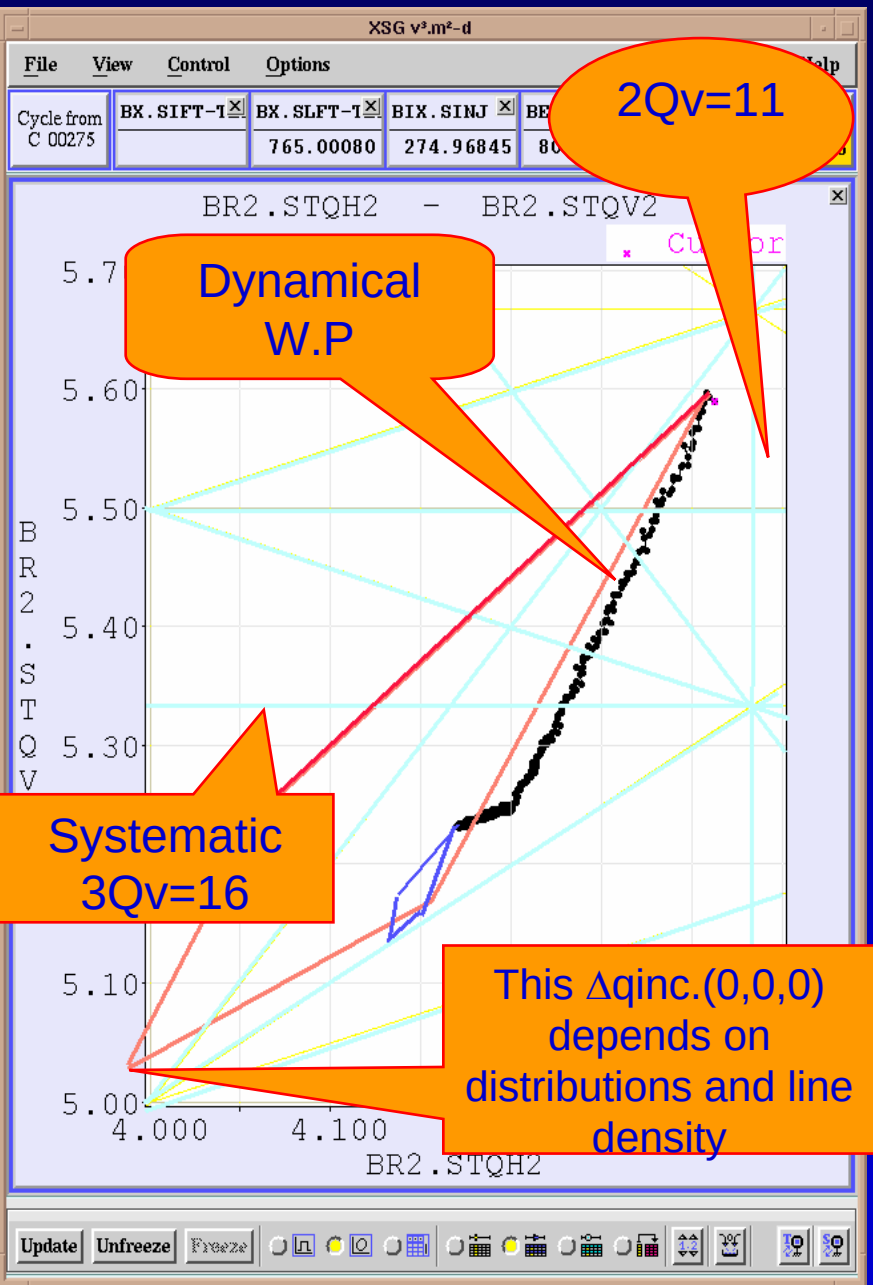
HIGH INTENSITY/DENSITY IN THE PSB
What is known?
which tests to benchmark simulation prog's?

