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Physical design of the EMuS muon beamlines

The accelerator complex of China Spallation Neutron Source (CSNS) is delivering a proton beam of 100 kW in beam power, 1.6 GeV in kinetic energy and 25 Hz in repetition rate, which will be upgraded to 500 kW in the CSNS-II project. A muon facility, the so-called Experimental Muon Source (EMuS), will be added to CSNS in the upgrading project. As a standalone facility located in a new experimental hall, EMuS will employ 25 kW or 5% of the total beam power. EMuS is planned to provide multiple muon beams for different applications. This presentation will introduce the physics design of the muon beamlines in the baseline scheme. With a conical graphite target located in a high-field superconducting solenoid, EMuS can provide muon beams of different characteristics to meet the requirements of different applications. For example, surface muon beams and a decay muon beam are for μSR applications, a negative muon beam for Muonic X-ray analysis, a high-momentum muon beam for muon imaging, etc. The trunk muon beamline that covers a large momentum range from 28 MeV/c to 450 MeV/c is based on superconducting solenoids. The branch beamlines to different endstations are based on either room-temperature magnets or solenoids. A one-to-three spatial beam splitting method with the surface muon beam is applied to serve three μSR spectrometers simultaneously. Sophisticated beam collimation systems are designed to provide muon beams with higher polarization and smaller beam spots at the μSR spectrometers.

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