

## **Current research and installation activities of X-ray imaging crystal spectrometer for KSTAR**

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### **1. INTRODUCTION**

The X-ray imaging crystal spectrometer (XICS) [1-3] for the Korea Superconducting Tokamak Advanced Research (KSTAR) device has been fabricated and a spectral resolution was measured by using an X-ray tube in a laboratory. The XICS will measure spatially and temporally resolved profiles of the ion and electron temperatures, toroidal rotation velocity, impurity charge-state distributions, and ionization equilibrium. The XICS is currently under installation process for the second KSTAR operational campaign starts from Oct. 2009. The two-dimensional segmented multi-wire proportional counter (MWPC) [4] for the KSTAR XICS has been upgraded to improve a photon count-rate capability of the spectrometer. The data acquisition system (DAS) utilizing a time-to-digital converter (TDC) electronics [5] for the segmented MWPC has been also upgraded to support for the segmented MWPC. The current research status of the upgraded MWPC, DAS for the segmented MWPC, and installation activities for the fabricated XICS on the KSTAR tokamak are described.

### **2. CURRENT RESEARCH AND INSTALLATION ACTIVITIES**

The detector for the KSTAR XICS is a large area, two dimensional (2D) segmented position sensitive MWPC. A two and four segmented MWPC have been fabricated and their performance test results were reported before [3,4].

Figure 1 shows an upgraded printed circuit boards for the eight segmented MWPC, which are essential internal components for the segmented detector. Figure 2 shows a schematic diagram of the DAS for the eight segmented MWPC.

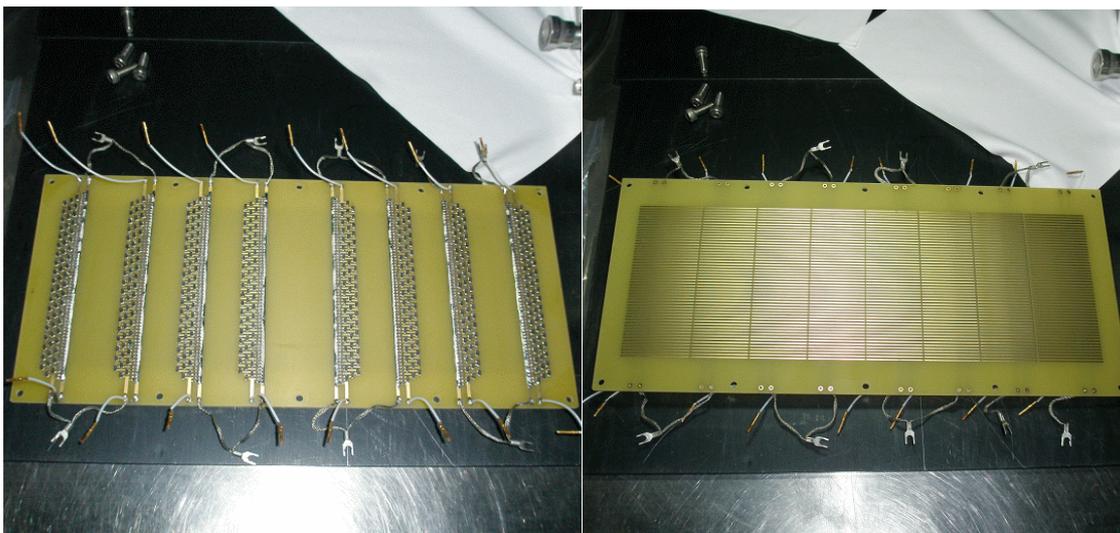


Fig. 1. Printed circuit boards for the eight segmented MWPC.

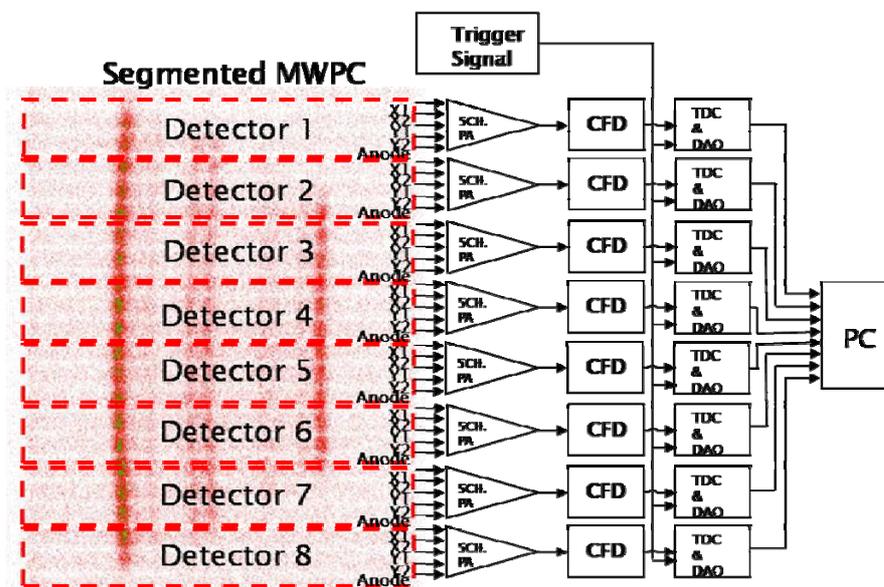


Fig. 2. A schematic diagram of the DAS for the eight segmented MWPC.

As shown in Fig. 1 and 2, both the eight segmented MWPC and its associated DAS are promising to fabricate successfully in the near future.



*Fig. 3. Installation activities for the fabricated XICS on the KSTAR tokamak.*

Figure 3 shows an installation view for the fabricated XICS on the KSTAR tokamak. The XICS was installed at the end of the large pump duct, which includes a gate valve.



*Fig. 4. A detail view of the XICS on the KSTAR pump duct.*

Note that there is a 100 micron thick Be window between the gate valve and the crystal housing. Although it is not installed in Fig. 3, there is a welded bellows between the crystal housing and the long vacuum tube for fine length adjustments. The location and expected space of the welded bellows are shown in Fig. 4. The XICS shown in Fig. 3 and 4 will be finally installed and aligned precisely on the KSTAR tokamak at the end of July, 2009.

### 3. SUMMARY

The X-ray imaging crystal spectrometer for the KSTAR device is currently under installation process. The eight segmented MWPC and its associated DAS are developing to improve a photon count-rate capability of the spectrometer. It is expected that the XICS will play an important role to provide many important plasma parameter for the next KSTAR experimental campaign.

### ACKNOWLEDGEMENTS

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### REFERENCES

- [1] S. G. Lee *et al.*, Rev. Sci. Instrum. **74**, 439 (2003).
- [2] S. G. Lee *et al.*, Rev. Sci. Instrum. **75**, 3693 (2004).
- [3] S. G. Lee *et al.*, Rev. Sci. Instrum. **78**, 063504 (2007).
- [4] J. K. Chen *et al.*, J. Korean Phy. Soc. **54**, 592 (2009).
- [5] U. W. Nam *et al.*, Rev. Sci. Instrum. **78**, 103504 (2007).