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Stability and Reliability Study on the China ADS Front end superconducting demo linac (CAFe)

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The he Chines ADS Front-end superconducting demo linac (CAFe) constructed 2017. It is used to demonstrate the SRF technology in low energy session and investigate the feasibility and the reliability for the Chinese initiative Accelerator Driven System (CiADS). It is designed to accelerator 10-mA continuous-wave (CW) proton beam to the energy of 25 MeV. It operated the first 25 MeV beam on June 5th, 2017 and primary stability with pulsed beam was investigated by 72 hours operation. Recently, it achieved the max beam power of 45 kW (2.55 mA and 17.5 MeV). The high-power reliability was demonstrated with the beam of the 2-mA, 16-MeV CW beam by the operation of more than 110 hours. During the operation, the availability was 89%, the MTBF was 99 min, and the MTTR was 12 min. CAFe has supplied user’ s experiments in 2018 and 2019. The reliability during user’ s operation was analysed too. All the sources of trips are traced, and two main reasons caused the frequent trips are identified. We found the field emission in the superconducting HWR cavity will lead to discharging in the pickup and the further the open loop of RF control. It is a special phenomenon in the compact coaxial superconducting resonators. The experiments show the relations between the field strength and the trips. The frequency and phase shift due to beam loading is another main reason of trips. It will exit the pondermotive oscillation. The stability testing results and sources analysis will be introduced.

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