Modeling the Electron Column Ring in IMPACT-Z for Benchmarking with Synergia

IOTA Electron Column Modeling Meeting

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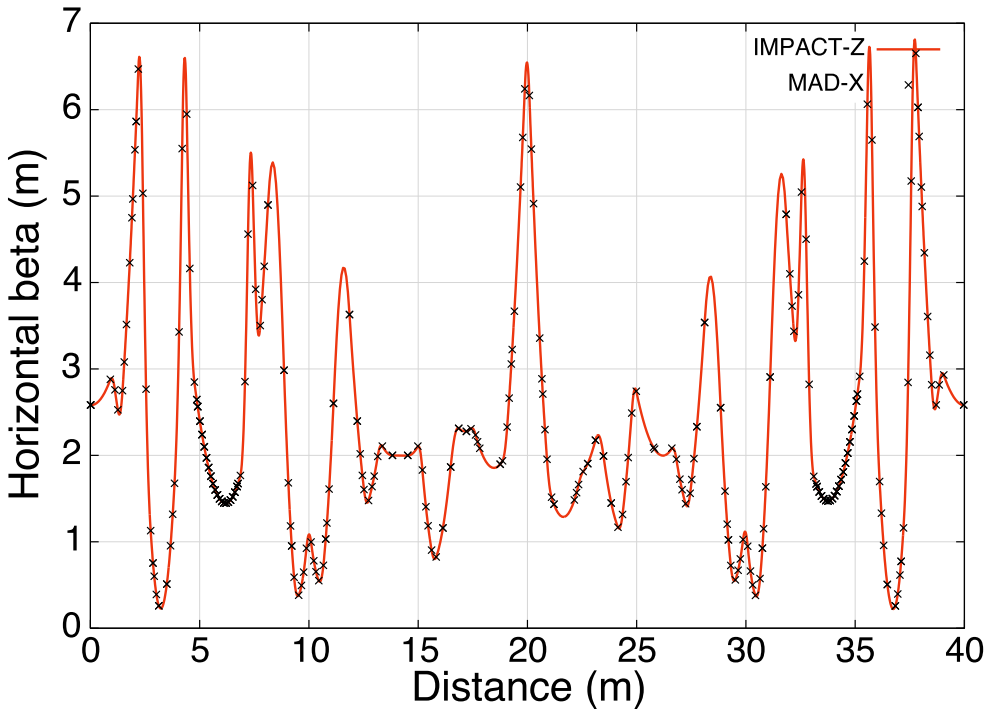
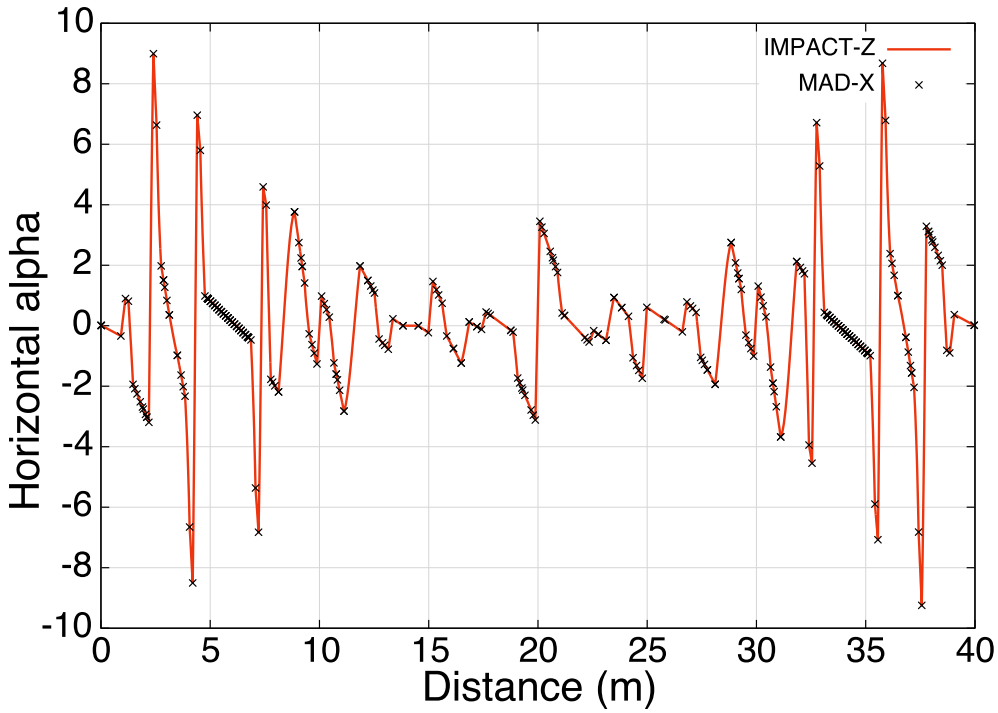
ACCELERATOR TECHNOLOGY & APPLIED PHYSICS DIVISION ATAP

