# AbstractID: 8456 Title: Experimental Study of Neutron Dose Equivalent in a Proton Treatment Facility

**Purpose:**
To characterize neutron dose equivalent per proton Gray (H/D) as a function of proton energy, spread-out Bragg peak (SOBP) and aperture size at a clinical proton treatment facility using both active and passive neutron detection instruments, and to evaluate the performance of the instruments for a possible candidate for routine patient neutron exposure monitoring.
**Method and Materials:**
The H/D were measured at 2 locations near isocenter, namely in proton field but 2 cm out of range and approximately 20 cm out of field, with neutron instruments of various types. Two types of rem-meters were used, the REM-500, a tissue equivalent proportional counter and SWENDI-2, a wide energy (up to 5GeV) neutron probe. The passive detectors consist of Neutrak® 144 Fast, Intermediate and Thermal Neutron Dosimeters, an etched-track detector, and two flavors of bubble detector, BDS®, a spectrometer, and BD-PND®. The results from these instruments were compared for 200 MeV and 160 MeV beam configurations. REM-500 and Neutrak® were used to study the dependency of H/D on proton energy, SOBP and aperture size.
**Results:**
Various instruments had comparable H/D measurements at the out field location but varies more at the in field location. The H/D value increased linearly with proton energy, with a factor of ~6 from 100 MeV to 250 MeV for medium snout. The H/D value increased ~50% with increasing SOBP from 2 cm to the maximum of clinical allowed value and had a small decrease with aperture size.
**Conclusion:**
The measured results show H/D increases strongly with proton energy, moderately with SOBP, and has minimal dependence on aperture size. This is consistent with the simulation results. The Neutrak® etched-track detector is a good candidate for patient neutron exposure monitoring due to its small size, excellent dose range, good energy range and commercial support.