Density distribution of Ni isotope from proton elastic scattering

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GSI Helmholtzzentrum für Schwerionenforschung GmbH
on behalf of
S272 collaborators

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S272: Density distribution of Ni isotope from proton elastic scattering

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Rituparna Kanungo : Saint Mary University, Canada

• GSI Contact Person: Chiara Nociforo
(+ Satoru Terashima)

• Year of Approval: 2001 (re-evaluation in 2008)

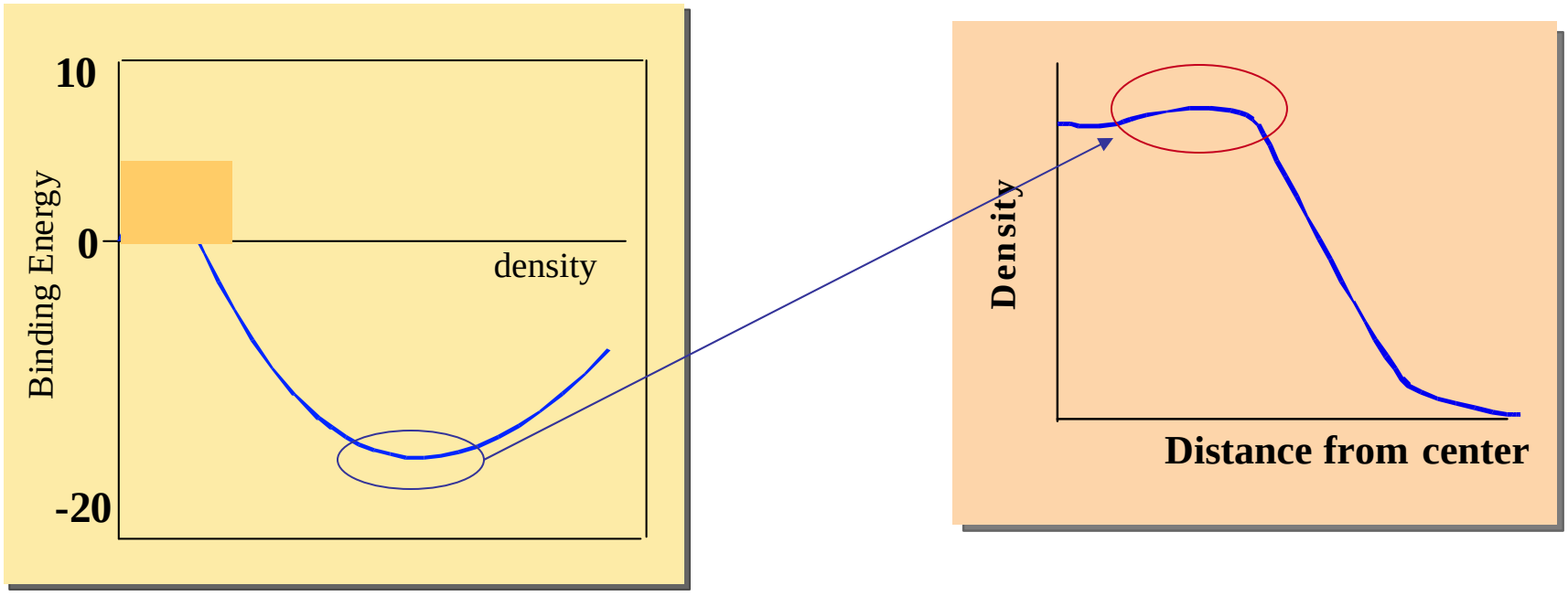
• Shifts: parasitic test in 2009
49 shifts used in 2010 [60 (main) approved]
8.2 shifts remain

Density Distribution and EOS

- **The saturation density of nuclear matter is reflected in the density of nucleus.**

  -> Saturation density of nuclear matter can be determined from density distributions.

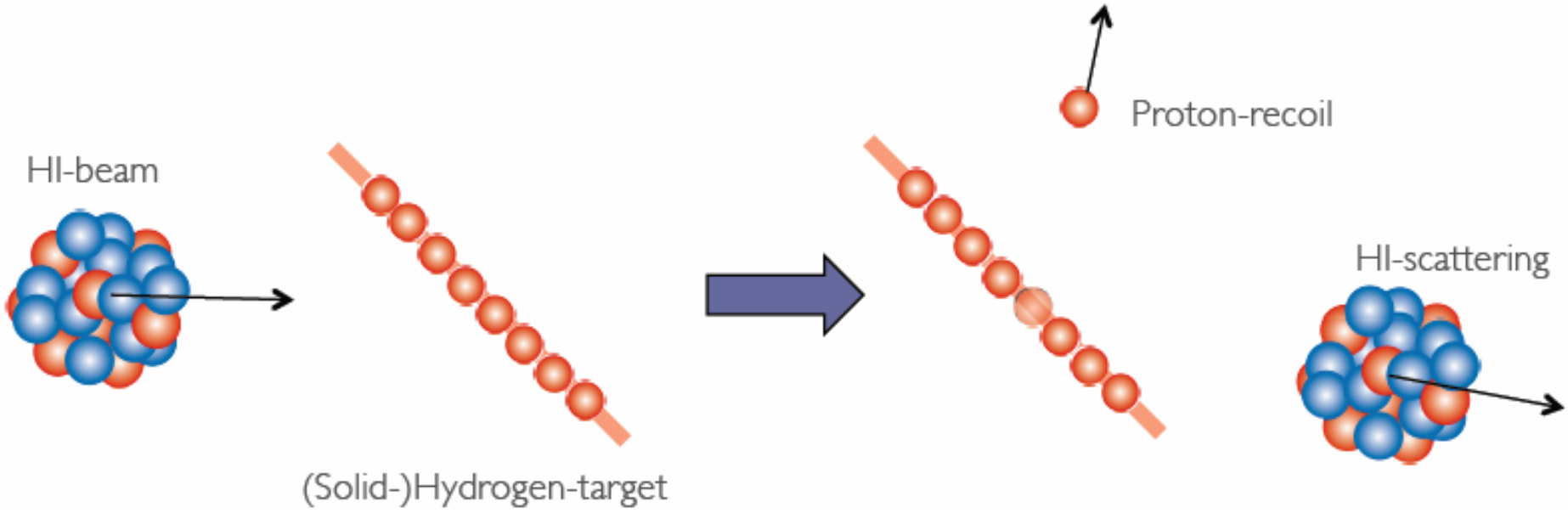
  -> EOS of asymmetric matter can be studied from density distribution of neutron rich nuclei.



