Precision measurements on charge-changing cross sections and total fission cross sections

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1. Motivation

•Collecting of exp. data for the development of ADS and Nuclear Waste Incineration Projects

-Total fission cross sections in proton-induced reactions with Pb at various energies

-Total reaction-cross sections and charge changing cross sections in proton-induced fragmentation of Fe at various energies

•Questions related to the analysis of experiments performed at the FRS

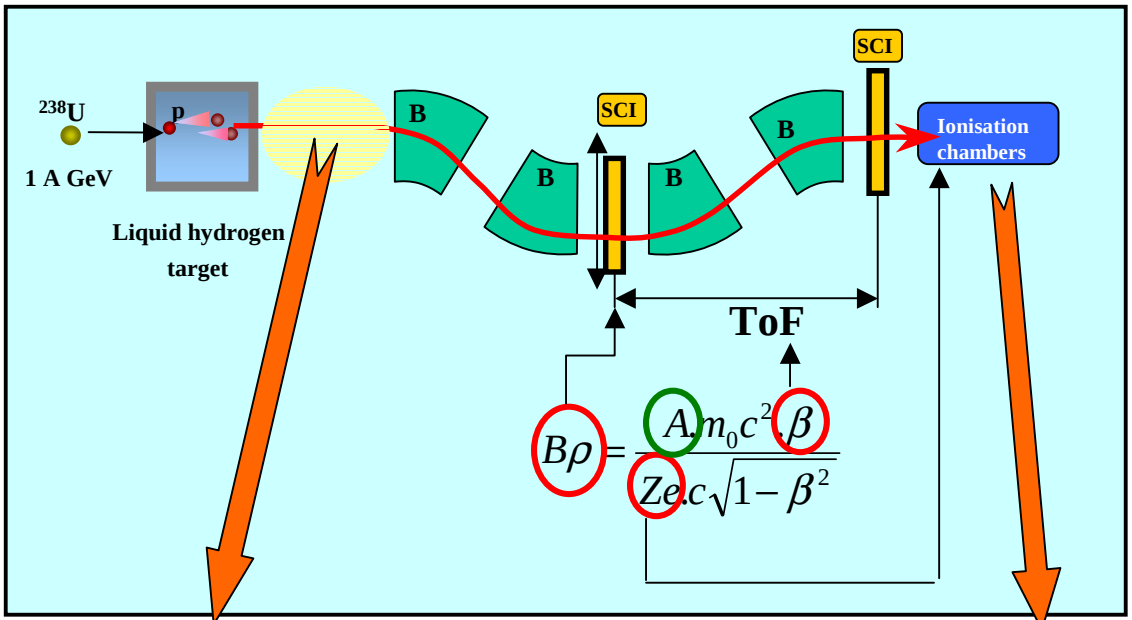
2. The experiments

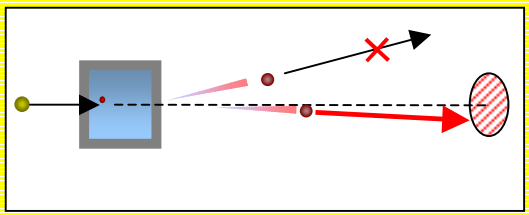
•Setup for measurement of charge-changing cross sections in fragmentation reactions

•Setup for measurement of total fission cross sections

3. Beamtime and technical requirements

- Questions related to the production cross sections measurements performed at the FRS





•$Y_{prod}(N,Z) > Y_{meas}(N,Z)$
•$T(N,Z) = Y_{meas}(N,Z) / Y_{prod}(N,Z) < 1$
•T(N,Z) is not an experimental observable
•T(N,Z) has to be calculated
•Accurate calculation of T(N,Z) is possible if the reaction kinematics is well known

*1*H(X*proj*,xpynzα)Y
*1*H(X*proj*,xpynzα)Y*1*,Y*2*
?

