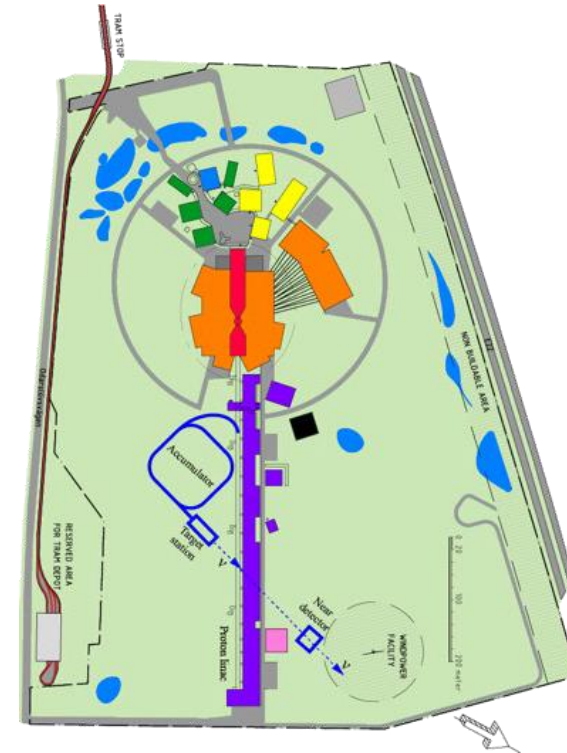


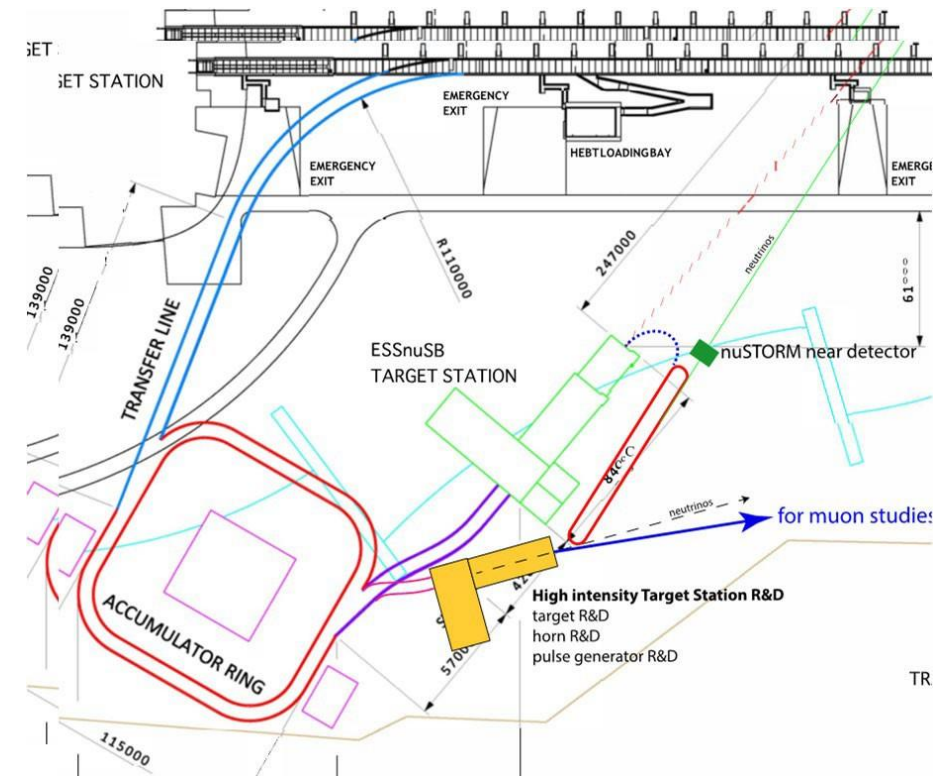
# Design Study within the International Muon Collider project of a Proton Complex Test Facility based on the use of the ESS linac and the ESSnuSB



# Design Study of Muon Collider Proton-Complex Test-Facility

It is proposed that during the next period 2022-2025 of the ESSnuSB Design Study, the study be enlarged in scope to include also how the already studied design of the upgrade of the ESS linac, the design of the accumulator ring and the design of the target station can be widened to encompass also the requirements of the Muon Collider.

