

# GAMMAJUMP IN THE PS

CERN

AUMON Sandra – Supervisors : S. GILARDONI and M. MARTINI

## Purpose

Designation and Reduction of beam losses due to the GammaJump

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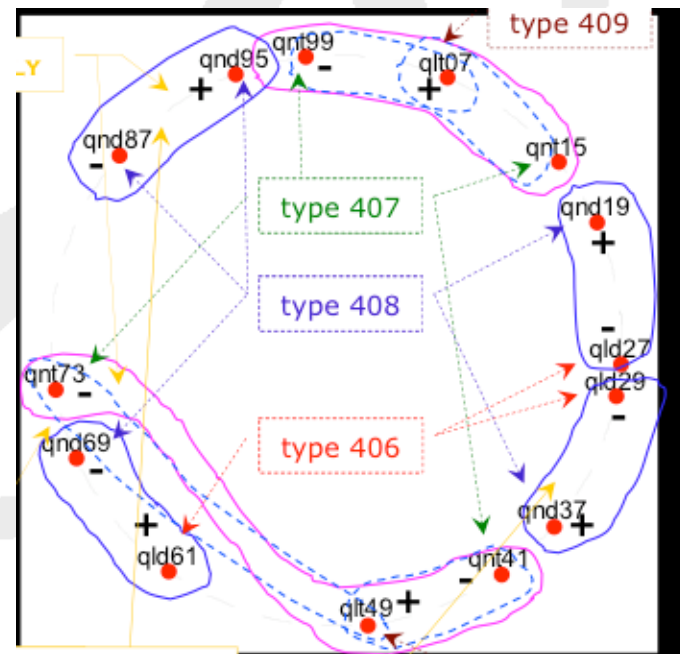
## Summary

- ✓ Introduction to the problem of beam losses due to the GammaJump
- ✓ Determination of beam losses with new PS simulation program with MAD8
- ✓ Propositions of solutions for reducing beam losses for GammaJump

# Introduction to the problem of beam losses through the GammaJump

- The GammaJump is done by pulsing the currents (idoublet, itriplet in the following) of 16 quadrupoles in the PS
- Energy of GammaJump: about 5 GeV
- Quadrupoles distributed in the machine in a quasi symmetric way.

(From M. Martini, APC)

