Follow-up on the Evian LHC operation workshop

Notes from the meeting held on

19 January 2011

1- Injection sequencer and IQC upgrade – Lene Drosdal, Delphine Jacquet, Verena Kain (slides)

Many improvements have been done:

- Injection sequencer double threading – request injection into the same ring independent of the analysis of the other ring;
- IQC result state: warning – introduced a new result state in the IQC to warn about a possibly bad injection, but not stop injection;
- Better IQC playback – will now include an option to better select the event to replay, also save result data;
- Additional check for circulating bunch configuration – sequencer will now check that the circulating bunch configuration matches the result from the BQMs before injecting and will better protect against overinjection;
- Additional check for injected beam if BCT=0 – in case of bad transfer line BCT, some corrections will be provided: If BCT = repeat, BQM = Successful (false zero)→ Result = unknown; If BCT = masked → result = unknown could be use in case any device misbehave) ;
- Transfer line data – BLM+ BPM data be available as well;
- (Injection oscillations interlock) – in progress, will be added.

Comments:

- Beam 1 – Beam 2 injection in interleaved mode: minimum time between injections: 21s
- Of course, continue to be able to only inject one beam continuously;
- Witness pilot will always stay- as long as there is no impact on the luminosity production – strategy still to be decided on.

2- New configuration of the LHC Nominal cycle – Stefano Redaelli – Mike Lamont – Joerg Wenninger (slides)

Stefano Redaelli presented the work done for the new 2011 configuration of the LHC nominal cycle.

Status:

- Ready to prepare settings for higher physics energy
  - Final decision after Chamonix. Start setting preparation right after!
  - Completely new settings for ramp and squeeze!
  - Require a campaign on setting validation + HWC tests on groups of circuits.
- We will have new beta* configurations in all IPs:
  - IP2 at injection optics for proton run.
  - IP1/5 and IP8 squeeze together (IP8 at an intermediate value).
  - Squeeze in IP2 will be commissioned separately at the end of the run.
- Try to reduce risks of errors
  - Minimize changes of references if possible (e.g. Xing at top energy);
  - Reduce un-necessary source of errors (e.g. squeeze stop points).
- New requirements combined to improvements of turnaround
  - Reduce time lost in various modes, when possible;
  - Gain time whenever possible within safety boundaries (function duration...).

The recapitulation of the 2010 configuration was given for the different steps of the cycle (inj, ramp, squeeze, collide).

2011 configuration:
Table of parameters was given – to be finalized after Chamonix11
Note:
- Long range b-b separation kept to 12 sigmas at all IP – tbc- Werner Herr
- Crossing angles at injection is +/-170 μm (and +/-120-140 μm in physics).

Ramp in 2011:
- Updated ramp functions: faster start (Mike)
  - Gain up to 5 minutes while respecting 10 A/s HWC constraint (TBC);
  - Needs validation with the first pilot ramps. Roll-back if problems.
- Keep the same optics and tune values as in 2010
- Reduce parallel separation according to √E
  - Benefits: optimize top-energy aperture (important with Xing, during squeeze); reduce time for collisions. Example: 2 mm → 0.72 mm for a 3.5 TeV ramp.
  - Linear variation as a function of time is ok for the moment.
  - Requires time-reference in the feedback for the IP knobs.
- How long a time we need for the decay compensation?
- Improved FiDeL model for snap-back?
  - Relevant if "preventive" trims used after pre-cycle! TBC!
- Re-use beta correction or start from scratch? To be decided.

Squeeze in 2011:
- Primary goals for 2011 commissioning:
  - 1 commissioning for protons, 1 for ions;
  - No stop points but run through functions!
- One set of functions until final value of beta* (unlike last year)
- Tune changes are kept at the beginning of the squeeze
  - Do not need to change optics if the final beta* is changed.
  - Safer against beam losses.
- Remove implementation of the hysteresis
  - Jump between "up" and "down" hysteresis branches identified as source of losses and tune and orbit perturbations.
- Time duration of the squeeze
  - Bug in Generation: can gain up to 30 %;
  - Studies ongoing for optimization of the matched points (X. Buffat);
  - Gain up to a factor 2 with respect to 2010 by removing stop points.
- Commissioning strategy proposal:
  (1) try a shorter beam process, with continuous beta measurements;
  (2) roll-back to previous settings with all matched points if needed.

