

First identified nuclear fragments with a mass number up to 75 at Radioactive Ion Beam Line in Lanzhou

May 15 2020, by Zhang Nannan

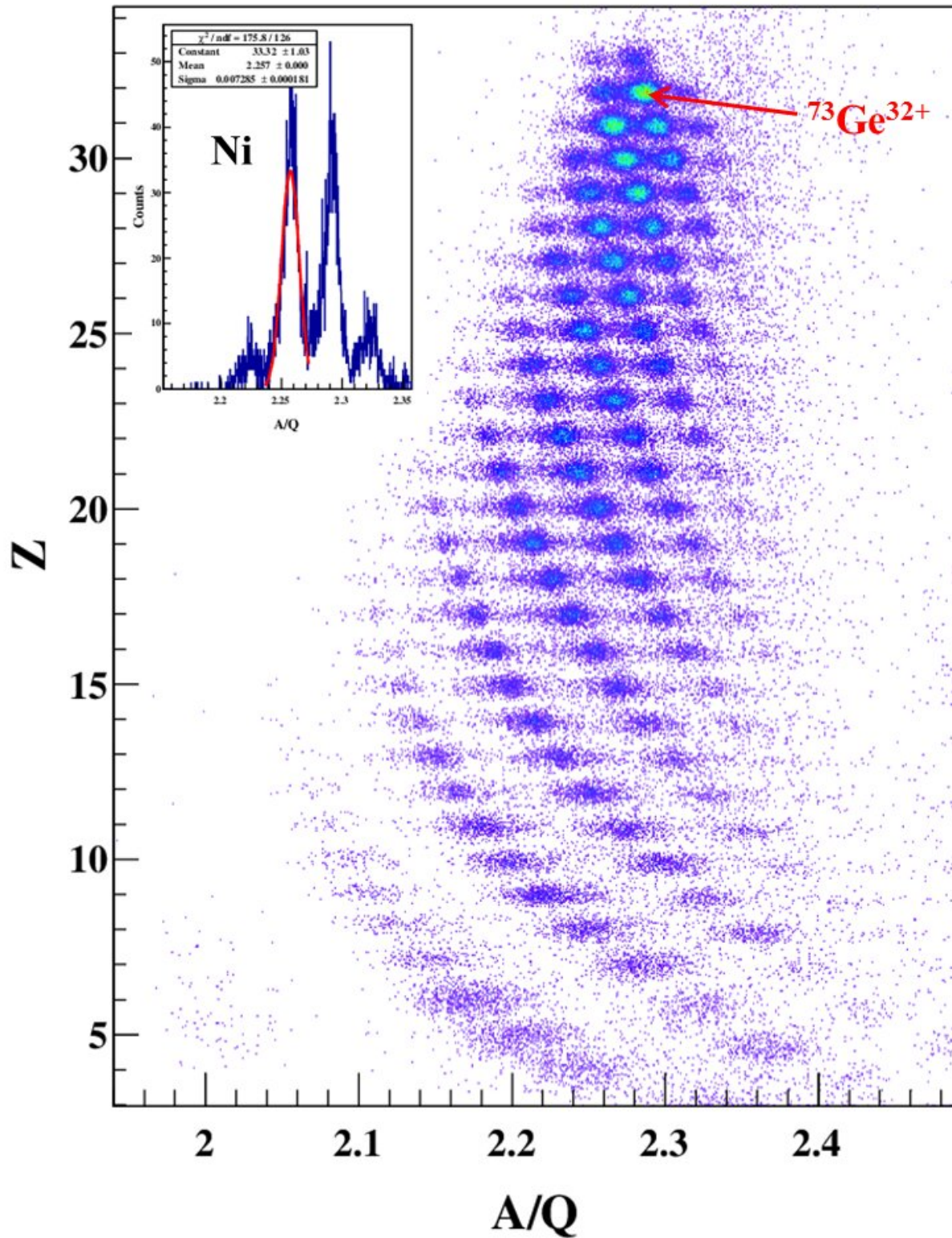


Fig.1. Z versus A/Q particle identification plot for fragments produced in the

reaction $^{78}\text{Kr} + \text{Al}_2\text{O}_3$ (1.84 mm) at 300 MeV/u. The inset is the projection of Ni isotopes into the A/Q axis. Credit: ZHANG Xueheng

Recently, the projectile fragmentation experiment of ^{78}Kr at 300MeV/u was performed at the Heavy-Ion Research Facility in Lanzhou (HIRFL) at the Institute of Modern Physics.

It is the first time that fragments with a mass number up to 75 have been identified clearly at the second Radioactive Ion Beam Line in Lanzou (RIBLL2) under full acceptance conditions.

The primary [beam](#) was extracted from the main cooling storage ring (CSRm) and implanted into the production targets at the entrance of RIBLL2. The products from B to As were transported to the External Target Facility (ETF) and identified with the $B\rho$ -TOF- ΔE method.

In order to improve the ability of particle identification and extend research fields, a new TOF start detector with high time and position resolutions was designed and installed in the F1 cave at RIBLL2, and the performances of other particle identification detectors were further optimized.