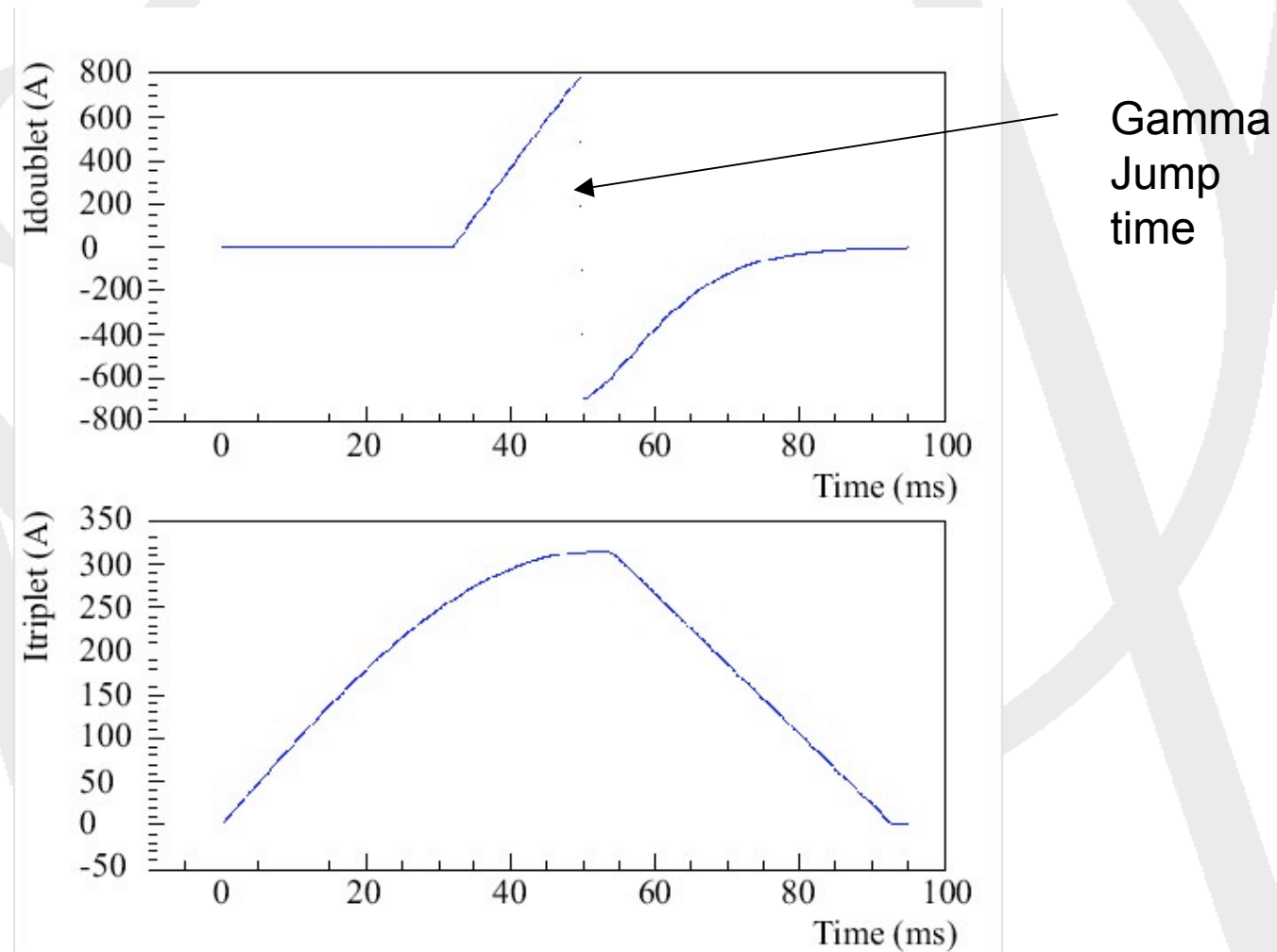


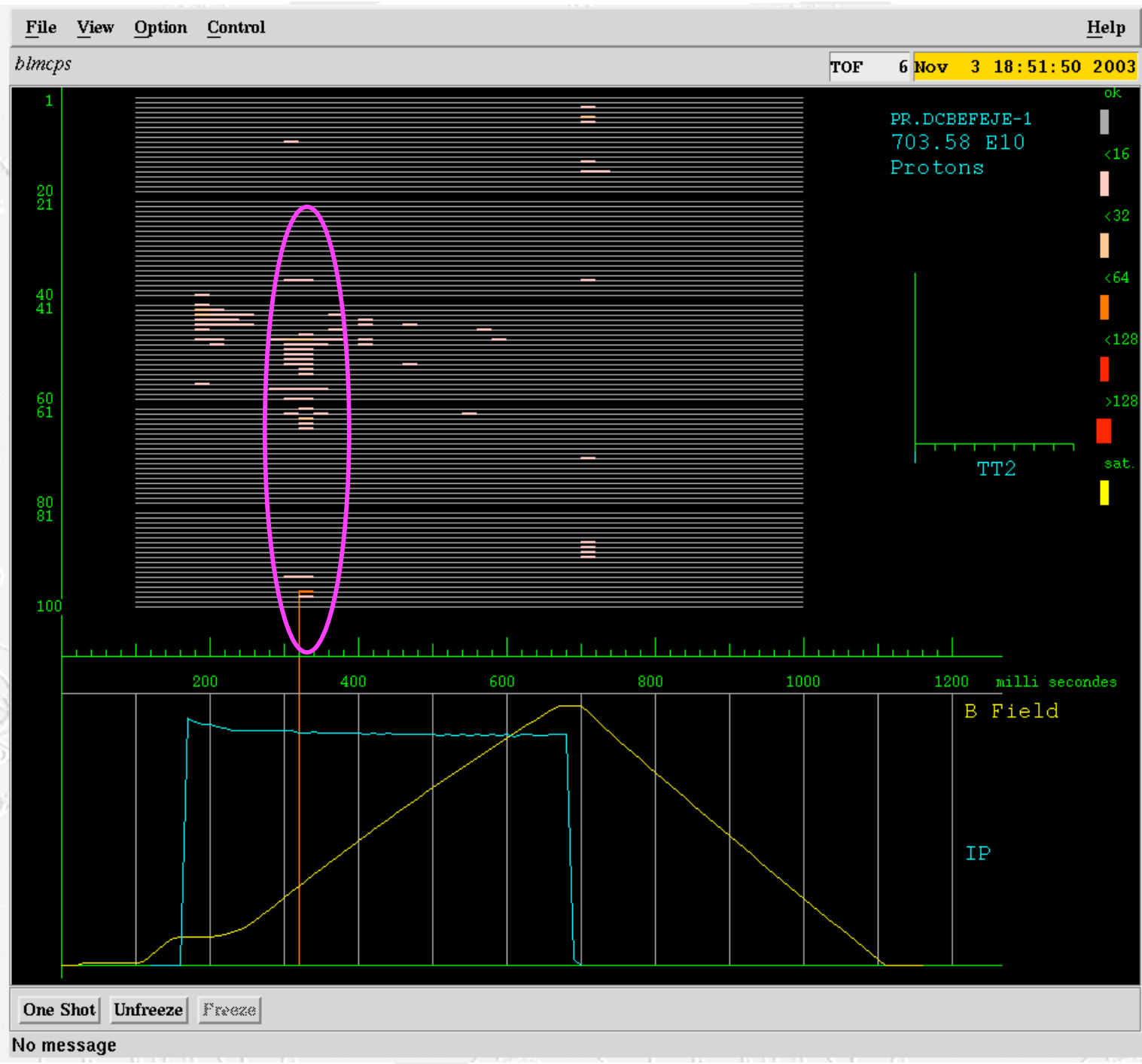
# Introduction to the problem of beam losses during the GammaJump (2)

## Framework

- ✓ Preparing a new PS simulation program with MAD8 according last changes
  - GammaJump Quadrupoles gradient modifications
  - Machine cleaning from unused equipment
- Losses in which sections ? Their importance ?  
Beta Twiss and dispersion time evolution?
- ✓ Integration of the new aperture model into the main program in order to localize beam losses
- ✓ Test of different solutions

# Currents of Doublet and Triplets vs. time





On line  
Beam loss  
Monitor  
Display

TOF beam  
2003

Time of TOF  
GammaJump

Ct= 314 ms

# Preparing a new PS simulation program with MAD8

(Without aperture model)

