



# Characterization of the Anisotropic Scintillation Response of Stilbene

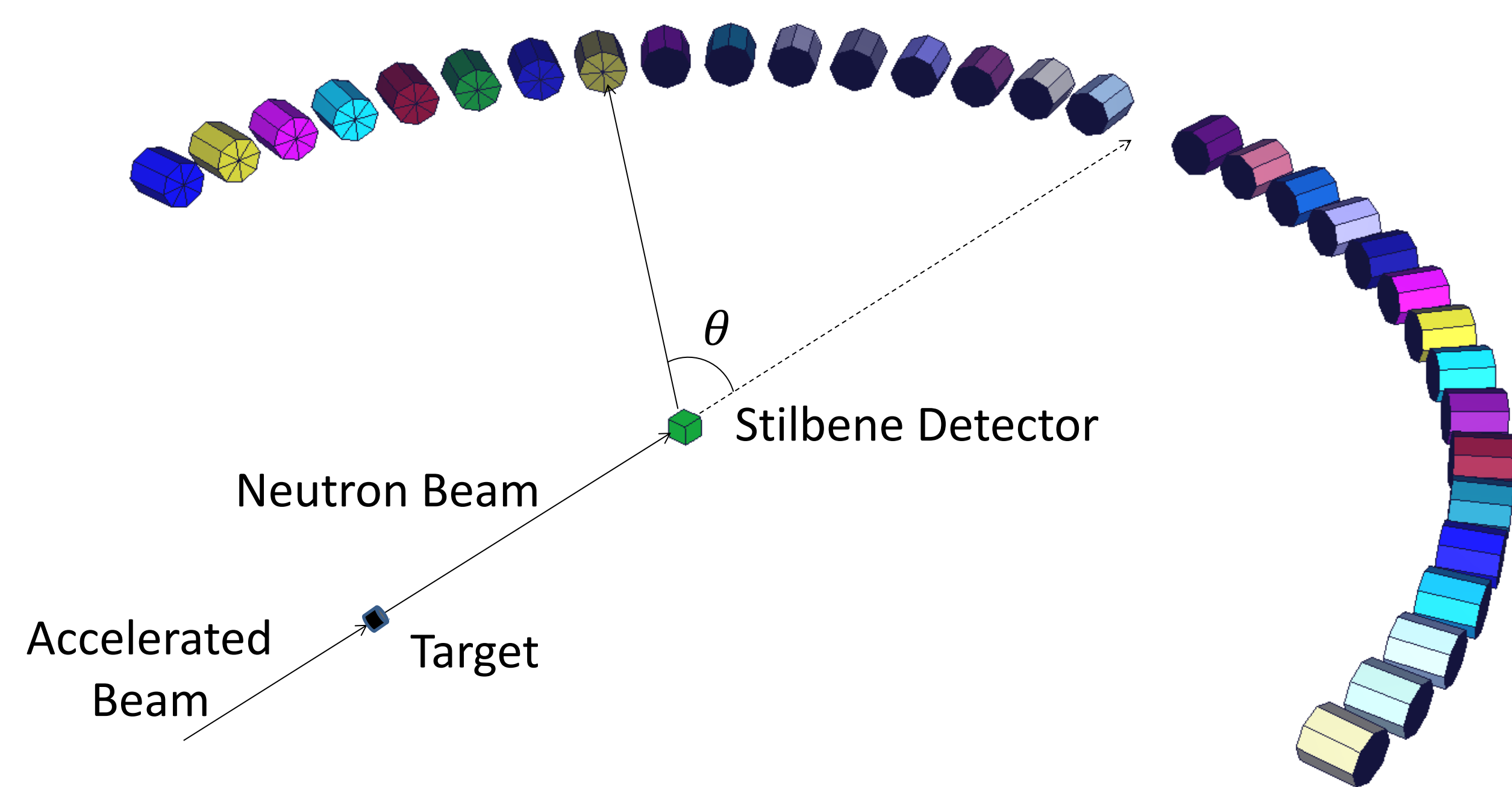
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## Motivation and Introduction