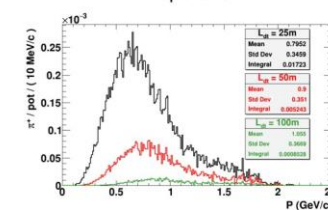
This implies the conceptual study of, inter alia, an alternative chopping scheme for the linac, of the accumulator acceptance, rf system, timing and optics, of a design from scratch of a compressor/bunch rotation ring and of a separate target station with a target and capture system (horn or solenoid) that can stand the 2 ns long bunches of  $10^{15}$  protons, using the ESSnuSB  $2.5 \times 10^{14}$  protons/  $1.3 \mu\text{s}$ /1.25 MW target design as starting point. Design is stages possible, i.e. first making a  $10^{15}$  protons/ $1.3 \mu\text{s}$ /5 MW target design.



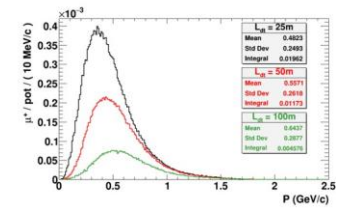
Accumulator ring to be complemented with a Compressor ring



Pion momentum distribution in a 4m x 4m aperture



Muon momentum distribution in a 4m x 4m aperture



## Proton Driver Proposals

Based on ESS adding Accumulator and Compressor Rings

From

C. Carli

'Proton Driver considerations'

at

Muon Collider –

Preparatory Meeting,

CERN, 11<sup>th</sup> April 2019

From a presentation by

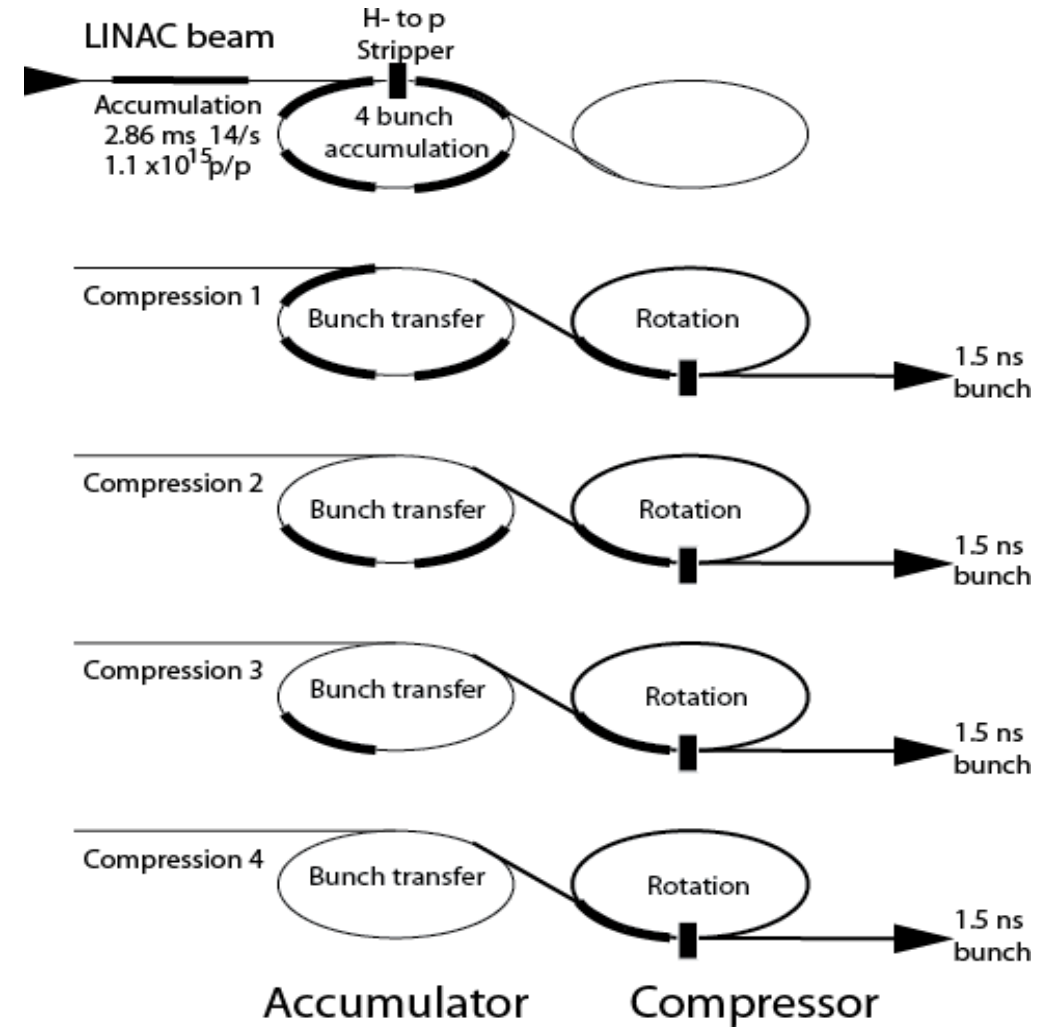
C. Rubbia at

XVIII Int. Workshop on

Neutrino Telescopes,

18-22 March 2019

- Rings with  $\sim 35$  m radius
- Accumulator ring filled with 14 Hz repetition rate
- Accumulator to compressor transfers with  $4 \times 14$  Hz up to 54 ms



