Minutes of ObsBox Planning Meeting

30th March 2016 864-R-B02

Participants: X. Buffat, A. Butterworth, L. Carver, W. Hofle, G. Iadarola, G. Kotzian, K. Li, E. Metral, D. Valuch,

Prior to the meeting, a slide was prepared and sent to D. Valuch which highlighted some of the outstanding questions (from ABP side) relating to the ObsBox in 2016. The questions were as follows:

- What are the file sizes for injection oscillation data? (Note: Needs to be less than 2 SPS cycles ~42 seconds).
- Is there anything in place for data compression of the buffer to reduce transfer speed over the network?
- Can we keep the buffer that was programmed directly onto the ADT crate for use during the scrubbing run while we adjust and test usage of the ObsBox.
- Clarification on plans for the instability trigger.
- What will the buffer sizes be, and how would we use the ObsBox to study unexpected effects throughout the year.
- Can we request data from a given list of buckets?

In response to these questions, D. Valuch prepared some slides to provide some answers.

He begins by giving an overview of the system architecture. Highlighting how the ObsBox fits in with the existing ADT setup. The ObsBox will make available the data (bunch by bunch, turn by turn) from the beam position modules Q7-Q10. When completed, the instability trigger will be made available through the LIST trigger network, which could also be used to trigger data acquisition from the ObsBox buffers. The LIST trigger network allows different devices (for example the ObsBox or the Headtail monitor) to easily be triggered from different sources.

The ObsBox buffer that was used in 2015 (FESA class "ObsBox") is now obsolete and should no longer be used.

There is now a 6 minute rolling buffer for the ObsBox and a series of new FESA classes have been made available. Each FESA class has an internal timing event, and when the FESA class is triggered (e.g. from an injection) it will copy the relevant data from the buffer and make the data available to be retrieved. This will remain until the next timing event occurs, which will cause the new data to overwrite the old data. Subscribing to the FESA classes will automatically retrieve the data when the relevant timing event occurs.

The device names for these FESA classes can be found by searching on ccdb.cern.ch. All of the new ObsBox device names begin with ObsBoxB. The new
ObsBox buffers are a set of dedicated devices with dedicated and well specified triggers. At the moment, there are several buffers in place:

- Injection Oscillation (i.e. “ObsBoxB.LHC.ADT.B1H.Q7.InjOsc” 4k turns)
- Post Mortem (i.e. “ObsBoxB.LHC.ADT.B1H.Q7.PosMor” 65k turns)

In the future, there will also be:

- Online Observation Display (4k turns)
- Instability Observation (tbd but ~200k turns)

A. Butterworth states that new buffers can easily be created within the existing functionality and that there is no limit on the number of new buffers that can be created. If one wishes to create a new buffer in order to routinely acquire data during a certain phase of the machine cycle, they should send a request to ‘obsbox-users@cern.ch’. D. Valuch adds that these buffers are configurable with regards to latency (between timing event and freezing of the buffer).

G. Iadarola asks if it is possible to affect the performance of the ADT if the ObsBox interface is used incorrectly. D. Valuch replies that the ObsBox is completely decoupled from the ADT and can have no effect on its performance.

Currently, the 4k turn data buffer (for all bunches) takes approximately 1 second to be retrieved over the network. M. Sandonis is currently working on the implementation of only retrieving the data for a specified range of buckets. This should be in place soon.

W. Hofle says that in order to retrieve only single bunches but with a high number of turns, the ObsBox would first have to save every bucket for a high number of turns before data filtering can be applied. In the present configuration, this puts a limit of approximately several hundred thousand turns, any more would require a new configuration.

The instability trigger will be implemented within the ADT signal processing FPGA. This allows all of the data to be available at the full rate, without the need to stream out data to another location. When the trigger is activated, it has already detected which bunches are becoming unstable, which can already help a lot in deciding which bunches to output.

**ABP should provide some information regarding the kind of instabilities that are considered interesting and how the trigger should perform. This will greatly help the development of the instability trigger.**

The injection transient data provides lots of useful information regarding the performance of the damper and the machine itself. G. Kotzian has developed a method of rapidly evaluating the performance of the ADT. This will allow the three commonly asked questions to be answered:
• Is the damper working?
• What was the damping time on May 12th at 07:31?
• What is the tune/chroma when a pilot is injected after a pre cycle?