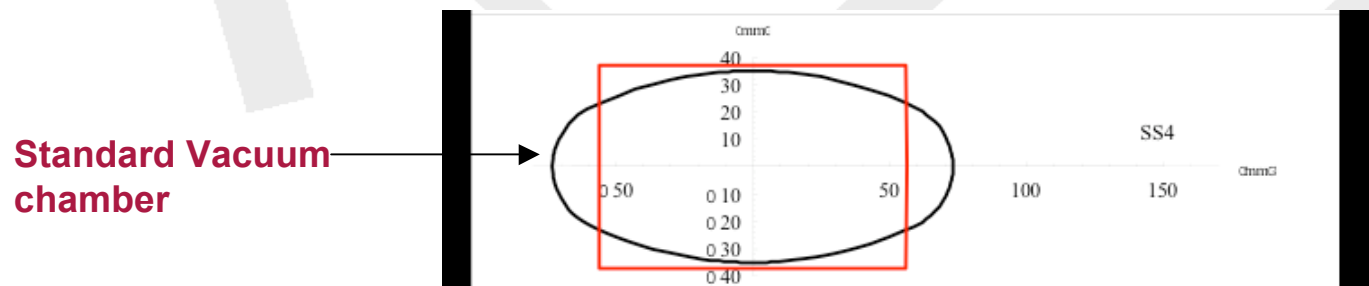
Are there losses ? Which section ?

Importance of the losses ?

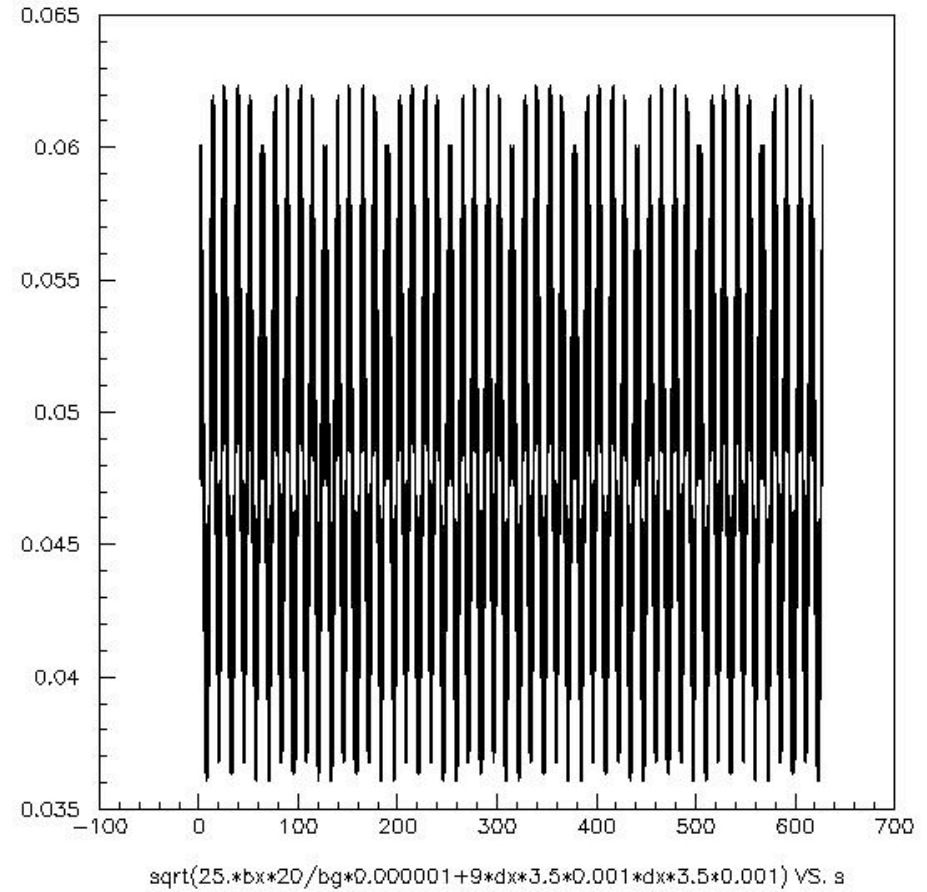
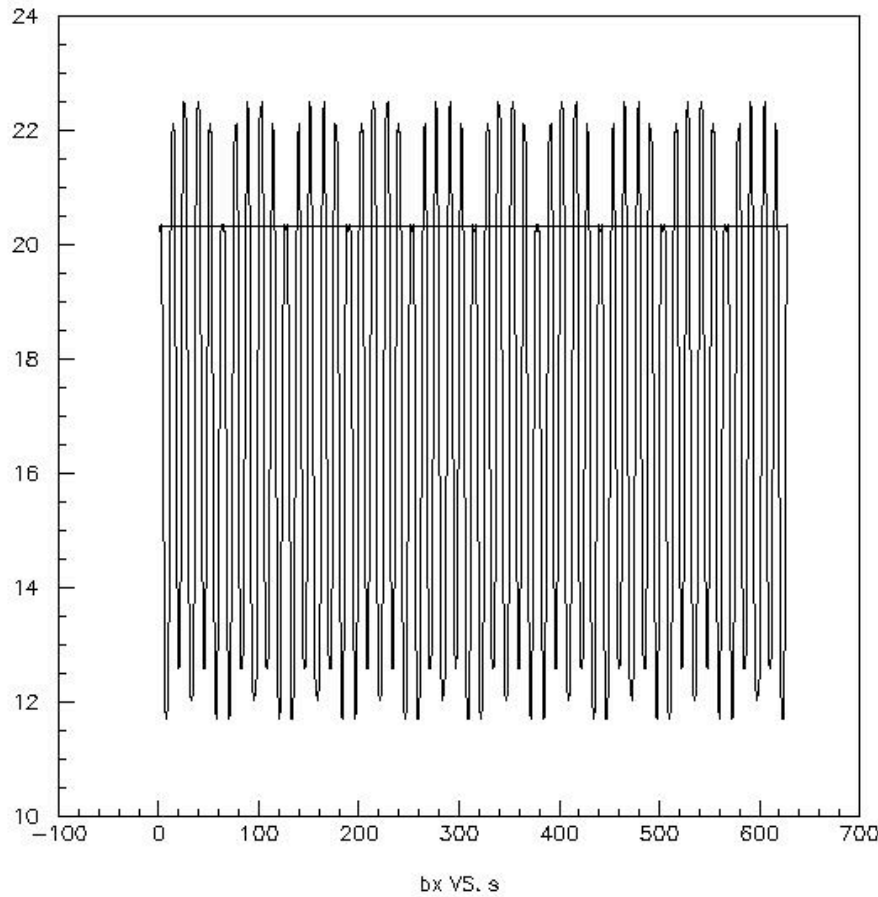
With GammaJump

