NOISE in MADX thin-lens tracking module & Update on 'aperture'

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Thanks to: Bernard Jeanneret, Frank Schmidt, Frank Zimmermann
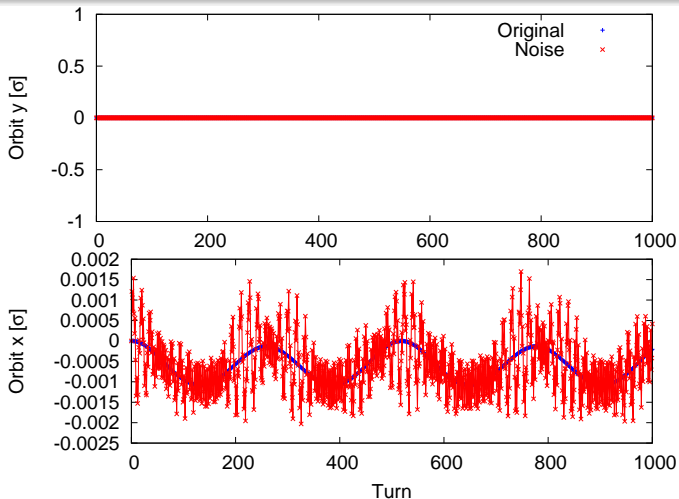
15 Dec., 2009

MADX code

In sequence

mqy..1: multipole,lrad:=(l.mqy)/(2.000000e+00),
noise=1,npeak={0.01,0.01,0.01,0.01},
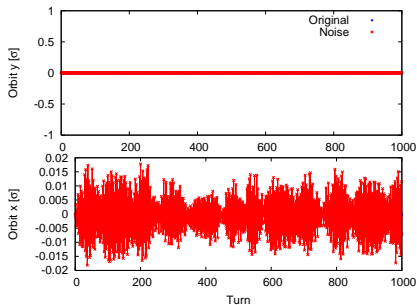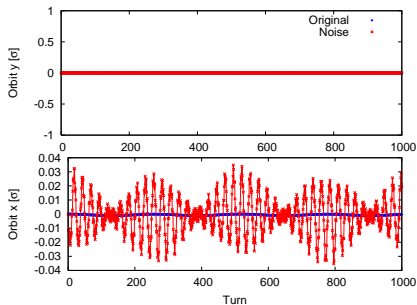nlag={0,0.3,0.7,1.5},ntune={0.41,0.35,350,410};

In the code

```
if(noise .eq. 1) then
...
temp = npeak * sin(nlag + ntune * turn)
do iord = 0, nn
vals(1,iord) = normal(iord) * (1+temp)
enddo
do iord = 0, ns
vals(2,iord) = skew(iord) * (1+temp)
enddo
```

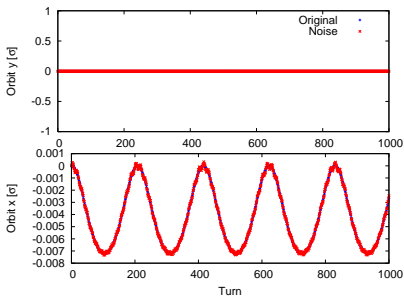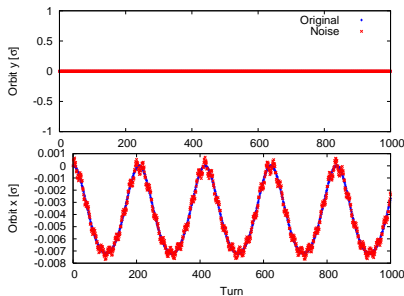# Check by MADX tracking, one quadrupole, dp=0.0003

$$N_{peak} = 0.01/0.005, 2.5KHz - 4.5MHz$$

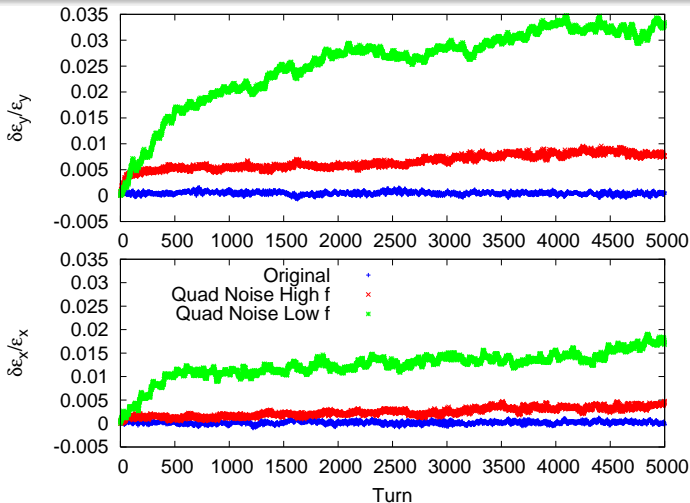# Check by MADX tracking, several quadrupoles, dp=0.0003

