# Report from S341 Experiment

Helmut Weick, FRS user meeting 13th Nov 2008

## Measure neutron removal cross section for proton rich carbon nuclei


**Participants:**

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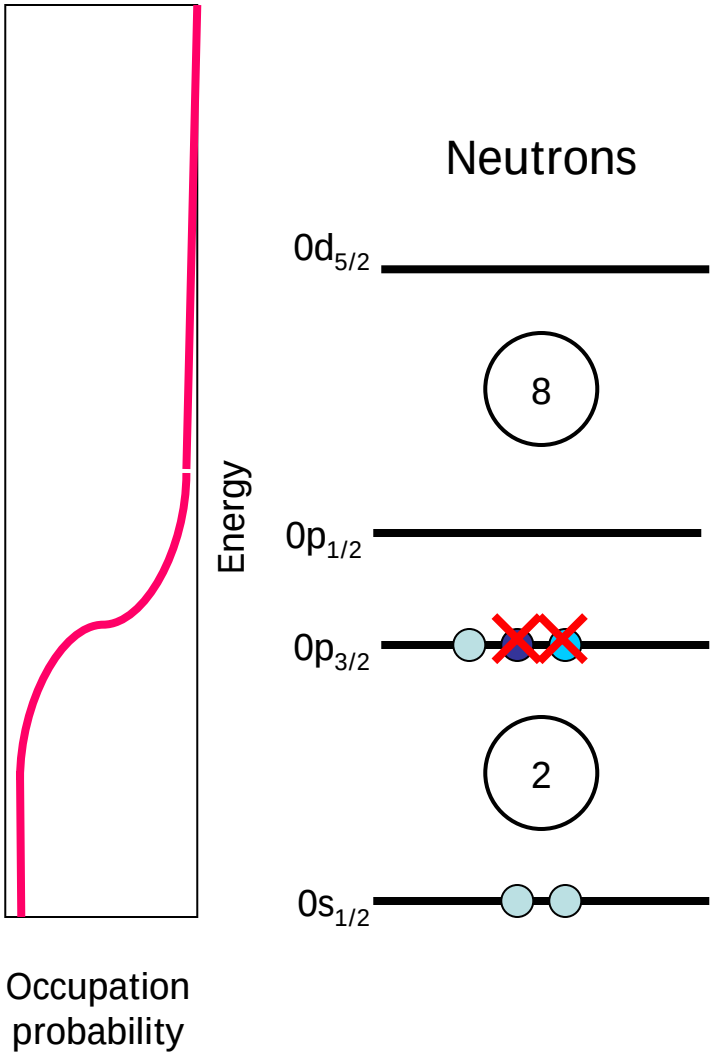
**TU Darmstadt, GSI, Univ. Santiago de Compostela, TU München, Univ. Bratislava, Univ. Tohoku**

