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H^- injection simulations

Jose L. Abelleira, Chiara Bracco

Current issues

- Issue with cluster SCL6 (only PTC ORBIT)
- Finding way to adapt the code from ORBIT to PTC ORBIT (with help of F. Schmidt and Sarah Cousineau, ORLN)

Teapot.cc

ORBIT version used

```
buildTPlattice(const String &MADTwissFile,
               const String &MADLATFile,
               const Integer &nstepTPD,
               const Integer &fringeD,
               const Integer &nstepTPM,
               const Integer &fringeM,
               const Integer &nstepTPQ,
               const Integer &fringeQ,
               const Integer &nstepTPB,
               const Integer &fringeB,
               const Integer &nstepTPS,
               const Integer &fringeS,
               const Integer &nstepTPK,
               const Integer &fringeK)
```

```
replaceTPQ(const String &n,  const Integer &order,
           const String &et,  const Real &tilt,
           const Real &kq,
           const Integer &nsteps,
           const Integer &fringeIN,
           const Integer &fringeOUT)
```

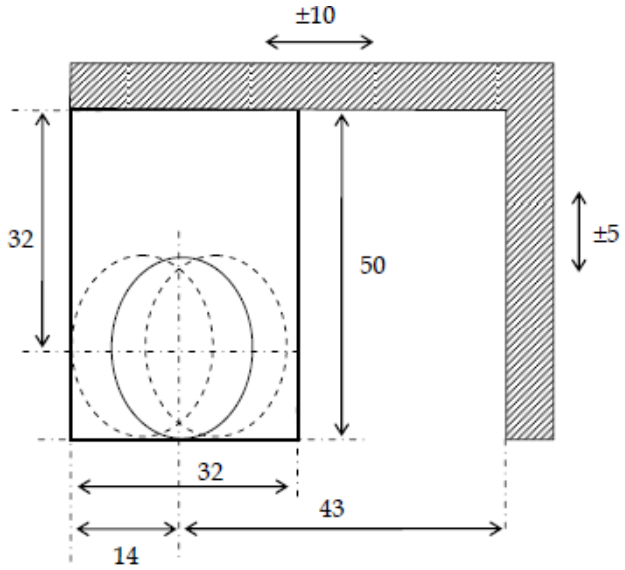
current PTC ORBIT

```
buildTPlattice(const String &MADTwissFile,
               const String &MADLATFile,
               const Integer &nstepTPD,
               const Integer &nstepTPM,
               const Integer &fringeM,
               const Integer &nstepTPQ,
               const Integer &fringeQ,
               const Integer &nstepTPB,
               const Integer &fringeB,
               const Integer &nstepTPS,
               const Integer &nstepTPK)
```

```
replaceTPQ(const String &n, const Integer &order,
           const String &et,  const Real &tilt,
           const Real &kq,
           const Integer &TPsubindex,
           const Integer &nsteps,
           const Integer &fringeIN,
           const Integer &fringeOUT)
```

Current work. assumptions

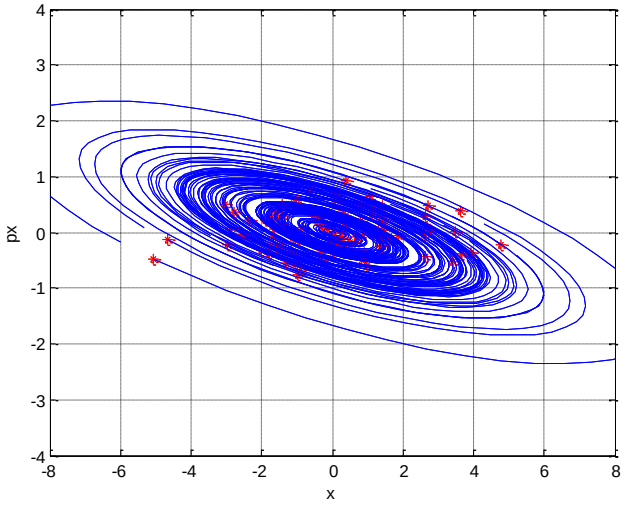
All simulations run with this foil size



And taking into account a current of 26 mA at injection (from the 50 mA at the source)