Unperturbed optics

Program generates a new PS optics by sampling in time the currents of gammaJump quadrupoles to simulate the optics evolution in time.



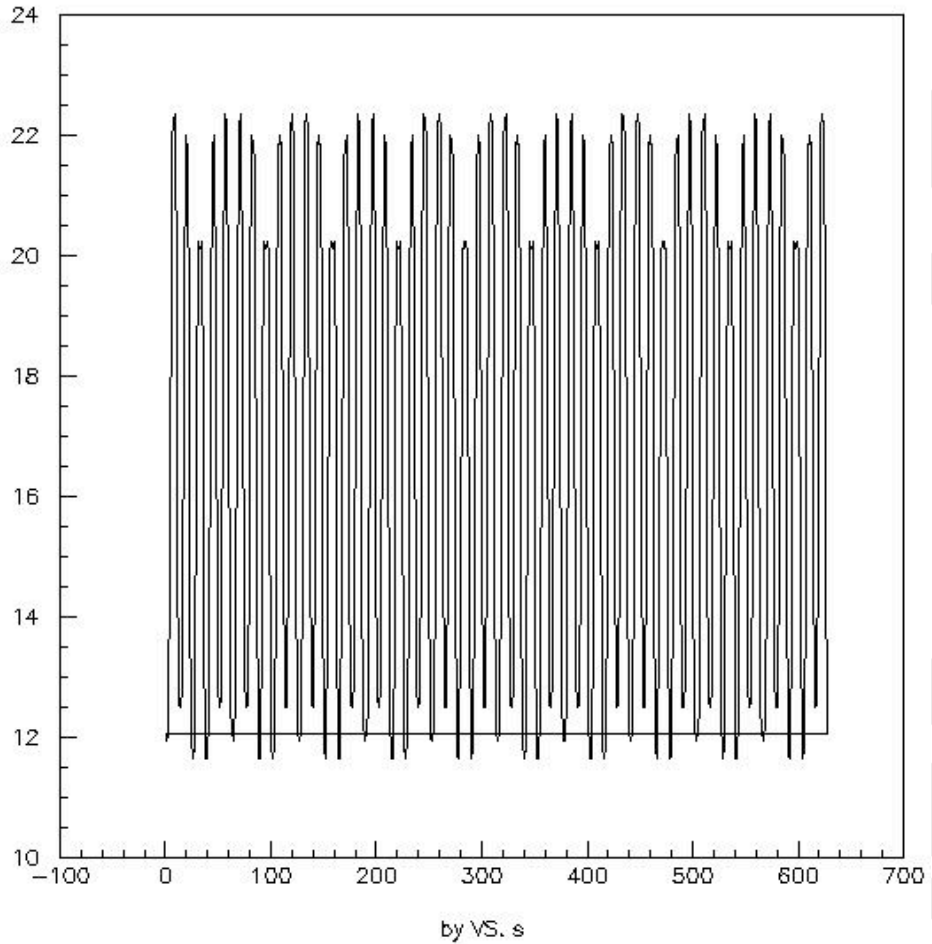
Unperturbed optics, TOF: Epsx=20 microm norm RMS, dp/p 3.5 \*10<sup>-3</sup> RMS  
(from E. Metral)