Benchmark of transverse optics - horizontal

KV beam initially matched to nominal MAD-X Twiss functions



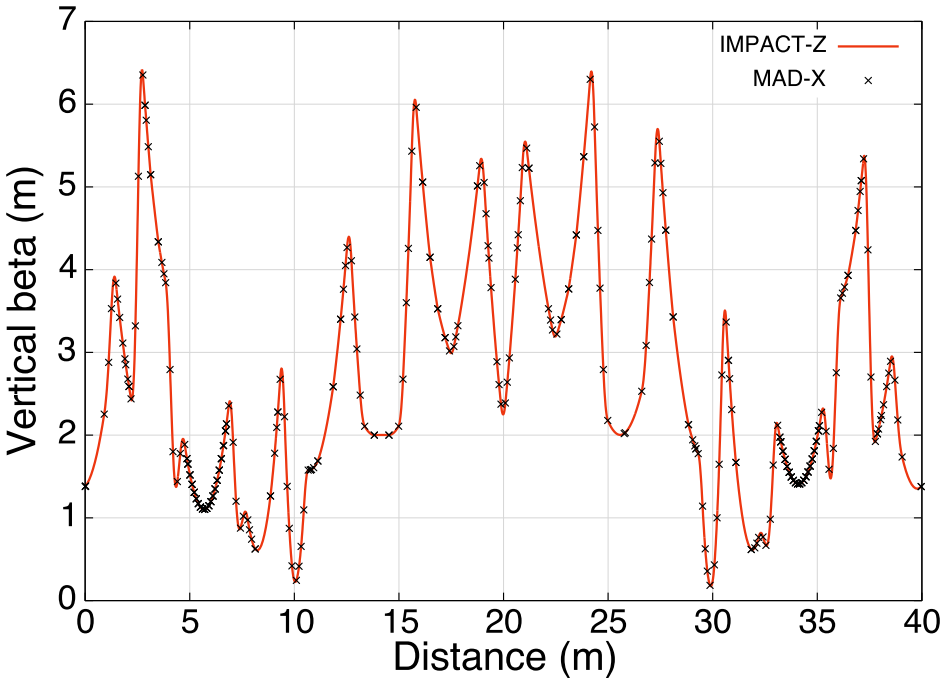


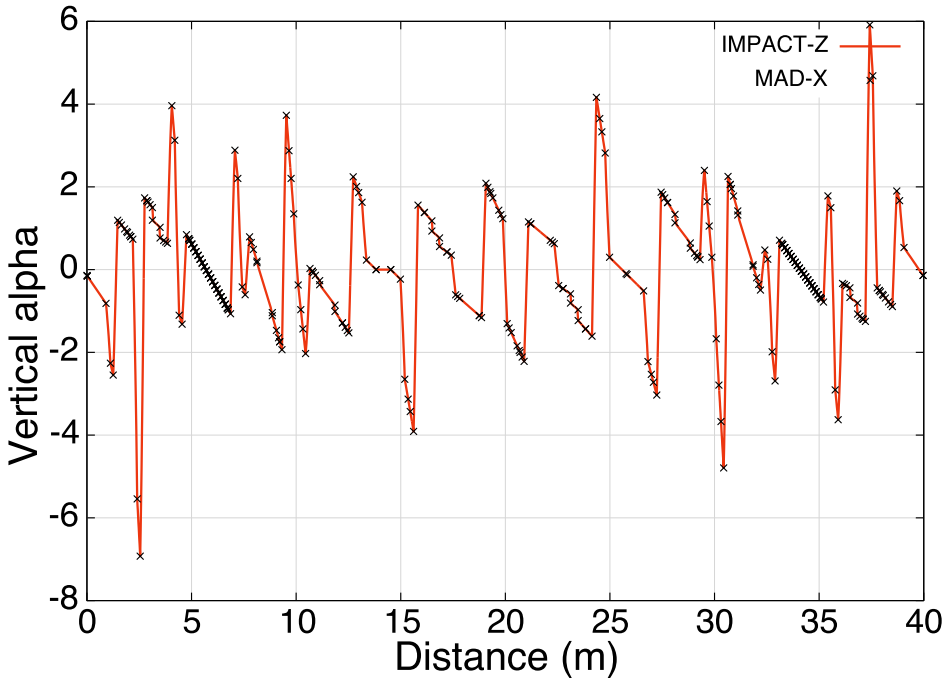
Space charge off, sextupoles off, no RF

Zero energy spread, zero bunch length (transverse dynamics only)

