



LIU-SPS action list for BE/BI

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from BL, PI, QP, PM

Introduction

SPS

<input type="checkbox"/>		<u>128846</u>			Upgrade Transverse diagnostics
<input type="checkbox"/>		<u>128842</u>			Upgrade SPS BGI
<input type="checkbox"/>		<u>128848</u>			Upgrade SPS Orbit Acquisition Electronics
<input type="checkbox"/>		<u>128841</u>			Produce New Fast SPS Wire scanners
<input type="checkbox"/>		<u>128849</u>			Provide fibre optic infrastructure LS1
<input type="checkbox"/>		<u>128847</u>			Upgrade Fast Ring BCTs
<input type="checkbox"/>		<u>128844</u>			Provide electronics for fast BLMs
<input type="checkbox"/>		<u>136906</u>			Upgrade synchrotron-light monitors
<input type="checkbox"/>		<u>129721</u>			Provide fibre optic infrastructure LS2
<input type="checkbox"/>		<u>128843</u>			Upgrade ionisation chamber BLMs

Input:

- TDR (2014):

<http://cds.cern.ch/record/1976692/files/CERN-ACC-2014-0337.pdf> (SPS BI page 520)

- Latest BI review with LIU-SPS (Malika/Brennan/Rhodri):

<https://indico.cern.ch/event/398944>

Upgrade transverse diagnostics (head-tail)

- Request:
 - Resolve coherent transverse position within the individual LHC bunches
 - Both planes H/V at the same time
 - 1000 turn
 - >10GHz sampling
- Proposed solution:
 - Electronics/software
 - Purchase Guzik digitizer => done (spare from LIU-PS ??)
 - Provide FESA3 class and expert GUI ((T. Levens BI/QP)
 - Dismantle old Tektronix scope (BB4)
- Later stage (??):
 - Investigate higher bandwidth detectors (CTF)
 - Cross fingers for Linux support (PCIe) ..

Upgrade BGI

- Request:
 - Provide relative beam size measurements during SPS cycle (H/V)
- Proposed solution
 - Magnets:
 - Some changes made during LS1 (3->2)
 - We need green light from OP-SPS to power
 - Detectors:
 - Upgrade cage/MCP similar to LHC -> completed
 - Electronics
 - Update to LHC solution
 - Cabling issues solved however cameras believed to not withstand radiation levels
 - Software
 - New electronics for HV control and acquisition (2016?)
- Issues in the past:
 - Space charge effects due to limited magnet strength (protons)
- Actions:
 - Understand/solve radiation issues (camera)
 - Commission system (BL/SW)
 - Dedicated MD ??
 - Decide next steps in view of LSS5 (LS2)

Upgrade SPS orbit system

- Problem:
 - Maintenance of old system (consolidation)
- LIU/OP request:
 - More acquisition modes
 - Integrate interlock (fast excursion) and extraction bumps
- Solution:
 - Replace old detectors (LS1)
 - Tunnel electronics with ADC
 - Long coax cables -> fibres
 - New acquisition electronics (VFC) with two chains (40MHz/200MHz)
- Actions:
 - Determine radiation hardness of tunnel electronics
 - Assess performance of front-end electronics
 - Produce electronics (tunnel and surface) with firmware
 - Investigate and implement interlock modes – if possible without need for external fast timing synchronisation
 - Publish EDMS document with software interfaces for each operational acquisition mode

Upgrade SPS wire-scanners

- Request:
 - Do scans with 4 PS batches at 450 GeV in the SPS (!)
 - BxB acquisition (@40MHz)
 - Improve precision with small / low-intensity beams
 - Decrease dependency on settings (PM gain etc)
 - Both planes H/V at the same time
 - Emittance accuracy 10% (absolute)
- Solutions:
 - New mechanical design installed in SPS (LSS5)
 - Diamond as PM replacement (parallel)
 - Fibres to replace long cables
- Actions:
 - 2015:
 - Provide electronics for movement and acquisition of profiles (BL)
<http://indico.cern.ch/event/405743>
 - Assess performance with beam of scanner and diamond
 - 2016:
 - Beam tests SPS with final electronics/software
 - Final detector and electronics design
 - 2017->2018:
 - Production and test
 - LS2:
 - Installation and commissioning (final locations to be specified)

