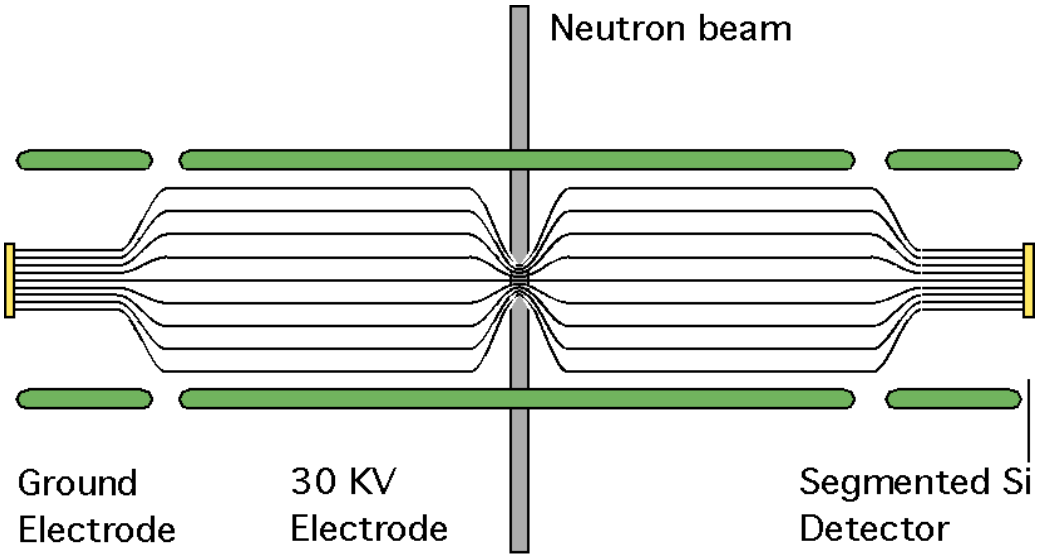
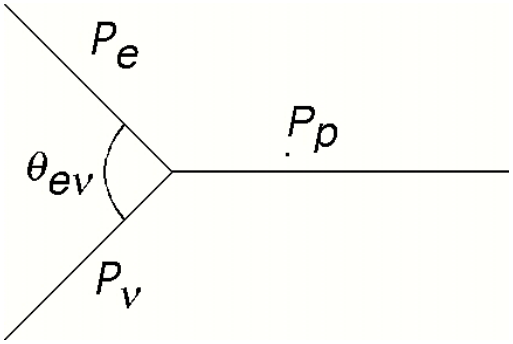
Measurement of the electron-neutrino correlation, a, in neutron beta decay

David Bowman (ORNL) for the Nab Collaboration

I describe a new approach to the measurement of the electron-neutrino directional correlation, a, in the decay of unpolarized neutrons. Even though the neutrino is not observed, the statistical uncertainty of the measurement is the same as would be obtained in a kinematically complete measurement.



The spectrometer operates on the magnetic-field-expansion principal where the magnetic guide field is expanded and the proton momentum vector is aligned with the guide field. The electron energy is measured and the difference between the proton and electron times of flight is measured in Si detectors.



P_e from T_e, P_ν from $T_e + P_\nu = Q$, and P_p from proton time of flight

$$P_p^2 = P_e^2 + 2P_eP_\nu Cos(\theta_{e\nu}) + P_\nu^2$$

The opening angle between the electron and neutrino is determined from momentum conservation. The event rate at SNS is 16 Hz/cc and a modest decay volume of 16 cc provides an event rate of 256 Hz. In the standard model, a depends only on Ga/Gv and a measurement of a and the neutron lifetime determine Gv.