Hellenic Institute of Nuclear Physics (HINP)

2nd Hellenic Institute of Nuclear Physics Workshop (HINPw2)

The first part of the LIPMAGNEX experiment: Elastic scattering measurements at near barrier energies for ^{6}Li+p

Soukeras Vasileios

Nuclear Physics Laboratory

Physics Department, University of Ioannina

12th of April, 2014

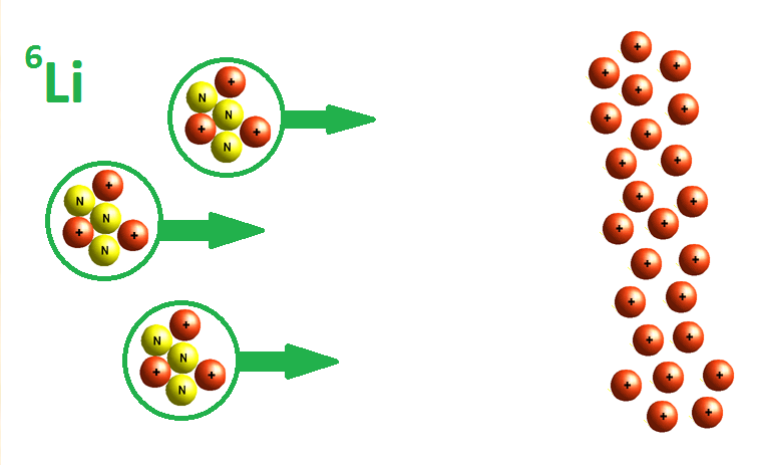
Thessaloniki, Greece

Motivation

- ✓ The reactions with ^{6}Li are of great practical and theoretical importance with applications on astrophysical problems.
- ✓ Coupling channel mechanisms for weakly bound nuclei appear most strongly at near barrier energies.
- ✓ Elastic scattering of nucleon–nucleus is the main tool for investigating the optical model potential.

The LIPMAGNEX experiment

- ✓ **Elastic scattering and breakup measurements for the system ^{6}Li+p were performed at 4 energies with MAGNEX spectrometer.**



Why MAGNEX ???

