EUROPEAN SPALLATION SOURCE

ESSnuSB, WP02 Update

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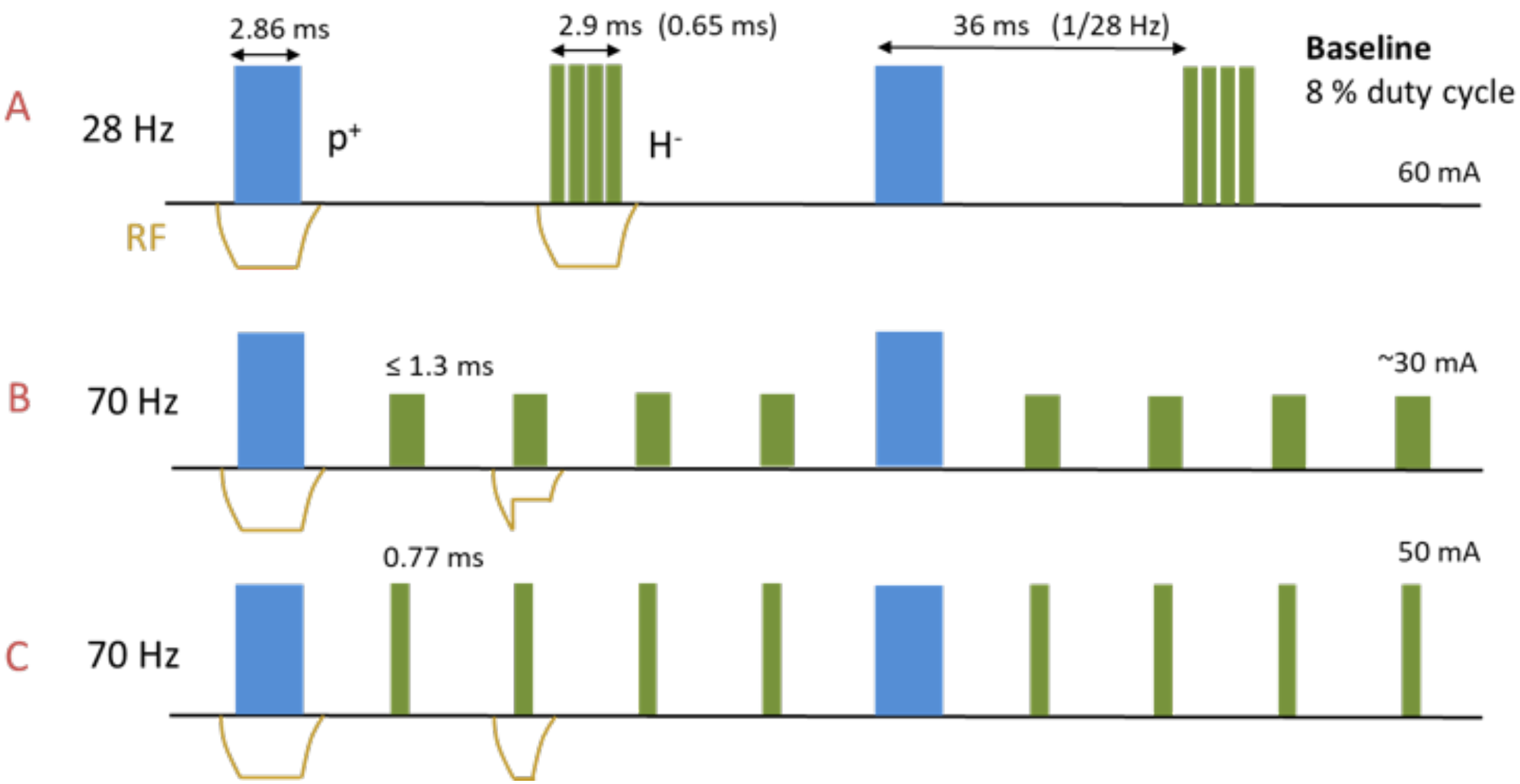
2019 June 11

