Proton Irradiation Beam Profile Measurements

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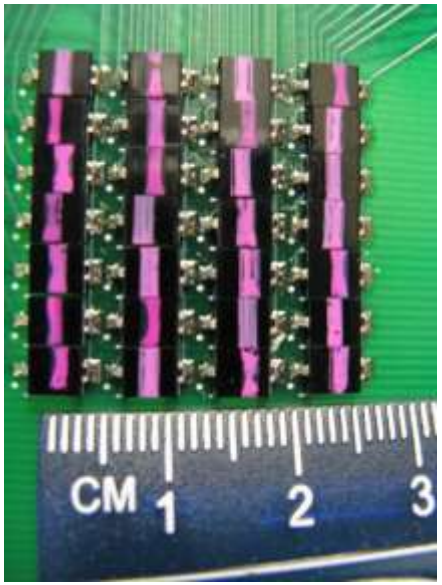
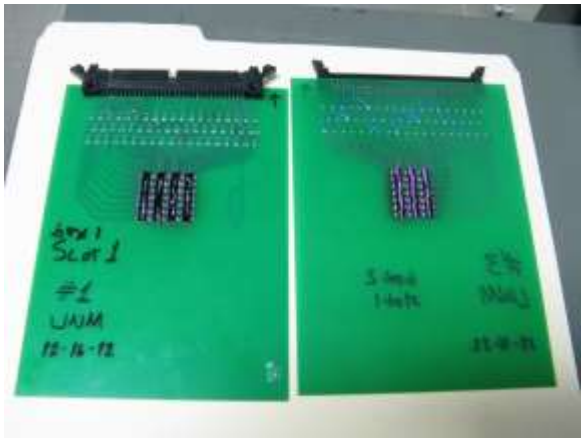
LANSCE beam profile

- The 800 MeV proton beam at LANSCE has the following characteristics:
  - approximately round beam spot
  - with approximately 1 cm spot diameter
- UNM measures the beam profile during each irradiation by two different methods:
  - with a 7 x7 matrix of PIN diodes
  - with a 4 x 4 matrix of Al foils