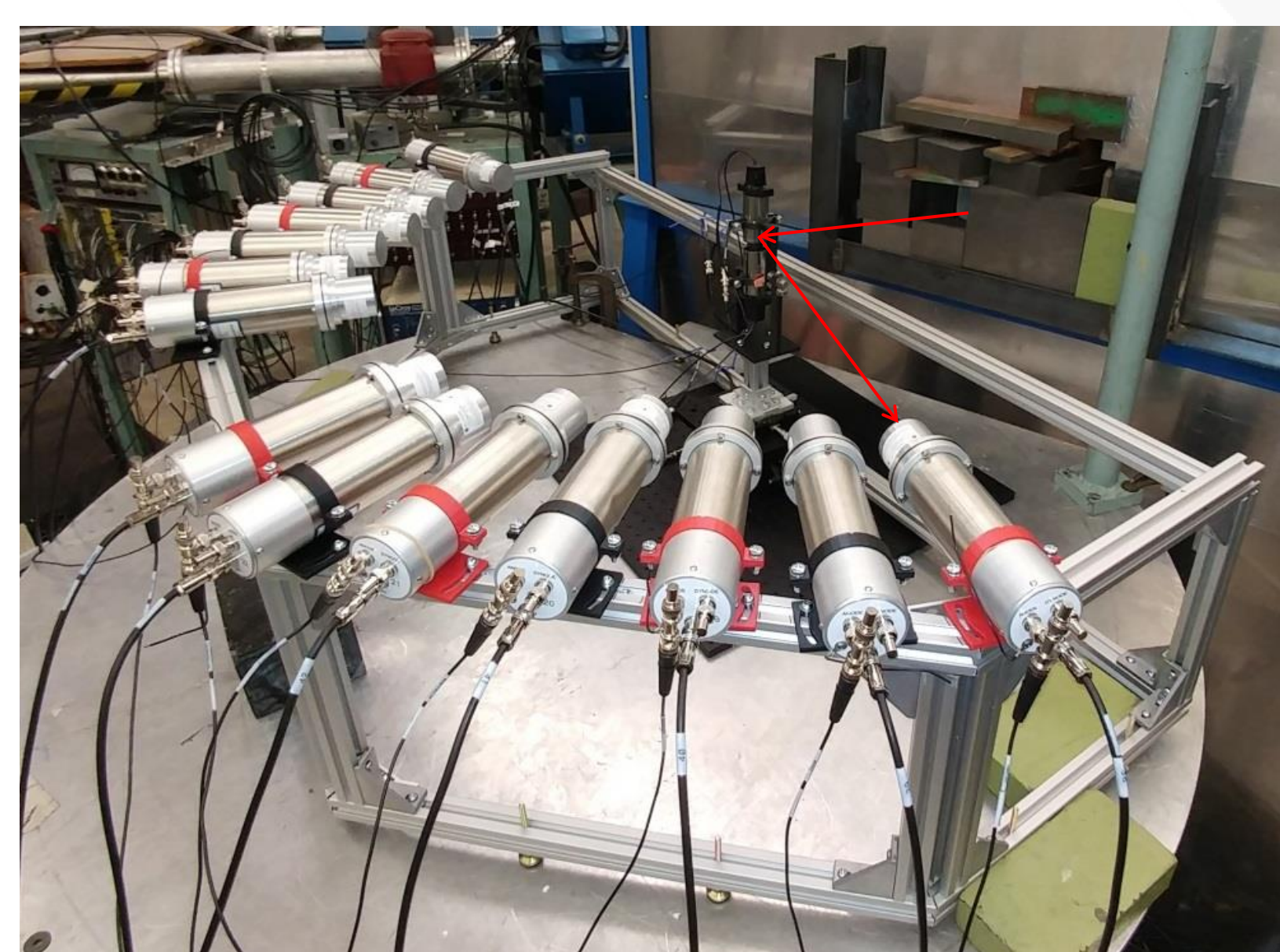
- Experiment goals:
  - Perform the highest precision single scatter light output characterization for stilbene to date
  - Characterize the anisotropic scintillation response