Experimental Principle

- **Proton Elastic scattering in inverse kinematics**

  SH (^{A}HI,p)
  Full tracking of incident particle onto target (x, y, θ, ϕ, p)
  position and energy of recoil particle on detector (x, y, p)



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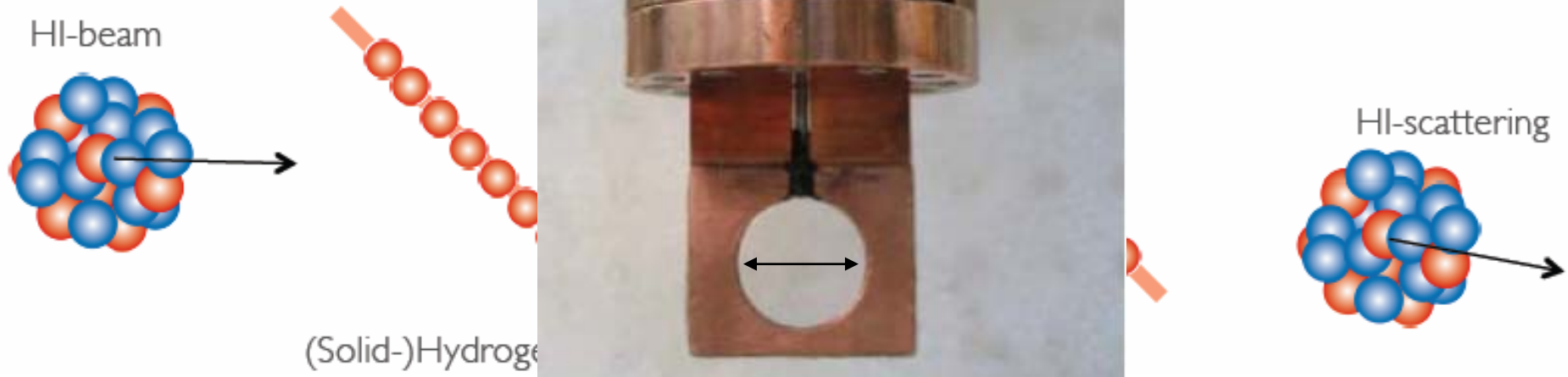
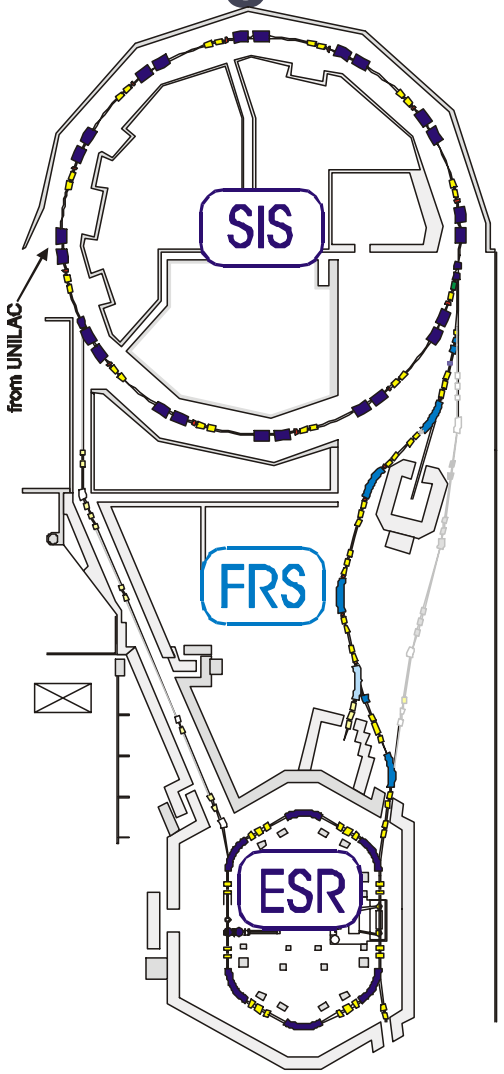
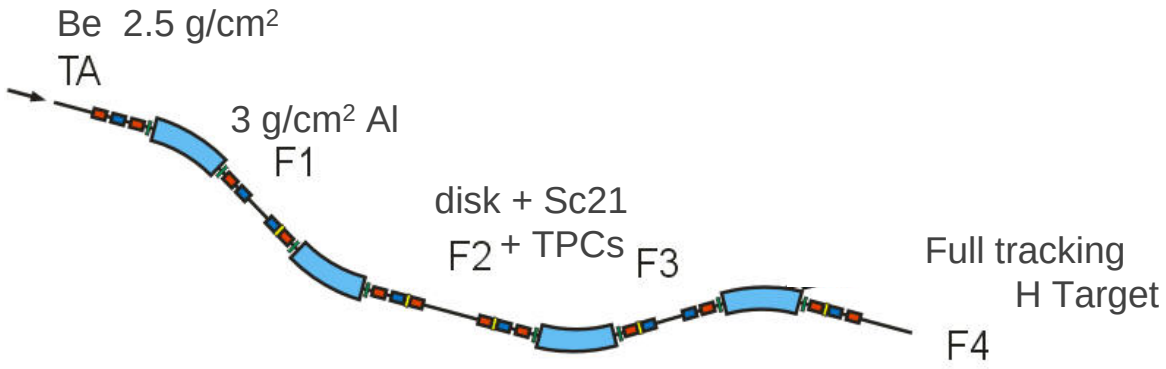