$N_{peak} = 0.01/0.005, Left : 2.5 - 4.5KHz, Right : 2.5 - 4.5MHz$

Check by MADX tracking, dp=0.001
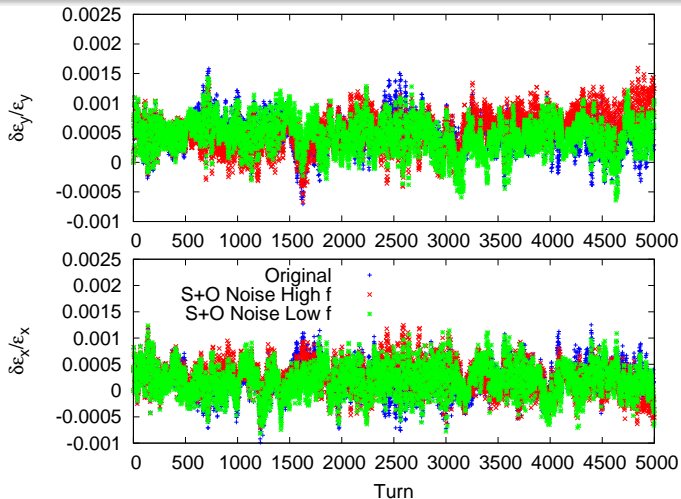

$N_{peak} = 0.1, 3.2 KHz$
Left: sextupole; Right: octupole
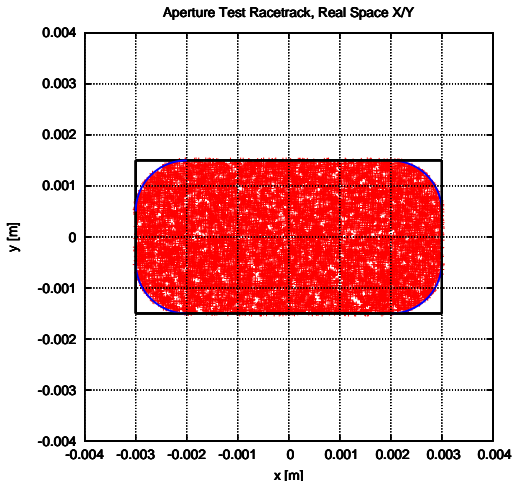
Emittance growth, quad noise

$$N_{peak} = 0.01, 2.5 - 4.5 K(M) Hz, 10 kparticles$$

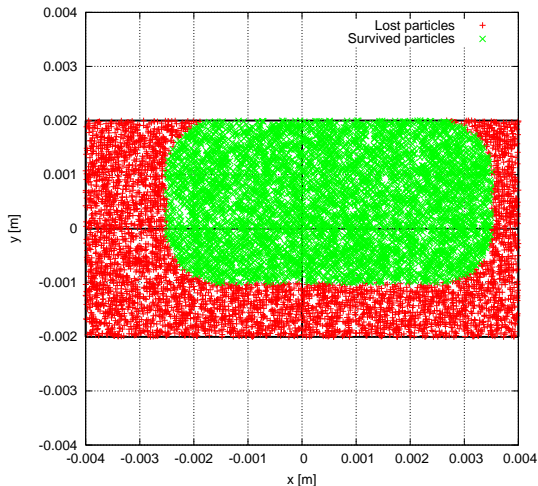## Emittance growth, sextupole+octupole noise