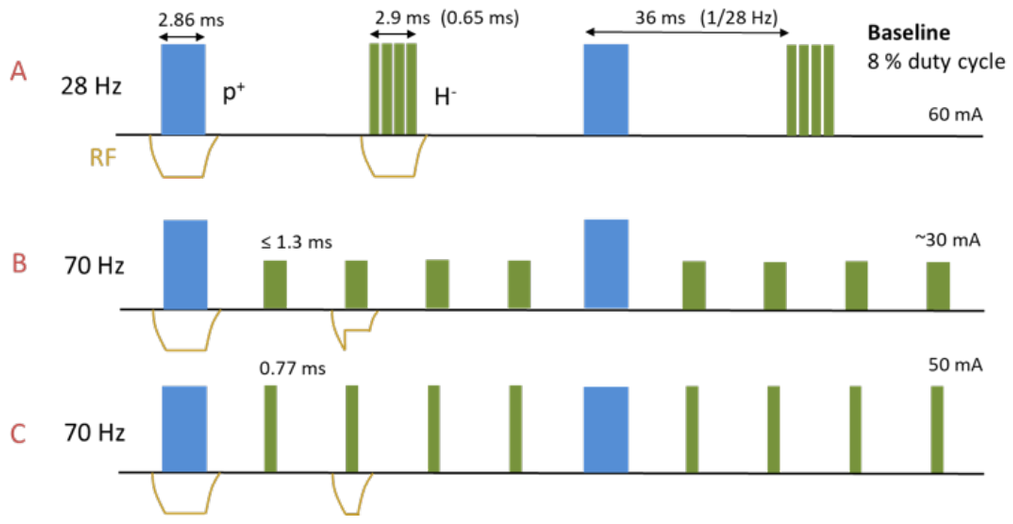
PULSING



Note the new labels for different pulsing schemes. "A" is the baseline

Ion Source and LEBT

Scenario	A	B	C
Sub-pulse length (ms)	0.65	~1.3*	0.77
Beam current# (mA)	60	~30	50
Frequency (Hz)	14	70	70
Time between pulses (ms)	72 (0.75)	14	14
Particles per batch	$2.23 \cdot 10^{14}$	$2.23 \cdot 10^{14}$	$2.23 \cdot 10^{14}$
Batches per macro pulse	4	4	4
Particles per macro pulse (72 ms / 14 Hz)	$8.93 \cdot 10^{14}$	$8.93 \cdot 10^{14}$	$8.93 \cdot 10^{14}$