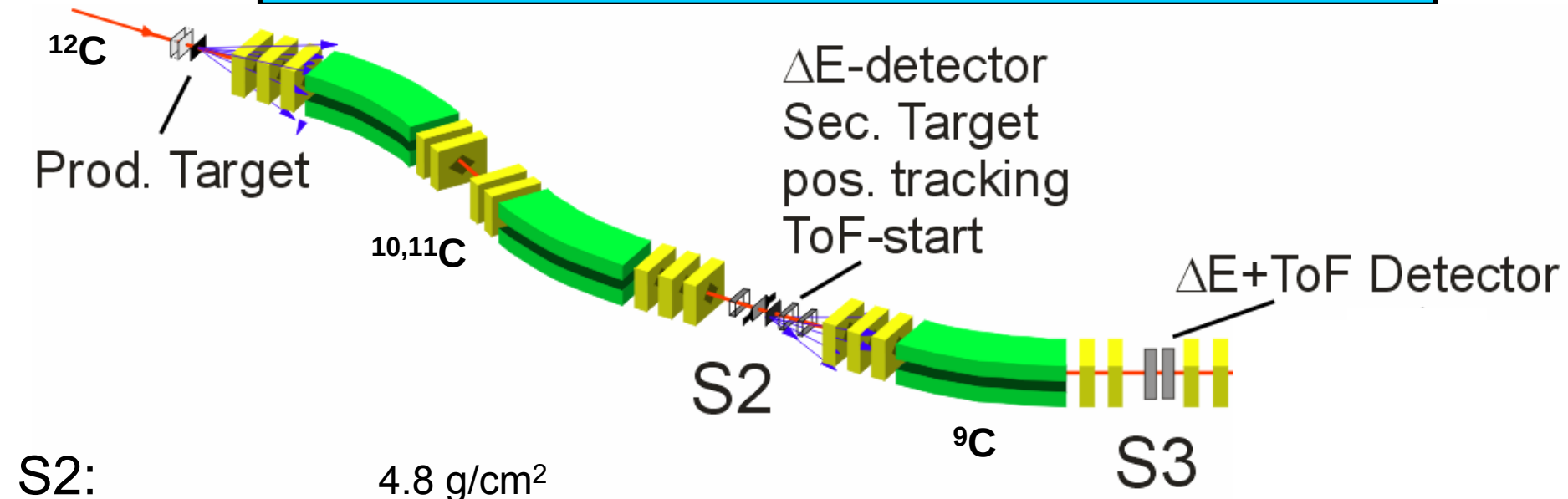
# Spectroscopic Factors



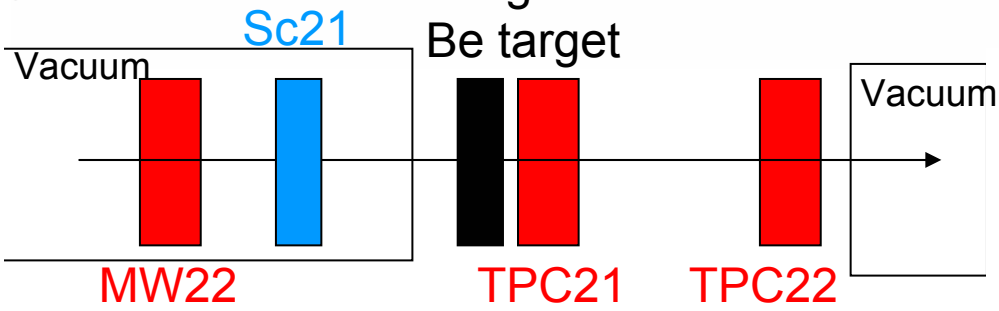

- **Experimental spectroscopic factors**
  - smaller than predicted within the shell model
  - short-range repulsion in deeply-bound states?
  - dependence on binding energy?
- **Knockout n from $^{10}$C / $^{11}$C**
  - learn about evolution of spectroscopic factors in the deeply-bound $0p_{3/2}$ neutron shell

Cross Section ↔ Spectroscop. Factor ↔ Occupation Probability

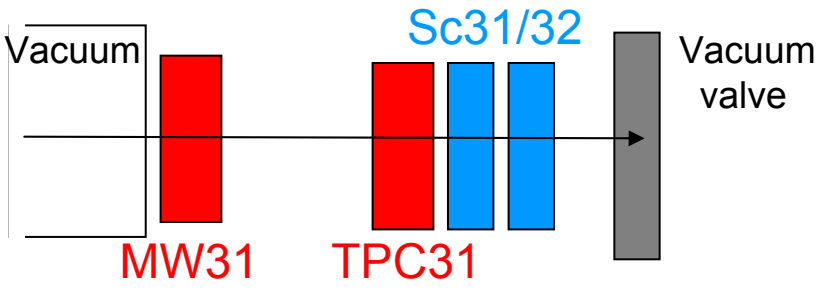
# Setup




S2:




S3:




**Use FRS from S2->S3 for large momentum acceptance:**
**$\Delta p/p_{max}$ = ± 5%**

**Take high energy ➔ ± 3-2.5 σ in the acceptance for $^{11}C$ -> $^{9}C$**

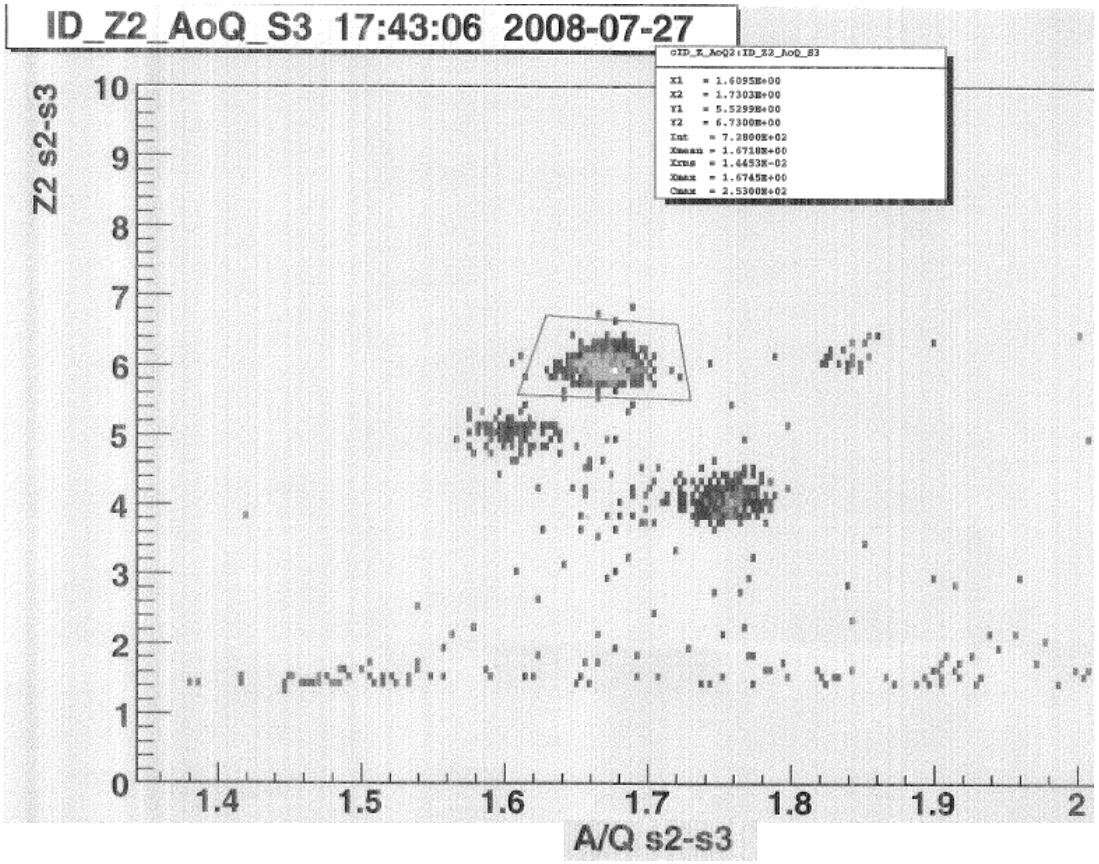
# Results

- Separation, identification and transmission worked as intended.

