

NPS survey requirements

Carlos Muñoz, munoz@jlab.org

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The NPS calorimeter detector is composed of an array of 30 columns and 36 rows of lead tungsten crystals (see Fig. 1).



Fig 1: View of the detector front face. The left picture shows the bare crystals and the right picture shows them covered by reflective material glued to plastic covers. Each crystal can be uncovered individually by removing its corresponding cover (see Fig.4).

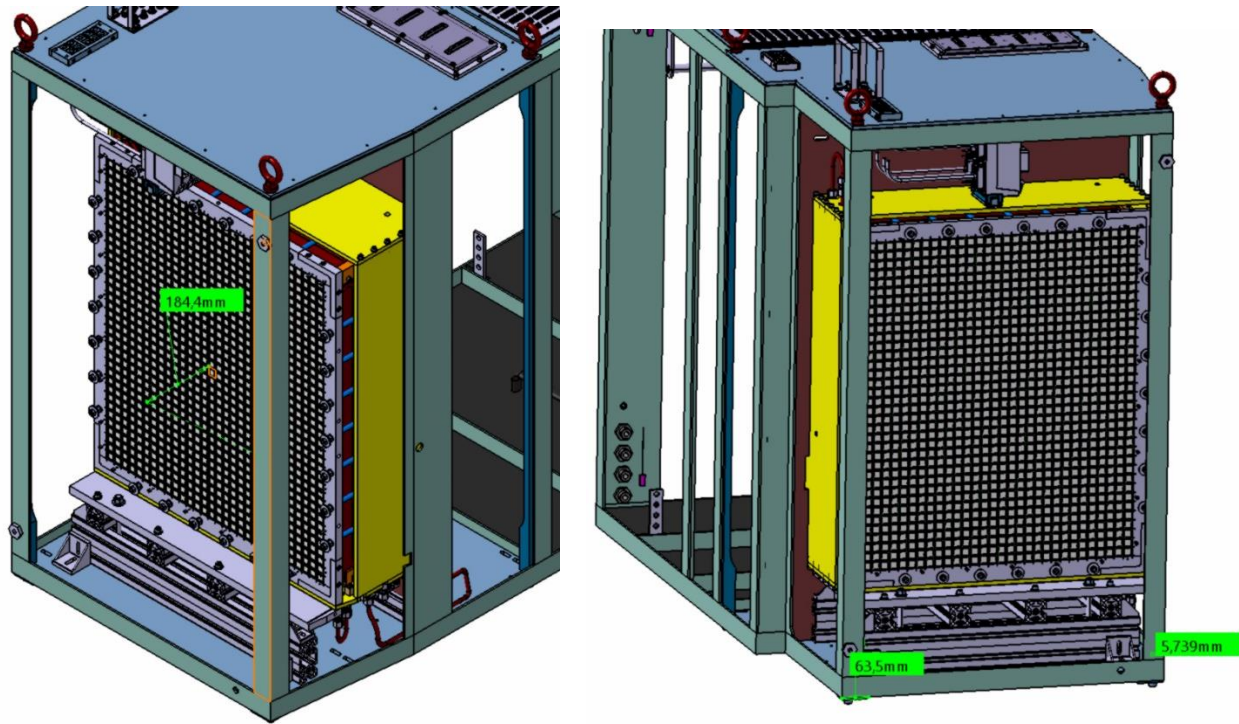
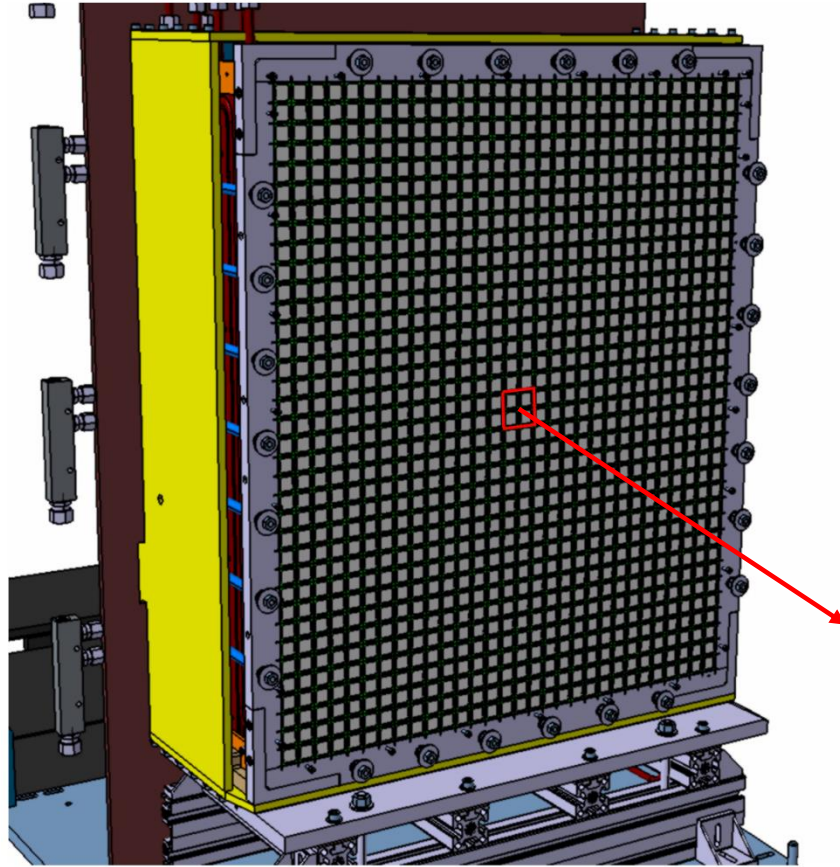


