# CeC Physics

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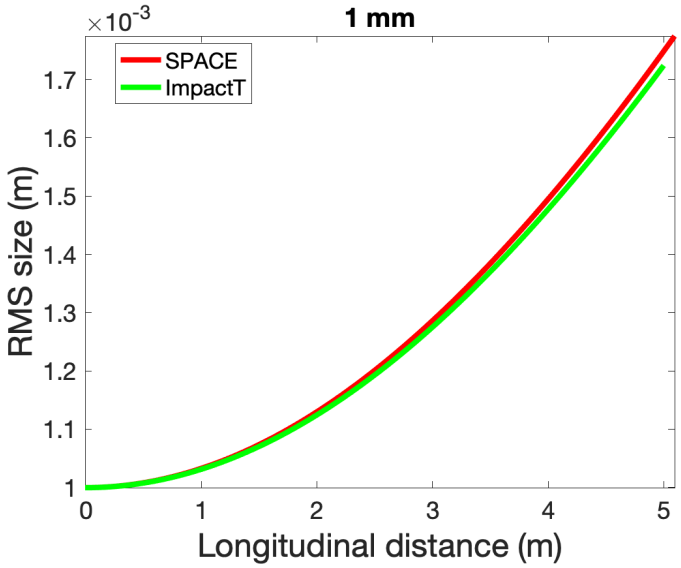
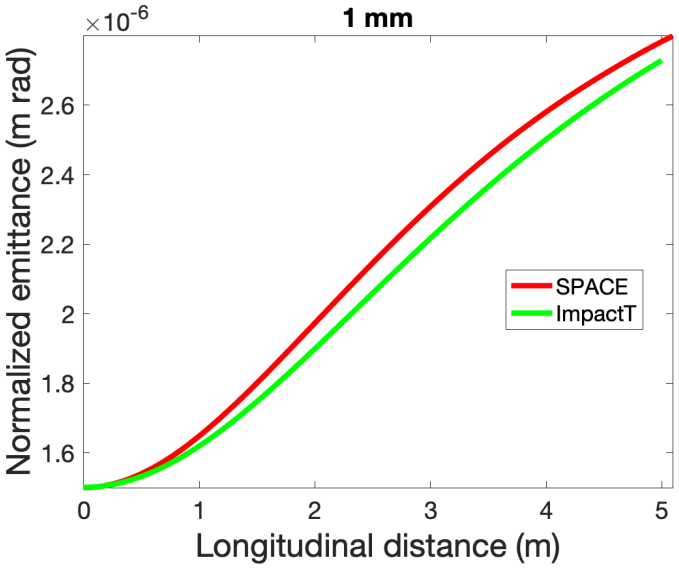
- 30 ps, 1.5 nC, uniform distribution in longitudinal
- Gaussian distribution in transverse
- Initial RMS size 1 / 2 / 3 mm
- Drift 5 m