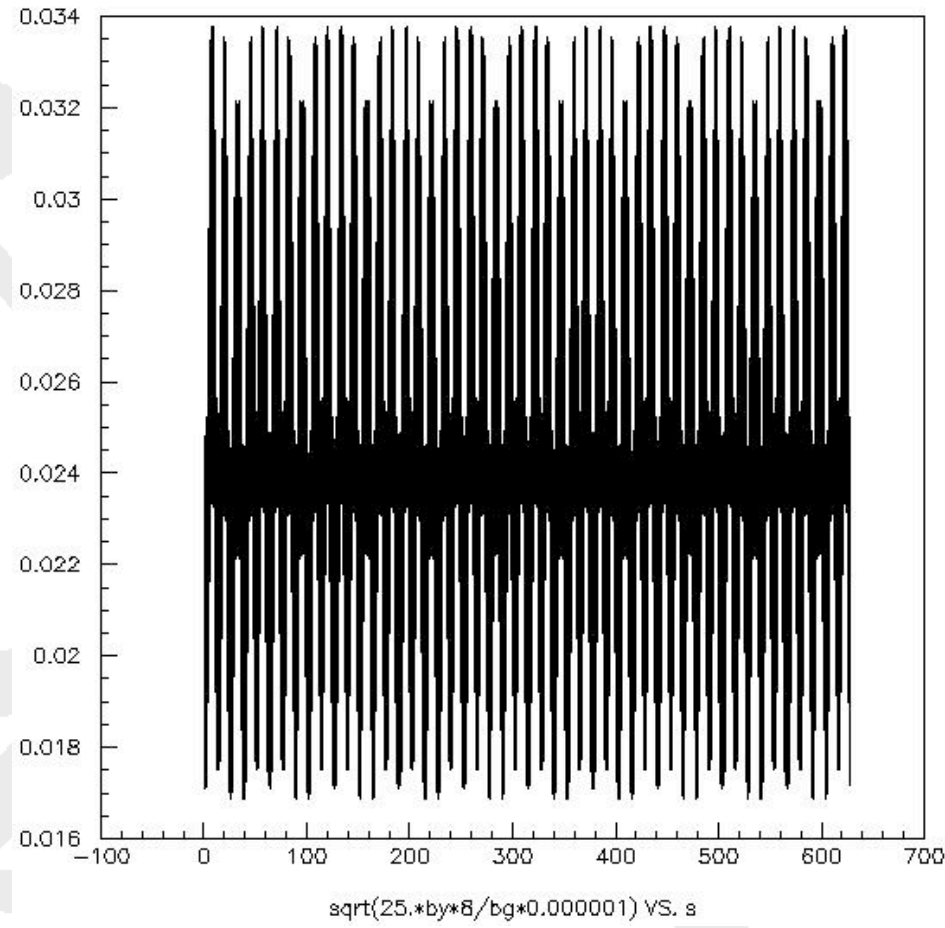
Envelope at 5 sigma betat.  
and 3 sigma dp/p



Unperturbed optics, TOF: Epsx=8 microm norm RMS, dp/p 3.5 \*10<sup>-3</sup> RMS from (E. Metral)



