Integrating Warp and Synergia for Electron Column Simulations

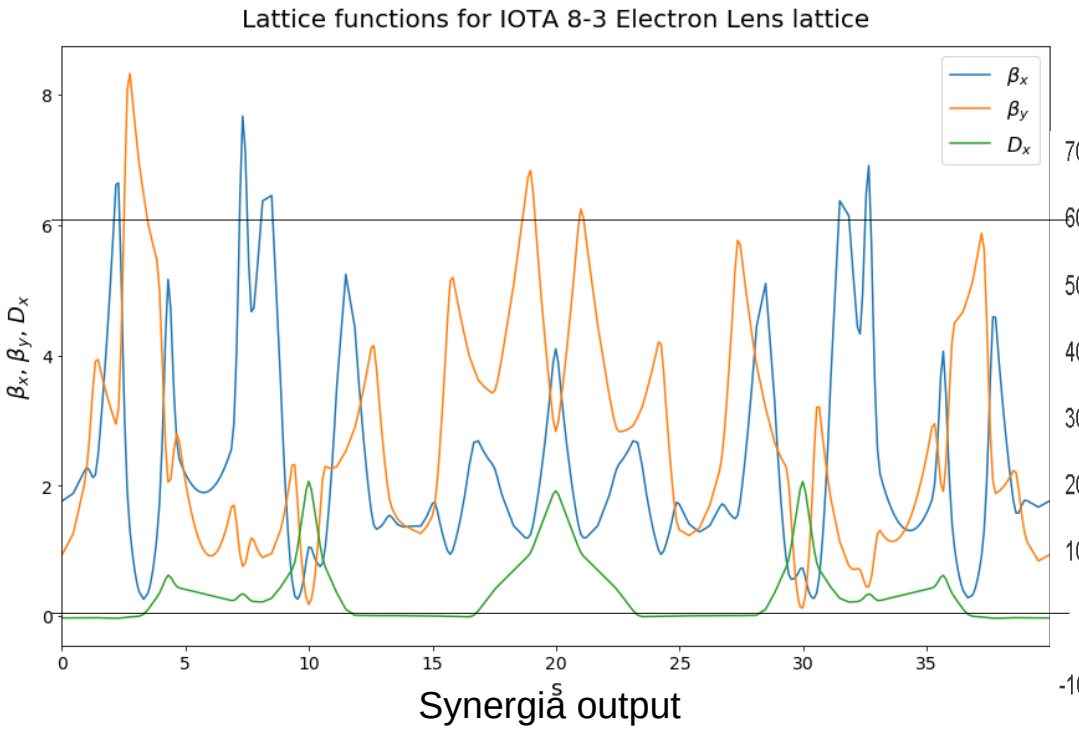
Ben Freemire

Northern Illinois University

Electron Column Meeting
September 25, 2018

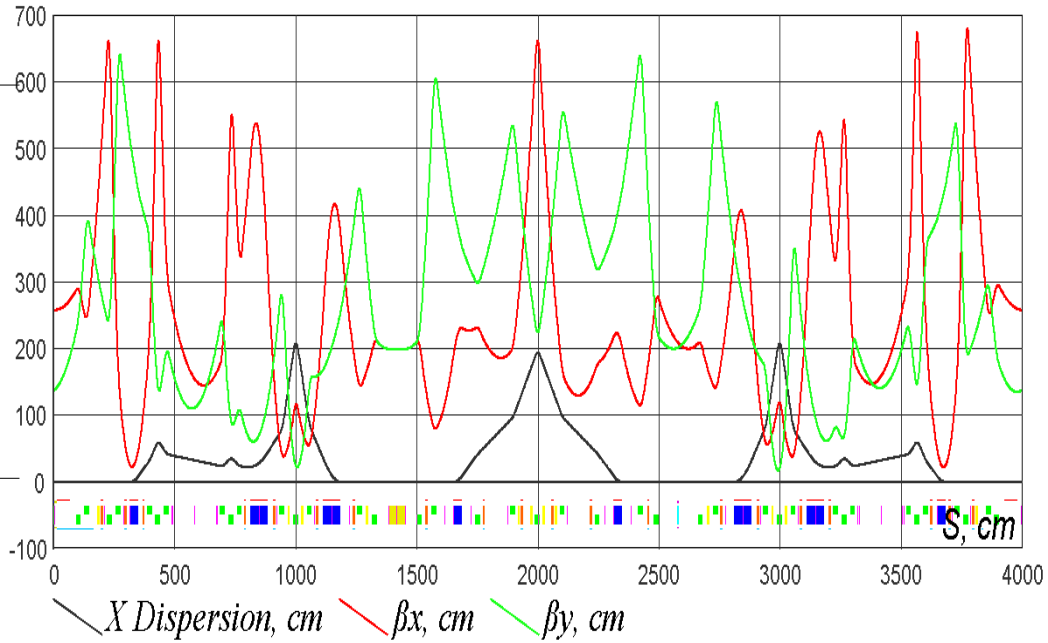
Lattice Functions – Old

- Default plotting functions in rssynergia notebook do not take into account account parameterization for transverse coupling



