# Full-size partition window for the SAMURAI spectrometer

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For future SAMURAI experiments measuring coincident heavy fragments and light charged particles, light charged particles are fully spread on the exit window of the SAMURAI spectrometer. In order to detect light charged particles efficiently, the vacuum partition window should have a maximum vertical size of 800 mm. In this report, the design and development of a full-size partition window for the SAMURAI spectrometer are described.

The window material deflects penetrating particles by multiple scattering and causes their energy fluctuation by energy loss struggling. At the same time, it is necessary to ensure that the material is strong enough to hold the vacuum. The vacuum partition is of the combination of a Kevlar textile for tensile strength support and a Mylar foil for vacuum partitioning. The thicknesses were 280 and 75 $\mu$m, respectively. The deflection of the Kevlar textile caused by the pressure difference and the induced stress is calculated by the general purpose finite element analysis program code ANSYS[1]. Since the elastic properties of the Kevlar textile are not known, they are determined to reproduce the vacuum test[2]. Figure 1 shows the results of ANSYS calculation of the displacements for the several flexures in the initial condition. At a larger flexure than 150 mm in the initial condition, the displacement becomes small enough. We determined a flexure of 155 mm in the initial condition.

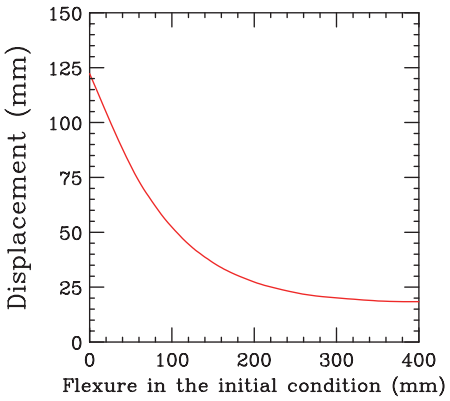


Fig. 1. The flexure dependence of Kevlar textile displacement.

Because of wrinkles of the Mylar at corners, a flat window cannot have larger flexure than 100 mm[2]. In order to have large flexure in every position, a window was designed having the shape of a partial cylinder with a radius of curvature of 715 mm. Figure 2 shows a drawing of the full-size partition window for the SAMURAI spectrometer. A flexure of 155 mm in the initial condition was achieved. The Kevlar and the Mylar were glued with an Araldite to the side pipe of the window frame. Owing to the pipe structure, every adhesion side was perpendicular to the direction in which the Kevlar and Mylar were pulled by the pressure difference

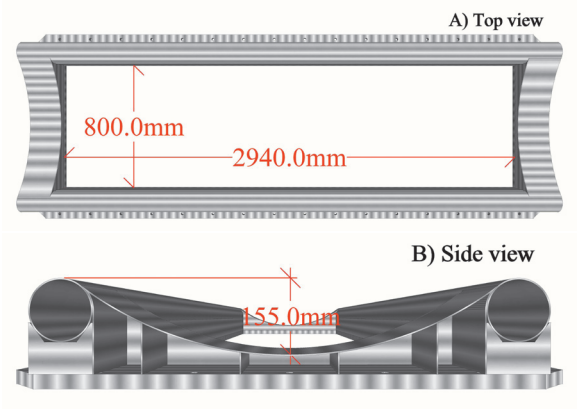


Fig. 2. Drawing of the full-size partition window.

This window was mounted on the test vacuum chamber. The achieved vacuum level was a few kPa. Figure 3 shows a photograph of the full-size partition window on the test vacuum chamber. The deflection was about 10 mm by visual observation. Therefore, since the Mylar foil is hardly extended, there is no fear of it collapsing. However, because this value differs from the ANSYS calculation, it may be necessary to improve the boundary condition in the ANSYS calculation.

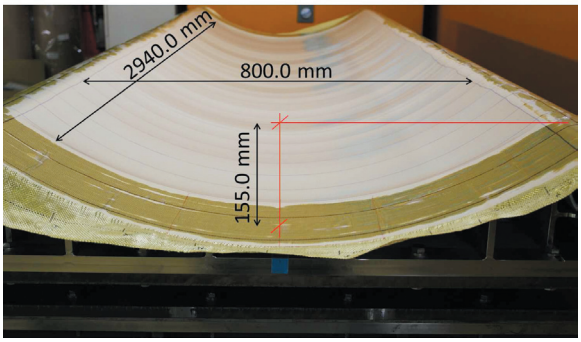


Fig. 3. Photograph of the full-size partition window.

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References

1) URL: http://www.ansys.com/
2) Y. Shimizu *et al.*, Nucl. Instrum. Meth. Phys. Res., Sect. **B 317**, 739 (2013).