ANGELOTTI – IKP

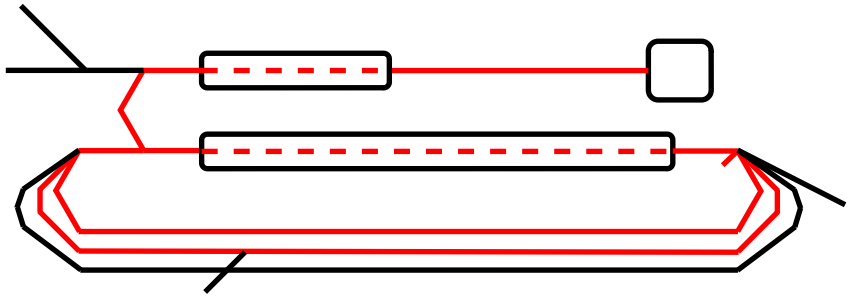
Accelerators: the Next GEneration – materiaLs, cOmponents, sysTems and simulaTIons

Picture: Jan-Christoph Hartung

Work supported by DFG (GRK 2128, SFB 1245), BMBF (05H21RDRB1), State of Hesse (Cluster Project ELEMENTS and LOEWE Research Cluster Nuclear Photonics)

Subproject Part I: 2x ERL @ S-DALINAC

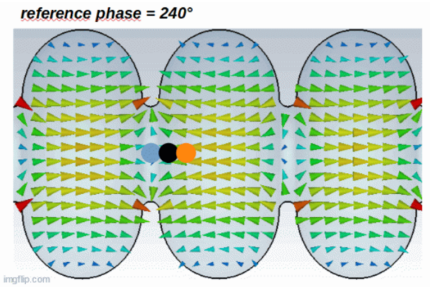
- Beam Dynamics Simulations
- Operation in 2x ERL setting and measurement results
- Beam diagnostics for superimposed beams

