to the radioactivity of scattered beam which is stopped inside the compact particle array. For more intense beams, however, the radioactivity of the scattered particles may cause an unacceptably high counting rate in the surrounding gamma-ray detectors (depending also on the probability of beta-delayed gamma-ray emission). In such cases, it will be necessary to allow the scattered beam to be removed from the region around the target so that it is further from the gamma-ray detectors. The division of the array into a barrel and separate annular detectors provides a natural division of scattering angles. The precise value of the division should take into account the kinematic focussing typically found in transfer reactions. For such reactions, when the forward laboratory angles contain the main part of the yield, a coverage of 30 to 40 degrees in the laboratory frame generally includes the most structured parts of the angular distributions. This angular range is approximately the maximum that can be spanned by a single silicon detector at a reasonable distance from the target. It is also sufficient to allow a suitable amount of scattered beam to escape to a greater distance (recalling that the Exogam array is designed to ensure only that the forward $22.5°$ escapes). For experiments that employ relatively intense radioactive beams (say, 10^8 to 10^9 pps), it could well prove necessary to remove the forward annular detector so as to avoid trapping radioactive beam particles too close to the gamma-ray array around the target. These experiments might be fusion-evaporation experiments or Coulomb excitation experiments, in which cases the barrel detectors are most important in terms of yield and the loss of the forward annulus can perhaps be tolerated. Alternatively, for a transfer reaction in these circumstances, the forward annulus could be retained if the primary beam were high enough in energy to punch through the thickness of silicon that substantially stops the light reaction products. Clearly, a number of possibilities present themselves when the forward annulus needs to be removed, including the provision of a larger area detector such as a PPAC at a greater distance from the target.

The design of the TIARA array will allow for the forward annulus to be moved along rails to larger distances from the target. There is also provision for a PPAC detector to be employed as an alternative. Thus, whilst the array is intended primarily for use with weaker beams, there are solutions built into the design to deal with radioactivity problems from more intense beams, should these problems arise for particular experiments.

2.3 Octagonal barrel of detectors around the target

The provisional design for the barrel around the target is shown in figs. 1 and 2. As shown in fig. 2, it envisages an octagonal box of silicon strip detectors with a length of 142 mm and with the width of each detector being 36mm. Each detector will have four resistive strips of width 9mm and length 140mm. The strips, which will run axially, will automatically offer measurement and pixellation of the azimuthal angle in 32 bins of approximately 11 degrees. The measurement of the position along the strip for scattered particles will be achieved by resistive division and should have a precision of better than 0.4 mm. This will give the scattering angle to better than one degree (limited by a 1 mm beam spot; better beam tracking would improve this by a factor of between 2 and 4). Resistive strip detectors of this general design have been used successfully by members of the TIARA team for over 8 years. Edge-connector technology which exists already will be able to deal with the extraction of the signals from both ends of the detectors via one end of their mounting board.

One side of the barrel has been sacrificed from the angular coverage in the present design. This is because it is necessary to be able to insert and change targets during the experiment. In view of the tight space constraints, a relatively simple plunger