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SRF cavity instability detection with machine learning at CEBAF

Tuesday 12 August 2025 15:10 (20 minutes)

During the operation of the Continuous Electron Beam Accelerator Facility (CEBAF), one or more unstable superconducting radio-frequency (SRF) cavities often cause beam loss trips while the unstable cavities themselves do not necessarily trip off. The present RF controls for the legacy cavities report at only 1 Hz, which is too slow to detectfast transient instabilities during these trip events. These challenges make the identification of an unstable cavity out of the hundreds installed at CEBAF a difficult and time-consuming task. To tackle these issues, a fast data acquisition system (DAQ) for the legacy SRF cavities has been developed, which records the sample at 5 kHz. An unsupervised learning framework has been developed to identify anomalous SRF cavity behavior. We will discuss the present status of the DAQ system and our framework, along with recent successes in detecting anomalous cavity behavior. Overall, our method offers a practical solution for identifying unstable SRF cavities, contributing to increased beam availability and machine reliability.

Please consider my poster for contributed oral presentation

No

Would you like to submit this poster in student poster session on Sunday (August 10th)

No

Footnotes

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I have read and accept the Privacy Policy Statement

Yes

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