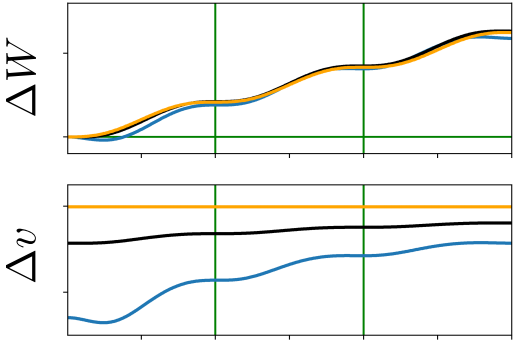


Subproject Part I: Simulations

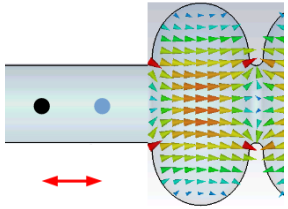
TECHNISCHE UNIVERSITÄT DARMSTADT

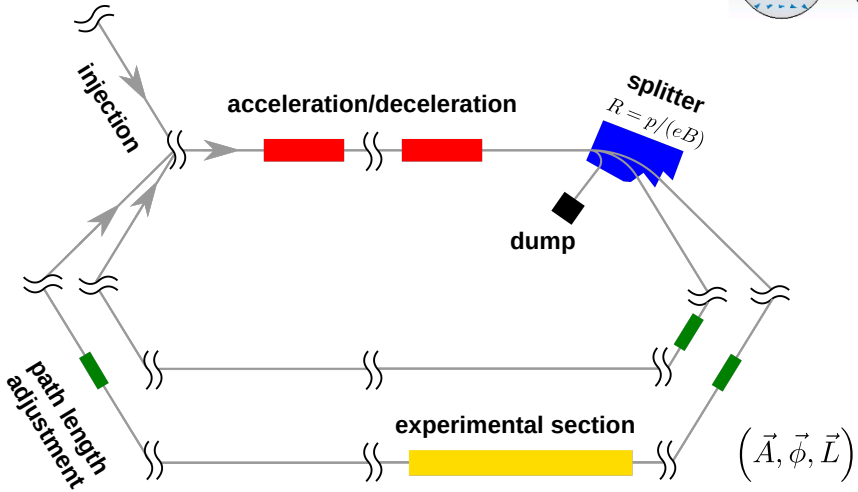
Phase Slippage





Setup for proper time-of-flight





Subproject Part I: Simulations

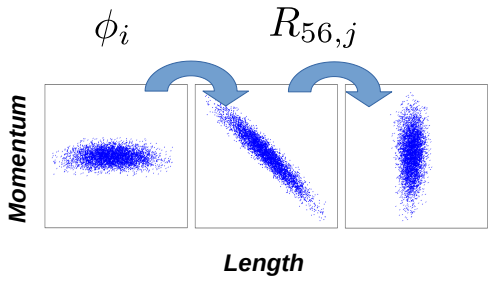
$$\min \left\| \begin{pmatrix} \mathrm{sene}(\bar{p}_{1\mathrm{x\,acc.}}, 4.73 \cdot p_{\mathrm{inj.}}, T_1) \\ \mathrm{sene}(\bar{p}_{2\mathrm{x\,acc.}}, 8.32 \cdot p_{\mathrm{inj.}}, T_2) \\ \mathrm{sene}(\bar{p}_{1\mathrm{x\,dec.}}, 4.73 \cdot p_{\mathrm{inj.}}, T_3) \\ \mathrm{sene}(\bar{p}_{2\mathrm{x\,dec.}}, 1.00 \cdot p_{\mathrm{inj.}}, T_4) \\ w_1 \cdot \sigma_{\delta_{1\mathrm{x\,acc.}}} \\ w_2 \cdot \sigma_{\delta_{2\mathrm{x\,acc.}}} \\ w_3 \cdot \sigma_{\delta_{1\mathrm{x\,dec.}}} \\ w_4 \cdot \sigma_{\delta_{2\mathrm{x\,dec.}}} \end{pmatrix} \right\|_{1*}$$

$$\mathrm{sene}(V_1, V_2, T) = \begin{cases} 0, & |V_1 - V_2| \leq T \\ ((|V_1 - V_2| - T)/T)^2, & |V_1 - V_2| > T \end{cases}$$

$$\|\vec{x}\|_{1*} := \sum_i x_i$$

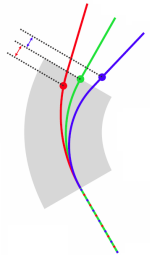
$$T_{i,\mathrm{min}} = 1\ \mathrm{neV/c}$$

$$w_i \in [10^1, 10^5]$$

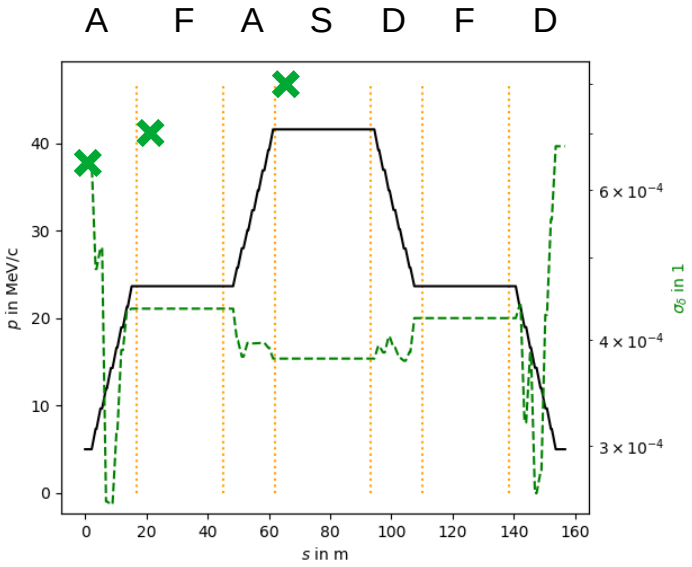


$$\mathrm{s.t.} \begin{cases} A_k \in [0, \hat{A}_k]\ \forall k \in \{1, ..., 8\} \\ \phi_i \in [0°, 360°)\ \forall i \in \{1, ..., 8\} \\ L_1 \in [0\,\mathrm{cm}, 6\,\mathrm{cm}] \\ L_2 \in [0\,\mathrm{cm}, 10\,\mathrm{cm}] \\ \{R_{56,\mathrm{I}}, R_{56,\mathrm{F}}, R_{56,\mathrm{S}}\} \in [-3\,\mathrm{m}, 3\,\mathrm{m}]^6 \end{cases}$$

