COTR Meeting

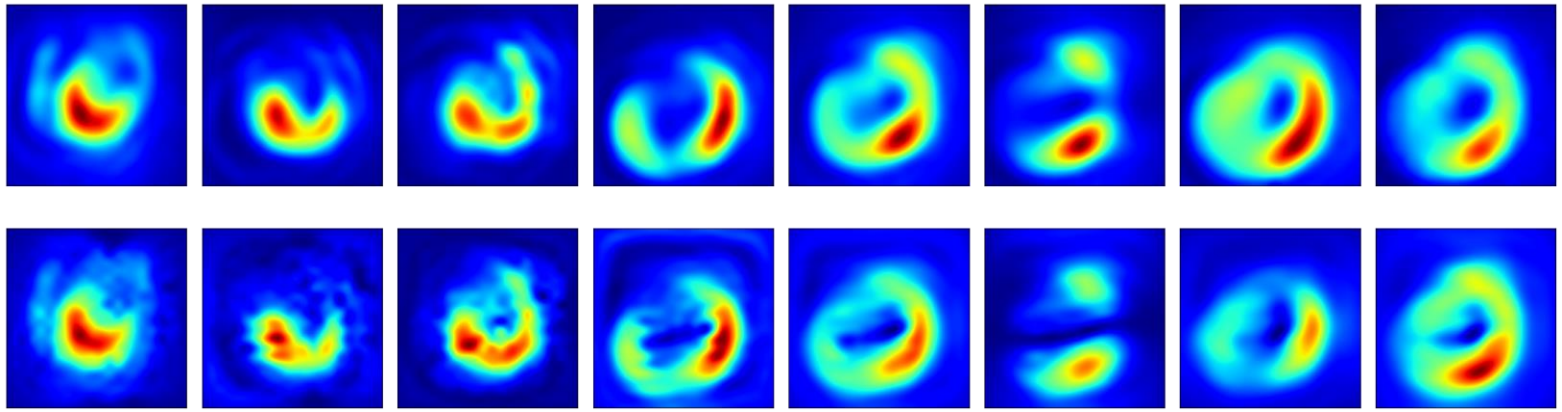
Ze Ouyang

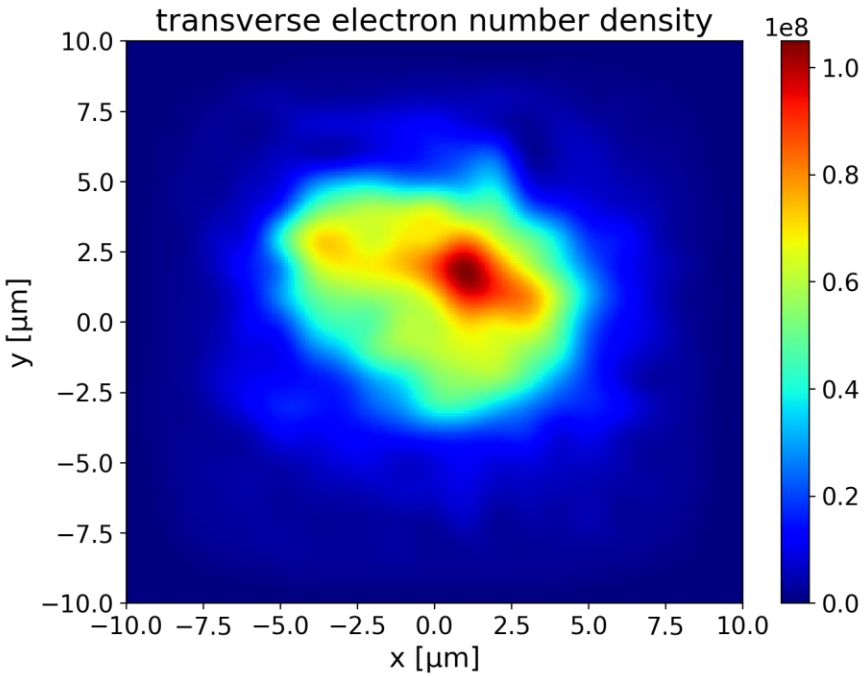
4th March, 2025