To note: beta beating between 1.1 and 1.5m being addressed by ABP.

Setting generation requirements: Start right after Chamonix with:
- One "faster" ramp to E >= 3.5 TeV;
- One "slower" ramp with 2010 parameters (5 min longer);
- "Aggressive" squeeze in IP1/5/8, less matched points;
- Conservative squeeze with all available optics as in 2010.
- Beam processes for collisions should be straightforward.
- Start the usual tests: Setting verification; tests with power converters in simulations;

Then, power groups of circuits as HWC advances, without beam.

To note:
- Premature to start with more aggressive approaches: combined ramp, squeeze and collide.

- Wait at the end of ramp few minutes for the Q' change;
- Gain 5 mn in the ramp: to check with RF if it is fine;
- Damper in the squeeze to be tested;
- IP8: leveling by separation to be done. If beta* change needs to be done, should be ready to do it from the beginning, just in case. Could separate the squeeze in IP8 from IP1 and IP5 at some point in the squeeze;
- Ramp of the LHCb magnet – ramp of the LHCb magnet is needed below 150 ns. To be taken into account;
- In commissioning: stop-point in the squeeze. Not anymore in the operation. Collimator will be moved with functions through the squeeze.

3- Commissioning plans and 2011 schedule – Malika Meddahi (slides)

The main debate concerned the start-up strategy for beam re-commissioning: start with 75 ns or 150 ns? The 75 ns would have the advantages to set up all the LHC injectors and the LHC with the configuration used in physics and gain experience. It will however be more risky than using the well known 150 ns to re-commission the machine. To be decided at Chamonix. Draft LHC schedule presented (see slides).

4- Evian follow-up – Mike Lamont on behalf of Brennan Goddard and Alick Macpherson (slides)

Some points out of the list were discussed:

- AGK = decide on the length – Jan Uythoven
- Low and high intensity bunches in same fill requested? Done last year – Elias Metral showed that it was performed for 1 LHCINDIV and 1 LHCpilot.
- Dedicate injectors to LHC filling is possible and could be done – Mike Lamont.
- VdM and lumi leveling – budgets for MP – Simon White – in progress. Moving tertiary is implemented and tested. Should be done with experts otherwise will lead to beam dump – due to the limits on the collimator positions.
- Enforcing intensity of all bunch satellites < 5% of main bunch – Giulia Papotti. Threshold at 3% for the moment, could be left there.
- Dump handshake improvement: ATLAS has still to give the green light to the proposal: Give warming to experiments that beam will be dumped in 5 mn, while staying in stable beams; stable beams for 5 mn; if no problem published, then dump - Reyes Alemany
- RF trip interlocking to be decided – not yet ready – Ed Ciapala
- Transverse blow up – part is done in PS and part in SPS. ppm implementation, not yet done – Giulia Papotti
- Injection loss mitigation techniques – BLM sunglasses to be developed. Work in progress. To be reviewed by MPP (1s disconnection)
- Injection gap cleaning deployment for 2011 operation – commissioning required
- BLM shielding put in TI 2 –Wolfgang Bartmann.
- Tracking the beam quality from injector chain – OP
- More rigor to bring to understanding dumps at injection (MPP) -
- Procedure for testing of TCDQ integrity to be developed after any asynchronous dump (ABT)
- Aperture meter needed – OP and ABP
- Strategy for injection oscillations, needs limits – Verena Kain and ABT
- MPS envelopes – improve method of enforcing it. Need to agree on the envelopes – Alick Macpherson.

5- Hardware Commissioning – Mirko Pojer

Hardware commissioning will start on Thursday 27, with test in sector 56 during the late afternoon.
The electrical quality assurance (ElQA) tests have been started on Wednesday in this sector, after getting the good cryogenic conditions from the cryo-operation.