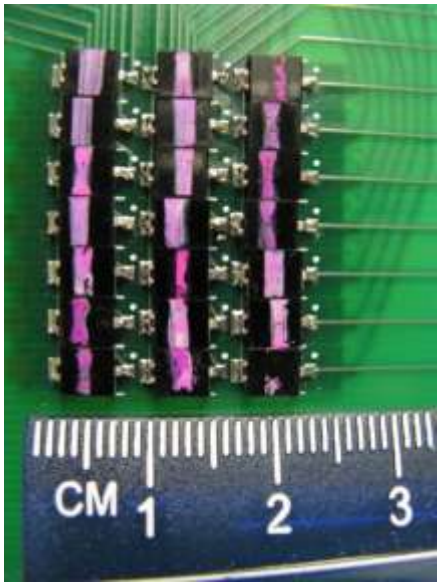
PIN diode matrix

- The PIN diodes are spaced in ~ 0.4 mm increments

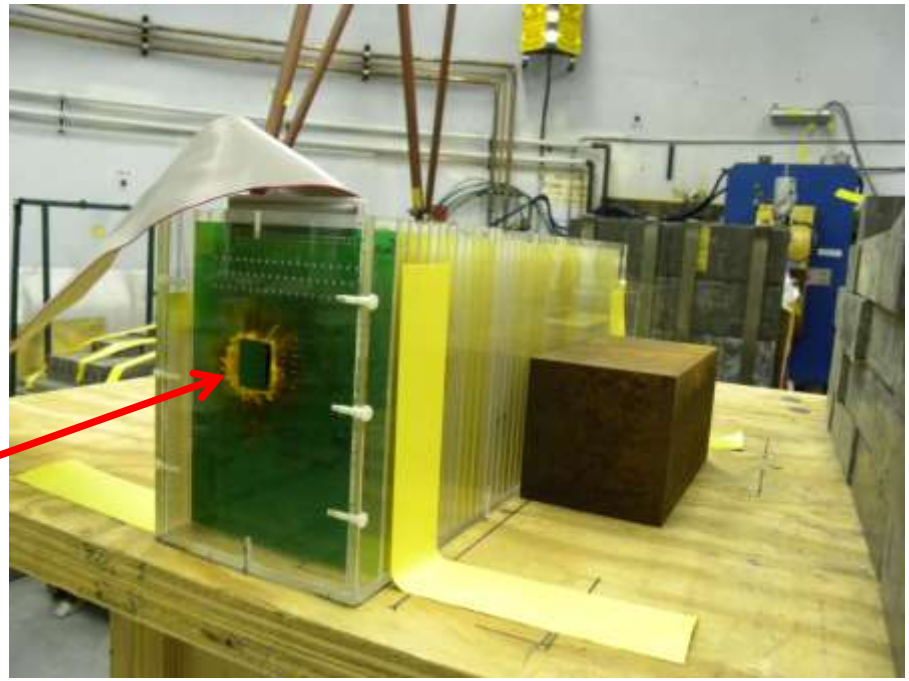




Front Back

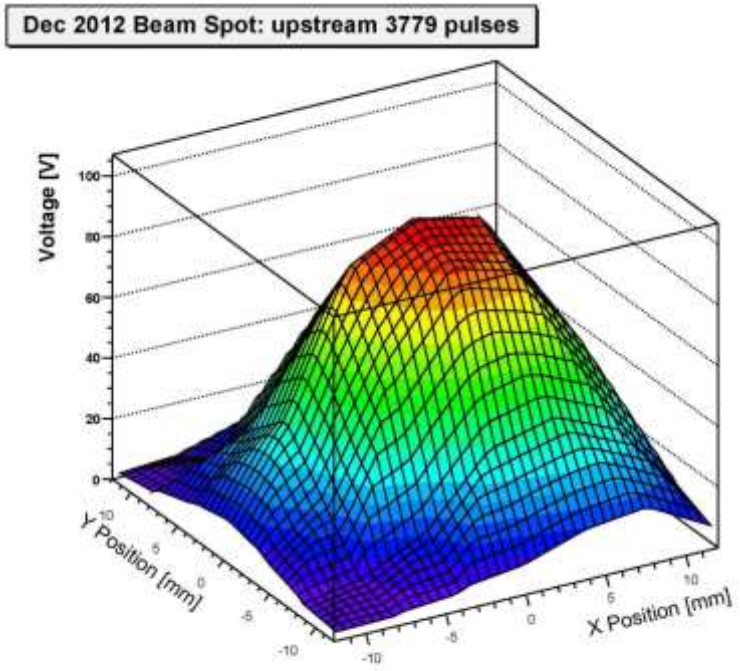


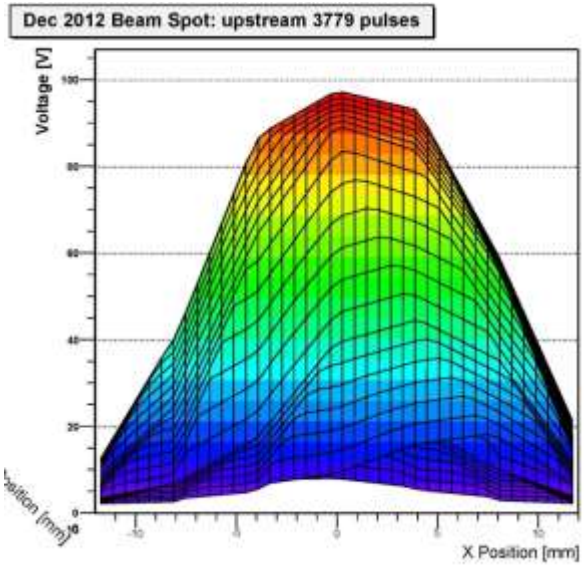
PIN Diode Matrix in the beam

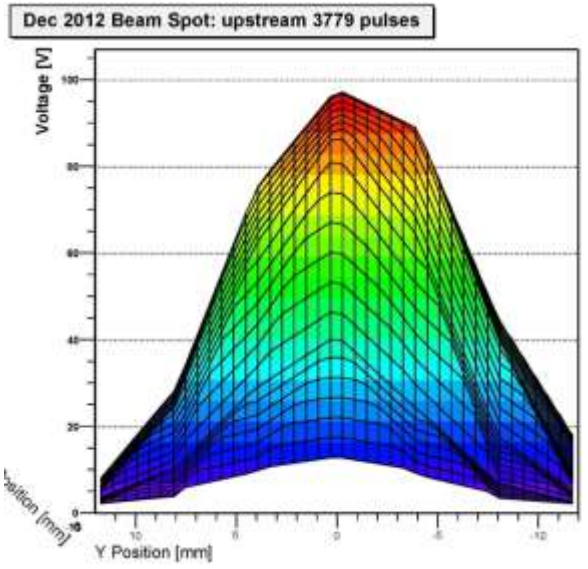


The diode matrix board in the front of the sample stack. The diodes are read out at various steps in real time during the irradiation, just to map the beam profile which may change from irradiation to irradiation.