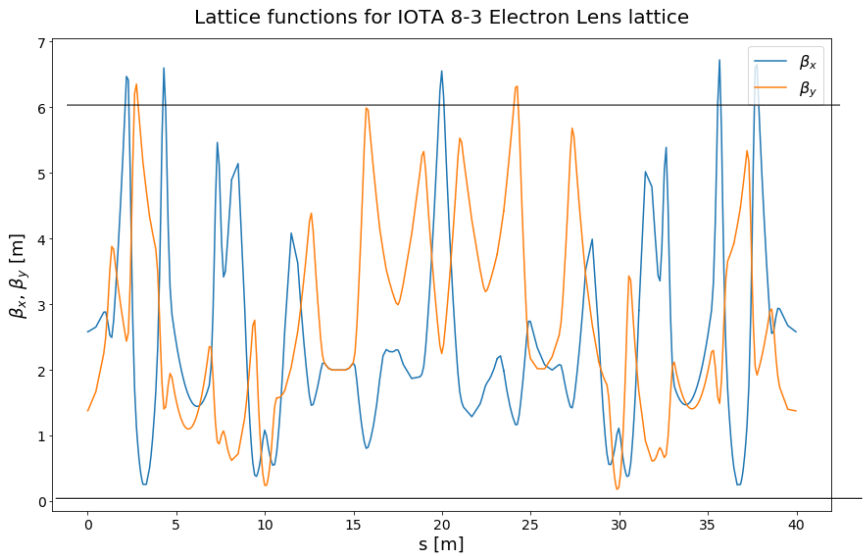
Synergia output

A. Romanov, FAST/IOTA Collaboration Meeting, 6/6/17



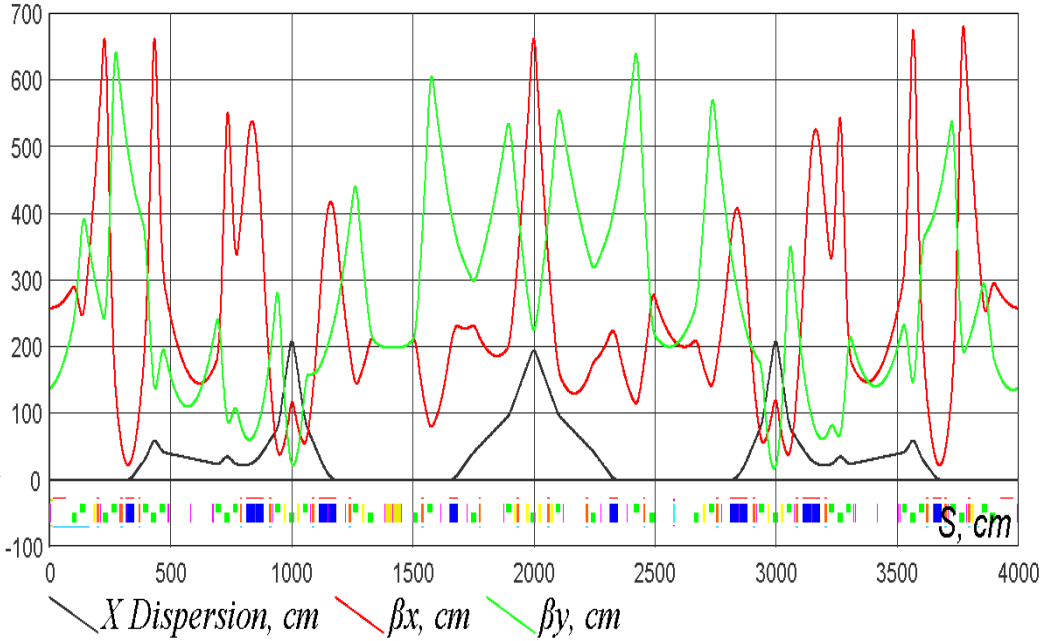
Lattice Functions – New

- Lattice functions obtained using Edwards-Teng parameterization match MADX output more closely
- Now betas matched at location of Electron Column (14 m)



Synergia output

A. Romanov, FAST/IOTA Collaboration Meeting, 6/6/17



Tunes

- MadX: 0.0557**0**462, 0.557**0**302
- Synergia: 0.0557**2**113, 0.557**1**157

Single Turn Transfer Matrices