status

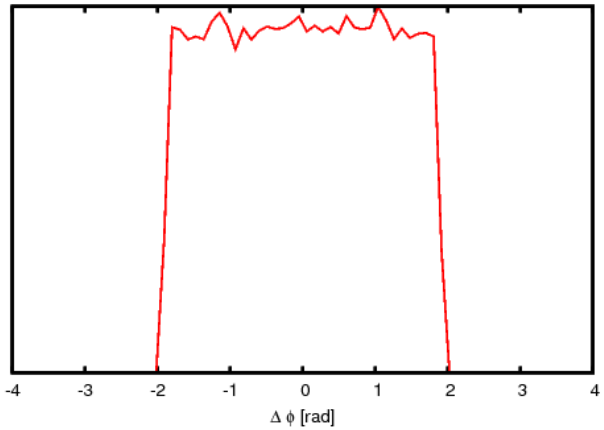
- Define optimum KSW waveforms for ISOLDE
- Add aperture tolerances (± 1 mm) and check impact on losses (ISOLDE)
- Check if any improvement is obtained combining a horizontal offset and painting.
- Provide Elena with best distribution (ISOLDE)
- Vary bx of the initial distribution from 5.6 m to 2.5 m and see if, by varying the KSW waveform, any improvement (more uniform distribution) is achievable (ISOLDE)
- Vary the horizontal tune (ISOLDE):

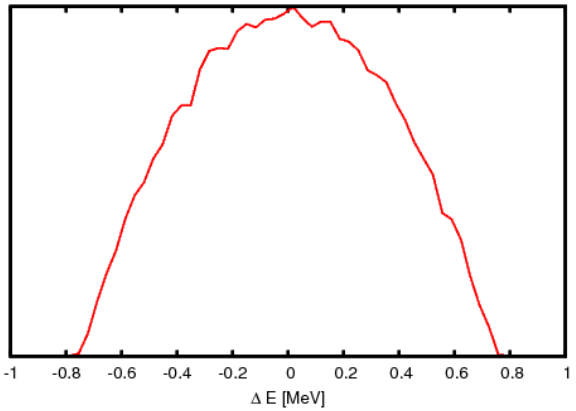


- MATLAB code to simulate ideal (linear) particle evolution in the phase space to study the influence of the tune in the painting without ORBIT simulation

