FOLLOW-UP OF THE FAST VERTICAL SINGLE-BUNCH INSTABILITY AT SPS INJECTION

E. Métral

Analysis of the time evolution

- Animation of the measurements in H and V
- Animation of the BBU theory
- Animation of the TMC theory (coupling between modes 3 and 4)
- Analysis of the FFTs (measurements and theory)
- Appendix
 - Animation of a Head-Tail mode m = 3 or m = 4 alone
 - Animation of the linear (unperturbed) head-tail phase shift for 0 chromaticity and 0.05 (which is the value of the measurements)





MEASUREMENTS IN THE VERTICAL PLANE (1/4)



MEASUREMENTS IN THE VERTICAL PLANE (2/4)



MEASUREMENTS IN THE VERTICAL PLANE (3/4)

Betatron phase difference between different temporal slices with respect to the central slice (=centre of the bunch)



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MEASUREMENTS IN THE VERTICAL PLANE (4/4)

FFT applied over the full acquisition depth (372 turns ~ 8.6 ms). The peaks at 40 MHz are due to the fact that at each turn only 25 ns out of the full revolution period of 23.1 μ s are acquired



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MEASUREMENTS IN THE HORIZONTAL PLANE (1/3)



MEASUREMENTS IN THE HORIZONTAL PLANE (2/3)

Betatron phase difference between different temporal slices with respect to the central slice (=centre of the bunch)



MEASUREMENTS IN THE HORIZONTAL PLANE (3/3)

FFT applied over the full acquisition depth (372 turns ~ 8.6 ms). The peaks at 40 MHz are due to the fact that at each turn only 25 ns out of the full revolution period of 23.1 μ s are acquired



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BBU THEORY (1/3)



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BBU THEORY (2/3)



BBU THEORY (3/3)





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TMC THEORY: COUPLING BETWEEN MODES 3 & 4 (1/4)



TMC THEORY: COUPLING BETWEEN MODES 3 & 4 (2/4)



TMC THEORY: COUPLING BETWEEN MODES 3 & 4 (3/4)



TMC THEORY: COUPLING BETWEEN MODES 3 & 4 (4/4)



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APPENDIX 1 : Time evolution for HT mode m = 3 alone



APPENDIX 2 : Time evolution for HT mode m = 4 alone



APPENDIX 3 : Time evolution for linear HT phase shift (1/4)



APPENDIX 3 : Time evolution for linear HT phase shift (2/4)



APPENDIX 3 : Time evolution for linear HT phase shift (3/4)



APPENDIX 3 : Time evolution for linear HT phase shift (4/4)



CONCLUSION

 Using the classical Broad-Band impedance model of the SPS machine (Q=1, 1 GHz, 10 MΩ/m), the time evolution of the vertical signal can be reasonably reproduced using either the BBU or TMC formalism