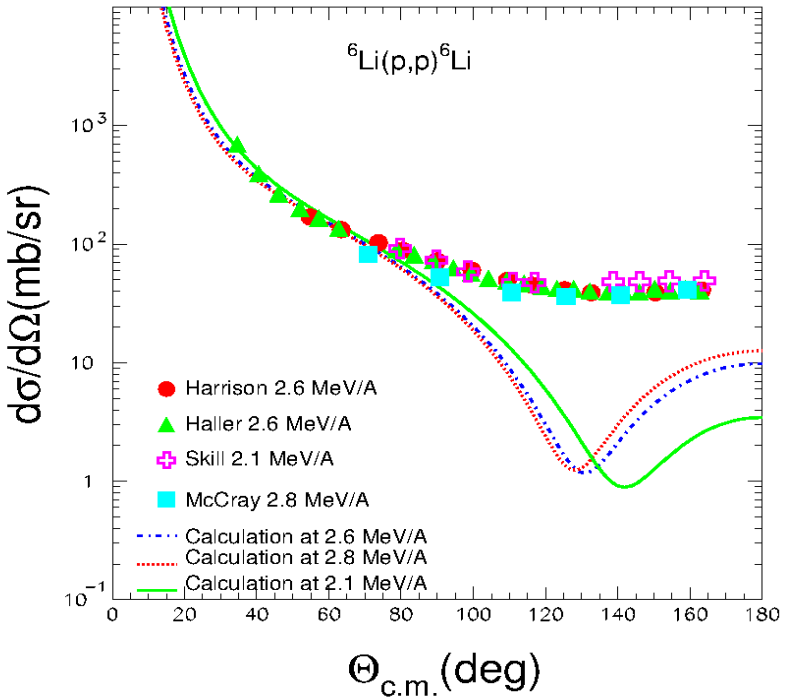
- ✓ **MAGNEX + inverse kinematics**

$$2^{o}<\theta_{LAB}<9.6^{o} \longrightarrow 14^{o}<\theta_{CM}<170^{o}$$

Elastic scattering

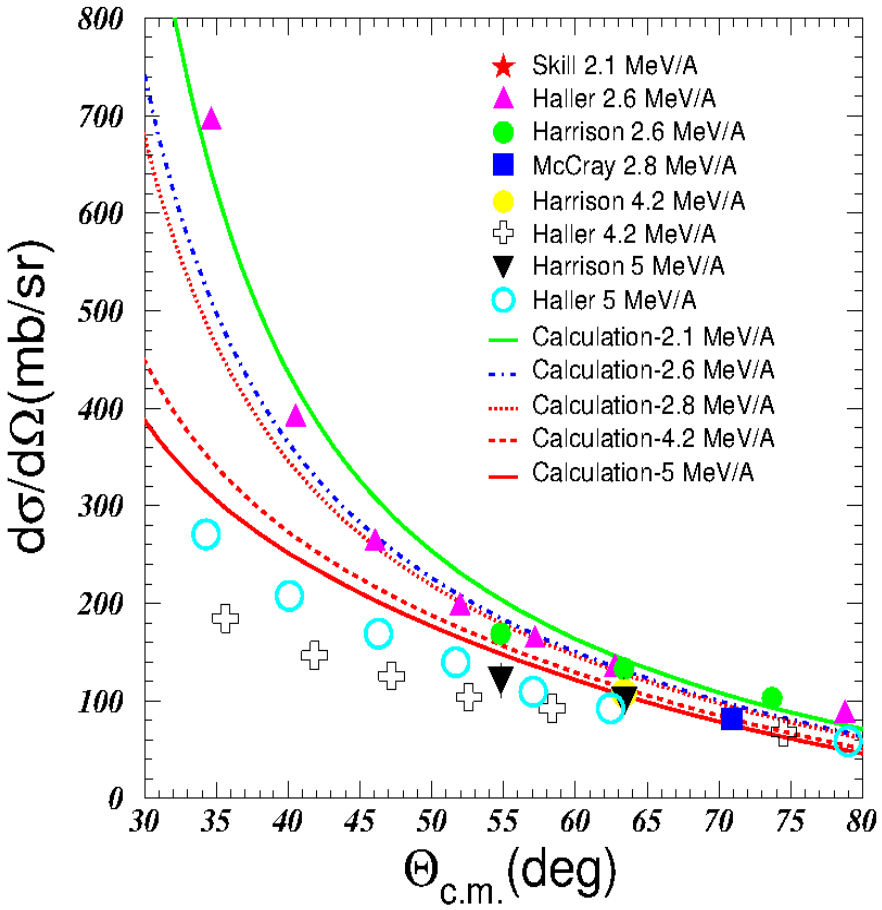
- ✓ Detailed measurements of proton scattering at Lithium target *(For normalization: McCray data).*