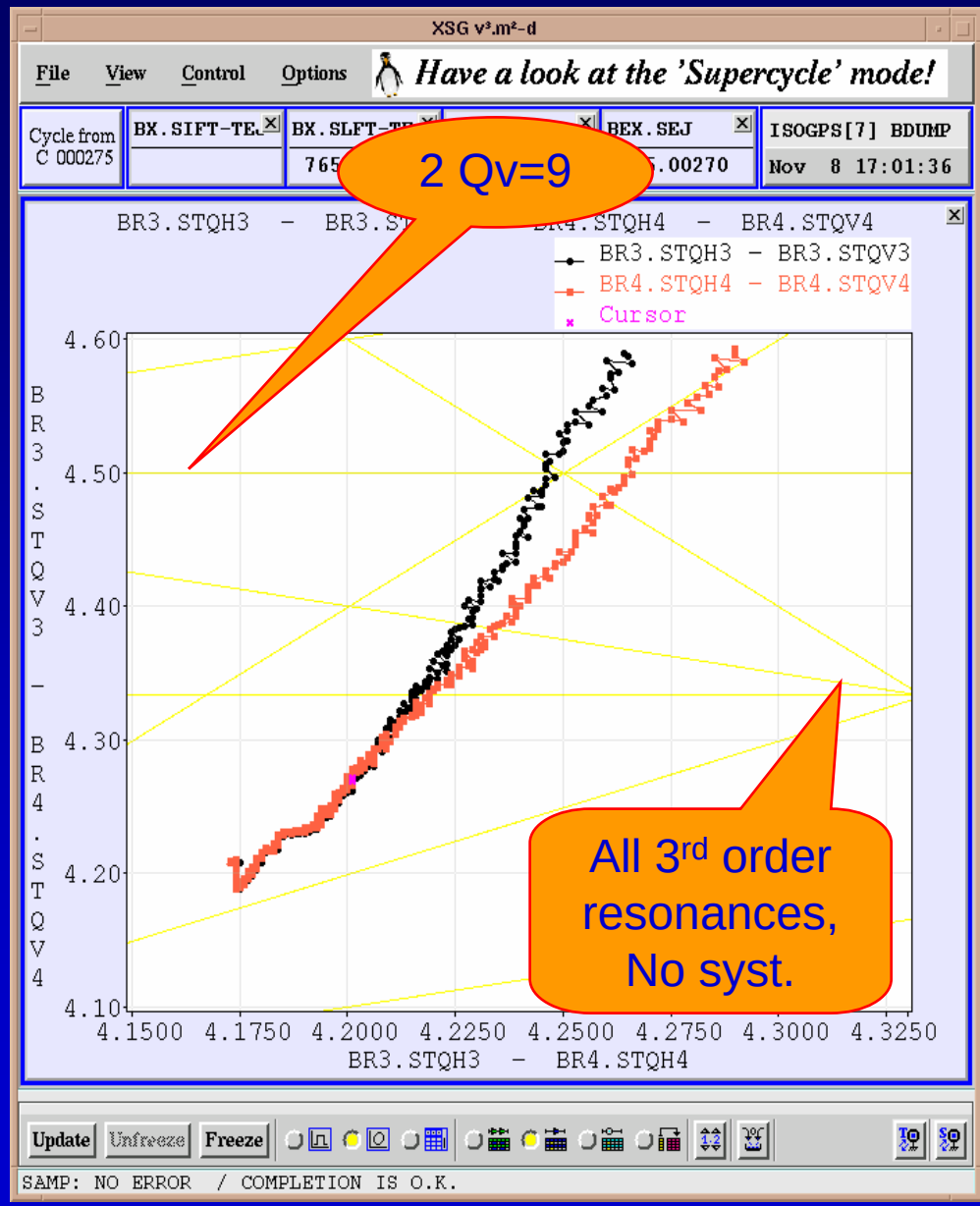
M. Chanel

TUNE SHIFT and WP's for N>8 10^{12}

- Protons Multiturn injection (1mm septum + decreasing bump) with mismatch,Dinj=0, misteering in Vplane and coupling at injection to fill the H+V acceptances (low Vrf)
- Inc. tune shift >0.5 (transverse dist.+ bunch shape h=1+2). Vert. Coh. Tune shift~0.13.
- Dynamical WP for high N starts (4.28,5.56) down to (4.17,5.23)
- Dynamical Working point changes depending on N and emittances(vertical)

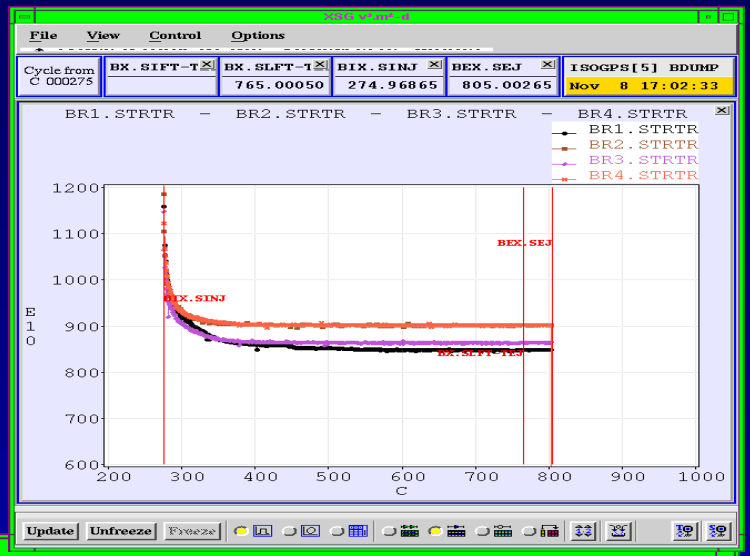
tunes

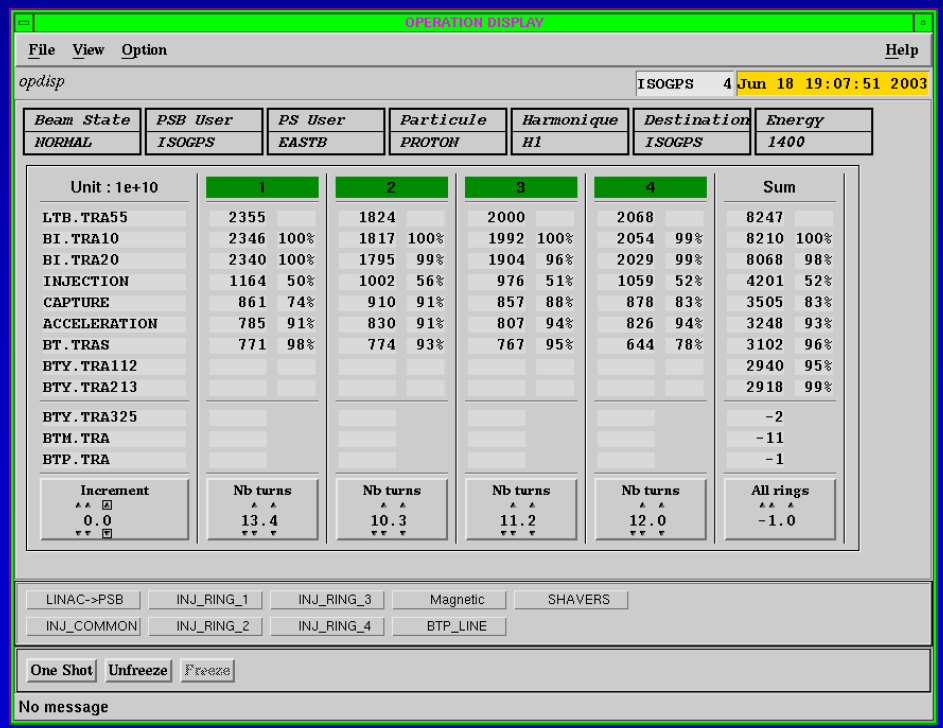

XSG v³.m²-d
File View Control Options
Cycle from C 00275
BX.SIFT-T
BX.SLFT-T
765.00080
BIX.SINJ
274.96845
2Qv=11
BR2.STQH2 - BR2.STQV2
Dynamical W.P
Systematic 3Qv=16
This Δqinc.(0,0,0) depends on distributions and line density
BR2.STQV
BR2.STQH2
5.7
5.60
5.50
5.40
5.30
5.10
5.00
4.000
4.100
Update Unfreeze Freeze

