Si Tracking Detector

Progress so far and future issues

Nick Ashwood – The University of Birmingham

Overview

- Simulation development
  - UK contribution
- Initial design
- Progress so far . . .
- Future issues
  - Validate previous experiments and simulations
  - Physics led design
- Discussion

Simulation Development

- R3BSim developed by the USC and Daresbury
  - Based on Geant4 + ROOT
    - 2 geometries of calorimeter
    - 2 geometries of tracker
    - ALADIN, LAND, ToF Wall, etc
  - Compatible with (p,2p) event generator
  - Analysis code exists

- R3BROOT developed at GSI
  - Based on ROOT + Geant3/4 + FLUKA
    - 2 geometries of calorimeter
    - 1 geometry of tracker
    - ALADIN, LAND, ToF Wall, etc
  - Not yet compatible with (p,2p) event generator
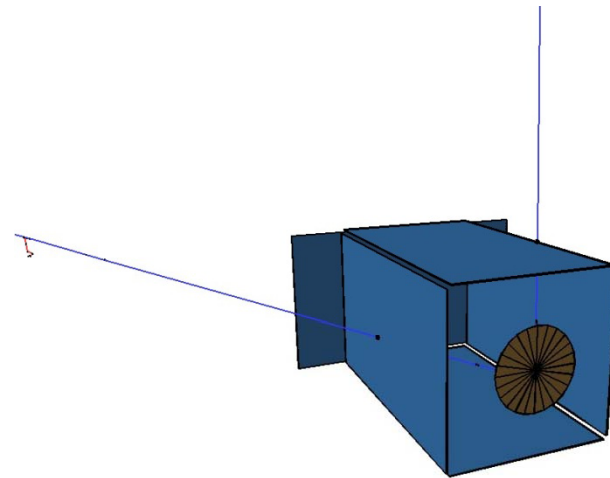 - No analysis code

Si Tracker UK Contribution

- To take responsibility for the simulations of the Si tracking detector.
- Implement realistic physics event generators for simulations
  - e.g. (p,2p) Leonid Chulkov
- Finalise design for the detector
  - 2 or 3 layers?
  - Granularity?
- Develop analysis code for both simulations and data analysis for Si tracker
- Validate simulations from ^{17}Ne/^{12}C(p,2p) work
  - Expt S296

Initial Design

- Main requirements are for high resolution for momentum and energy.
  - Good intrinsic energy resolution ~ 50 keV
  - High position resolution
- At least 2 layers are required to track particle.
  - Also gives E-ΔE particle identification
- Large angular coverage able to cope with multi-physics requirements.
  - Do we require detectors close to zero degrees?

Si tracker:

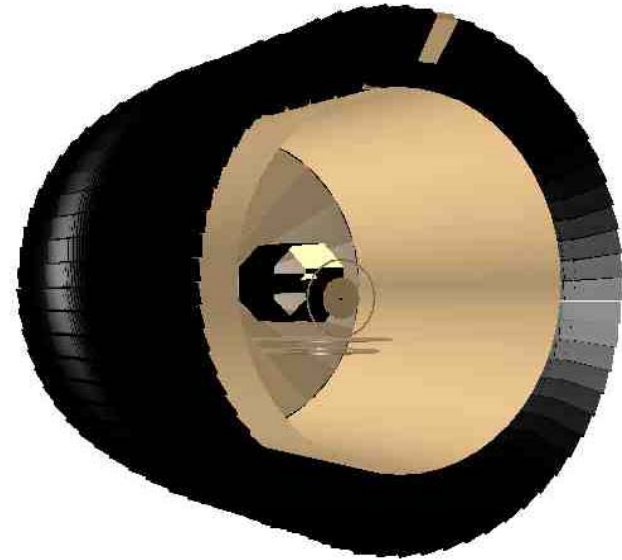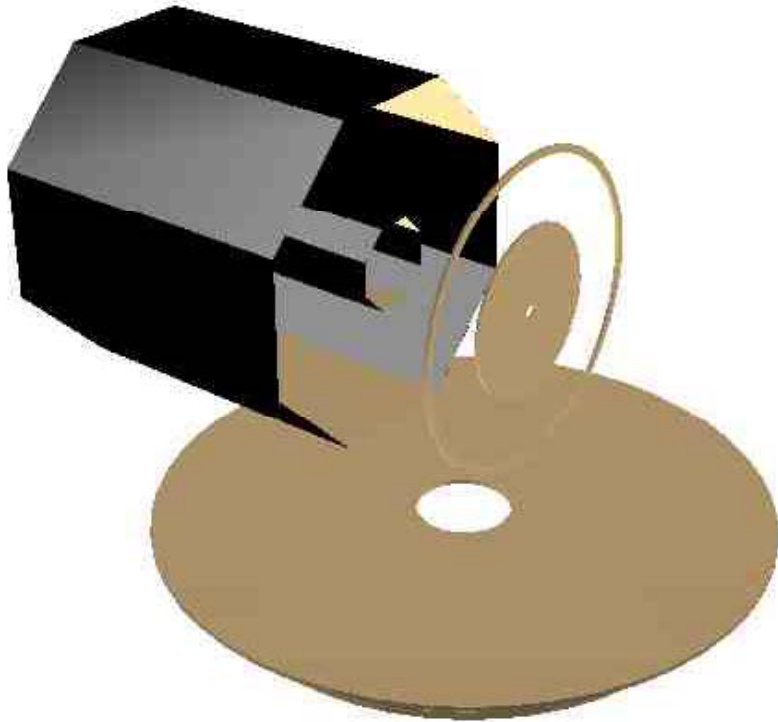- Cubic configuration
$^{12}C(p,2p)$ experiment