$$N_{peak} = 0.01, 2.5 - 4.5K(M)Hz, 10kparticles$$
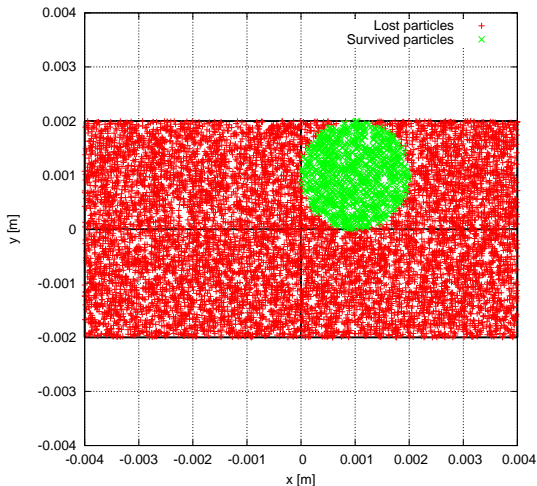
Aperture 'Racetrack', no offset

Aperture Test Racetrack, Real Space X/Y

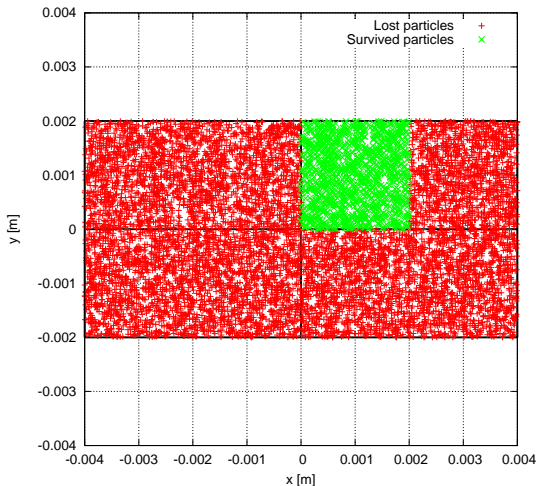qd:multipole, knl={0,-0.0}, apertype= racetrack,
aperture={0.002,0.0005,0.001},aper_offset={0,0}

Aperture 'Racetrack', with offset {0.5mm, 0.5mm}

qd:multipole, knl={0,-0.0}, apertype= racetrack,
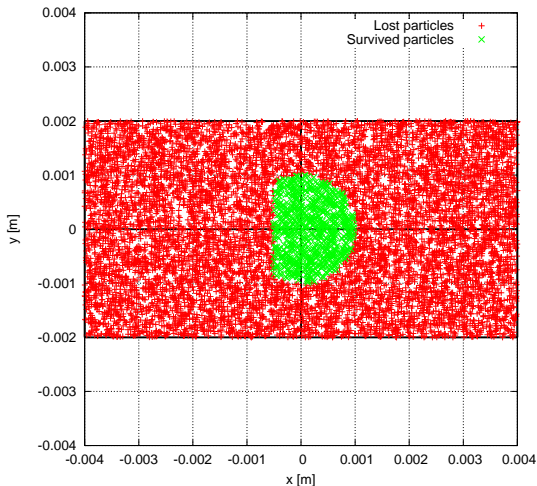aperture={0.002,0.0005,0.001},aper_offset={0.0005,0.0005}

Aperture 'CIRCLE', with offset {1mm, 1mm}

Aperture 'RECTANGLE', with offset {1mm, 1mm}

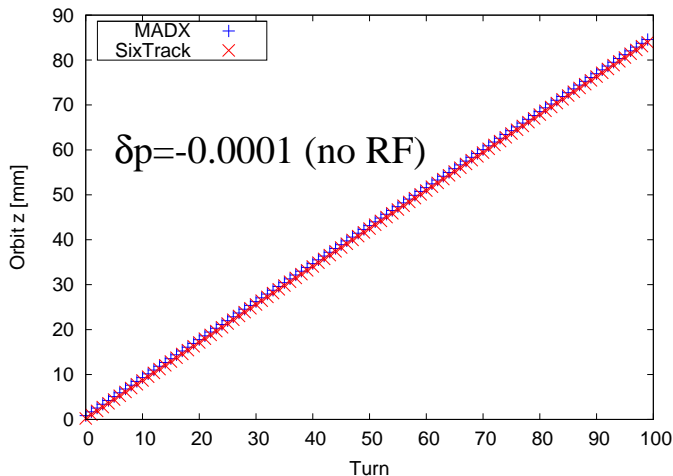# Aperture 'RECTANGLE' (offset) & 'CIRCLE'

Crab crossing BB tune shift

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Thanks to: Stephane Fartoukh, Frank Schmidt

