Polarized positron Injector

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Plan

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Beam line parameters

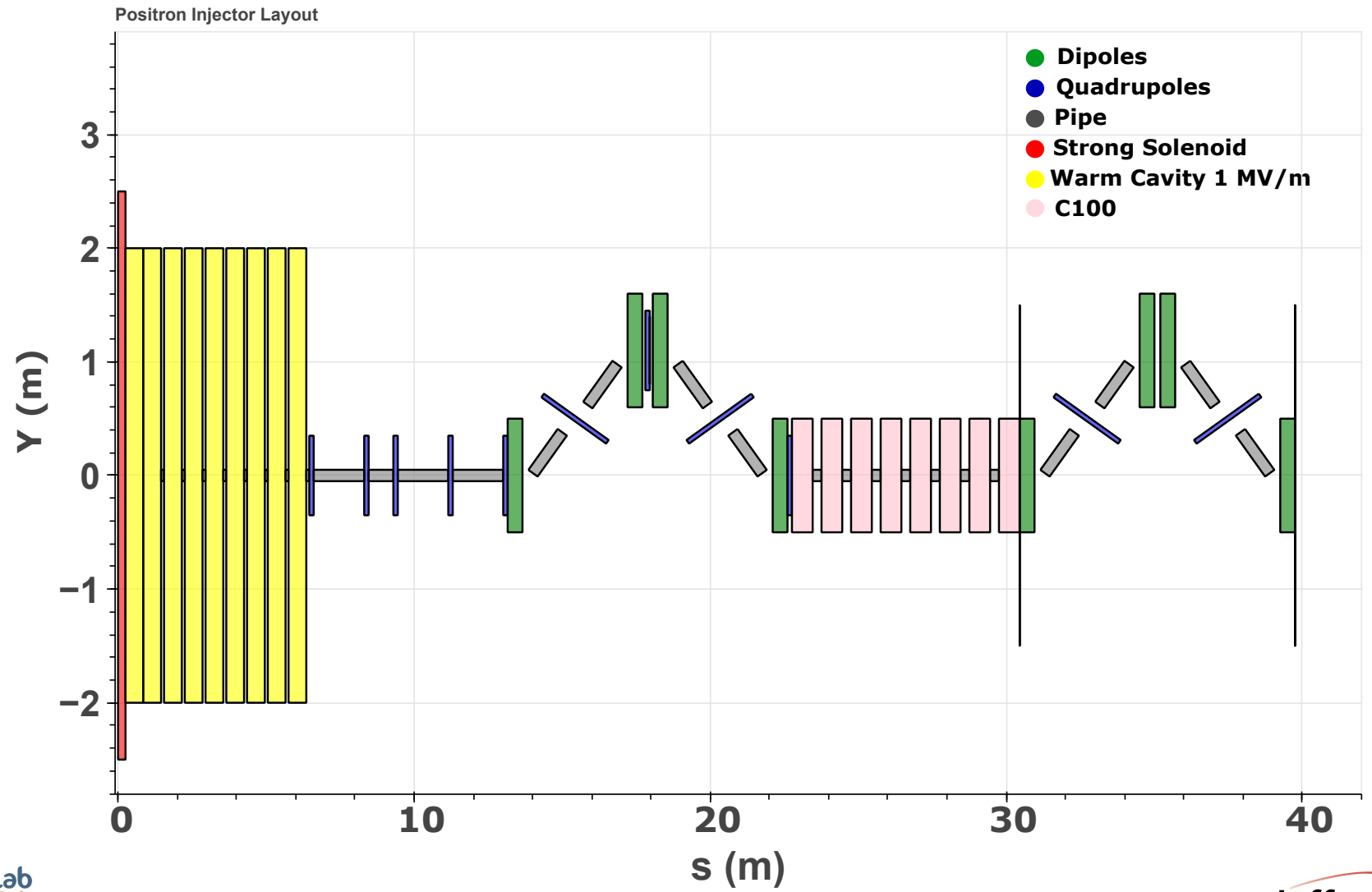
Params	Value
E_{e^-}	120 MeV
Target thickness	4 mm
QWT : B_1	2.5 T
QWT : L_1	0.25 m
QWT : B_2	0.05 T
QWT : L_2	5.4 m
Frequency	1497 Mhz
Cavity Gradient	1MV/m
Cavity length	0.2 m
Matching section	4 quadrupoles
Matching section: quad length	0.15 m
Matching section : Q_1	0.0276 kG/cm
Chicane dipole length	0.5 m
Beam pipe radius	0.03 m
collimator radius	0.008 m