PIN diode matrix results



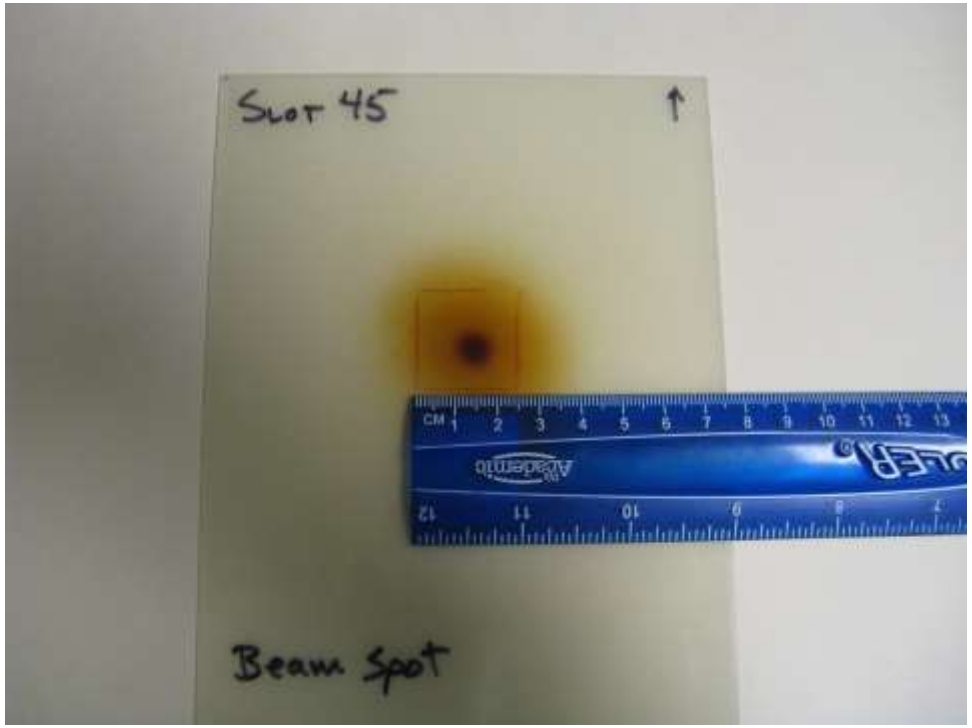


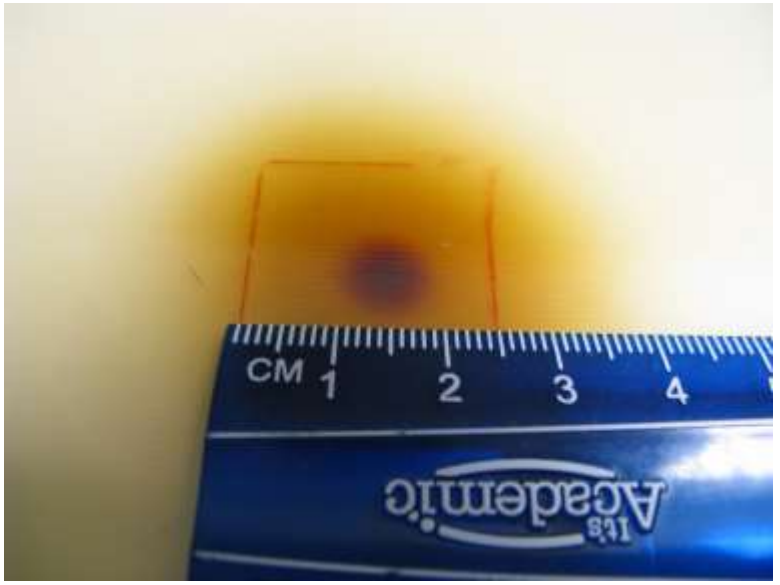


X: fwhm ~ 1.5 cm

Y: fwhm ~ 1.2 cm

Beam spot on g10 board

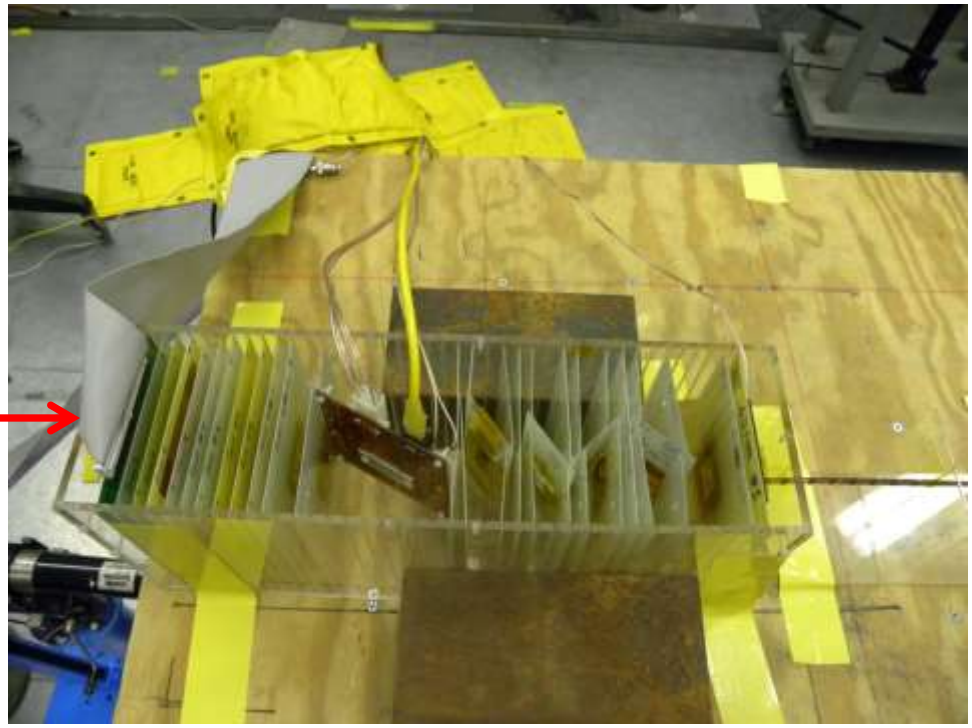




The beam spot marked or burned into a g10 board, with ~ 1cm spot diameter

