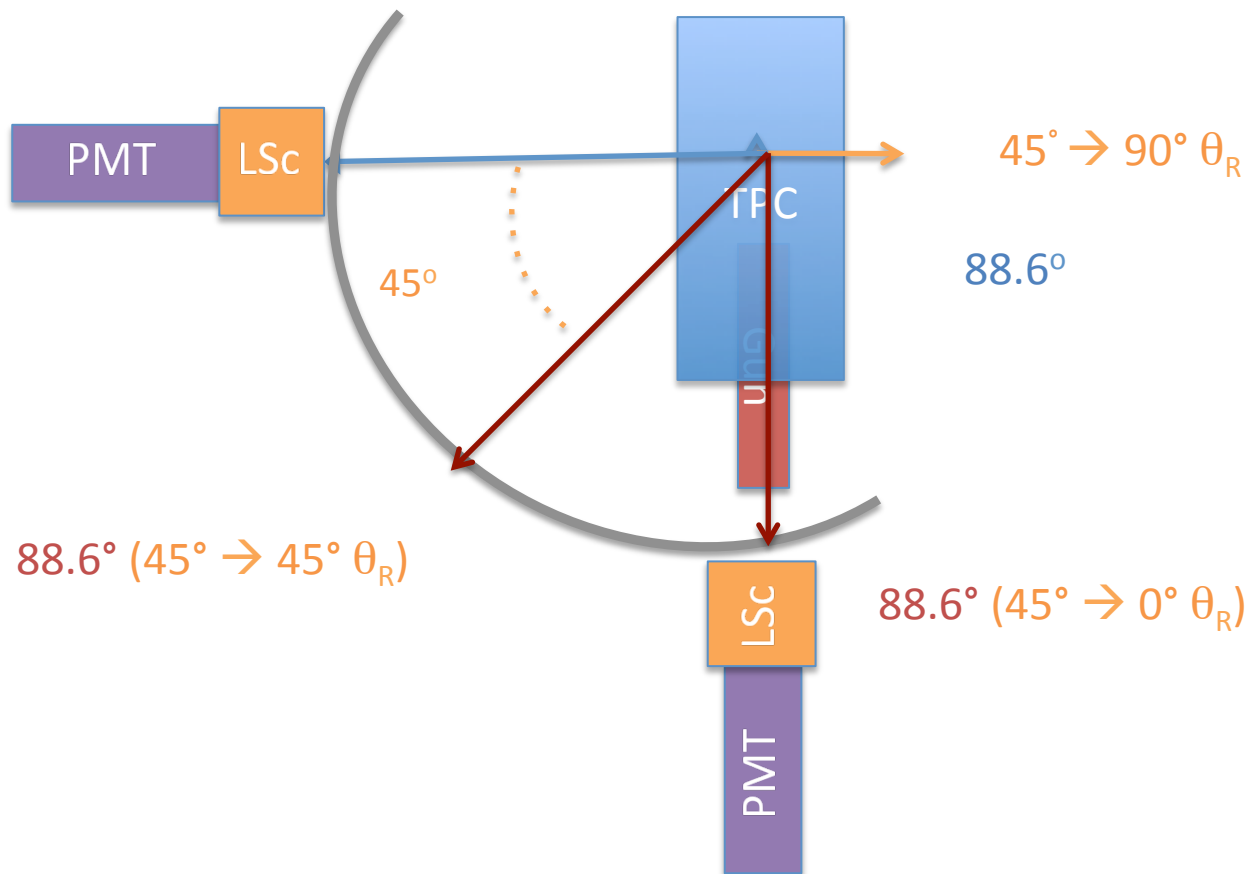
# $^{40}\text{Ar}$ recoil T vs $^{40}\text{Ar}$ recoil angle