Beam line parameters

Params	Value
E_{e^-}	120 MeV
C100 gradient	6 MV/m
C100: N cell	8 cells
C100: Cell length	0.7 m
C100: Frequency	1497 Mhz
R56 : Chicane 1	-0.25 m
R56 : chicane 2	-0.13 m
Beam chirp: chicane 2	4.2 m^{-1}
Dispersion: chicane 1	0.7 m
Dispersion: chicane 2	1 m

Plan

Positron Injector



Accelerating section

Cavities configuration

- $f = 1497\ Mhz$
- $E = 1\ MV/m$
- $L_{cell} = 0.2\ cm$
- $r_{cell} = 3\ cm$

Goal

- Reduce the energy spread of the accepted e^+ @ p = 60 MeV/c

Optimization method

- Track e^+ distribution using the QWT and the accelerating section.
- Set the on-crest mode to the smallest momentum.
- A different Off-crest phase is used.

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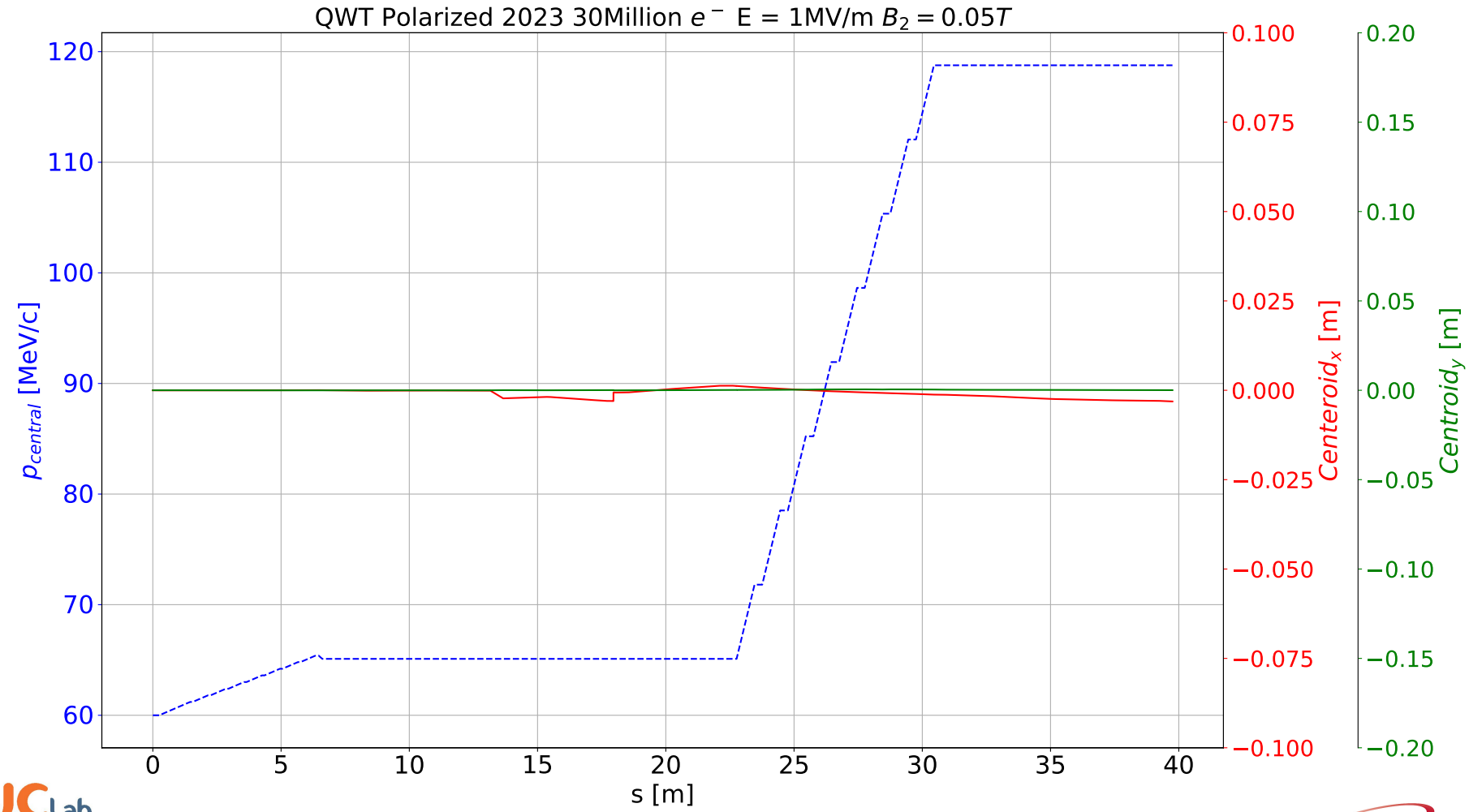
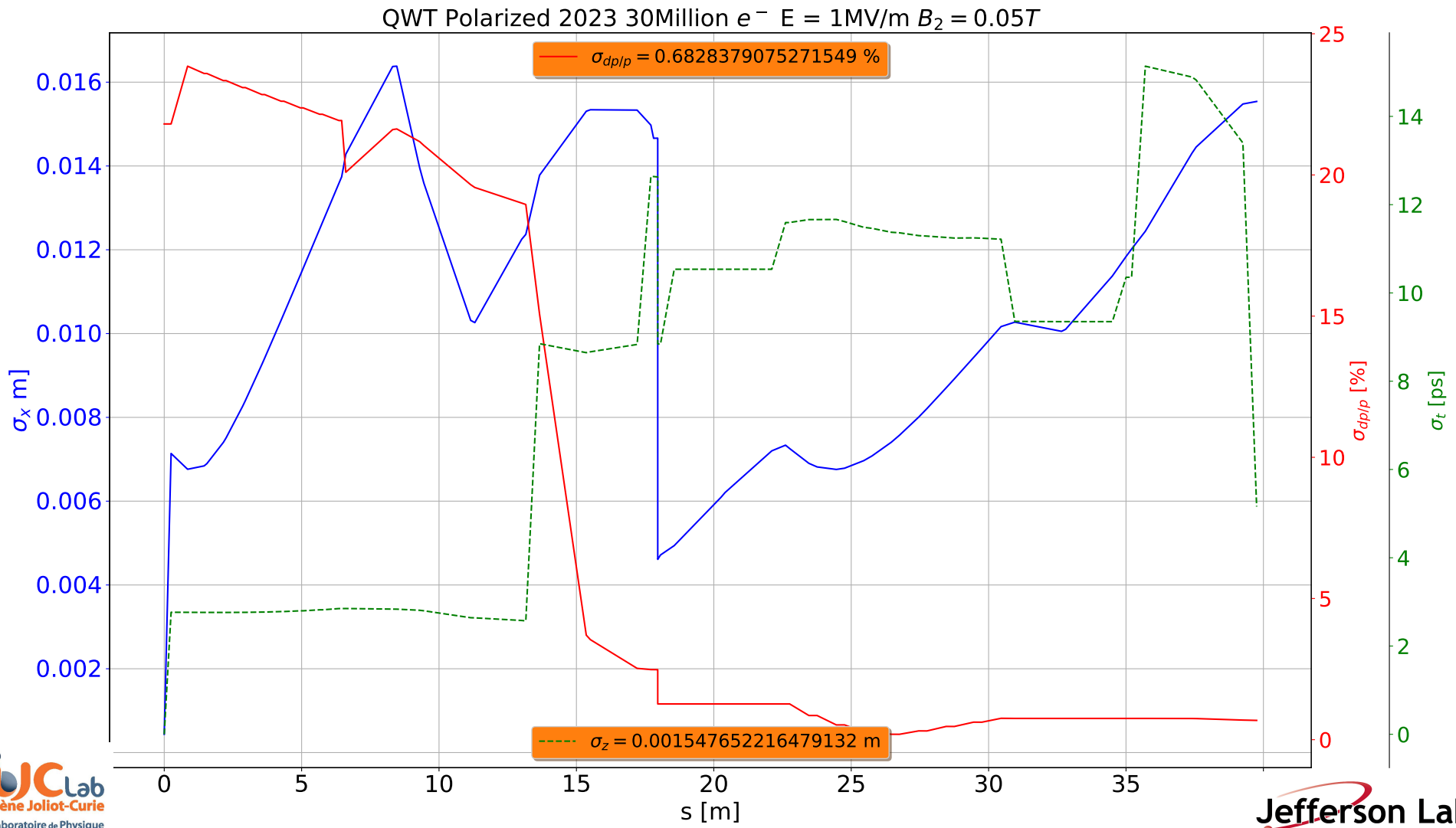
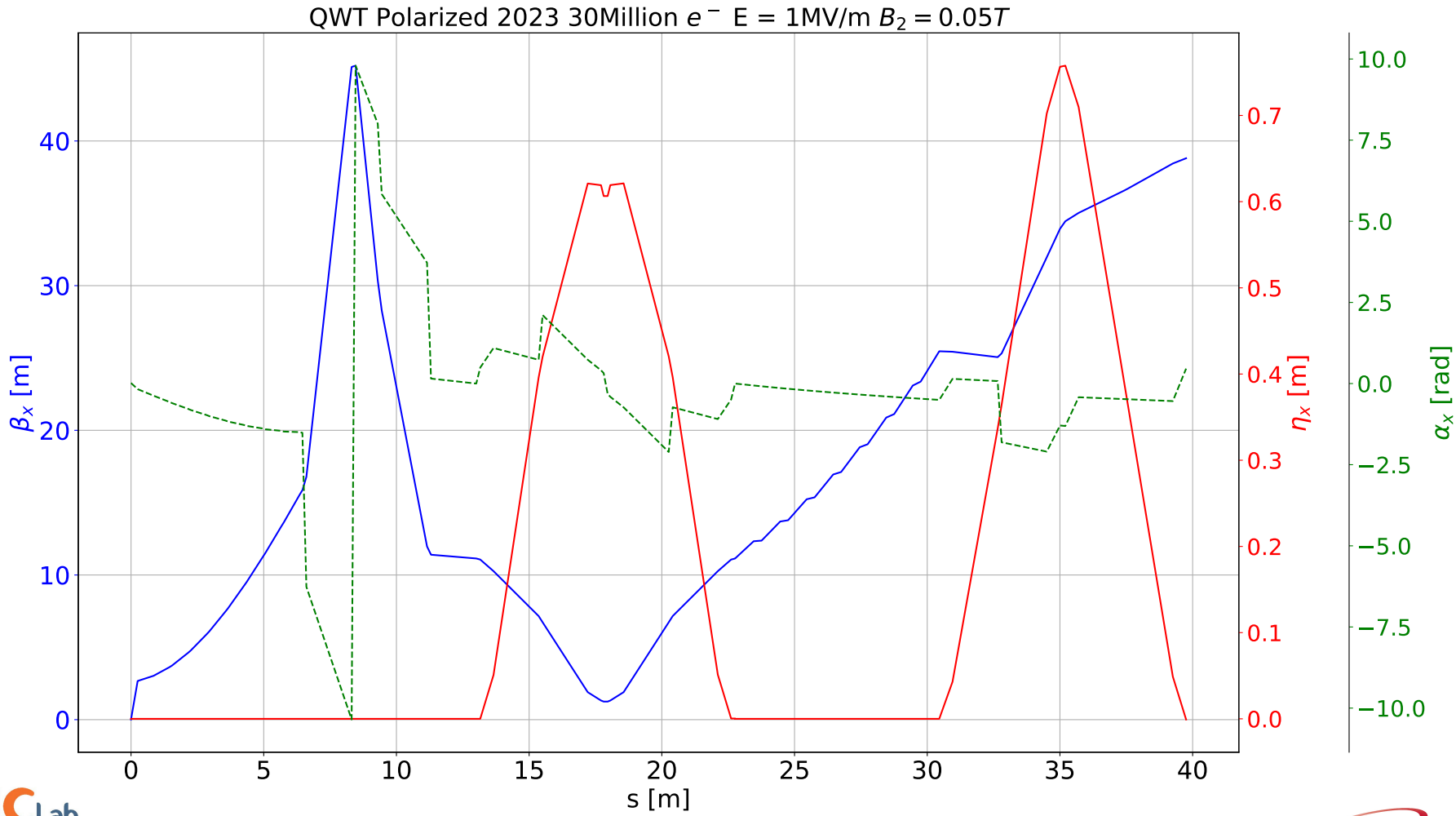
Central Momentum