$$\Delta l = R_{56} \cdot \delta$$



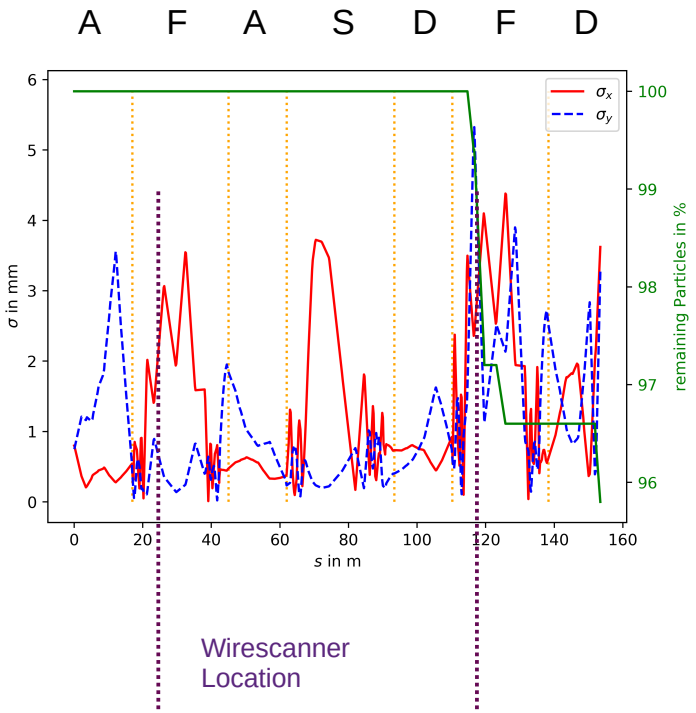
Subproject Part I: Simulations



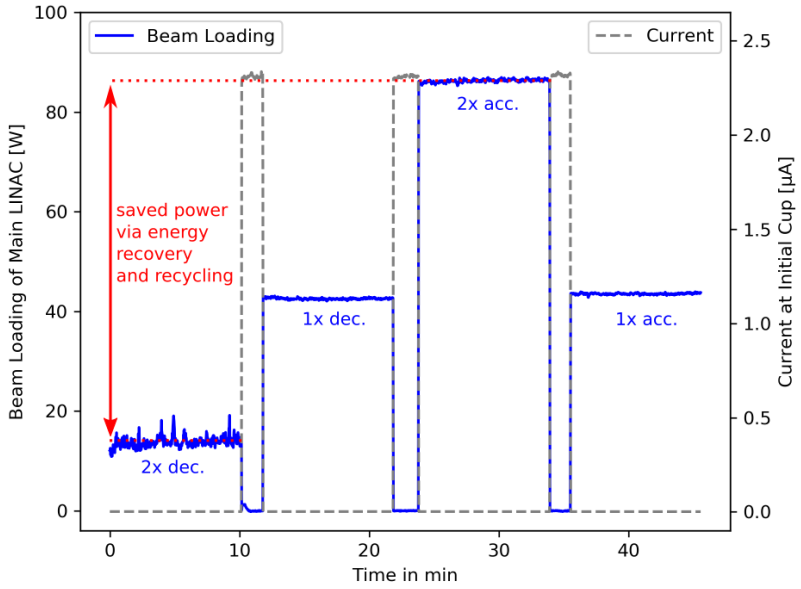
$\sigma_{\delta,\mathrm{I}} \leq 6.5 \cdot 10^{-4}$ $\sigma_{t,\mathrm{I}} \leq 0.4\,\mathrm{ps}$

$\sigma_{\delta,\mathrm{F}} \leq 7 \cdot 10^{-4}$

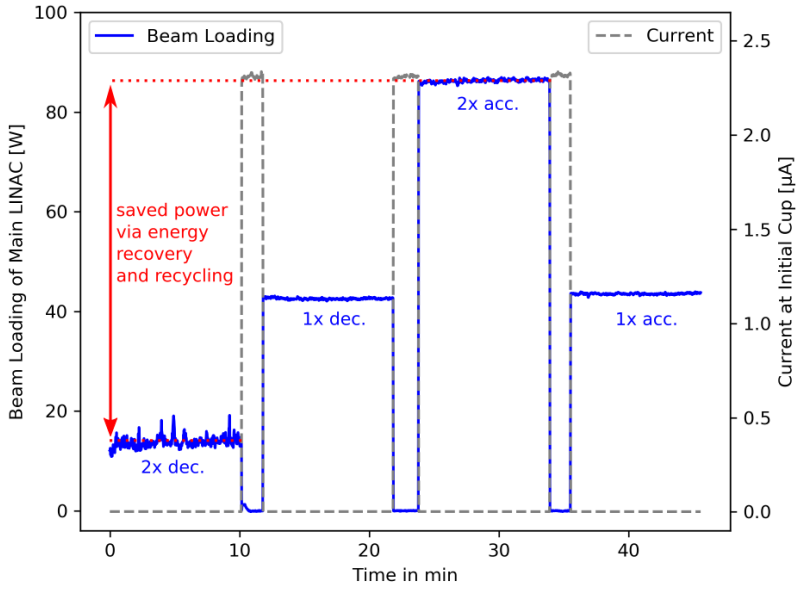
$\sigma_{\delta,\mathrm{S}} \leq 8 \cdot 10^{-4}$