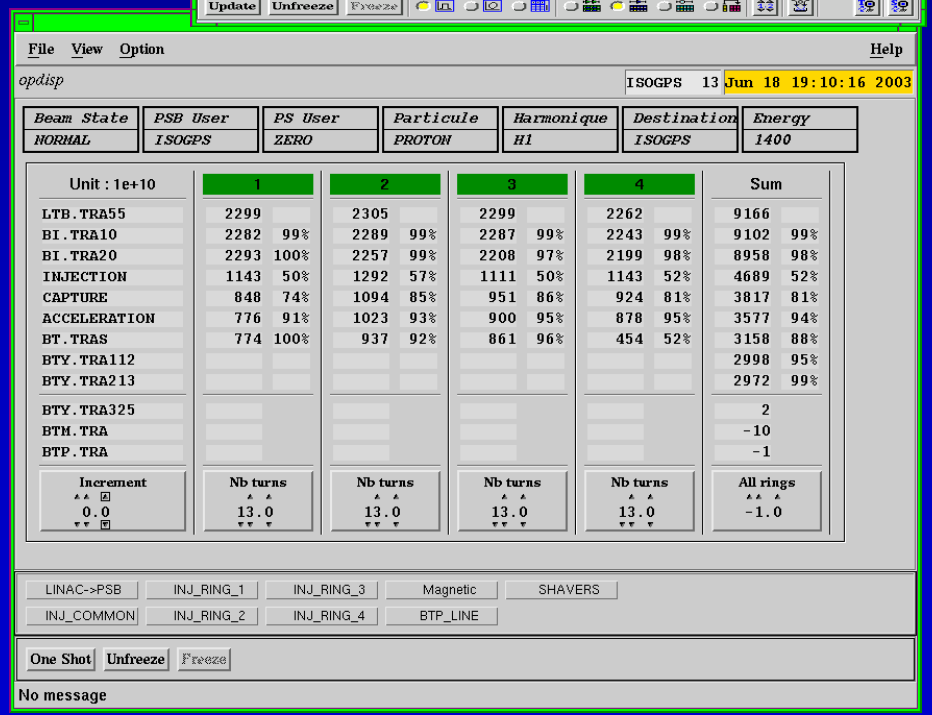

XSG v³.m²-d
File View Control Options
Have a look at the 'Supercycle' mode!
Cycle from C 000275
BEX.SEJ
ISOGPS[7] BDUMP
Nov 8 17:01:36
2 Qv=9
BR3.STQH3 - BR3.STQV3
BR4.STQH4 - BR4.STQV4
Cursor
All 3rd order resonances, No syst.
BR3.STQV3 - BR4.STQV4
BR3.STQH3 - BR4.STQH4
4.60
4.50
4.40
4.30
4.20
4.10
4.1500 4.1750 4.2000 4.2250 4.2500 4.2750 4.3000 4.3250
Update Unfreeze Freeze
SAMP: NO ERROR / COMPLETION IS O.K.

ISOLDE TYPE BEAM

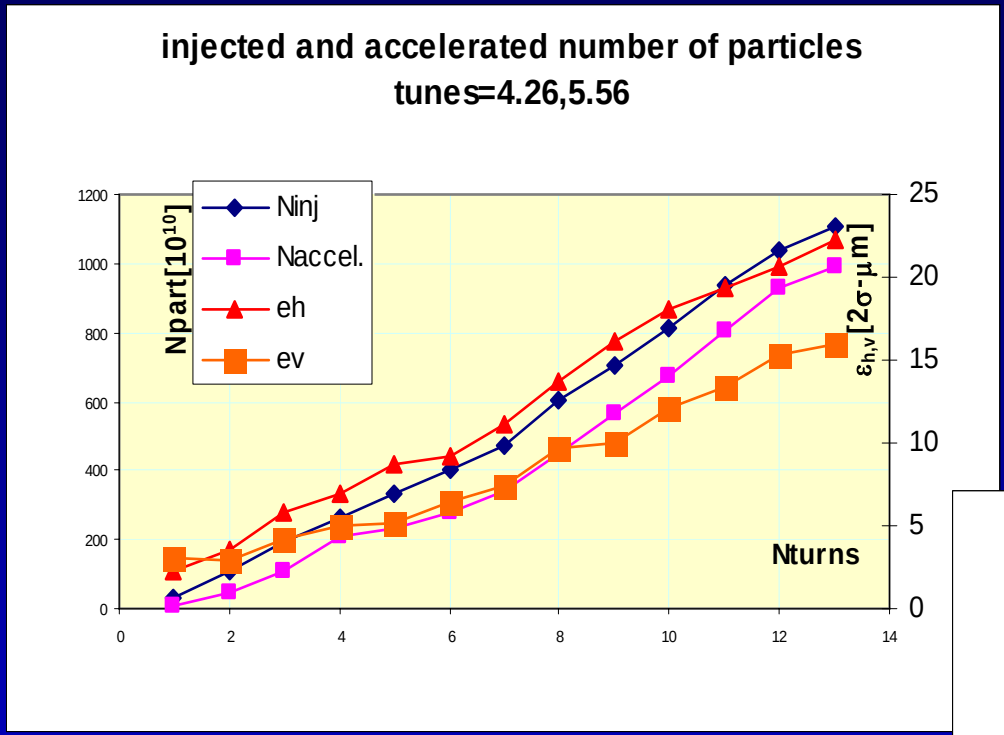
- Linac >165mA
- Routinely possible around 3700E10
- 4 rings equal,4 bunches, about 3200E10 with $(\varepsilon_h,\varepsilon_v)(2\sigma)$ $=(20,13)\pi$mmmrad
- Max ever obtained 4200E10(not operational)