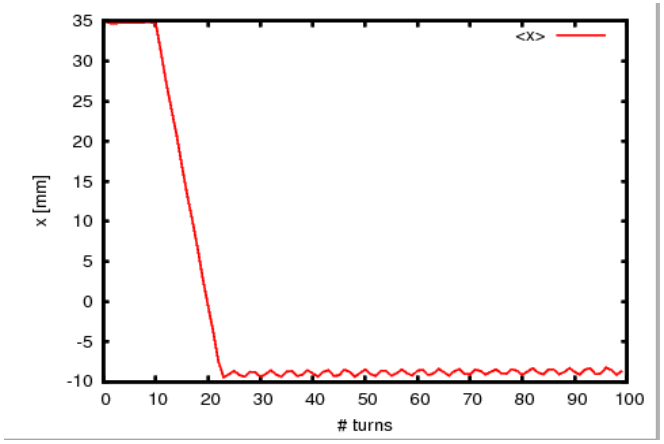
Results : LHC beam

1.62×10^{12} particles
5×10^{3} macroparticles

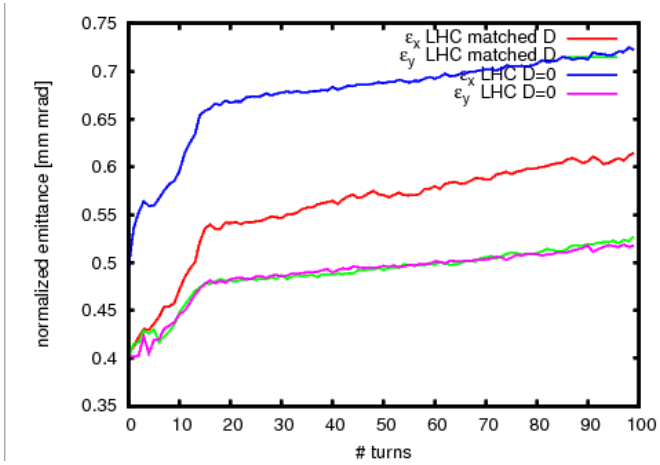




No longitudinal painting. $\sigma_{\Delta E}$=336 keV



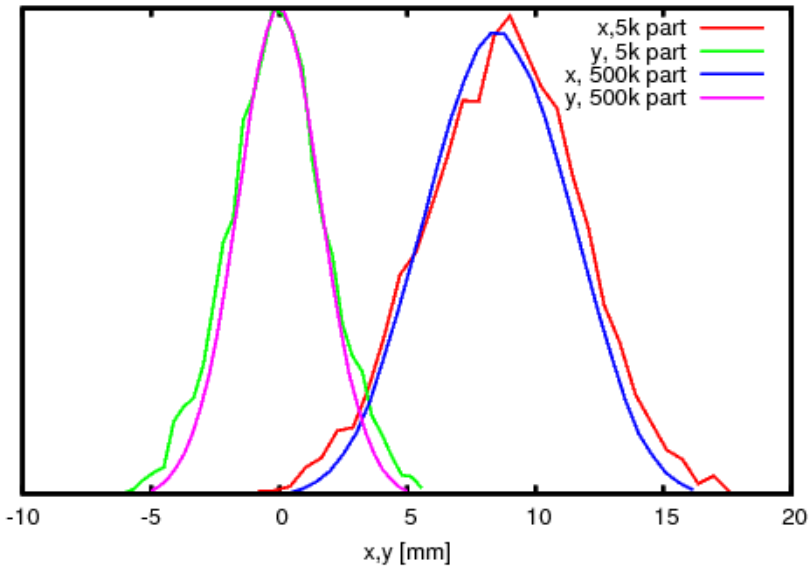
10-turn injection



sim62
sim63

Results : LHC beam