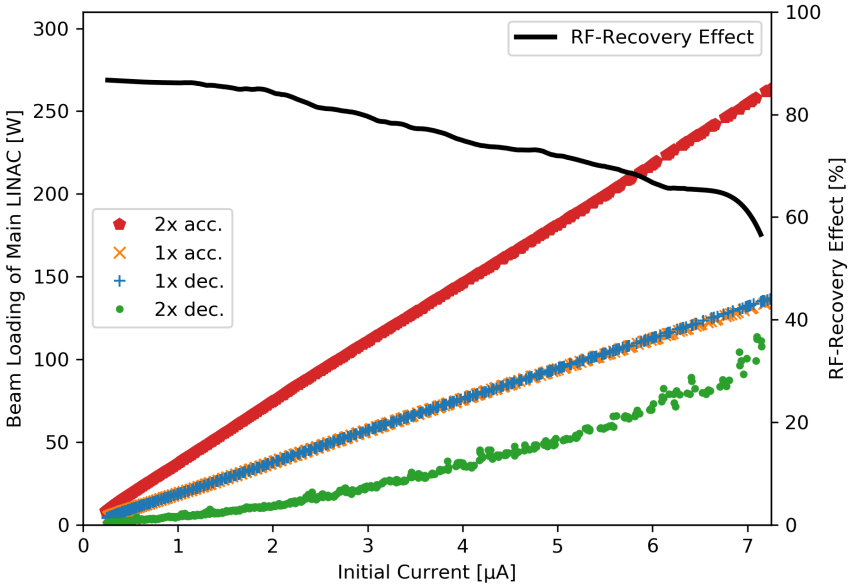


Subproject Part I: Measurements



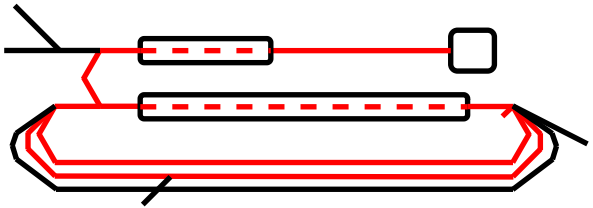
Subproject Part I: Measurements

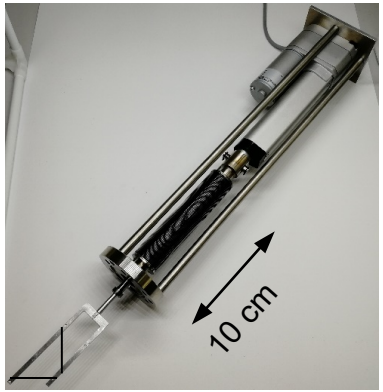


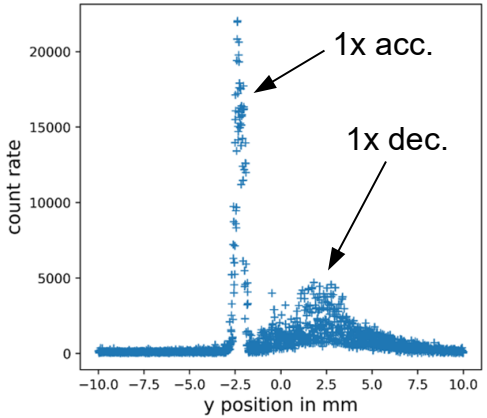


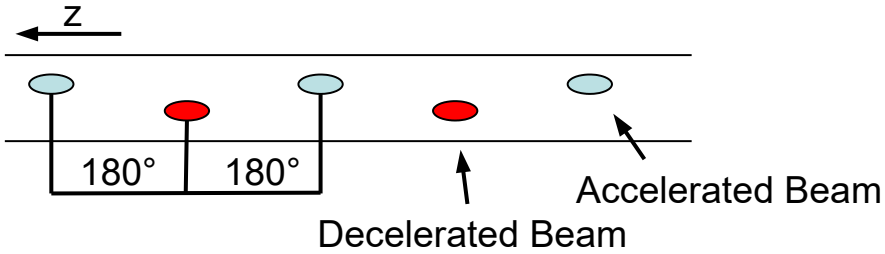
Subproject Part I: Diagnostic

Diagnostic of superimposed beams





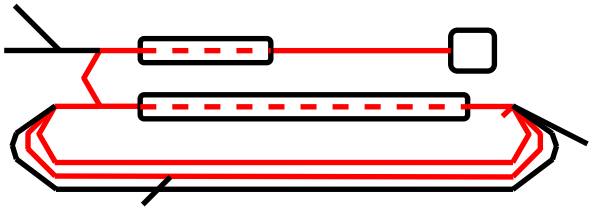