R3BSim
and
R3BROOT
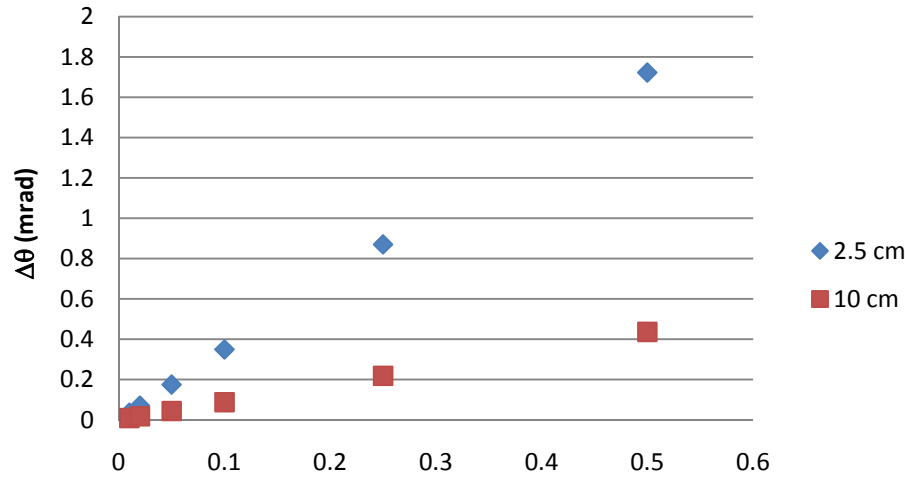
- Double layer
of DSSSD
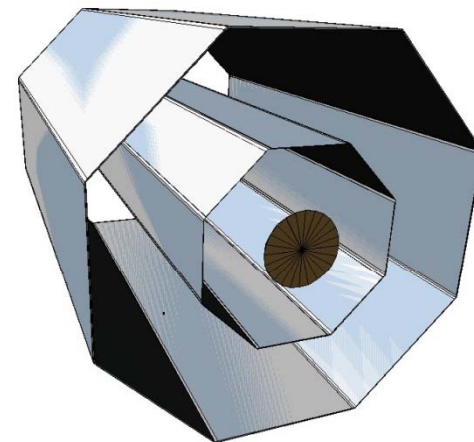
R3BSim
only

Progress so far . . .