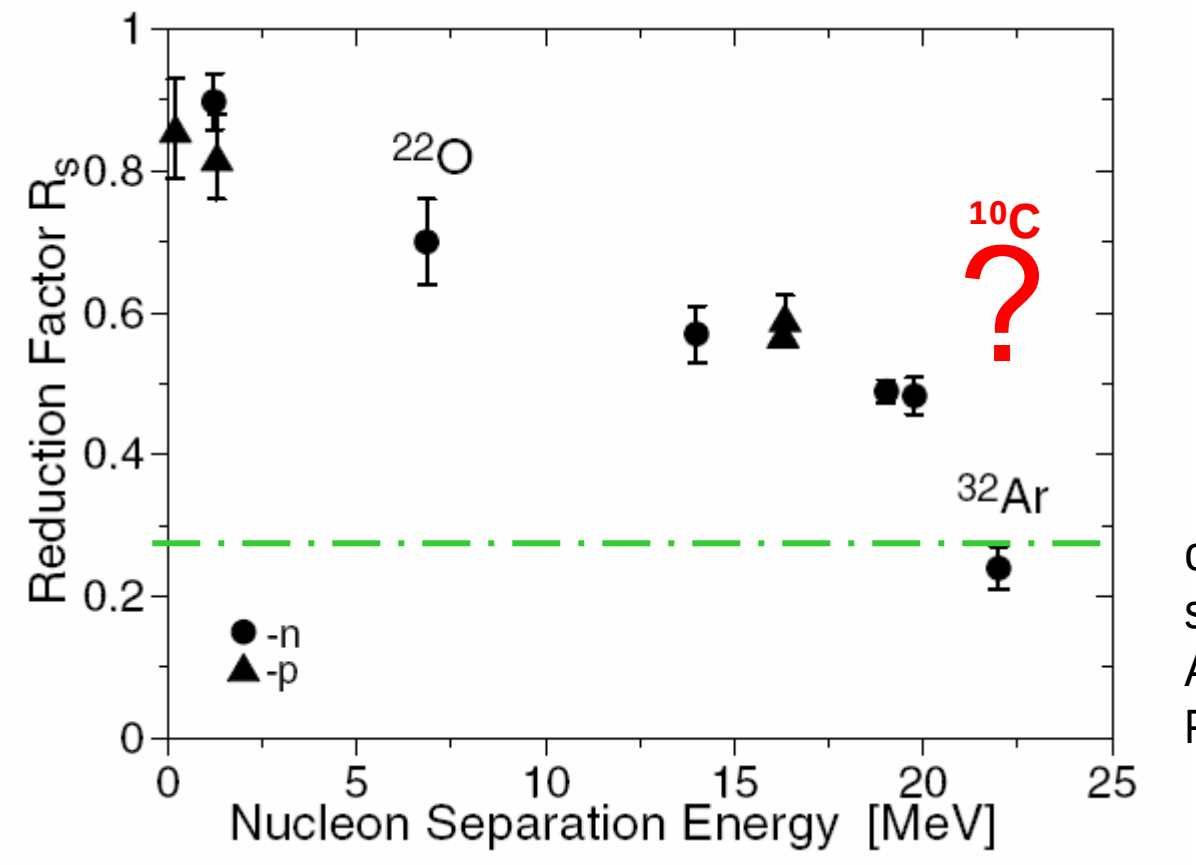
- Rates of secondary beams were anyway sufficient and breakup cross sections were high. We got good statistics in short time. Vasiliy Volkov analyzes the data ($^{10,11}$C -> $^{9}$C).

**Reaction $^{10}$C -> $^{9}$C on Be target at S2**

**Identification plot at S3:**



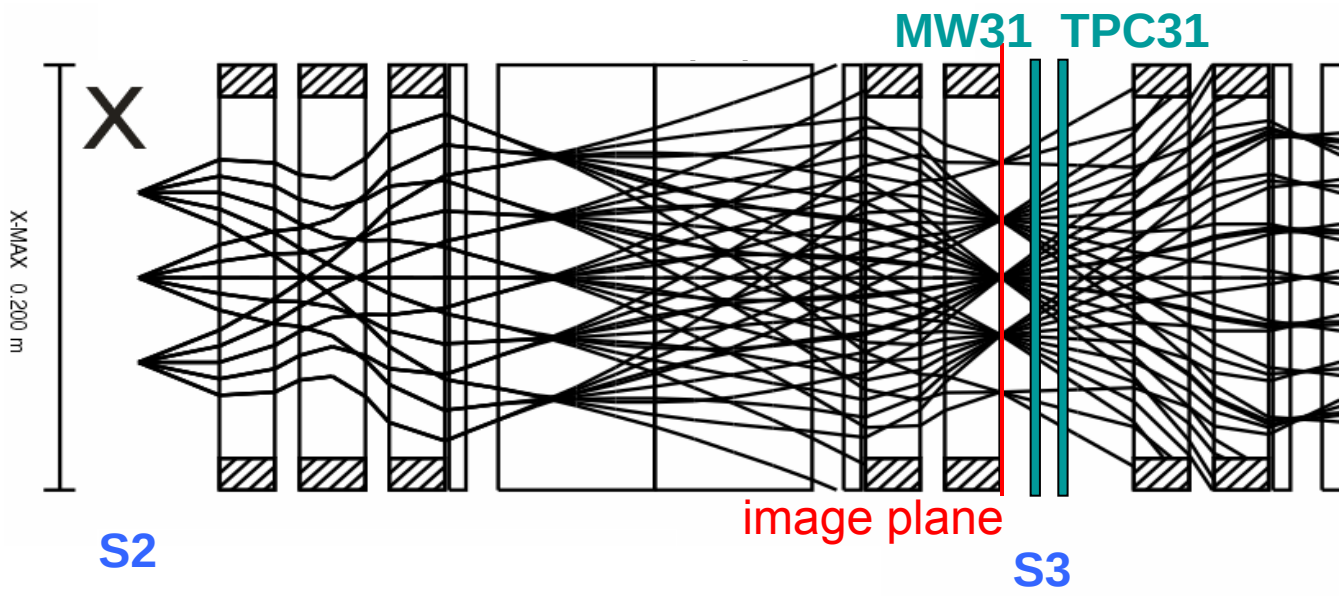
# Results




comparison with systematics by A. Gade et al., PRL 93 (2004) 042501.