# Geometry for vertical (other angles)

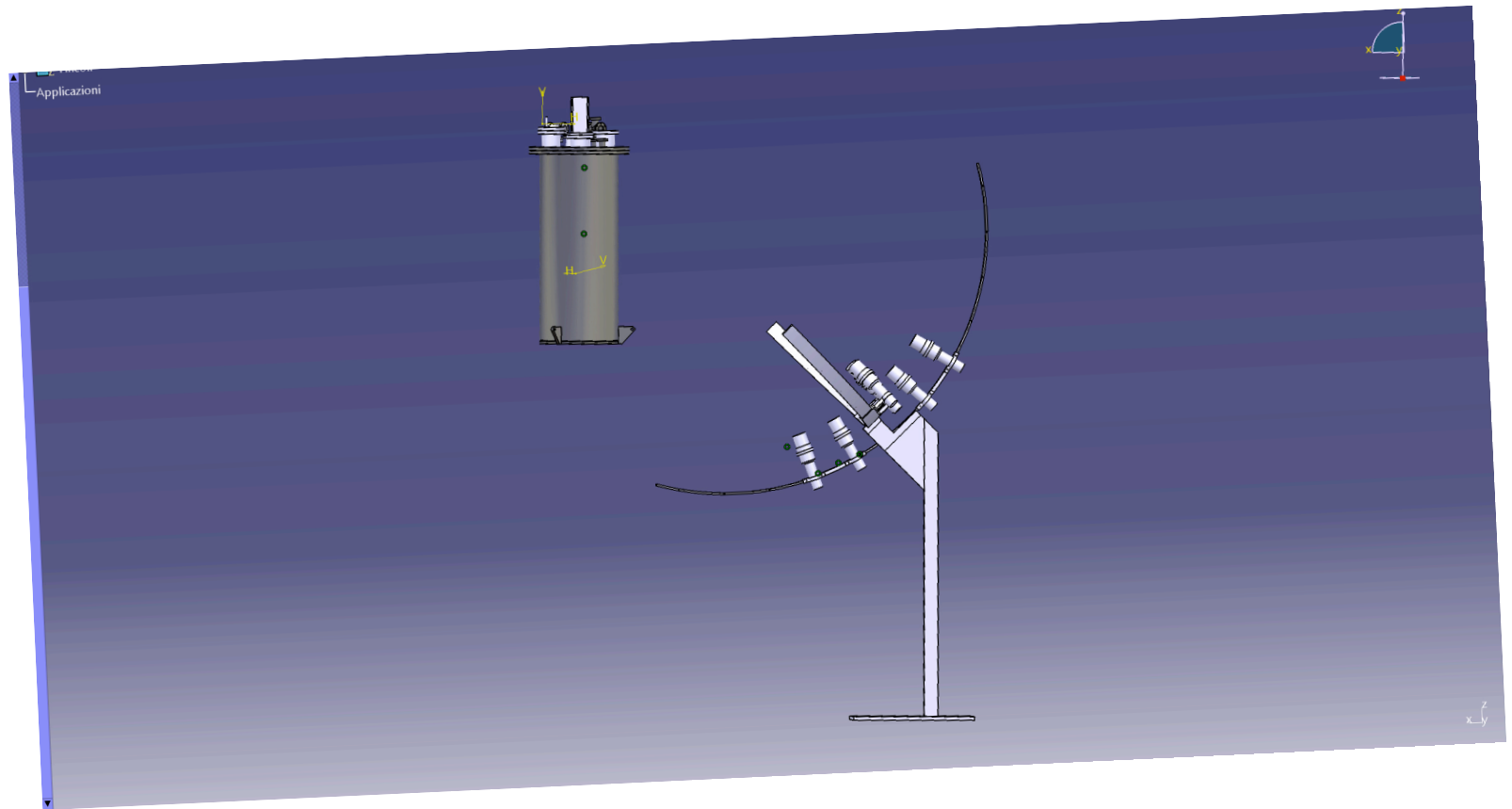


# Geometry (other angle – rear view)

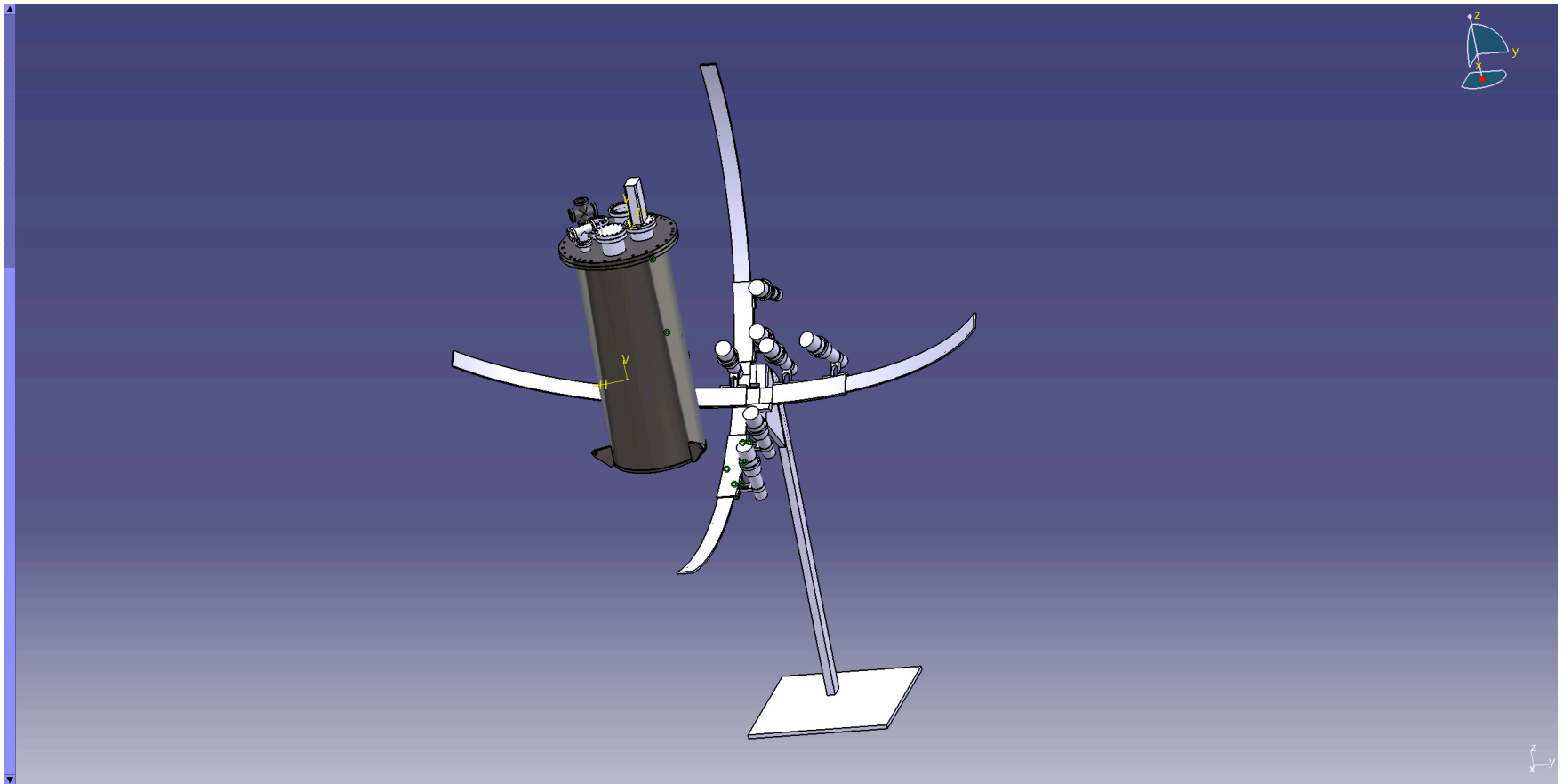




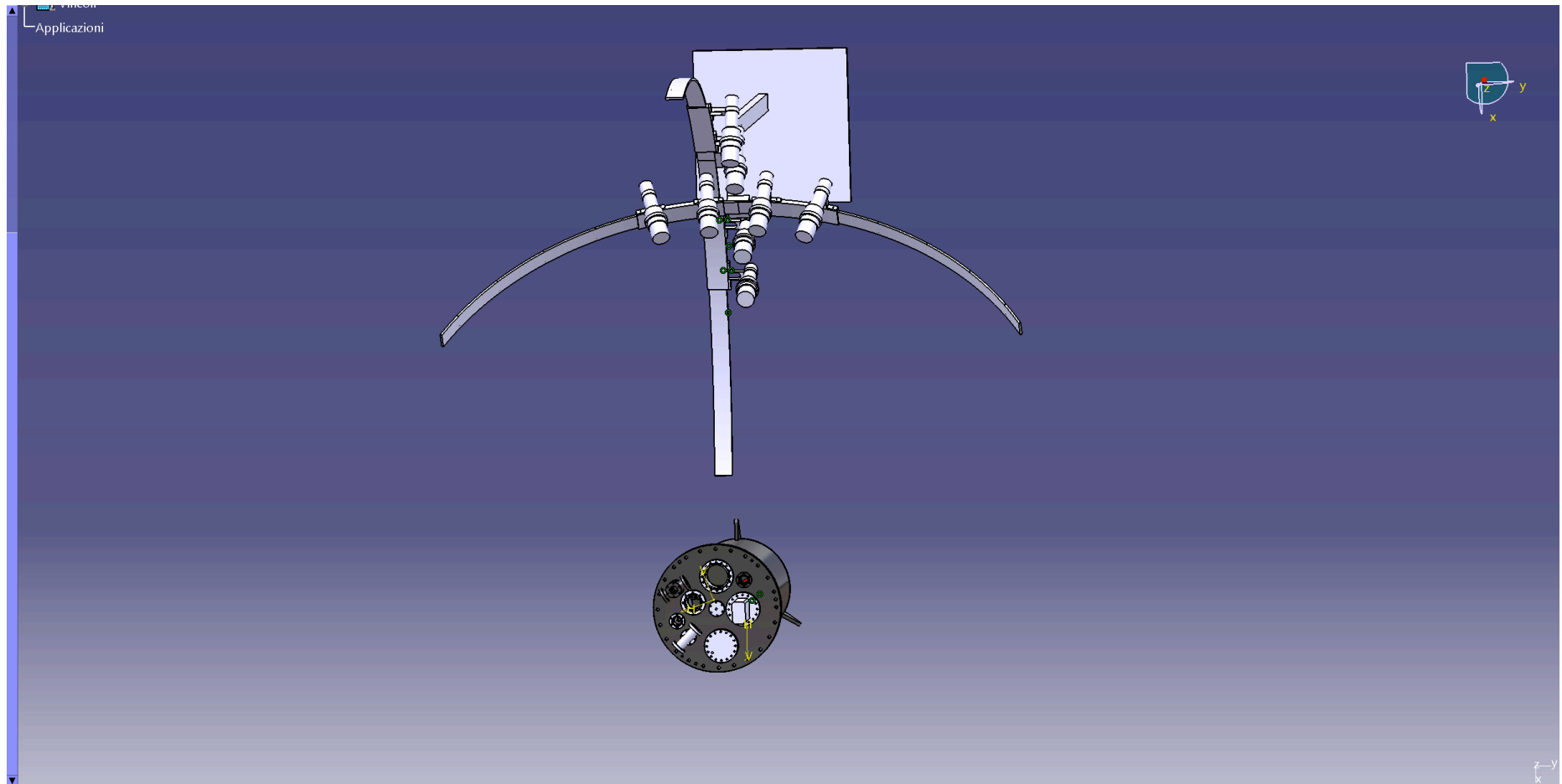
# Neutron Spectrometer Support Side view



# Neutron Spectrometer Support Front view



# Neutron Spectrometer Support Top view



# To be continued

- Calculate needed angles in lab frame for different possible geometries of the gun to TPC geometry:
  - Neutron beam angle
  - Neutron beam energy (?)
- Try and cover the interesting region in transverse and parallel recoil with the limited number of neutron detector at hand
- Which recoil energy range ?
  - Sample same recoil energy at different angle?
  - Sample different recoil energies and different angle?
- Fix distances (gun to TPC, TPC to LSc) and set optimal tube size with a simple toy MC;
  - A simple simulation strategy has been agreed with Mauro Caravati hope to have something to show soon