Weak Beam Diagnostics Utility for ATLAS-CARIBU

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Abstract

The CAlifornium Rare Isotope Breeder Upgrade (CARIBU) for the ATLAS facility requires the transport of very low intensity ion beams through the accelerator. Weak beam diagnostic stations at several strategic locations throughout the accelerator will be installed to duplicate beam position as measured with a more intense guide beam. One of these methods will be using an ANL designed Beam Profile Monitoring Device which will use secondary electrons directed onto a phosphor screen, and then the image is captured by a CCD camera. A video capture program to enable integration of weaker beam signals from video devices is being developed using ITT Visual Information Systems IDL [1] software on a Linux based PC. The software will process the image from the CCD camera and accumulate the frames together to produce a viewable image of the beam spot. This will allow an operator to adjust the beam and potentially match the live image and averaged images to previously saved images. The software will also allow the selection of a particular diagnostic location to view and control from a single interface.

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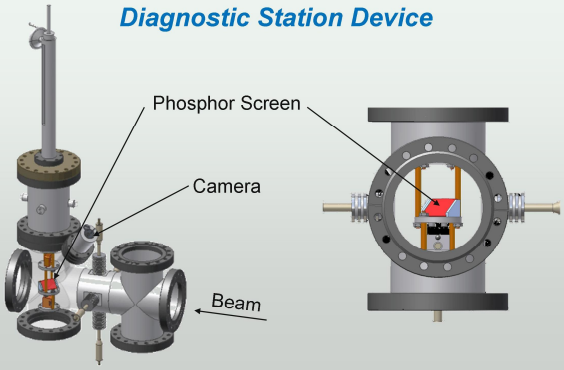
Diagnostic Station Device

Attached to a linear motion feed-through is a target plate coated with a phosphor which fluoresces when exposed to heavy ions.

A CCD (Charged Coupled Device) camera is mounted such that it is focused on the phosphor screen.

When placed into the beam path the phosphor will fluoresce and the image displayed on a computer system.



Three types of fluorescing powders are been tested.

Nichia of America Corporation:
Gd_2O_2S:Tb and Y_2O_2S:Tb

GTE: ZnS:Ag

CCD Camera

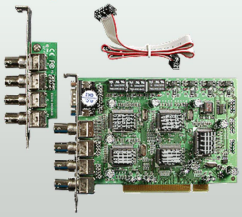
KT&C KPC-EX230HL:

- Sony Black and White 1/3" Super HAD CCD Camera
- 420 TV Lines of Resolution
- Sensitivity of 0.003 Lux
- Interchangeable Lens
- 12VDC

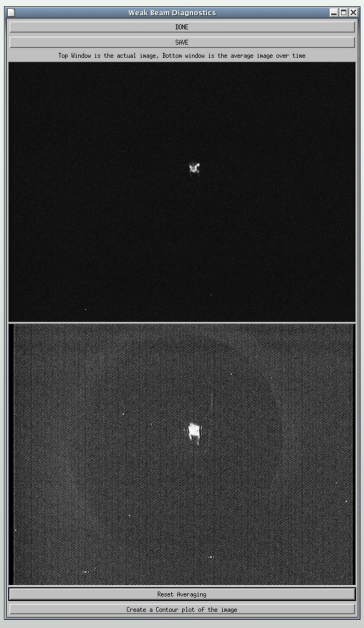
Linux Media Labs PCI Video Input Board

LMLBT44

- Video digitized using YUV 4:2:2 color format
  - ◊ NTSC 640x480 60 fps
  - ◊ PAL 758x576 50 fps
- 4 full rate channels
- 4 optically insulated sensor inputs
- 4 composite video inputs (BNC connectors)
- PCI board based on Bt878 chip



System Software



Created using ITT Visual Information Solutions IDL 7.1

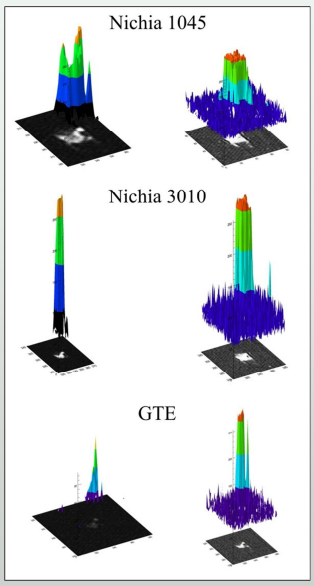
Saves both images to JPEG file format

Live Image from camera captured 10 frames per second.

Accumulated and Equalized Image created by summing individualized frames that are enhanced by the IDL HIST_EQUAL () function.

Clears the stack of saved images and resets the accumulation.

Creates a contour plot using IDL iTools functions similar to those shown at right.



Phosphor Comparisons