Vertical plane at the limit of aperture

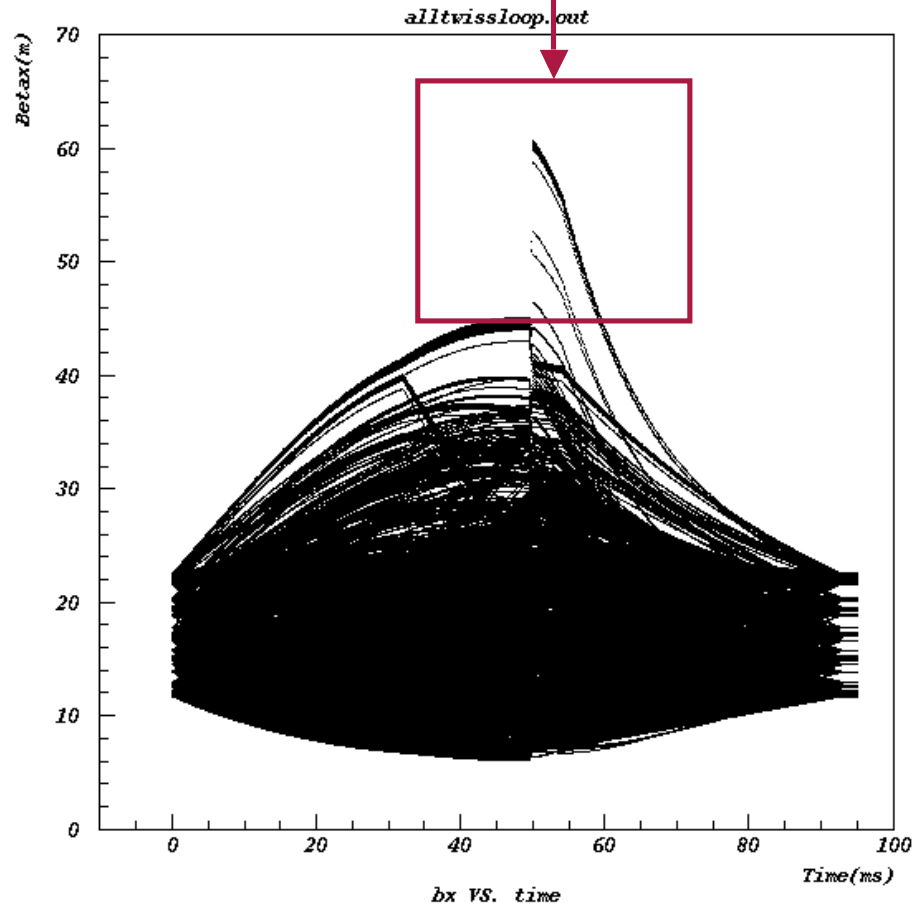


Envelope at 5 sigma betat.  
and 3 sigma dp/p

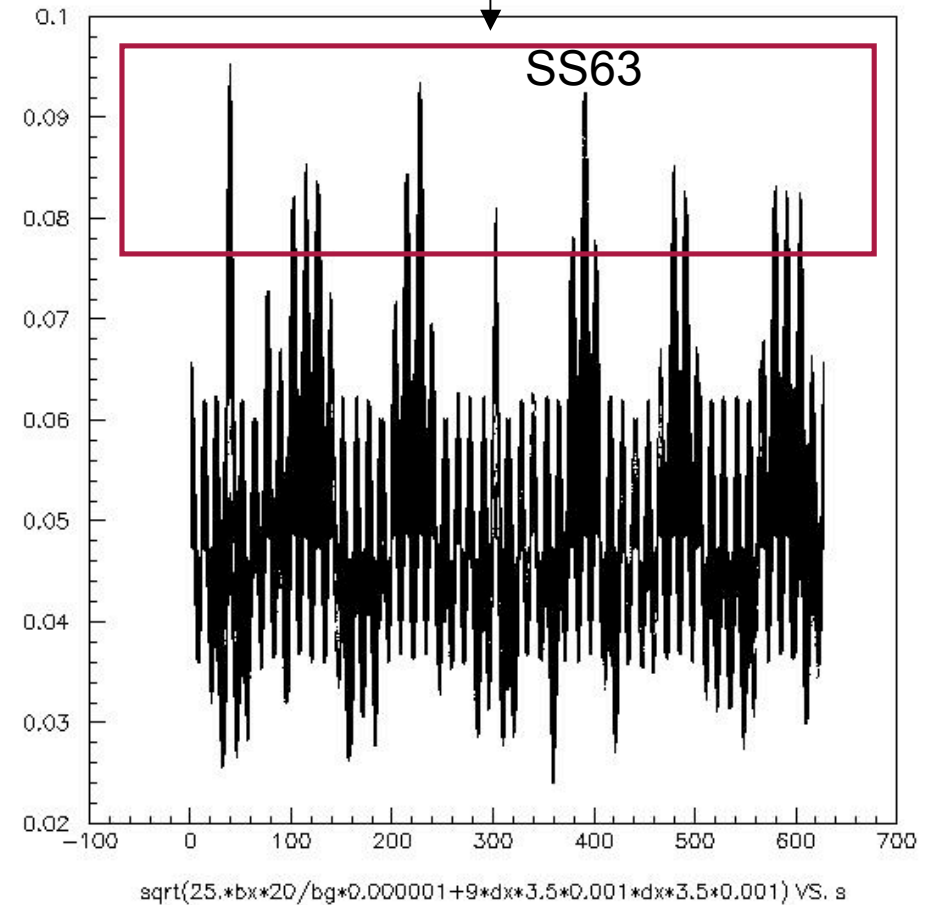
# Horizontal plane With Gammajump

Locations candidate for losses

Betax more than 60

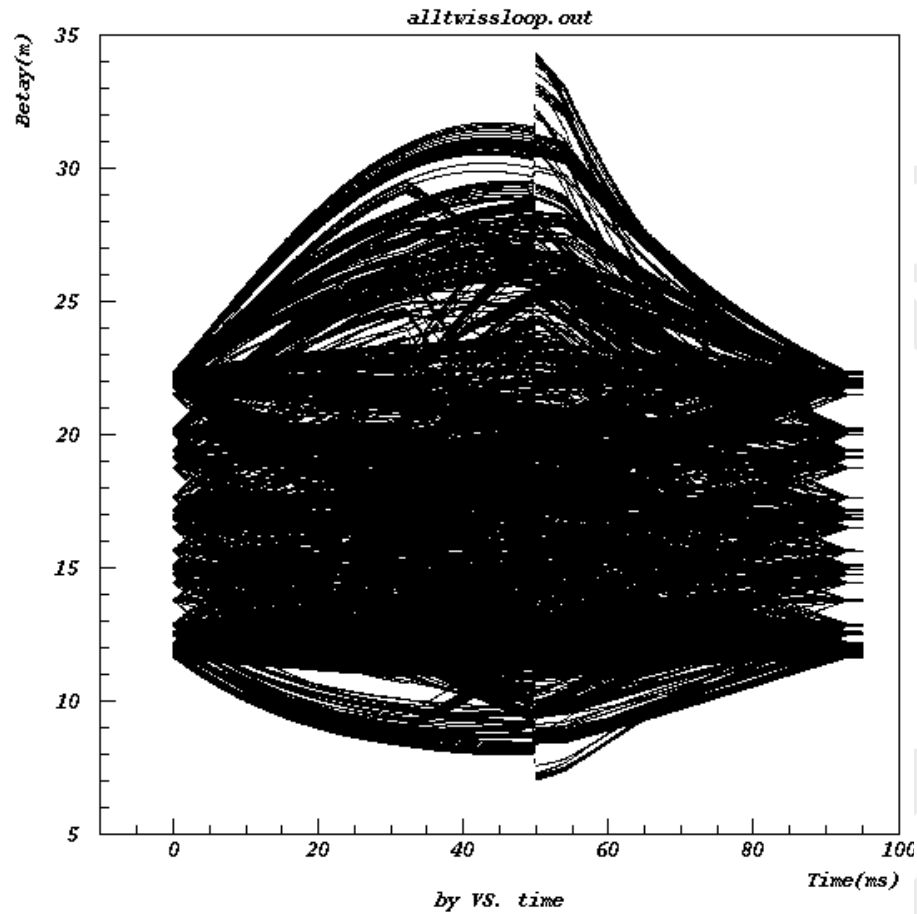


Betax vs time

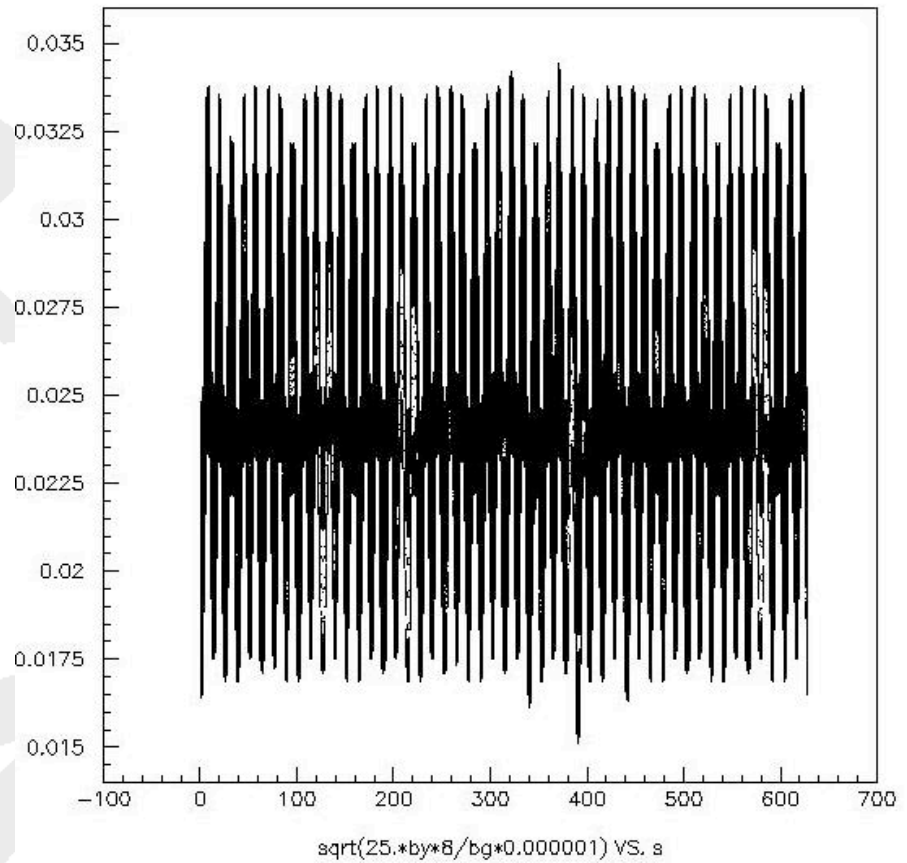


Envelope at 5 sigma betax and 3 sigma dp/p

## Vertical plane With Gammajump



Betay vs time