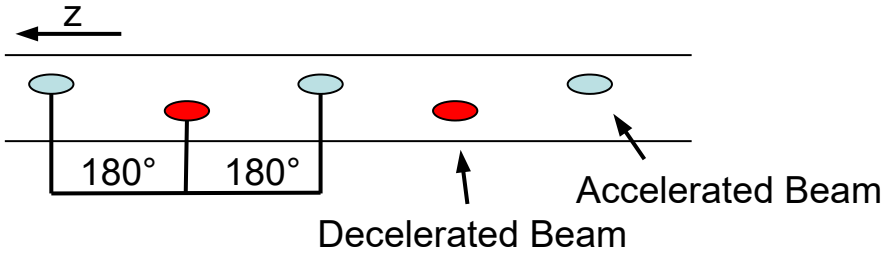


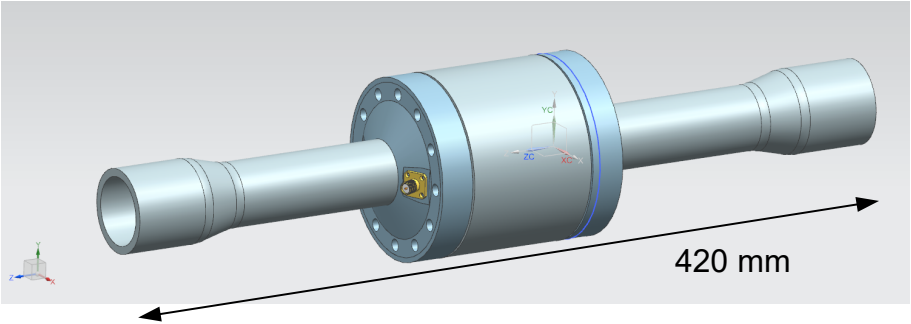
Subproject Part I: Diagnostic

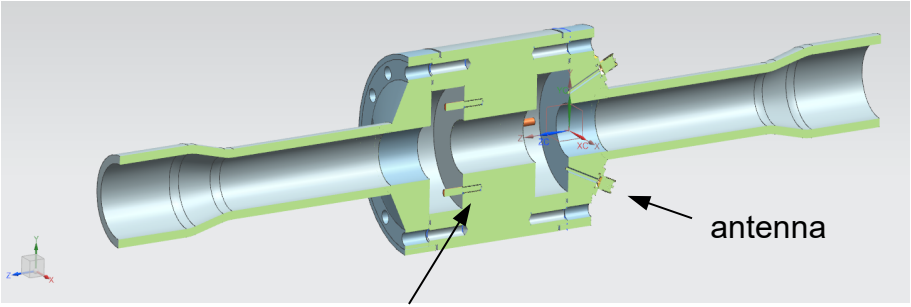
TECHNISCHE UNIVERSITÄT DARMSTADT

Diagnostic of superimposed beams





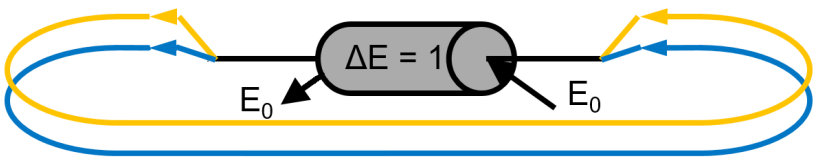


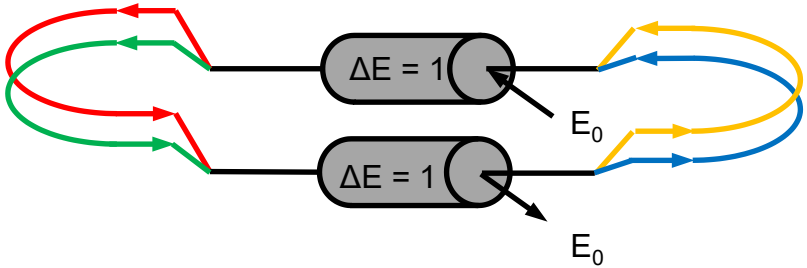


Subproject Part II: Design Study

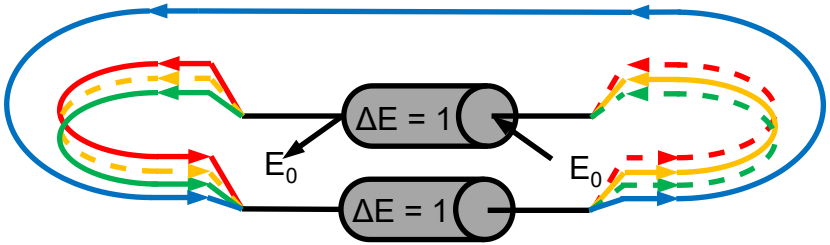