The injection oscillation data will automatically be analysed and the results (e.g. damping times per bunch) will be made available on Timber. For more information on the methodology used within the analysis, see G. Kotzian “SPS and LHC transverse Feedback Parameter Extraction: An Alternative Approach” LBOC Presentation, Dec 8th 2015.

W. Hofle asks about the ability to store and further analyse (e.g. calculate tunes using SUSSIX) the raw data used to analyse the ADT performance. A. Butterworth says that we can check with colleagues responsible for data logging to store the raw data.

The implementation of the ADT diagnostic was made with a FESA class that will be running with the ObsBox. This FESA class is already available and being tested with LHC beams. This will also be used as a fixed display for the LHC operators. This work has a lot of potential and there is room for expansion.

There has been significant progress with the ObsBox throughout the YETS, and everyone now needs to work together to get the best out of the system. **If there is a need for new data or if you are embarking on a new study, please discuss with the ADT team in order to determine how to obtain the data in the most optimal way.**

To summarise the answer to the original questions that were presented:

• What are the file sizes for injection oscillation data? (Note: Needs to be less than 2 SPS cycles ~42 seconds). **The files for the injection oscillation (4k turns) data take approximately 1 second to send over the network.**
• Is there anything in place for data compression of the buffer to reduce transfer speed over the network? **This is being worked on by M. Sandonis, and should be in place soon. It is not currently available.**
• Can we keep the buffer that was programmed directly onto the ADT crate for use during the scrubbing run while we adjust and test usage of the ObsBox? **The original buffer used in the scrubbing run should still be in place, however D. Valuch has noted that its performance has degraded since it was last used. This should be checked and tested before the scrubbing run in 2016.**
• Clarification on plans for the instability trigger. **Plans for the instability trigger were very well clarified above.**
• What will the buffer sizes be, and how would we use the ObsBox to study unexpected effects throughout the year? **The buffer sizes are fixed for their given purpose, but new buffers can easily be created for a custom set of parameters. If new buffers are required, they should speak to A. Butterworth.**
• Can we request data from a given list of buckets? **M. Sandonis is currently working on it, and it should be implemented soon.**
Miscellaneous:

The Multiband Instability Monitor (MIM) version 3 is currently being assembled. T. Levens wants to install it in the first technical stop of 2016. This should hopefully be implemented and added to the LIST trigger network by the end of the year.

G. Iadarola recalls that in 2015 the probe was not detected by the ADT. D. Valuch replies that in 2016, it is planned that probes will also be detected by quickly switching the ADT settings (but both can not be detected at the same time).

L. Carver recalls that in 2015 there were some instabilities whose characteristics were consistent with a trip of the ADT and asks if there will be a method of determining if ADT trips have occurred? D. Valuch states that the interlock has been changed and that the ADT is either on and working or completely off. There will be no more intermediate trips / retrips.

There was a discussion regarding the performance of the instability trigger, and how multiple triggers in quick succession could lead to some data not being saved in time and being overwritten. This led to a discussion on whether some buffers, once triggered, can remain frozen until the data is saved and the buffer is manually rearmed. It was suggested that there are times (for example if there was an instability that caused a beam dump) when it might be easier to wait for the buffer to be manually rearmed.

W. Hofle says that there is a clear need for some organizational structure, suggesting either an ObsBox mailing list or for each group to have one contact person who the information regarding changes and plans flow through. For ABP this person will be L. Carver. Since the meeting, a mailing list has also been created by D. Valuch for quick dissemination of information. To join this mailing list, speak to D. Valuch.

E. Metral raised the problem of data storage for the data saved from the instability trigger. If we do not know the source of the instability, it would be beneficial to save all bunches, both beams for 60s worth of data (~660k turns) for the first (real) instability. This is to allow a full analysis of the beam behavior to try and understand what is causing it, however this is a very large quantity of data. After the meeting, V. Baggioolini was contacted regarding a solution to data storage, and a meeting has been scheduled for 06/04/16 to further discuss the issue.

Reported by L. Carver.