【Grant-in-Aid for Specially Promoted Research】
Science and Engineering (Mathematics/Physics)

Title of Project : A global research and development program of a state-of-the-art detector system for ILC

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Research Area : Experimental Particle Physics

Keyword : Experimental Particle Physics, Advanced Detectors, Computational Physics

【Purpose and Background of the Research】

The proposed international linear collider (ILC) has far superior sensitivity for physics within its energy reach than the LHC that will provide a glimpse into the Terascale. The resolutions required for detectors at the ILC far exceed those of the LHC detectors and the detector R&Ds for the ILC have been significantly raising the standard of the field in the recent past.

The objective of this program is to prepare the ILD detector technically and organizationally to be ready to be constructed when the scientific and political climate allows it to start. To do so, we will complete, in a timely manner, a detector design that is fully capable of realizing the physics potential of the ILC, and develop the necessary key detector elements focusing on vertexing, tracking, and calorimetry. We pursue this goal within international frameworks, closely working with international collaborators.

A project as large as the ILC cannot be realized without understanding and support of general public. Communicating the values of basic sciences such as the ILC with the public is also an important goal of this program.

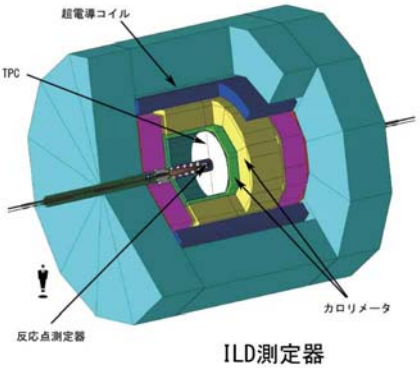
【Research Methods】

In order to achieve the required quark energy resolution, we employ the particle flow algorithm (PFA) where charged particles are measured by tracking devices while neutral particles measured by the calorimeters. In addition, the momentum and vertex resolutions also need to surpass the current state of the art.

The PFA is realized by calorimeters with number of channels that is greater than LHC by three orders of magnitude. The required momentum resolution is achieved by a time projection chamber (TPC) read out by GEM (Gas Electron Multiplier) where the mass of the device is reduced by factor 6 leading to momentum resolution that is factor of 10 smaller compared to the current standards of TPC. The necessary vertex resolution is provided by FPCCD (Fine Pixel CCD) whose pixel size is about 1/1000 of that at LHC.

【Expected Research Achievements and Scientific Significance】

We will realize a detector for ILC based on the PFA concept. The technologies developed for the purpose are novel ones that open new horizons for detectors in the field of high-energy physics. If a linear collider is to be built as planned, the results of this program will be fully utilized. In addition, these detector technologies are likely to become new standards in this field with many applications in nuclear physics, astronomy, biology, and medicine.



ILD測定器

【Publications Relevant to the Project】

[1] http://www.linearcollider.org/, ILC Reference Design Report vol.1-4 (2007):
[2] The International Large Detector (ILD) Letter of Intent, ILD group, http://www.ilcild.org/documents/ild-letter-of-intent/LOI.pdf
[3] “Construction and Commissioning of the CALICE Analog Hadron Calorimeter Prototype”, The CALICE collaboration, C. Adloff, et al., JINST 5 P05004 (2010).
[4] “CCD-based vertex detector for GLC”, Y. Sugimoto, et al., Nucl. Instrum. and Meth. A549: 87-92 (2005):
[5] “Study in a beam test of the resolution of a Micromegas TPC with standard readout pads”, The LCTPC Collaboration, D.C.Arogancia, et al., Nucl. Inst. And Meth. A602 403-414 (2009);

【Term of Project】 FY2011-2015

【Budget Allocation】 428,300 Thousand Yen

【 Homepage Address and Other Contact Information】

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