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Simulation of ^{41}Ca Detection with PHITS

○Lezhi Wang [1], Yasuto Miyake [2], Takeyasu Yamagata [3], and Hiroyuki Matsuzaki[1,3]

The Univ. of Tokyo [1], RIKEN Nishina Center [2], Univ. Museum, The Univ. of Tokyo [3]

Short Abstract: Long lived radioactive isotope ^{41}Ca (1.02E+05 years) is suggested to be a good tool for dating Pleistocene samples. To develop a ^{41}Ca detecting system in our lab, simulation system for the ionization chamber is needed. With PHITS (Particle and Heavy Ion Transport code System), a beam simulation software using the Monte Carlo method, I successfully finished the simulation of the gas ionization chamber, however, to detect ^{41}Ca, a gas filled magnet is also necessary. Considering calibration of simulation system, before accomplishment of the gas filled magnet simulation, I will simulate ^{10}Be/^{10}B spectrum which doesn't need gas filled magnet first and then simulate ^{36}Cl/^{36}S spectrum which also needs gas filled magnet after building the gas filled magnet simulation system, compare both spectrums with real ones in MALT, and finally design the ideal detection configuration for ^{41}Ca.

Keywords: ^{41}Ca, AMS, Simulation, PHITS

Long lived radioactive isotope ^{41}Ca (1.02E+05 years) is suggested to be a good tool for dating Pleistocene samples, which is formed about 2.6 million to 11.7 thousand years ago. Due to the extraordinary low ^{41}Ca concentrations in such samples, it cannot be detected by traditional methods like decay counting, instead, AMS (Accelerator Mass Spectrometre) is a good choice because of its ability in detecting rare isotopes. Among all AMS components, gas ionization chamber is basically one of the most important--the detector is placed inside this chamber. To develop a ^{41}Ca detecting system in our lab, simulation system for the ionization chamber is needed. With PHITS (Particle and Heavy Ion Transport code System), a beam simulation software using the Monte Carlo method, which is developed by JAEA, RIST and KEK, I try to program the ionization chamber in PC and so far successfully finished the simulation of the gas ionization chamber, well simulated the geometry of the inside chamber, plate, foil and so on. However, to detect ^{41}Ca, to differentiate ^{41}Ca and ^{41}K, a gas-filled magnet is indispensable. At the same time, considering calibration of simulation system, before accomplishment of the gas-filled magnet simulation, I will simulate ^{10}Be/^{10}B spectrum which doesn't need gas filled magnet first and then simulate ^{36}Cl/^{36}S spectrum which also needs gas filled magnet after building the gas filled magnet simulation system, compare both spectrums with real ones in MALT, and finally design the ideal detection configuration for ^{41}Ca.

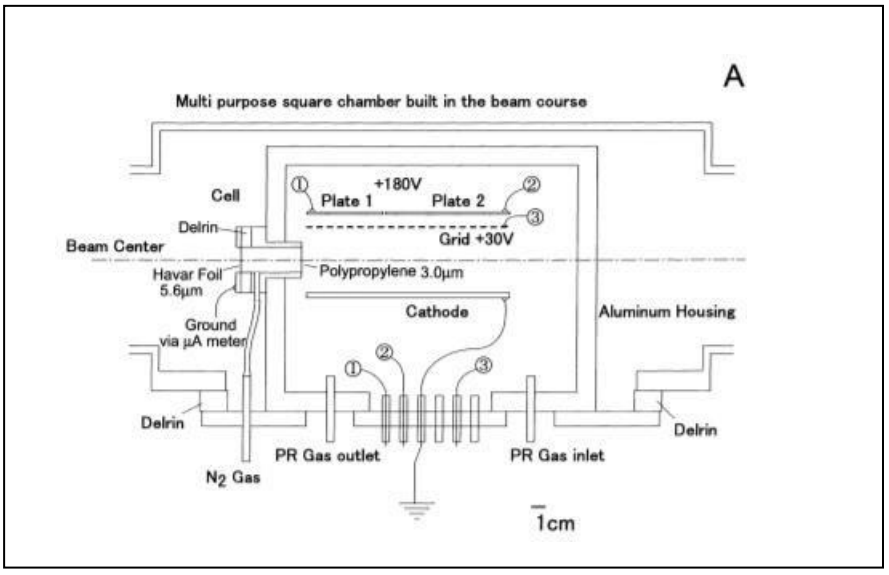

Fig1. Simplified layout of the gas ionization chamber

Reference

1) Hiroyuki Matsuzaki *et al.*, Development of a gas counter for AMS measurement of ^{10}Be and ^{26}Al of cosmic spherules., Nucl. Instr and Meth. B 172 (2000) 218-223.