- First layer 2.5cm from beam axis
    - -100 μm thick
    - - 2 x 10 cm
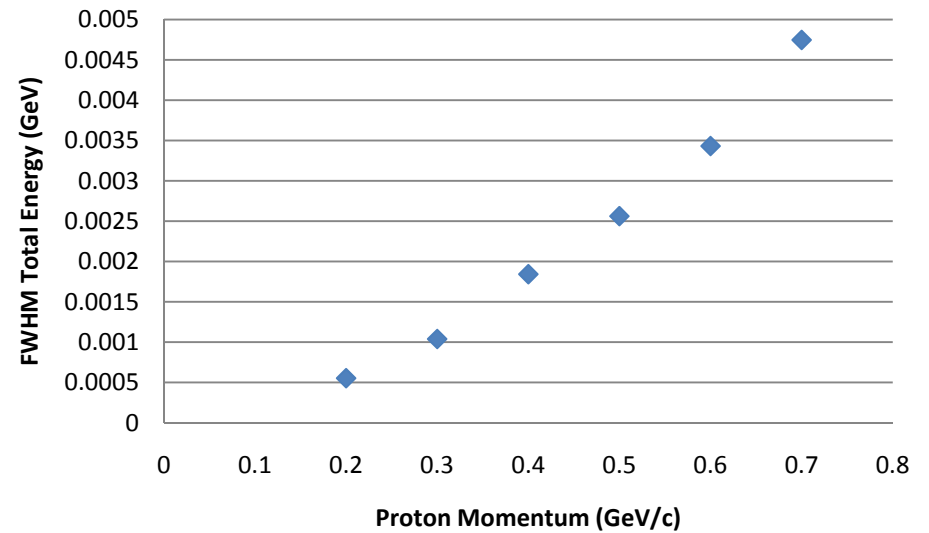- Second layer 10 cm from beam axis
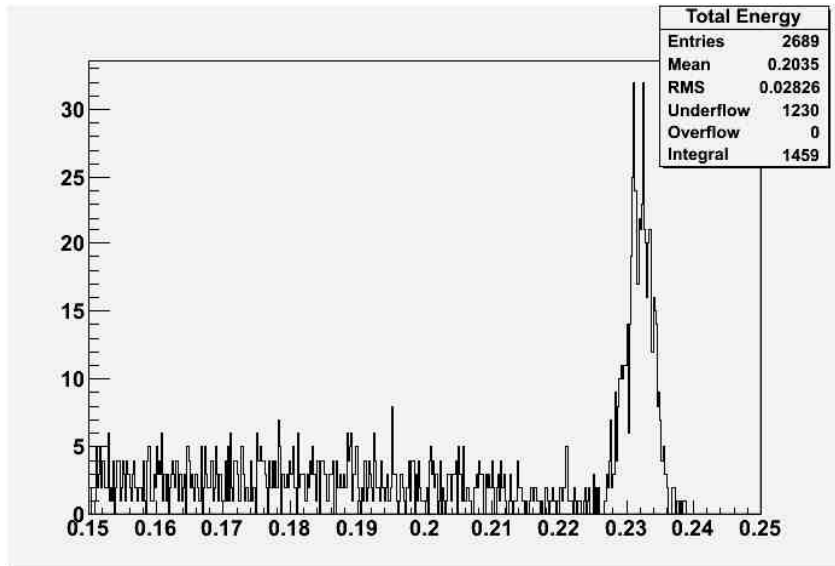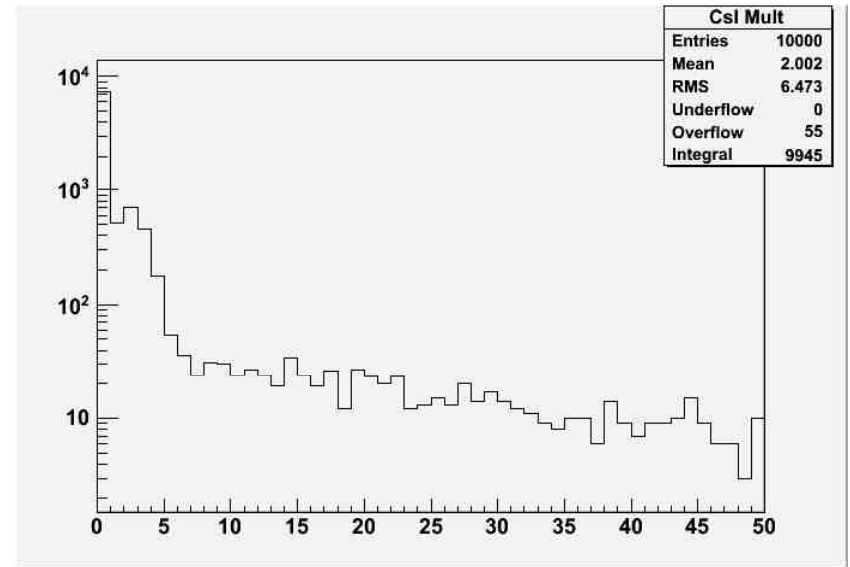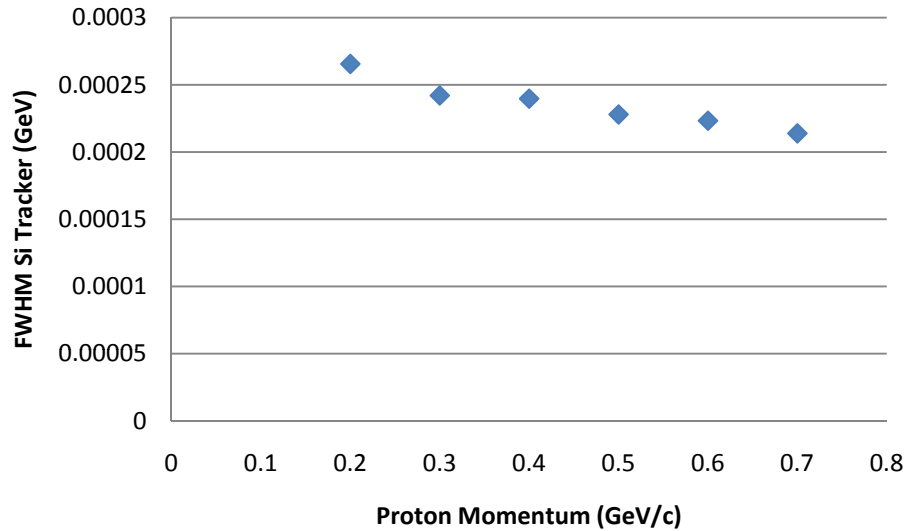   - -300 μm thick
    - - 5 x 10 cm

