

International
MUON Collider
Collaboration

Muon Collider Community Meeting 2021 May 2021



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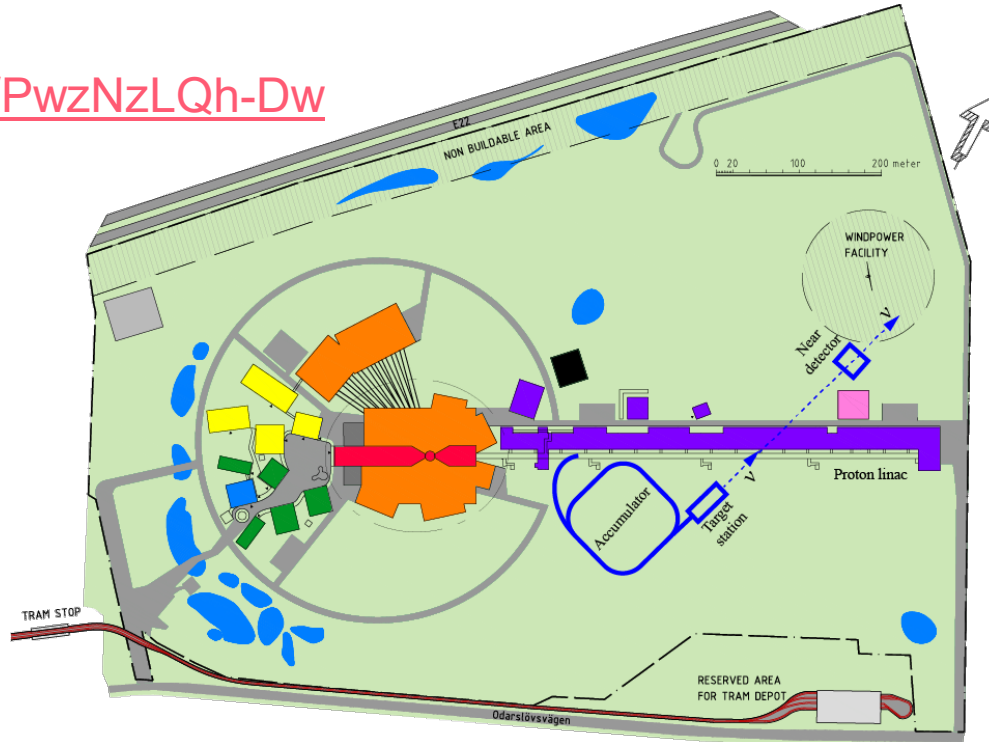
**High-charge 2ns
protons bunches from
the
ESS linac for muon
cooling tests**

