π^- detection system for the study of the $pn \rightarrow p\Lambda$ reaction

S.Minami[a], S.Ajimura[a], T.Fukuda[b], H.Hayakawa[a], T.Hayakawa[a], W.Imoto[c], T.Itabashi[a], T.Kanie[a], H.Khori[a], T.Kishimoto[a], K.Matsuoka[a], Y.S.Miyake[a], T.Mori[a], K.Morikubo[a], T.Nagao[a], H.Noumi[d], T.Numata[a], T.Ogaito[e], P.K.Saha[b], A.Sakaguchi[a], M.Sekimoto[d], Y.Shimizu[a], M.Sumihama[a], K.Tamura[e], K.Wakae[a]

[a] *Osaka University,* [b] *Osaka Electro-Communication University,* [c] *Tokyo University of Science,* [d] *High Energy Accelerator Research Organization,* [e] *Fukui Medical University*

The experiment to study $pn \rightarrow p\Lambda$ reaction is under progress[1]. It is inverse reaction of the nonmesonic weak decay of Λ hypernuclei(NM-decay), which is so far only tool to investigate weak hyperon-nucleon(Y-N) interaction. To obtain information of two-body Y-N interaction, the NM-decay is some extent indirect, because it takes place in nuclei. The result is affected by ambiguity of estimation of the final state interaction and the multi-nucleon process. The study of $pn \rightarrow p\Lambda$ reaction give us direct two-body information. And also $pn \rightarrow p\Lambda$ reaction suits the study of spin dependent observables because high polarization is available to initial proton beam and final Λ polarization can be derived from asymmetric emission of decayed particles. In the first stage of the experiment, we are aimed to obtain its cross section, which is estimated to be $10^{-39} \sim 10^{-40} cm^2$ [2-5]. The experiment will be performed at the Research Center for Nuclear Physics (RCNP), Osaka University, using a 400MeV proton beam, where no other process produces Λ. Rare process has to be measured under huge backgrounds caused by strong interaction, it is essential to select Λ event efficiently by trigger system.

The schematic drawing of the detector system is shown in Fig.1. The trigger system consist of inner and outer trigger counters. In order to shield out protons scattered from a target directly into detectors, a heavy-metal collimator is placed. Despite of it, there expected to be still too many backgrounds to make a trigger by two coincident signals of inner and outer trigger counters. Backgrounds are mostly protons and neutrons produced by nuclear reaction in collimator, therefor the trigger system is designed to be sensitive only to negative charged particle which momentum is the same region with that of Λ decayed π^-s. With magnetic field, positive charged particles like protons hit only one or two segments of outer trigger counter, while π^-s from Λ decay hit three segments, as shown in Fig 1. We performed experiment to test the trigger system and confirmed its ability to select π^-s.

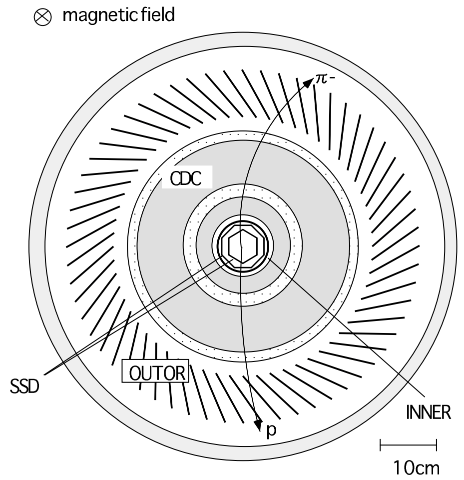

Figure 1: schematic layout of the detector system (beam view).

References

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