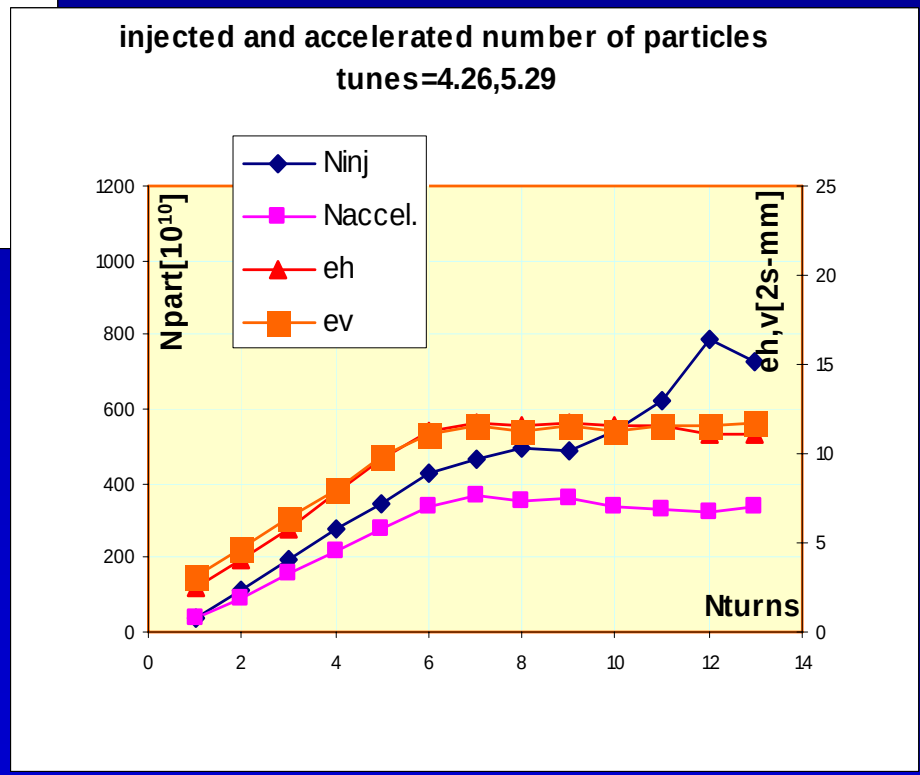


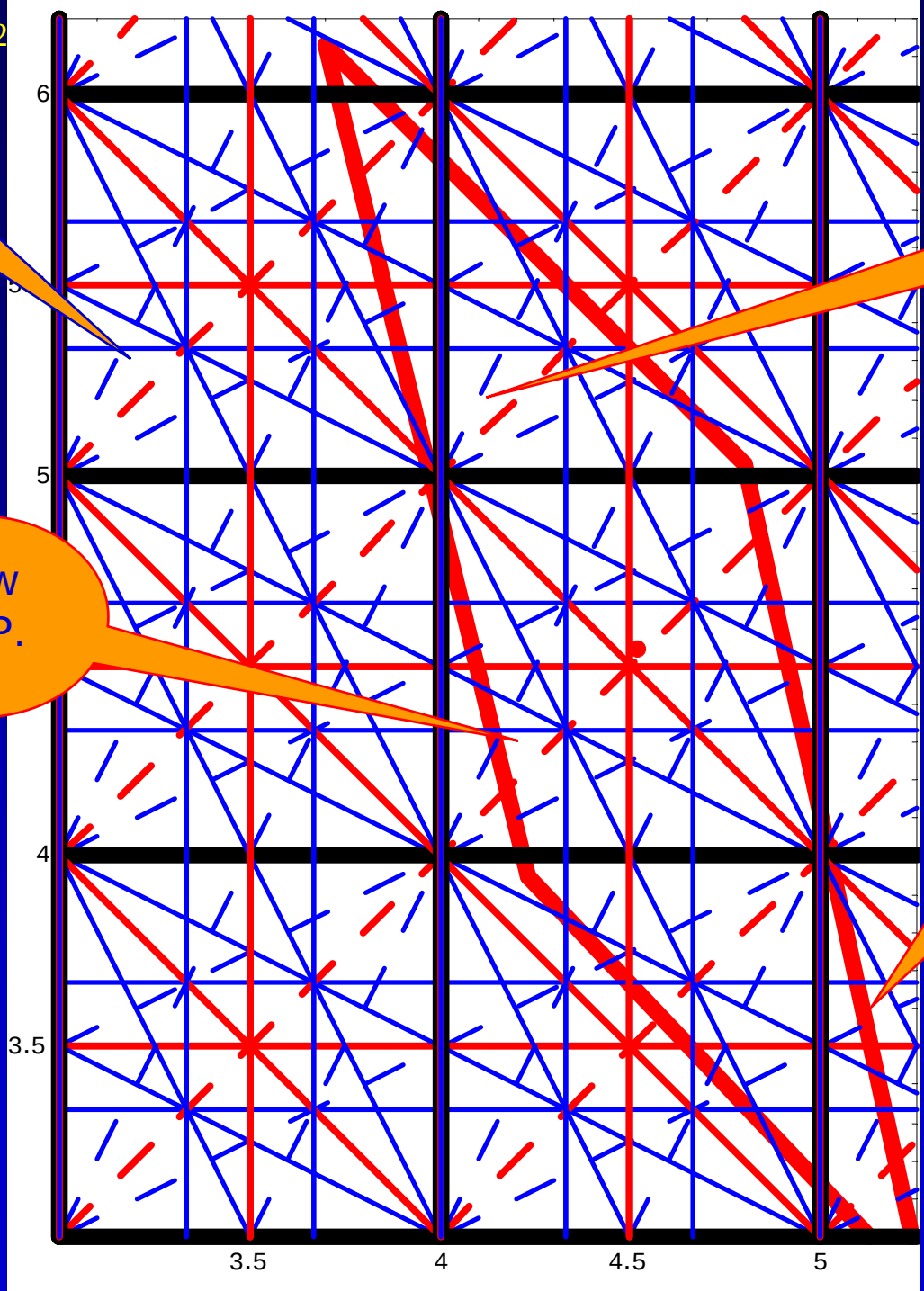




Dynamic tune effect







Could be tested at L.E.

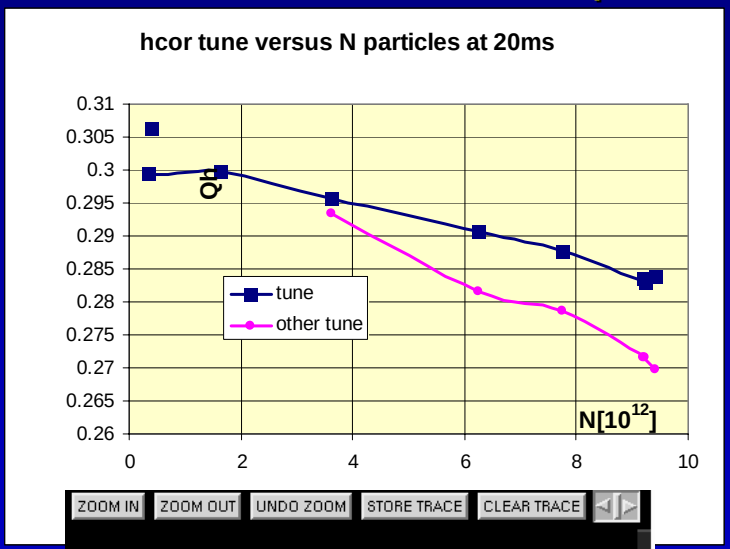
High W.P.

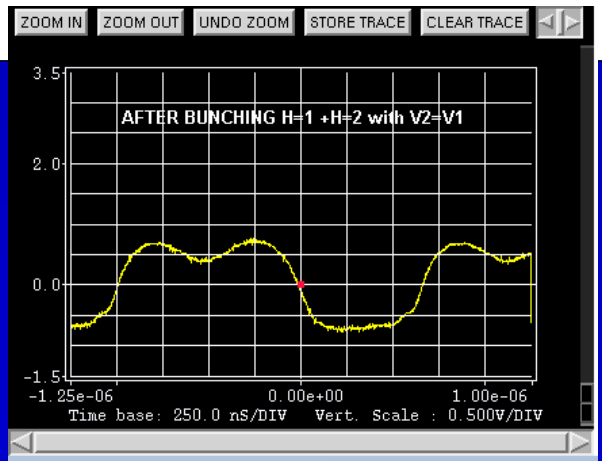
Low W.P.