- **In the spare time we extended the program to:**
  **$^{9}$C -> $^{8}$B, breakup**
  **$^{10}$C -> $^{11}$N, p-pickup (not observed)**
  **$^{12}$C -> $^{12}$N, $^{12}$C -> $^{12}$B, $^{11}$C -> $^{11}$B, charge exchange**

# Measure Momentum Distributions




track back to the image plane

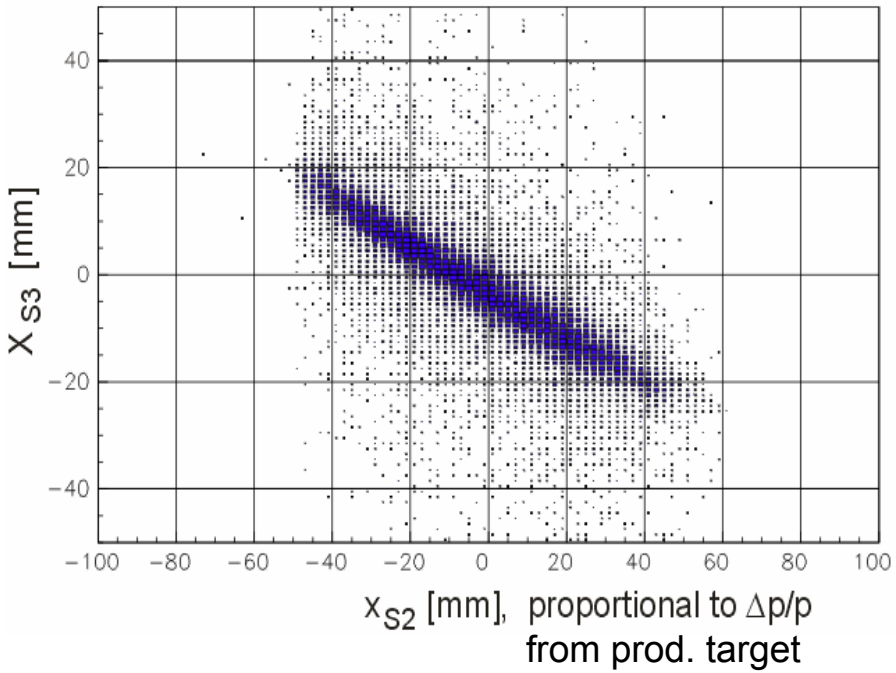
# Make “achromatic” system by tracking

Equation to determine momentum deviation from breakup at S2:
x = measured positions, D = dispersion, M = magnification, $\kappa$ for degrader