# Summary I

- The Proton Complex is one of the critical parts of the Muon Collider project
- A study of a Muon Collider Proton Complex based on the use a CERN 4 MW Super Proton Linac (SPL) was made in 2013
- The 5 MW ESS proton , now under construction, is similar in several respects to the SPL design that was made
- Since 2018 is carried out an EU supported Design Study of a uniquely intense neutrino-beam complex based on the ESS linac, which will result in January 2022 in a Conceptual Design Report

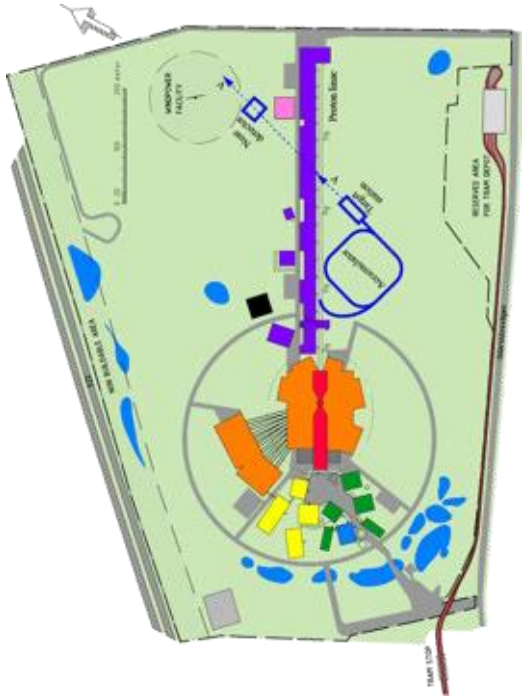
## Summary II

- It is proposed to enlarge in 2022-2025 the scope of the ESSnuSB design of the linac and the accumulator and to make a design of a compressor/buncher ring generating 2 ns bunches of order  $10^{14}$ - $10^{15}$  protons and of a target and focusing horn that can stand such bunches, with the aim to fit the requirements of a Muon Collider Proton Complex
- A Conceptual Design Report of this complementary design study would be ready by 2025 and could serve as a basis for the discussion of the realization of an ESS based Muon Collider Proto-Complex Test-Facility to be operational in the first half of the 2030's. The estimated amount of required person-power is 11 person-years of which it is planned to apply for the major part through a ESSnuSB-HIFI Horizon Europe INFRADEV-1 Design Study application.
- The ESS Proton Complex could also possibly come to serve as the first stage of a facility to test muon cooling at full intensity - until CERN has taken the decision to build an SPL for a 3, 10 or 14 TeV Energy Muon Collider, allowing such tests to be made at CERN - and, in an maybe even longer perspective, as the proton complex of a 125 GeV Muon Collider Higgs Factory at ESS that you will hear about from Carlo Rubbia in his talk following now.

**Back up slide**



# ESSvSB schedule a 2<sup>nd</sup> generation neutrino Super Beam



**2012:**  
inception of  
the project

*Nucl. Phys. B 885  
(2014) 127*



**2016-2019:**  
beginning of  
COST  
Action  
EuroNuNet

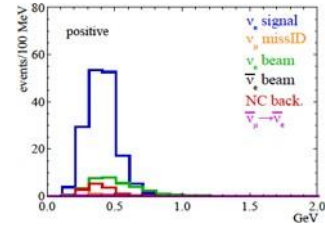
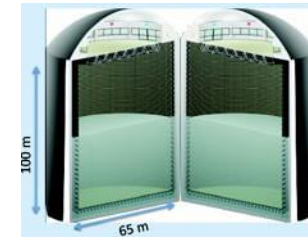


**2018:**  
beginning of  
ESSvSB  
Design  
Study (EU-  
H2020)

**2021:** End of  
ESSvSB  
Design Study,  
CDR and  
preliminary  
costing



**2022-2024:**  
Preparatory  
Phase, TDR



**2035-:**  
Data  
taking

**2027-2034:**  
Construction of  
the facility and  
detectors,  
including  
commissioning

**2025-2026:**  
Preconstructi  
on Phase,  
International  
Agreement

