

Progress Status Report

(Mainly about GSI)



TOHOKU
UNIVERSITY



宇宙創成物理学
国際共同大学院

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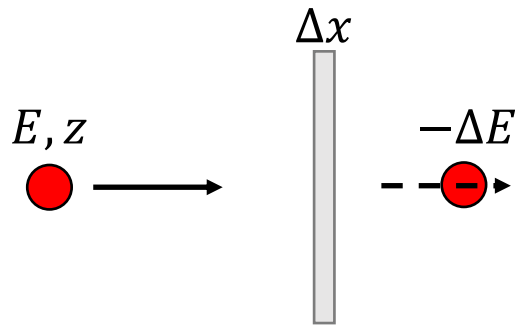
PhD 2nd year

Laboratory of Experimental Nuclear Physics

Department of Physics, Tohoku University

Heavy Ions Slowing Down in Matters

1

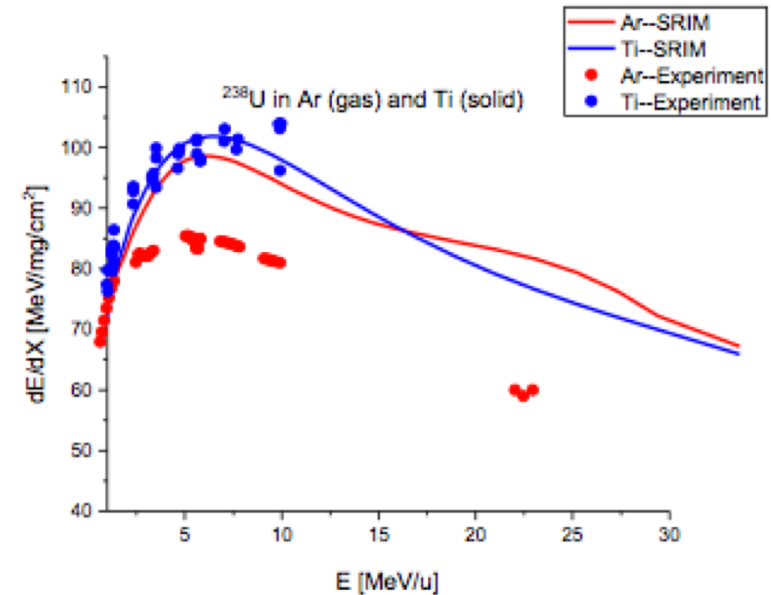


$$\text{Stopping Power } S = -\frac{dE}{dx}$$

$$\leftrightarrow -\frac{dE}{dx} \propto \rho \frac{z^2}{\beta^2} \times L$$

e.g. Bethe-Bloch formula

$$-\frac{dE}{dx} = 2\pi N_a r_e^2 m_e c^2 \rho \frac{Z}{A} \frac{z^2}{\beta^2} \left[\ln \left(\frac{2m_e \gamma^2 v^2 W_{\max}}{I^2} \right) - 2\beta^2 - \delta - 2 \frac{C}{Z} \right]$$



**Gas-solid effects
(low-energy density effect)**

In measurements...