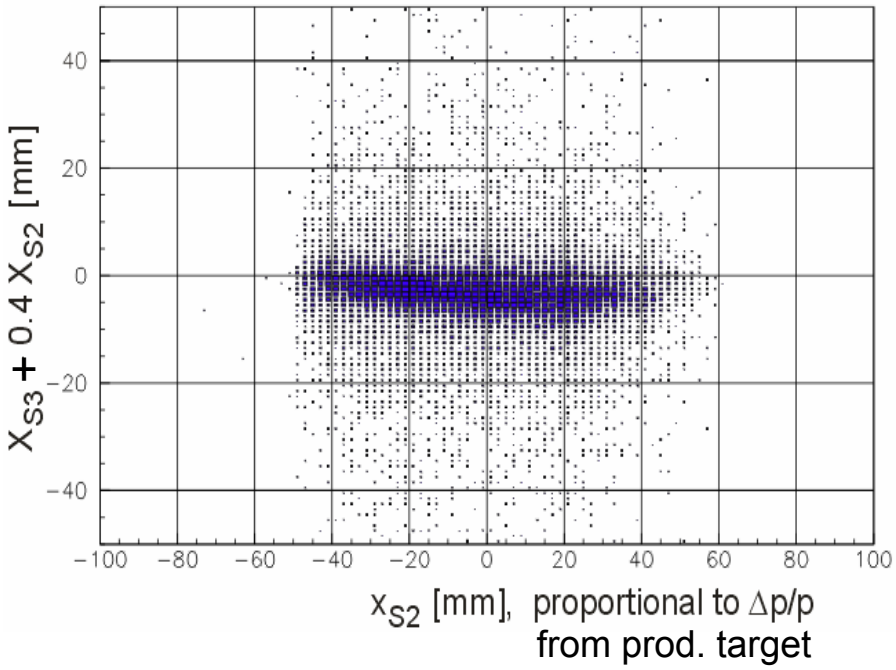
$$\frac{\Delta p}{p_0}_{\text{breakup}} = \frac{X_{S3} - X_{S2}\left(M_{S2\text{-}S3} + \kappa \frac{D_{S2\text{-}S3}}{D_{S0\text{-}S2}}\right)}{D_{S2\text{-}S3}}$$

by the term in brackets the momentum from the production target is subtracted.

not achromatic




“achromatic” by subtracting momentum deviation at S2



# S293

## Investigating fissioning systems with high barriers

## $^{181}$Ta (300, 500 and 1000 A MeV) + p

CEA-DAPNIA Saclay, France
Universidad de Santiago de Compostela, Spain
GSI Darmstadt, Germany

**slides from José Benlliure**

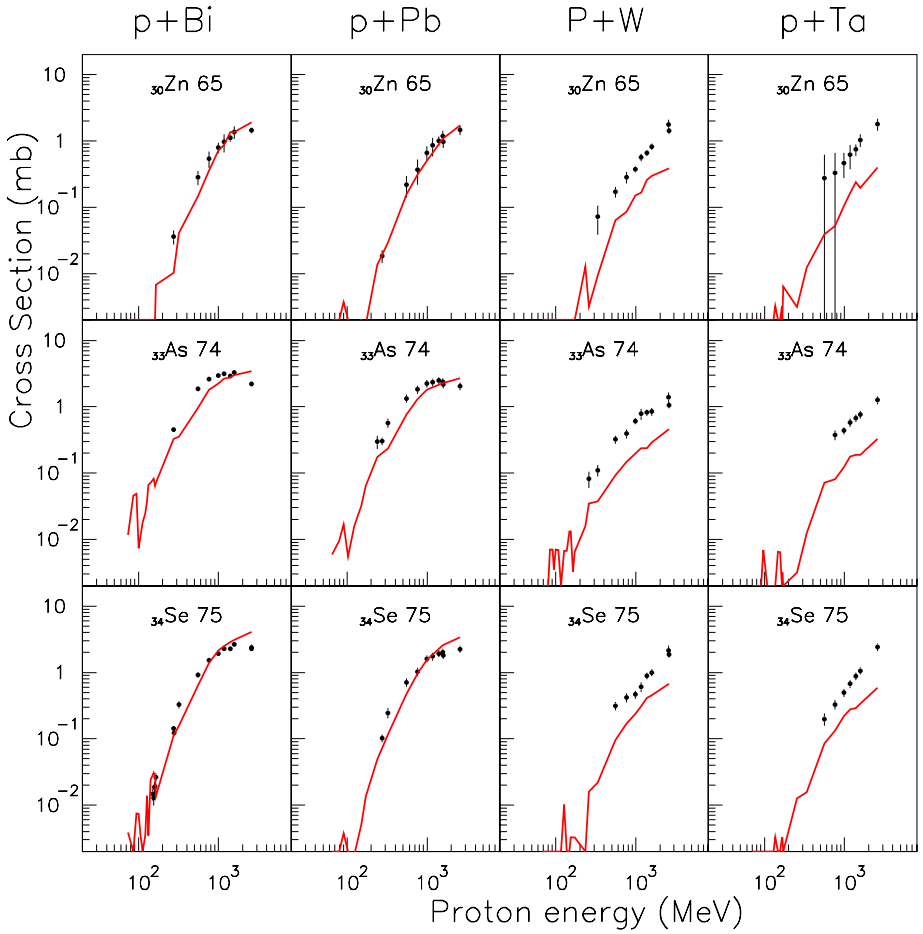
USC UNIVERSIDADE DE SANTIAGO DE COMPOSTELA

# Motivation

- Discrepancies in fission cross sections at low fissilities

- Fissioning systems with high barriers are expected to be more sensitive to dissipative effects

