An electron beam is normally defined by its (6+1) 7 parameters.

Phase-space + charge = (x, y, z, px, py, pz) + charge

Input in many simulations is like: σ_x, σ_y, σ_z, ϵ, γ, $\Delta\gamma$, Q + distribution

In impactX we give: Beam kinetic energy (E_b).

Bunch charge.

Particle numbers (npart).

&

Particle bunch distribution (waterbag)

$$\lambda_q = \sqrt{\frac{\epsilon}{\gamma}}$$

$$\lambda_p = \sqrt{\frac{\epsilon}{\beta}}$$

$$\mu_{qp} = \frac{\alpha}{\sqrt{\beta\gamma}}$$

Further, input parameters for impactx

$$\lambda_{px} = \sqrt{\frac{\epsilon_x}{\beta}}$$

$$\lambda_{py} = \sqrt{\frac{\epsilon_y}{\beta}}$$

$$\lambda_{pt} = \sqrt{\frac{\epsilon_?}{\beta}} \leftarrow ?$$

$$\lambda_x = \sqrt{\frac{\epsilon_x}{\gamma}}$$

$$\lambda_y = \sqrt{\frac{\epsilon_y}{\gamma}}$$

$$\lambda_t = \sqrt{\frac{\epsilon_?}{\gamma}} \leftarrow ?$$

$$\mu_{xpx} = \sqrt{\frac{\alpha_x}{\beta\gamma}}$$

$$\mu_{ypy} = \sqrt{\frac{\alpha_y}{\beta\gamma}}$$

$$\mu_{tpt} = \sqrt{\frac{\alpha_?}{\beta\gamma}} \leftarrow ?$$

We know beam kinetic energy, therefore, γ and β can be calculated.

Kinetic energy = $E_b = m_0c^2 (\gamma - 1)$

$$\beta = \sqrt{1 - \left(\frac{1}{\gamma}\right)^2}$$

If we know ϵ_x and ϵ_y we may calculate λ_x, λ_y, λ_{px}, λ_{py} (right ?)

But how to calculate λ_t and λ_{pt} ??

Also, how to calculate μ_{xpx}, μ_{ypy}, μ_{tpt} ??