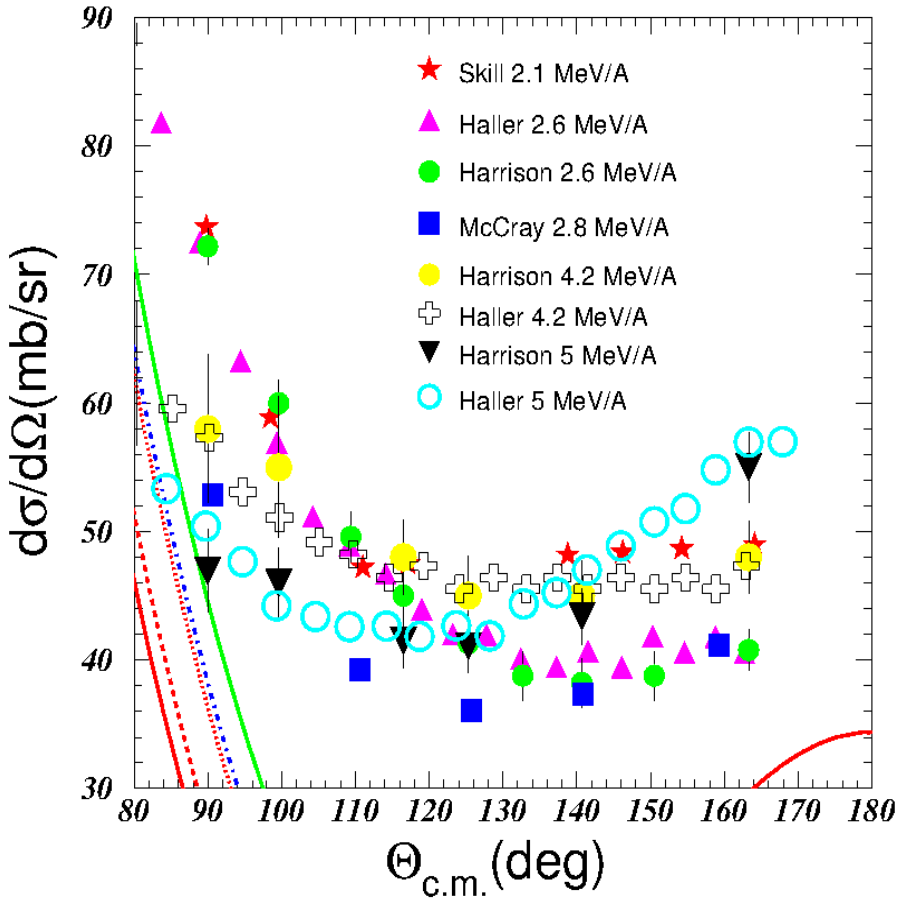
McCray, Phys. Rev. 130 (1963) 2034
Harrison and Whitehead, Phys. Rev. 132 (1963) 2607
Petitjean et al., NPA 129 (1969) 209
Haller et al., NPA 496 (1989) 189
Haller et al., NPA 496 (1989) 205
Skill et al., NPA 581 (1995) 93