6- Organisational changes- Mike Lamont

The LHC commissioning working group is no more! An LHC operational working group will be launched, chaired by Joerg Wenninger, with Tatiana Pieloni acting as a scientific secretary. The working group will concentrate on all LHC operational aspects.
LHC Machine study working group will be launched – chaired by Ralph Assmann, responsible for the MD scheduling, follow-up and analyses.
Mike Lamont will take over the deputy chair of the LMC.
Joerg Wenninger is becoming LHC section leader in the OP group.
Jan Uythoven will take over the Chair of the LIBD (LHC Injection and Beam Dump) working group.
Proposal being discussed for the machine protection working groups: Ruediger Schmidt to take over the Chair of the Restricted MPP (Restricted Machine Protection Panel). Markus Zerlauth to take over the Chair of the MPP and Joerg Wenninger to act as deputy chair.

Malika Meddahi

LAST NAME	FIRST NAME	DEP/GROUP	Present
ALABAU PONS	Maria Carmen	BE-ABP-LCU	
ALEMANY FERNANDEZ	Reyes	BE-OP-LHC	X
AQUILINA	Nicholas	TE-MSC-MDA	
ARDUINI	Gianluigi	BE-ABP-LIS	X
ASSMANN	Ralph Wolfgang	BE-ABP-LCU	X
BAER	Tobias	BE-OP-SPS	
BAILEY	Roger	BE-OP-LHC	
BARTMANN	Wolfgang	TE-ABT-BTP	X
BAU	Jean-Claude	BE-CO-HT	
BAUDRENGHIEN	Philippe	BE-RF-FB	
BELLESIA	Boris		
BELLODI	Giulia	BE-ABP-HSL	
BHAT	Chandrashekhara	BE-ABP	
BOCCARDI	Andrea	BE-BI-PM	
BOTTURA	Luca	TE-MSC-SCD	
BRACCO	Chiara	TE-ABT-BTP	X
BRUCE	Roderik	BE-ABP-LCU	X
BRUNING	Oliver	BE-ABP	
BRUNNER	Olivier	BE-RF-KS	
BUFFAT	Xavier	BE-OP-LHC	
BURKHARDT	Helmut	BE-ABP-LCU	
BUTTERWORTH	Andy	BE-RF-CS	X
CALAGA	Rama	BE-ABP-LCU	X
CALVIANI	Marco	EN-STI-EET	
CARLI	Christian	BE-ABP-LIS	
CARLIER	Etienne	TE-ABT-EC	
CAUCHI	Marija	BE-ABP-LCU	
CHAPOCHNIKOVA	Elena	BE-RF-BR	X
CHARRUE	Pierre	BE-CO-IN	X
CIAPALA	Edmond	BE-RF	X
CROCKFORD	Guy	BE-OP-LHC	

LAST NAME	FIRST NAME	DEP/GROUP	Present
DEHNING	Bernd	BE-BI-BL	
DENIAU	Laurent	TE-MSC-MDA	X
DOMINGUEZ SANCHEZ	Octavio	BE-ABP	
DROSDAL	Lene	BE-OP-LHC	X
DUBOURG	Sylvia	BE-ASR-AS	
FARTOUKH	Stephane	BE-ABP-LCU	X
FERRO-LUZZI	Massimiliano	PH-LBD	X
FORAZ	Katy	EN-MEF-LPC	
FUCHSBERGER	Kajetan	BE-OP-SPS	
GAROBY	Roland	BE	
GIACHINO	Rossano	BE-OP-LHC	X
GIANFELICE	Eliana	TE-ABT	
GIOVANNOZZI	Massimo	BE-ABP-LCU	X
GODDARD	Brennan	TE-ABT-BTP	X
GRAS	Jean-Jacques	BE-BI	X
GRUWE	Magali	BE-ASR-SU	
HAGEN	Per	TE-MSC-MDA	X
HATZIANGELI	Eugenia	BE-CO	
HERR	Werner	BE-ABP-CC3	
HESSLER	Christoph	TE-ABT-BTP	
HOFLE	Wolfgang	BE-RF-FB	X
HOLZER	Bernhard	BE-ABP-LCU	X
HOLZER	Eva Barbara	BE-BI-BL	X
IKEDA	Hitomi		
JACQUET	Delphine	BE-OP-LHC	
JEANNERET	Bernard	BE-ABP-CC3	
JENSEN	Lars	BE-BI-SW	X
JONES	Rhodri	BE-BI	X
JOWETT	John	BE-ABP-LCU	X
KAIN	Verena	BE-OP-LHC	Excused
KOZANECKI	Witold	PH-UAT	