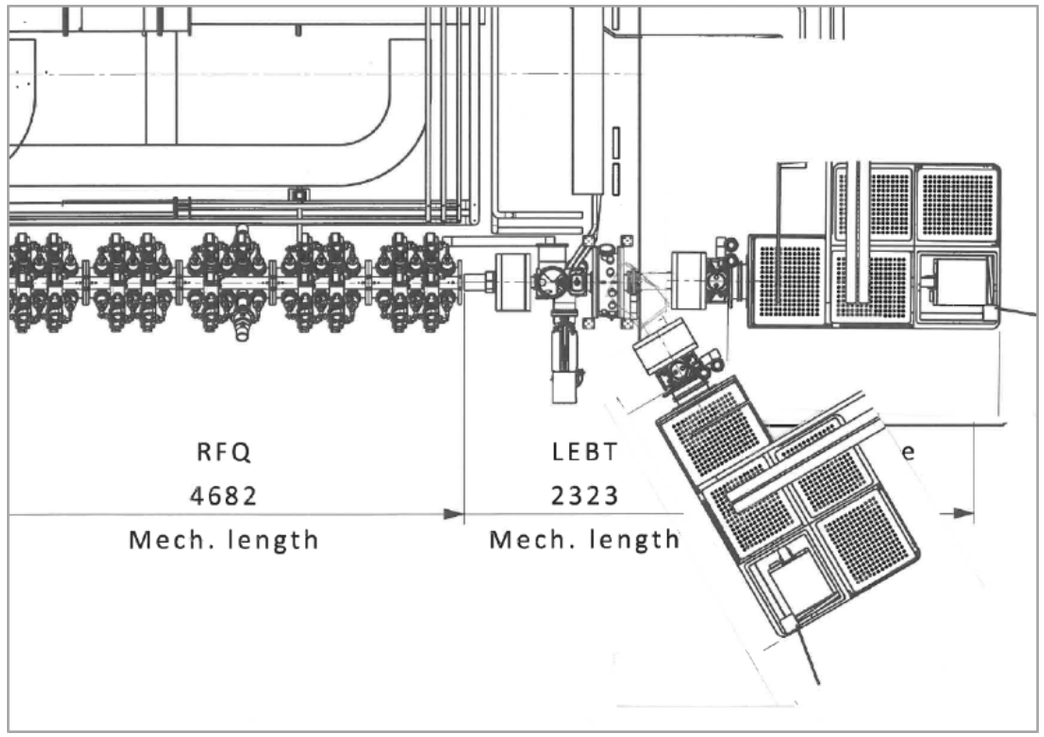


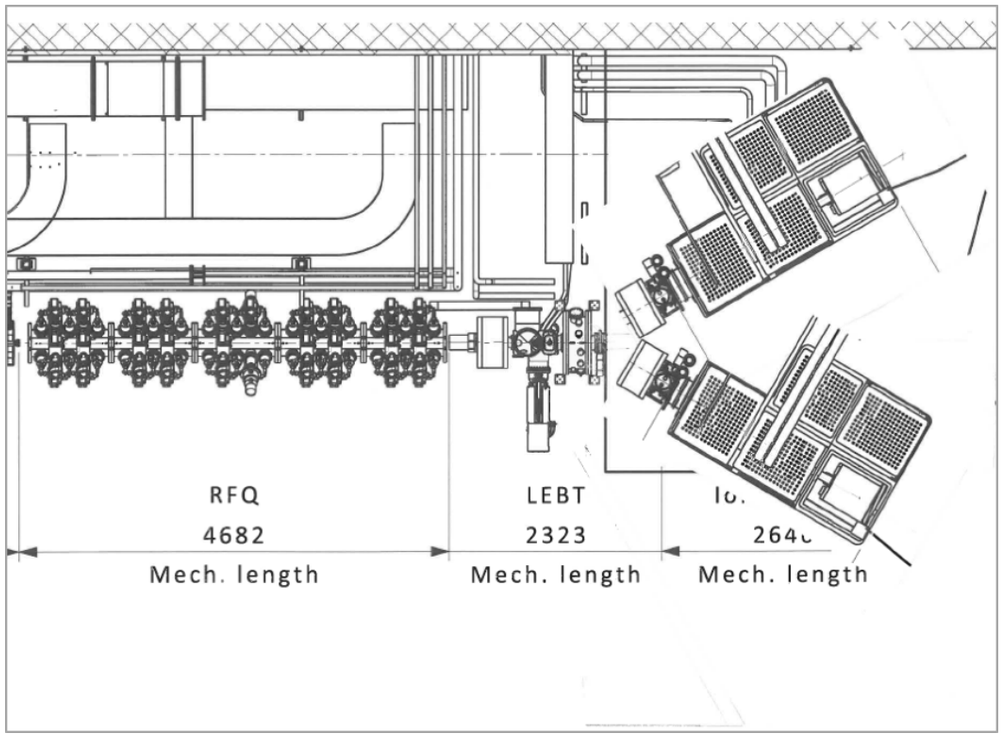
RAL AND SNS SOURCES

- Started collaboration with RAL and SNS on developments on their existing sources to make them meet the ESSnuSB needs

Parameter	RAL Penning 1X ISIS	RAL Penning 2X FETS	SNS, Oak Ridge, RF surface enhanced volume source
Beam pulse length (ms)	0.25 ms	2 ms	1 ms
Repetition frequency	50 Hz	50 Hz	60 Hz
Beam current	55 mA	100 mA	60 mA
Duty cycle	1.25 %	10 %	6 %
Lifetime	5 weeks	2 weeks	14 weeks
Cs consumption	~0.7 g/week	~3.5 g/week	~2 mg/week
Emittance rms norm	0.25 mm mrad	0.3 mm mrad	0.25 mm mrad
LEBT	Sector magnet 90 degrees bend plus Cs	Einzel lens, carbon Cs trap	Electrostatic LEBT
Emittance rms norm after inital beam transport stage	0.7 mm mrad	0.3 mm mrad	N/A
Extraction voltage	18 (35) kV	18 (65) kV	65 kV

