Overview of Kibo experiment candidates for around 2012

1. Experiment Title

The establishment of dosimetric system in the International Space Station (ISS) using Position Sensitive Tissue Equivalent Proportional Chamber (PS-TEPC)

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3. Outline of Experiment

Radiation effects on the human body are evaluated using the dose equivalent H (Sv), which is defined as the product of the absorbed dose D (Gy) and the quality factor Q given as a function of linear energy transfer (LET). In space, there exist many kinds of radiation, such as galactic cosmic rays (GCR), geomagnetic trapped particles, solar energetic particles (SEP), and their secondary particles. Workers in space (e.g., astronauts) always face the risk of intense radiation exposure. The dose in space reaches up to 1mSv per day, which is compatible to that received in a year on the ground. The main components contributing to the dose in space are primary charged particles (protons and heavy ions) and secondary neutrons produced by the interaction between cosmic radiation and the spacecraft materials. Since the LET of these radiations is widely distributed, the direct measurement of the LET is essential for evaluating H in space. The standard space dosimeter has been the Tissue Equivalent Proportional Counter (TEPC), which is a simple gas counter made of tissue-equivalent materials. In TEPC, the lineal energy is measured instead of LET since no position information is given. Obviously, the lineal energy does not represent LET accurately. The dose obtained using TEPC is reported to be inconsistent with those measured with real LET spectrometers.

We have developed a new dosimeter, the Position Sensitive Tissue Equivalent Chamber (PS-TEPC), which is based on a time projection chamber (TPC) using a Micro Pixel Chamber (μ-PIC) as a two-dimensional position-sensitive detector. An ideal space dosimeter should have the following properties: (1) position sensitivity, (2) construction with tissue-equivalent materials, (3) neutron sensitivity, (4) LET measurements in a wide range from 0.2 to 1000keV/μm, and (5) a wide detection view (~4π). PS-TEPC was designed as a dosimeter having these properties, in which LET and the absorbed energy of a particle can be measured simultaneously, event by event, in real time. Our goal in this study is to complete the final form of PS-TEPC used in space, to demonstrate its performance as an ideal real-time space dosimeter by operating it in the International Space Station (ISS), and finally to establish a dosimetric system in space using PS-TEPC.