

Design and high-power test of a short prototype of high gradient S-band accelerating structure for the FERMI free electron laser linac upgrade

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Located on the site of the Elettra Sincrotrone in Trieste, Italy, the FERMI free-electron laser (FEL) is a user facility fed by a 1.5 GeV, 10 to 50 Hz, S-band radio-frequency linear accelerator (linac). In order to achieve shorter wavelengths and improved beam quality, a high gradient upgrade to the facility has been proposed which will extend the current capabilities of the system allowing the generation of beams up to 1.8 GeV while keeping breakdown rates low enough for high machine up-time

To demonstrate the reliability and feasibility of the upgrade plan, a short prototype was built in collaboration with Paul Scherrer Institute (PSI), Switzerland. Using a newly commissioned S-band cavity test facility, the short prototype was successfully conditioned to an accelerating gradient of 40 MV/m with a pulse length of 600 ns at a breakdown rate of 8×10^{-8} bpp. A comprehensive overview of the testing facility, its data processing tools and the conditioning of this short prototype will be illustrated. Concluding the paper is a visual inspection of the cells for signs of damage resulting from RF breakdown during the high power testing.

Summary

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