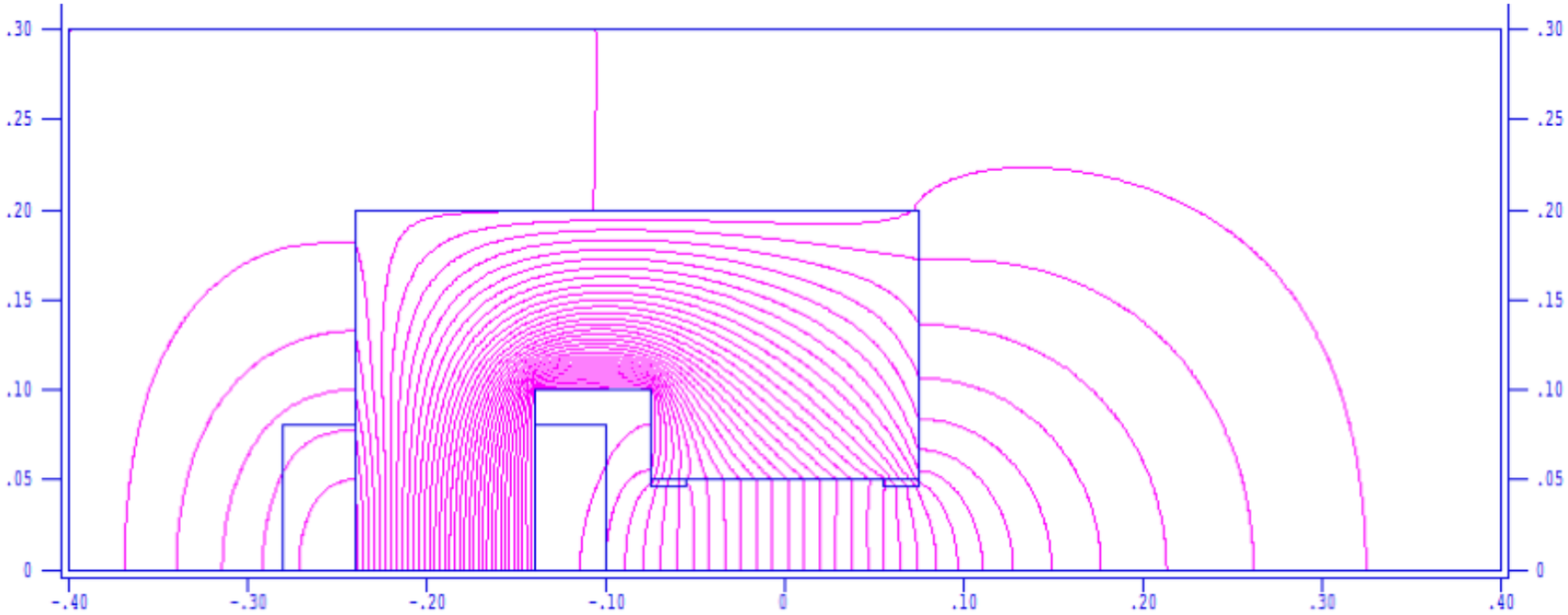
MERGING OF THE SOURCES





A PULSED DIPOLE

- Possibility of merging the two beams at 70 Hz (cases B and C).

