

Request for Beam Time at the NSRL at BNL for the Calibration Exposure of MoEDAL NTD Elements

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Introduction.

Below is the proposal for our first NSRL run. Each batch of plastic we use must be calibrated with a known ion beam meaning we need to redo exposures on a regular basis with slight changes to ion type or energy to probe the response threshold of the plastic.

The Large Hadron Collider Committee (LHCC) and the Research Board of the European Centre for Particle Physics Research (CERN) approved the MoEDAL experiment in March 2010. The MoEDAL TDR was accepted by the LHCC in February 2010. MoEDAL is an international collaboration - consisting of ten institutes from Canada, CERN (Switzerland), the Czech Republic, Germany, Italy, Romania, UK and the USA, dedicated to an essentially background-free search for new physics signals in the form of highly ionizing particles such as magnetic monopole, dyons, Q-balls and a variety of Stable Massive Particles (SMPs).

The MoEDAL detector, deployed around the LHCb intersection region, is the largest passive array (no HV, electronics, gas or trigger) of plastic Nuclear Track Detector (NTD) stacks (~400 stacks each consisting of 10 sheets on NTDs with area 25cm x 25 cm) ever deployed at an accelerator. Also, it is the first time that NTDs would be used to (also) detect electrically charged SMPs. Possible backgrounds will be monitored by a small array of eight MediPix1 silicon pixel imaging chips that will enable us to measure the radiation field and the important spallation product background, online.

The Request

A small test array of CR39 NTD was deployed at the MoEDAL/LHCb IP in November 2010 and removed in January 2011, when a much larger test array was installed. The plastic we wish to test/calibrate at the NSRL at BNL is from the test array removed last January. The plastic to be calibrated is incorporated into four identical test stacks.

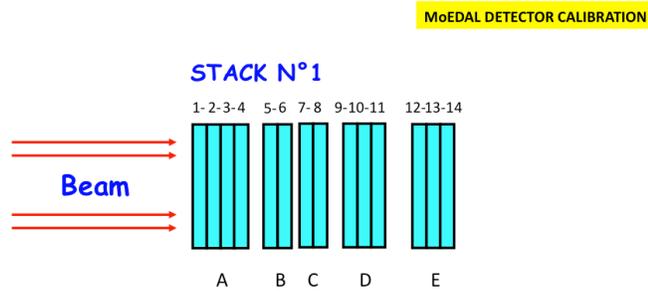
One of the four identical stacks is shown in the Figure 1. Each stack is 11.5 x 11.5 cm² and the stacks are only a centimeter or so deep. We require the following beam conditions for the exposure of each stack:

- a) Fe ions at 1000 MeV/n (one stack exposed to Ti would be nice, but not essential);
- b) Around, but not more than, 2000 (+/- 30%) particles per cm² across the face of the stack.

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A 100 ions/cm² per spill would seem to be a good setting allowing the particles to be delivered over a reasonable number of spills.

We could expose the whole sheet to a largely dispersed beam with a flat profile (the “biology” beam?) or a smaller “physics” beam, again with a flattish profile, where the beam is scanned across each stack allowing not more than ~2000 particles per cm² to be recorded on each stack.



A = 4 CR39 sheets. Status: new (production for MoEDAL 2009), not exposed

B = 2 CR39 sheets. Status: (SLIM 2000), exposed in MoEDAL

C = 2 CR39 sheets. Status: (SLIM 2000)

D = 3 Lexan sheets. Status: new (2000)

E = 3 Makrofol sheets. Status: new (2000)

Figure 1 One of four identical test stacks