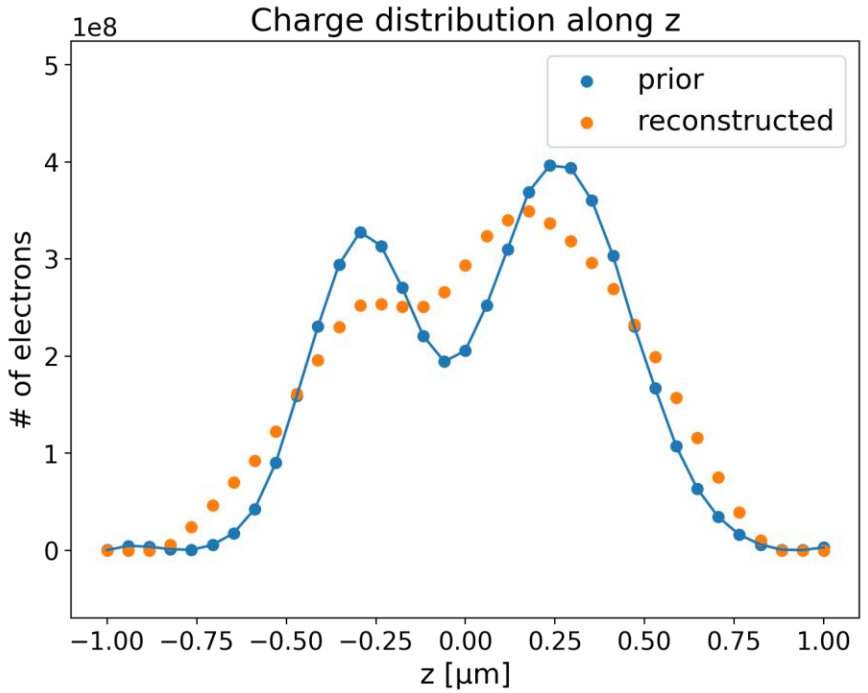
Reconstruction on Shot 228

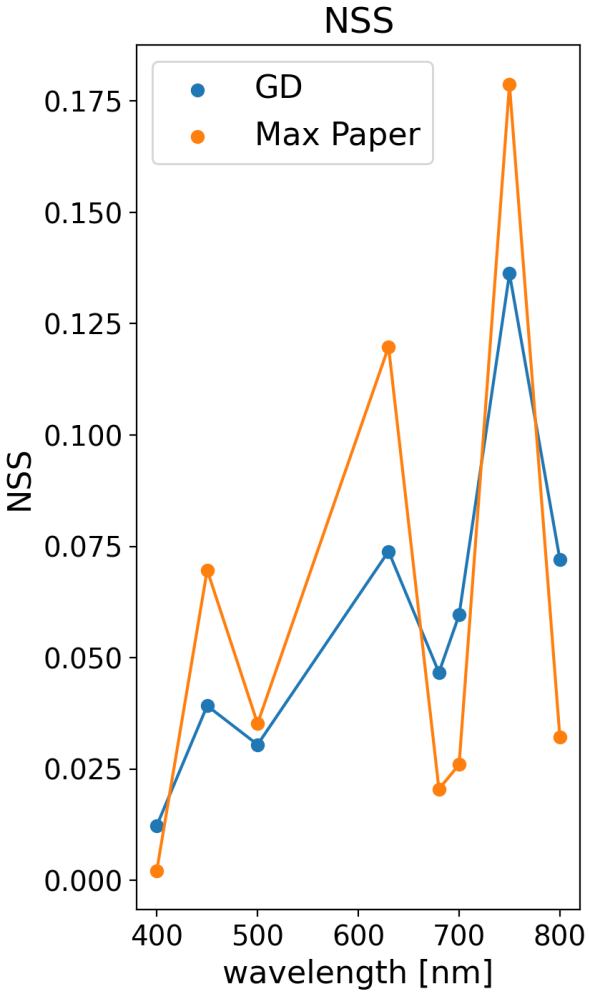
Measured COTR

Reconstructed COTR