•Fragmentation reactions: M=1
•Fission reactions: M=2
•Production of light residues : M>1

We need:

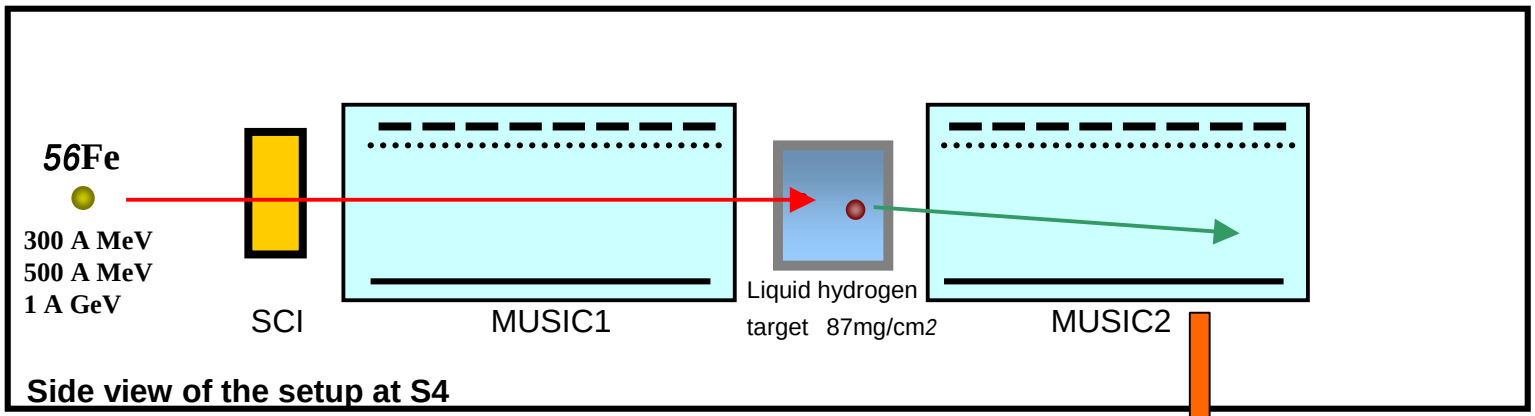
-comparison to independently evaluated cross section data

-verifying of the calculated angular transmission values and data normalization procedures

- measurement of total reaction- and charge-changing cross sections independend from the multiplicity of the outgoing residues

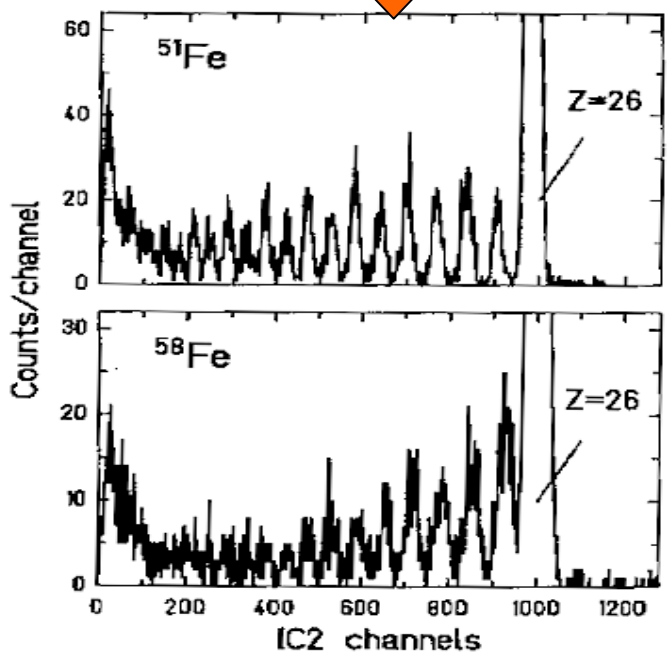
2. The experiments

•Measurement of charge-changing cross sections in proton-induced fragmentation reactions on *56*Fe