Benchmark of transverse optics - vertical

KV beam initially matched to nominal MAD-X Twiss functions



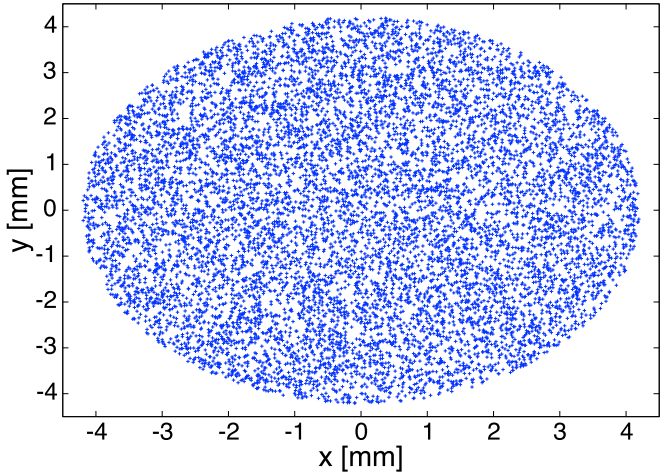


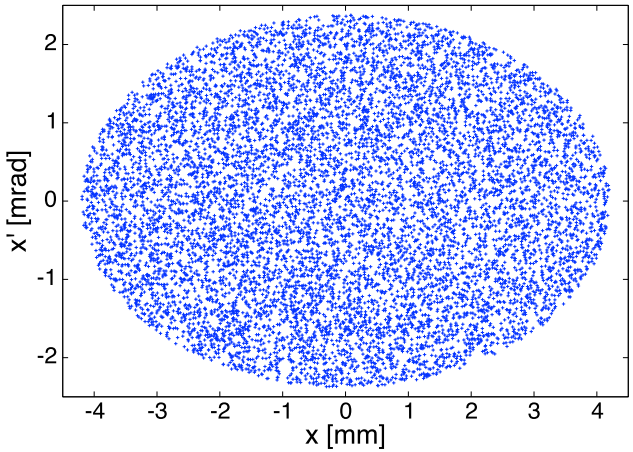
Space charge off, sextupoles off, no RF
Zero energy spread, zero bunch length (transverse dynamics only)

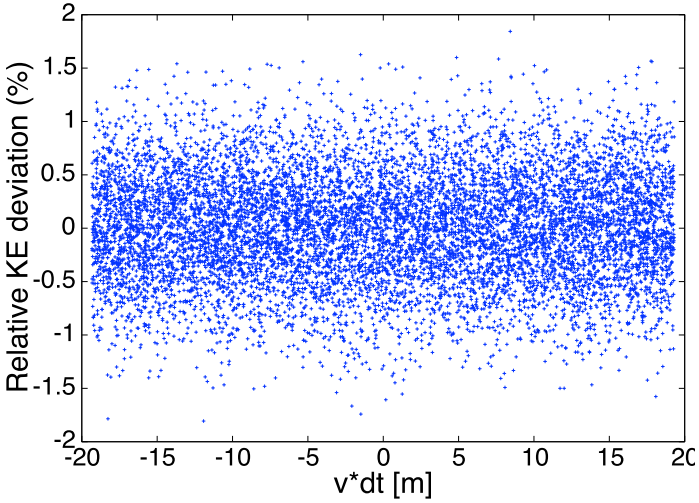
Initial distribution (converted from Synergia)

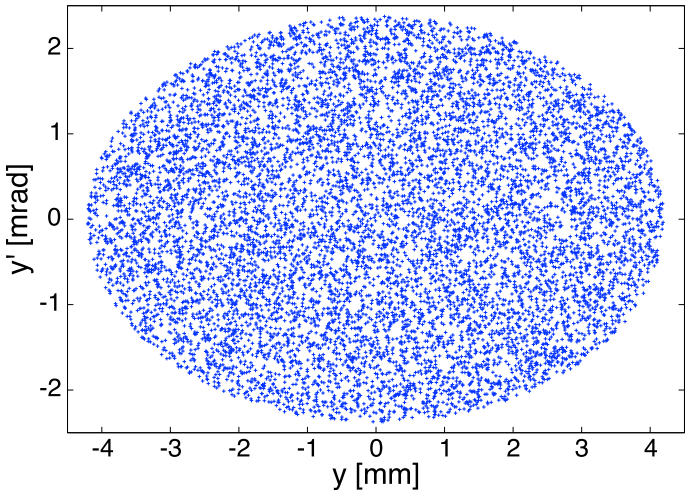
Initial particle data from Ben F.