Fig. 2: Relative position of crystals with respect to the frame.

The position of the detector is defined by the coordinates of its center with respect to the Hall center and the 3 angles (pitch, roll and yaw) of its axis. The detector center and axis are defined as follows.

- The front face of the detector is the plane defined by surveying the front face of a large number of crystal faces (>20) evenly distributed across the detector. In order to survey the crystal faces, the corresponding crystal must be uncovered (see Fig. 4 for details).
- The detector axis is defined as the perpendicular line to the front face of the detector that goes between the 15th and 16th columns and between the 18th and 19th rows of crystals.
- To survey the detector center, remove the cover of each of the 4 crystals around the detector center (Fig. 3) and use the carbon fiber plates supporting the crystals (shown in magenta in Fig. 4) to define two planes. Project the intercept of these two planes onto the detector face to define the detector center.

After removing the crystal covers, there will be 2.4 mm of carbon fiber plate accessible for surveying (Fig. 4). For increased rigidity of the carbon fibers plates, it would be preferable to uncover only one crystal at a time.



- Fig. 3: Front face of the detector showing the 4 crystals that can be used to survey its center.

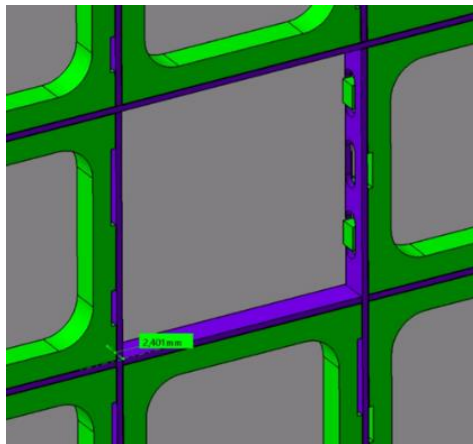


Fig. 4: Detail of the detector front face when one crystal is uncovered. The bare crystal face is accessible for surveying the crystal face and define the detector front face. The carbon fiber plates (magenta) holding the crystals extend 2.4 mm beyond the crystal face and can be used to define a horizontal and vertical planes whose intercept projected onto the detector front face will define the detector center.

Notes:

- Due to possible small motion during transportation out of the EEL building, its survey and fiducialization should be performed after the detector is in Hall C.

- Alignment of the detector should minimize mispointing of the detector axis to the Hall center (tolerance: ~2-3 mm), and position its center at the same vertical position ($Y=0$) as the Hall center (tolerance: 1 mm).

- The detector should be surveyed at different reference distances to the target center:
 - 3.00 m
 - 4.00 m
 - 6.00 m
 - 7.00 m

Distance is measured from the detector front face to the Hall center. Repeatability of placing the detector at each of these reference distances should be measured (3 or more times at each position).

- The angle of the detector axis with respect to the SHMS optical axis should be reported.