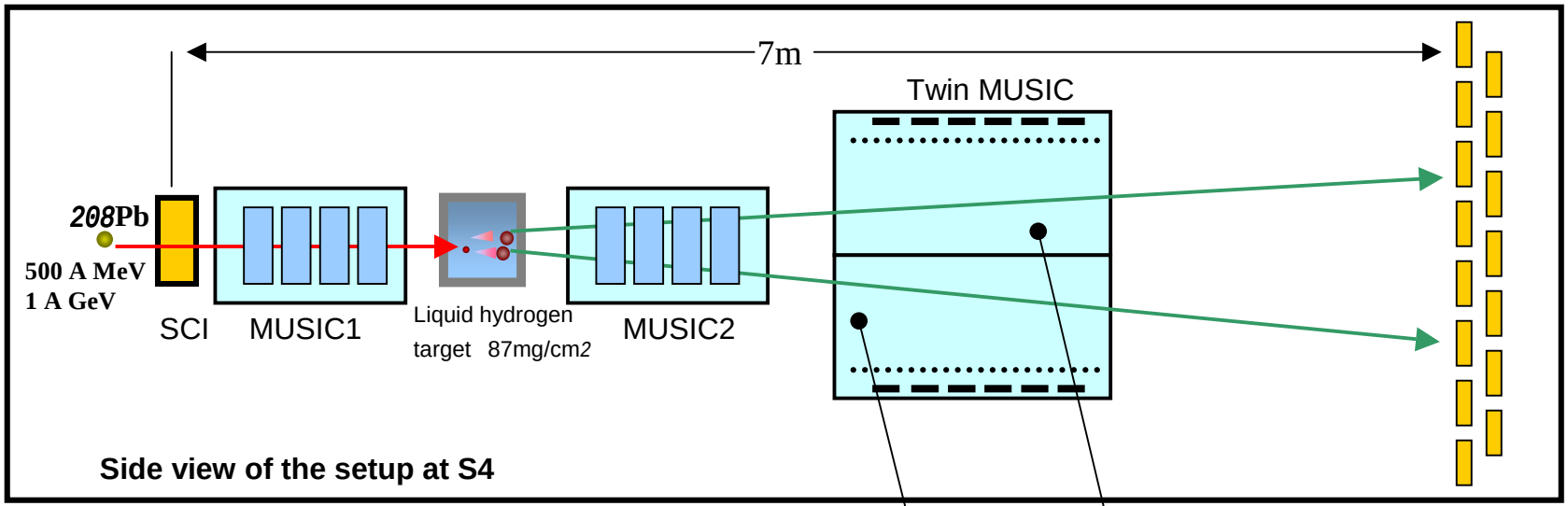
Side view of the setup at S4

Energy loss spectra of fragments produced in fragmentation reactions of *51*Fe and *58*Fe impinged on a $(CH_2)_n$ target *1*.
1 **T. Brohm et al., Nucl. Phys. A 550 (1992)**

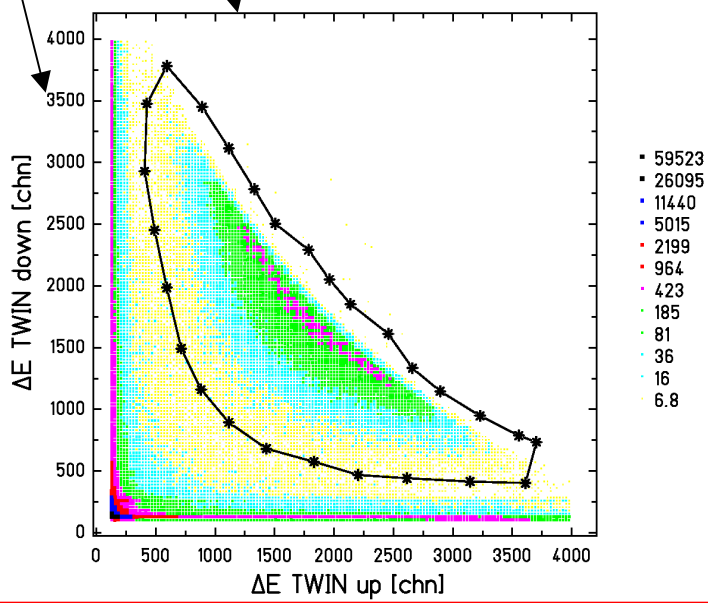


•full acceptance of all reaction products
•the measurement has to be performed using the primary beam of *56*Fe only
•the measured counting rates are independent from the ang. transmission
•results could be directly compared to previously measured cross section data

•Measurement of total fission cross sections for proton-induced fission of *208*Pb



Scatter plot of energy loss spectra of fission fragments produced in fission reactions of *238*U Impinging on a (CH2)*n* target *2*.
2 **Beatriz Jurado, PhD Theses, GSI 2002.**



•full acceptance for the fission fragments (!)
•simultanious detection of both fission fragments
•data on energy dependence of the total fission cross-sections could be measured with high accuracy

3.Beamtime and technical requirements

•need of rel. small amounts of beamtime:
- about 2 or 3 days of beamtime with ^{56}Fe beam depending on the energy range
- up to one week for total fission cross sections measurements on ^{208}Pb (partly in parasitic mode)

•Uncomplicated setup, which was already in use, specially designed to fit to the support existing at the S4-site