- Evaluation of a more suitable scheme for future ERLs → individual transport
- Simulation of an individual transport

sharing



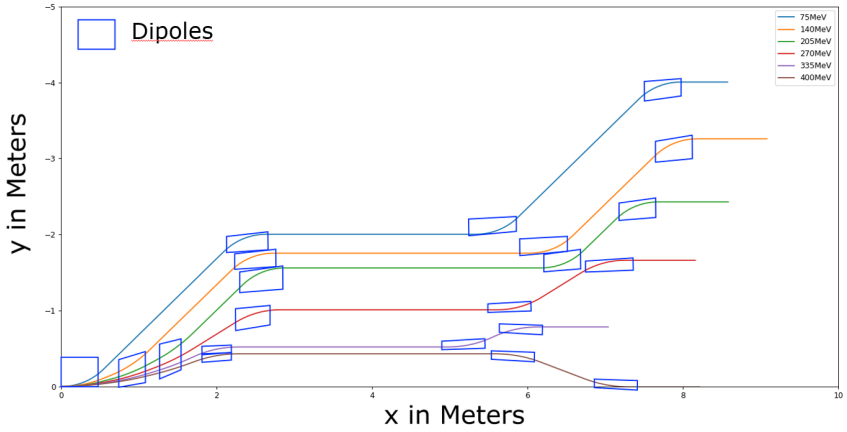


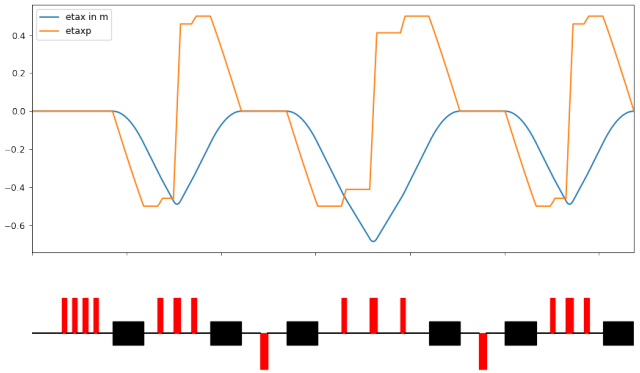
individual

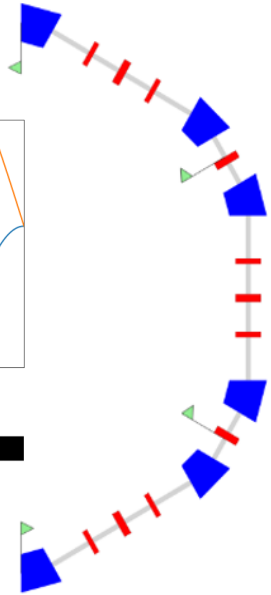


Subproject Part II: Design Study

Simulation of an individual transport







Thank you for your attention.