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Future ESS upgrade to medium pulse length: what are the technical challenges for the accelerator and the target?

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A compression of the ESS proton pulse from the present 2.86 milliseconds to a few tens microseconds which is better matched to the moderator time constant of thermal neutrons would considerably boost the performance for many instruments at ESS. Generating such a proton pulse with preserved instantaneous beam power requires a storage ring to be added to the ESS accelerator. Such a ring has been studied within the ESSnuSB neutrino super-beam study. The proton pulse length extracted in single turn extraction from this ring would be 1.2 microseconds long which could be destructive for the present ESS target and is very short compared to the moderator time constant. The more desirable medium length pulse could possibly be generated by multi-turn extraction. Another way to generate the longer pulses is to extract a bunch train using fast strip line kickers but this would require a larger storage ring. Using a “bunch train” has been successfully applied at the CERN ISOLDE facility to avoid destruction of sensitive liquid metal targets used for Nuclear Physics experiments. Other challenges are linked to the injection into the storage rings and the understanding of the target, moderator and neutron extraction systems with short and medium pulse length. We will in this presentation review the technical challenges linked to a future medium pulse length ESS facility and the ways proposed to address them for the accelerator and target.

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