Beam profile after 100 turns



sim62
sim36

Results : ISOLDE beam

Longitudinal painting

100 turns, 1.60×10^{13} part

120 turns, 1.95×10^{13} part

5×10^3 macroparticles

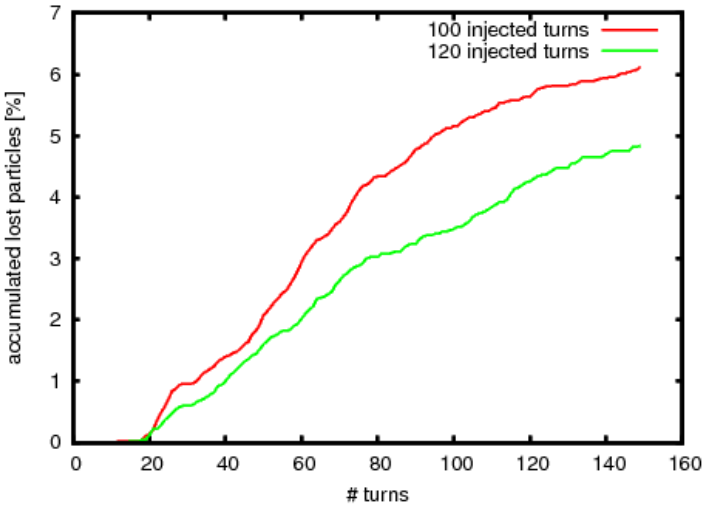
Vertical offset : 10 mm

I_1=0.57*35 mm

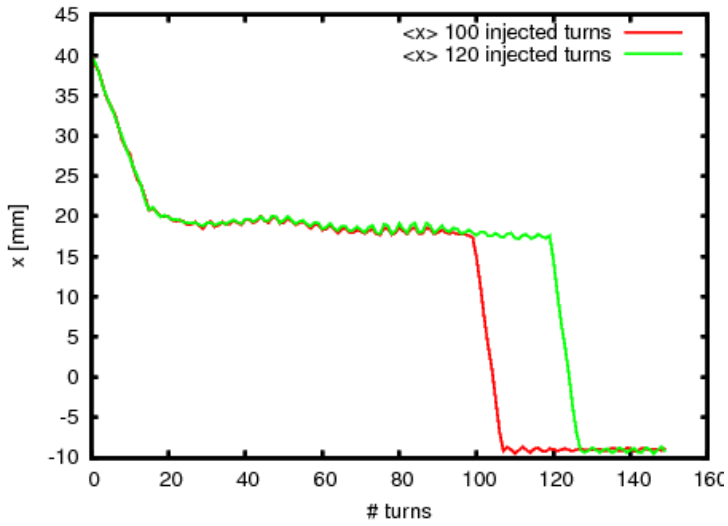
t_1=15 μs