FEI4 Module placed in the beam

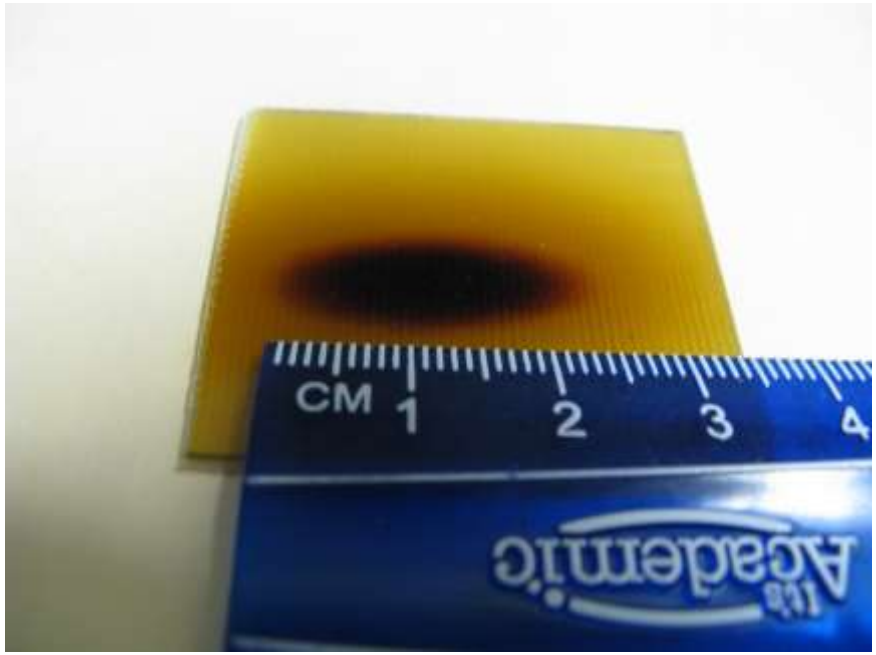
Beam direction

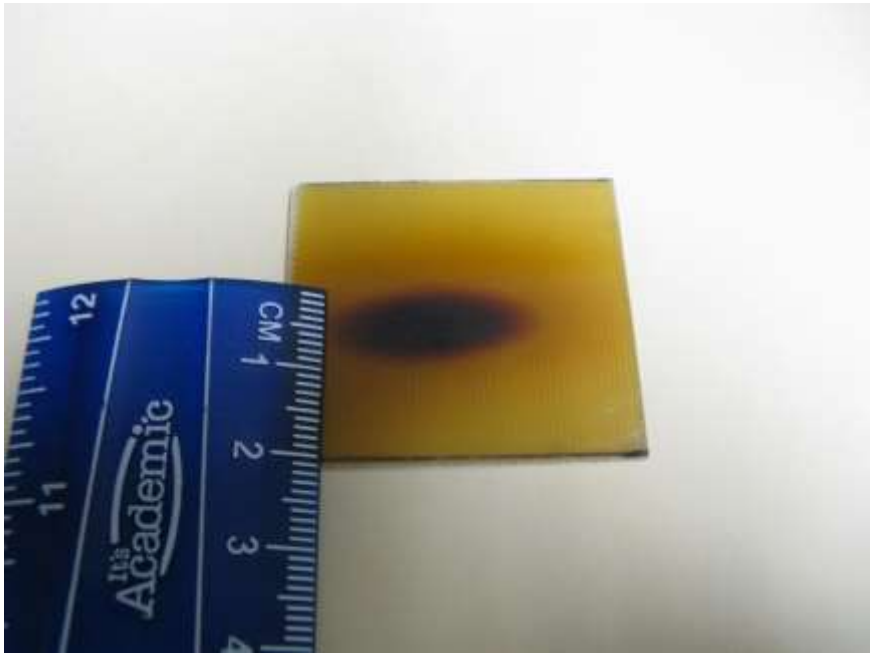


The FEI4 modules are placed in the beam at a 60 degree or greater angle,

