

Measurement of angular variation of cosmic ray flux with plastic scintillator

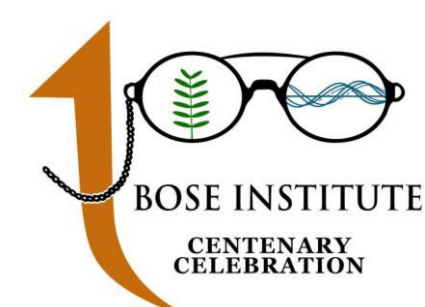
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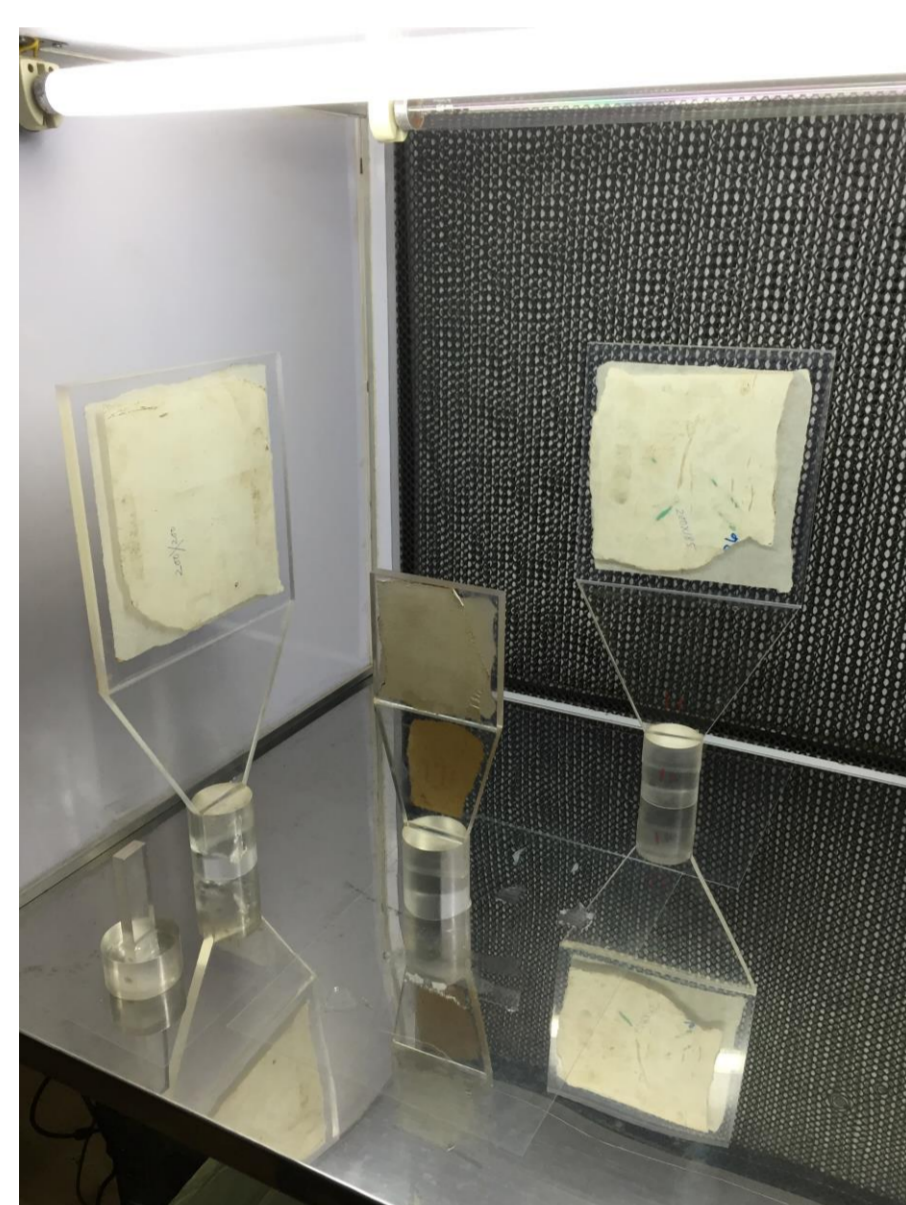


Advanced Detectors for Nuclear, High Energy and Astroparticle Physics, February 15-17, 2017 Bose Institute, Kolkata

Introduction

We have fabricated several plastic scintillator paddle detectors to build a cosmic ray trigger set up required for our R&D with gaseous detectors. The plastic scintillator material and the photomultiplier tube are commercially procured. All other components such as Perspex light guide, coupler of light guide are made in proper dimension at Bose Institute workshop. Two such modules are completed initially and tested with cosmic rays and different radioactive sources. Using these detectors a preliminary study has been carried out to measure the angular variation of cosmic ray flux. To do this one detector is kept fixed in position and the position of the other one is changed and the coincidence count is measured.