- Analysis code progressing
    - -Multiple hits and particles
- (p,2p) event generator now compatible with R3BROOT
- CALIFA combined with tracker
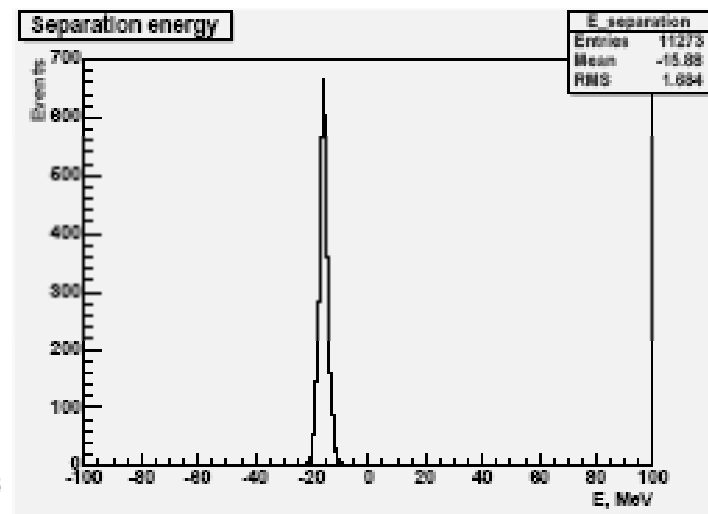