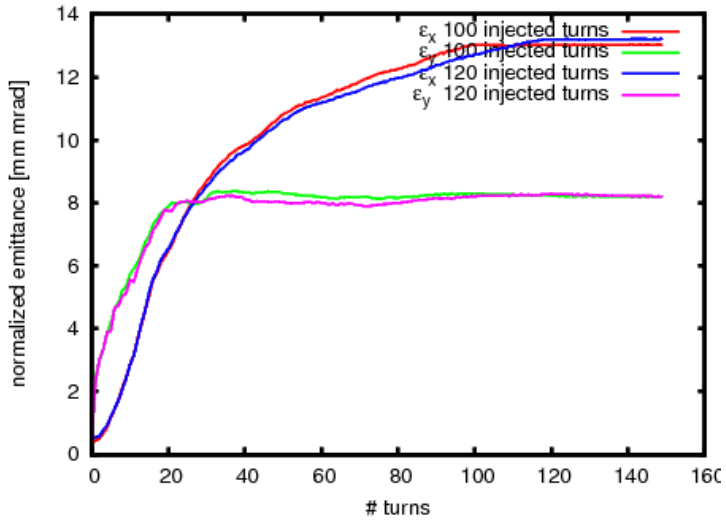
I_2 =0.50*35 mm

t_2=[100,120] μs



Too many losses





ε_x=13 μm

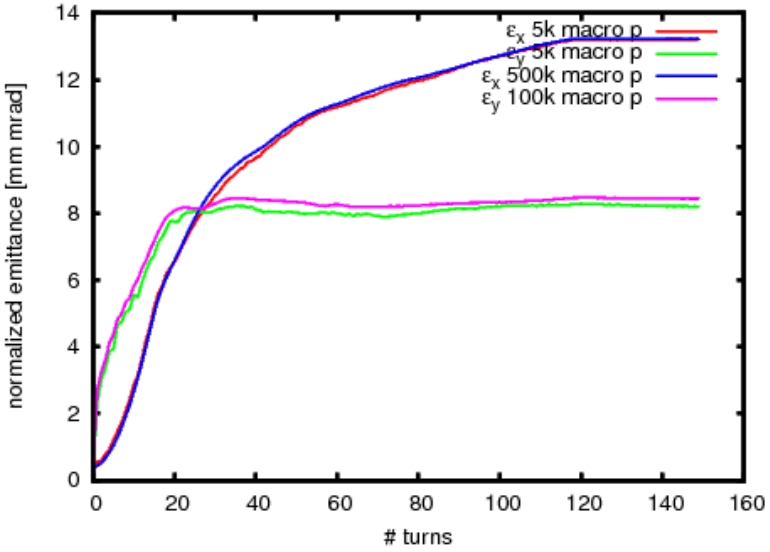
ε_y = 8 μm

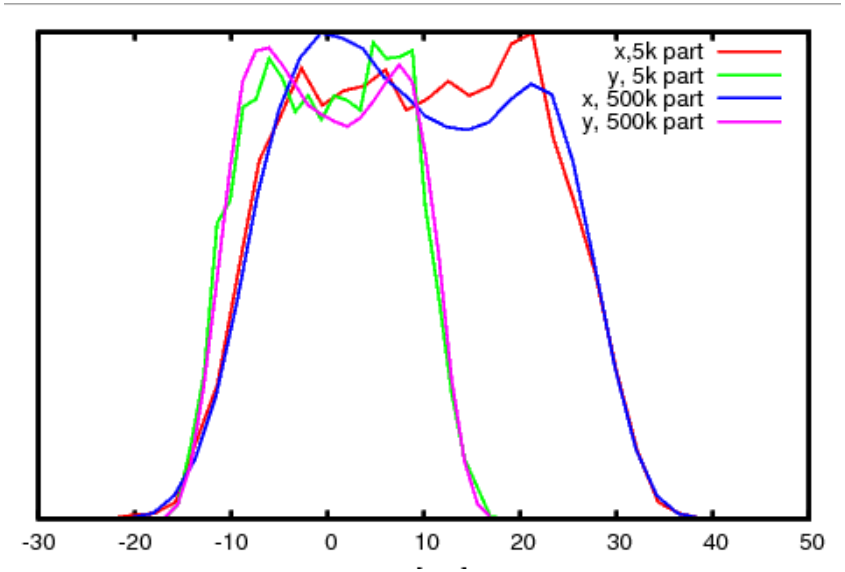
sim55

sim56

Results : ISOLDE beam

For 120 injected turns, compared with a full simulation with 500k macro particles