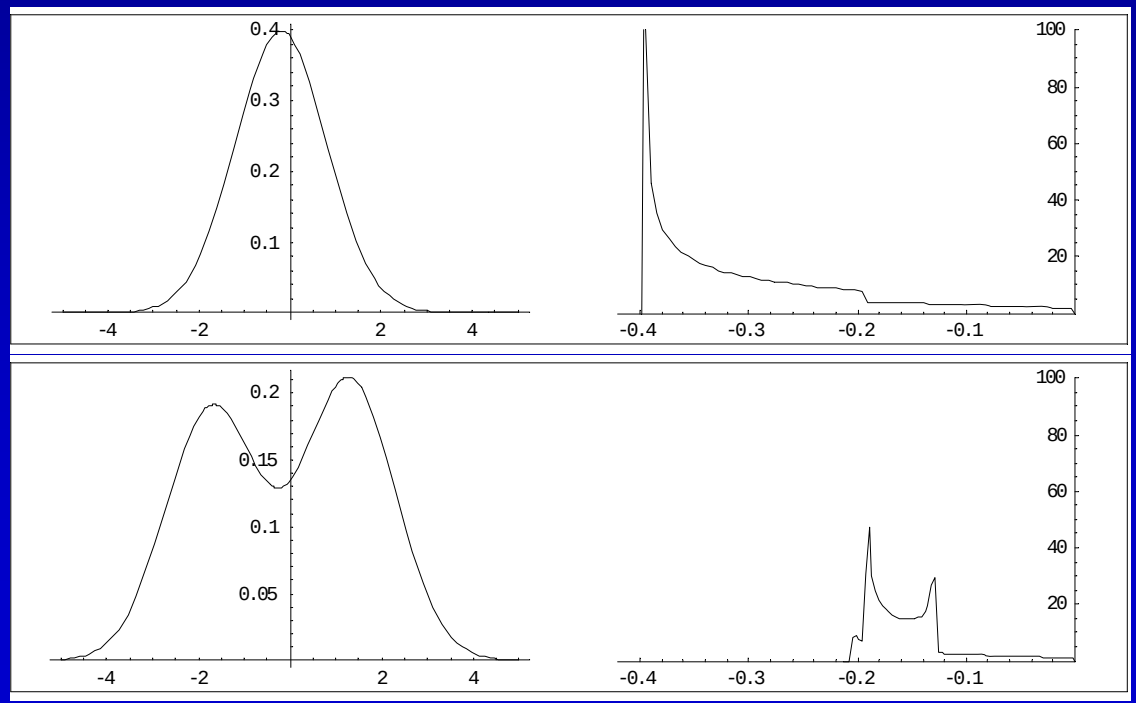
Limits at 1.4 GeV by actual P.Supplies

Coherent tune(1)

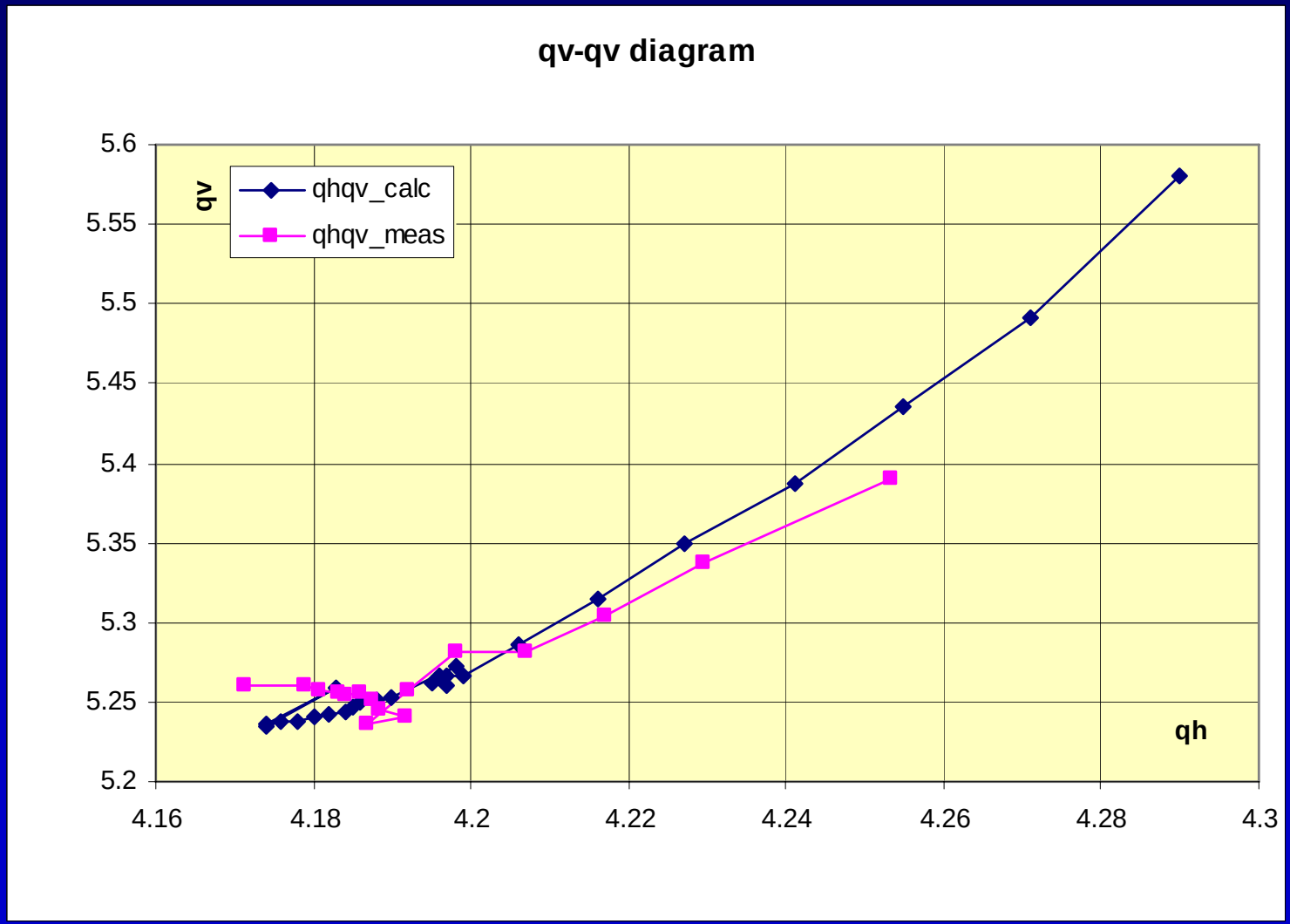
- If the beam is oscillating as a whole(rigid body), the image currents (vacuum ch., magnets) give additional force on the whole beam and change its coherent tune.
- Due to density change along the bunch there is a coh. tune dist. In the case of h=1+2, two peaks appear.