To get a more uniform irradiation in one dimension

Beam spot on angled g10 board



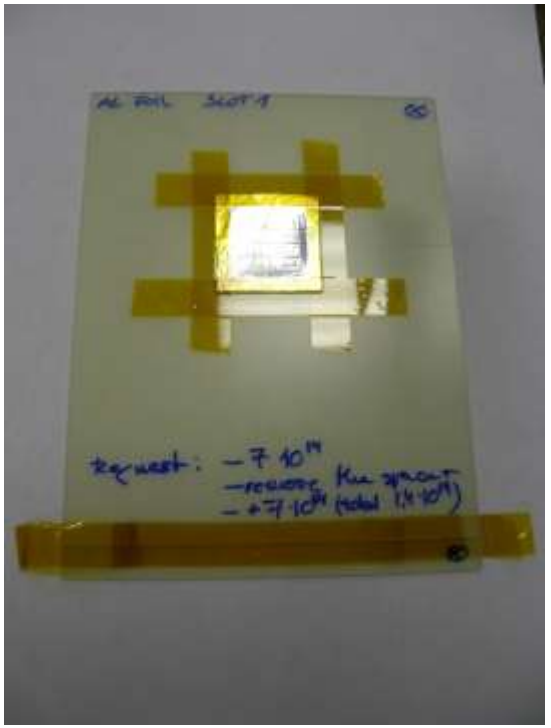


Beam spot marked on a 60 degree angled g10 board,

Showing that the direction having the ~ 2cm spot is more uniformly irradiated in that dimension