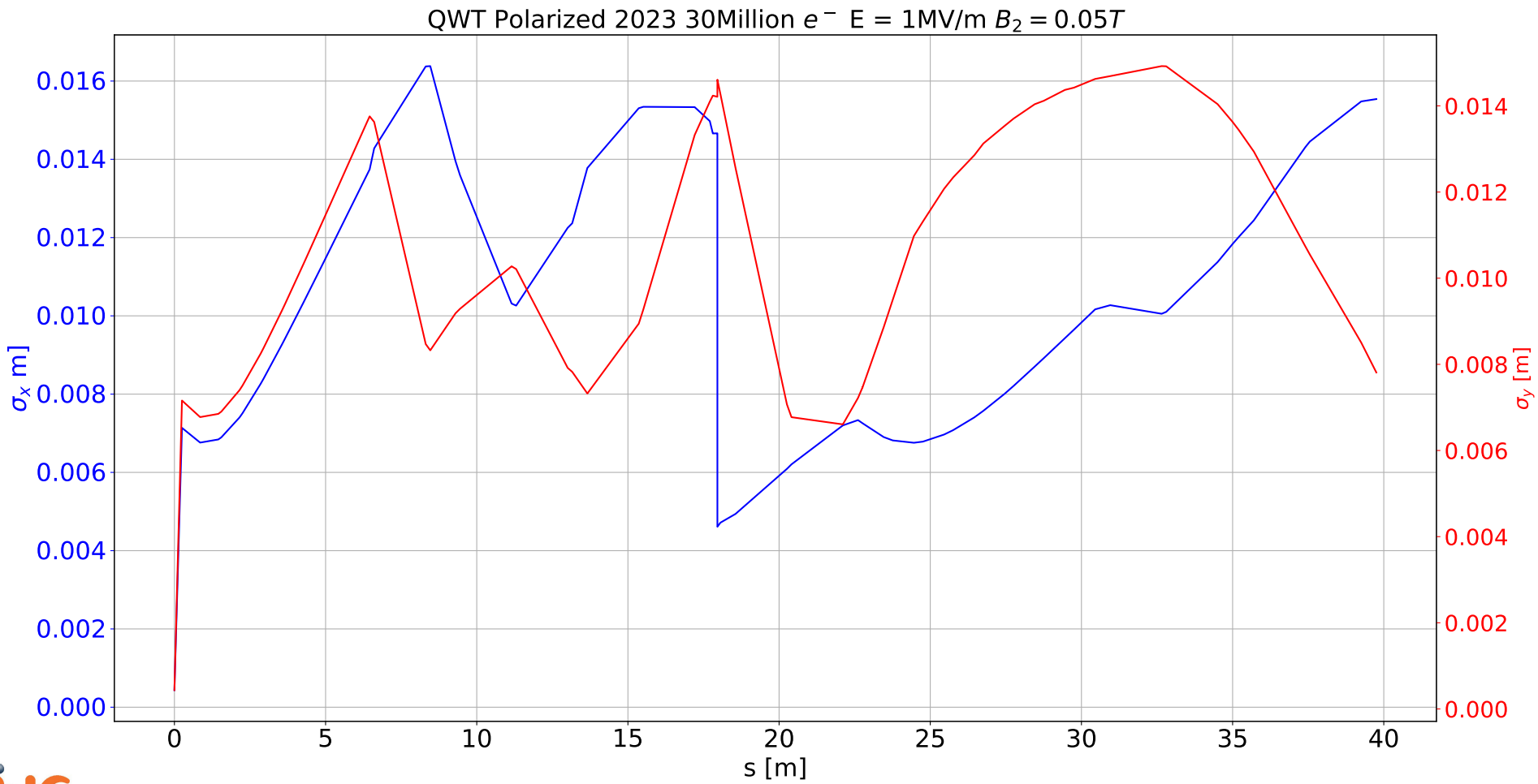
Energy spread and bunch length



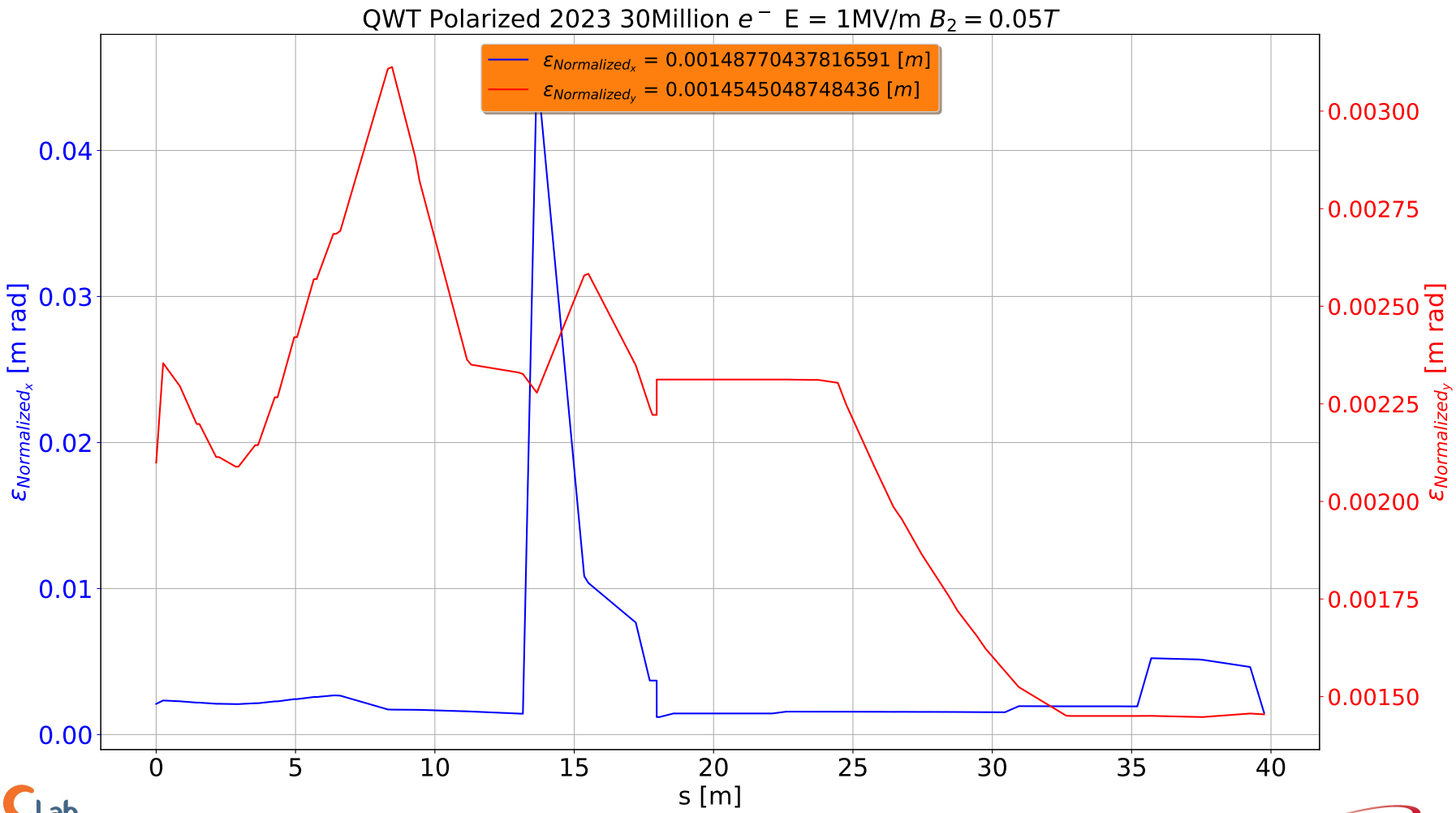
Twiss functions



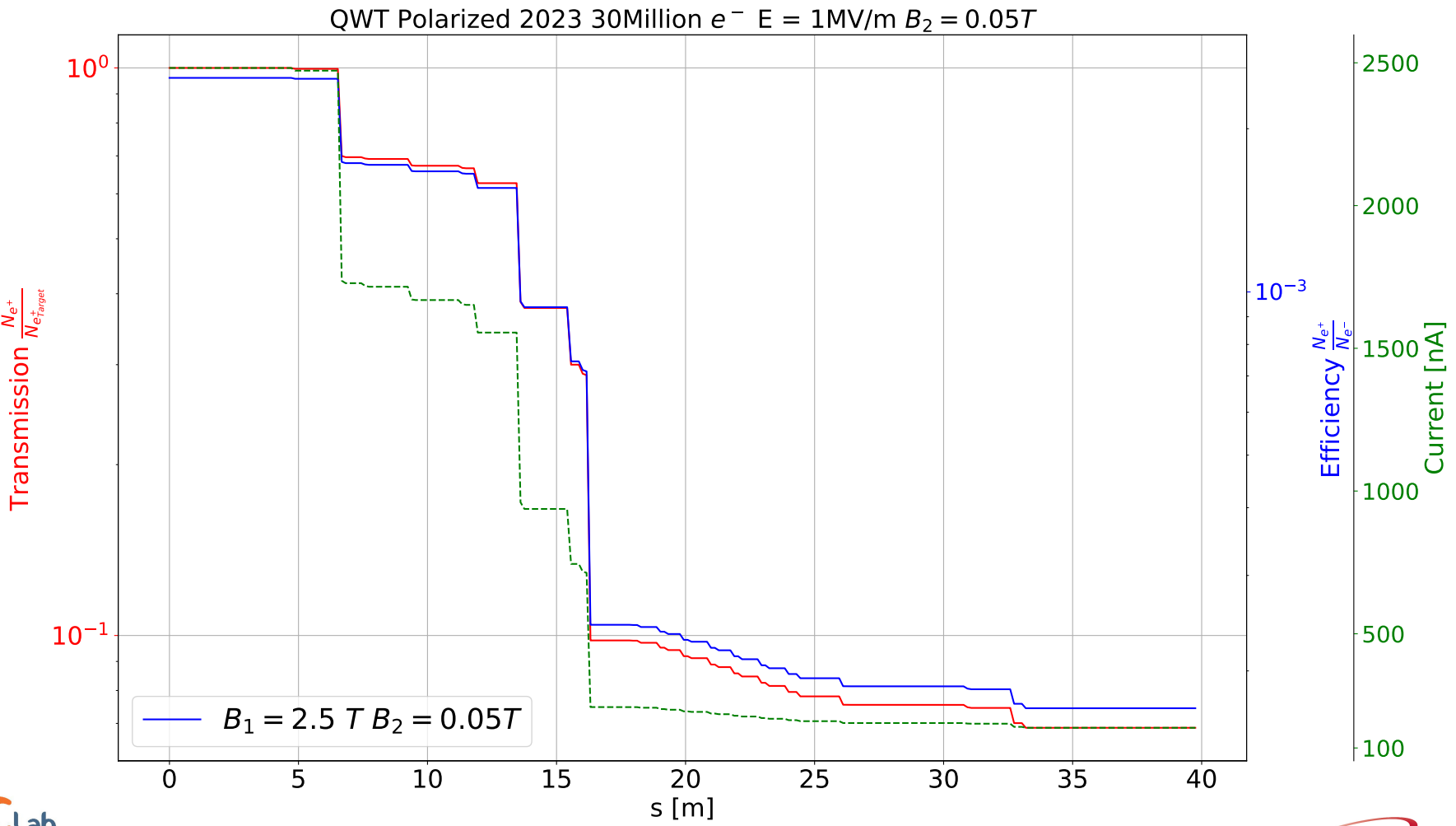
Beam size


