

Progress Update

William Shields

(william.shields@rhul.ac.uk)

WP6 Meeting

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- No progress on solenoid optimisation
 - Other commitments
- Solenoid focus discrepancy due to suspected user error – apologies!
- Assembling & tabulating data for 6 month report
 - Beam parameters
 - Nozzle transmission
 - Lattice geometry changes
 - Solenoid strengths (nominal & optimised – all configurations)
 - Gabor Lens strengths (nominal & optimised – all configurations)
 - Collimator settings
 - ...
- Overleaf document ?

- Beam after 5cm (unsure which code used to simulate 0-5cm)
- Down-sample & apply energy cut ($\pm 2\%$, $\pm 5\%$)
- 2mm radial cut - nozzle entrance aperture
- Propagate in GPT for 5cm
- Apply 2.87mm radial cut – nozzle exit aperture

Beam Energy (MeV)	Particle Numbers at nozzle entrance (with 2.00 mm cut)	Particle Numbers at nozzle exit (with 2.87 mm cut)	Transmission (%)
$15 \pm 2\%$	35574	27321	76.80
$15 \pm 5\%$	88610	68038	76.78

- Minimal impact on spectrum
 - Momentum cleaning collimator in vertical arc generates $\pm 2\%$ target
- Further down-sample beams to 10k particles for computational efficiency

- Tabulating beam parameters for 6 month progress report:
 - RMS emittance

Beam Energy (MeV)	E_x (m rad)	E_y (m rad)	β_x (m)	β_y (m)	α_x	α_y
$15 \pm 2\%$	$1.25e-7$	$1.24e-7$	12.71	13.13	-128.70	-132.84
$15 \pm 5\%$	$2.43e-7$	$2.42e-7$	6.61	6.70	-66.73	-67.58

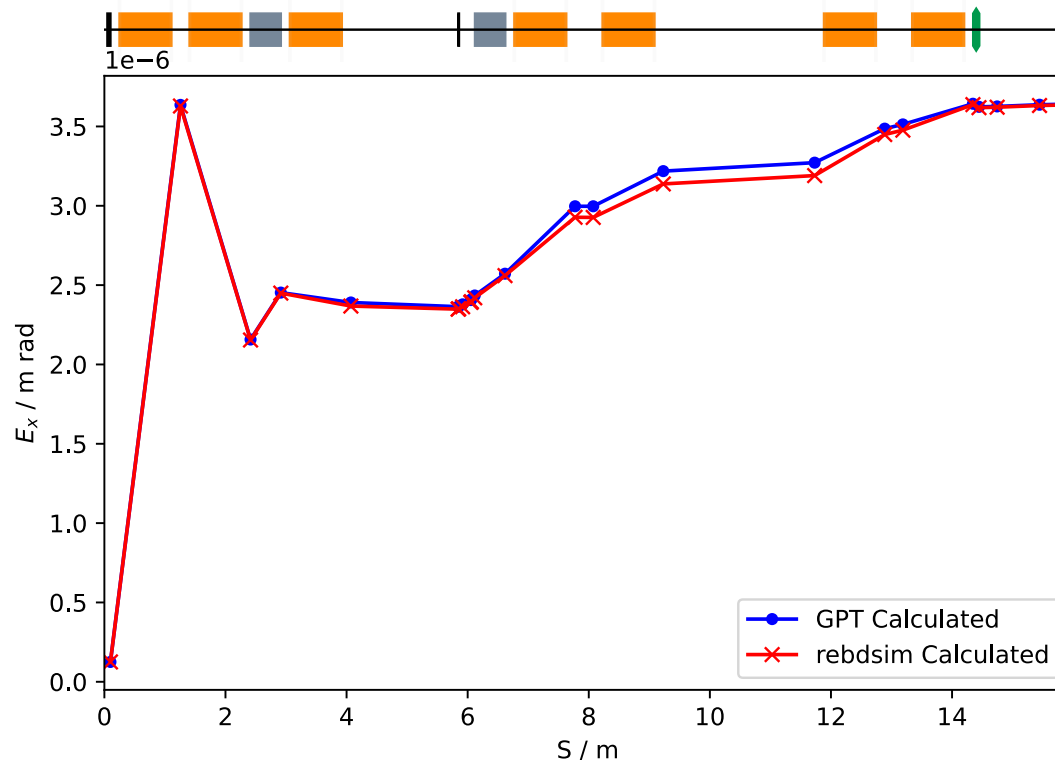
- Nominal parameters from Jaroslaw (15 MeV $\pm 2\%$):

- RMS physical emittance $1.26 \cdot 10^{-7}$ m
- Beta 12.82 m
- Alpha -129.79

- Beam will be 15 MeV $\pm \sim 5\%$ at the start of the FFA injection line
 - Momentum cleaning required in FFA injection line or FFA acceptance OK at $\pm 5\%$?

Emittance Growth

- Emittance changes significantly within the first solenoid
 - 3 cm spot size configuration
 - Spike between GL1 & GL2 due to finite solenoid fields
- Two independent emittance calculations:
 - GPT analysis program (gdfa)
 - BDSIM analysis program (rebdsimOptics)



Beam Energy (MeV)	Nominal E_x (m rad)	Nominal E_y (m rad)	Simulated E_x (m rad)	Simulated E_y (m rad)
$15 \pm 2\%$	$1.25e-7$	$1.24e-7$	$3.64e-6$	$3.52e-6$
$15 \pm 5\%$	$2.43e-7$	$2.42e-7$	$7.72e-6$	$7.71e-6$

- Horizontal beam size (1 sigma radius) for $\beta = 50\text{m}$:

Beam Energy (MeV)	Nominal E_x	Simulated E_x
$15 \pm 2\%$	2.5 mm	13.5 mm
$15 \pm 5\%$	3.5 mm	19.7 mm

- Impact on FFA & injection line?
 - Re-optimisation needed for parallel beam
- Provision of small spot sizes still important
 - Beam transport flexibility
- Revisit 5 Gabor Lens model
 - Suspect $\beta = 50\text{m}$ is met/achievable. Flexibility remains an issue.

- Done:
 - Begun assembling & tabulating crucial data for 6 month report
- Ongoing:
 - Find solutions for smaller beam sizes
 - Update models of alternative baseline design (v5.5)
- Todo:
 - Find new solution for for $\beta = 50\text{m}$
 - Determine nominal octupole settings
 - Quads only model (v6.0)
 - Develop OPAL model of FFA – need JP input.