Distribution	KV
Number of particles	10,240
RMS size in x,y	2.1 mm
Norm. emit. in x,y	0.182 μm
RMS b. length	0.51 μs
KE spread (w/r/t 2.5 MeV)	0.5%







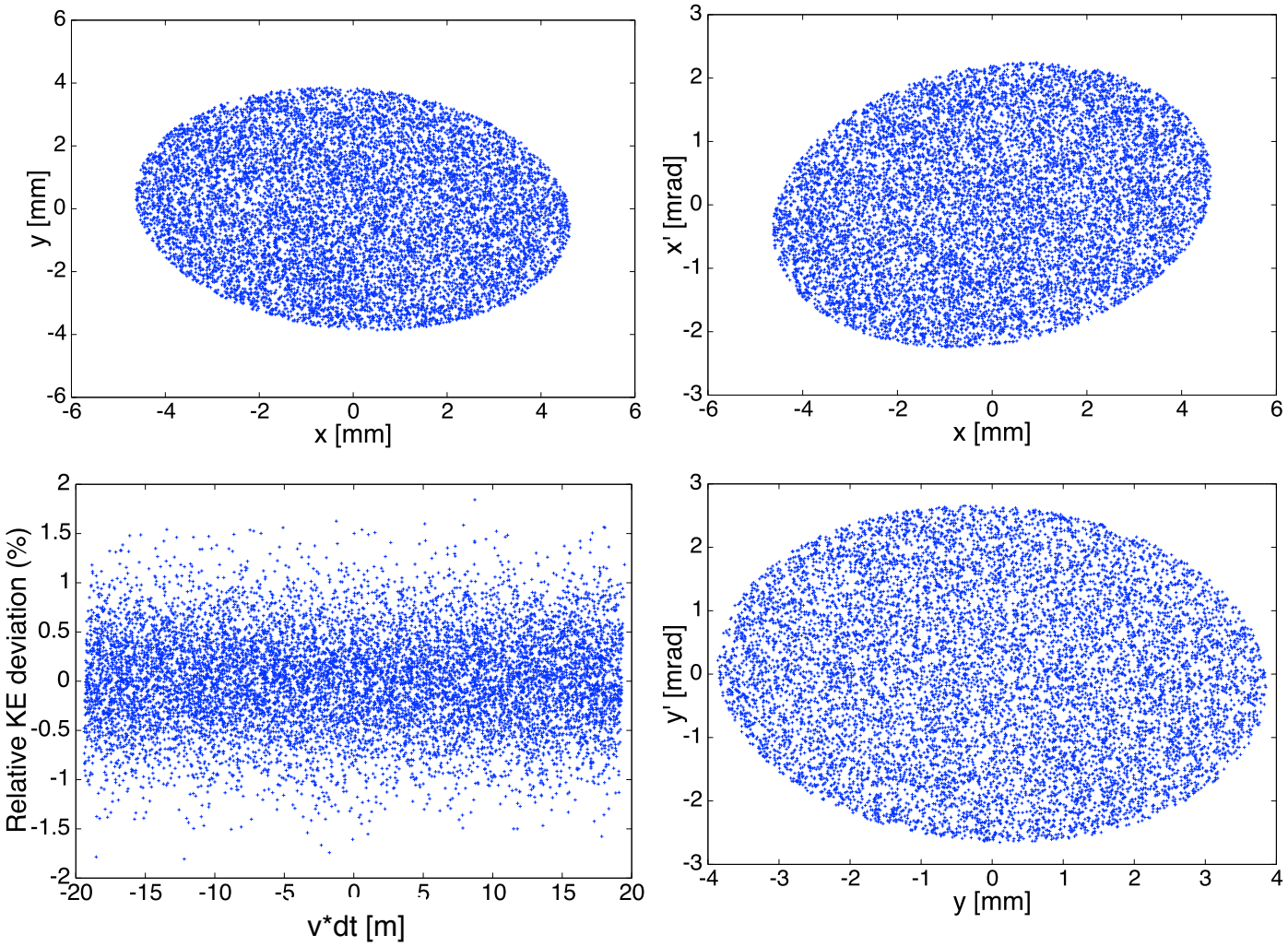


Distribution after 1 pass – linear dipoles

After tracking in IMPACT-Z

RMS size in x	2.32 mm
RMS size in y	1.93 mm
Norm. emit. in x	0.187 μm
Norm. emit. in y	0.187 μm
RMS b. length	0.51 μs
KE spread (w/r/t 2.5 MeV)	0.5%

The first 5 values above are unchanged if zero initial energy spread is assumed.



