of this cycle. From the right panel of Fig. 1, one can see that under the favourable condition, rp-process ends up at Zr-Nb cycle at the temperature of $\sim$ 2 GK. Then, the importance of this cycle reduced quickly as the temperature decreased dramatically in tens of seconds. By this work, similar tendency can be found if AME12 values are used. But the important difference of the branching ratio into Zr-Nb cycle is much smaller in this work than AME12 and even at the temperature of $\sim$ 2 GK, the contribution of this cycle still can be ignored.

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2 - 8 Direct Mass Measurements of Short-Lived A=2Z+3 Nuclides at CSRe

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Nuclear mass is one of the fundamental quantity of atomic nucleus. The total binding energy of a nucleus derived from the related mass values reflects all the interactions among the constituting nucleons. Masses of short-lived A=2Z+3 nuclei of ^{112}Sn projectile fragments have been measured at the experimental cooler storage ring CSRe, employing the Isochronous mass spectrometry (IMS). The experiment was conducted at the Heavy Ion Research Facility in Lanzhou at the beginning of 2016. The primary beam of ^{112}Sn^{35+} was accumulated in the synchrotron CSRm and accelerated to 467.91 MeV/u. Secondary beam were produced by impinging the high intensity ^{112}Sn^{35+} beam onto a 10 mm beryllium target which was located at the entrance of the radioactive beam line RIBLL2. The projectile fragments of ^{112}Sn emerged from the target were then transmitted, separated in flight through RIBLL2 and finally injected into CSRe. The RIBLL2-CSRe system was set to a fixed magnetic rigidity of $B\rho$= 5.337 4 Tm to guarantee best transmission efficiency for ^{101}In. The mass of this nucleus is unknown up to date[1]. In the present experiment, the transition point of CSRe was tuned to be γ_t= 1.302 in order to fulfill the isochronous condition of γ_t=γ for ^{101}In where γ is the Lorentz factor of the stored ions. The revolution times of the stored ions were measured by a Time-Of-Flight detector which is installed inside the vacuum pipe of CSRe. The secondary beam was injected and stored in CSRe every 25 s, and the measurement last for 200 μs after each injection. The standard deviations of the measured revolution times for different nuclei are shown on the left panel of Fig. 1. The best isochronous condition was fulfilled for ^{110}In as it can be seen in Fig. 1 where the minimum standard deviation was achieve for ^{101}In. A metal slit was used at CSRe during the experiment in order to reduce the momentum acceptance of the ring and therefore higher mass resolving power for all nuclides were achieved ($R \leq 3.8\times 10^5$). As a result, the ground state and isomeric state of ^{101}In were clearly separated in the revolution time spectrum, as was shown on the on right panel of Fig. 1.

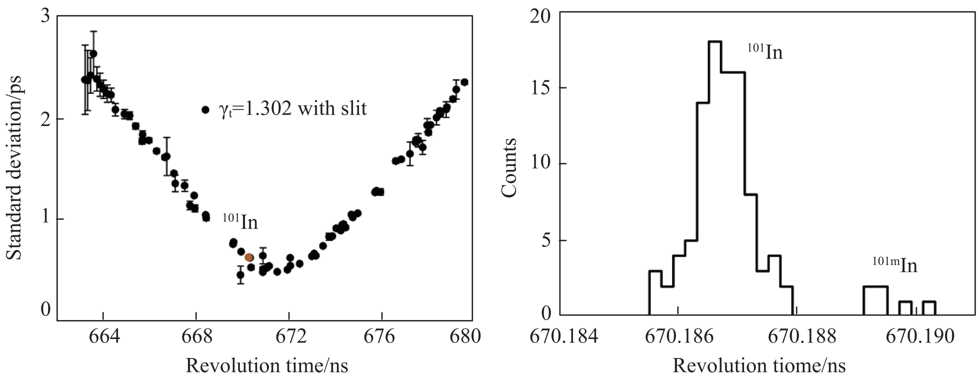

Fig. 1 Left: The standard deviation of the measured revolution time for different nuclei. The data were taken under condition γ_t = 1.302 and the slit in CSRe was positioned at ±30 mm. Right: The revolution time spectrum for ^{101}In and ^{101m}In.

