

Beam Commissioning Working Group

Minutes for 23 August 2019

Present: **V. Kain, G. Rumolo, A. Huschauer, S. Albright, F. Antoniou, H. Bartosik, D. Cotte, H. Damerau, G. P. di Giovanni, M. Gourber-Pace, A. Lasheen, K. Li B. Mikulec, R. Steerenberg, F. Velotti**

Meeting objectives

Overview of the SPS beam readiness dates post-LS2 and the outcome of the beam performance tracking meetings.

Approval of Minutes and Matters Arising - V. Kain

The minutes of the 9th of August are approved without comment.

- There will be an LS2 day on the 9th of October, the IST planning will be presented in collaboration with EN-ACE including resource loaded planning. Hardware commissioning planning for 2020 should be included as well, with the dates for the dry runs.
- After completing the beam readiness dates in this meeting a prototype schedule will be compiled.

Beam Readiness Dates - SPS - K. Li

Presentation

- The initial schedule was presented at the LIU workshop, relationship to the PS schedule and experiments to be defined.
- The schedule is tight when considering the amount of new/refurbished equipment and the need for recovering vacuum in most of the machine.
- The beam start date is the 18th January, followed by 6 weeks of beam commissioning and 1 month of conditioning.
- Fixed target, HiRadMat and AWAKE start dates are specified, fixed target ions are still undefined.

Discussion

- V. Kain asks how long the slots for ion beam commissioning will be, K. Li says the plan is to have extended times of about 1 week, where ions will be the primary focus. V. Kain suggests specifying those weeks on the schedule.
- R. Steerenberg asks if the end of the conditioning run is when the bunch trains will be available for the LHC. K. Li says that is the intention, but it could be a little flexible.
- V. Kain suggests specifying when 12 bunch beams will be available, K. Li says it should be around week 8 or 9.

- V. Kain says HiRadMat is expected to take beam in 2021, and asks how many days of beam they can be expected to have. K. Li says it is not yet known, but will be checked, and that AWAKE will run in a similar way to 2018.
- R. Steerenberg says it will be important to keep track of physics beam requirements to avoid too many parallel activities when there is a lot of commissioning still required.
- V. Kain asks for the weeks used for the AWAKE and HiRadMat to be specified as soon as possible, R. Steerenberg suggests they should be fixed and care should be taken in case there is a request to move them.

Beam Performance Tracking Outcome - V. Kain & A. Huschauer

Presentation

- Following on from a series of presentations giving the desirable parameters for beam performance tracking across the complex, a summary of the requirements has been compiled to give necessary input for CO by defining the system requirements.
- The proposal given here is not intended as a reference measurement system, but purely for performance tracking.
- All beams in LHC injectors are covered, beams destined for the AD and ISOLDE are included, but not beams in the AD or ISOLDE.
- The tracking is split into machine specific data tracking, and performance tracking per beam type.
- As well as tracking specific performance metrics for each beam type there could also be event based analysis, giving online analysis of machine specific data as in the SPS.
- The event based analysis gives the benefit of grouping data in a practical manner, and links analyses to avoid repeating them. Events need to be identified by some unique metric.
- The existing SPS event based analysis system is split into online and playback modes. Where the playback version allows events in a given time period to be reviewed.
- A couple of examples are given ([example 1](#), [example 2](#)) of how the web interface may work using interactive python based plotting.
- A possible approach to tracking beams through the complex using a tree structure is proposed. Each cycle would identify the upstream and downstream cycles connected to it.
- A full set of requirements should be defined for CO as soon as possible, to enable the time scale and developers to be defined.

Discussion

- R. Steerenberg asked what "Events" are in the context of event based analysis, V. Kain says it is specifically cycles. B. Mikulec asks if it is cycles or beams, because in e.g. the PS uses multiple beams to fill an SPS cycle, V. Kain says it is cycles. R. Steerenberg asks how the 4 PS cycles for single LHC beam would be handled, V. Kain says it would still be cycle by cycle.

