T473: Beam-test of a CsI calorimeter, GEANT4 and KONOE and education of novice graduate students

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1 Purpose

1. Beam test of a calorimeter made of CsI(pure), which is going to be used in KEK-PS/E391a!J$K_L \to \pi^0\nu\overline{\nu}$!K experiment, to test/measure
   - calibration method
   - energy resolution for electrons including position dependence
   - shower sharing effect
   - longitudinal development of the shower
   - response to hadrons
   - timing resolution and gate time effect etc.
2. Education of novice graduate students especially working mainly on very specialized experimental field or software work in big collaborations.
3. First application of KONOE-based DAQ system on a real experiment.; KONOE = toolKit for Object-oriented Network-distributed Online Environment
4. Performance check of GEANT4 simulator by comparing with real data.

2 Method

1. Beam-line and Setup: The beam-line was KEK-PS π2-beam line, where the maximum available momentum was 4GeV/c. The experimental setup is shown in Fig. 1. Two sets of gas(N_2) Cherenkov counters were used for electron triggering. A pair of beam counters, S_1 and S_3 were used for the time of flight measurement. The counter S_4 is a small, 1cm$\times$1cm, beam defining counter, which is placed just in front of the calorimeter. The counter S_5 was used to identify penetrating particles. The counters S_6 and S_7 are used for tagging muons together with a couple of iron filter of 40cm thick.

[width=1.0]setup.eps

Figure 1: Seup of T473 Experiment

2. Detector: The detector, of which the characteristics was to be measured in this beam-test, is consisted of 5$\times$5 blocks of pure CsI scintillator as shown in Fig. 2. Each block has a dimension of 7cm$\times$7cm$\times$30cm. This calorimeter is planed to be used in the KEK-PS E391a, where a CP violating mode of $K_L \to \pi^0\nu\overline{\nu}$ is going to be measured. The calorimeter was surrounded by copper walls which were cooled by chilled water.

[width=1.0]T473Cal.eps

Figure 2: CsI(pure) Calorimeter of T473 Experiment

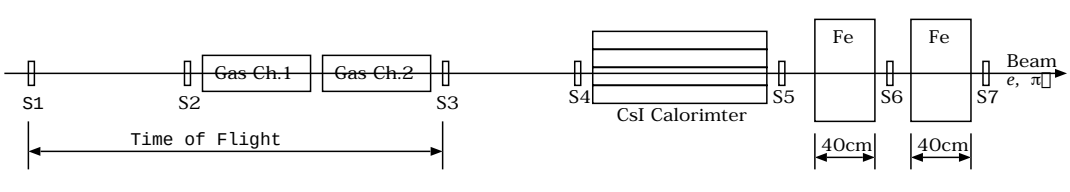
3. Data acquisition system: The data acquisition system is another feature of this experiment. KONOE is a project to prepare a toolkit set for data acquisition and/or analysis programs in object-oriented and network-distributed environment. T473 was the first place where a KONOE-based DAQ program was used in a real experiment.

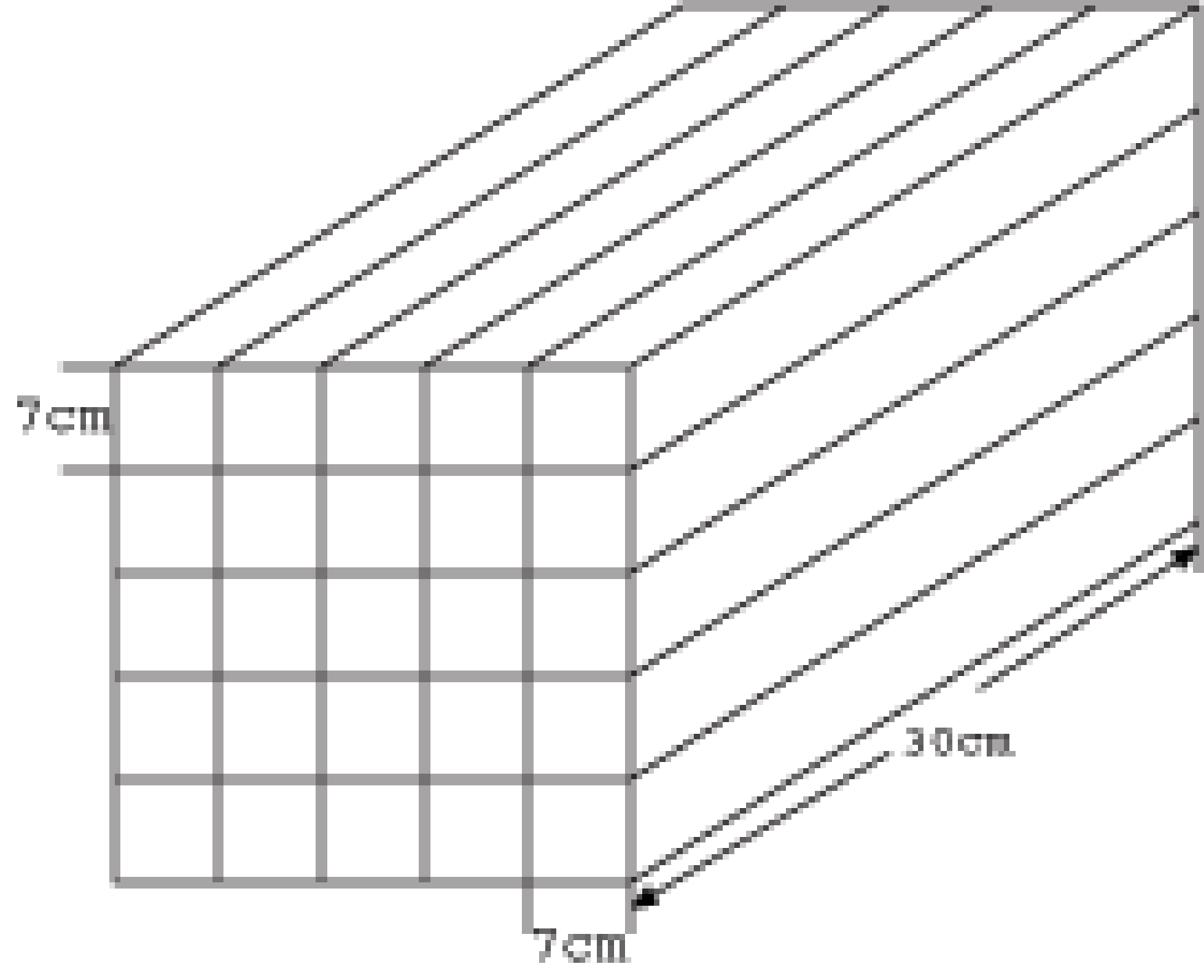
3 Result and present status

1. Many, 16, young students from Saga Univ., Hiroshima I.T., Okayama Univ. and Niigata Univ. participated in the experiments, for many of whom this was the first experiment in which they are a part of core members. We believe this experiment was an extremely valuable chance for them.

2. The experiment was performed with no serious problems.

3. The data acquisition system based on KONOE worked reasonably well with no serious problems, though the experience in this experiment suggested us some important improvements to be made. The summary of the KONOE-DAQ was reported by K. Uchida in the JPS meeting, March 2001, Tokyo.


Gas Ch.1
Gas Ch.2
Fe
Fe
Beam
e, π
S1
S2
S3
S4
S5
S6
S7
CsI Calorimter
Time of Flight
40cm
40cm


7cm
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