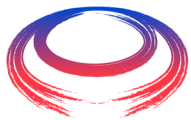
Tord Ekelof

Uppsala University

The European Spallation Source neutrino Super Beam EE`SSvSB

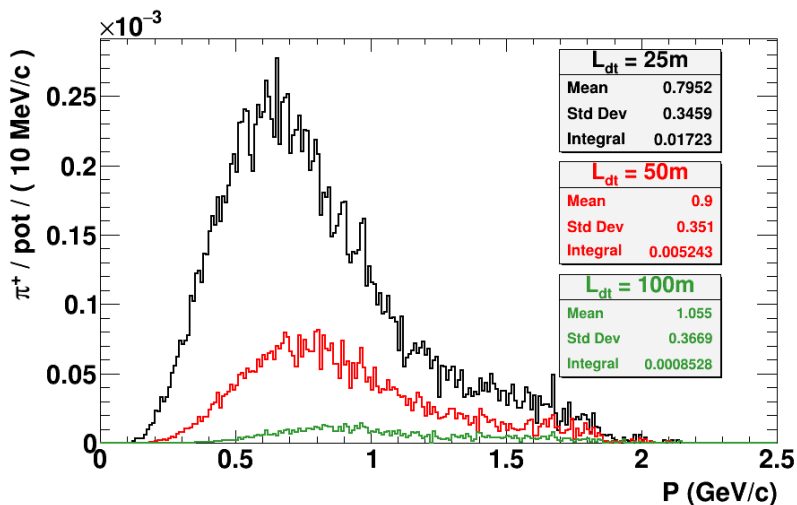
<https://youtu.be/PwzNzLQh-Dw>



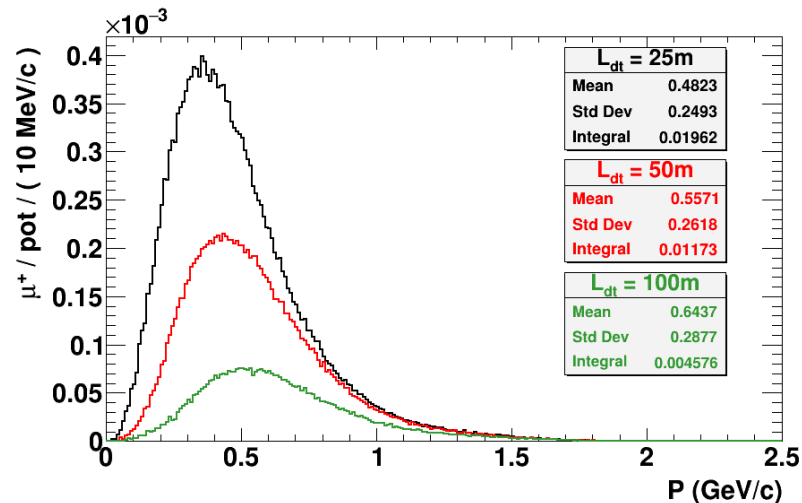


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Pion momentum distribution in a 4m x 4m aperture

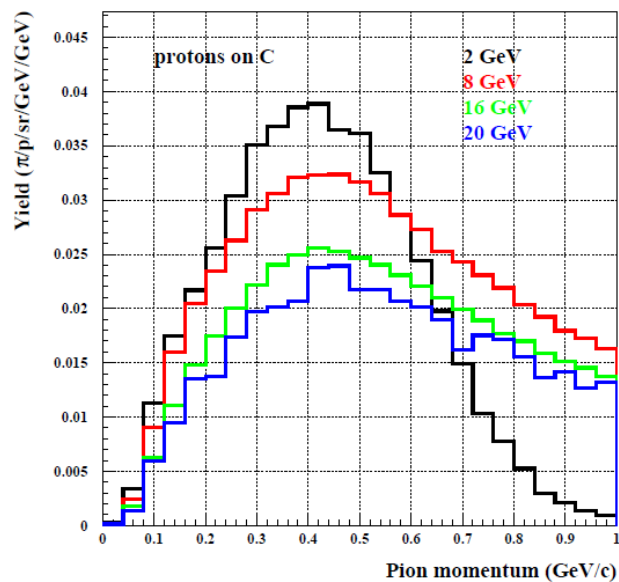
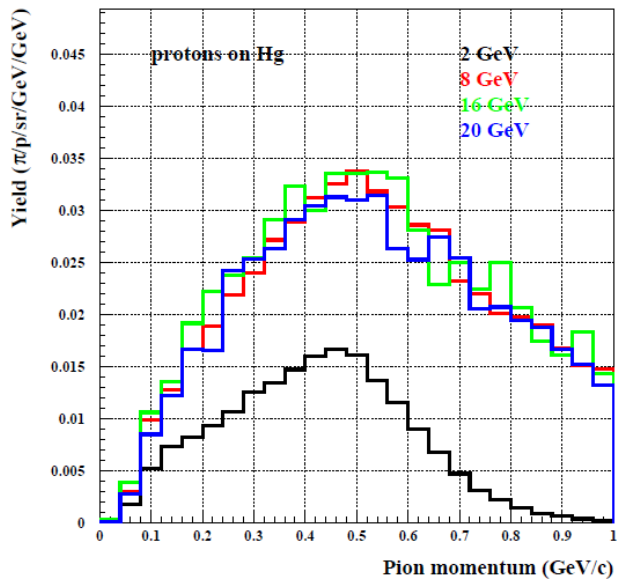


