



WP3 : Target Station and Pion Extraction

"Summary"

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ESSnuSB+ TARGET STATION CONFIGURATION

Beam Entrace Window (BEW)



3 mm BEW

 $\dot{m}_{Porous} = 0.18 \text{ kg/s}$ $\dot{m}_{BEW} = 0.02 \text{ kg/s}$ $v_{porous max} = 38 \text{ m/s}$

An additional effect of creating a bypass Flow is that the velocity through the porous media lowers reducing the overall pressure drop.



J. Aguilar





ESSnuSB+ Target PROTOTYPE DESIGN

The ETHEL loop contains a booster compressor blowing about 3 g/s helium at between 6

Compressor skid

Crank case



J. Aguilar





ESSnuSB+ Target PROTOTYPE DESIGN



R&D Program (Target Prototyping)





WP3: Horn Optimisation



Horn Parameters:



For this work, the following parameters of the horn have been considered:

• L1, L2, L3, L4, R2, R3, ztg

The value of the i-th parameter has been rescaled by a scale factor, which value is included in the range [0.5, 2.5], w.r.t. the corresponding baseline value.



- Note: aperture at ~50 cm from horn
- Pions scored with all energies
- Figure of merit for optimization:



Note: Current is fixed at 350 kA Parameters h0, h1 and L5 are fixed

WP3: Horn Optimisation





Parameter	Baseline	Scale factor	Best fit
	(cm)	range	(cm)
L1	83.08	[1.0, 2.5]	91.66
L2	46.80	[0.5, 2.5]	43.99
L3	60.30	[0.5 <i>,</i> 2.5]	37.38
L4	47.50	[0.5 <i>,</i> 2.5]	26.60
L5	1.08	—	1.08
RO	54.40	[0.5, 2.5]	43.52
h0	3.30	—	3.30
h1	22.10	—	22.10
ztg	8.10	[0.5, 2.5]	7.14

Reshaped horn

Parameters of the reshaped horn

WP3: Power Supply Unit





New values for the electrical components

C = 1120 μF	Charging	Discharging	Recovery
Ec = 10kV	Lc = 25 mH	Ld = 0.911 μH	Lr = 0.25 mH
lpeak = 350 kA	Rc = 0.475 Ω	Rd = 0.866 mΩ	Rr = 5.94 mΩ
m	0.050	0.0152	0.0063
ω (rd/s)	189	31300	1890
dl(t=0)/dt (A/µ			
s)	0.014	10955	38
V ₀ (V)	9332	10000	-9518
V _{end} (V)	10000	-9518	9332
I _{peak} (A)	69	350 k	20.14 k
IRMS (A)	23.46	9276	2173

(P. Poussot)

25/09/2024

WP3 : Power Supply Unit **ESS neutrino Super Beam plus**



(P.Poussot)

3,2m

hight:





The secondary-beam distribution, at a distance of 10 m from the target/horn system, shows a 2D-Gaussian distribution

with $\sigma \sim 0.38$ m \rightarrow Requires large-opening dipole magnet!







Magnetic field flux, B, normal to the beam axis at coil current of 1540 A. No B field found outside the iron yoke













(T. Tolba)













Energy [GeV]/cm³



(T. Tolba)





Summary Deliverable & Milestones

- MS 3.1 : First design of the hadron collector (M12)
- D3.1 : Optimize the ESSnuSB+ horn design and its pulse generator (M18)
- MS 3.2 : Preliminary design of the pion extraction and focusing system (M24)
- D 3.2 : Design of the pion extraction and focusing systems (M24)
- MS 3.3 : Final estimation of the pion beam (M36)
- MS 3.4 : Evaluation of the baseline design of the target station (M42)
- D 3.3. : Design of the Target Station (M46)