The Texas-Edinburgh-Catania silicon array (TECSA): a status report

M. McCleskey, B. T. Roeder, L. Trache, A. Banu, S. Cherubini,[1] T. Davinson,[2] V. Goldberg, C. Spitaleri,[2] R. E. Tribble, and P. J. Woods[2]

[1]*INFN Laboratori Nazionali del Sud & DMFCI Università di Catania, 95123 Catania, Italy.*

[2]*School of Physics and Astronomy, University of Edinburgh, Edinburgh EH9 3JZ, United Kingdom.*

The Texas A&M-Edinburgh-Catania Silicon detector Array (TECSA) is a collaborative effort to build a high-efficiency detector array for reactions involving radioactive ion beams produced in MARS or by the facility upgrade at Texas A&M. The array consists of up to 16 Micron Semiconductor YY1-300 detectors with 8 detectors being used to measure position and energy loss and the other 8 behind in close geometry to measure the residual energy. Each detector has 16 annular ring sectors and is about 300 um thick. TECSA will be useful for measuring reactions of interest for nuclear astrophysics.

In the last year much progress has been made in preparation for the commissioning run with TECSA on MARS, scheduled for May 2010. Two new chambers have been built, one to house the target (henceforth to be referred to as the "TECSA target chamber") and a second for the detector array itself (the "detector chamber"). The new chambers are designed such that they may be bolted to the existing MARS target chamber in either a backwards scattering or forward scattering configuration. The targets are on a holder with a rotating, six position wheel to allow for up to five targets and one target detector. The target detector is a four corner [1] position sensitive detector from Micron, which allows for good position and energy resolution whilst minimizing the number of signals that must be processed. This target detector is in addition to the usual MARS target detector on which initial beam identification and tuning will be performed and will allow precise focusing of the secondary (radioactive) beam so as to minimize the beam spot size at the target and the associated degradation of the angular resolution. The target holder is on a precision linear motion track mounted to a plate in the detector chamber to allow reproducible control of the z-axis position of the target relative to the detector-as well as fixing the x and y position-and thus the angular range of the array.

The current MARS target chamber (Fig. 1) is electrically isolated from the beamline and is grounded to the clean power ground, which is shared by the electronics. The TECSA chambers are on this same ground and are in electrical contact with the MARS target chamber. Each of the detectors used for position and energy (the front 8) is connected to its preamplifier by a standard flat 34 conductor cable. Two 34 pin electrical vacuum feedthrough flanges are mounted on each of the four 6" diameter CF flanges on the detector chamber. Mounting each of the 34 pin feedthroughs on its own flange allows for easy swapping in the event of a vacuum leak in one of the connectors. The preamplifier boxes are mounted directly to these 34 pin feedthrough flanges to that the unamplified signals never have to pass outside shielding and thus to minimize noise pickup and so as to keep the length of the cables from the detectors to the preamplifiers as short as possible. Also on each of the 6" CF flanges on the detector chamber are four Lemo 00 coaxial feedthroughs to be used for the residual energy detectors, the TECSA target position detector and for any other electrical connections that are in the future desired such as, for instance, a thermistor for monitoring detector cooling. A provision for detector cooling has been made-

though not yet implemented- that consists of a set of extended copper detector mounts. A ¼" diameter copper tube may be soldered to these mounts, through which chilled water could be run. A QF25 flange is provided for the supply and return connections.

The electronics arrived from Edinburgh in May 2009. They have since been tested using a pulser and with sources. The setup is basically as follows: They consist of RAL-108 16 channel preamplifiers (one for each YY1-300 detector) whose output goes into RAL-109 shaper-amplifiers [2]. The RAL shaper-amplifiers have both an analog output which is converted by Mesytec VME ADCs and an ECL timing signal output. The ECL output is split between CAEN VME TDCs and an OR module which gives a NIM logic signal for an event in any of the detector strips. This OR signal is sent to a Phillips 756 logic unit where an OR condition is made for all of the strips in all of the detectors. This final OR is used in the master trigger and for the ADC gates. The ADC, TDC and scaler outputs are read using our in-house data acquisition system.

The first test run for TECSA is scheduled for May 2010 and will use a ^{14}C beam at 12MeV/nucleon on a CD_2 target to measure $^{14}C(d,p)^{15}C$ in inverse kinematics which will be analyzed to extract the ANC for $^{15}C_{gs}$ which is also being extracted from neutron transfer with heavy ions.

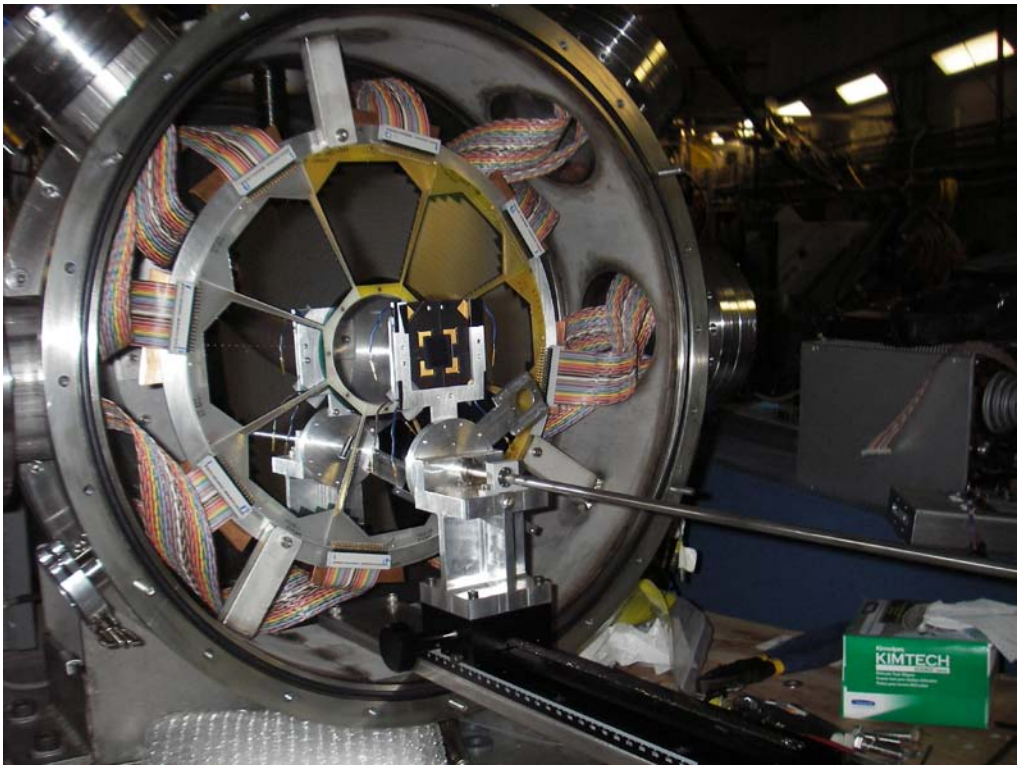

FIG. 1. TECSA with target chamber removed.

[1] A. Banu *et al.*, Nucl. Instrum. Methods Phys. Res. **A593**, 399 (2008).

[2] S.L. Thomas *et al.*, Nucl. Instrum. Methods Phys. Res. **A288**, 212 (1990).