Muon momentum distribution in a 4m x 4m aperture



L_{dt} (m)	N_{μ} (μ^+ /pot)	N_{μ} (μ^+ /s)	N_{μ} (μ^+ /200d)	$\langle P_{\mu} \rangle$ (GeV/c)
50	0.01	1.2×10^{14}	2.1×10^{21}	0.56

Fluka simulations of low momentum meson production provided by Paola Sala



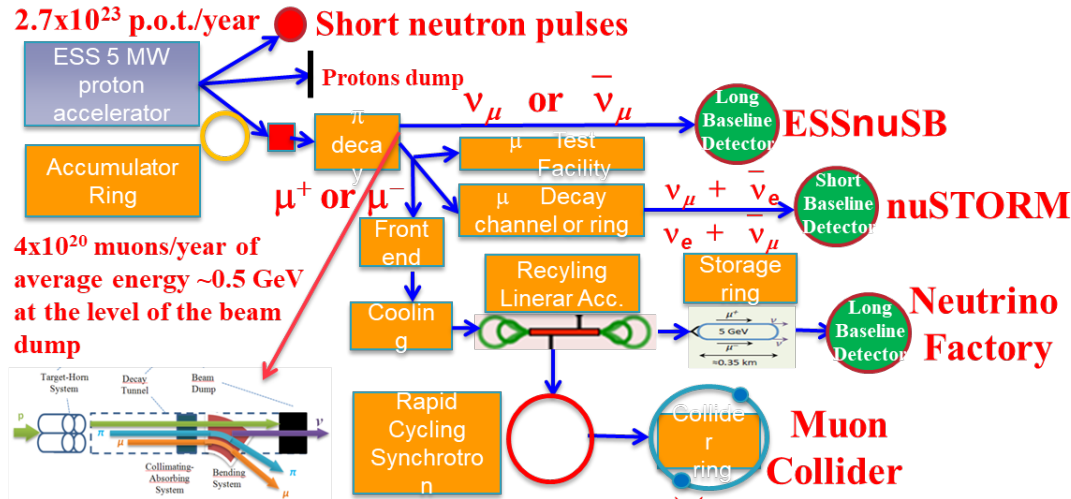
Prospects for Intensity Frontier Particle Physics with Compressed Pulses from the ESS Linac



Open workshop at Uppsala University
2-3 March 2020



Program and registration at: <https://indico.cern.ch/event/849674/>



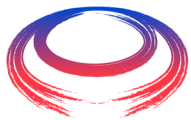
The participants in the Uppsala Workshop 2-3 March 2020





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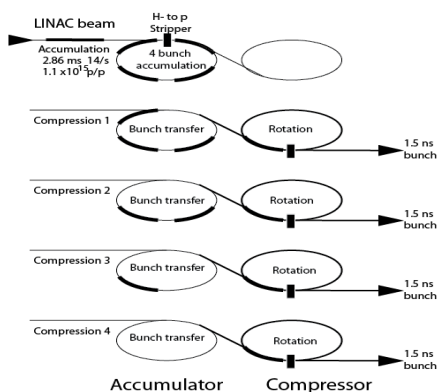
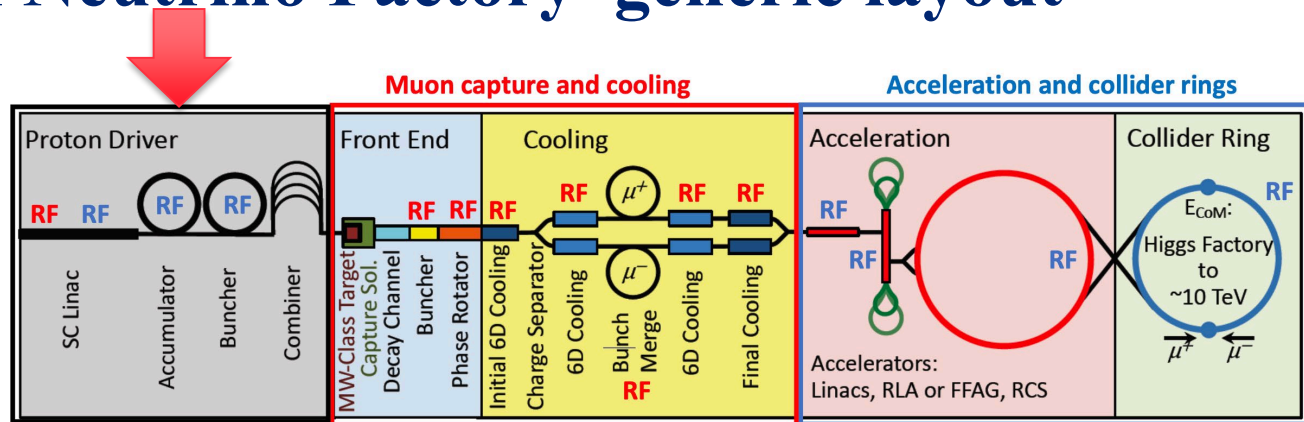


