STATUS OF THE
FEASABILITY STUDY OF THE DISTRIBUTION OF 4X1 MW PROTON BEAM ONTO THE HORN SYSTEM

EUROnu WP2 meeting

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Beam and target characteristics*

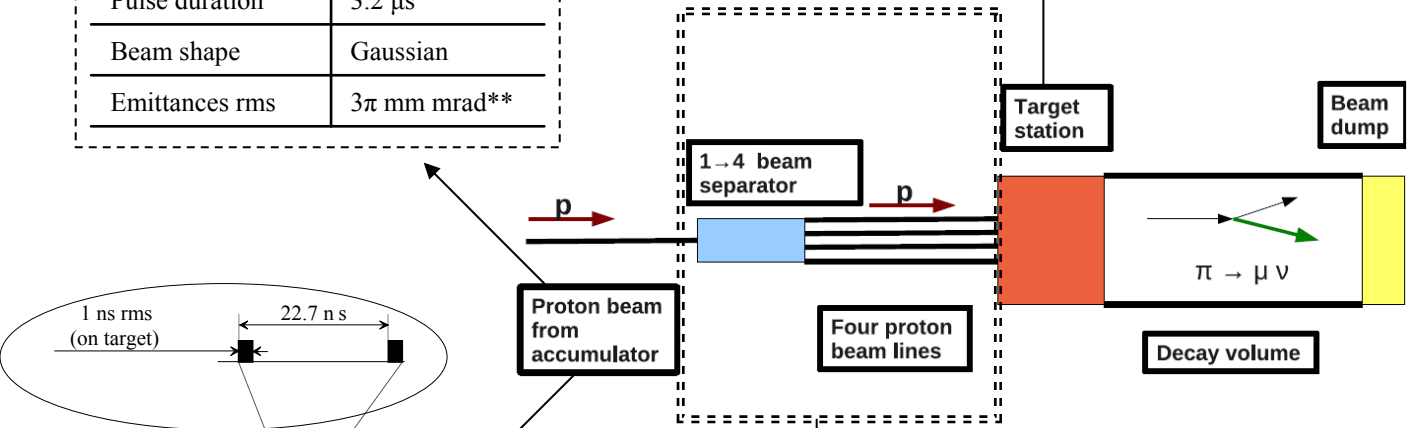
Beam rigidity:
16.16 T.m (4 GeV)
17.85 T.m (4.5 GeV)

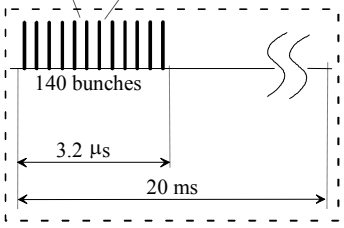
$$B \cdot \rho = \frac{1}{q \cdot c}\sqrt{E_k(E_k + 2E_0)}$$

kinetic energy / rest energy

Energy	4-5 GeV
Beam Power	4 MW
Proton per pulse	1.1 x 10^{+14}
Rep. rate	50 Hz
Pulse duration	3.2 μs
Beam shape	Gaussian
Emittances rms	3π mm mrad**

Target length	78 cm
Target radius	1.5 cm
Beam shape	Gaussian
Rep. rate	12.5 Hz
Pulse duration	3.2 μs
Sigma	4 mm