FRagment Separator FRS





-- Beam Intensities --

^{86}Kr 500 MeV/u ~2x10^{10} /spill @TA

[^{58}Ni 320 MeV/u 1x10^{6} /spill]

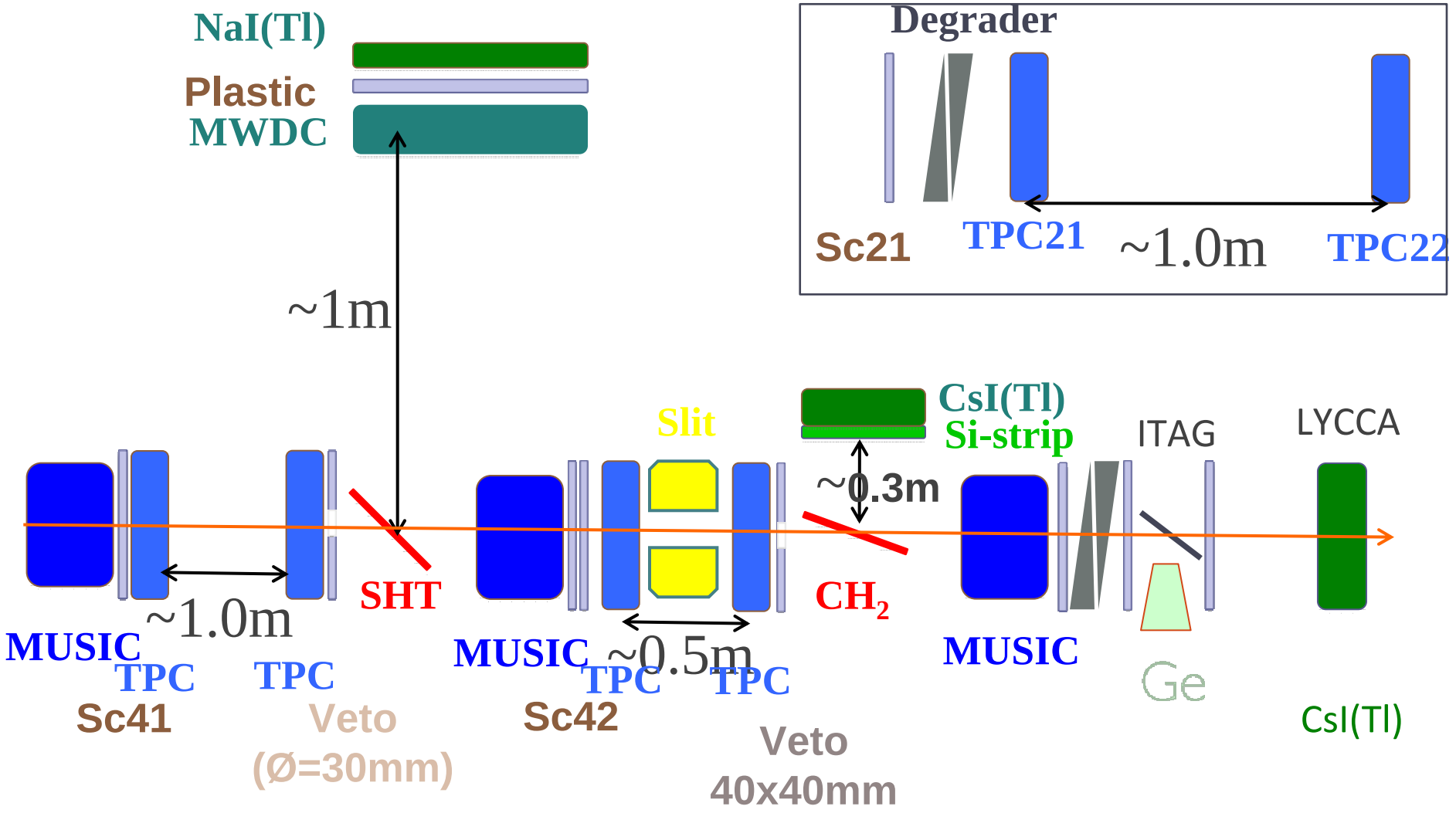
=>^{70}Ni 300 MeV/u ~1x10^{3} /spill

^{66}Ni 300 MeV/u ~2x10^{4} /spill

