SPS Ring and Extraction Interlock System modifications for 2009.

J. Wenninger

November 2008

SPS Ring Modifications

1. <u>Bend crystal (+ roman pots) setup</u>: will be installed during the shutdown in LSS5 for crystal collimation studies in the SPS. To be operated with LOW intensity (safe) beam in dedicated periods.

    >> After consultation with AB/ATB : position interlocks will be using the same BIC input as LSS5 LHC-type collimator (backed up with SIS).

2. <u>Improvement of the protection against settings errors etc of PCs</u>: extension of the concept of the fast extraction surveillance to the SPS ring and the North Extraction Line.

    >> Up to 5 new channels for 2009/2010.

    >> Decided to install a test systems on the SPS main bends and quads in 2009 (BA3) : <u>1 CIBU + cable for BA3.</u>

Beam Quality for the LHC

❑ Surveillance of the LHC beam parameters (beam quality) will become important already in the early phases of commissioning.

❑ Parameters to be surveyed:

   ✓ Intensity (+ spread)

   ✓ Bucket (+ ghost bunches)   For 2009
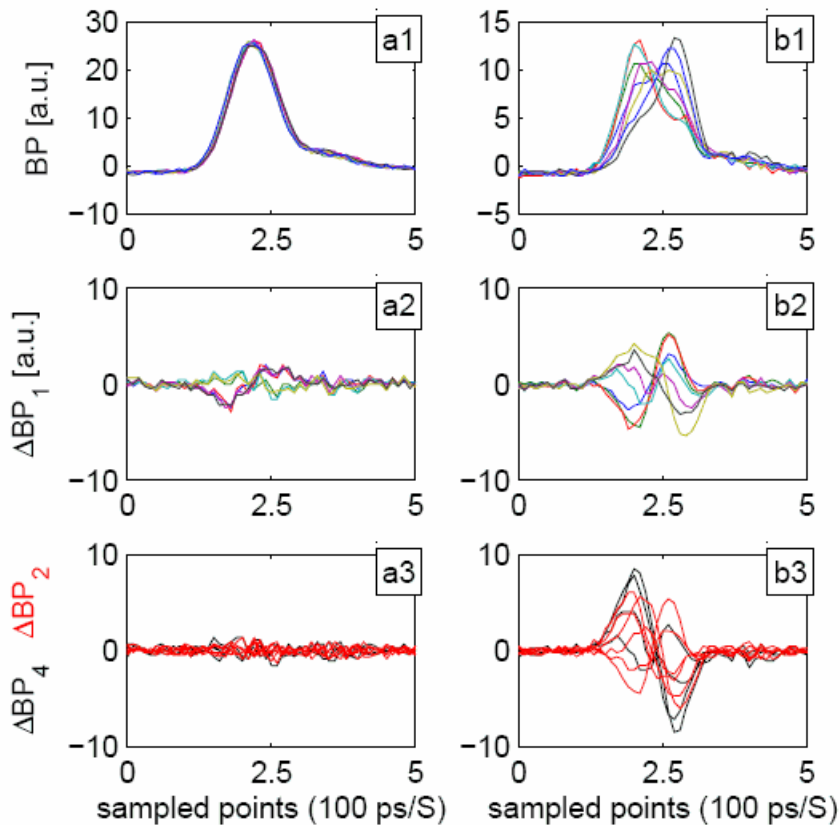
   ✓ Bunch length

   ➢ Transverse emittance   Missing adequate instrument

(RF) Beam Quality Monitor (BQM)

- ❑ RF BQM will survey <u>bunch positions (bucket), bunch length and intensity spread</u>, but not the absolute intensity.

- ❑ Contact G. Papotti (AB/RF).

<u>From G. Papotti (EPAC08)</u>

Table 2: Parameters to be checked with the BQM, typical values and acquisition time (acq. time) in the SPS cycle.

parameter	typical values	acq. time
bunch pos. (coarse)	bucket number	during ramp
bunch pos. (fine)	$\Delta_{\text{batch}} = \pm 0.1$ ns	before extr.
bunch length	1.4–1.7 ns	before extr.
peak amplitude	$\Delta_{\text{batch}} = 10\%$	before extr.

4

Fast BCT Quality Interlock

❑ We must rely on the SPS ring fast BCT to survey the absolute intensity (and spread). Note that the fast BCT cannot easily detect ghost bunches.