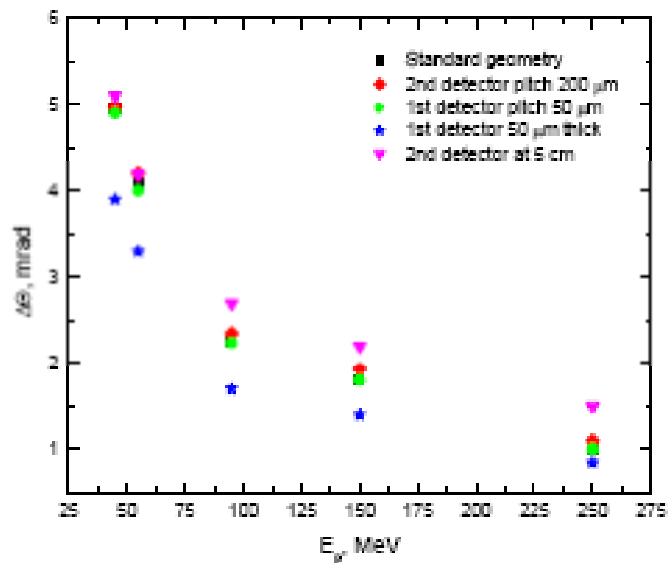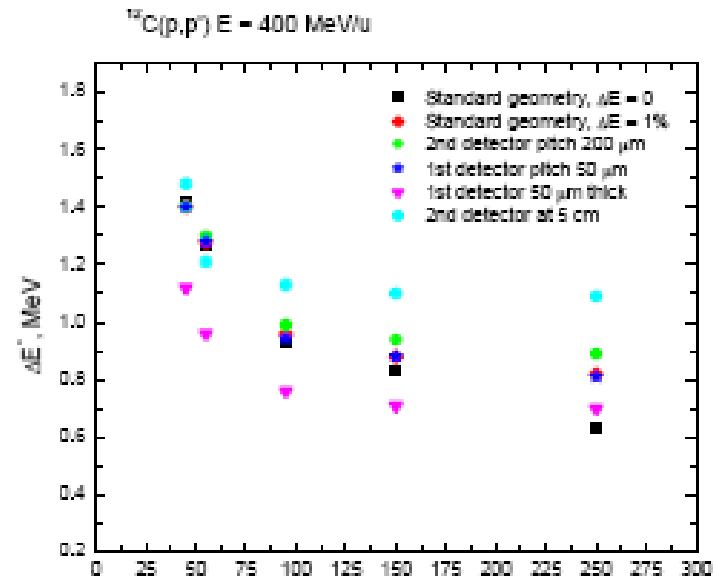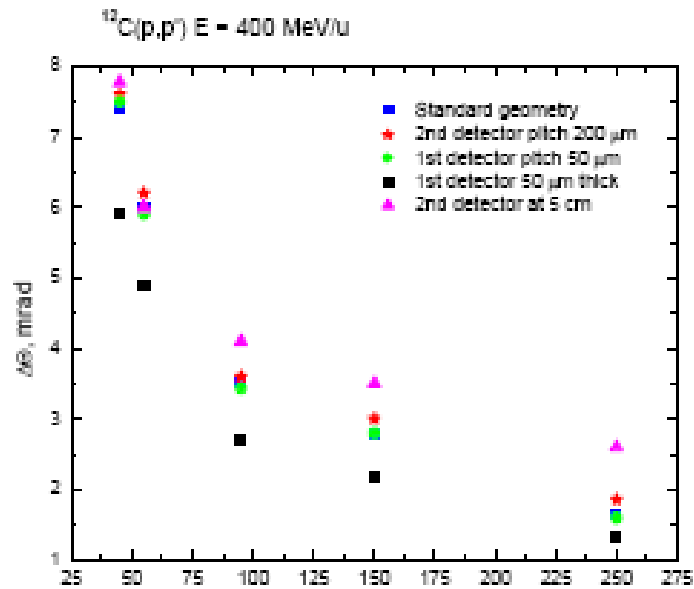   - - Total energies and angles can be found
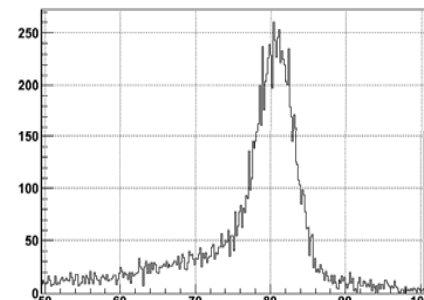