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The first particle-free beam stop for the ESS superconducting linac

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For the ESS superconducting linac, a compact beam stop for [21, 100] MeV protons was designed instead of a bulky beam dump. Its mass is 60 kg, its length 1200 mm (perpendicular to the beamline), and the cylindrical beam-intercepting part fits into a CF160 flange. In the most demanding beam mode (40 MeV, 50 µs, 1 Hz, 62.5 mA), thermomechanical calculations predict a peak temperature of 685˚C in the graphite core that is enclosed in a shell of TZM (a Ti-Zr-Mo alloy). The beam stop is water-cooled, equipped with thermocouples and moved by a pneumatic actuator. The beam stop was manufactured by Proactive R&D in Spain and shipped under vacuum to ESS in Sweden. The assembly, tests and metrology measurements were performed in an ISO 5 cleanroom. During August 2024, the beam stop was installed with a dedicated cart in the ESS beamline, surrounded by a portable cleanroom to maintain a particle-free environment next to superconducting cavities. The results of the beam commissioning and the main challenges (e.g. ISO 5 requirements, unconventional brazing and demanding engineering tolerances) are summarized and useful to design future particle-free devices intercepting high-power beams.

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