

# Physics and Applications of High Brightness Beams



Contribution ID: 97

Type: **Poster**

## Extending the functionalities of the ASTRA tracking code with the GIOTTO AI code

ASTRA is a well-known tracking code able to simulate with high accuracy space charge dominated beams dynamics.

GIOTTO, on the other hand, is an AI code (based a genetic algorithm) used to optimize beam dynamics in the presence of strong nonlinear correlations, such as those introduced by space charge forces or more generally by complex collective effects.

GIOTTO was designed to natively integrate with ASTRA and drive it by interpreting its outputs, but it could potentially be integrated with any other simulation code.

In this work we present the recent developments in the GIOTTO code that allow ASTRA to be used for new types of optimizations.

These new features enable the ASTRA user to close dispersion in doglegs (even in the presence of space charge forces) and more generally to optimize beam parameters in rotated reference systems with respect to the machine main axis, optimize combed beams and perform phase space cuts before optimizing.

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**Session Classification:** Poster