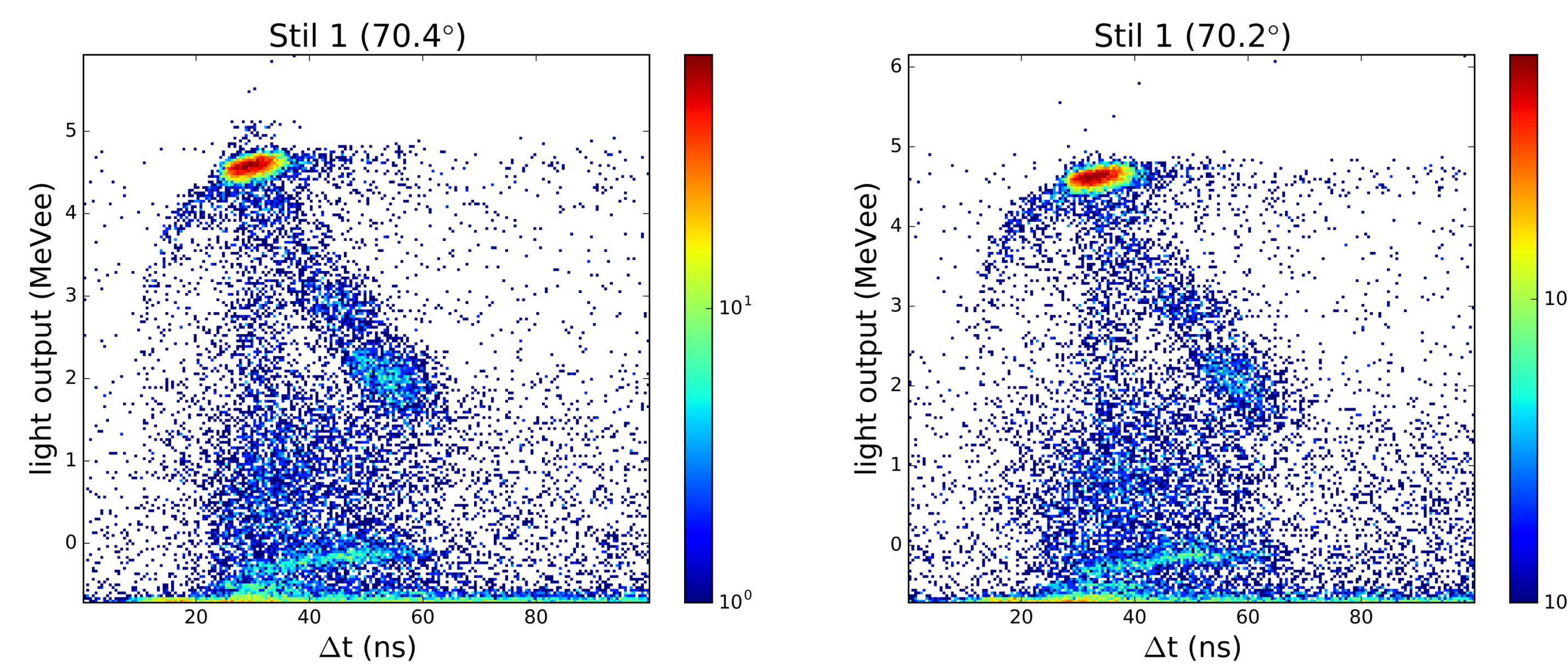
- Energy deposition measured by n-p scatter kinematics:
 
$$E_p = E_n \sin^2 \theta$$
  - Neutron scattering angle  $\theta$  is identified by the backing detector that is hit in coincidence with the stilbene
- Characterization energy range of  $\sim 500$  keV to 10 MeV

## June 2016 Measurements

- 14 EJ-309 backing detectors
- 11.4 MeV neutron beam generated by d(d,n)
  - Proton recoil energy range: 1 – 10 MeV
- Two crystals with known axes orientations measured
  - First oriented with  $c'$ -axis vertical w.r.t the neutron beam
  - Second oriented with  $b$ -axis vertical w.r.t the beam
- 14 crystal orientations measured for the two stilbene crystals
  - $0^\circ$  to  $360^\circ$  measured in  $30^\circ$  increments with a repeated measurement at  $60^\circ$

