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INTENSITY LIMITS FOR BI SYSTEMS



Estimated Intensity Limits for BI



■ BPM System

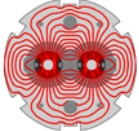
- A bunch of $2.8e11$ with length 1ns gives $>50V$ at the button output
- Limiting components are the resistances on the 70MHz input filter
 - These see approximately half the button output voltage
 - Can withstand 200V so no issue with peak voltage
 - Their 0.25W rating gives the overall power limit
 - Allows 2808 bunches with $2.8e11$ spaced by 25ns
- No fundamental intensity limit from BPM system for next few years

■ BLM System

- Not concerned with bunch characteristics

■ BSRT Systems

- No major problems envisaged
- Only issue may be intensity dependent beam spot displacement
 - Suspect EM coupling heating the extraction mirror or mirror support
 - Can normally be easily recovered by steering of the telescope



Estimated Intensity Limits for BI



■ BCT Systems

□ DCCT

- No anomaly seen during MD with single bunches of $2.8e11$
- New test bench being prepared to check the DCCT beyond 400mA
 - Equivalent to 1380 bunches of $1.6e11$ at 50ns

□ FBCT

- MD with bunch intensity of $2.8e11$ and 1.1ns bunch length
 - Non filtered systems saturated while 75MHz low pass filtered systems OK
 - All systems are now equipped with 75MHz low pass filters
- Attenuation required if bunch length reduced or intensity increased

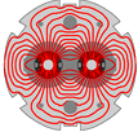
■ Head-Tail & BI Wall Current Monitor

□ Both systems OK for bunch intensities of $2.8e11$ and lengths of 1.1ns

- Gives $>500V$ at the monitor output
- Now attenuated by 46dB to match allowed oscilloscope input level
 - OK provided the bunch length/charge ratio does not exceed this by 20-30%

□ Power per bunch for this intensity < 10 mW

- No issue in terms of power - 20W for 2808 bunches at $1.8e11$



■ Wire Scanners

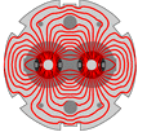
- Wire-scan limits determined by the BLM thresholds
 - Based on overall intensity.
 - 2.1×10^{13} @ Injection
 - 4.9×10^{12} @ 3.5TeV
- Reduction of emittance will impact
 - Number of points for the fit
 - Wire-melting limit (3×10^{13} for $3 \mu\text{m}$ emittance)
 - Still higher than BLM threshold for $1.5 \mu\text{m}$ emittance

■ BBQ Systems

- No impact expected
- Saturation experienced due to short bunch lengths & high charge mitigated by using several diodes in series

■ BGI

- No impact



BUNCH BY BUNCH MEASUREMENT PROSPECTS FOR BI



Bunch by Bunch Measurement Prospects



■ BSRT for 2011

□ Standard camera in gated mode

■ Acquisition will remain as it is

- 1Hz acquisition with 2-3 acquisitions per measurement

■ For measurements at injection

- Bunch by bunch not possible (takes over 1 hour)
- Propose to measure each PS batch

- Would allow measurement of all batches in ~2 minutes for 1380 bunch fills

□ Fast camera

■ Installed for both beams & currently undergoing testing

- Capable of 3564 frames per second (transfer & processing time not yet known)
- Acquisition time required will also depend on light available & sensitivity of camera
 - Looks OK for single bunch single turn measurement at 3.5TeV
- No time estimate yet on when this can be made operational
 - Still some fundamental issues to be sorted out with camera readout & control

■ BSRT for the future

□ Standard camera in gated mode

■ Can be run at up to 25Hz

- Would allow complete bunch by bunch beam size acquisition in a few minutes

■ Requires new frame grabber & FPGA code development to perform on-line processing

- No resources yet allocated to this



Bunch by Bunch Measurement Prospects



■ Schottky

□ Chromaticity at Injection

- Studies ongoing to see if reliable spectra can be obtained at injection for Physics fills with many bunches (not bunch by bunch)
 - Chromaticity derivation from asymmetry of Schottky sidebands difficult at 4.8GHz
 - Width from dp/p is factor 50-100 larger than asymmetry from typical Q'

□ Bunch by bunch Tune

- Successfully used in MD mode for beam-beam studies
- B1H always gives much cleaner spectra than all other planes
 - Needs to be understood

■ Fast BCT

□ No further changes foreseen

- Now provides bunch intensity measurements with accuracy better than 1%
 - BUT cannot distinguish between main bunches & ghosts/satellites

■ LDM

- Correction algorithms being evaluated
- Full integration into controls system underway

■ Head-Tail

- Instability trigger added & also made available to ADT



Conclusions



- Intensity Limits for BI in 2011/2012
 - No Total Intensity Limits foreseen
 - No Bunch Intensity Limits foreseen

- Bunch by bunch measurements
 - No major changes foreseen in 2011
 - Only small improvements to existing systems