Vertical beam extension with 3 sigma vs s

## Conclusion of first part of the study

Considering standard beam pipe and far from the GammaJump, losses should be below 1%.

At the GammaJump considering only standard vacuum pipe, different locations candidates for losses have been identified.

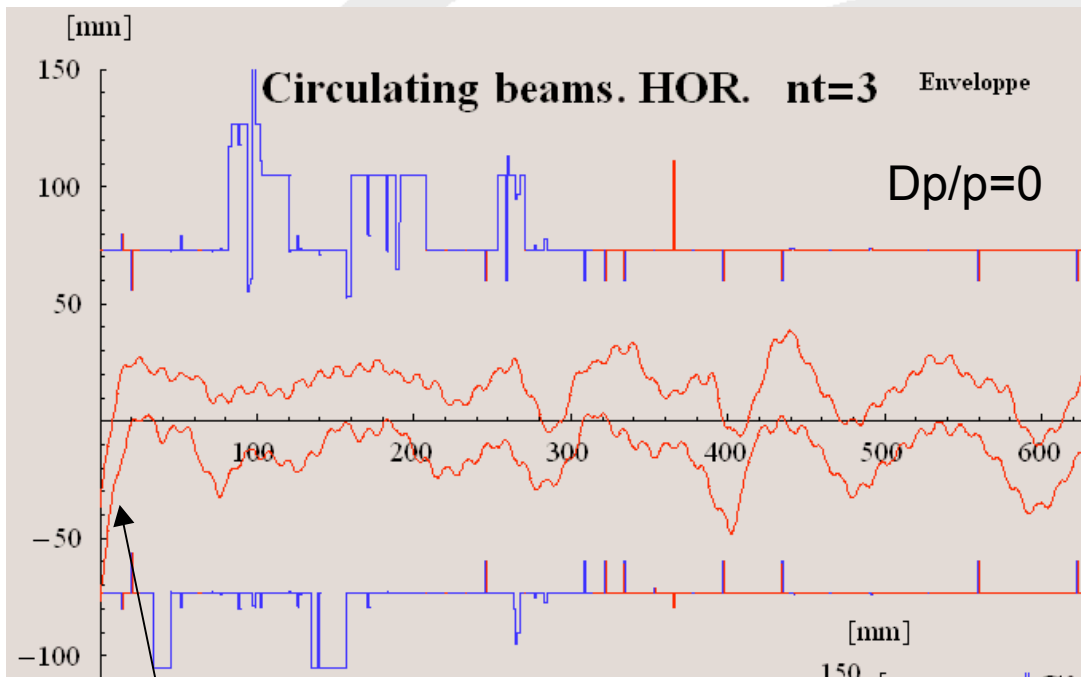
However study with detailed aperture model required during Gamma Jump

Integration of the new aperture model into the main program in order to localize beam losses

