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Status of the DCBA Experiment

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Momentum analyzers called DCBA (Drift Chamber Beta-ray Analyzer) are being developed at KEK in order to study neutrinoless double-beta decay. DCBA consists of drift chambers interleaving thin decay-source plates and a solenoid magnet serving a uniform magnetic field. The momentum of individual beta-ray is measured from the helical track reconstructed in three dimension. Then its kinetic energy is calculable. As for backgrounds, pair creation events are easily rejected by electric charges in the magnetic field. Alpha particles have so large momenta that they don't make helical tracks. Since the vertex point of a double beta-decay event is clearly identified, a single electron track is easily eliminated, and double Compton scatterings are also identified. A prototype called DCBA-T2 had been operated, and the energy resolution of about 150 keV (FWHM) was obtained for 976 keV electrons, which were the internal conversion electrons from Bi-207. The DCBA-T2 has been in engineering run using natural Mo plates of 45 mg/cm2 thickness to check comprehensive capabilities. New prototype DCBA-T3 is now under construction to improve the energy resolution and to increase the source amount accommodated in drift chambers. The main different points from DCBA-T2 are the pitches of signal wires, which are changed from 6 mm to 3 mm, and the strength of magnetic field, which is done from 0.8 kG to 3 kG maximum. In order to improve the energy resolution with the reduction of the multiple scattering of electron in chamber gas, a stronger magnetic field is produced by a super-conducting solenoid. It makes the helical track radius smaller, and then smaller pitches of signal wires are required to obtain enough sampling point data on the helical track. A detector module temporarily named Magnetic Tracking Detector (MTD) has been designed on the basis of DCBA in order to search for Majorana neutrino mass down to 50 meV. Status of DCBA-T2 and T3 will be presented together with the future project of MTD.