

SIS100 Quad Module Errors: Comparison of Beta-Beat Levels

SixTrackLib Simulations

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Setup

SIS100 cold lattice with **only QUADRUPOLE module** linear + non-linear field errors!

- MAD-X non-linear field error definition (no misalignments):

```
!!Relative systematic errors
RSysQD5n = 6.9e-4;

!!Relative random errors
rErrQD_2n = 0.7e-4;
rErrQD_2s = 1.2e-4;
rErrQD_3n = 2.7e-4;
rErrQD_3s = 2.6e-4;
rErrQD_4n = 1.0e-4;
rErrQD_4s = 0.7e-4;
rErrQD_5n = 3.45e-4;
rErrQD_5s = 1.0e-4;
rErrQD_6n = 0.3e-4;
rErrQD_6s = 0.3e-4;
```

```
!!Adding field errors to quadrupoles
select, flag=error, clear;
select, flag=error, pattern=qd11\.\.slice;
select, flag=error, pattern=qd12\.\.slice;
EFCOMP, radius=0.04, order=1,
dknr:={0, rErrQD_1n*tgauss(2), rErrQD_2n*tgauss(2),
        rErrQD_3n*tgauss(2), rErrQD_4n*tgauss(2),
        (RSysQD5n+rErrQD_5n*tgauss(2)),
        rErrQD_6n*tgauss(2)},
dksr:={0, rErrQD_1s*tgauss(2), rErrQD_2s*tgauss(2),
        rErrQD_3s*tgauss(2), rErrQD_4s*tgauss(2),
        rErrQD_5s*tgauss(2), rErrQD_6s*tgauss(2)};
```

- dipole and quadrupole modules are sliced into 9 slices
- **fixed frozen space charge** with 1000 macro-particles, 501 kicks
- ⇒ vary amplitude of random (normal+skew) linear errors up to
 $rErrQD_1n = 24e-4$; and $rErrQD_1s = 20e-4$;

Results

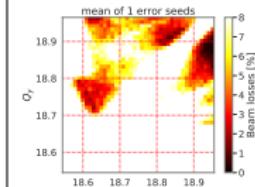
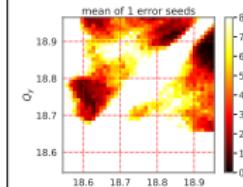
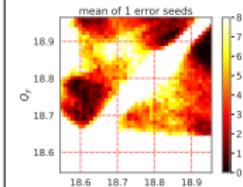
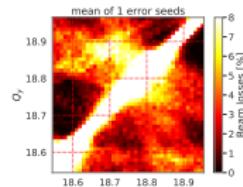
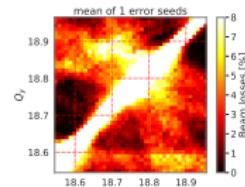
rErrQD_1n = 0;
rErrQD_1s = 0;

rErrQD_1n = 0.5e-4;
rErrQD_1s = 0.5e-4;

rErrQD_1n = 6e-4;
rErrQD_1s = 5e-4;

rErrQD_1n = 12e-4;
rErrQD_1s = 10e-4;

rErrQD_1n = 24e-4;
rErrQD_1s = 20e-4;



RMS beta-beat level
x : 0% and y : 0%

RMS beta-beat level
x : 0.03% and y : 0.06%

RMS beta-beat level
x : 0.37% and y : 0.77%

RMS beta-beat level
x : 0.73% and y : 1.53%

RMS beta-beat level
x : 1.49% and y : 2.87%