Steps of fabrication



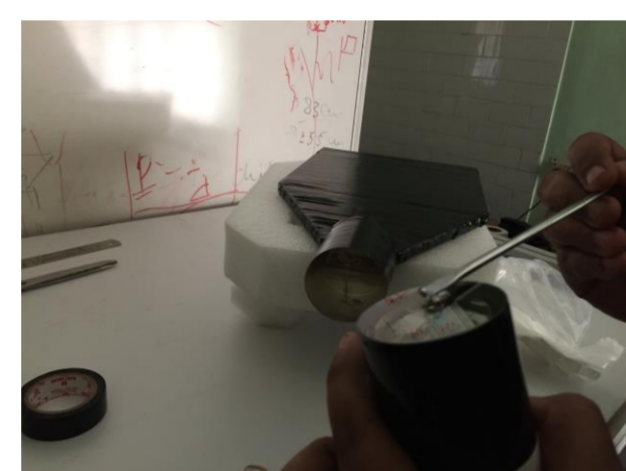
1. Gluing different components



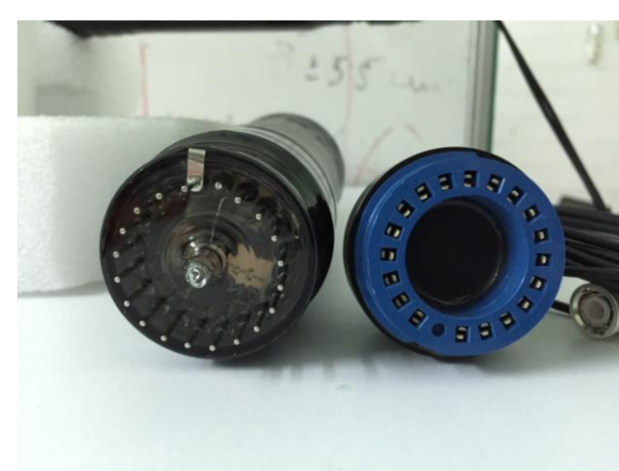
2. Wrapped with Tyvek paper



3. Wrapping with black tape



4. Application of optical grease to PMT



5. PMT and base of the voltage divider



6. Assembly of PMT with Scintillator



7. Completed Scintillator paddle

Experimental technique

Dimension of Sc-01: Plastic scintillator paddles 20 cm x 20 cm, 1 cm thick

Dimension of Sc-02: Plastic scintillator finger 10 cm x 2 cm, 1 cm thick



Two scintillators in coincidence



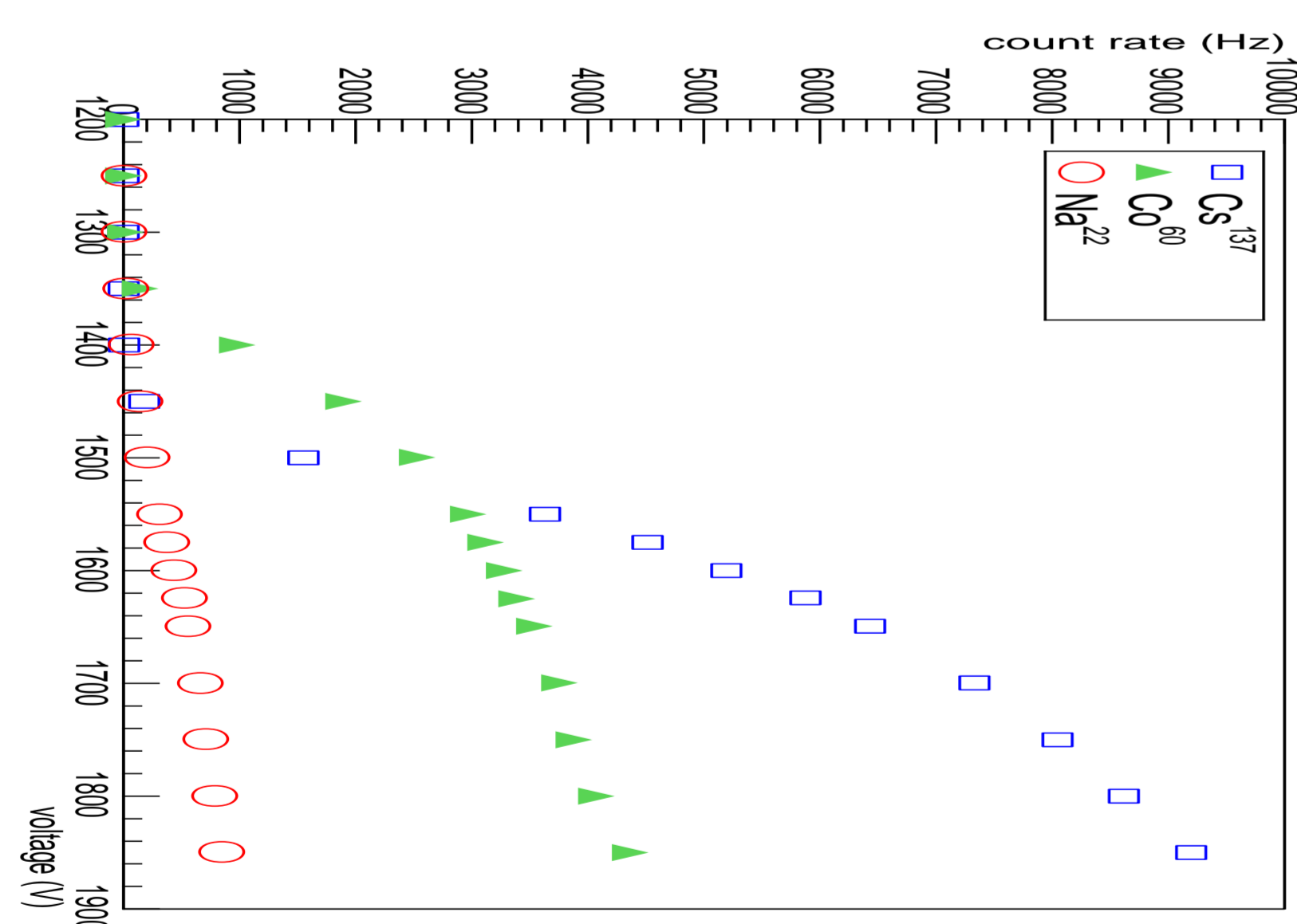
Coincidence signals



