Commissioning Run For Laval "Heracles" Array

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The Laval "Heracles" Multidetection Array [1,2] has been moved from TASCC in Chalk River and installed at the Cyclotron Institute. Its main features are the determination of the Z of the projectile-like fragment and isotopic resolution of light charged particles. With the addition of several silicon detector telescopes, the array can also achieve isotopic resolution of intermediate-mass fragments. Heracles consists of a hundred detectors in seven concentric rings covering almost 100 percent of the solid angle from 6.8° to 46.8°. Four of the five inner rings are each composed of sixteen plastic phoswich detectors which cover from 3.3° to 24°. The innermost ring has four phoswich detectors covering from 1.8° to 3.3°. The two outermost rings have sixteen CsI(Tl) detectors each and cover angles from 24° to 46.8°. A Correlation Array, mounted with a double sided silicon strip detector has been added at forward angles replacing four phoswich detectors between 10° and 24°. The detector in this array has sixteen strips in the x direction and also has sixteen strips in the y direction. This 16x16 position sensitive transmission array is mounted in front of 32 plastic scintillators viewed by a position-sensitive photomultiplier tube.

Two Si-Si-CsI(Tl) triple telescopes were also added to provide fragment isotopic resolution at angles from 55.1° to 71.9° while two additional quadrant Si-Si detector pairs were mounted in front of two of the outermost CsI detectors and cover 34.6° to 46.8°. An additional quadrant-Si-CsI telescope was positioned at backward angles to provide sensitivity in the angular range from 118.2° to 151.8°. In addition, a surface-barrier silicon detector was placed in front of one detector from each of three phoswich forward-angle rings between 6.8° and 24° in order to provide isotopic information over a wider range of emission angle.

This array was installed and tested using beams from the K500 cyclotron during the summer of 1998. An experiment was performed using this augmented array in March 1999. The physics objective of this experiment was to investigate projectile-fragmentation and mid-rapidity emission in systems with large entrance-channel isospin

asymmetries. The study of such systems can provide new information on the dynamical processes involved in nuclear reactions at intermediate energies. In this experiment, beams of ^{64}Ni and ^{58}Ni at 40 MeV/nucleon provided by the Cyclotron Institute's K500 cyclotron impinged on a ^{64}Zn target located in front of the detector array. Additionally, the ^{58}Ni beam was used with a ^{70}Zn target and a ^{70}Zn beam was used with both Ni targets to complete the study in reverse kinematics. An energy calibration has been performed by using secondary particles produced by a ^{19}F beam on thick upstream targets and by ^{228}Th and ^{230}Th sources. Events with at least three fragments detected in the forward array were accepted and recorded on magnetic tape using the Midas acquisition system [3]. The multiplicity distributions and isotopic composition of the detected fragments will be analyzed in order to study the processes driving the fragmentation and emission in these reactions.

Reference:

1. Pruneau, *et al.*, Nucl. Instr. and Meth. in Phys. Res. A 297 (1990) 404.

2. Larochelle, *et al.*, Nucl. Instru. and Meth. in Phys. Res. A 348 (1994) 167.

3. http://midas.psi.ch/