Guo et al., Phys. Rev. C87 (2013) 024610

Elastic scattering





- Inconsistencies between the previous experimental data

Elastic scattering

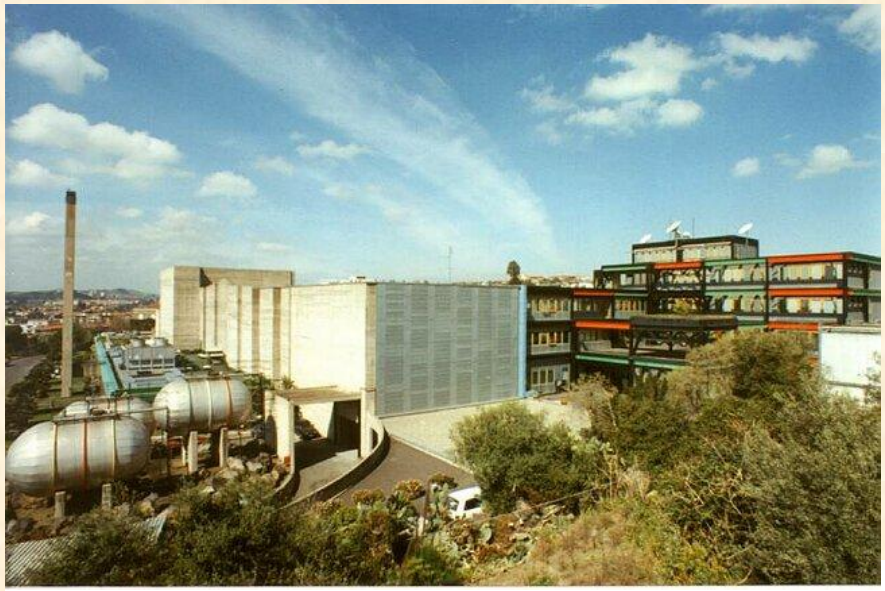
PREVIOUS MEASUREMENTS

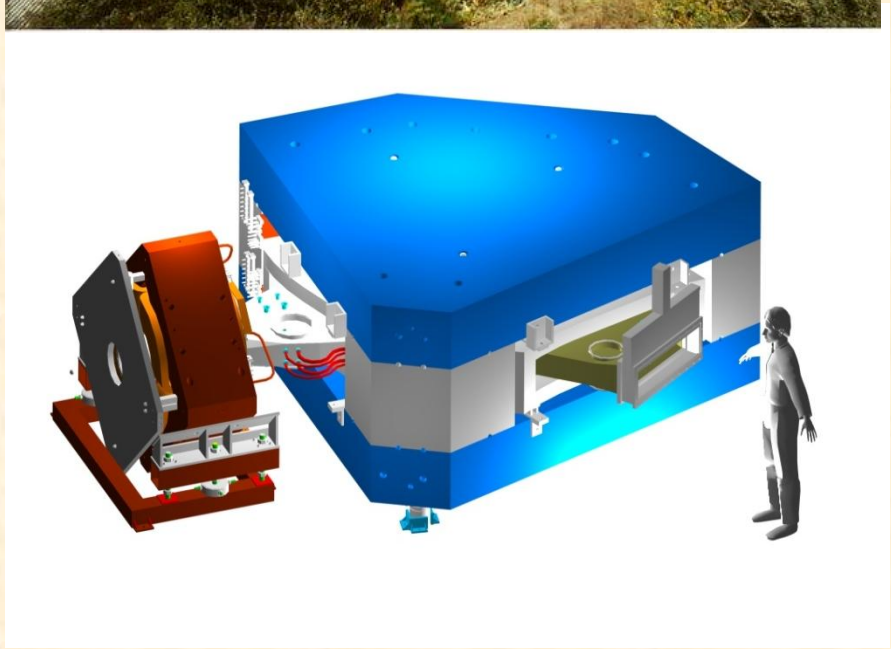
- Inconsistencies
- Not absolute values (normalization to an old measurement)

LIPMAGNEX

- Energy resolution
- Angular resolution
- Inverse kinematics
- Normalization by Rutherford
- 3+ charge state of the ^{6}Li beam
- Very well – defined flux