QWT Polarized 2023 30Million e^- E = 1MV/m $B_2 = 0.05T$
σ_x [m]
σ_y [m]
s [m]
0.000
0.002
0.004
0.006
0.008
0.010
0.012
0.014
0.016
0
5
10
15
20
25
30
35
40

Normalized emittance



Transmission and current



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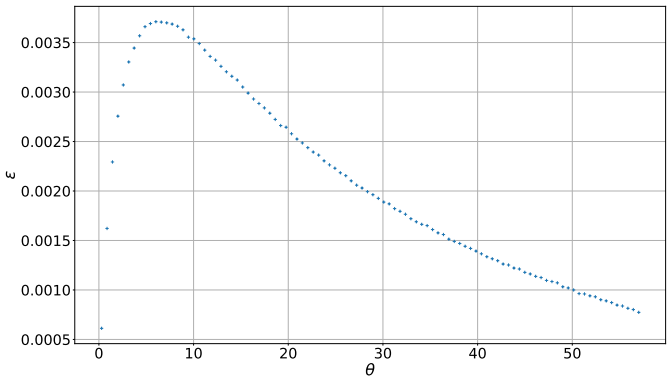
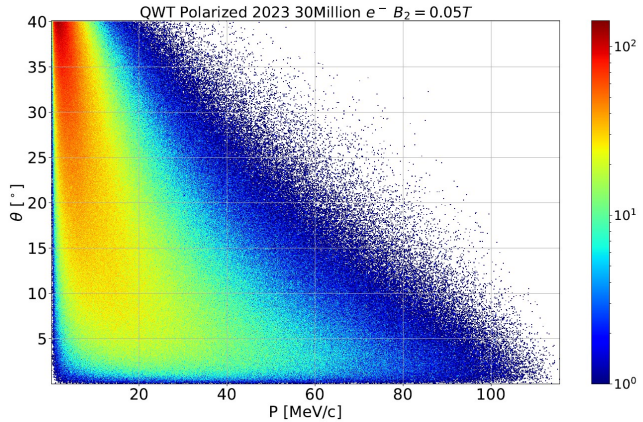
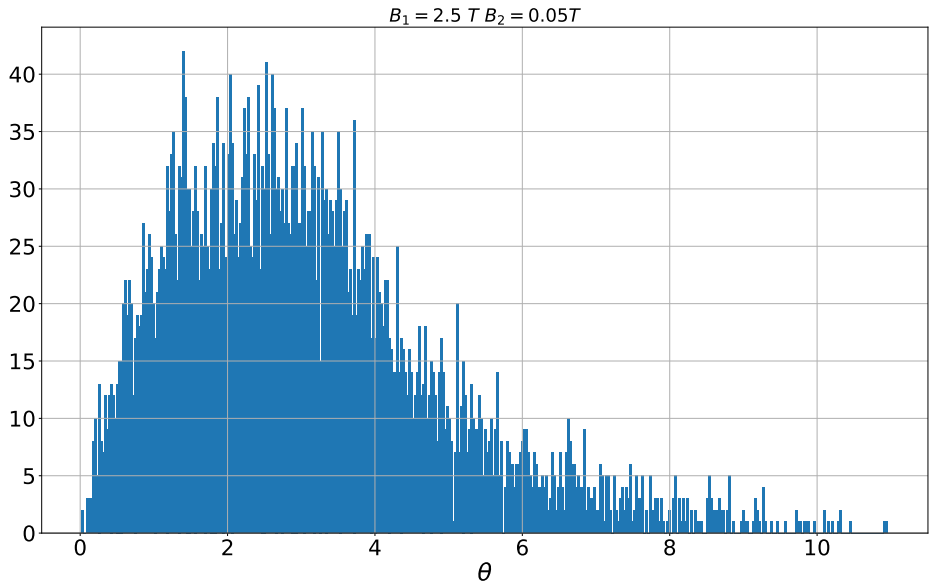
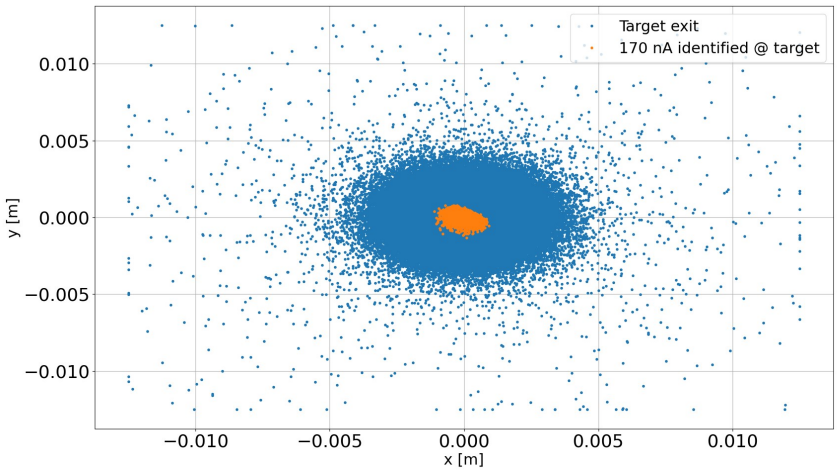
Angular distribution