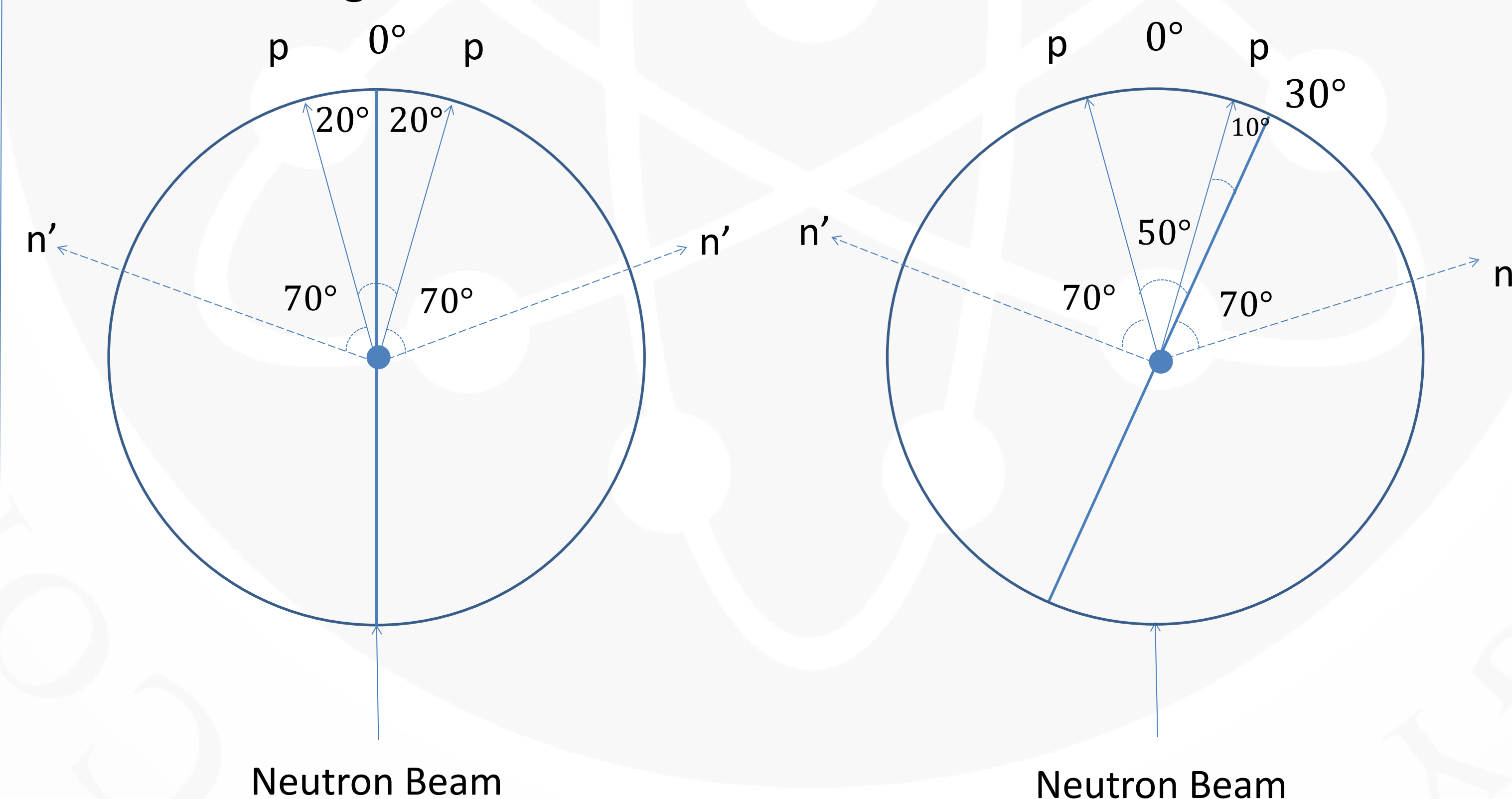


## Results (I) – LO vs TOF

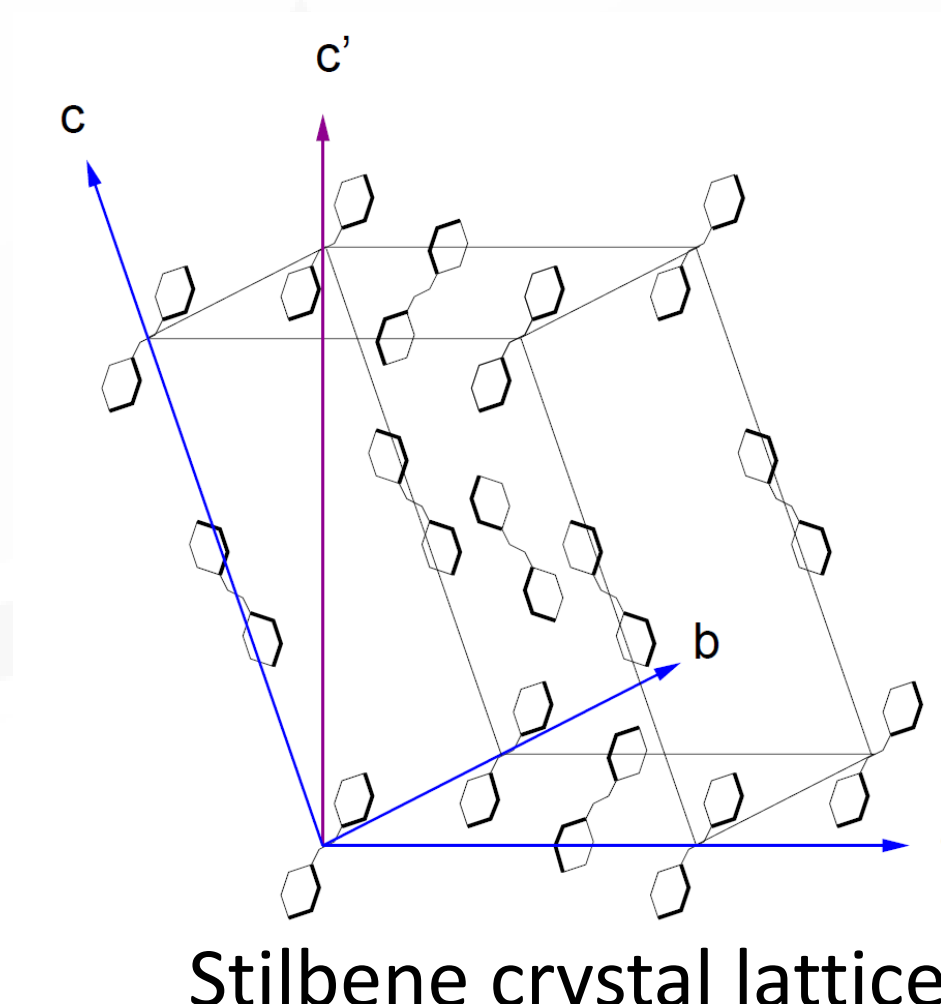


- LO of the  $c'$ -axis vertical crystal vs time of flight between the stilbene and backing detector
- Correspond to 10.09 MeV and 10.12 MeV proton recoils
- Hot spots are single proton recoil events
- Other features:
  - D-D breakup
  - Double scatters