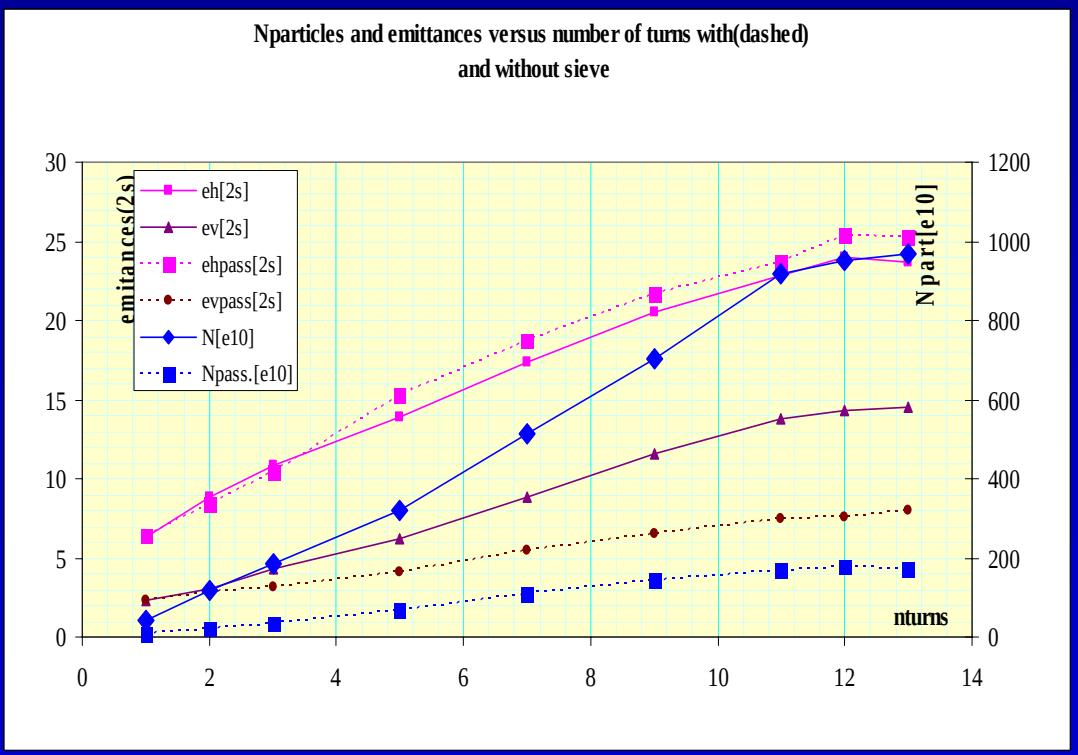


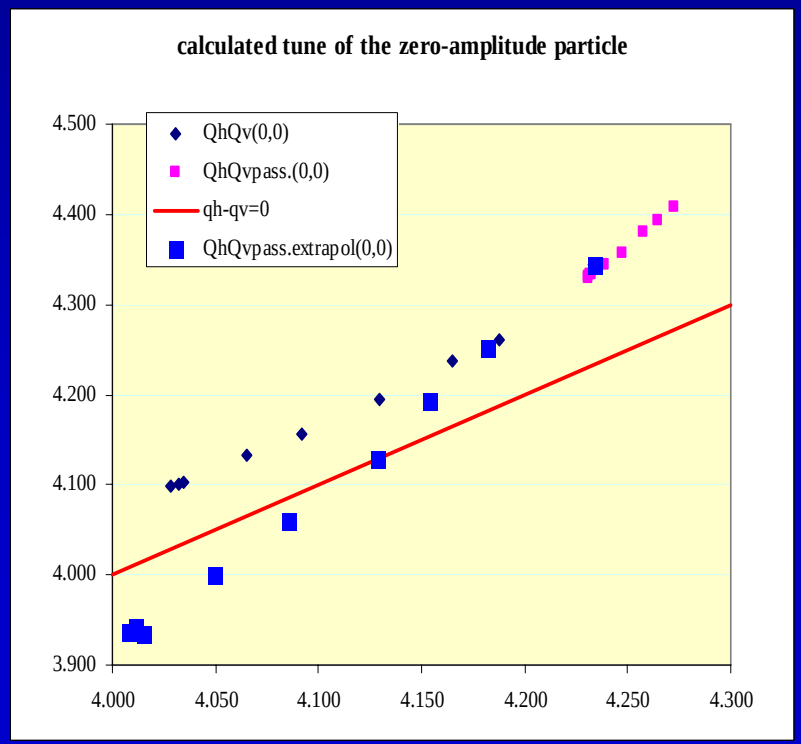
Coherent tune (2)



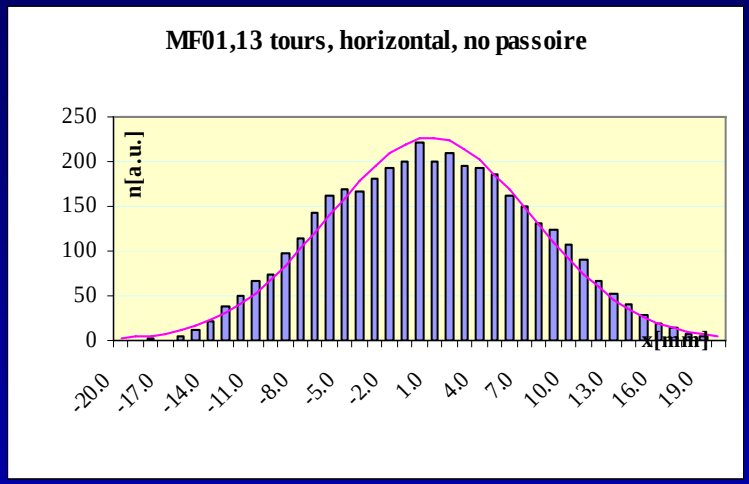
Emittances(1)

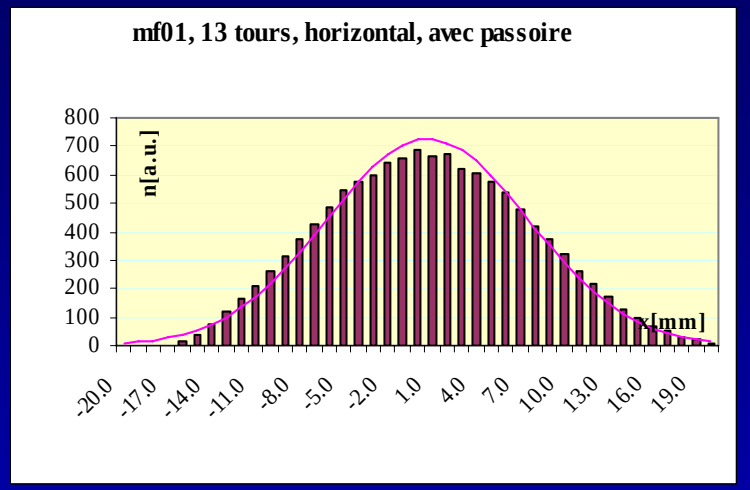
- Measurements taken after acceleration, in ML
- Difference between normal/sieve is only important in V plane
- Calculated zero-ampl tune is made with some assumptions , the accelerated emittances and N!!!
- Extrapolated is dq sieve*N normal/Nsieve