From the revolution time spectrum, the masses of ^{101}In and ^{101m}In were obtained for the first time in this experiment, leading to the determination of the excitation energy of the isomer to be larger than 675 MeV. Since the TOF measuring time is 200 μs after injection, the lower limit of the half-life of this isomeric state should be several hundred microseconds. Shell model calculations for this isomeric state in ^{101}In was in progress, which would yield valuable information about the nuclear shell structure around doubly magic nuclide ^{100}Sn.

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2 - 9 Data Acquisition System for Schottky Resonator at CSRe

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To meet the requirement of long-time acquisition without interruptions for the planned nuclear decay experiments at CSRe, a new data acquisition system has been successfully developed in 2016. During the beam time in Dec. 2016, our new system has been running stably without any problems and continuously acquiring hundreds of data without any breaks.

The whole system is based on a spectrum analyzer (R&S FSVR7) and an IQ recorder (R&S IQR100). Both of them are connected to a server via Ethernet. The spectrum analyzer acquires the time-domain information in the frequency range of interest from the Schottky resonator. The IQ recorder collects the information from the analyzer and packs it into data. Once the data have been entirely transferred to the server, it will immediately be removed from IQ recorder. The high-volume solid-state drive (1TB) of IQ recorder allows for a virtually unlimited size of acquired les to be stored in practice. Besides, in order to bypass the unreliable trigger system of IQ recorder, we built an independent trigger system with a microcontroller (Arduino Yun) to translate the TTL signal to network commands.

To implement the aforementioned procedures in an automatic way, we have developed a particular remote control program from scratch. The program is written in Python 3. It has a simple GUI based on terminals with screen-painting and keyboard-handling facility in Linux. The program displays the real-time states of the processing devices and catches the signal emitted from the keyboard to pause or terminate itself.

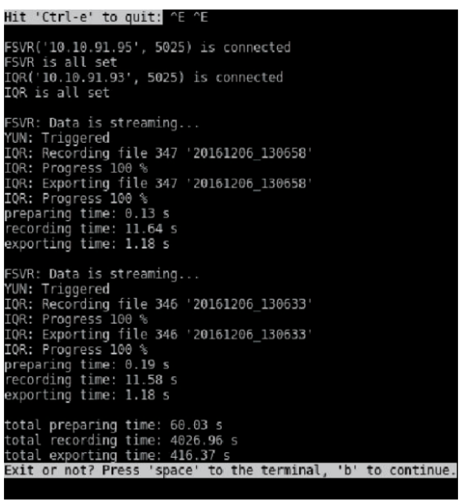

Fig. 1 GUI of the program. The displaying results demonstrate that our system has successfully collected 346 data in our Dec. 2016 experiment.

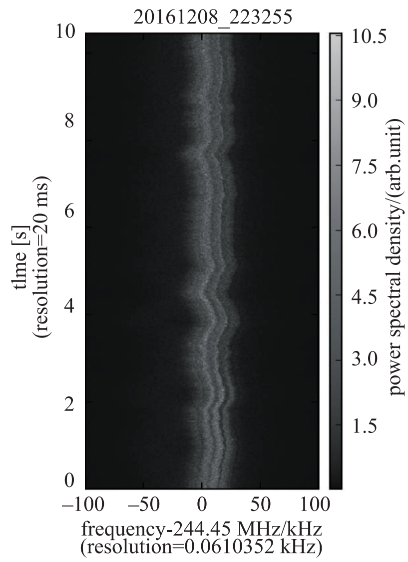

Fig. 2 Typical test result. The waterfall plot arises from a typical data taken in Dec. 2016 experiment. It shows the stripped primary beam $^{40}Ar^{18+}$.

The tests for our new system have been successfully completed in the mass measurement experiment in Dec. 2016. In one of our test runs, the system acquired tens of huge les whose size amounts to ca. 2 GB each. In another test, it has been continuously running for hours while collecting 346 les in total as demonstrated in Fig. 1. In one of test data les, we could get sharp time-frequency spectrogram of $^{40}Ar^{18+}$ from that experiment as displayed in Fig.2. In conclusion, our data acquisition system satisfies the demands of successively collecting measurement data. As an important step, it paves the way towards the nuclear decay measurements at CSRe in the near future.