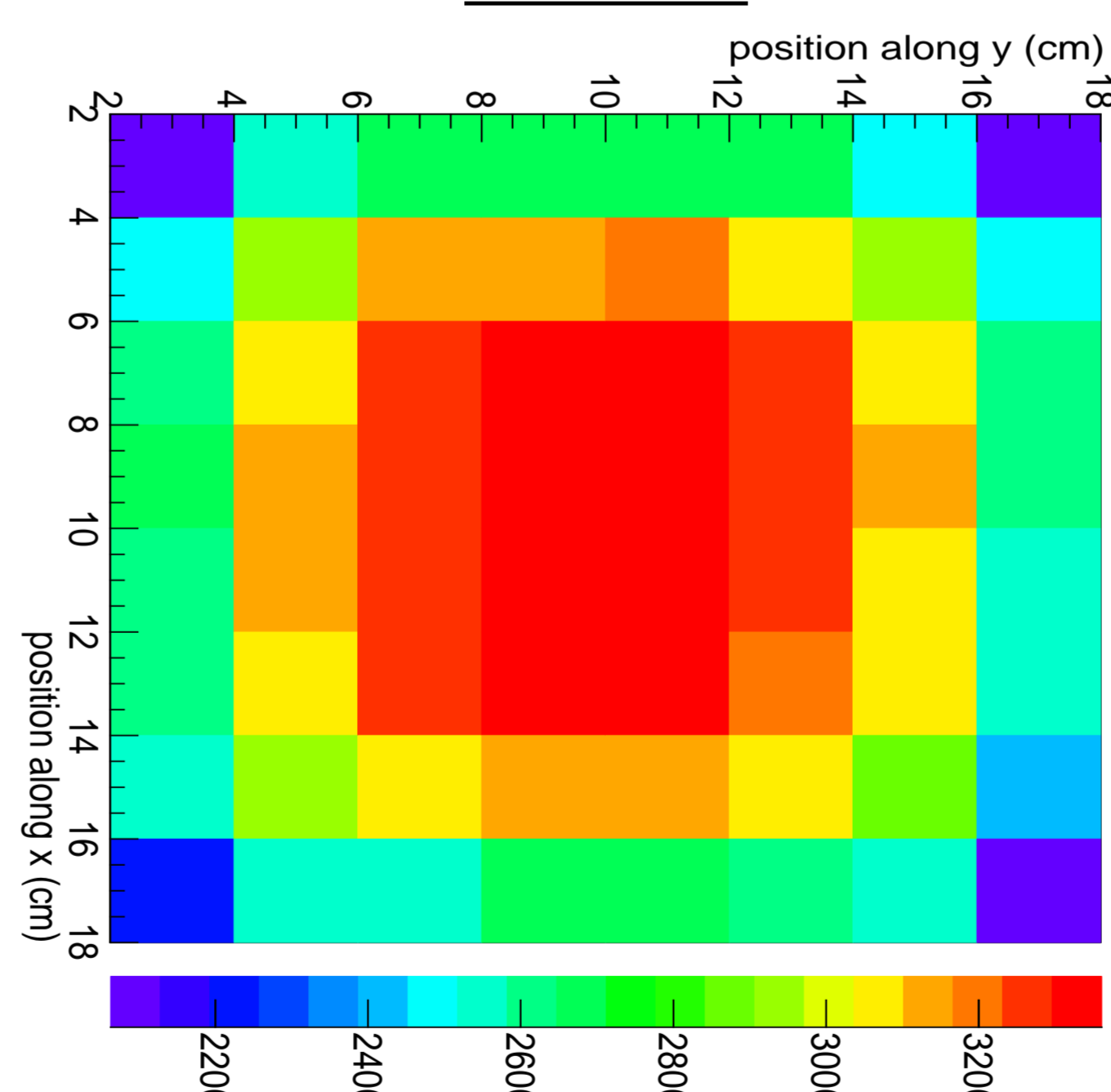
Measurement of angular variation

- Plateauing is done for both the detectors with different radioactive sources.
- Uniformity of count rate with Co^{60} is measured for Sc-01 at +1650 V.
- For the measurement of angular variation of cosmic ray flux constant voltage of +1650V is applied to both the scintillators.
- The signals from the scintillator is fed to the leading edge discriminator.
- Thresholds to the discriminator are set -50 mV.
- Sc-01 detector is kept fixed and Sc-02 detector is kept below Sc-01 (along y axis)
- Coincidence counts are measured for a time duration of 30 minutes
- Sc-02 is moved in horizontal plane and coincidence counts are measured at different positions of Sc-02 (along x axis).
- Thus cosmic ray flux that are incident at different angle with the normal to the ground level per unit time per unit solid angle subtended by Sc-01 at Sc-02 is calculated.
- The calculation for solid angle subtended by Sc-01 at Sc-02 is done using a 2D integration program in ROOT.
- The same experiment is repeated for four days with different perpendicular separation of Sc-01 and Sc-02.
- The singles count for both the scintillators are also measured in each set of readings. No such remarkable variations in singles count have been observed.