- Ta or W are considered as appropiate materials for the spallation blanket in neutron sources

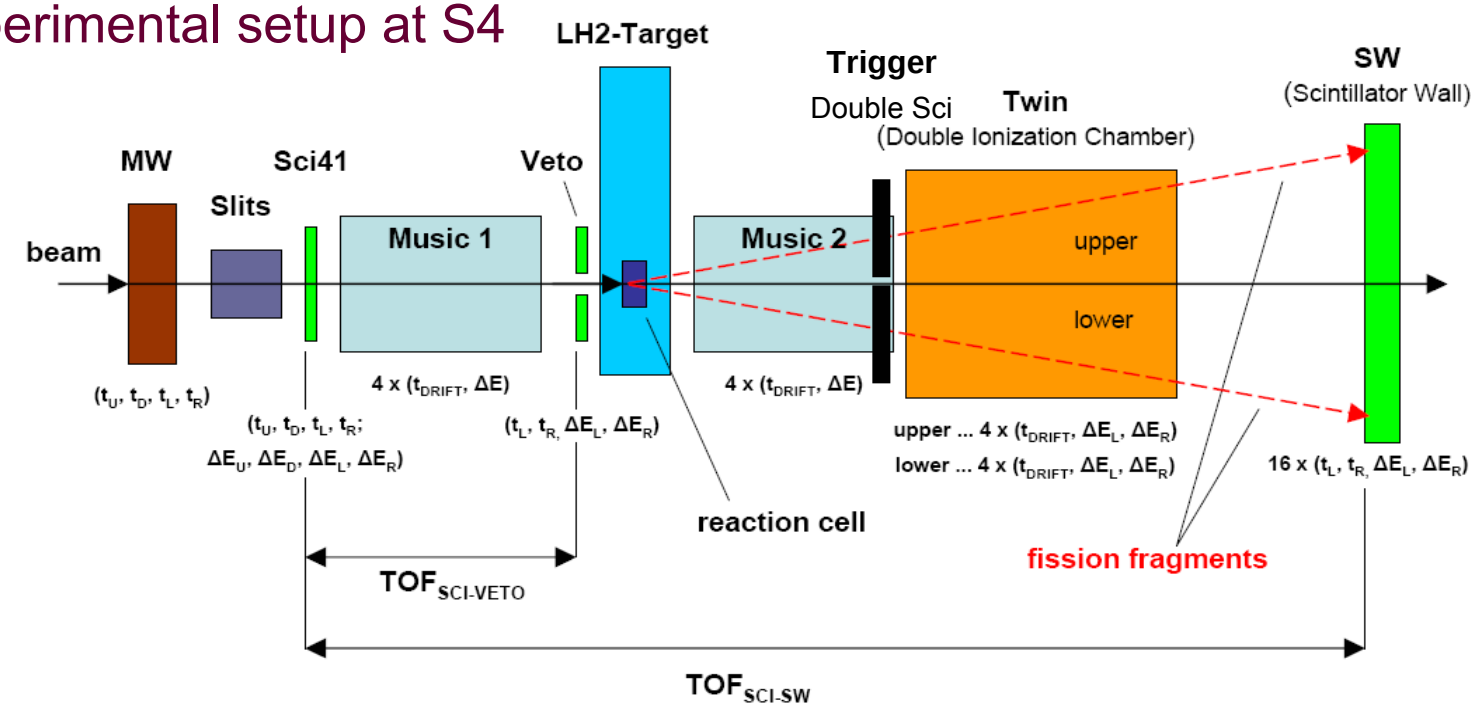



- Experimental technique

- Inverse kinematics allows full angular coverage and accurate cross section determination for fission