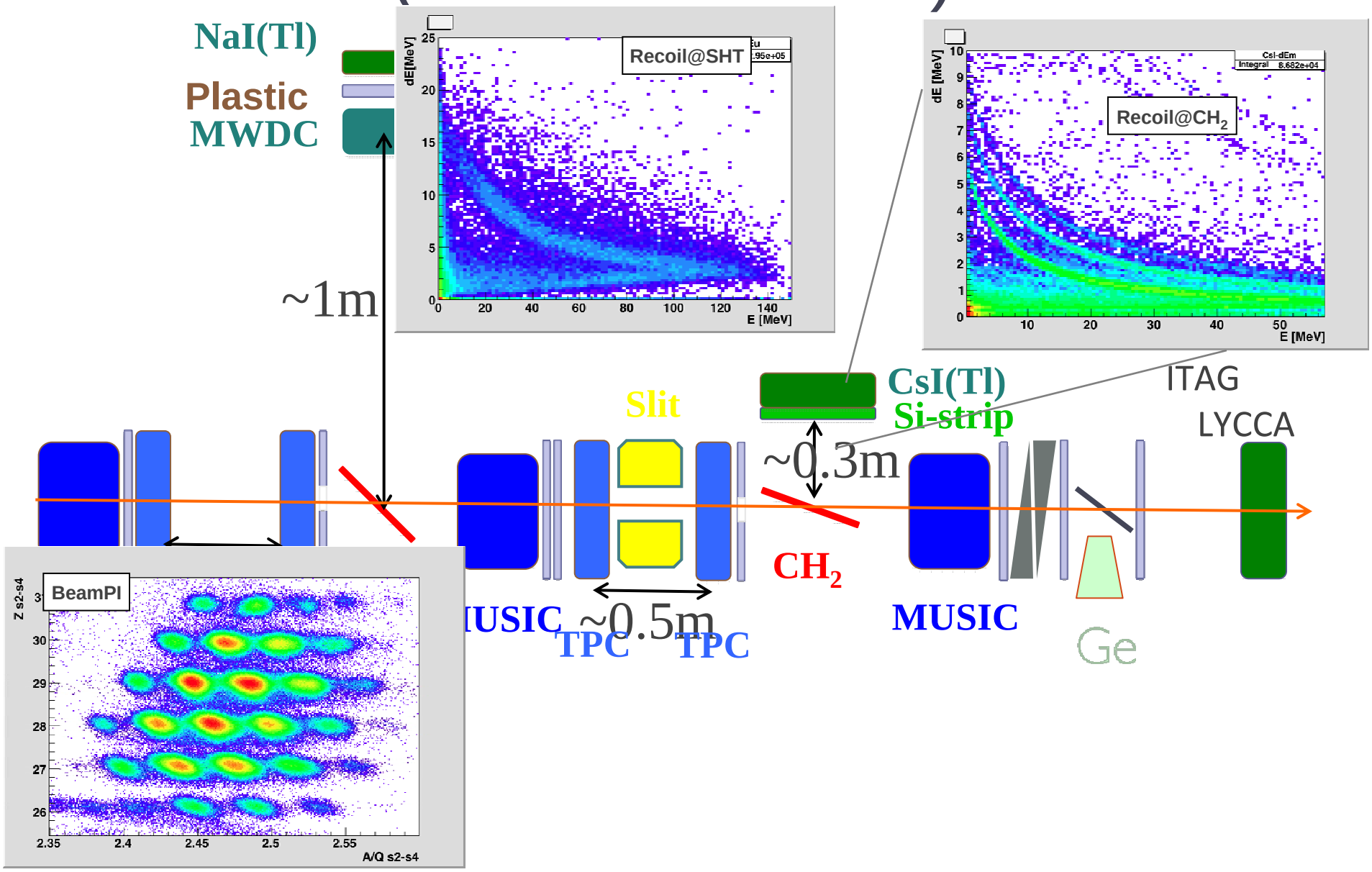
[^{58}Ni 300 MeV/u 1x10^{6} /spill]

in March-April/2010

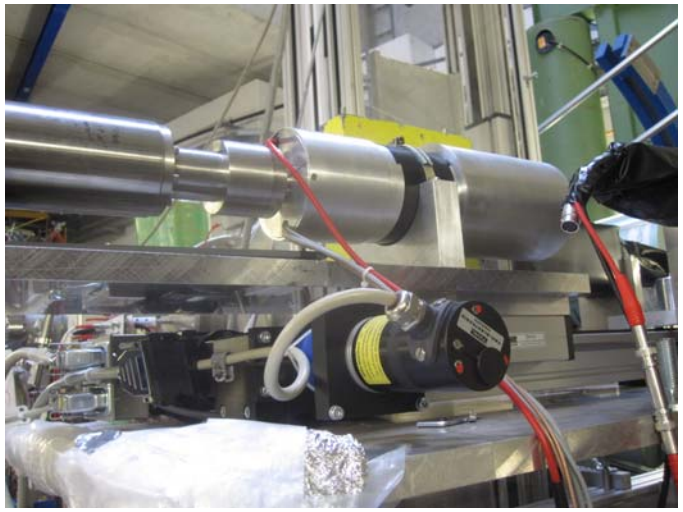
Scheme of Experimental Setup@S4(S2)



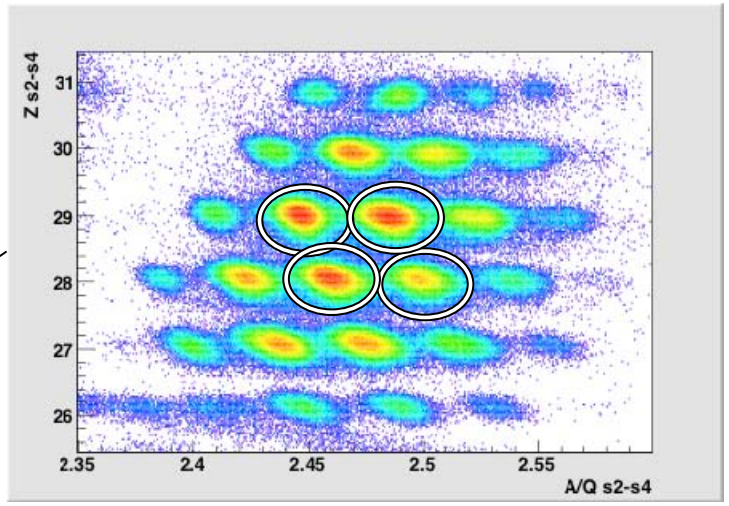
Particle ID (Beam and Recoil)