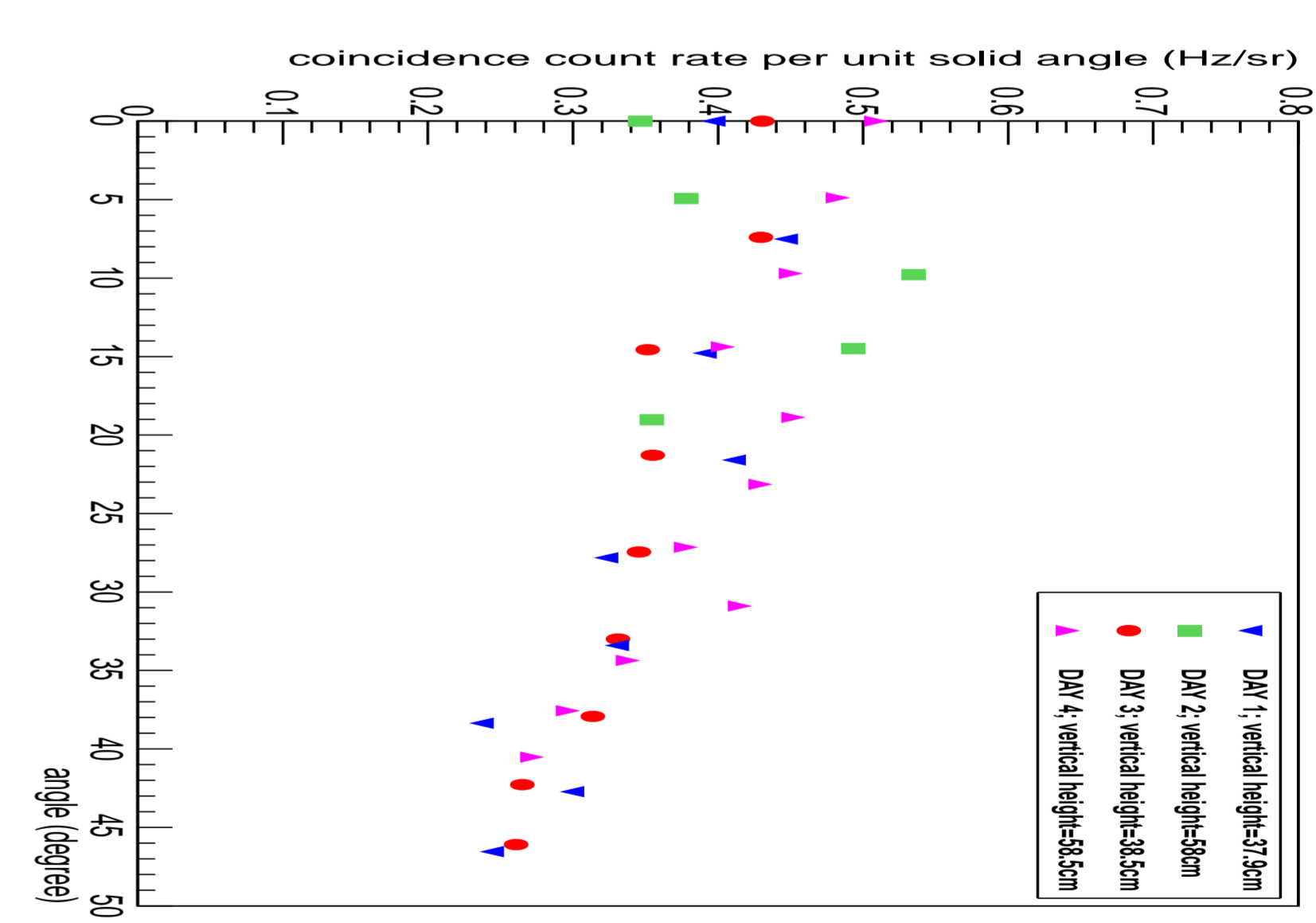
Results



Count rate as a function of applied voltage for Sc-01



Uniformity of count rate with Co^{60} for Sc-01



Coincidence count rate per unit solid angle vs angle

Summary and outlooks

One plastic scintillator paddle and one finger detector are fabricated (mainly for cosmic ray trigger). The count rates are measured for both the detectors with cosmic, Co^{60} , Cs^{137} and Na^{22} sources. The angular variation of cosmic ray is measured with the coincidence technique. The same measurement with two finger scintillators is in future plan.

Acknowledgements

We would like to thank Prof. Sibaji Raha, Prof. Sanjay K. Ghosh, Dr. Rajarshi Ray and Dr. Sidharth K. Prasad for their valuable suggestion and discussions during the course of the study. We would also like to thank Mr. Aritra Mondal of Department of Physics, University of Calcutta for his help in the study. We are thankful to Bose Institute workshop for all the mechanical work to build the light guide, coupler. Finally we are thankful to GSI detector laboratory, Germany for providing the optical glue, grease etc. used to build the detector.