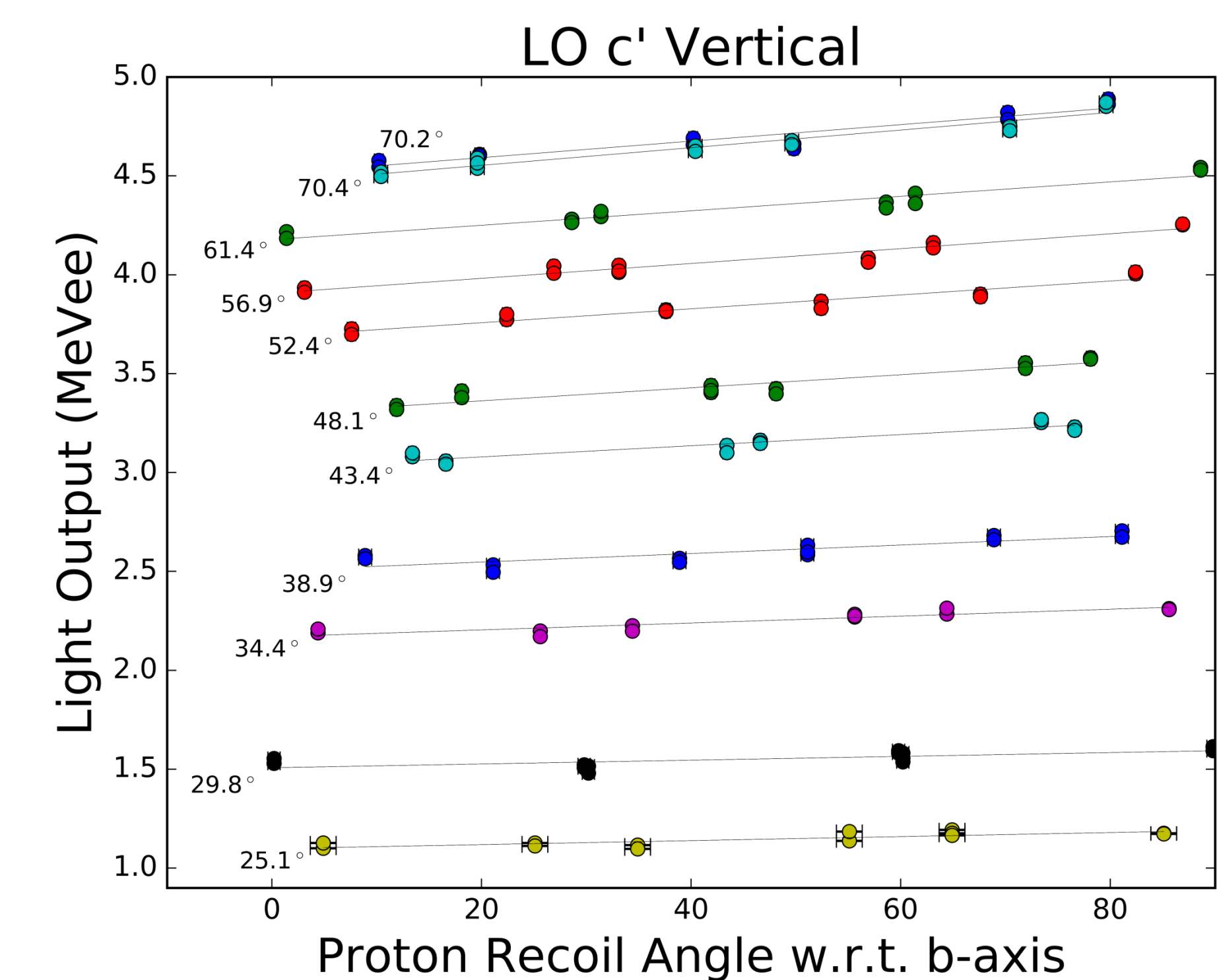
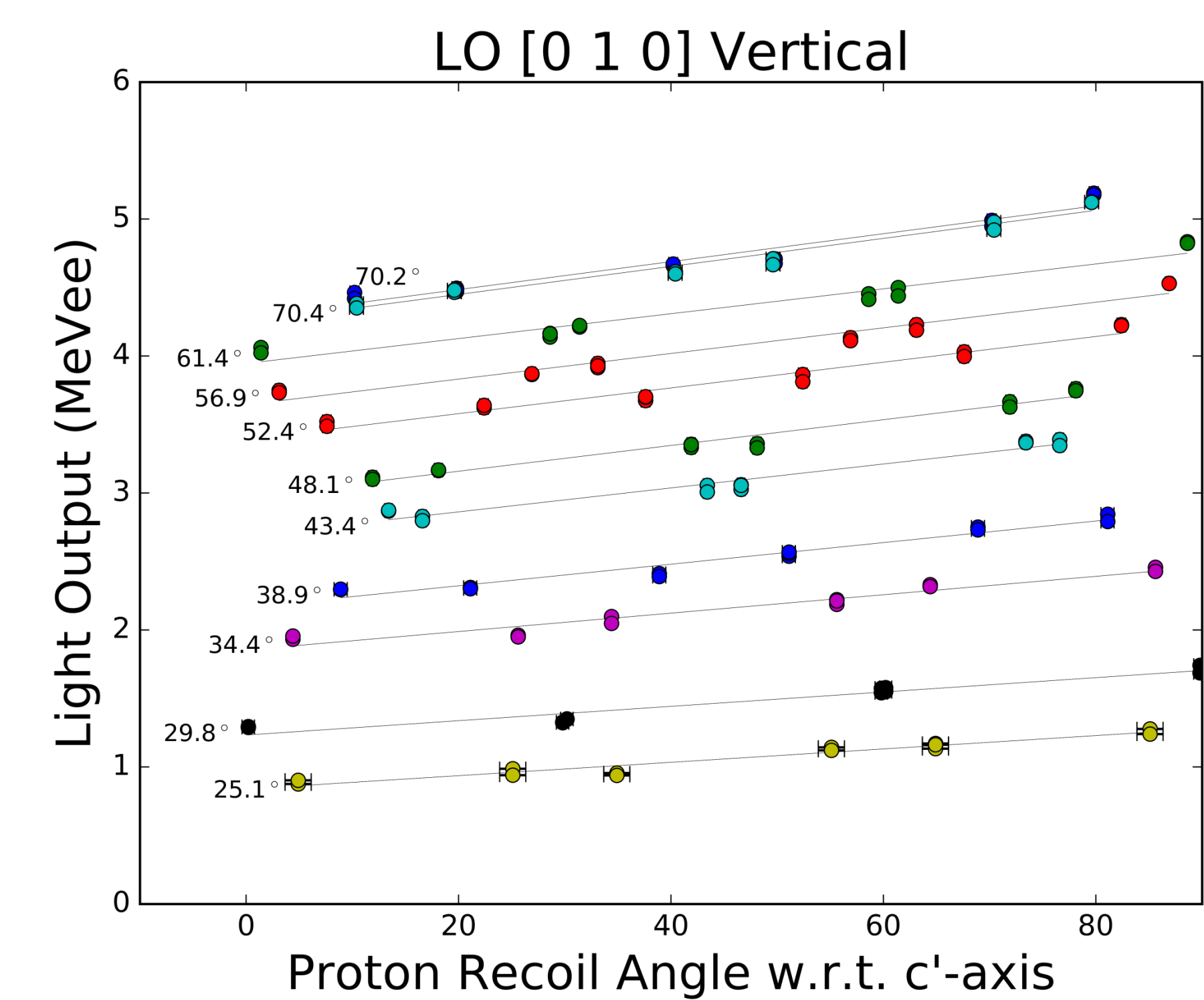
- Examine the light output in terms of the proton recoil w.r.t the lattice angle:



- For  $c'$ -axis vertical crystal this is a measurement of the light output w.r.t. the angle between the scattered proton and the  $b$ -axis
- For the  $[0\ 1\ 0]$ , or  $b$ -axis vertical, this is a measurement of the light output w.r.t the angle between the scattered proton and the  $c'$ -axis



## Results (II) – LO Anisotropy



## Conclusions and Future Work

- Perform final analysis for calibration of the two crystals
- Investigate the differences between our anisotropic trends and previous work
- Account for systematic uncertainties
- Next set of experiments to be conducted October 24-30, 2016
  - Cover energy range down to 500 keV
  - Use results to interpolate the response at arbitrary (polar, azimuthal) angles

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