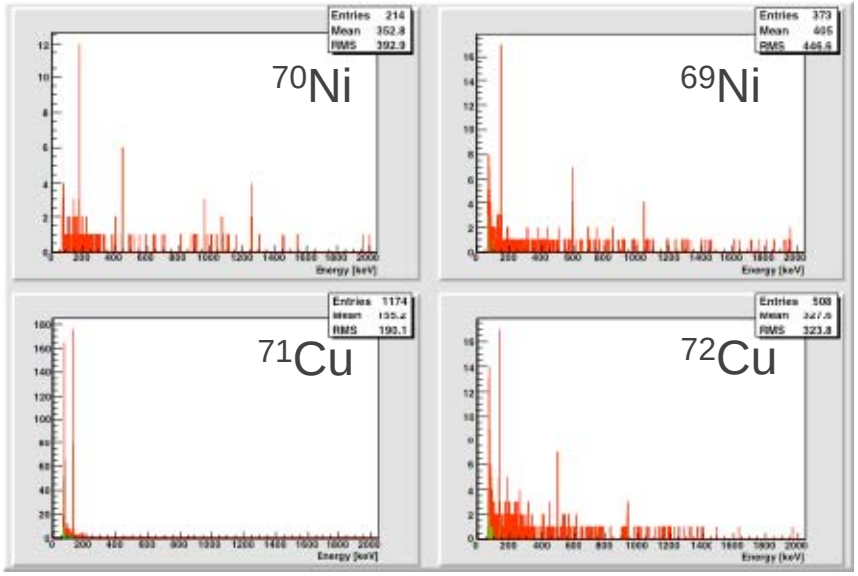


Isomer Tagging for Beam ID and measurement of isomer ratio



single Ge crystal



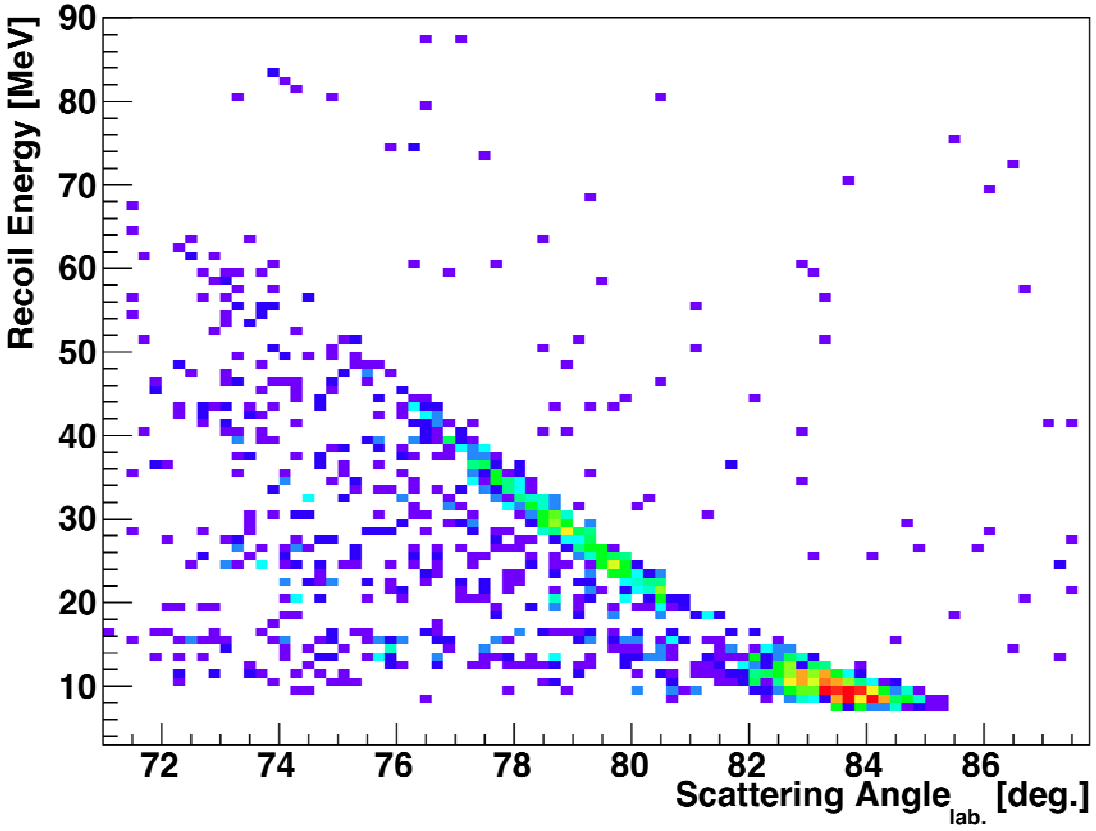


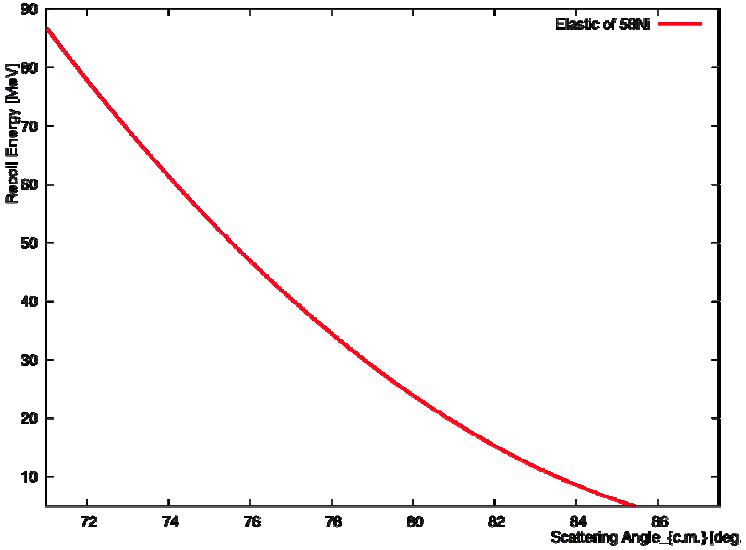
with particle identification and
delayed gates [150-3900 nsec]

