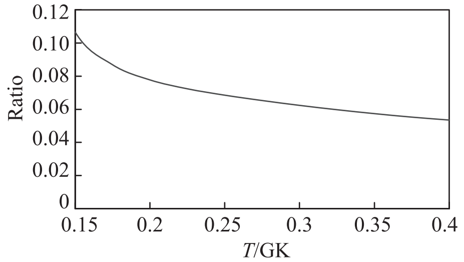

Fig. 2 The ratio of ^{134}C β-decay rate obtained by shell model to Takahashi's.

The impact on nucleosynthesis with new decay rates are investigated by NucNet code[5]with classical s-process calculation[6]. The abundance of Ba isotope with various ^{134}Cs decay rates are shown in Table 1. Note that the value is relative to solar abundance[7] and normalized to ^{136}Ba. With shell model rates, higher temperature (T=0.35 GK) scenario for s-process is preferred according to ^{134}Ba/^{136}Ba ratio. The more detailed study of ^{134}Cs β-decay rate and its impact on nucleosynthesis will be performed in the near future.

Table 1 Relative abundances with various ^{134}Cs β-decay rates.

		Ba-134	Ba-136
T=0.35 GK	Takahashi	1.16	1.00
	SM	0.99	1.00
T=0.17 GK	Takahashi	1.10	1.00
	SM	0.50	1.00

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2 - 12 Geant4 Simulation for the ^{14}O(α, p)^{17}F Measurement Using Time Projection Chamber (TPC)

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Type I X-ray bursts are the most frequent thermonuclear explosions in nature, resulting from thermonuclear runaway on the surface of an accreting neutron star[1]. The breakout reaction ^{14}O(α, p)^{17}F from the hot CNO cycle may have a prominent impact on the burst light curve and burst ashes[2]. However, insufficient experimental information is available to calculate a reliable, precise rate for this reaction[3]. We proposed to address the experimental investigation of the ^{14}O(α, p)^{17}F using Time Projection Chamber (TPC)[4].

The TPC operates with mixed gases of ^{4}He and CO_2. ^{4}He gas acts both as target and counter gas. The three-dimensional trajectories and the energy loss of the beam particle and the ejected charged particles from the reaction can be measured event by event, which makes it possible to identify the true reaction event. The energy-loss process of the beam particle is utilized to scan the center-of-mass energy to deduce the excitation function without changing the secondary beam energy. Emitted proton can be detected by the surrounding $\Delta E-E$ silicon telescope array.

A Geant4[5] simulation was performed to get the optimal condition for the ^{14}O(α, p)^{17}F measurement. A ^{14}O beam with an energy of 21 MeV was simulated to impinge on the mixture gas of 95% ^{4}He and 5% CO_2. The target gas at 200 torr pressure is confined in a chamber with an entrance window of 2.5-μm-thick Havar foil. The recoiling protons produced by ^{14}O(α, p)^{17}F were traced by the TPC and stopped in the Si telescope. A rectangle structure (8×5 mm) was chosen for the read-out pads, in order to reconstruct the projected trajectory. Once the trajectory is known, the angle of the out-going protons in the laboratory system are able to calculate and be compare with their corresponding "real" values given by Geant4. Then we are able to analyze the angular resolution of the TPC for a given gas, gas pressure, and pad information. Similarly, the position resolution can also be obtained by comparing the reconstructed reaction vertex Z-value with its "real" Geant4 value. Fig. 1 shows the Geant4 simulated results. Compared to the traditional thick-target method, the ^{14}O(α, p)^{17}F measurement with TPC can determine the reaction point with smaller uncertainty and distinguish the inelastic scattering protons clearly. A more realistic and considerate simulation is still in progress.