All transverse components agree to better than 1e-5

MadX

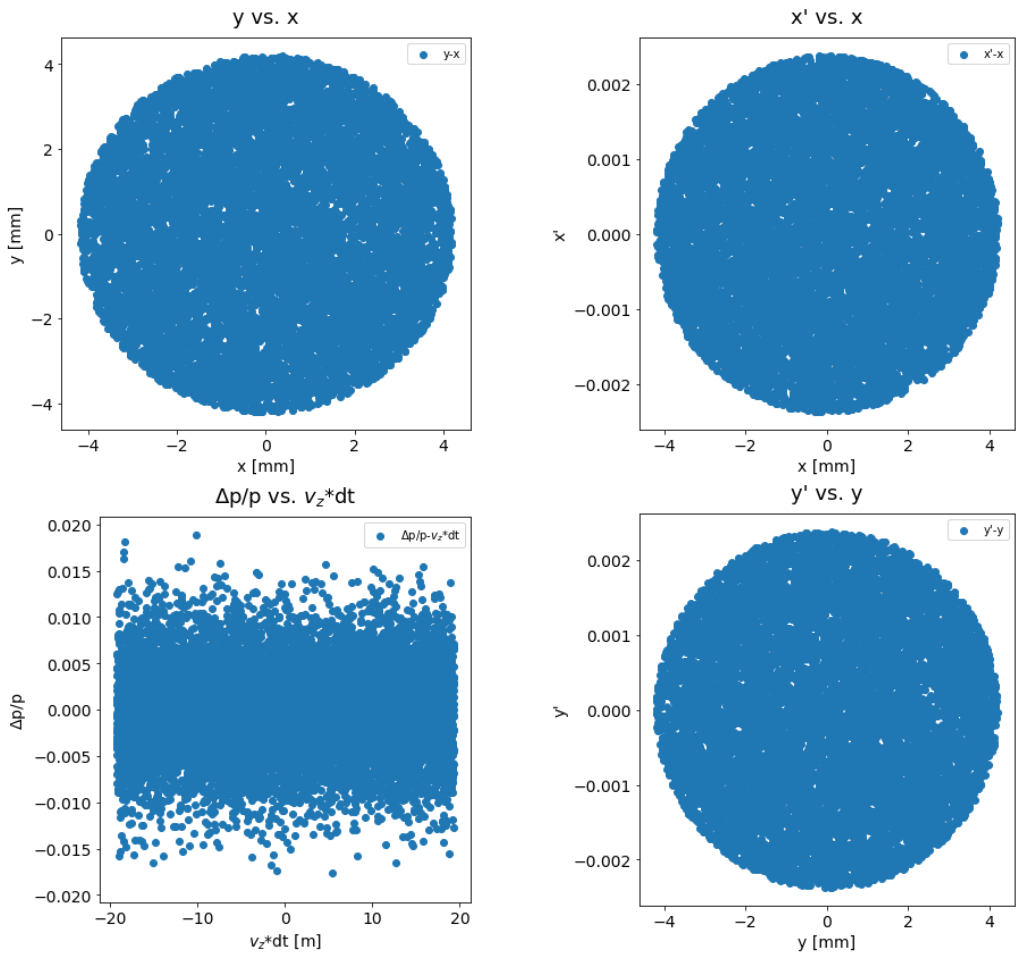
0.886913**3**343	0.832064**7**504	0.447662**2**818	0.125513**1**302	0	4.442066556e-5
-0.124720**9**092	0.877920**7**661	-0.062954**1**6516	0.245000**1**631	0	-9.612252562e-5
0.220897**9**767	0.312833**8**25	-0.836770**9**042	-0.443185**8**088	0	-1.381117117e-6
-0.06294**8**77339	0.443129**4**584	0.238461**8**662	-0.928076**3**705	0	-1.074105455e-5
9.325215235e-5	4.373021184e-5	3.650974937e-5	-2.303727948e-6	1	7315.682648
0	0	0	0	0	1