❑ 'Test' interlock via SW implement by L. Jensen in 2008, but not used…
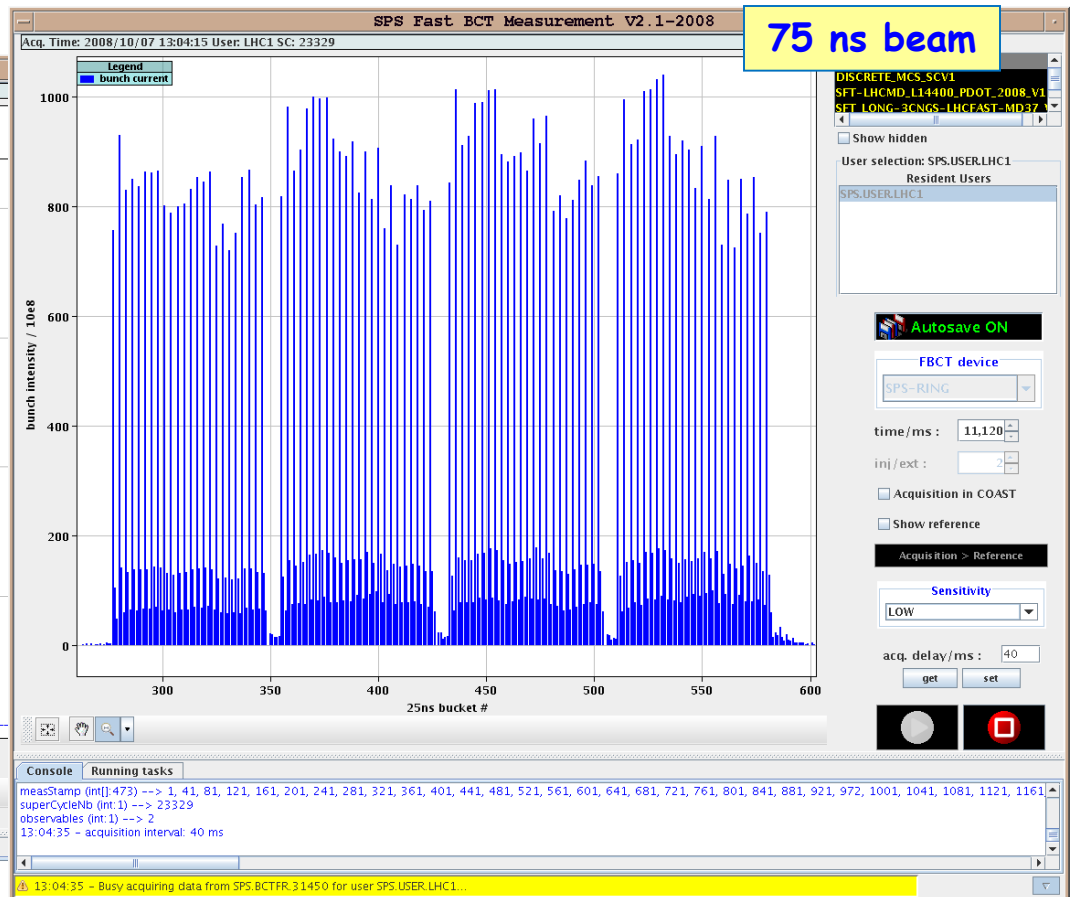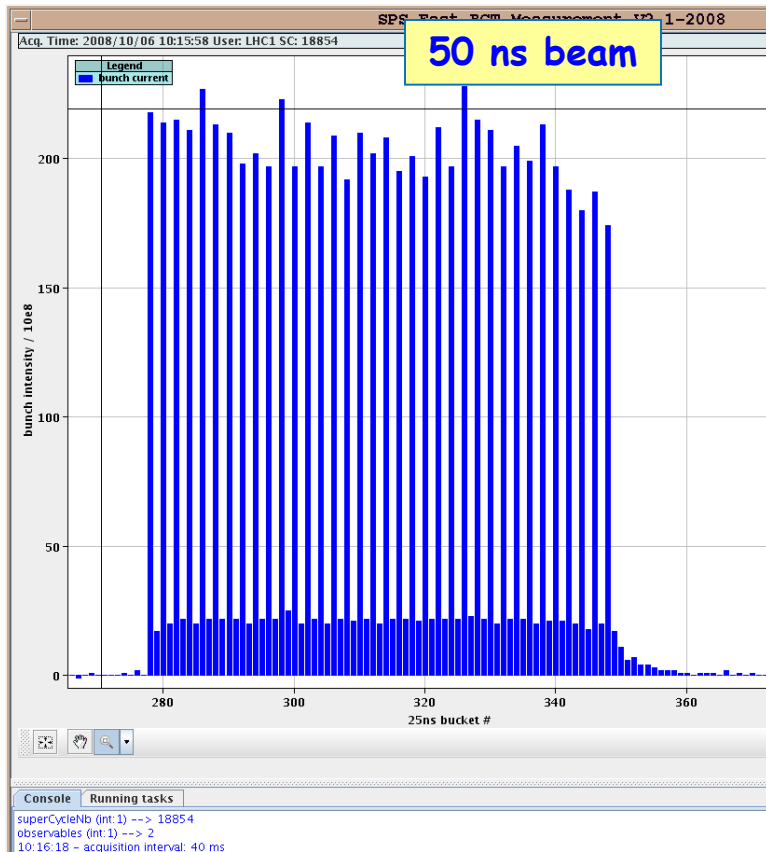
Beam Quality Interlocks Connections