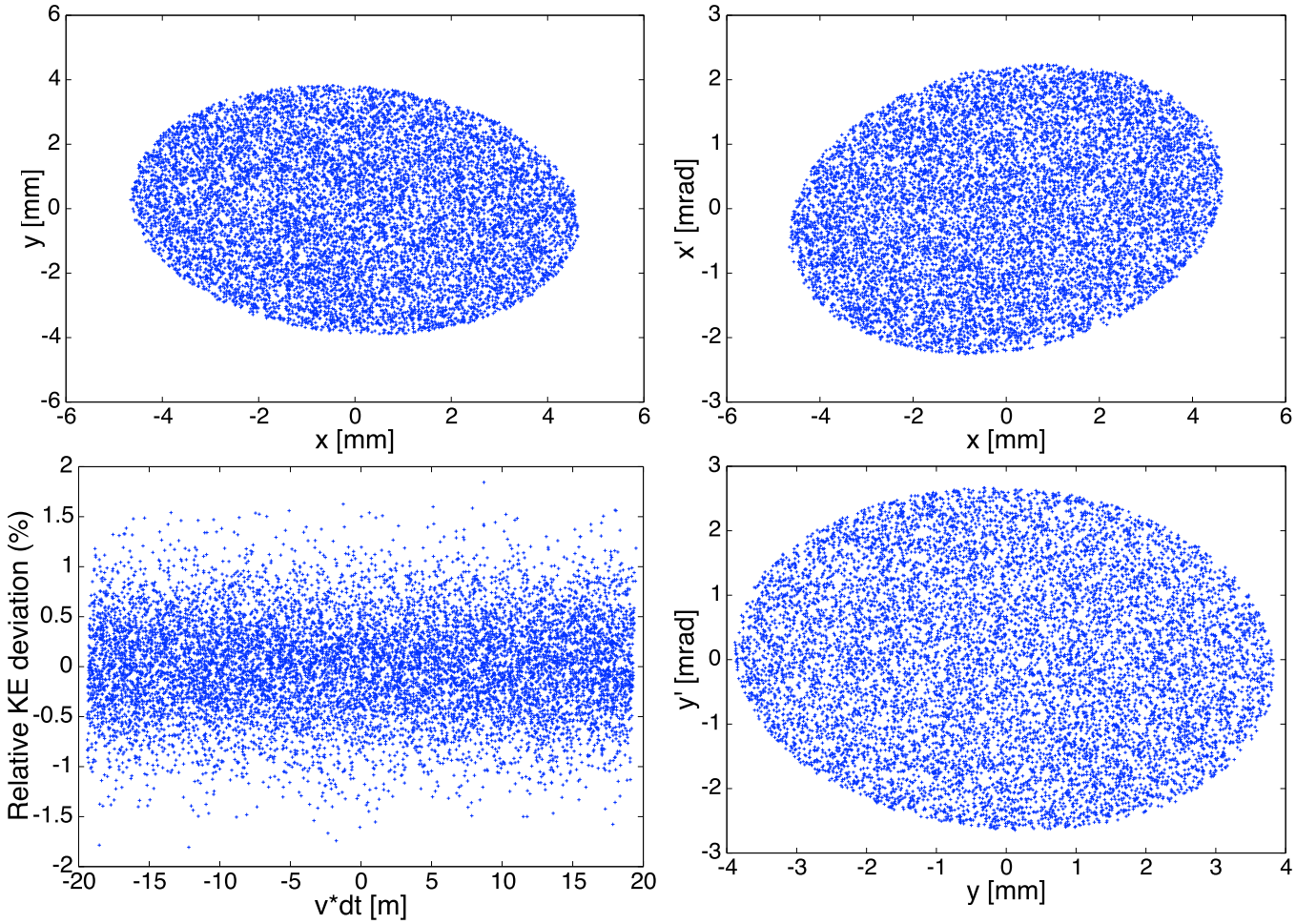
Space charge off, sextupoles off, no RF

Distribution after 1 pass – 3rd-order dipoles

After tracking in IMPACT-Z

RMS size in x	2.33 mm
RMS size in y	1.93 mm
Norm. emit. in x	0.187 μm
Norm. emit. in y	0.187 μm
RMS b. length	0.51 μs
KE spread (w/r/t 2.5 MeV)	0.5%

The first 5 values above are unchanged if zero initial energy spread is assumed.



Space charge off, sextupoles off, no RF