0.88691**2**806	0.83206**7**495	0.44766**1**996	0.125513**8**21	0	-3.26294171e-6
-0.12472**1**615	0.87792**6**540	-0.062954**4**077	0.24500015**4**	0	-7.06231664e-6
0.220897**8**92	0.31283**4**411	-0.83677**0**637	-0.44381**9**603	0	-1.13143306e-7
-0.06294**9**0085	0.44312**9**128	0.23846**2**326	-0.92807**6**111	0	-7.94958183e-7
-9.41228661e-5	-4.40891725e-5	-3.67348991e-5	2.20861440e-6	1	-532.675020
0	0	0	0	0	1

Synergia

Input Distribution

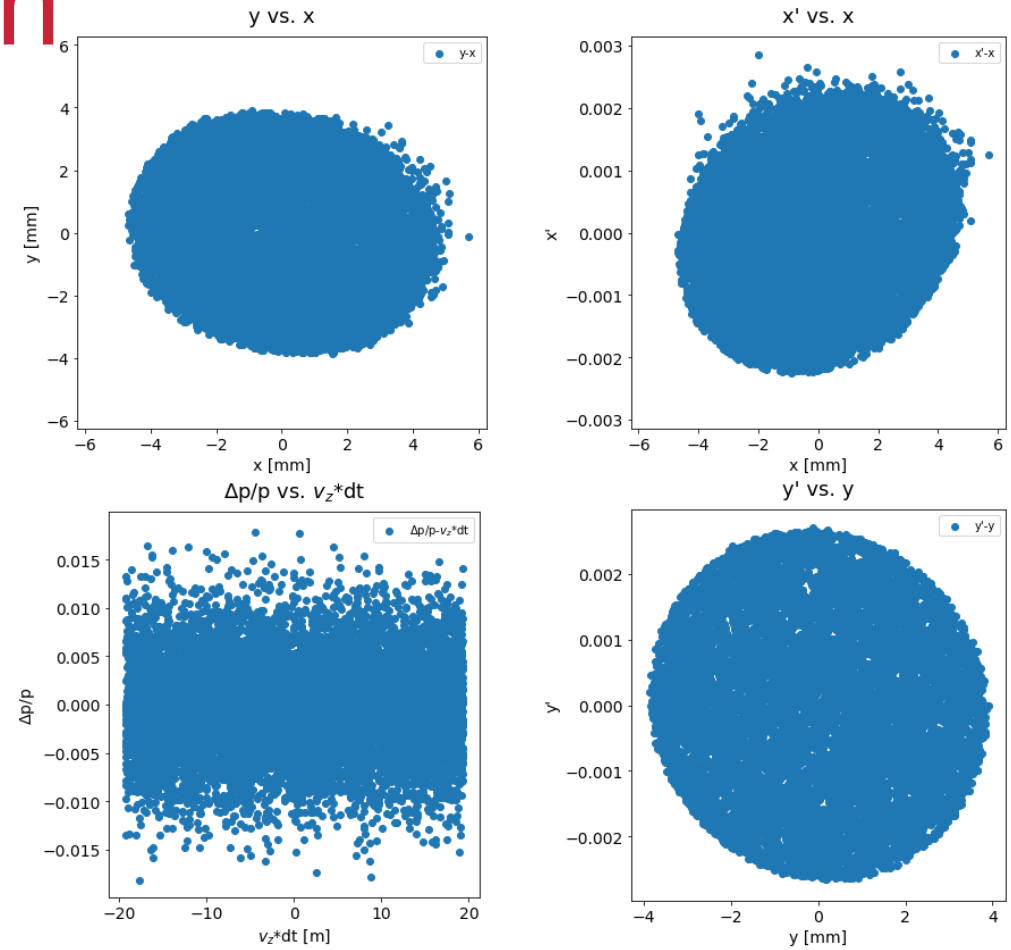
Distribution	KV
Macro particles	10,240
Current	8 mA
dp/p	0.005
Bunch length	1.77 μs
RMS x, y	2.1 mm
Norm. emit. x, y	0.182 mm-mrad
RMS emit. x, y	2.50 mm-mrad