❑ Both the SPS Fast BCT and the SPS RF are located in BA3.

❑ The cleanest solution for the quality interlock are direct connections from both FBCT and RF to BA4 and BA6 Extraction Interlock Systems.

>> 2 connections (Fibers) from BA3 to BA4.

Connect to TI8 Upstream BIC (interference CNGS).

>> 2 connections (Fibers) from BA3 to BA6.

Connect to TI2 Upstream BIC (symmetry wrt BA4).

More Extraction Interlock Changes / I

<u>**Removals :**</u>

❑ BCT interlock in BA4. Lost its 'raison d'être'. FBCT quality interlock will do the same job (and for both extractions).

❑ (Unused) ROCS connection in BA4.

>> 2 CIBUs to recuperate.

<u>**Additions :**</u>

❑ New beam position interlock system to replace (eventually) existing system that was patched on top of the MOPOS system. Will be in the test phase…

>> 1 connection within BA6 to TT60B BIC (maskable).

>> 1 connection within BA4 to TT40B BIC (maskable).

<u>To be confirmed</u>

❑ TCLI collimator in upstream part of TI2.

>> 1 connection from BA7 to BA6 to TI2 Upstream BIC.

More Extraction Interlock Changes / II

'Movements' :

❑ Move FMCM RBIH.878 from TI8 Downstream to INJ2 BIC.

❑ Move FMCM RBIH.293 from TI2 Downstream to INJ1 BIC.

❑ Move LHC injection inhibit from INJ2 BIC to TI8 Downstream BIC.

❑ Move ALICE injection inhibit from INJ1 BIC to TI2 Downstream BIC.

  >> To be confirmed. For the moment a SW interlock (SIS) is doing the 'same job'. Could be an issue for commissioning !

❑ Move ROCS TI8-after-TED interlock from TI8 Downstream to INJ2 BIC.

❑ Move ROCS TI2-after-TED interlock from TI2 Downstream to INJ1 BIC.

  >> To be confirmed. There is an issue with the USER_PERMIT pulse timing and length (because of difference MKE/MKI wrt PFN charging).

Summary : LSS4

Type	From	To	Reason	Status
New	BA3	TI8U	RF BQM	OK
New	BA3	TI8U	FBCT BQM	OK
New	BA4	TT40B	New LSS4 beam position	To be confirmed
Remove	BA4	TT40B	BCT interlock	OK
Remove	BA4	--	ROCS misba4	OK
Move	TI8D	INJ2	FMCM RBIH.878	OK
Move	TI8D	INJ2	ROCS After-TED m1ssr8	To be confirmed
Move	INJ2	TI8D	LHCb injection inhibit	To be confirmed

Summary : LSS6 & Ring

Type	From	To	Reason	Status
New	BA3	TI2U	RF BQM	OK
New	BA3	TI2U	FBCT BQM	OK
New	BA6	TT60B	New LSS6 beam position	To be confirmed
New	BA7	TI2U	Collimator interlock	OK
Move	TI2D	INJ1	FMCM RBIH.293	OK
Move	TI2D	INJ1	ROCS After-TED m1ssr2	To be confirmed
Move	INJ1	TI2D	ALICE injection inhibit	To be confirmed

Type	From	To	Reason	Status
New	BA3	BA3	ROCS interlock SPS mains	OK

BIC Controls

❑ To ease the monitoring of the fast signals the LHC Injection BICs should:

  ➢ Either move to SPS timing (+ LHC PM event added from LHC timing).

  ➢ Or have the SPS extraction timing marker added (+ data publication with SPS cycle, how ??).

❑ Q : Will the SPS extraction timing marker be available for all extraction BICs in 2009 (presently only master) ? For the SW preparation…