Frame design for the γ-ray detector array CATANA

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The γ-ray detector array CATANA[1] is being constructed to measure the E1 response of the neutron-rich nuclei. 200 CsI(Na) detectors compose CATANA, and are configured the packed layout (barrel shape) to realize the high detection efficiency and position resolution. This report describes the design of the CATANA frame and its concepts.

Since CATANA will be used in many experiments with SAMURAI, The frame should have the high maintainability and flexibility. The CsI(Na) crystals will be configured to have a barrel like structure (CsI unit) to achieve the high efficiency as shown in the left side of Fig. 1. To achieve the high maintainability, the 10 detectors will be supported by a frame shown in the right side of Fig. 1 , and the barrel like configuration will be realized by using 20 CsI units. The CsI(Na) crystal and PMT are connected by using an inlaid support on the top of the crystal. An O-ring is put for light shielding between the inlaid support and the crystal. The detector is connected to the CsI unit by a jig. Individual detector can be easily removed from the CsI unit, for the high maintainability. Fine adjustment of the detector positions can be done on the CsI unit. The total weight of the CsI unit is about 25 kg so as to handle it without a crane operation. A side plate of CsI unit has numerous small holes for the easy and clean cabling.

Figure 2 shows the main frame of the CATANA (left) and half of the top part (right). The CsI unit is mounted on the main frame by a guide attached to the main frame. The guide is made of a synthetic resin to isolate the CsI unit electrically. The frame width along the beam line and the frame height are 59 cm and 276 cm, respectively. The width is almost half of the present DALI frame[2], so as to put a reaction target closer to the SAMURAI magnet. The whole frame can be craned by using eyebolts on the main frame. The top part of the main frame can be opened to the direction perpendicular to the beam line for easier work around the reaction target put at the center of CATANA. The shaft for the opening is a trapezoidal screw to fix the position of the frame without any locking mechanism. Ladders for cables are put on a plate to support the CsI unit (shown in purple in Fig. 2). The bottom part of the main frame has space at both sides to put a high-voltage power supply for PMTs and/or circuits for signal processing. The space follows the EIA standard for 19-inch racks. The parts for seismic reinforcement are put under the main frame. The offsets of heights can also be attached under the main frame, to cope with the different beam-line height depending on the focal planes such as F8 of BigRIPS.

The CATANA frame construction is now in progress.

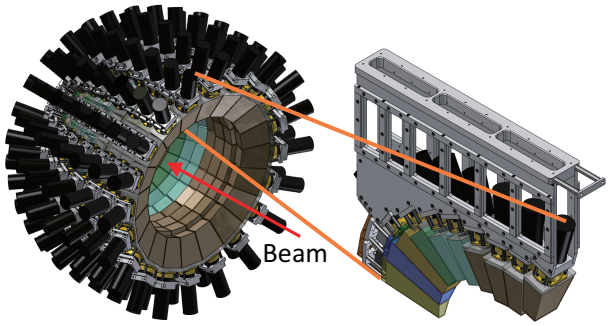

Fig. 1. Configuration of CsI(Na) detectors in CATANA (left) and the support frame for 10 detectors (right).

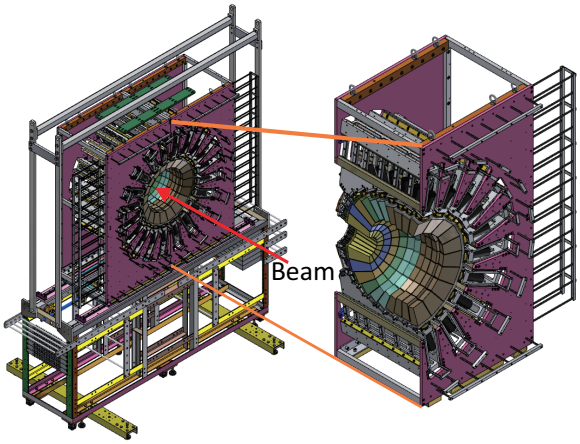

Fig. 2. The frame of CATANA with 200 CsI(Na) crystals.

References

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2) S. Takeuchi et al.: Nucl. Instr. and Meth. A **763**, 596 (2014).

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