- B. Mikulec suggests that as well as cycle by cycle there should be something based on the beam. A. Huschauer suggests this is a parallel to the performance tracking, and you would look at an "event" to identify which cycle went wrong, and then use the performance tracking to see which beam lead to this. R. Steerenberg says this sounds equivalent to things that are already done, V. Kain says it is similar to what is possible with NXCALC but more detailed and easier for operation, as you can identify an event then immediately get all the associated information.
- H. Damerau asks if the event based analysis shown is cycle by cycle, V. Kain says yes but the event can be anything such as an LHC beam dump. For the SPS it is the cycle, because that is what they are interested in. H. Damerau asks if it would be possible to have multiple events for a single cycle, such as injection as one event and something else as a different event. V. Kain says yes in principle but in this case the entire cycle is probably the most useful way of doing it.
- R. Steerenberg says some of the analysis approach shown is integrated in the logging system and asks if the event based analysis may avoid some lag in the data. V. Kain says yes, but the real benefit of this system is that you can chain analyses, which allows you to avoid repeating the analysis in several places. H. Damerau asks why the LSA framework isn't used, which would allow results to be saved into LSA virtual parameters, V. Kain agrees that it could be done, but LSA doesn't subscribe to parameters, however the post-mortem system used in the SPS is also sub-optimal and is being rediscussed. M. Gourber-Pace says that it should be discussed with CO in case a more suitable approach can be defined.
- G. P. di Giovanni asks how punctual measurements such as wire scans are included. V. Kain says the idea would be to include the data if there is some associated with that event, and not if there isn't as is done with the FT spill data.
- H. Bartosik asks how performance tracking would be done for non-operational beams as for some it would be useful but not for all. V. Kain agrees and says it should be discussed.
- M. Gourber-Pace says that if the web application is intended to be interactive it will need some discussion to define the functionality and implementation.
- F. Velotti says that using the python interface would be useful, as it would enable reuse of existing scripts. V. Kain agrees, and says that it would also make it possible for more people to modify the system.
- R. Steerenberg says the data tree proposal had already been discussed in the past, and there was a lot of work as part of this to measure e.g. injection efficiency from PSB to PS, but it was very difficult to maintain. If there were a low level system based on the telegram that uniquely identified each cycle it would be a lot easier.
- M. Gourber-Pace requests that a meeting is arranged with CO as soon as possible to allow discussion of the precise requirements of any new tools.
- R. Steerenberg says that for some aspects of the logging there had been something similar to event based analysis for the fixed target system, something similar should be possible with NXCALC. A. Huschauer says that the NXCALC system is not intended to be able to replicate that performance because the intention is that analysis user side will be much easier.

- R. Steerenberg says that whilst the event based analysis is currently cycle based, it may be beneficial to look at a higher granularity system breaking it down to e.g. injection and extraction events. V. Kain says it needs to be discussed further, but the big advantage is having all the information available and not requiring repeated analysis and acquisition of data. R. Steerenberg suggests the definition of "event" becomes important because if it is left to cycle there is less work required CO side, but multiple events per cycle may make it more powerful.
- H. Damerau suggests finding out what sort of universal interfaces there are for generating the graphics for a web application, that might make it usable with multiple codes. K. Li says the benefit of the web interfaces shown is that they are based on HTML, which can be expected to last for a long time. H. Damerau asks how some arbitrary piece of code can be interfaced with these websites, K. Li says the only requirement is that it can be exported to JavaScript.
- V. Kain asks if the event based analysis is suitable for the other machines. B. Mikulec suggests the first priority should be good performance tracking between the machines. The event based analysis looks valuable, but is perhaps a more long term and difficult to define objective and will also be harder to develop.
- V. Kain says that for the next meeting a collection of metrics for each beam will be collected and shown.

AOB

Synergies for the Wirescanner Application - V. Kain

Presentation —

- PSB will keep its own system to work with the new wirescanner. A common GUI will be developed for the SPS and PS.
- Several (bunch-by-bunch) scans per cycle, combining data from several cycles, will be possible in the new application.

Synergies for the BLM Application - B. Mikulec

Presentation —

- Two applications required, one for the LHC type BLMs another for the older BLMs.
- The injectors have different requirements to the LHC, and the transfer lines should be treated individually.
- The proposal is to maintain the situation as is for now, but to involve the settings management working group to discuss the possibility of a generic application in the longer term.

Discussion —

- D. Cotte says there is on going discussion on a common basis, enabling different GUIs for each machine.

- V. Kain suggests it should also be discussed whether so many different GUIs are necessary. B. Mikulec says that to enable visualising where the losses are in the machine the graphical part probably needs to be different. V. Kain says since that is a universal requirement it is probably possible to have a common basis for them.