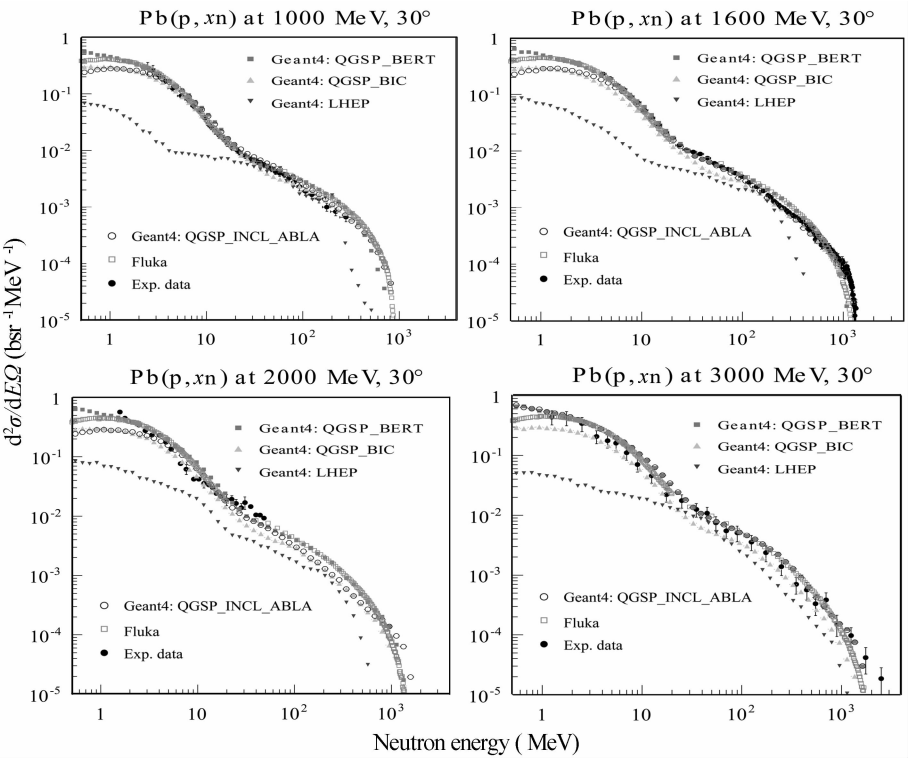

Fig. 2 Neutron-production double differential cross sections for 1, 1.6, 2 and 3 GeV proton on Pb.

References

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[2] Geant4 Reference Manual, available from http://cern.ch/geant4.
[3] Zhang Suyalatu, et al., IMP & HIRFL Annual Report, (2011)57.

2 - 26 Simulation of Neutron-production Double Differential Cross Sections on Bi Target Bombarded with Energy Range Up to 3 GeV Protons

Zhang Suyalatu, Chen Zhiqiang, Han Rui, Liu Xingquan, Lin Weiping
Jin Zengxue, Liu Jianli and Shi Fudong

In recent years, the wide range applicationsof ADS in many fields[1], such as energy production, condensed matter physics, neutron sources for material irradiation, neutron scattering science, arouse worldwide range interest again. USA, Japan, Korea, Russia, Europe, et al. have developed ADS project[2] for their needs and are underway vigorously.

China has started to design ADS project[3] with according the situation of China sustainable development of nuclear energy from the end of last century. After many years of research and analysis, Chinese Academy of Sciences launched the ADS project at the 2011. This project mainly applied to high radioactive nuclear waste transmutation, nuclear fuel generation and clean energy production, etc.

Prophase research of ADS shows that there are many significant advantages use Pb-Bi as liquid spallation target[2, 4]. For the design of liquid Pb-Bi target of the ADS, nuclear data in the energy region up to a few GeV are required. These data mainly include the neutron production cross section, neutron production yield, neutron energy spectrum and angular distributiondata[2,5], etc. Monte Carlo simulations play

very important role in evaluating these nuclear data related to neutron. Naturally, this reliance on simulation alone must be accompanied by validation of the codes against other experimental data, and by comparison between different packages.

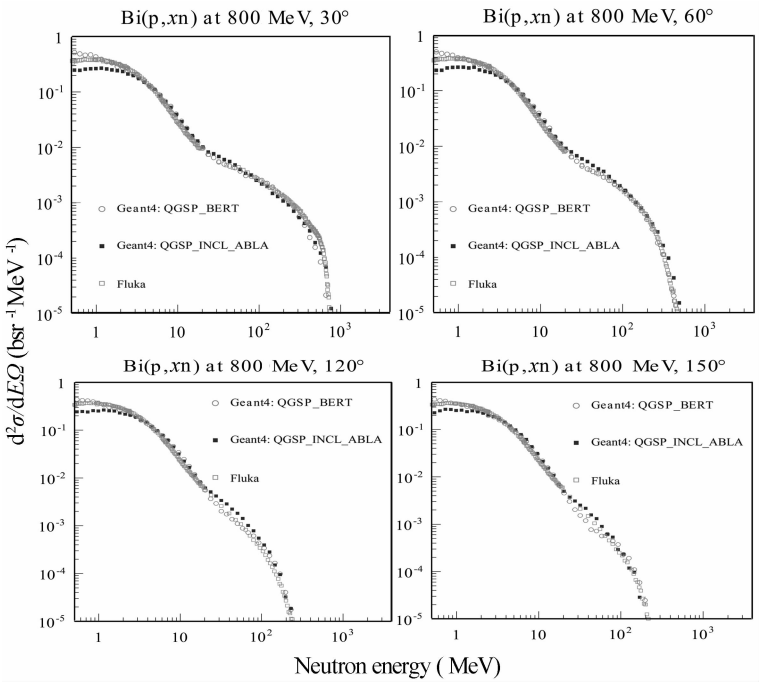

Fig. 1 Neutron-production double differential cross sections for 800 MeV proton on Bi.