PS Mad8 Model

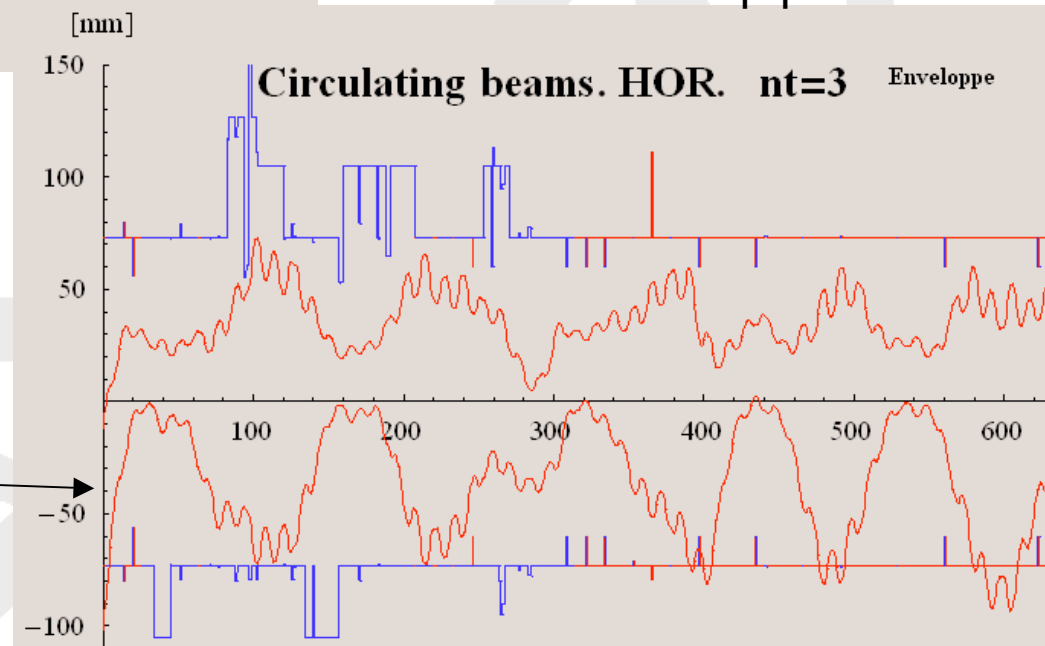
PS Aperture Model  
(Olav)

Mathematica

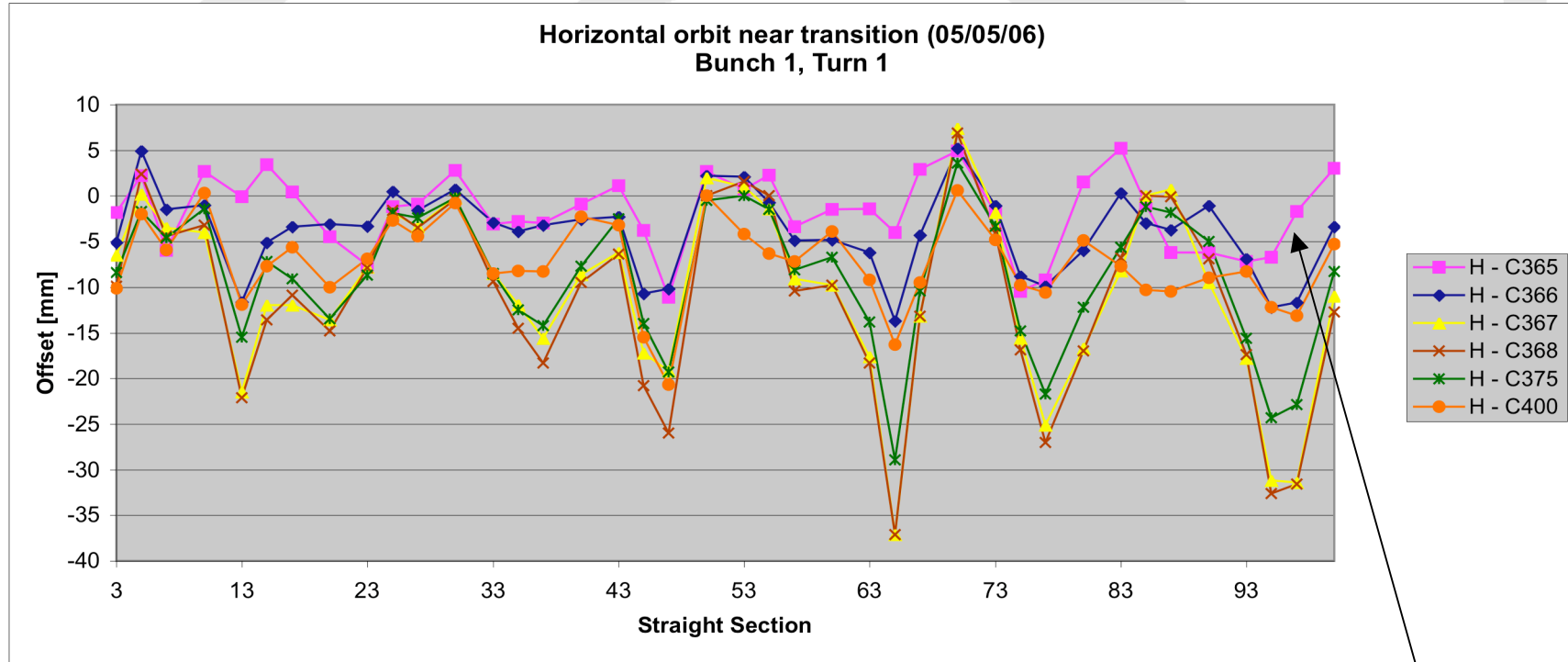


Envelope + Orbit Measured  
at about the gammaJump  
Last week by Elias and Rende

$Dp/p=3.5 \cdot 10^{-3}$



Wrong orbit interpolation  
before PU03



Before Gammajump

Horizontal orbit measured during Gamma Jump last week by Rende and Elias

## Conclusion

With new PS simulation program + Aperture model:

- ✓ As series of SS candidates for losses during gammajump have been identified:  
SS07, SS20, SS36, SS63-64, SS77, SS90-93
- ✓ Most of the loss locations confirmed by BLMs
- ✓ Proposed solutions:
  - ✓ Unbalance the current of doubl. And triplet in the two halves of the PS
  - ✓ Place in a different SS the GammaJump quads.