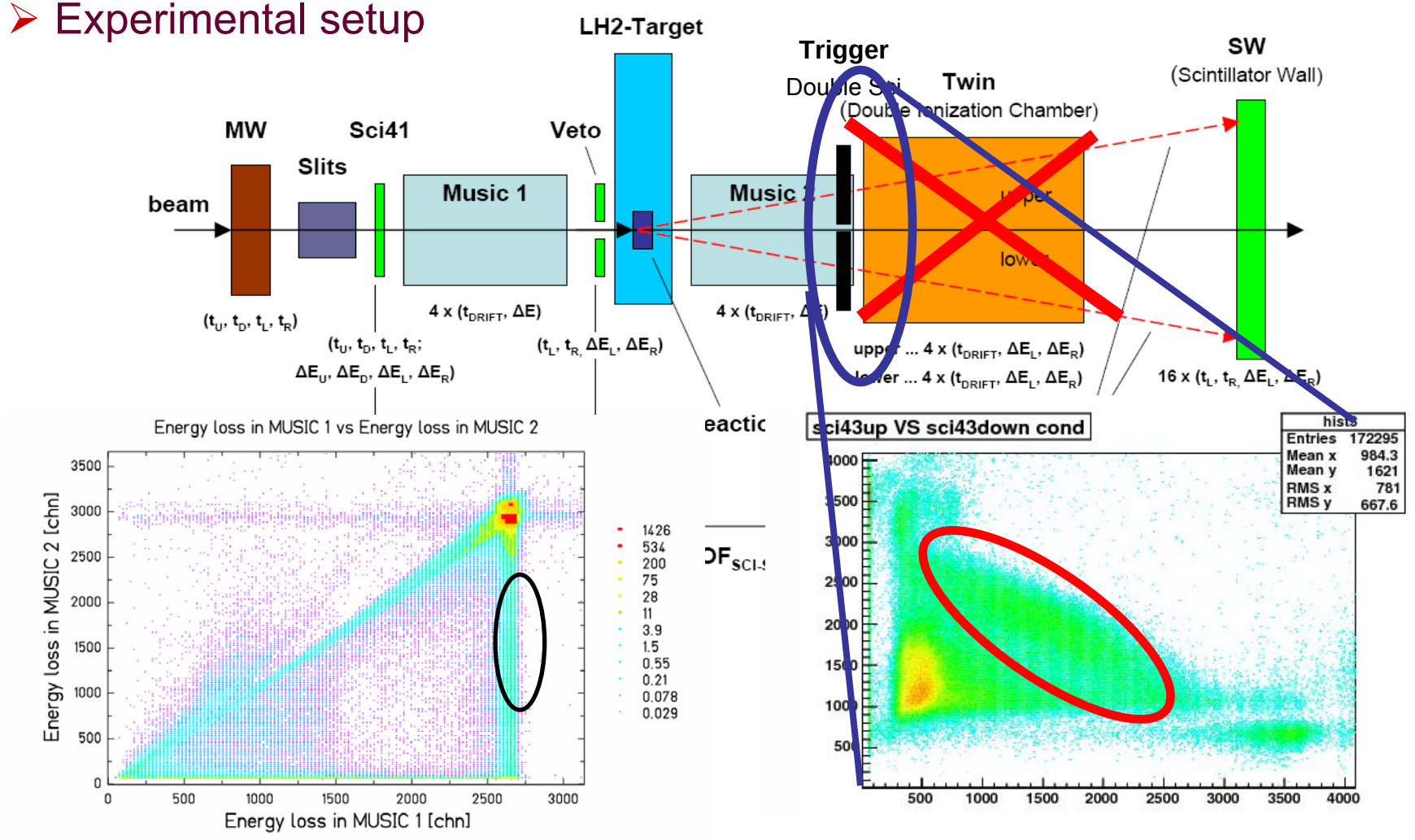
# Fission in $^{181}$Ta (100, 200 and 500 A MeV) + $H_2$

- Experimental setup at S4



# Fission in $^{181}$Ta (100, 200 and 500 A MeV) + $H_2$

- Experimental setup



# Present status

- Experiment run late June 2008
- Despite the problems with the TWIN-MUSIC, fission cross sections could be measured using the energy-loss signals from the trigger plastic scintillators
- Data analysis is in progress but preliminary cross sections are available
- The possible characterization of the charge distribution of the fission residues from the measured data will be investigated