Experiment ^{6}Li + p



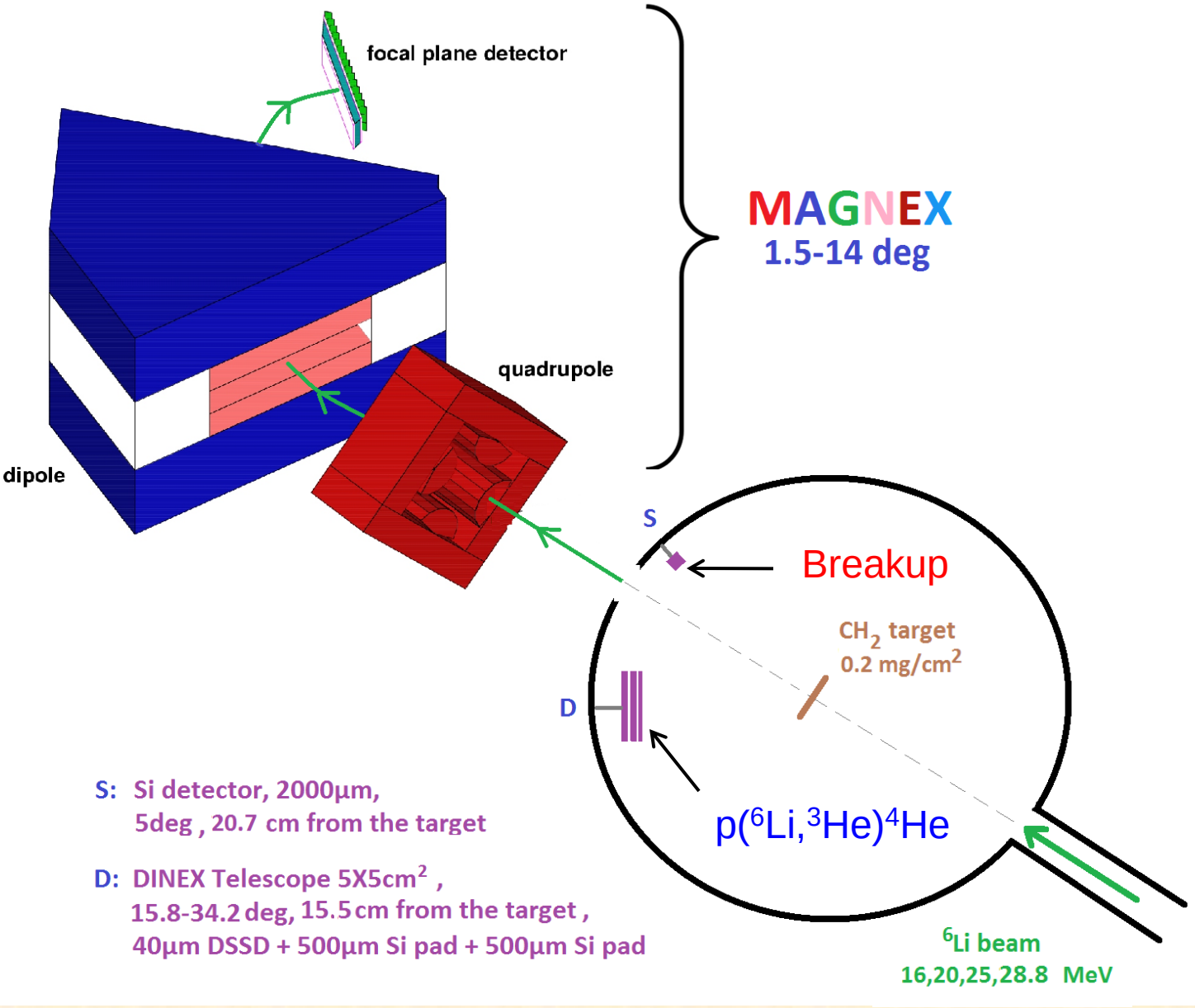


- The experimental setup was visualized in MAGNEX facility at LNS (Catania).
- MAGNEX is a large acceptance spectrometer

Main components:

- Target chamber
- Quadrupole
- Dipole
- Focal Plane Detector

Experimental setup

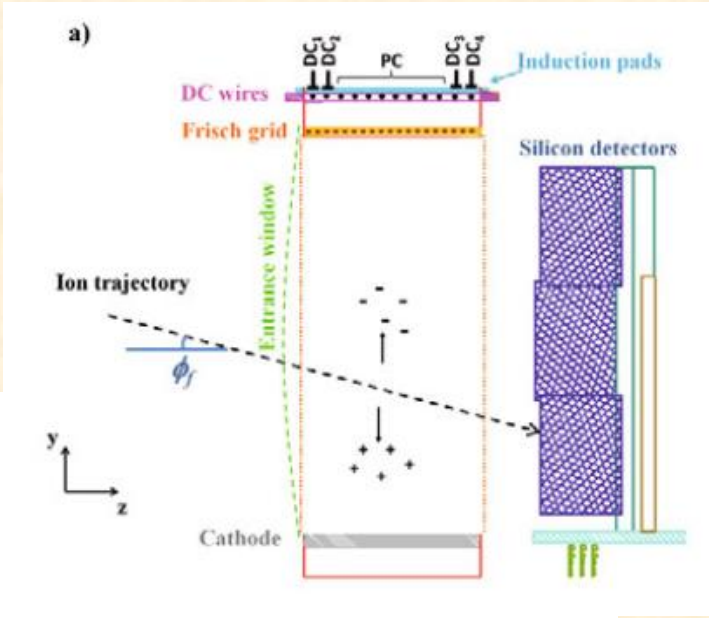


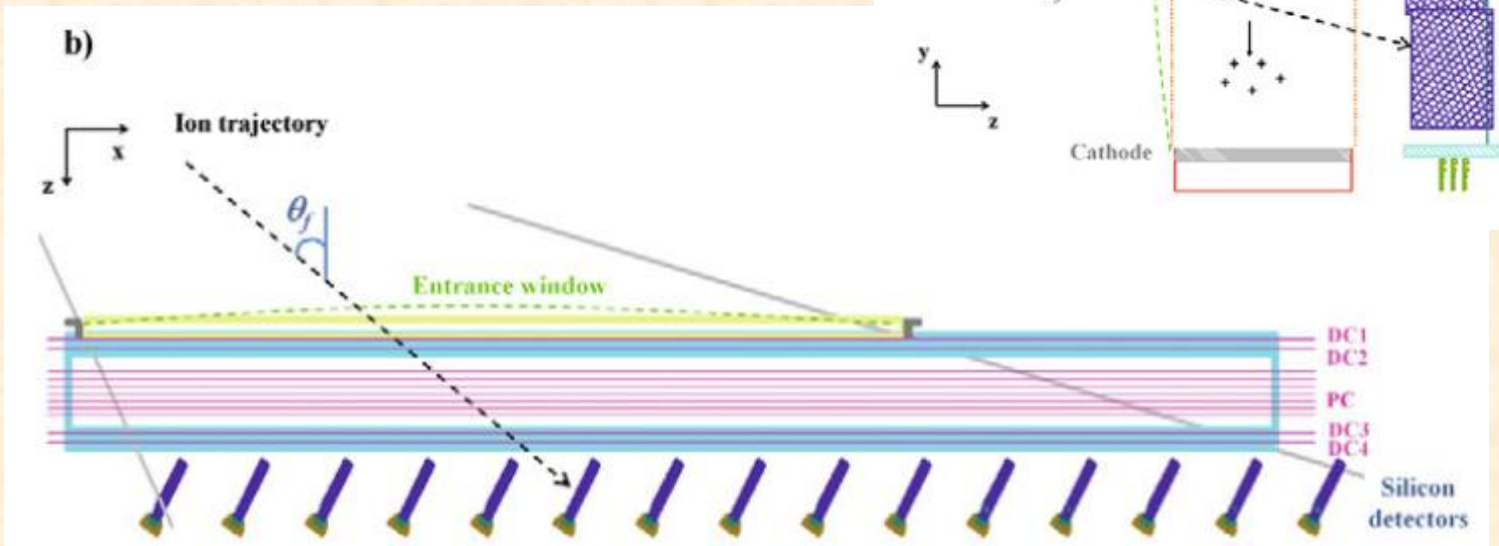
S: Si detector, 2000µm,
5deg , 20.7 cm from the target

D: DINEX Telescope 5X5cm^2 ,
15.8-34.2 deg, 15.5 cm from the target ,
40µm DSSD + 500µm Si pad + 500µm Si pad