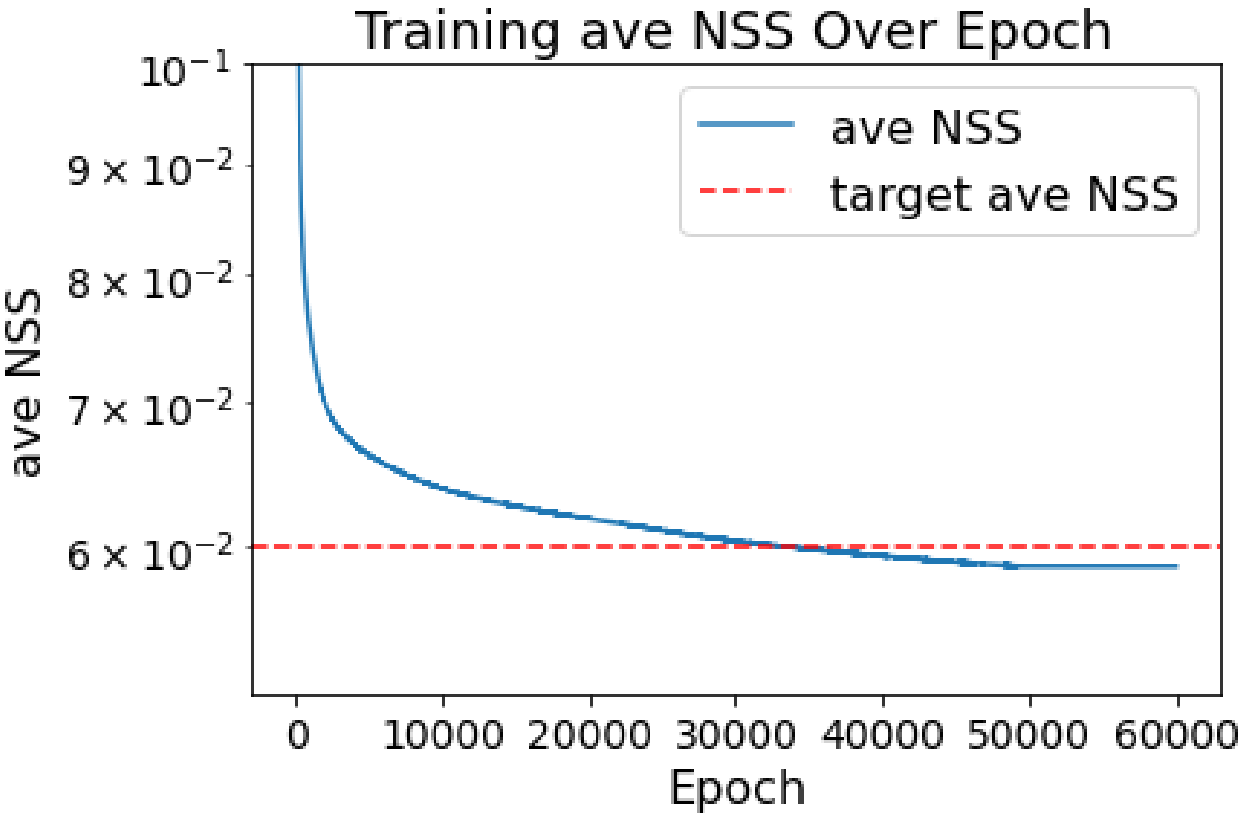




Average NSS in Max paper: 0.060

Average NSS with GD: 0.058

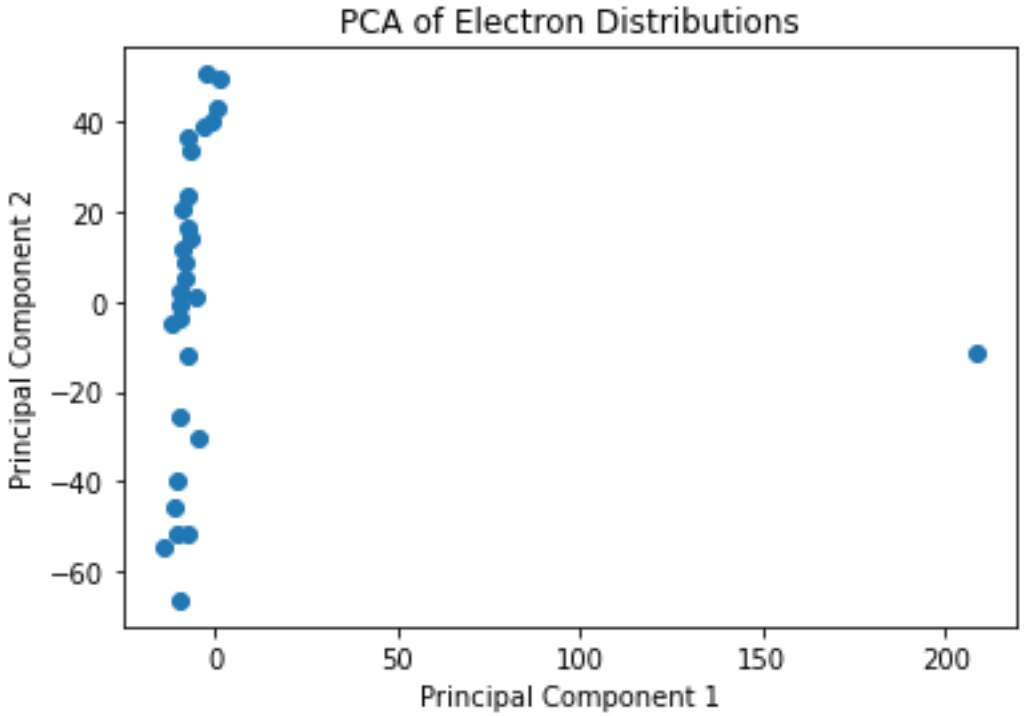