Isomer contaminations on the hydrogen target are small, less than 10 %

Kinematics Correlation

SH(^{58}Ni,p) 300 MeV/u on SH





expected kinematics of elastic channel

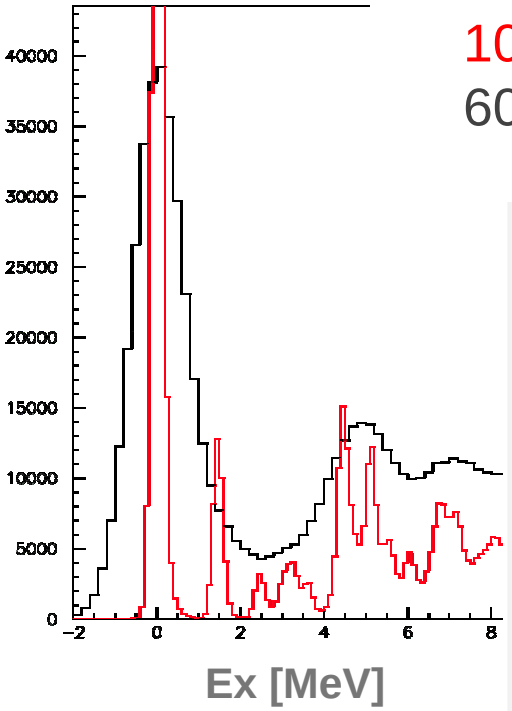
Calculate Q-value [Excitation Energy]