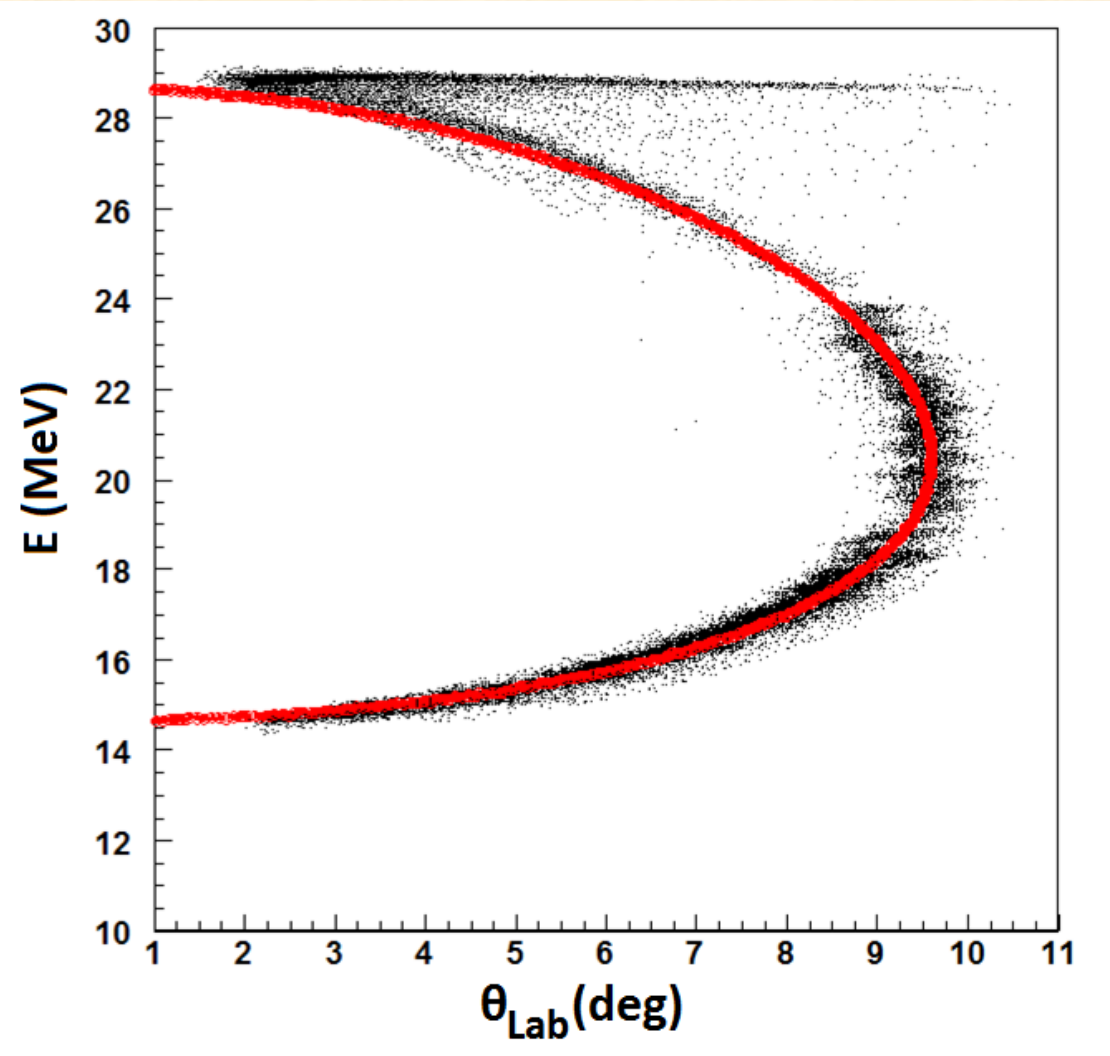
The Focal Plane Detector

- A. Cunsolo et al., Eur. Phys. J. Special Topics 150 (2007) 343
- F. Cappuzzello et al., NIM A 621 (2010) 419
- M. Cavallaro et al., Eur. Phys. J. A 48 (2012) 59





Identification of Elastic channel



Energy VS Scattering angle

Summary

1. Elastic scattering measurements for the system ^{6}Li+p were performed at 16, 20, 25 and 28.8 MeV with MAGNEX spectrometer.
2. A software ray-reconstraction was performed for the elastic scattering data of 28.8 MeV.
3. The identification of elastic channel at 28.8 MeV was performed.
4. The analysis is under process.

Collaborators

- ✓ *Department of Physics and HINP, The University of Ioannina, Greece*
- ✓ *Laboratori Nazionali Del Sud (LNS), Catania, Italy*
- ✓ *Dipartimento di Fisica e Astronomia, Universita di Catania, Italy*
- ✓ *INFN - Sezione di Catania, Italy*
- ✓ *Departamento di Fisica Aplicada, Universidad de Huelva, Spain*
- ✓ *Institute of Accelerating Systems and Applications and Department of Physics, University of Athens, Greece*
- ✓ *Departimento di Fisica and INFN – Sezione di Padova, Italy*
- ✓ *INFN – Sezione di Napoli, Italy*
- ✓ *CEA-Saclay, DAPNIA-SPhN, Gif-sur-Yvette, France*
- ✓ *Heavy Ion Laboratory, University of Warsaw, Poland*
- ✓ *National Center for Nuclear Research, Otwock Warsaw, Poland*

Thank you very much!