Reconstruction on Shot 228

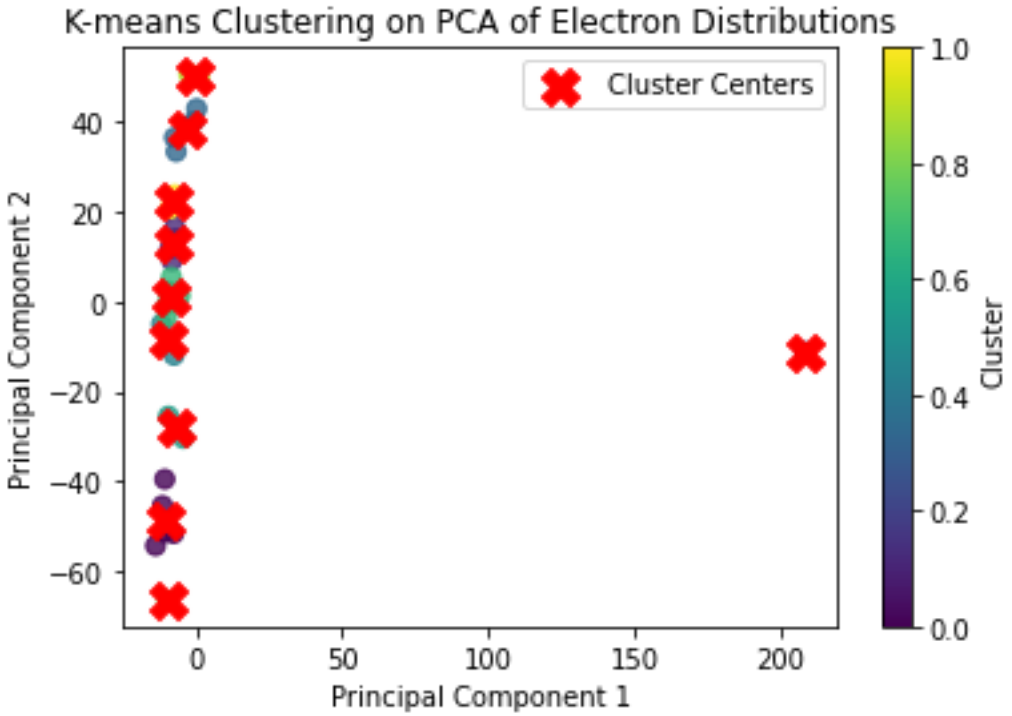


~50 mins for 60k iterations

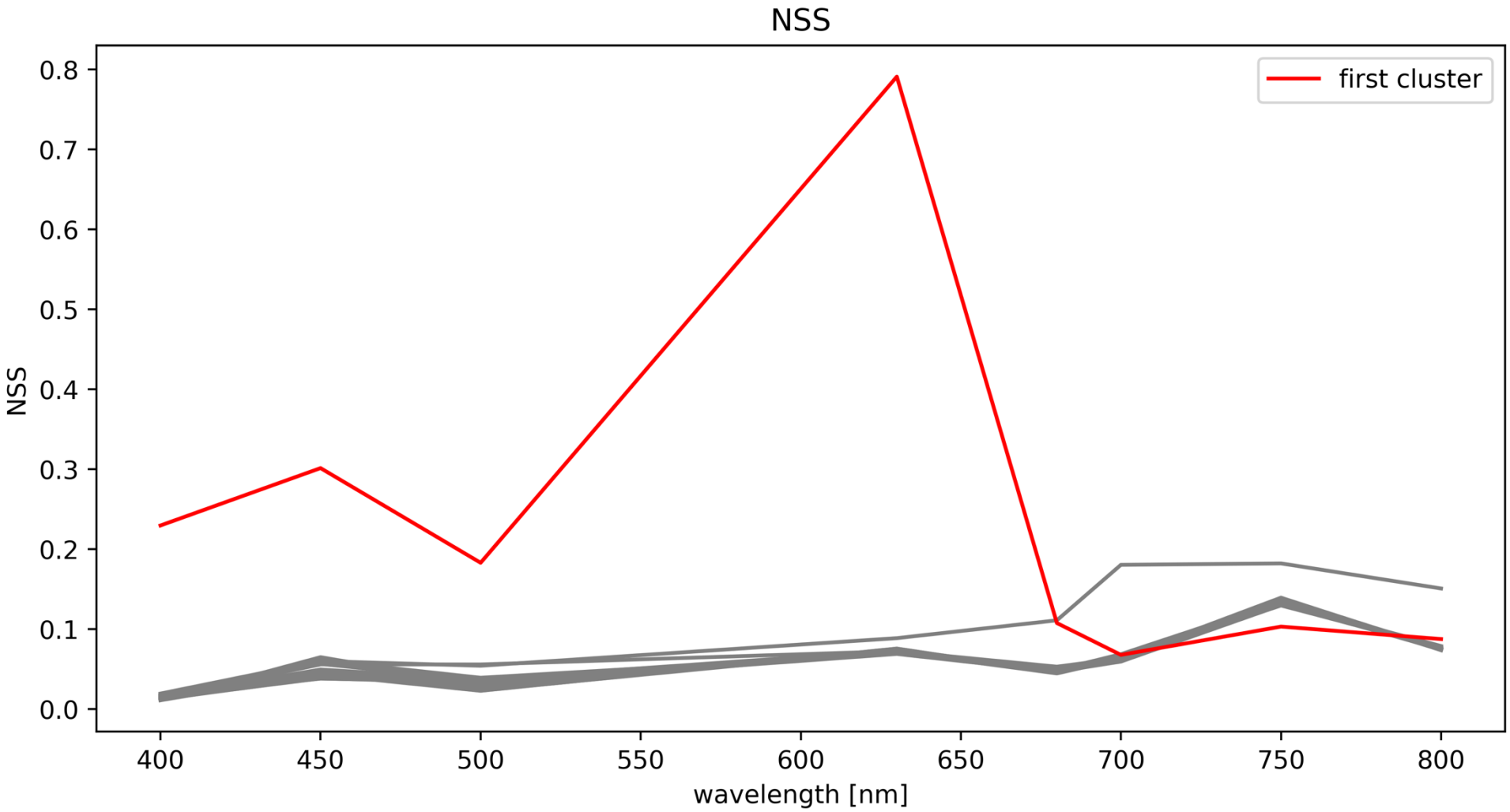
PCA & K-means analysis

- After 30k iteration, save a solution, NSS = 0.6 for each solution, respectively
- List below is a set of 30 solutions.