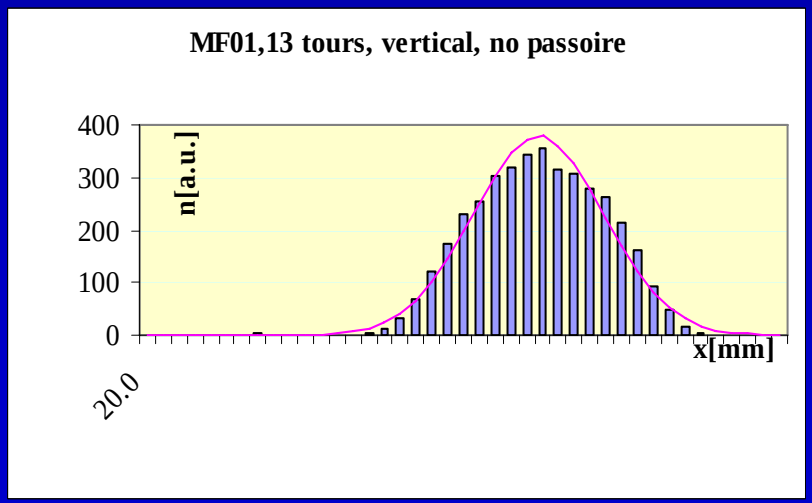


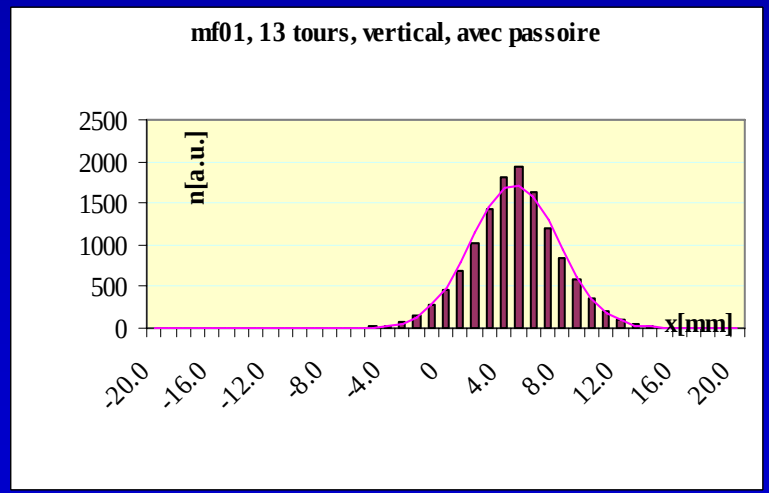


Emittances(2)



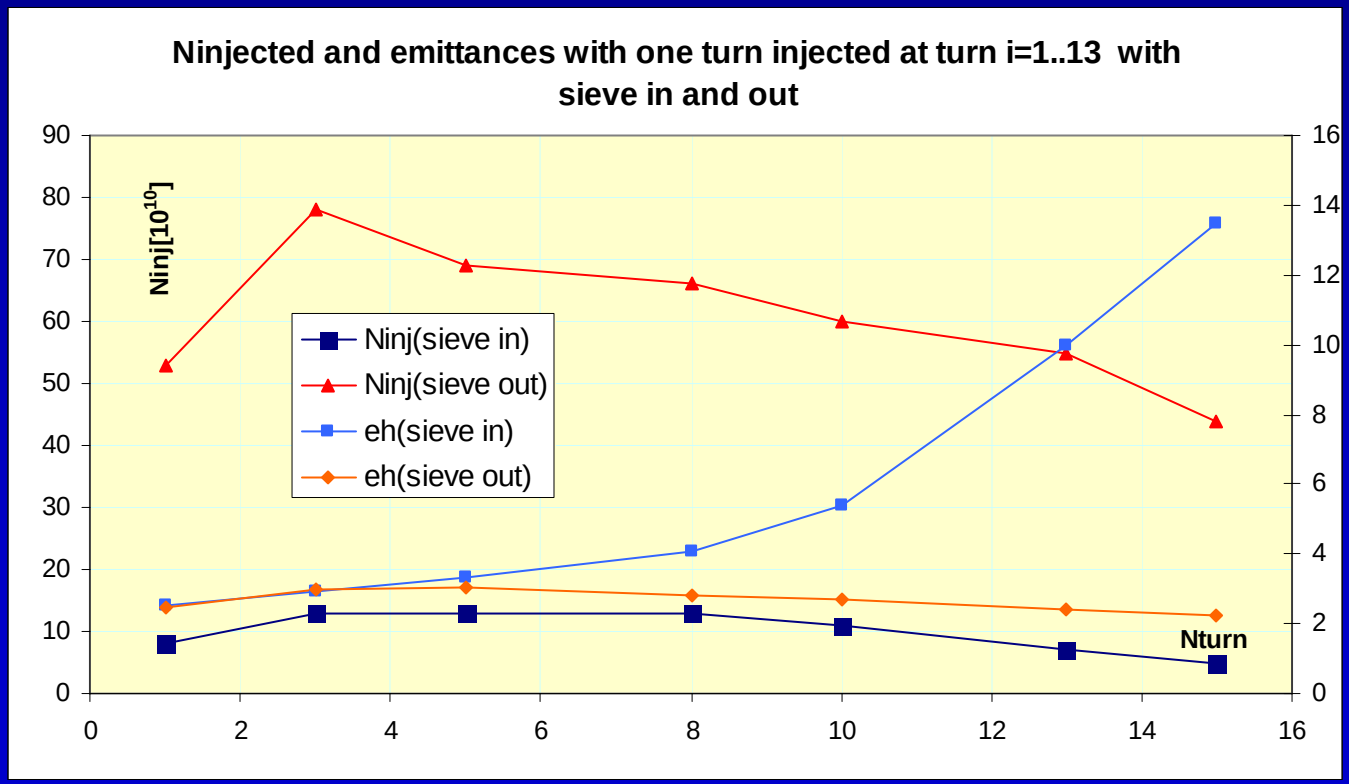






Emittances(3)

- One turn injected as turn 1 to 13
- Note the emittance with sieve seems ‘‘follows’’ the large amplitude oscillation for large N (filamentation present)
- Note the density effect which seems to indicate that the beam is a rigid body (no filamentation)
- The large oscillations without sieve continue for ms and are damped!!!