Typical Energy Spectrum

Data@RCNP

100 keV folding

600 keV folding

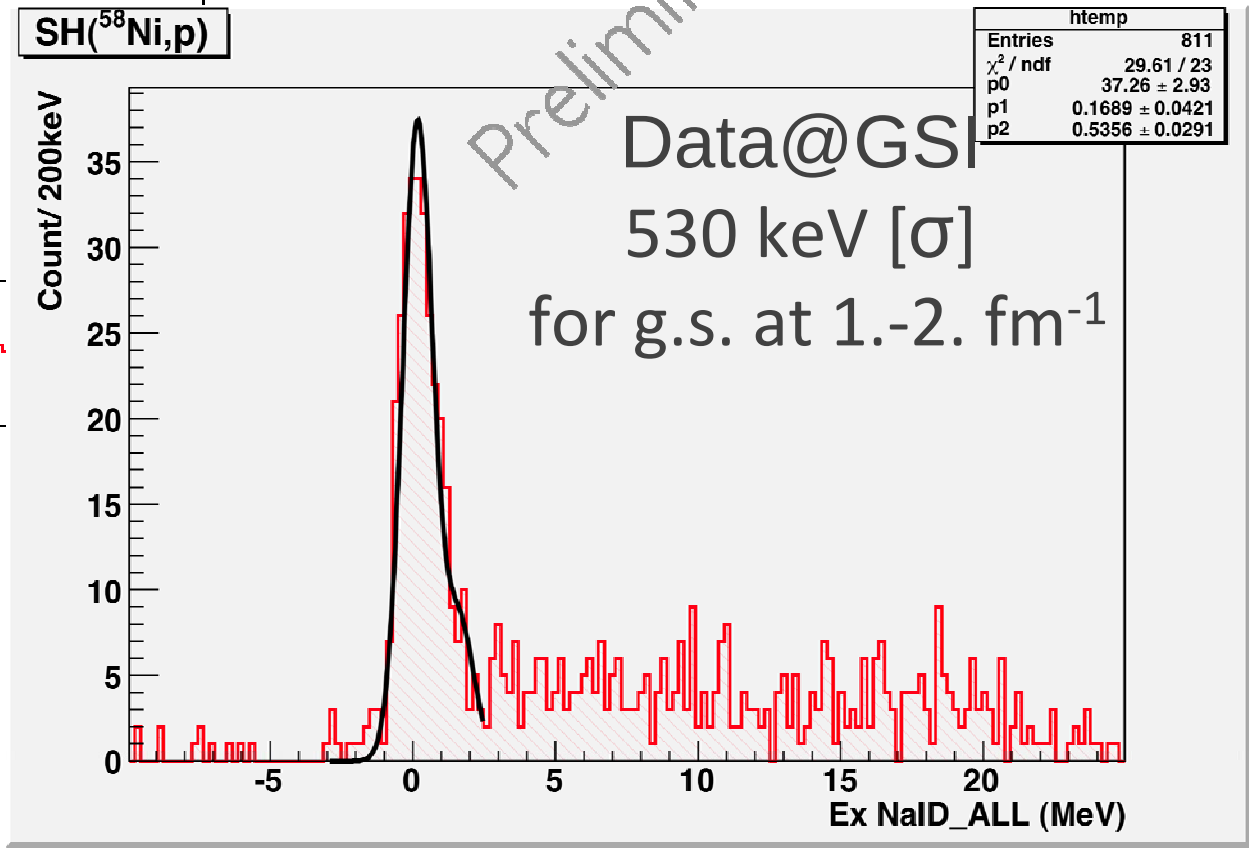


Preliminary

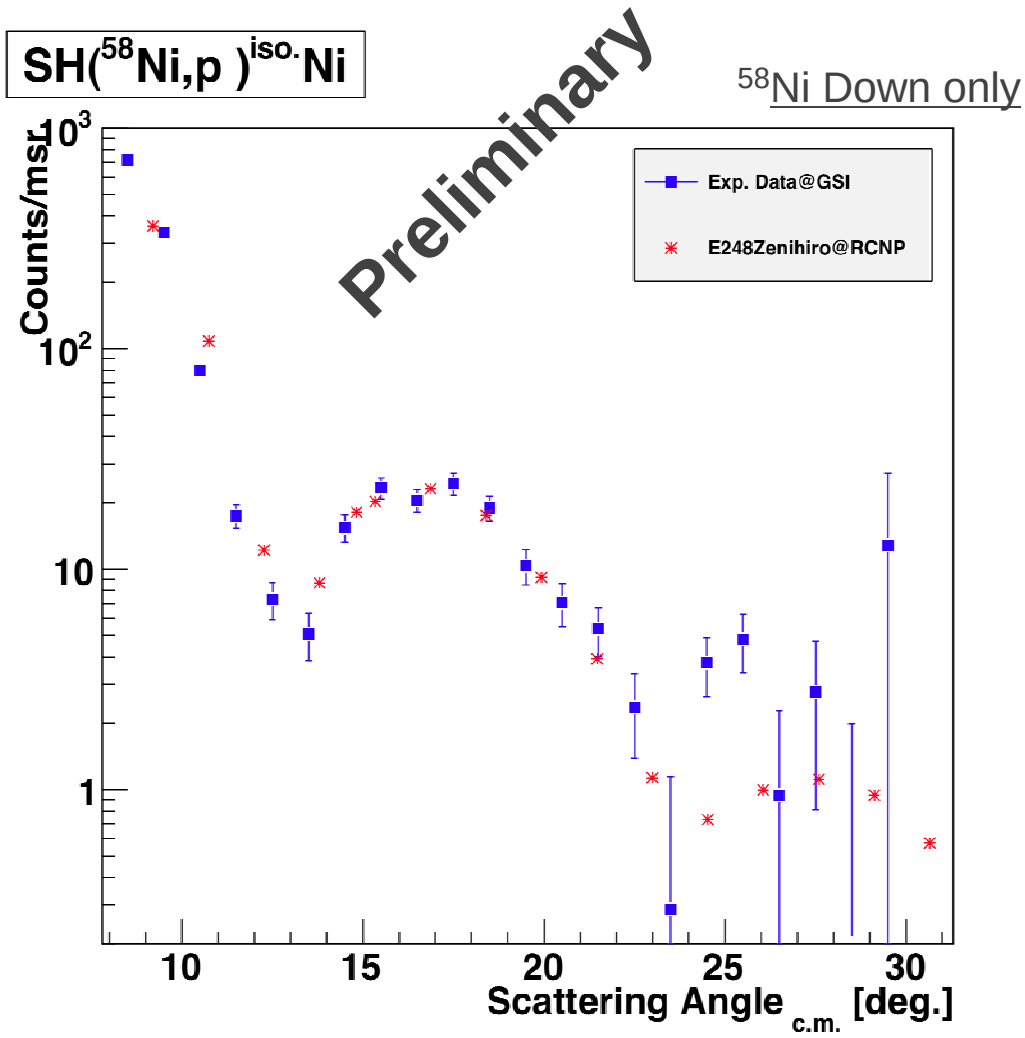
Data@GSI

530 keV [σ]