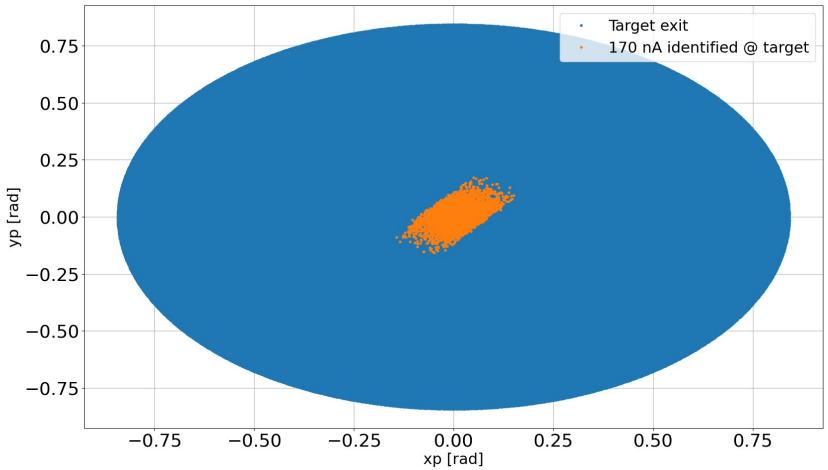






Transverse space





- The transmitted positrons are within the acceptance of the QWT
- $p_t^{QWT} = \frac{eB_1R}{2}. = 10.31°$
- $r_0^{QWT} = \frac{B_2}{B_1} R = 0.6\ mm$

Summury

Params	e^- beam	Target Exit one period	Exit ch2
$\sigma_{dp/p}$ [%]		1.3870	0.68
$\sigma_z[m]$		0.0002	0.0016
$\sigma_x[m]$	0.0005	0.0028	0.0081
σ_{xp} [rad]	pencil beam	0.0021	0.0007
N $\epsilon_x[mrad]$		0.019	0.0014
N ϵ_y [m rad]		0.002	0.0014
p Central [MeV/c]	120	60	123
e^+	1 mA	2482 nA	170 nA

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Conclusion

- Improve the compression.
- To get better compression, the energy spread has to be at least five times smaller at the exit of the C100.
- To improve the current we need more quadrupoles.
- Expecting higher current for the unpolarized mode P=15 MeV/c