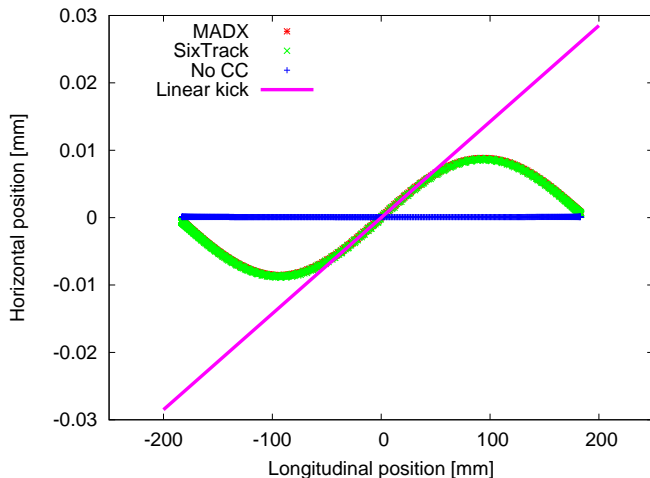15 December, 2009

Convention of longitudinal coordinate

$\delta_p < 0 \longrightarrow$ head in the bunch (above transition) $\longrightarrow$ (z>0)

Crab crossing at IP5

Global CC at IP4
gcc: crabcavity,l:= 0,volt:=9.8,lag:= 0,freq:=800;

Tune shift, 4D and 6D

	plus crossing $(+\theta/2)$		minus crossing $(-\theta/2)$	
4D (Twiss)	0.30647081	0.31642733	0.30647081	0.31642733
4D (FFT)	0.30646809	0.31642174	0.30646809	0.31642174
6D (Twiss)	0.30730306	0.31674641	0.30730306	0.31674640
6D (FFT)	0.30730314	0.3167463	0.30730314	0.31674629

Crab crossing BB tune shift, H-crossing at IP5 (1)
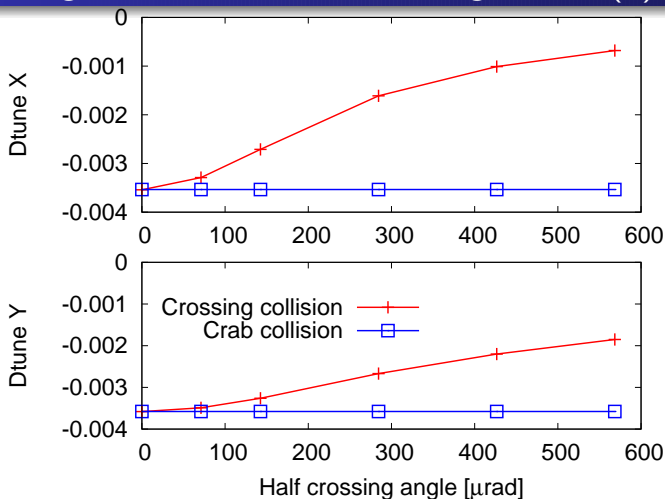
Hori. (top) and ver. tune shift (bottom);
Crab crossing tune shift = head-on collision case

Crab crossing BB tune shift, H-crossing at IP5 (2)

Tune shift (BB @ IP5, θ/2=142 μrad), LHC collision
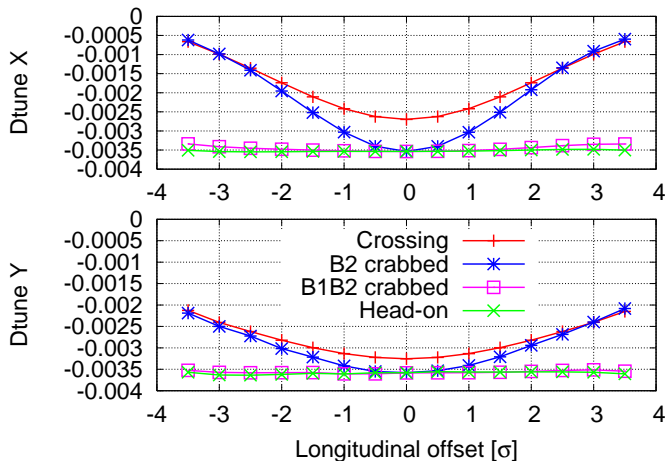
Hori. (top) and ver. detuning (bottom) at different longitudinal position inside the bunch