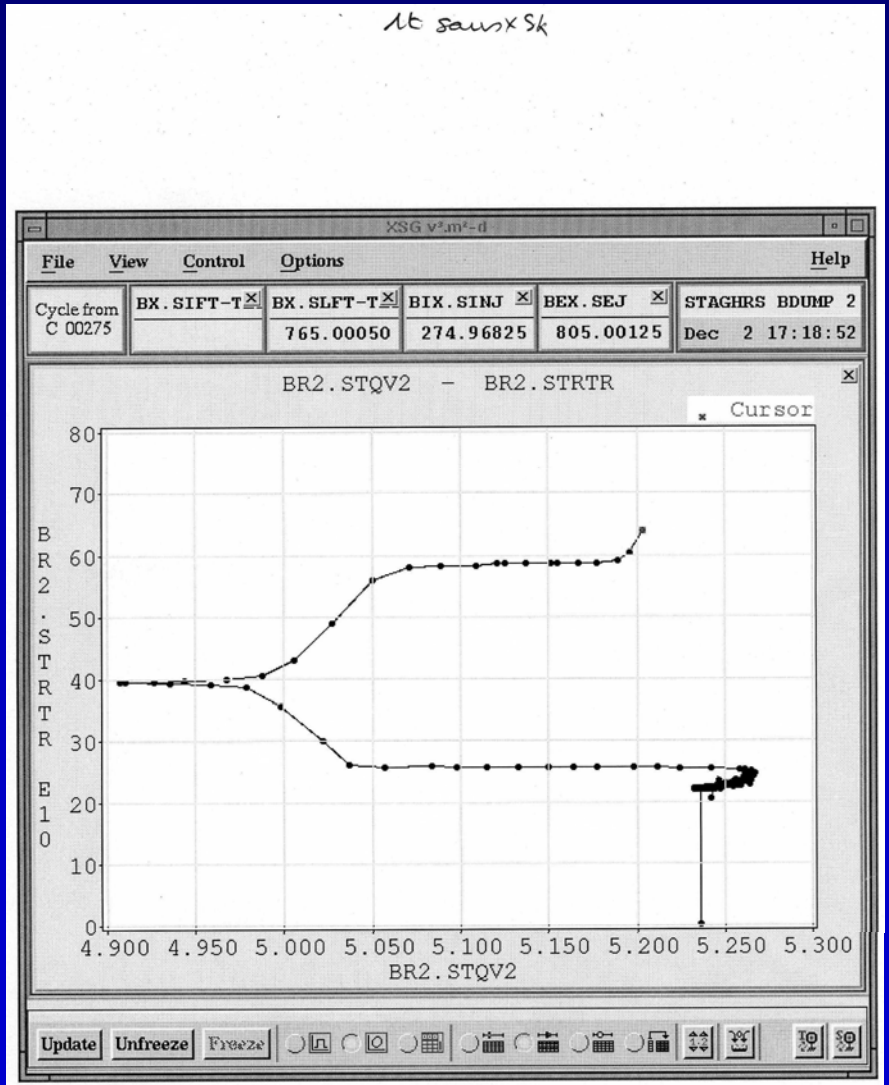


Resonances(1)

- 2 Qv=9/11 no pb for compensation
- Third order
  - HIGH wp PB WITH 3 Qv=16**!**
  - Low WP ...no syst then less pb with external rings.
- Coupling
  - qh-qv=-1 used for coupling injection and fast stop (HWP)
  - qh-qv=0 compensated (LWP)

Integer resonances(2)

- Qh=4 not possible/success
- Qv=4 not tried
- Qv=5 possible (dipole+quad+sext.) but no positive effect onto the beam and performances



Which measurements systems(1)

- Tunes calculated(N=1), measured(N>>1) and tune dispersion
- Emittances
- Oscillations and dampings
- Quad oscillations (incoherent tunes)
- With/without sieve
- Bunch shape, bunching factor
- Beam position along bunch
- Beam H/V at high freq. (wide band PU connections modified)
- Spectrum/network analysers

- Same parameters for simulations

Which tests

- Tune, tune shift/spread, emittances versus ....
- Evolution of beam on ft, bunched/coasting
- Tests bunching factor versus losses
- Are there electrons in the beam (vacuum influence)...get rid of them
- Damper efficiency (H,V)

- Tests integer resonances
- Tests other WP (3.7,3.7)...(3.2,6.3)
- Tests effect of ramping rate

Which energy

- Most at 50 MeV, on ramp or on FT(hard to keep beam stable)
- Tests 160MeV...for extrapolation

Space charge versus tune

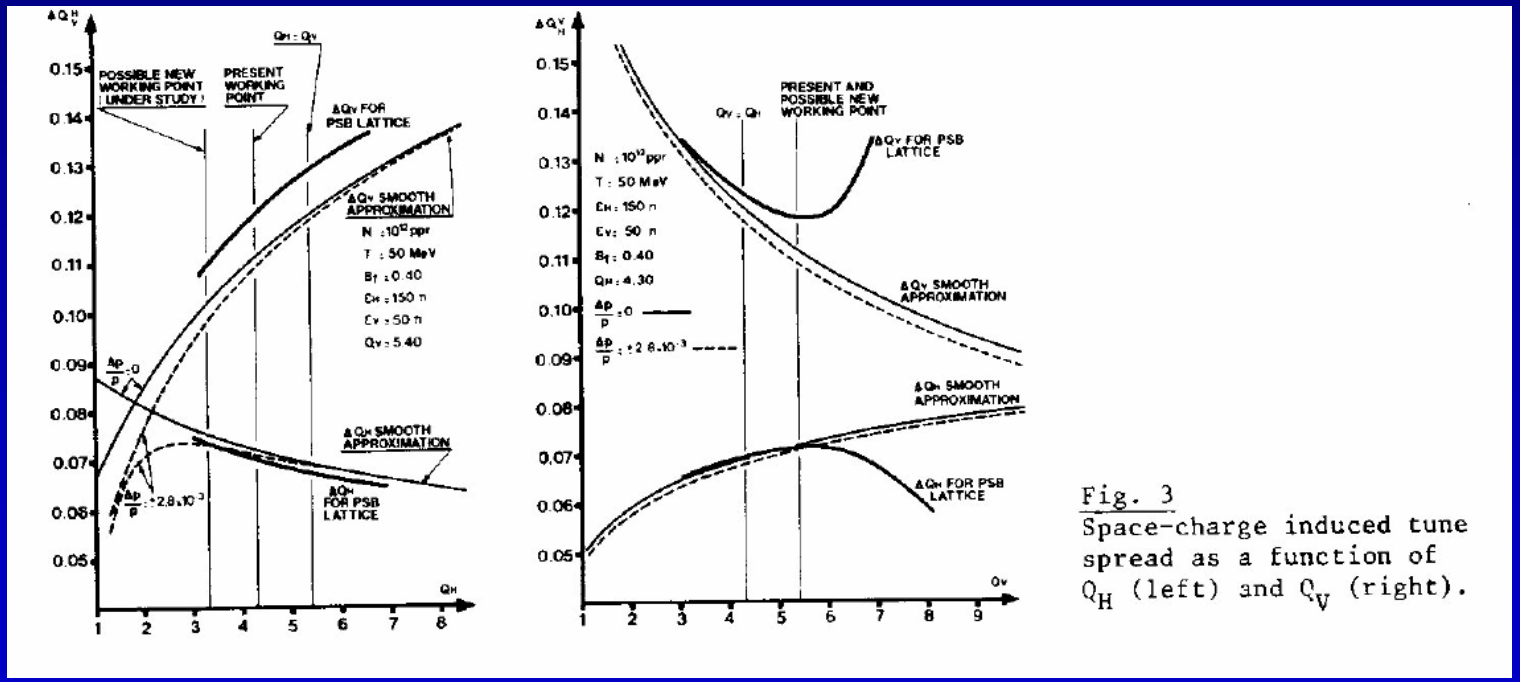


Fig. 3
Space-charge induced tune spread as a function of Q_H (left) and Q_V (right).