IMAGE ACQUISITION SYSTEM FOR THE INJECTION DUMP AT THE SPALLATION NEUTRON SOURCE*

W. Blokland†, A. Oguz, D. Willis, and N. Evans, Oak Ridge National Laboratory, Oak Ridge, TN, USA

Introduction

The Image Acquisition System for the Injection Dump visualizes the different beamlets on the vacuum window for the upgraded injection dump beam line (Fig 1):

- The two species are "H0 beam" (partially stripped H− beam), and "H− beam" (beam that misses the primary foil).
- PXI platform with LabVIEW and EPCIS Channel Access implements the data-acquisition including timing decoder.
- Non-radhard GigE camera with shielding.
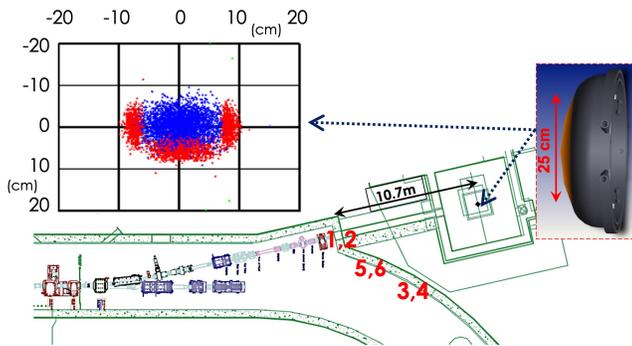
Figure 1. The Ring Injection Dump line with the calculated projection of beam particles on dump window. The red letters indicate dosimeter locations

Imaging Setup

The imaging system's requirements are:

- Survive a 16-hour study to document the new beamline's behavior,
- position resolution of < 4 mm, accuracy < 10 mm → Use fiducials (Fig 2), and
- interface with the EPICS controls system

Figure 2. Fiducials on window.

To evaluate the feasibility of the camera (FLIR Blackfly 23S6M-C), we measured radiation doses at different locations and the final selected location with shielding, see Table1. We used CERN HiRadMat results, [3], to convert doses to lifetimes.

Table 1. Doses, expected Time to Death (T2D), and Time to Significant Event (T2SE) at 1.4 MW beam power.

Location	Total (Gy/MWHr)	T2D (Hrs) unshielded	T2SE (Hrs) unshielded	T2D (Hrs) shielded	T2SE (Hrs) shielded
1	0.29	285	0.91	11,500	37
2	0.24	339	1.09		
3	0.04	2246	7.20		
4	0.05	1797	5.76		
5/6	0.08	998	3.20		

The camera installed in the shielding survived many months of running, see Fig 3.

Figure 3: The Camera image after 1800 MWHrs of exposure at 1.4MW at 1 GeV. Left a close-up of the test image center.

Acquisition System

The system is based on PXI and LabVIEW (Fig 4):

- The PXIe-8840
- PXIe-4112 to reboot FLIR Blackfly 23S6M-C
- SNS Timing with PXIe-7971
- BK Precision 1687B power supply to power lamp

Figure 4: System Hardware

The software, see Fig 5 provides:

- horizontal and vertical projections,
- centroid of the image,
- a circle overlay matching the edge of the coated area,
- an adjustable crosshair overlay, and
- an EPICS Channel Access interface.
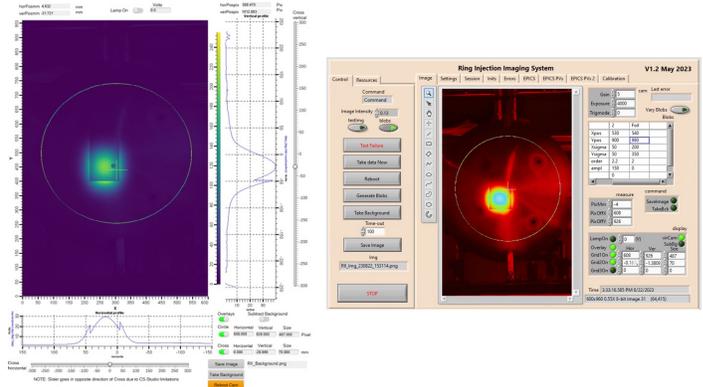
Figure 5: The CSS Control Room interface (left) and the LabVIEW expert screen (right).

Conclusions

An image acquisition system has been created for the injection dump to visualize the waste beam from the stripping foil using a shielded non-radhard camera to provide months of operation.

Unfortunately, the installation of the optics system was delayed due to problems with the installation of the coated vacuum window and no field measurements have yet been taken.

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