Moreover, the beam orbit was carefully tuned to ensure the particles transmit along the center of pipelines during the experiment. This allows researchers to derive the first-order matrix elements from the measured position and TOF information. Then, the precise $B\rho$ determination could be realized by the trajectory reconstruction method.

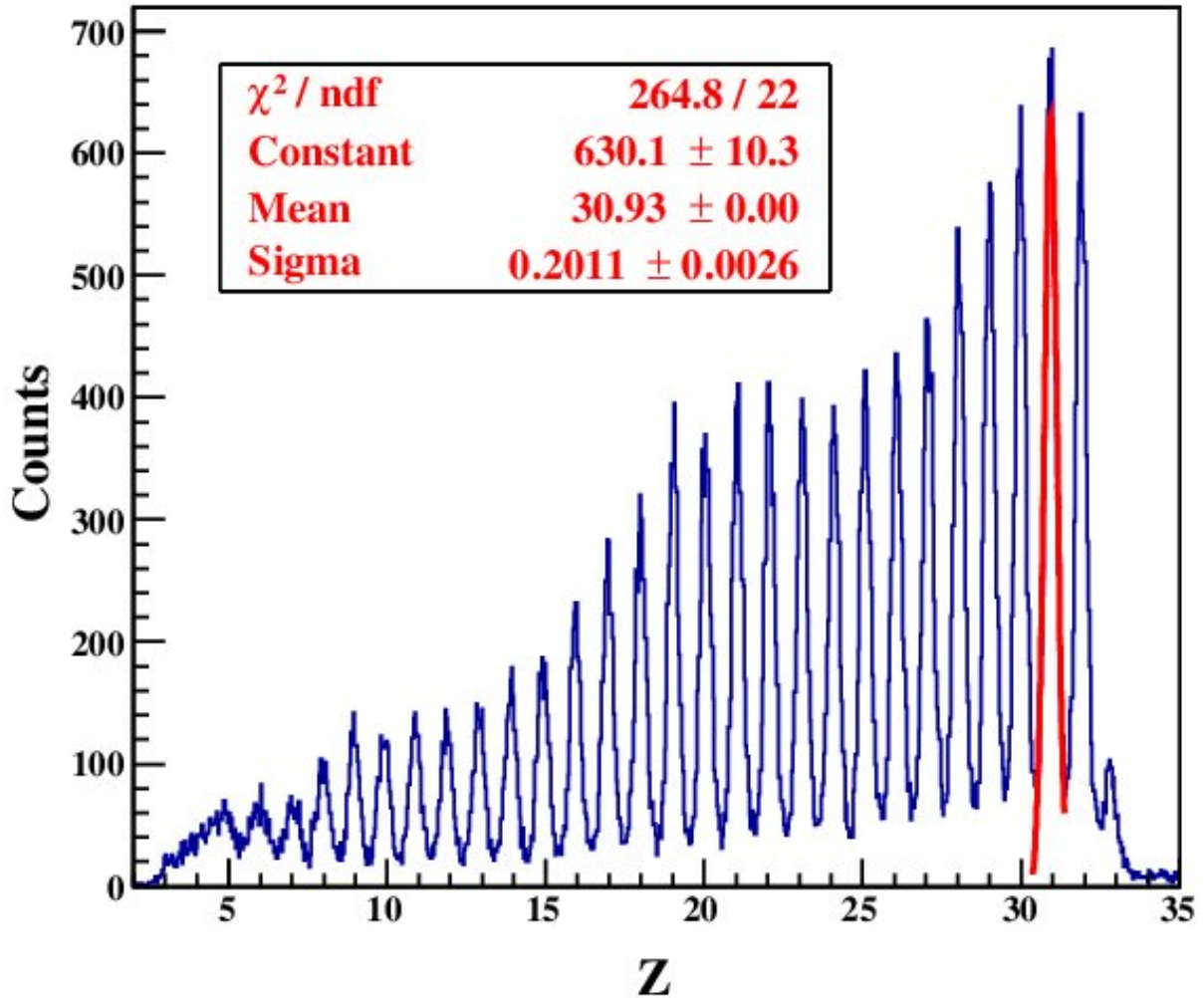


Fig.2. Charge spectrum for fragments produced by the fragmentation of ^{78}Kr at 300 MeV/u. Credit: ZHANG Xueheng

With the help of these high-powered detectors and the precise $B\rho$ determination method, the fragments produced by the fragmentation of ^{78}Kr at 300 MeV/u were identified clearly at RIBLL2, which has a full momentum acceptance of $\pm 4.5\%$. The charge resolution of $\sigma_Z \sim 0.2$ and the A/Q resolution of $\sigma_{A/Q} \sim 7.3 \times 10^{-3}$ for $^{63}\text{Ni}_{28}^+$ were obtained in this experiment.

This improvement will increase the yields of exotic nuclei, extend research fields, and promote the development of radioactive nuclear beam experiments.

Provided by Chinese Academy of Sciences

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