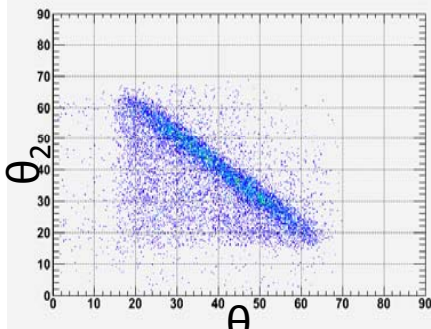
Angular Resolution
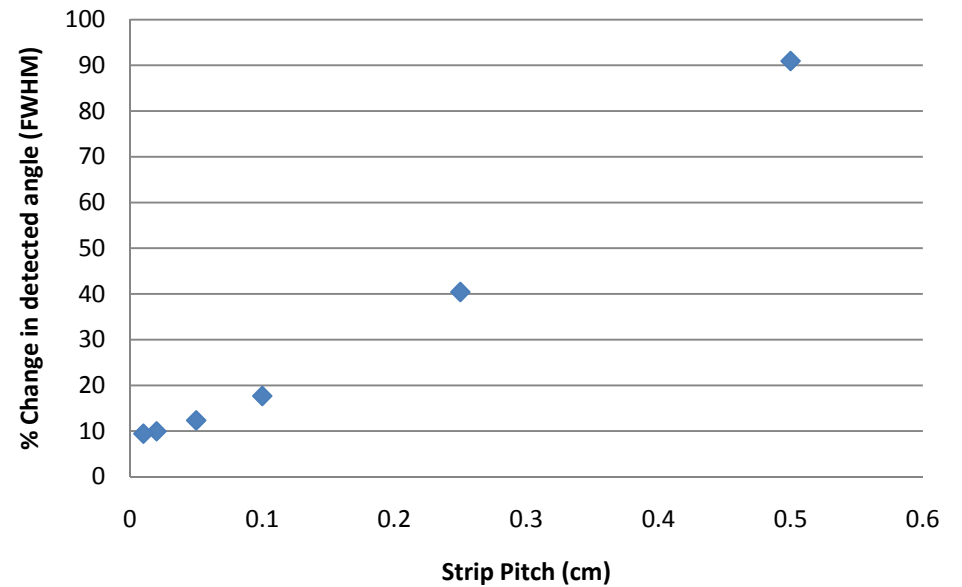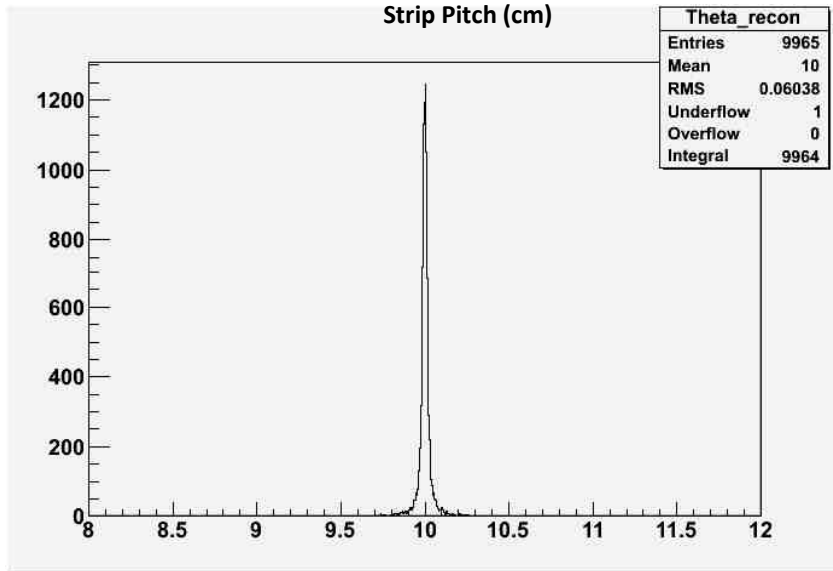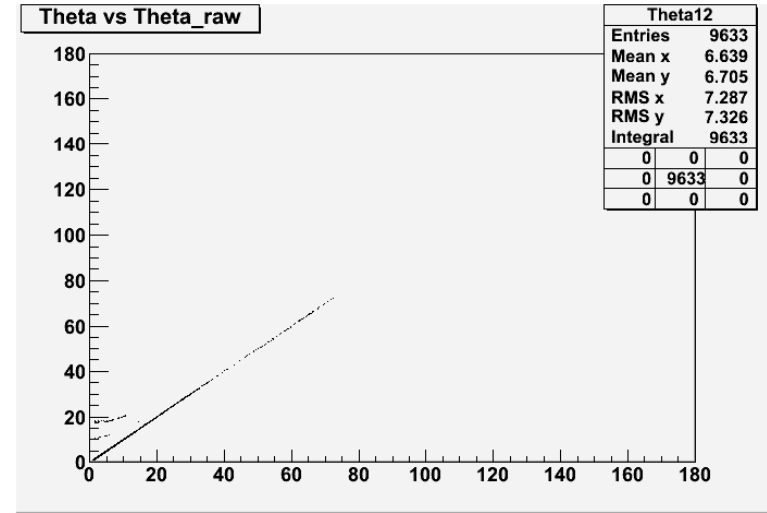
Energy Resolution