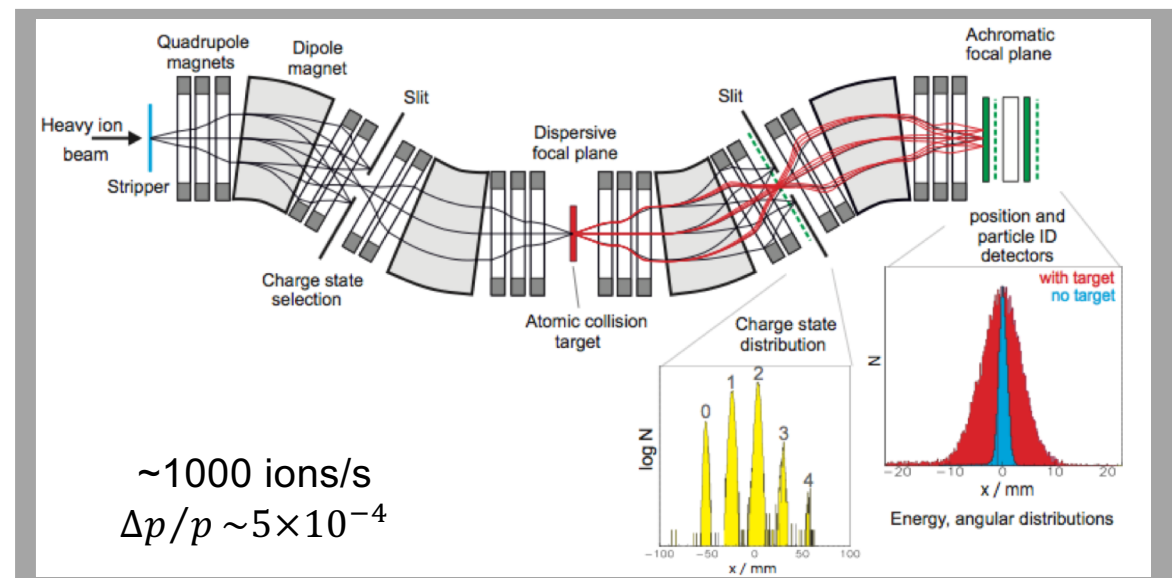
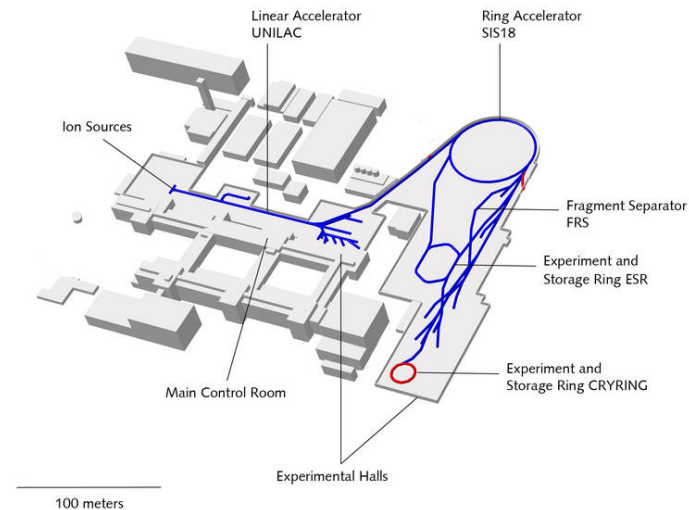
- Energy
- Areal density
- Charge state

“Accurate Slowing-down measurements of heavy ions in gases and solids in the energy range of 30 – 300 MeV/u”

Stopping power and Charge state distribution for Gas-Solid Effect

- Engineering run (2019 winter)
U beam at 70, 100 MeV/u
- Measurements (2020 April-May)
Pb beam at 35, 50, 70, 100, and 280 MeV/u on various gas/solid targets

~800 spectra !!



GSI

1. Data analysis

- Ongoing. In a well communication with the researchers in GSI.
- Gas-solid effect?

2. Update of ATIMA code

- Supports all FRS/Super-FRS experiments

3. Publication

JAEA

(Should be reported in the next time)

1. Measurement 1

- Planned on June-July, 2020
- Optimization of the exp. conditions.
- Offsite preparation: Done.

2. Measurement 2

- 2020 winter or 2021 spring
- 10-days of machine time

3. Data analysis

4. Update of BBN model code

5. Publication

Travel to GSI

2019

- Aug. 7 – Oct. 8
- Nov. 22 – Dec. 17 (a part of the engineering run)

2020

- Apr. 29 – May 2
(Measurements, from remote)

Future Plans

2020

- ?? Hopefully in summer

JSPS application

2020

- DC2: accepted

FAIR School

2019

- Sep. 7 – 14
- Italy, Castiglione della Pescaia
- Accommodation (at the beach!), food, travel expenses (€350) are covered.