1st Pass Distribution

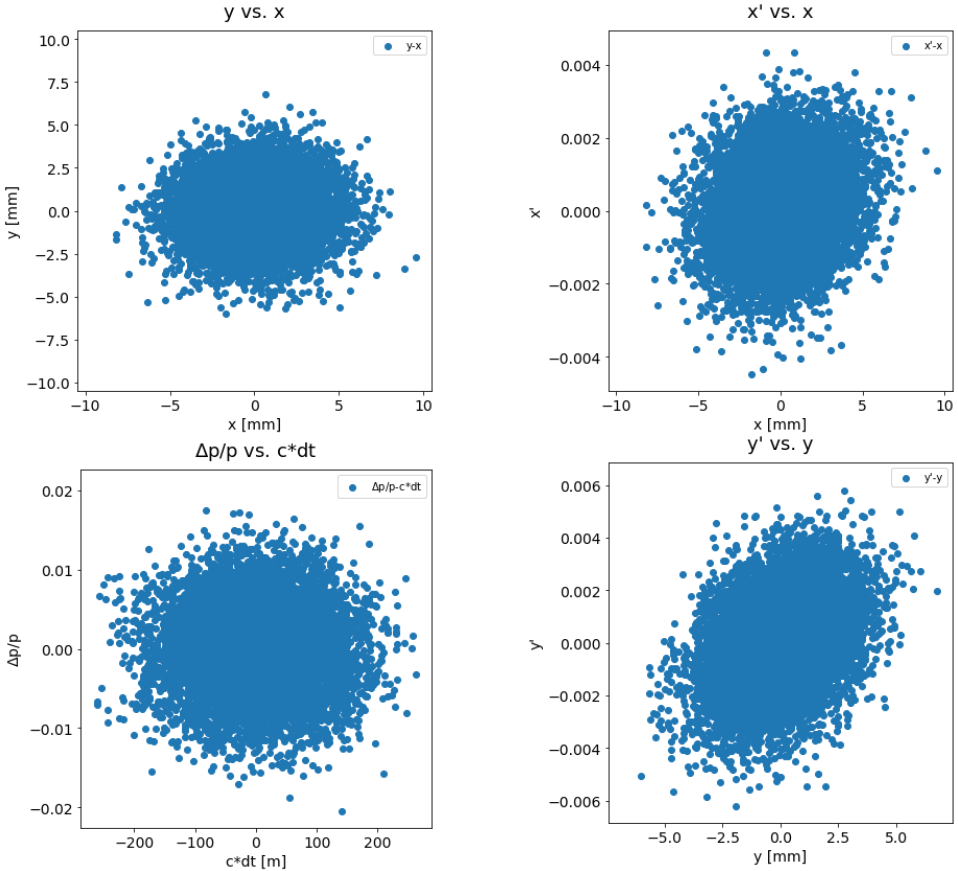
- Space-charge off, sextupoles off

Distribution	KV
Macro particles	10,240
Current	8 mA
dp/p	0.005
Bunch length	1.77 μs
RMS x, y	2.34, 1.93 mm
Norm. emit. x, y	0.192, 1.88 mm-mrad
RMS emit. x, y	2.63, 2.57 mm-mrad