# 1 mm

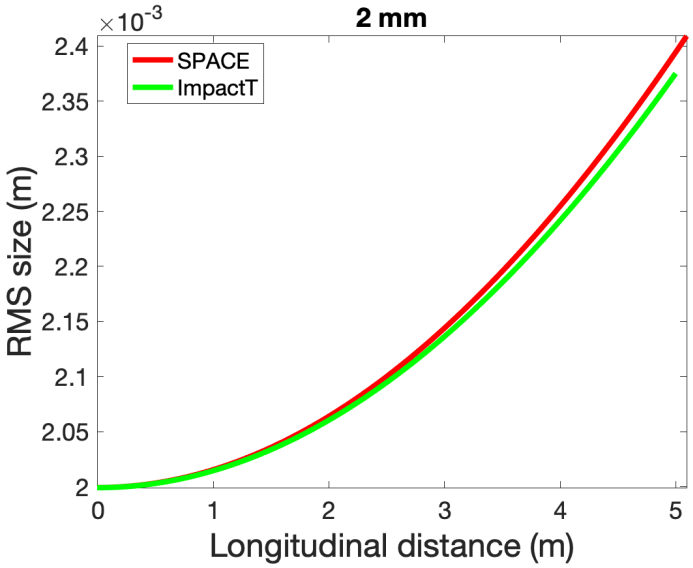



(a) Beam size

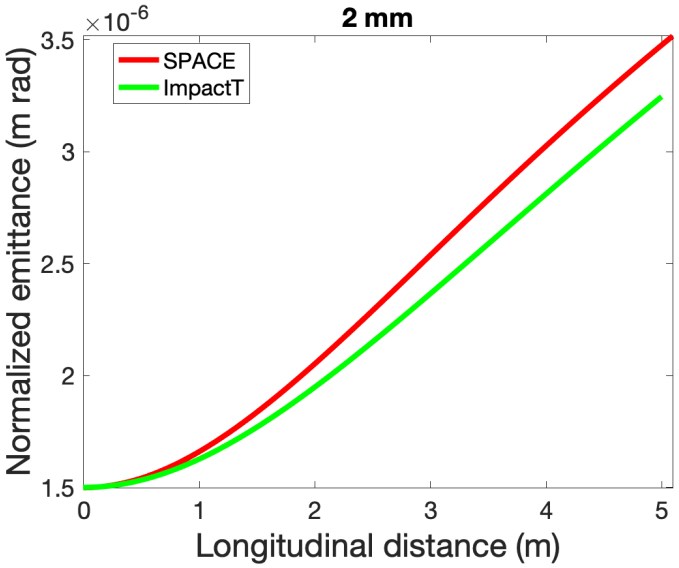



(b) Emittance

# 2 mm

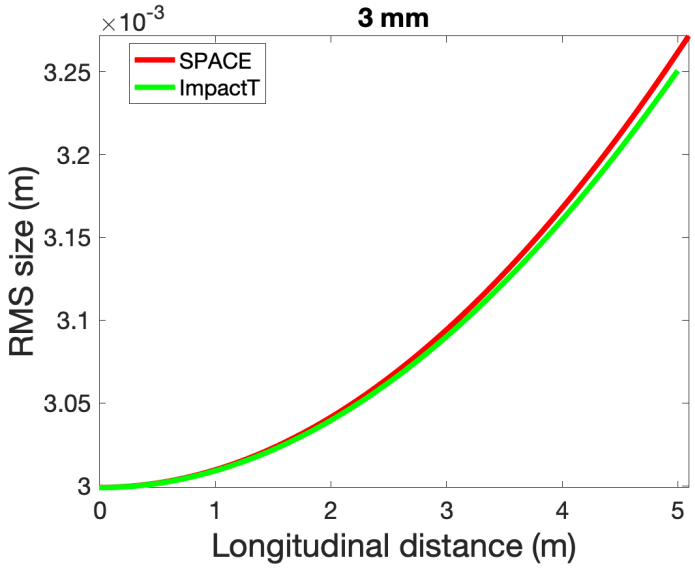



(a) Beam size

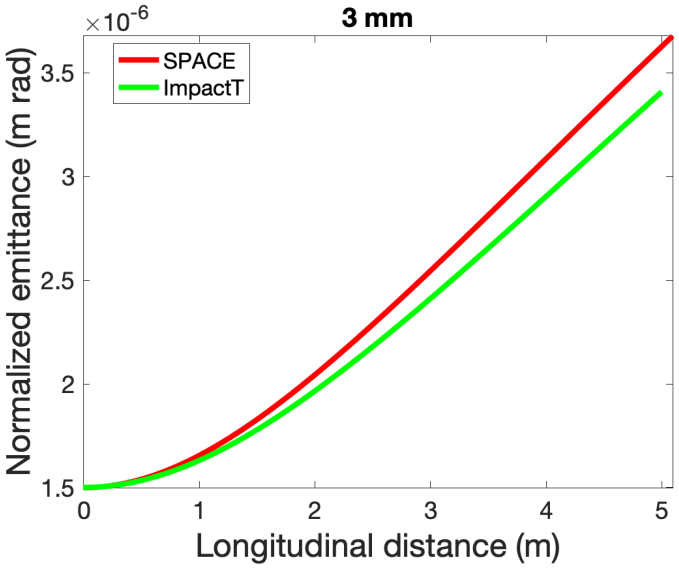



(b) Emittance

# 3 mm




(a) Beam size



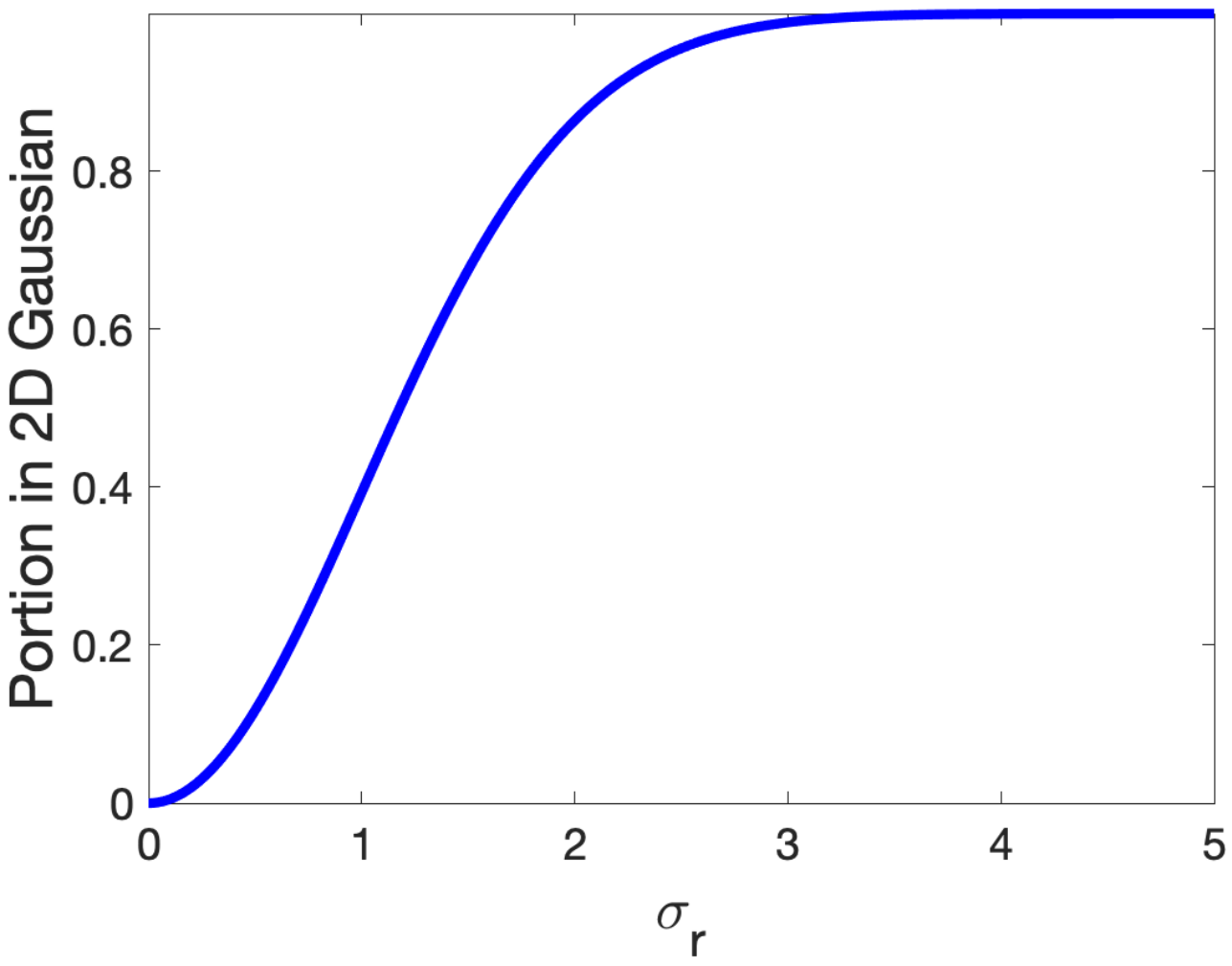

(b) Emittance

# 2D Gaussian

$$
\begin{aligned}
f(x,y) &= \frac{1}{2\pi\sigma_x\sigma_y\sqrt{1-\rho^2}}\exp\left(-\frac{1}{2(1-\rho^2)}\left[\left(\frac{x-\mu_x}{\sigma_x}\right)^2\right.\right. \\
&\quad \left.\left.-2\rho\left(\frac{x-\mu_x}{\sigma_x}\right)\left(\frac{y-\mu_y}{\sigma_y}\right)+\left(\frac{x-\mu_x}{\sigma_x}\right)^2\right]\right) \\
f(x,y) &= \frac{1}{2\pi}\exp\left(-\frac{x^2+y^2}{2}\right)
\end{aligned}
$$

# 2D Gaussian

$$
\begin{aligned}
\int_{x^2+y^2<R^2} f(x,y)dxdy &= \int_{x^2+y^2<R^2} \frac{1}{2\pi}\exp\Big(-\frac{x^2+y^2}{2}\Big)dxdy \\
&= \frac{1}{2\pi}\int_0^{2\pi} d\theta \int_0^R \exp\Big(-\frac{r^2}{2}\Big) rdr \\
&= -\exp\Big(-\frac{r^2}{2}\Big)\Big|_{r=0}^{r=R} \\
&= 1-e^{-R^2/2}
\end{aligned}
$$




(a)

- Full Gaussian, 6000000 macro particles,
  $\varepsilon = 1.72\mu m, \beta = 4.85m, \sigma = 0.54mm$
- Cut at $1.794\sigma$ keeps 80% particles, 4800014 macro particles,
  $\varepsilon = 1.33\mu m, \beta = 3.75m, \sigma = 0.42mm$