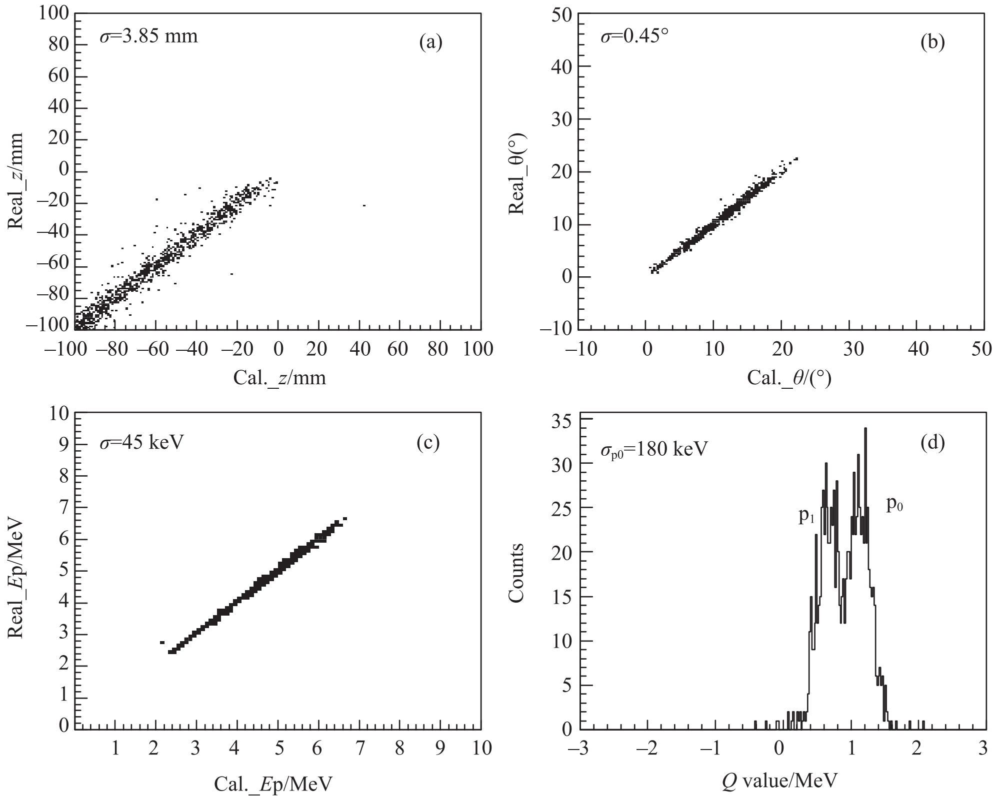

Fig. 1 Geant4 simulation results of the ^{14}O(α,p)^{17}F reaction. The "Real_" represents the values given by Geant4 and the "Cal._" indicates the reconstructed values. (a) reaction position resolution, (b) angular resolution, (c) proton energy resolution, (d) Q value spectrum. The sigma values are indicated in the figures respectively. The p_0 and p_1 peaks in (d) are the protons deexciting to the ground and 1^{st} excited state of ^{17}F.

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2 - 13 New Solution to Cosmological Lithium Problem

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In the Big Bang theory, primordial nucleosynthesis was finished during first half hour of the universe's existence. This process yielded the main light elements including hydrogen, deuterium, helium and lithium. The theoretical predictions match very well the observed deuterium and helium abundance, but the ^{7}Li abundance is overpredicted by a factor a three[1]. This inconsistency is called "cosmological lithium problem". In the past decade, many attempts to solve this problem using conventional astrophysics and nuclear physics failed. Recently, we proposed a new solution to lithium problem by introducing non-extensive statistics into Big Bang nucleosynthesis[2].

It is well known that astrophysical reaction rate is derived by the convolution between the energy dependent reaction cross section and the Maxwell-Boltzmann distribution of the interacting particles[3]. Motivated by non-extensive statistics has been applied in a host of different fields, including physics, astronomy, biology and economics[4]. Here, we use non-extensive distribution to describe particle's velocity distribution in primordial plasma instead of clas-