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Charged Particle Radiography

In the past several years significant advances have been made in charged particle radiography both in the development of 800 MeV proton radiography and the research into the potential for Transmission High Energy Electron Radiograph (THEEM). A summary of this work will be presented.

800 MeV Proton Radiography Simulations

Significant effort at Los Alamos has been dedicated to the development of two models of the 800 MeV proton radiography at LANSCE in Los Alamos. One model is based on GEANT 4 and allows the study of the impact of particles that have scattered substantially or that are generated in the process of interacting with the object and imaging elements [1]. This tool has been used to study the details of proton radiography. A second model has been developed to study the imaging process of proton radiography. This model has been developed to follow the protons which are used to form the radiographic images and use high order beam optics to study the radiographic performance of lens systems as well as providing a platform for removing the aberrations introduced by the radiography system [2].

800 MeV Lens Systems

Various lens systems have also been investigated recently. Applications of proton radiography have required an increase in dose delivered to the object. This increase in dose has resulted in an increase in dose delivered to the lens systems, resulting in radiation damage to permanent magnet imaging systems. The higher than expected radiation damage has been understood and the improvements of radiation resistant permanent magnet material has been studied along with the introduction of replacement electromagnet systems [3].

THEEM

High energy electrons are an ideal probe for the study of fast processes in thin systems [4,5]. Most recently the capability of this process has been studied with 14 GeV electrons at the Stanford linear accelerator. These measurements have demonstrated the remarkable capabilities of this technique as well is identifying the challenges of utilizing ultra-relativistic particles as radiographic probes.

References

[1] Freeman, Matthew S., et al. "Inverse-collimated proton radiography for imaging thin materials." Review of Scientific Instruments 88.1 (2017): 013709.

[2] Sjue, S.K.L. , et al. "High order magnetic optics for high dynamic range proton radiography at a kinetic energy of 800 MeV." Review of Scientific Instruments 87.1 (2016): 015110.

[3] Danly, Christopher R., et al. "Nonuniform radiation damage in permanent magnet quadrupoles." Review of Scientific Instruments 85.8 (2014): 083305.

[4] Merrill, F. E., et al. "Multi-GeV electron radiography for measurements of fast dynamic systems." AIP Conference Proceedings. Vol. 1793. No. 1. AIP Publishing, 2017.

[5] Merrill, F. E. "Imaging with penetrating radiation for the study of small dynamic physical processes." Laser and Particle Beams 33.03 (2015): 425-431.

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