Abstract Submitted
for the DPP11 Meeting of
The American Physical Society

An accelerator-based in-situ surface diagnostic for plasma-wall interactions science on Alcator C-Mod[1] ZACH HARTWIG, DENNIS WHYTE, HAROLD BARNARD, BRANDON SORBOM, PETE STAHLE, MIT Plasma Science and Fusion Center — Boundary science in magnetic fusion devices is severely hindered by a dearth of in-situ diagnosis of plasma facing component (PFC) surfaces. The ideal in-situ PFC diagnostic would perform surface composition measurements on a plasma shot-to-shot time scale with 1 μm depth and 1 cm spatial resolution over large PFC areas. To this end, the customary laboratory surface diagnostic - nuclear scattering of MeV ions - is being adapted to the Alcator C-Mod tokamak. A compact ($\sim$1 m), high-current ($\sim$mA) radio-frequency quadrupole accelerator injects 0.9 MeV deuterons into the vacuum vessel. The deuterons are steered to PFC surfaces with tokamak magnetic fields in between plasma shots, where they induce high-Q nuclear reactions with low-Z isotopes in the first $\sim$10 μm of material. The induced gammas and neutrons are detected with scintillators, where energy spectroscopy provides quantitative surface analyses. Techniques to measure the thickness of low-Z PFC film coatings and profiles of retained hydrogenic fuel are presented along with simulated measurements by ACRONYM, a comprehensive Geant4 synthetic diagnostic.

[1]Supported by USDoE DE-FG02-94ER54235 and DEFC02- 99ER54512.

Zach Hartwig
MIT Plasma Science and Fusion Center

Date submitted: 13 Jul 2011

Electronic form version 1.4