

## **SAMURAI TPC: detailed design and construction of a time projection chamber**

A.B. McIntosh, J. Barney, J. Dunn, J. Estee, T. Isobe, M. Famiano, W.G. Lynch, T. Murakami,  
R. Olsen, R. Shane, A. Taketani, M.B. Tsang, and S.J. Yennello

The detailed design and fabrication of a new time projection chamber, the SAMURAI TPC, has progressed rapidly, and continues to do so. The utility of the device and specifications have been previously described [1, 2]. The detailed designs have been posted online [3].

The fabrication of the enclosure, motion chassis and hoisting structure is completed; see photograph in Fig. 1. The fabrication of the top plate (a critical element) is also completed, as are the structural ribs mounted to it. The angle iron skeleton was welded together at the TAMU chemistry machine shop, including the load-bearing legs along the four vertical edges. After polishing the outer surfaces, we expect no difficulty sealing the gas volumes with an O-ring across the weld seams.



**FIG. 1.** Photograph of the SAMURAI TPC enclosure with motion chassis attached.

Imperfections in the surface (gouges, scratches) were filled in with Hysol epoxy, which was allowed to cure for 3 days before being sanded smooth with 600-grit sandpaper. The side plates, fabricated on the large mill at the NSCL Machine Shop, were shipped to TAMU. The hole pattern on these plates was used as a template to tap matching holes in the angle iron skeleton. These plates each have two dovetail O-rings grooves for 0.139" rope. Custom length vulcanized O-rings were procured inexpensively from American Packing. After lightly sanding the joints smooth, the O-rings were covered with Apiezon-M vacuum grease and inserted into the grooves. The motion chassis and hoisting structure were machined and welded at the TAMU Cyclotron Institute Machine Shop. The ribs, bars between 58" and 82" long,

were machined at the TAMU Wind Tunnel Machine Shop. These were assembled, checked for accuracy, and shipped to MSU to be assembled on the top plate, which was fabricated by Digitrace in Michigan. The parts for the cooling of the front-end electronics were also fabricated at the TAMU wind tunnel machine shop.

The assembled enclosure skeleton with side plates and the motion chassis, as well as the parts for the front-end electronics cooling system, were inspected by the US project manager at the May 2012 fabrication deadline, and received a highly favorable review. Testing of the manipulation of the TPC with the motion chassis and hoisting structure is underway; following completion of this, the entire enclosure, motion chassis and hoisting structure will be shipped to Michigan for mating with the top plate.

Fabrication of the field cage, wire planes, and pad plane is underway at Michigan State. Design of the readout electronics is underway at RIKEN. Testing of the front-end electronics is underway at Western Michigan and Michigan State. Fabrication of the target mechanism and simulations (detector response to ionizing radiation and track reconstruction) will commence shortly at TAMU.

[1] [http://rarfaxp.riken.go.jp/RIBF-TAC05/10\\_SAMURAI.pdf](http://rarfaxp.riken.go.jp/RIBF-TAC05/10_SAMURAI.pdf)

[2] A.B. McIntosh *et al.*, *Progress in Research*, Cyclotron Institute, Texas A&M University (2010-2011) p. V-33.

[3] <http://groups.nscl.msu.edu/hira/sep/sepwiki/doku.php/start>