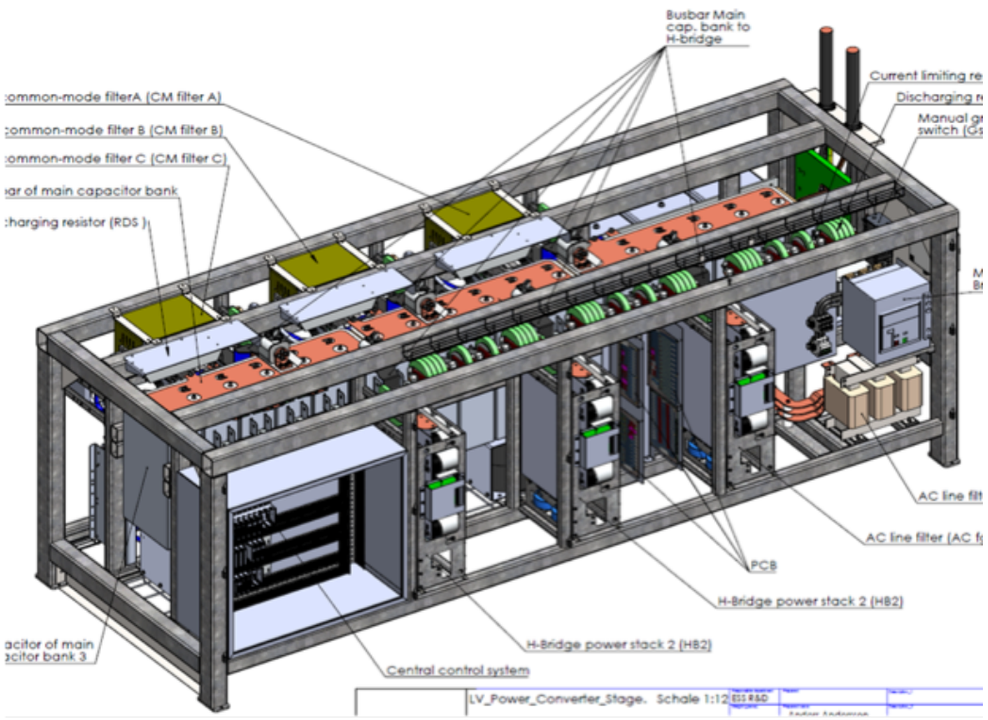


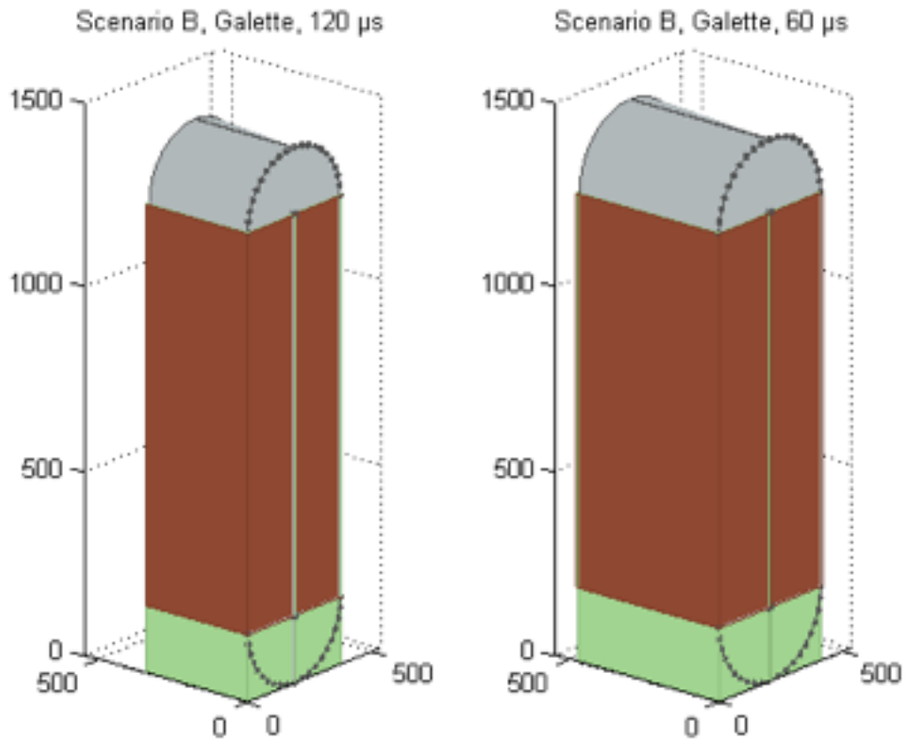
- B field: 0.1 T
- Bending radius: 400 mm
  - pole gap: 100 mm
- A coil with100 turns
  - Inductance: 17 mH (possible to switch at 70 Hz)
- Power supply:
  - Current: 80 A
  - Voltage: 170 V

Håkan Danared

MODULATOR

- Two different power upgrades for the modulators have been studied:
  - Using the SML modulators of ESS and upgrading the capacitor chargers
  - Using the SML modulators of ESS and adding pulse transformers for the H- beam





Max Collins and Carlos Martins

MODULATOR

Scenario	Solution	Eta	Investment cost [M€]	Electricity cost per year	Increased system footprint	Total system height	H^- pulse rise time [µs]
A	SML upgr.	0.82	13.4	14.6	0	3.1	< 120
B	SML upgr.	> 0.80	13.4	14.8	0	3.1	< 80
	SML + PT	> 0.80	26.3	14.8	< 2.5 x 1.5	2.4	60-120
C	SML upgr.	> 0.71	13.4	16.7	0	3.1	< 170
	SML + PT	> 0.72	26.6	16.5	< 2.5 x 1.5	2.4	50-120
Baseline	SML	0.82	N/A	7.30	N/A	2.6	N/A

FURTHER STUDIES

- Design the linac from 2 GeV to 2.5 GeV

- Study the optics and H- stripping phenomena to make sure the losses are limited

- Study the requirement on field regulation for the H- beam such that the total losses do not exceed 1 W/m

- Updating the drawings on site with the depth.

EUROPEAN SPALLATION SOURCE

THANKS!