for g.s. at 1.-2. fm^{-1}



Angular Distribution

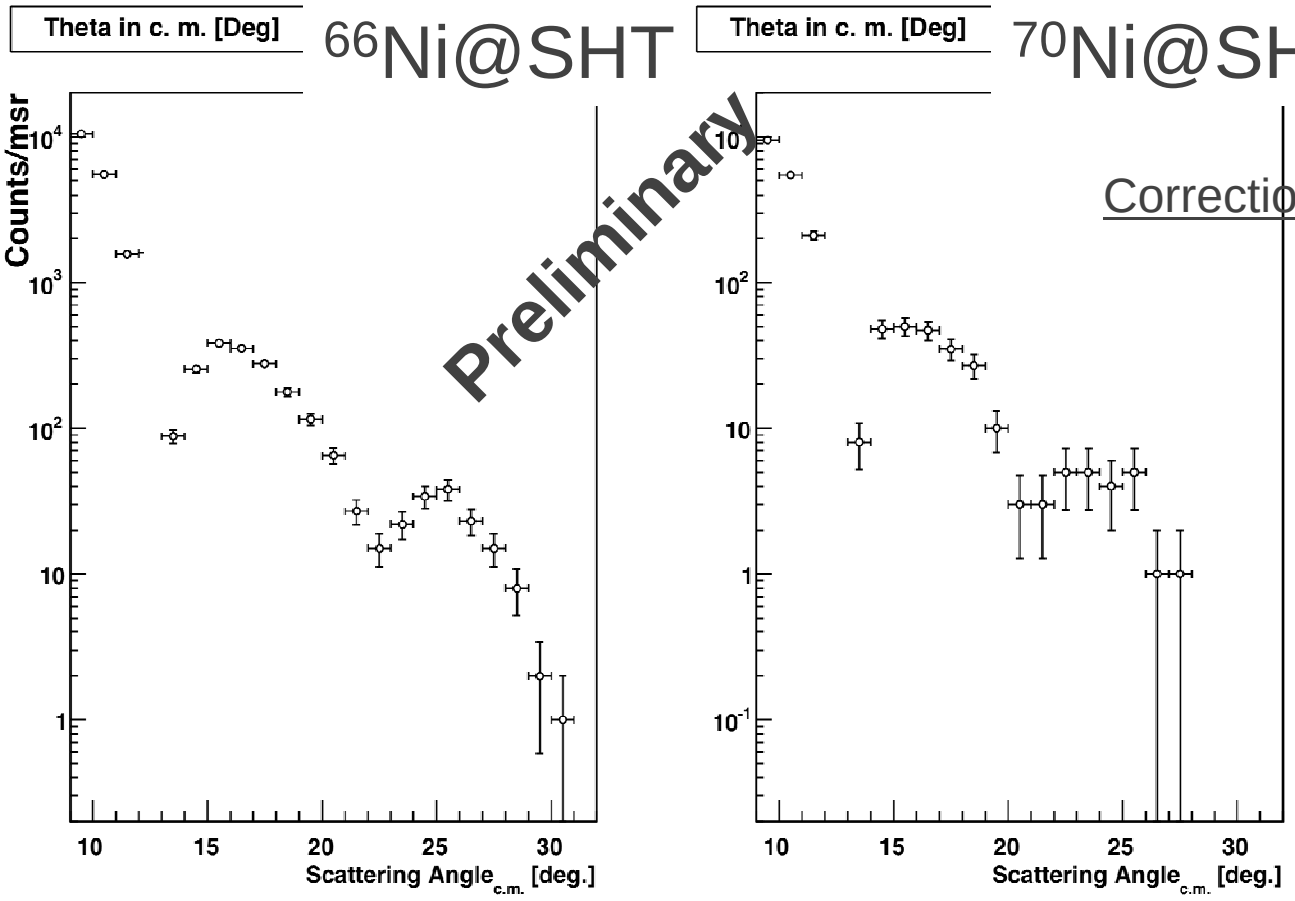


Acceptance correlated,
Efficiencies and beam normalizations
are not included (no absolute values yet)

Reference cross sections (red)
are scaled to 16 deg. -18 deg. region.

Consistency of angular distribution can be confirmed.

Angular Distribution of exotic Ni



Correction is same as ^{58}Ni, only acceptance.

Only 1st target (Solid Hydrogen d =1 mm, 45^{o} tilt)
Energy: ~300 MeV/u ^{66,70}Ni on SHT

Summary and Perspective

- Proton elastic scattering experiment of Ni isotopes at 300 MeV/u region was performed at GSI for the further understanding of the nuclear EOS.
- Solid hydrogen target can give much better background condition compared to CH_2.
- Detectors well work, All particle identifications are clear.
- Clear diffraction patterns of elastic ^{58,66,70}Ni were observed in angular distributions.
- Final differential cross sections will be presented as soon as possible.

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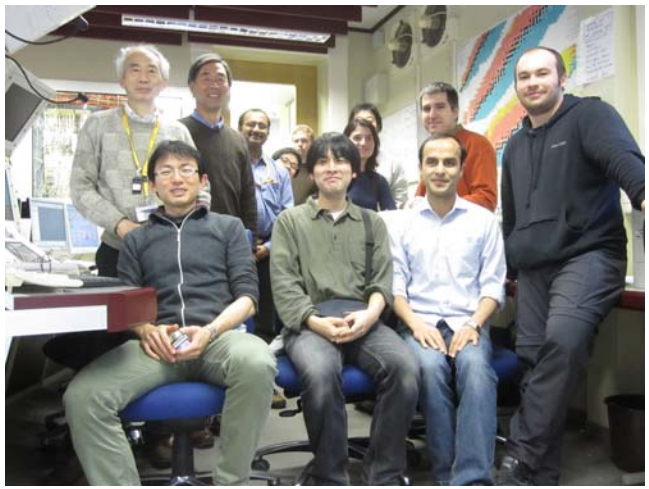

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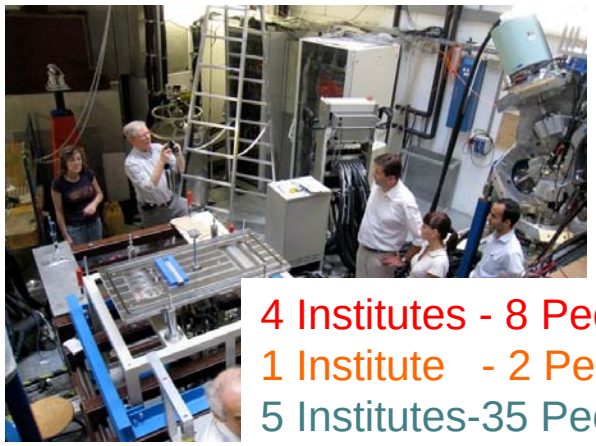

4 Institutes - 8 People-Japan
1 Institute - 2 People-Canada
5 Institutes-35 People-EU