**Dataset: 6D phase space of charged beam in particle accelerator**

HPSim, **an advanced, open-source tool developed at LANL**, enables rapid, online simulations of multiple-particle beam dynamics is used to collect data. HPSim **solves Vlasov-Maxwell equations** to calculate the effects of external accelerating and focusing forces on the charged particle beam as well as space charge forces within the beam. **We utilize HPSim to collect limited data for the deep learning model**. The simulations are performed on macroparticles (1,048,576 in number). To generate the dataset from HPSim, the RF set points (amplitude and phase) for the first four modules are randomly sampled from a uniform distribution keeping the rest of the set points of 44 modules at a mean value. Other beam and accelerator parameters, like the initial beam condition, are also set to constant realistic values. Using the RF set points as inputs to the simulation, HPSim provides a six-dimensional phase space of the charged particle beam in the form of 15 unique projections (x-px, x-y, x-py, x-z, x-pz, y-px, y-py, y-z, y-pz, z-px, z-py, z-pz or E-ϕ, px-py, px-pz, and pz-py) at each of the 48 modules. **1400 different simulations are performed to collect training data and another 100 simulations for the test data**. The figures show how the dataset looks like. Here we are showing only 3 out of 15 projections of the 6d phase space.
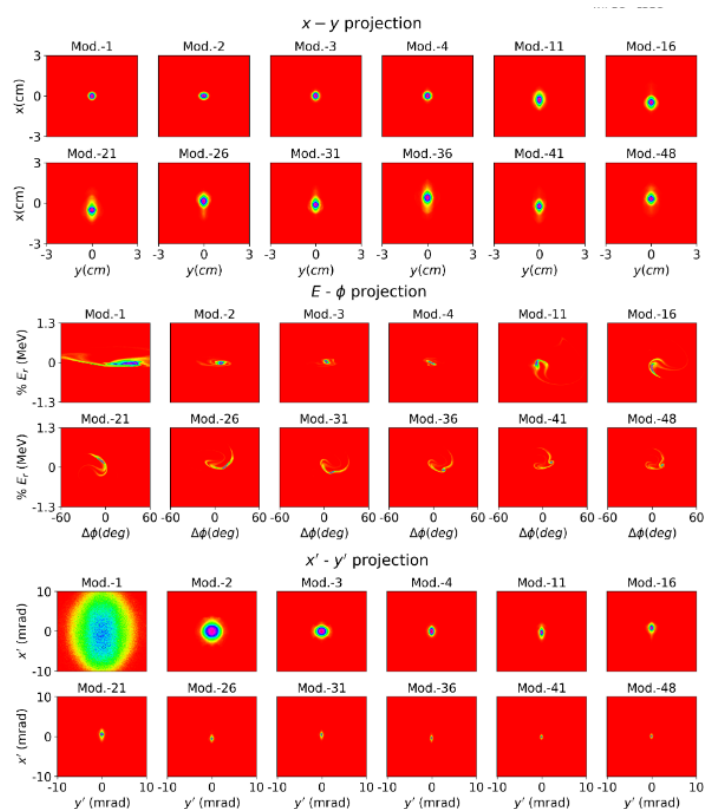
Dataset specifications:

- Training set (numpy array): 1400 simulations of projections of phase space 15 x 256 x256 in 48 modules
- Test set (numpy array): 100 simulations of projections of phase space 15 x 256 x256 in 48 modules.