

Beam test preparation note for the Neutral Pion TFF experiment

pi0 TFF collaboration

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This note describes the goals, necessary equipment, beam time, and preparation procedure for the pi0 TFF experiment beam test in Hall B.

1 Introduction

The main goal of the beam test for the pi0 TFF experiment is to record a short (~ 4 hours) data sample suitable for the estimation of the following experimental conditions:

- 1) the proposed trigger rate and optimal trigger thresholds;
- 2) HyCal counters rates, multiplicities, and energy gains degradation;
- 3) load of the GEM detector.

2 Test run conditions

We would like to use modified PRaD-1 experiment setup. Modifications include:

- 1) electron beam energy increase to ~ 10.5 GeV;
- 2) different beam current values will be used: 1 nA, 3 nA, 5 nA, and 10 nA;
- 3) use of the new $250 \mu\text{m}$ silicon target situated in the ladder allowing to change target remotely, and installed at ~ 5.6 m distance to HyCal crystals face. This requires the new vacuum pipe segment to be installed;
- 4) the new wide tungsten absorber covering 6x6 inner HyCal modules needs to be fabricated and installed in front of HyCal;
- 5) random trigger needs to be setup with ~ 10 kHz frequency;
- 6) one GEM detector plane installed right after the vacuum box;
- 7) HyCal light monitoring system needs to be tested and used for the HyCal modules degradation monitoring;
- 8) The most inner layer of crystals needs to be switched off.

3 Target

250 μm thick chemically pure silicon target with the transverse sizes about 1" needs to be fabricated and available for the beam test. The target is located in the new vacuum box section shown in fig.reffig:setup.

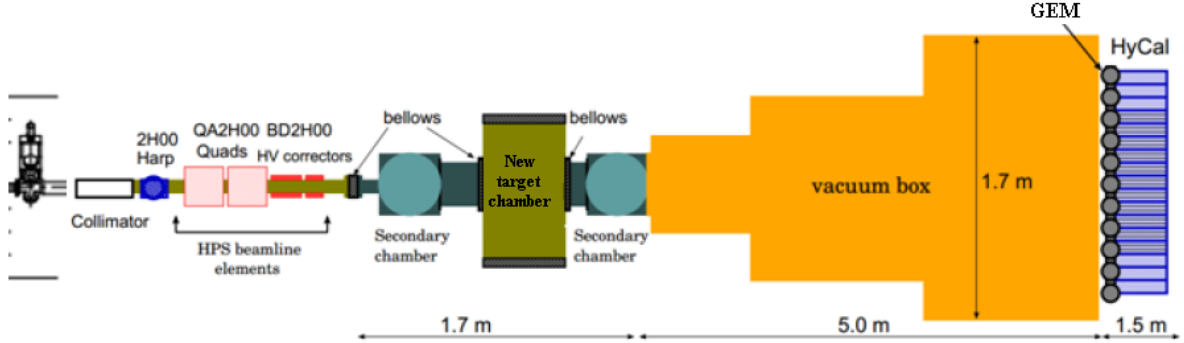


Figure 1: Modified PRad setup with the new solid target chamber.

4 Trigger and electronics

We will set up random trigger with frequency 10 kHz. We will need EPICS events added to the data stream at ~ 1 Hz rate. Calorimeter modules need to be connected to fADC-250 (at least ~ 100 channels with fADCs are needed for the reliable rates estimation).

5 GEM detector

The GEM detector needs to be installed in between vacuum chamber and HyCal,

6 Tungsten absorber

The new absorber needs to be fabricated (made of tungsten or W90/Cu10 tungsten-copper composition). The absorber has a truncated pyramidal shape, with the square hole in the center as shown in fig. 2. The height of the truncated pyramid is 6", the base and the hole sizes coincide with HyCal 6x6 and 2x2 central modules squares.

7 Preparation and beam time

We will use about 4 hours of beam time to record random trigger events at four different beam current values: 1 nA, 3 nA, 5 nA, and 10 nA. The HyCal and GEM detectors need

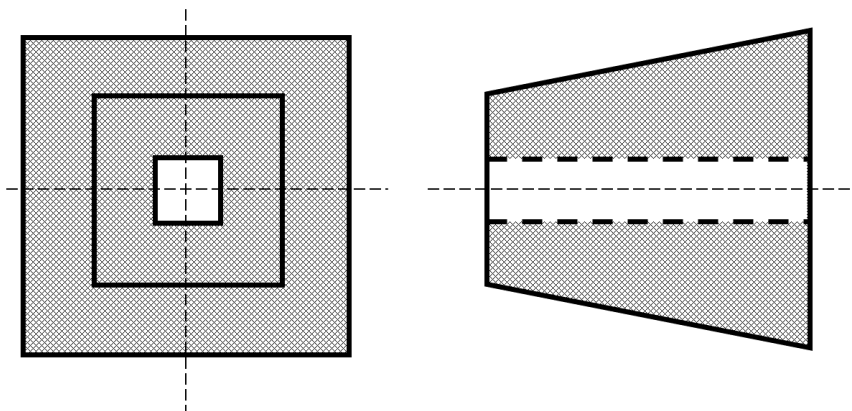


Figure 2: Absorber.

to be checked before beam test. The calorimeter modules need to be gain equalized with the cosmic data (about a week of no-beam statistics collection).

Table 1: Additional equipment to be installed for the beam test

target vacuum chamber with ladder for loading two silicon and one empty targets	
calorimeter prototype (~ 20 PWO modules) (movable)	
GEM detector plane	
tungsten absorber	
target	
DAQ crate	
PRaD vacuum box	