Experiment
CLARA
Quad Currents (strengths) of quads 3, 4, 5
Beam sizes and coupling xy terms obtained from the N cameras
If experiment
If simulation
Simulation
GPT Covariance Matrix
Setup Optics
Match beam divergence (obtain function to optimise the quad 1 and 2 strengths that produce beam with waist at reconstruction point (beam approximately round and convenient size at the camera)
Calculate the transfer matrix at the reconstruction point using the optimum quad 1 and 2 strenghts
Recalculated covariant matrix ∑ at reconstruction point
Performing a quad scan
Set initial set of quads from the array of quad strengths (quads 3, 4, 5)
Determine beam size at observation point for each set of quad strengths
Beam size at each step of the scan
N< length of the array of quad strengths
Total array of beam sizes for the set of quad strengths (quads 3, 4, 5)
Determine Quad Strengths to be used during the quad scan
Split total range into the number of steps
Initial range of quad strengths to scan for quad 3
For a Quad 3 strength , adjust quad 4 and quad 5 to get the beam at observation point which will be “round” enough and not “too big” or “too small” (as it would appear in the camera).
Choose number of steps
Nscan < number of steps
Nscan > number of steps
Record optimised quad 3, 4, and 5 strengths
Total set of quad strengths (for quad 3, 4 and 5)
Data analysis to compute the emittance and optics
Calculate the D matrix (3N×10) from the quad strengths (quads 3, 4, 5)
Construct the vector of beam sizes from measurements or simulations (obtained at the end of quad scan step), $\sigma_{x,y}$ (3N× 1)
Find the covariance matrix ∑’’ at reconstruction point from the D matrix and the vector of beam sizes as
∑’’ = pseudoinverse(D) × $\sigma_{x,y}$
Calculate emittances and optics from the eigenvalues and eigenvectors of ∑’’· S_matrix
S_matrix = [0 1 0 0
-1 0 0 0
0 0 0 1
0 0 -1 0]
ε_I
ε_{II}
α, β, γ for both normal modes