Future Work

Future Work
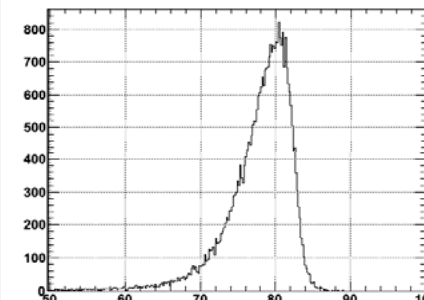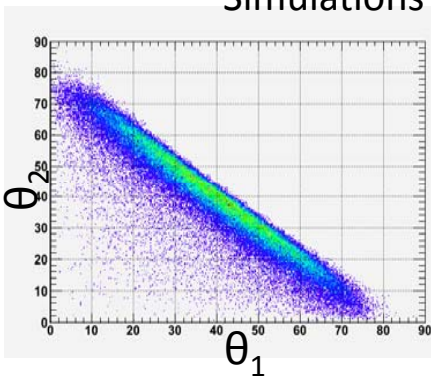
- Validate S296 experiment – $^{12}C(p,2p)$ and $^{12}C(p,p\alpha)$
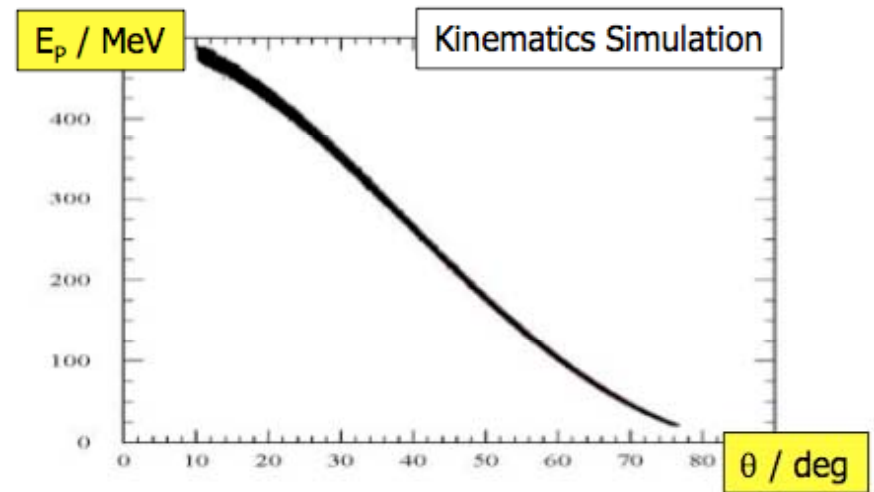
Experiment

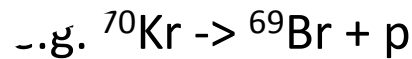Opening angle ~ $(\theta_1+\theta_2)$

Simulations (Leonid Chulkov)

Opening angle ~ $(\theta_1+\theta_2)$

E_P / MeV   Kinematics Simulation

θ / deg
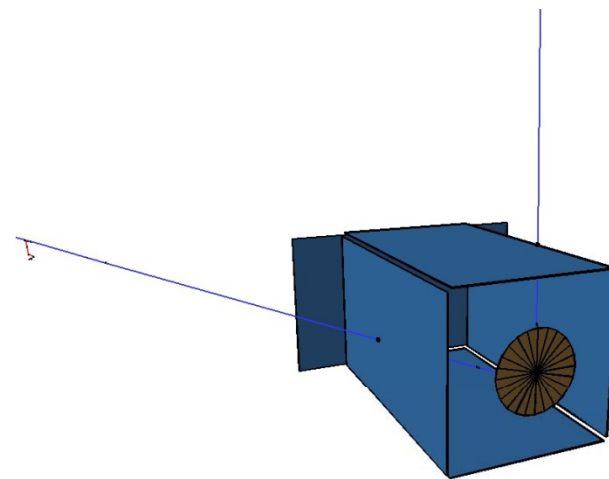
Future Issues

- Physics driven design:
  - (p,2p), (p,pn), (p,pα) QFS:
    - Study single particle s⁺
    - E-ΔE techniqu⁺
      - S⁺
  - Fl⁺

Need input from the collaboration and physics event generators!

...g. ^{70}Kr -> ^{69}Br + p

...arget not funded by STFC however Saclay keen to get

...olved

Discussion

- What type of physics does the collaboration envisage using the Si tracking detector for.
  - What is the minimum energy and angular resolution?
  - What angular coverage is needed.
- We need theoretical input.
  - Reaction calculations
  - Easy to use event generators