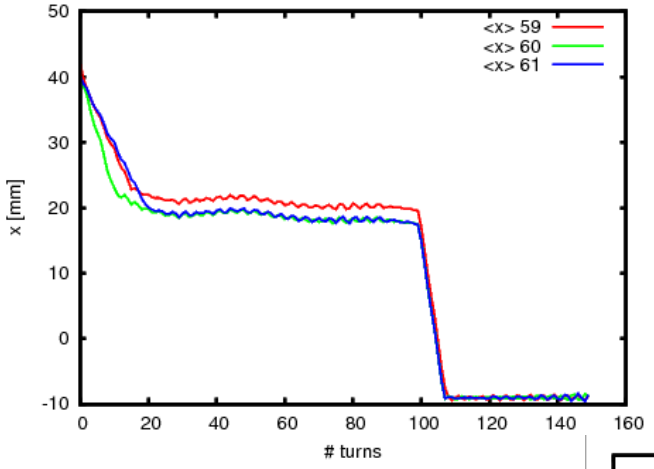
sim56
sim58

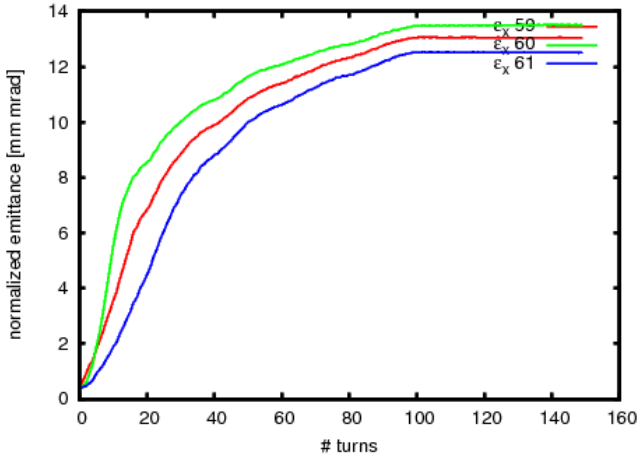
Results : ISOLDE beam

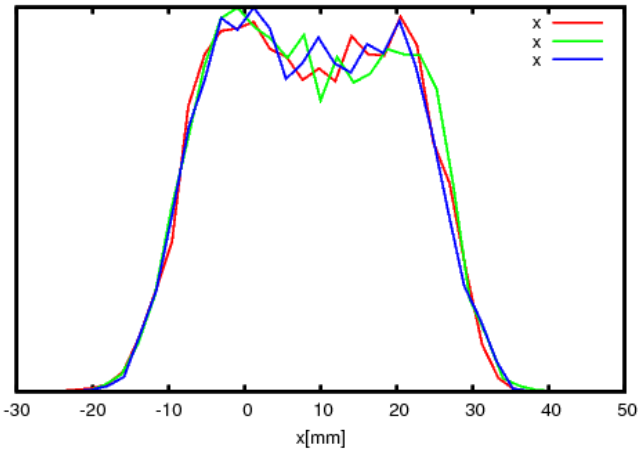
- Influence of transverse offset

  -no change appreciated with 5k particles (more resolution needed)

	x_offset
sim59	-2
sim60	0
sim61	-2







Planing

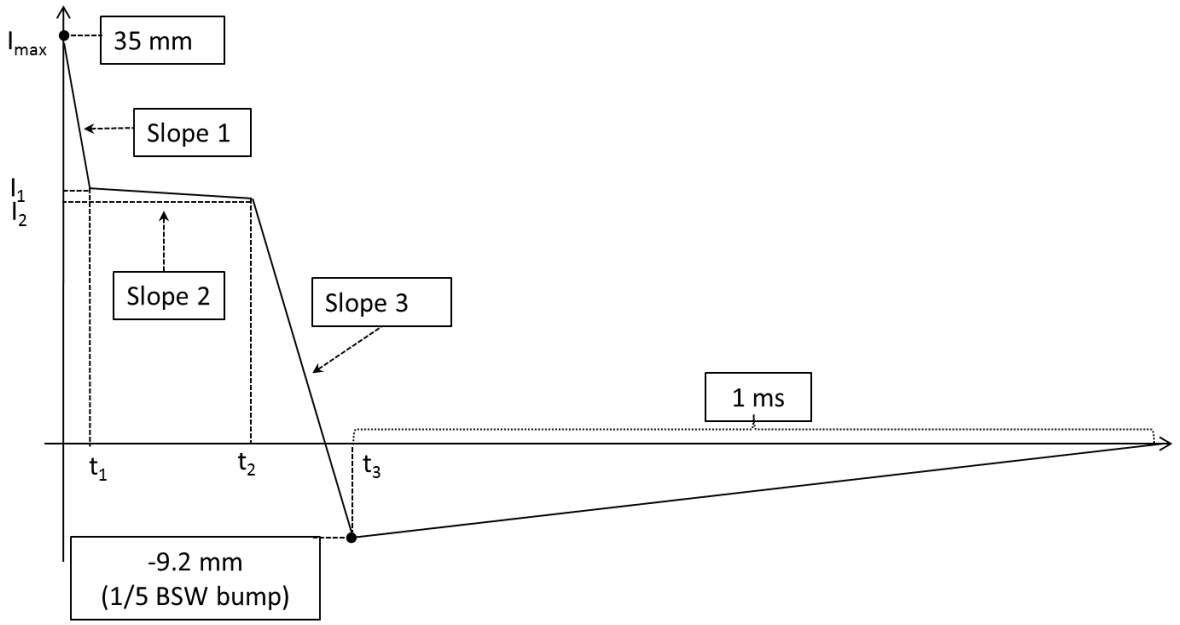
- Revise aperture and add tolerances for ISOLDE beam. (17/10/2014)
- Tune study. Matlab model simulating injection for different turns. (17/10/2014)

- Verify the previous results with 500k particles. 22/10/2014
- Try with βx=5.5->2.5 (22/10/2014)
- Repeat x_offset study (22/10/2014)

With PTC-ORBIT

Conclusions

- 5k macroparticles seem enough to adjust the KSW waveform, as no big effect from spacecharge on the order of injection time
- Still need 500k to define well the beam profile, and to verify emittances.


I_{max}
35 mm
Slope 1
I_1
I_2
Slope 2
Slope 3
1 ms
t_1
t_2
t_3
-9.2 mm
(1/5 BSW bump)