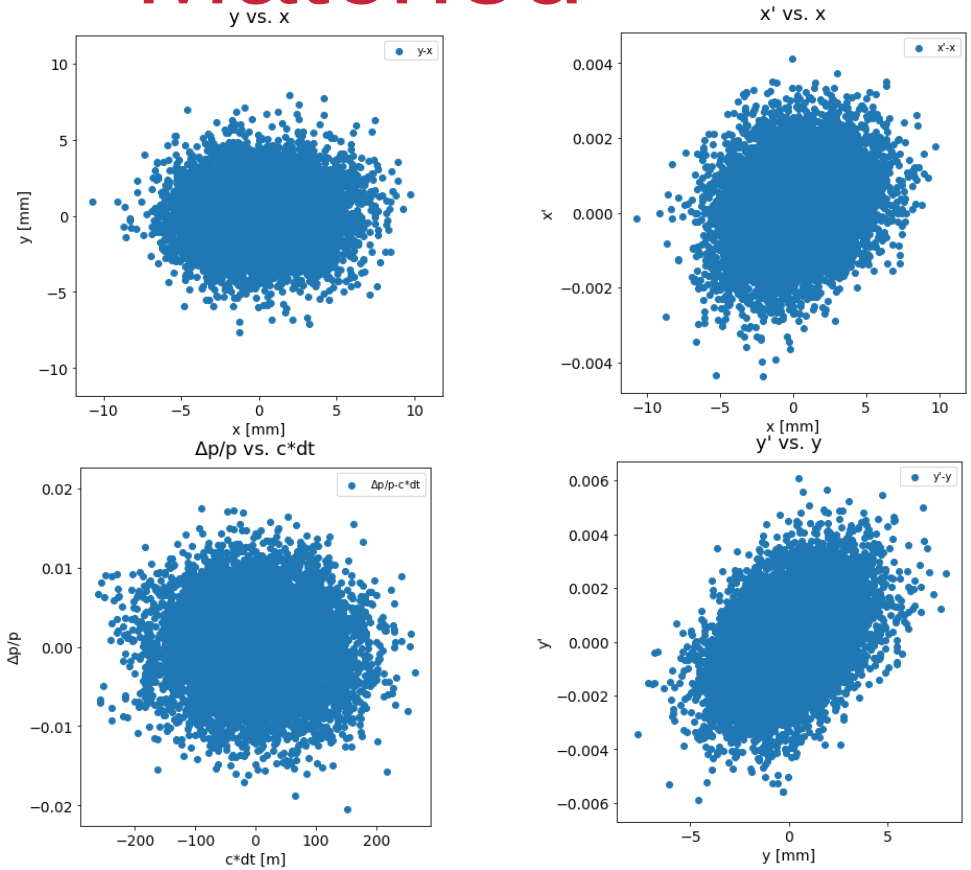
Input Distribution – Matched

Distribution	Gaussian
Macro particles	10,240
Real particles	8.84E10
dp/p	0.005
σ_z	0.4 m
RMS x, y	2.25, 1.66 mm
Norm. emit. x, y	0.189, 0.195 mm-mrad
RMS emit. x, y	2.59, 2.68 mm-mrad