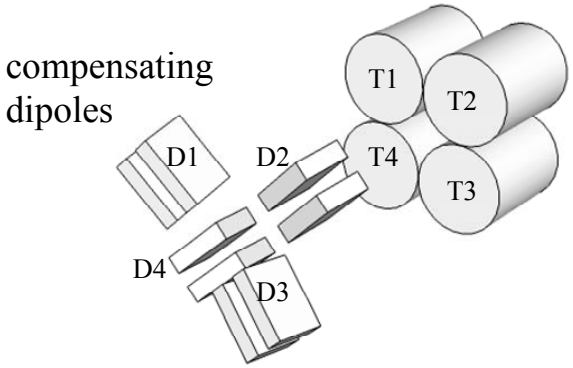


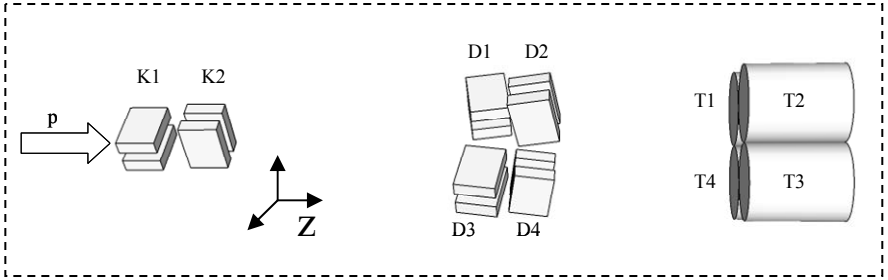
Subject of interest

Ref.
-*The target and horn for the SPL-based Super-Beam: preliminary design report, C. Bobeth, M. Dracos, F. Osswald, EUROnu WP2 Note 11-01. March 2011
-**Feasability Study of Accumulator and Compressor for the 6-bunches SPL based Proton Driver, M. Aiba, CERN-AB-2008-060-B1

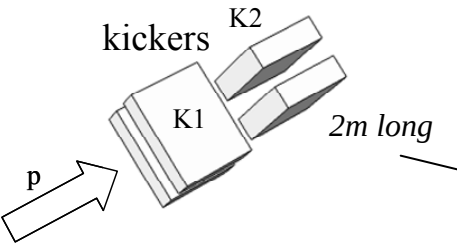
Layout currently investigated

not at scale





Distances: $d_{K1\text{-}D1} = d_{K1\text{-}D3} = d_{K2\text{-}D2} = d_{K2\text{-}D4}$



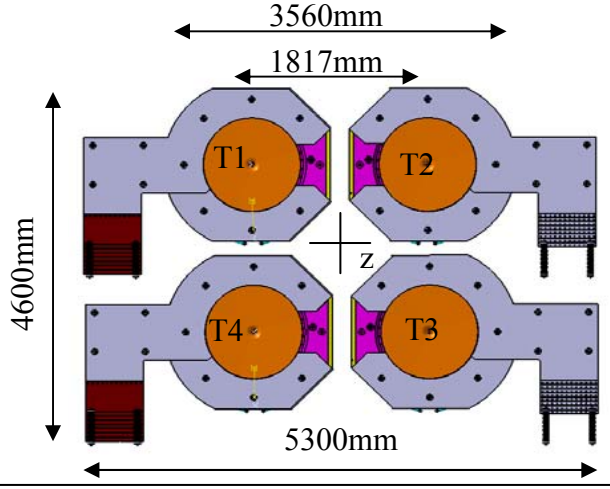
Magnetic field (T) — Angle of deflection (rad)

$$B = \frac{\sin(\alpha)}{0.2998 \cdot L_{eff}} \cdot E_k$$

Magnetic length (m) — Kinetic energy (GeV)

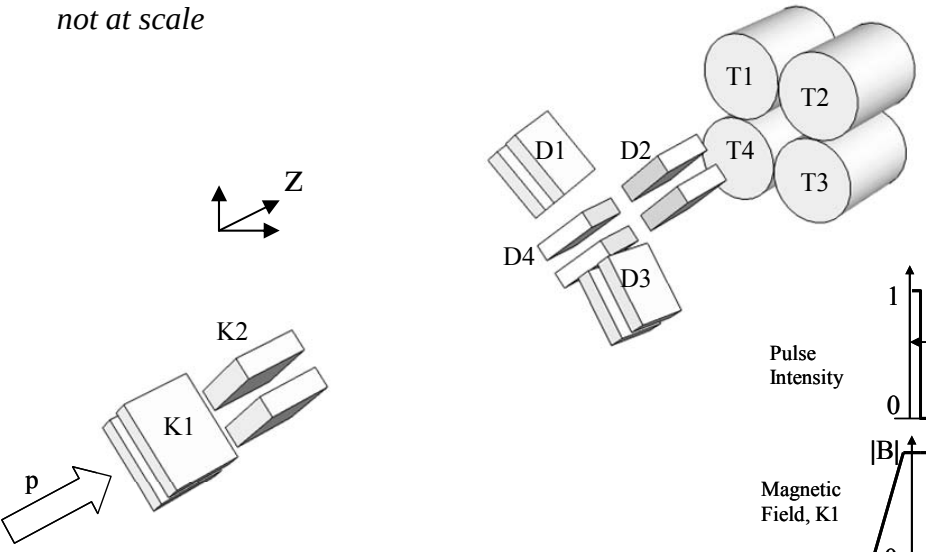
Principle:

- Use of 2 bipolar kickers (or bipolar pulsed magnets): ± 45° rotation wrt the z axis
- K1 (K2) deflects to D1 and D3 (D2 and D4) by same angles of deflection: ± 116 mrad
- Need of 4 compensating dipoles (1 angle for each target) [to apply a symmetry in the system and then minimize chromaticity/aberration effects]
- K1, K2, D1,2,3,4 have the same magnetic field B: 0.87 T (4.5 GeV, $d_{K\text{-}D}$ = 11m)

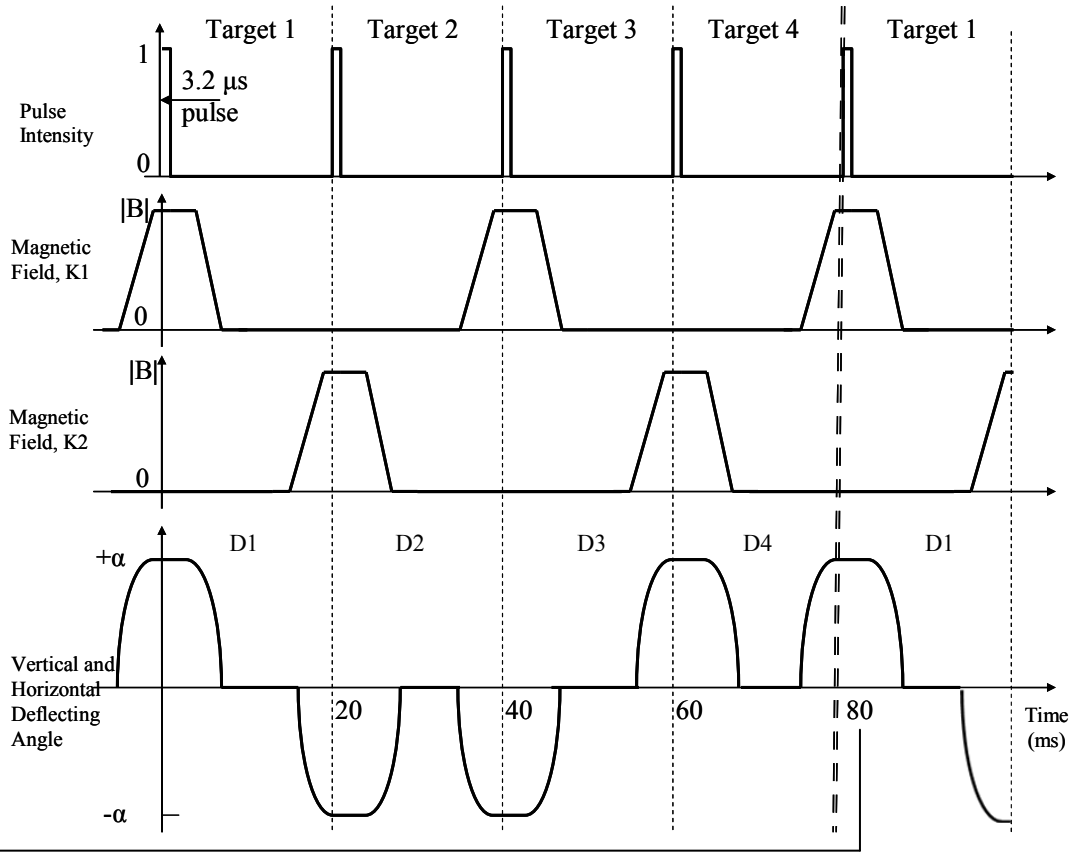


Layout currently investigated

not at scale



Example of operation mode



Repetition rate:
50/4 = **12.5 Hz**

→ T = 80ms

Layout currently investigated

Under progress…

- Use of TRANSPORT Code* for optimisation of
  - the magnetic lengths / apertures of the kickers [higher the aperture lower the quality of B]
  - the distance between the dipoles and the horn system
- Generation of magnetic field maps
- Study of the chromaticity phenomena at 1st order calculation (2nd order if needed):
  - addition of quadrupoles / steerer
- Rising & falling times of the magnetic fields to be defined
- New configurations to come…

Next steps:

- Meeting with the CERN accelerator team to discuss the feasibility and magnet technology to use

**Developed at PSI by Urs Rohrer*

Thank you for your attention