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Spatio-temporal measurements of stripper foil temperatures at 1.7 MW H⁻ beam power at the SNS

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We propose and demonstrate a time-resolved, two-dimensional temperature monitoring technique for nanocrystalline diamond stripper foils exposed to high-intensity hydrogen ion (H⁻) beams at the Spallation Neutron Source (SNS) accumulator ring which is independent of foil emissivity. The technique utilizes a two-color imaging pyrometer in the shortwave infrared (SWIR) spectral band to measure thermal radiation from stripper foils located 40 meters away from the measurement site. This work presents a unique optical design, optical calibration of the system using a high-temperature blackbody source, preliminary temperature measurement results from two stripper foils (new and used) under various H⁻ production beam conditions with average powers up to 1.7 MW and energy of 1.0 GeV. This technique can be utilized to understand the thermal behavior of charge strippers under high-intensity particle beams, providing crucial feedback to operations to control foil temperature and ensure foil lifetime.

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