Experience with and Studies of the SNS* Target Imaging System

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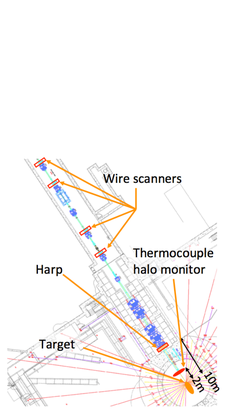
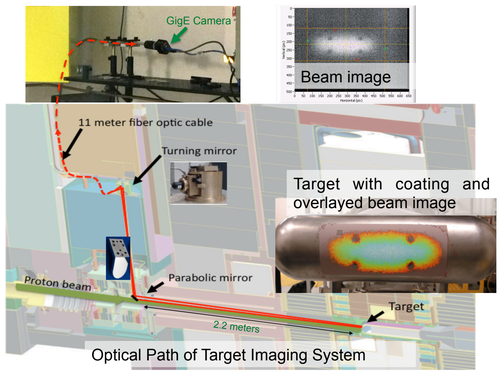
INTRODUCTION

The Target Imaging System (TIS) shows the size and position of the proton beam by using a luminescent Cr:Al2O3 coating on the SNS target.



Nearby diagnostics



Optical Path of Target Imaging System

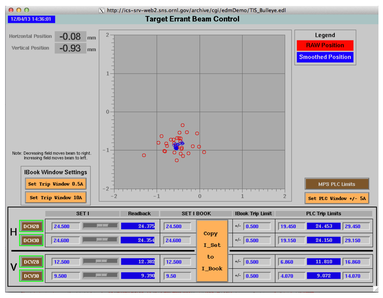
OPERATIONS

The TIS results, beam size, peak density, and position are used for:

- Errant Beam Monitoring
- Initial accelerator setup

The TIS runs:

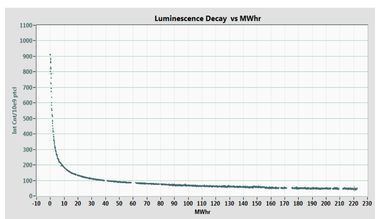
- Mostly without interaction
- Reliably (few restarts per year)



Errant Beam Control Screen

LUMINESCENCE DECAY

Newly created software tool to analyze image and correct for differences in camera gain/exposure and beam intensity:

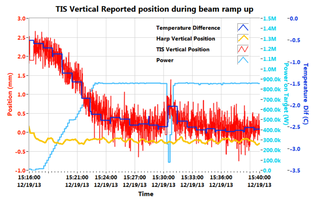


Decay of brightness versus MWhrs of beam on target

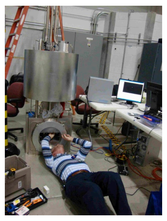
- Use for future studies on different coatings
- Decay due to protons (15%) & neutrons (85% but more uniform distribution)

TIS POSITION VERSUS BEAM POWER

TIS reported position is sensitive to beam power. Is there a problem with the optical path?



Data trends after beam power interruption



Installation of mirror on Proton Beam Window

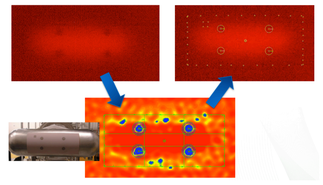
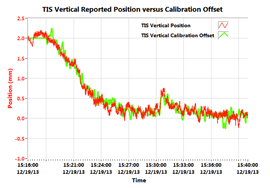


Image recognition



TIS position correlates with fiducial movement

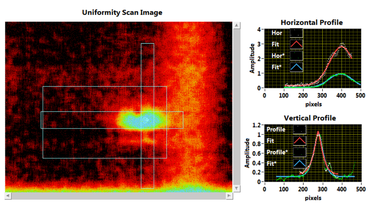
To study: Image recognition to automatically track the fiducials

→ Yes: Fiducials are moving the same way.

UNIFORMITY SCAN

Scan the coating surface with a pencil beam to determine luminescence uniformity. New:

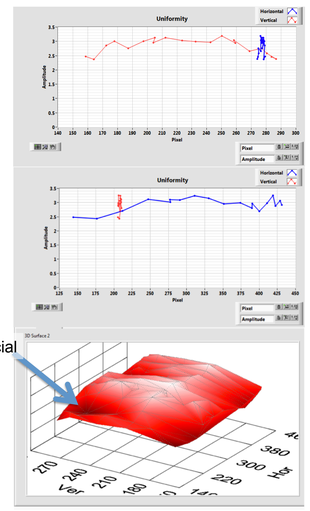
- Script to steer the beam
- Automated analysis



New analysis program to track pencil beam

Results:

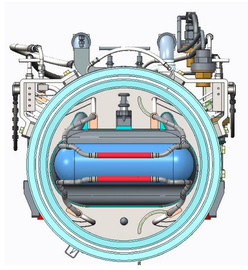
- ±12.5% variation but about half is noise due to low light (0.1kW to 5kW)



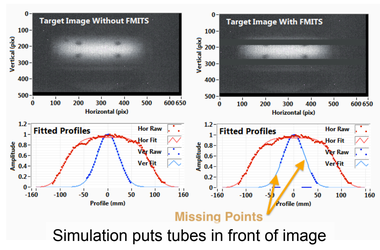
Top: vertical middle scan. Middle: horizontal middle scan, Bottom: all points in 3D

UNIFORMITY SCAN

The proposed Fusion Material Irradiation Test Facility (FMITS) puts tubes with materials in front of the target to study radiation damage. What effect has this on the TIS?



Red FMITS tubes in front of target

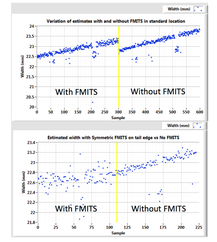


Simulation puts tubes in front of image

Results:

- Widths off by 2-3%
- Position off by <0.5mm

→ Lower but acceptable performance



Results with or without the FMITS

CONCLUSION

- Tools have been created to study the characteristics of the TIS. These tools can be used to do future R&D to improve the TIS.
- The TIS is sensitive to beam power but we have characterized this and can correct dependency.
- The TIS can function, given certain FMITS tube configurations.

ACKNOWLEDGMENT
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