LAST NAME	FIRST NAME	DEP/GROUP	Present
KOZSAR	Ioan	BE-CO-HT	
KRUK	Grzegorz	BE-CO-AP	
KURFUERST	Christoph	BE-BI-BL	
LAFACE	Emanuele	BE-ABP-LCU	
LAMONT	Mike	BE-OP	
LEVINSEN	Yngve Inntjore	BE-ABP-LCU	X
MACLEAN	Ewen	BE-ABP	
MACPHERSON	Alick	BE-OP-LHC	X
MANGLUNKI	Django	BE-OP-SPS	X
MARSILI	Aurelien	BE-BI-BL	
MEDDAHI	Malika	TE-ABT-BTP	
MERTENS	Tom	BE-ABP-LCU	
METRAL	Elias	BE-ABP-ICE	X
MONTABONNET	Valerie	TE-EPC-OMS	
MUELLER	Gabriel Johannes	BE-OP-LHC	
NEBOT DEL BUSTO	Eduardo	BE-BI-BL	
NORDT	Annika	BE-BI-BL	Excused
NORMANN	Lasse	BE-OP-LHC	X
PAPOTTI	Giulia	BE-OP-LHC	X
PIELONI	Tatiana	BE-ABP-ICE	X
POJER	Mirko	BE-OP-LHC	X
PONCE	Laurette	BE-OP-LHC	X
PUCCIO	Bruno	TE-MPE-MI	X
REDAELLI	Stefano	BE-OP-LHC	X
ROESLER	Stefan	DGS-RP-AS	
RONCAROLO	Federico	BE-BI-PM	X
ROSSI	Adriana	BE-ABP-LCU	X
ROY	Ghislain	BE-ASR-SU	
SAPINSKI	Mariusz Gracjan	BE-BI-BL	
SCHMIDT	Frank	BE-ABP-ICE	x
SCHMIDT	Rudiger	TE-MPE-PE	

LAST NAME	FIRST NAME	DEP/GROUP	Present
SIEMKO	Andrzej	TE-MPE	X
SIGERUD	Katarina	BE-CO-AP	X
SIVATSKIY	Gennady	BE-CO-FE	
SLIWINSKI	Wojtek	BE-CO-IN	
SOLFAROLI CAMILLOCCI	Matteo	BE-OP-LHC	
STEINHAGEN	Ralph	BE-BI-QP	X
STRZELCZYK	Marek	BE-ABP-LCU	X
TERRA PINHEIRO FERNANDES	Mario	BE-OP-LHC	
THIESEN	Hugues	TE-EPC-MPC	
TODD	Benjamin	TE-MPE-MI	
TODESCO	Ezio	TE-MSC-MDA	X
TOMAS GARCIA	Rogelio	BE-ABP-CC3	
UYTHOVEN	Jan	TE-ABT-BTP	X
VALENTINO	Gianluca	BE-ABP-LCU	
VALUCH	Daniel	BE-RF-FB	
VANBAVINCKHOVE	Glenn	BE-ABP-LCU	X
VENTURINI DELSOLARO	Walter	BE-OP-LHC	X
VINCKE	Heinz	DGS-RP-AS	
VINCKE	Helmut	DGS-RP-AS	
WENNINGER	Jorg	BE-OP-SPS	X
WHITE	Simon	BE-ABP	X
WIENANDS	Uli	BE-OP	
WOLLMANN	Daniel	BE-ABP-LCU	X
ZANETTI	Marco	PH-UCM	
ZIMMERMANN	Frank	BE-ABP-LCU	X
SOBY	Lars	BE-BI	X
MIYAMOTO	Ryoichi	BE-ABP	X
CALVO	Eva	BE-BI	X