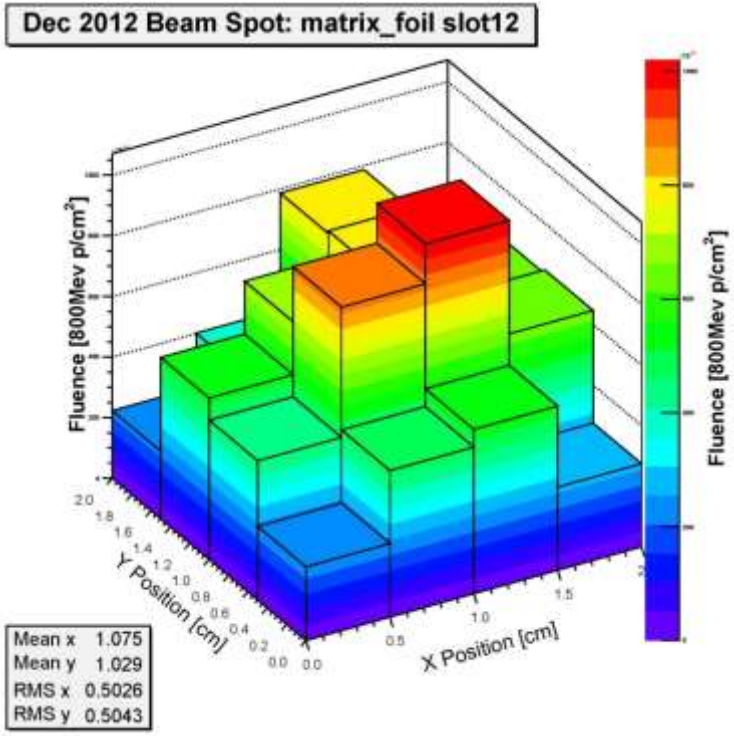
Al foil matrix

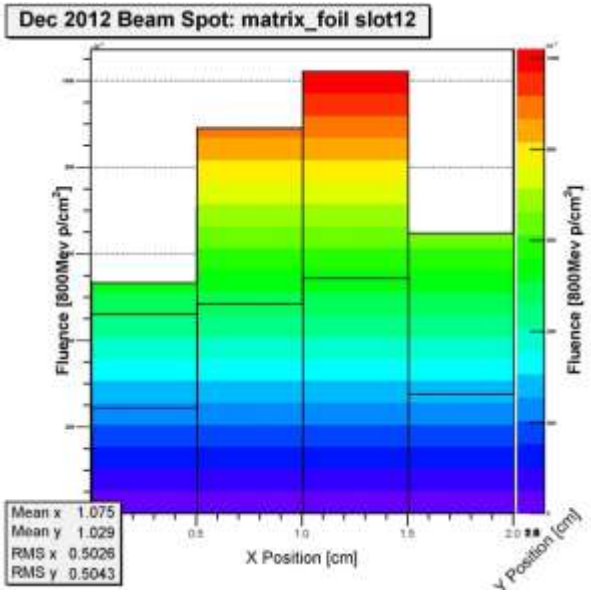
4 x 4 matrix of 5 mm x 5 mm squares

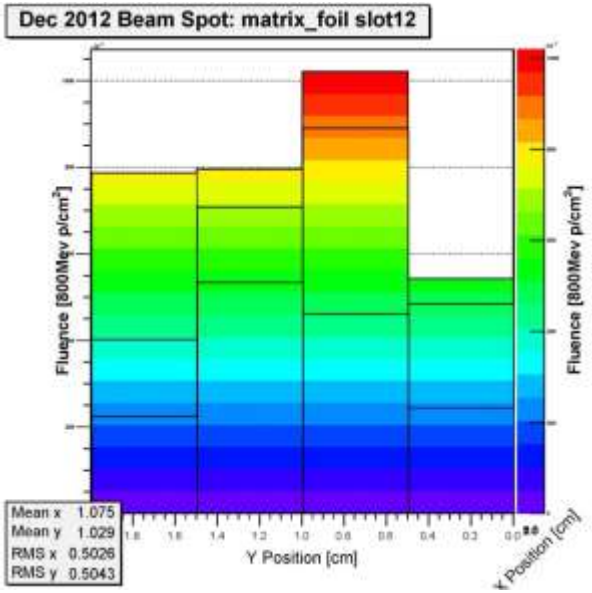


Placed in a frame to go into the samples box

Al foil matrix results







X: fwhm ~ 1.5 – 2 cm

Y: fwhm ~ 0.5 – 1.0 cm

Discussion

- The PIN diode matrix gives good results for measuring the beam profile.
- The Al foil matrix gives better results for beam fluence measurement.