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Compact AMS at PKU - 20 years' progress in instrumentation and application

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A compact AMS was installed at Peking University in September 2004. The instrument was the fourth of newly developed low energy compact Pelletron model 1.5SDH AMS manufactured by the National Electrostatics Corp. Here we reflect major instrumental improvements and applications associated with the instrument over the past 20 years. The 500kV compact AMS was upgraded for 10Be measurements in two phases. The first phase involved installation of a silicon nitride foil in front of the electrostatic deflector near the focal plane of 10Be as passive boron degrader and replacement of the Si detector originally for radiocarbon detection at the end of the beam line with a high-resolution ΔE-Eres gas ionization chamber, allowing for 10Be identification. In the second phase, a 90-bending magnet with 350 mm radius was added after the electrostatic deflector for the re-focusing of the 10Be ions. The gas detector for 10Be was mounted after the additional magnet. The upgraded spectrometer remains compact and requires no more space than the original instrument. The new system allows quick shifts for 10Be set-up without affecting any parameters for radiocarbon measurements. An overall transmission of 5-6% for 10Be was achieved with the 10Be/9Be background level down to 2.4x10-15. Recently, a control system including MBS system controller, PPCI, PXI chassis and ACT chassis was installed to replace the original CAMAC-based system, providing assurance for the compact AMS to make high quality measurements in many years ahead. The instrumental upgrade was accompanied by the improvement in sample preparation. The hydrogen method line was rebuilt with increased output capacity and remains dedicated to dating applications. A new line using sealed tube zinc reduction method was set up for geoscience applications and a special line for bio and medical applications was constructed. As for applications, PKU AMS remains to serve as a most trusted dating facility for Chinese archaeology and Quaternary communities, contributing to the fields of human evolution, origins of agriculture, origins of Chinese civilization and Paleolithic archaeology as well as Quaternary paleoclimate changes. Over the last 20 years, PKU compact AMS has also facilitated exciting integration of AMS applications into Earth system science. This was started with the use of 14C in estimating afforestation soil turnover, fossil fuel derived CO2 in the air and in the carbonaceous aerosols, then followed by a large-scale investigation of the full-depth seawater 14C in the South China Sea, Indian Ocean and the NW Pacific. Other applications supported by the compact AMS are found in the field from the environmental monitoring of nuclear power plant facilities to the development of innovative drugs.

Student Submission

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