

Objectives, Deliverables and Resources

for a Design Study of an ESS-based Muon Collider Proton Complex Test Facility

Objectives

Basic: Demonstrate the feasibility of a Muon Collider Proton Complex Test Facility that is based on the use of the power-upgraded ESS linac, of an adapted ESSnuSB accumulator ring and of a new compressor/buncher ring for achieving 2 ns pulses of 10^{14} - 10^{15} protons at 14 Hz as well as the feasibility of a granular Titanium target with forced He gas cooling for use with such a beam.

High-level Deliverables

Assessment of the possibility to use of the ESS linac as proton driver for a Muon Collider Proton Complex Test Facility

Design of the Proton Complex Test Facility and evaluation of its operation using simulations

Evaluation of the effect of the heat shocks from 2 ns 10^{14} - 10^{15} protons bunches at 14 Hz on the granular Titanium target

Resources are given in total number of FTE-years for the whole duration and in kEuro for material

Resources	1	2	3		1	2	3
Staff	4			Student	3		
Postdoc	4			Material	0		

Interested partners

The European ESSnuSB Collaboration and the ESS Laboratory

Tasks and Resources



International
Collider
Corporation

1	Task description	Resource estimate			
		staff [FTEy]	postdoc [FTEy]	PhD [FTEy]	material [kEuro]
1	Design study of the required modifications of the chopping scheme for the linac H- source and of the ESSnuSB Accumulator ring design to enable operation for the Muon Collider	1.5	1.5	1	
2	Design study of a Compressor /Buncher ring and simulations of its operation together with that of the modified Accumulator as a Proton Complex Test Facility	2	2	2	
3	Evaluation of the effect of the heat shock from 2 ns 10^{14} - 10^{15} protons bunches at 14 Hz on the Titanium target and design study of possible mitigation schemes	0.5	0.5		



Work Package Description



Workpackage Description

The design study of a Muon Collider Proton Complex at ESS would comprise, inter alia, an alternative chopping scheme for the linac, a new operation scheme for the accumulator ring, a new design of a compressor/bunch rotation ring and a separate target station with a target and capture system (horn or solenoid) that can stand the 2 ns long bunches of 10^{15} protons, using the ESSnuSB Helium-gas-cooled granular Titanium target design as starting point. A study will be made of the effects of the heat chocks induced in such a target by the very short high-charge proton pulses. The basic scheme for the generation of the 2 ns long pulses from the 2.84 ms 10^{15} proton linac pulses is that the linac pulse is chopped into many short pulses that are injected in the accumulator ring and then extracted into the compressor/buncher ring where they are phase rotated to be of a length of ca 2 ns. This calls for the development of a high frequency chopper acting at the level of the linac H- source and an adaption of the accumulator ring acceptance, rf system, timing and optics. As to the design of the accumulator and the compressor/buncher rings, there has been a design based on the use of the 5 GeV 4 MW SPL proton linac, that was planned for construction at CERN, as well as a design based on the use of the 8 GeV high power Project-X proton linac. These designs will be used as starting points for a design and simulation of a compressor/buncher based on use of the ESS linac.