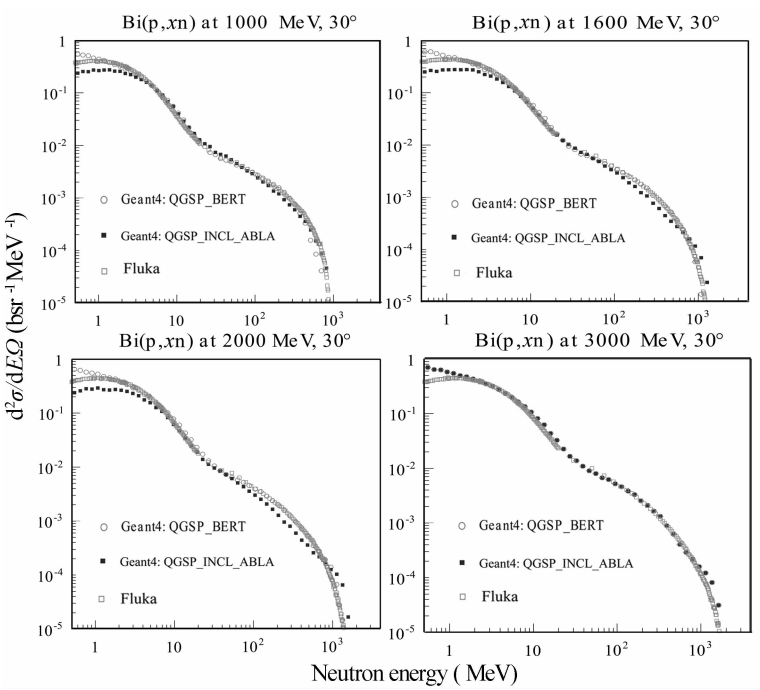

Fig. 2 Neutron-production double differential cross sections for 1, 1.6, 2 and 3 GeV proton on Bi.

We have used GEANT4[6] and FLUKA[7] Monte Carlo simulation packages to simulate neutron-production double differential cross sections for Pbtarget at incident proton kinetic energies between 113 MeV and 3 GeV[8]. The accuracy GEANT4 and FLUKA simulation codes were obtained by comparison study of the simulation results and experimental data. In this work, we simulate neutron production double differ-

ential cross sections for Bi target materials and incident proton kinetic energies between 800 MeV and 3 GeV, using validated GEANT4 and FLUKA simulation codes. The overall agreement of Geant4 results with Fluka results had been obtained. As shown in Figs. 1 and 2.

There were no available experimental data of neutron production double differential cross sections for Bi target materials and incident proton kinetic energies between 800 MeV and 3 GeV. However, the present results provide very important nuclear data for the design of liquid Pb-Bi target of the ADS project.

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2 - 27 Primary Fragments Reconstruction

Lin Weiping, Liu Xingquan, Zhang Suyalatu, Huang Meirong, Liu Jianli, Shi Fudong, Han Rui
Jin Zengxue, Ren Peipei, Jia Baolu, Zhao Minghui, Chen Zhiqiang and R. Wada

In order to reconstruct the primary fragment distribution experimentally, a fragment-particle correlation technique based upona kinematical focusing method was used to detecting the light particles (LPs) associated with intermediate mass trigger fragments (IMFs). The experiment was performed at the K-500 superconducting cyclotron facility at Texas A&M University. ^{64,70}Zn and ^{64}Ni beams were used to irradiate ^{58,64}Ni, ^{112,124}Sn, ^{197}Au, and ^{232}Th targets at 40 *A*MeV. The detector setup is same asthat in references[1-7].

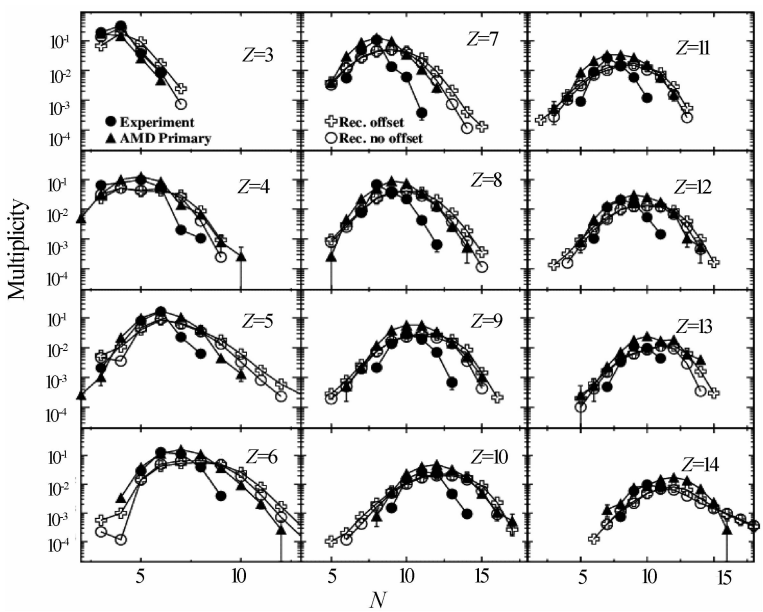

Fig. 1 The isotopic distribution of reconstructed primary with(✣) and without(○) AMD offset, experimental (●) as well as the AMD primary (▲) fragments as a function of fragments mass number *N*.

By kinematical focusing, the LPs associated with the triggered IMF are observed as an excess in their velocity or energy spectra above the yields of uncorrelated LPs. To determine the multiplicities of LPs asso-