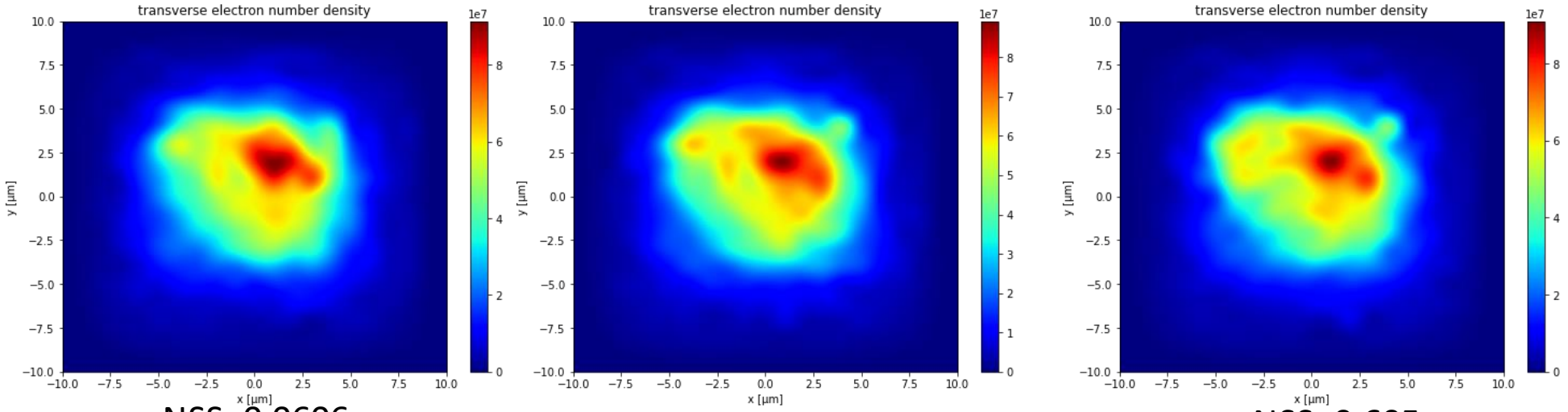
PCA & K-means analysis



First cluster has solution: 1st, 4th, 6th, 11th and 17th

Preliminary Analysis on Uniqueness

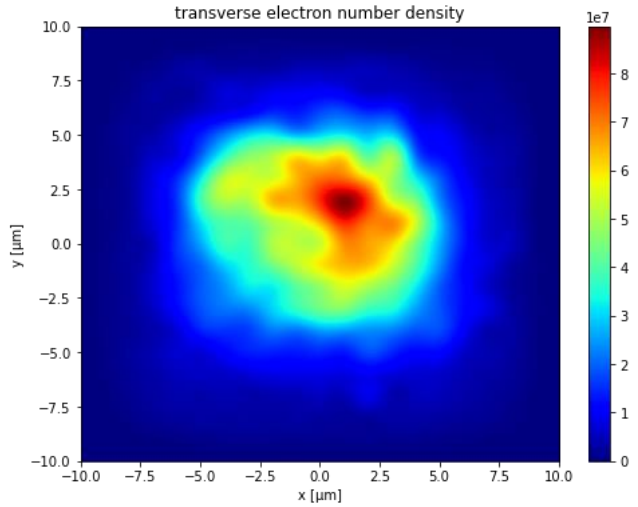
First cluster of the 30 solutions.



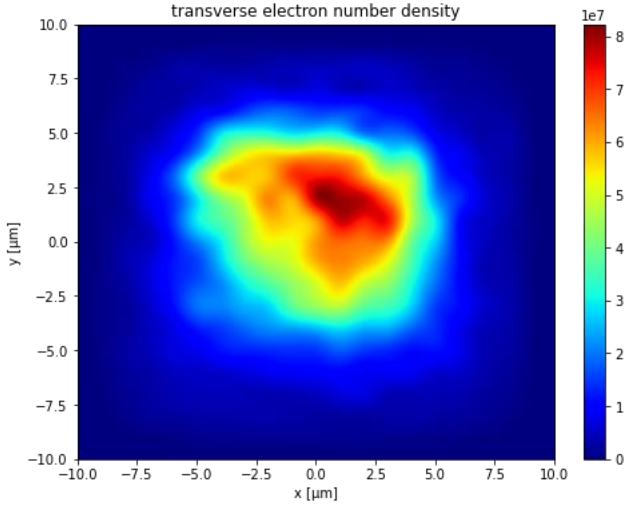
NSS=0.0606

NSS=0.0608

NSS=0.605



NSS=0.608



NSS=0.600

Work Ahead

1. Tuning hyper-parameters: Nx, Ny, Nz, Ne, loss weight design, initial condition, Hanning window edge ratio, learning rate, learning schedule, lambda_1, lambda_2, & penalty design (**HZDR machine learning team contribution**) for better convergence
2. Developing Generative Neural Network Method, current NSS = 0.08
3. Data exploration of the other two injection
4. Manuscript preparation
5. Supercomputer usage: We have in total 5000 unit computation hour, 60% has been used now. We **may** need to top it up.

Proposed Work in HZDR (Hopefully)

1. Discussion (technical details) and manuscript preparation on ML-based **3D** reconstruction of electron bunches, with Max, Ritz, Jady, Alex, …
2. Discussion on DE-based & ML-based **5D (2D)** reconstruction of electron bunches, with Max, Ritz, Jady, and ….
3. DRACO Laser training, designing & running next-generation COTR experiments (optical noise, theory of form factor determination with phase measurements of COTR, wavefront sensors or microlens array)
4. Learn more about FEL experiments, find new simulation work & ML-collaboration