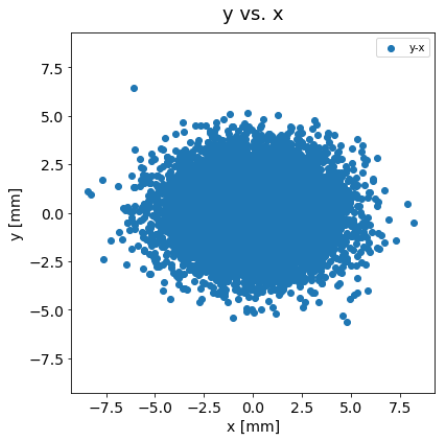
1st Pass Distribution – Matched

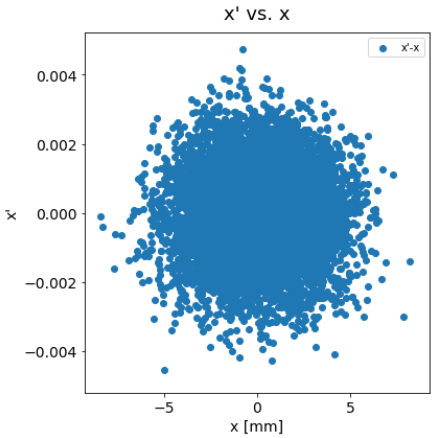
RMS x, y	2.56, 1.88 mm
Norm. emit. x, y	0.200, 0.207 mm-mrad
RMS emit. x, y	2.75, 2.83 mm-mrad

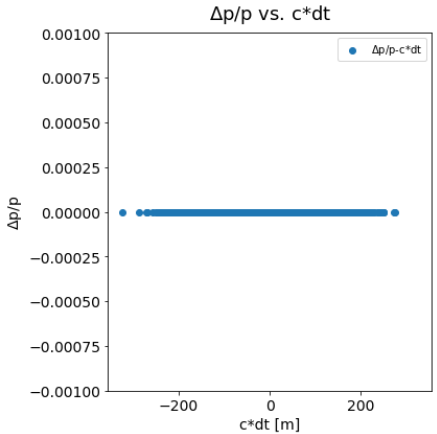


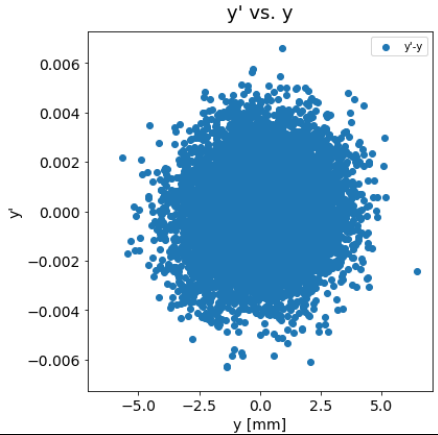
Input Distribution – Matched

Distribution	Gaussian
Macro particles	10,240
Real particles	8.84E10
dp/p	**0.000**
σ_z	0.4 m
RMS x, y	2.10, 1.54 mm
Norm. emit. x, y	0.183, 0.183 mm-mrad
RMS emit. x, y	2.50, 2.51 mm-mrad









1st Pass Distribution – Matched

RMS x, y	2.23, 1.65 mm
Norm. emit. x, y	0.187, 0.195 mm-mrad
RMS emit. x, y	2.57, 2.67 mm-mrad