Upgrade SPS Fast (Ring) BCT

- Request:
 - Provide BxB intensity = $f(\text{cycle-time})$
 - Accuracy (p/b) = 5%
- Problems:
 - Position and bunch length dependence and limited analogue bandwidth (bunch cross-talk)
- Proposed solutions:
 - Detectors:
 - Install BCTI(CT) or BCTW (being tested on LHC)
 - To be installed in LSS5 (LSS3 taken by RF upgrade)
 - Electronics/software:
 - Commission Digital Integration (DI) system
 - Adapt existing software for new electronics
- Actions:
 - Decide on best suited detector and order suitable detector for SPS
 - PI/QP
 - Decide whether deconvolution is required and how
 - Plan for installation (LSS3/LSS5) during YETS (2016) or EYETS (2017)
 - PI/ML
 - LS2 (new internal beam dump)
 - Move complete girder (DCCT*2 + Fast) downstream of QD.519 (by LS2 at the latest)

SPS BSRT, matching and BLDM

BSRT:

- Request
 - Acquire beam size at SPS top energy as possible Beam Quality Monitor before extraction to LHC
- Solution
 - Update with optical line during LS1
 - Some performance tests done (G. Trad) – stability to be assessed
- Issues:
 - Only enough stable light at flat-top (>400 GeV)
 - Radiation levels preventing use of digital cameras
 - Limited number of profiles acquired (BTVI card)
- Longer term (2016)
 - Redesign electronics and software with new VFC electronics for profiles and HIE-module for motors
 - Parallel system based on slit and gated PM being investigated (BI/PM)
 - Operational integration

Matching:

- Request
 - Acquire turn-by-turn beam size for SPS injection matching
- Issues
 - Bad signal/noise with low intensity beams
- Longer-term
 - Low priority for LIU – standby

BLDM (satellite monitoring) – ‘nice to have’:

- Possible solution:
 - Use of PM on synchrotron light
- Request:
 - Intensity distribution
 - nsec resolution – 200MHz
 - $\sim 1E-4$ from ultimate LIU bunches ($\sim 5E7$ charges)

Diamond BLMs

- Requests:
 - Acquire fast (BxB) losses at SPS extraction
 - New requests:
 - SPS injection
 - SPS scraper
- Solution (2014/2015):
 - Install commercial LeCroy scopes for diamonds in LSS4/LSS6
 - Software interface (FESA) implemented
- Longer-term:
 - Investigate the use of VFC/DI as for Fast BCT for sampling and BxB histograms
- Issues:
 - Problems with Windows installation
- Actions:
 - Clarify specifications for operational use (detector location and acquisition data) OP-SPS
 - Purchase DI mezzanine for Fast BLM developments (PI) - done
 - Test system in lab
 - Prototype installation for SPS
 - Decide on electronics for PSB/PS later
 - Propose BI/TB later this year
 - Oliver Stein to present results with diamonds in LHC

Gated tune measurement (QP)

- Request:
 - Allow tune measurements on selected bunches/batches rather than default envelope
- Solution:
 - Install dedicated LHC-type electronics in BA2
 - Implement software interface BQSB
- Actions:
 - Make necessary changes to BI front-end software (BQSB)
 - OP-SPS operational application modification allowing gate selection
 - Hope to test during Q4/2015

Upgrade of SPS BLM system

- Request
 - Turn by turn acquisition of losses in SPS ring
 - Equip TT10 with BLMs + consolidate SPS->LHC (not LIU)
 - 'Sun-glasses' on scraper BLM (LSS1)
- Solution:
 - Base electronics on HL-LHC developments
 - Signal transmission over fibres to surface (as MOPOS)
- Issues:
 - No man-power resources to renovate complete system available until after LS2
- Actions:
 - OP/LIU to provide list of critical BLM locations
 - BI to investigate whether possible to equip subset during LS2
 - Investigate compatibility with new VME CPU (lab setup)

Conclusions

- Beam Size (BGI/BSRT/Matching/BLDM):
 - Complex instruments (radiation concerns)
 - Often requires expert presence (maintenance)
 - New electronics for SPS BSRT (2016)
 - LSS5 relocation for kickers and dump TBD
- Orbit system:
 - Radiation testing tunnel electronics critical
 - VFC-HD decisions pending
- Fast BCTs
 - Choice of detector (ICT/BCTW) to be made before end of 2015 (LHC/SPS)
 - Digital integration electronics being tested
- Diamond BLMs
 - Possible new locations (injection/scrapper)
 - New VFC electronics (possibly for PSB also)
- Ionisation BLMs
 - No full renovation before after LS2
 - Subset equipped before?