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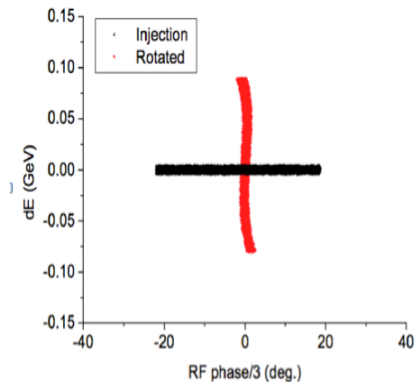
HIFI Neutrino Factory generic layout

Linac 2.5 GeV
5MW
2.86 ms pulses
 9×10^{14} H- per pulse
Pulse frequency 14 Hz
RF frequency 352 MHz
Bunch spacing 2.84 ns
Bunches washed out in
the accumulator ring

H- ion source chopped
with $f = 3.215$ MHz
 $T_c = 320$ ns
160 ns with protons
160 ns empty
Accumulator ring
circumference = 386 m
= 1280 ns revolution time
 $\Rightarrow 4$ H- pulses around the ring



Compressor has RF field
with $f = 3.215$ MHz
Compression of
160 ns proton bunch to
2 ns creating a large
momentum spread which
depends on RF field
voltage





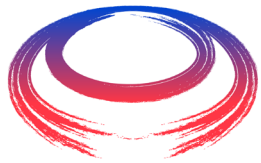
Accumulator-compressor test program

Test program step	No of 150 ns H-bunches injected in the accumulator per linac 2.86ms pulse	No of circulating compressed bunches in the accumulator	Number of trombone tubes of different length	Total number of protons in the final 2 ns bunch produced 14 times a second	Power of a beam of 14 such bunches per second
1 Fill one chopped 160 ns ion source pulse per linac pulse to test compression time	1	1	0	4.7×10^{10}	250W
2 Fill every 4 th chopped 160 ns ion source pulse with H-	2'400	1	0	1.1×10^{14}	0.63 MW
3 Fill every 2 nd chopped 160ns H-ion source pulse with H-	4'800	2	2	2.2×10^{14}	1.25MW
4 Fill all chopped H- ion source source with H-	9'500	4	4	4.5×10^{14}	2.5MW

SPS 100 GeV: 4×10^{13} protons per extraction, 2100 bunches of 2ns per extraction
=> 1.9×10^{10} protons per 2ns bunch

Conclusion

Complementing the ESSnuSB program to upgrade the ESS linac to 10MW and an H- ion source and to provide it with an accumulator ring with a 3.125 MHz compressor ring and add a 3.125 MHz chopper to the H- ion source would make it possible to generate, concurrently with the spallation neutron production, 2ns proton bunches with more than 10^{14} protons per bunch at a rate of 14 per second that could be used for full intensity tests of different 6D muon cooling modules.



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***Thank you
for attention***