# Status of SπRIT-TPC

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The SAMURAI Pion-Reconstruction and Ion-Tracker Time-Projection Chamber (SπRIT-TPC)[1] was constructed at Michigan State University and transferred to RIKEN RIBF-SAMURAI in February 2014. The main aim of this project is to constrain the symmetry energy term in the nuclear-matter equation of state (EoS) at supra-saturation density. The SπRIT-TPC is capable measuring the momentum of pions and light particles emitted in heavy nuclear collisions, such as $^{132}$Sn + $^{112}$Sn at beam energies of hundreds of MeV/nucleon.

In summer 2014, an installation procedure for the SπRIT-TPC into the SAMURAI magnet chamber was developed and verified. The SπRIT-TPC is designed to maximize the coverage in the SAMURAI magnet chamber. The internal height of SAMURAI chamber is designed to be 800 mm. Bolts, covered by 25 mm high caps, surround the magnet pole on top and bottom to prevent the chamber from crushing due to the pressure difference when the chamber is under vacuum. On the other hand, the design height of the SπRIT-TPC is 742 mm and thus there is a very small margin of error for installing it into the SAMURAI chamber. Thus the confirmation of the installation is one of the most important issues in this project. Also confirmation of safe operation in the magnetic field is critical.

The setup for installation of the SπRIT-TPC in the chamber is shown in Fig.1. In this figure, the SAMURAI magnet was oriented at 30 degrees, it is most common experimental configuration. However, the SpiRIT TPC was designed to sit inside the SAMURAI magnet chamber when it is oriented at zero degree. To test the installation procedure without expending a lot of resources to reconfigure the SAMURAI magnet, the SπRIT-TPC was inserted from one half side of the exit window with the oblique angle. Rails placed in the chamber extended toward the downstream window where additional rails were located on tables. The SπRIT-TPC was set on a slider which moves along rails with negligible friction. It was able to be pushed and pulled in the chamber using dual hydraulic jacks. When the SπRIT-TPC was installed inside the chamber, it was raised up about 25 mm to the beam height. Installing and dismounting the SπRIT-TPC was completed in about 20 minutes.

An operational test in the magnetic field was also performed. Before hand, all magnetic material items on the SπRIT-TPC were removed. The read out electronics described in Ref.[2] were set up. Finally, charged particle tracks of cosmic rays and beta source were detected in a magnetic field ranging from 0.1 to 0.5 T. Figure 2 shows a part of a helical track produced by a cosmic ray was observed within the detection area read out by one AsAd electronics board.

Furthermore, a remote controlled target ladder was mounted inside the TPC-enclosure. The target position is determined by reading the voltage drop between the fixed and movable contacts on a resistive strip.

The overall geometry and position of the field cage and the target ladder relative to the enclosure were measured using photogrammetry[2]. The deviation from the design value was evaluated as less than 200 $\mu$m.

In summary, significant progress on the preparation for the SπRIT-TPC experiment has been achieved.

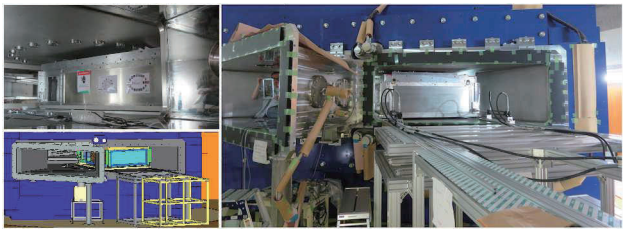

Fig. 1. Picture of the SπRIT-TPC inserted into the SAMURAI chamber. Left top: picture in the chamber. Left bottom: schematic view of the installation method.

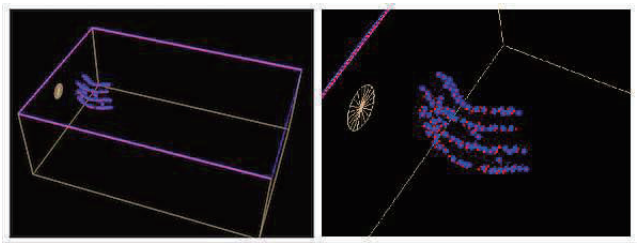

Fig. 2. Event display for a cosmic ray detected by the SπRIT-TPC in the SAMURAI magnet at 0.3 T. Enlarged view of the track is on the right.

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2) http://www.geodetic.com/products/systems/v-stars-s.aspx
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