

LHC Injection scheme

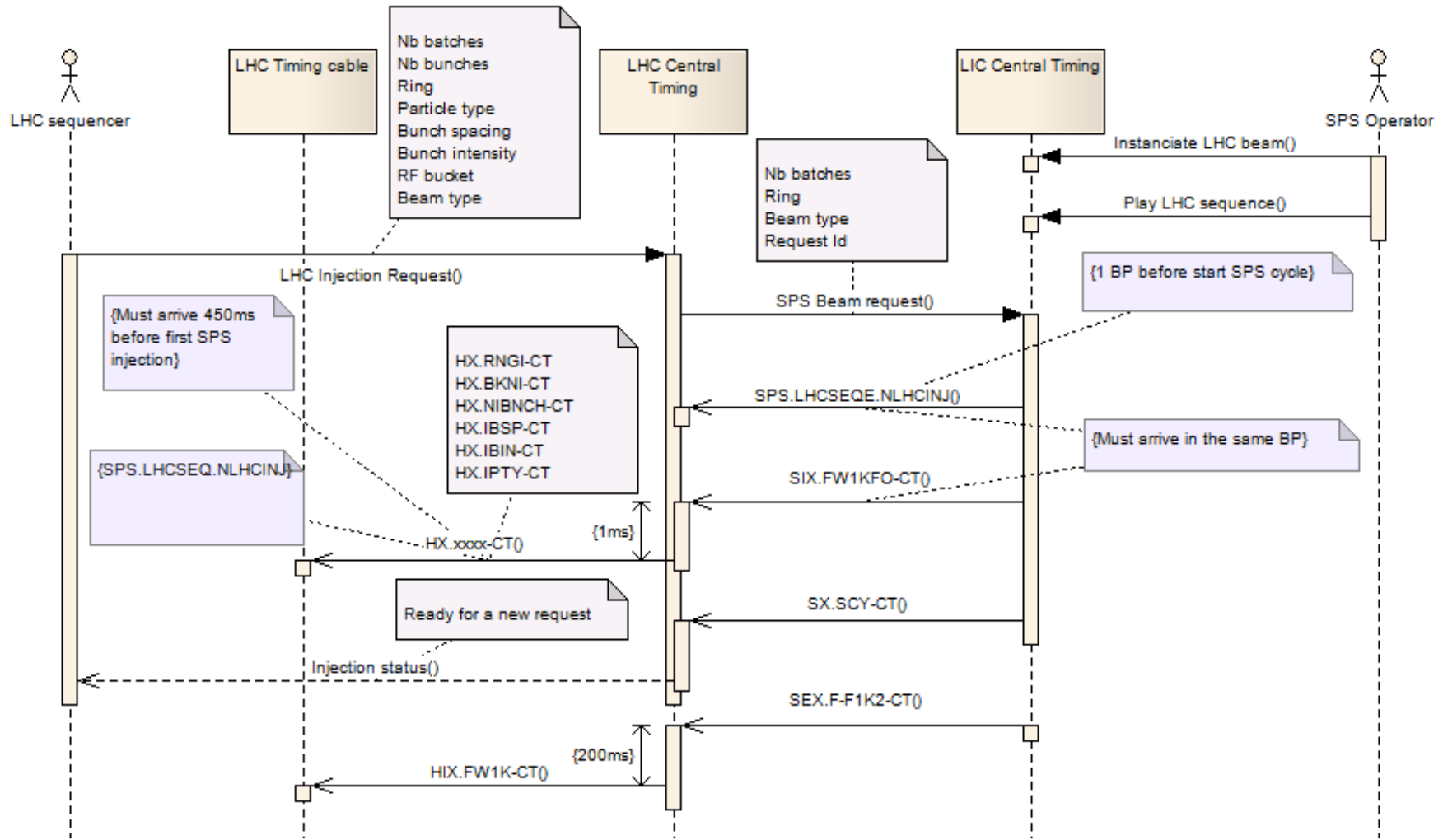
What happened on
Friday 30 November 2012 ?

outline

- LHC injection scheme
- Issue detected on Friday 30 November 2012
- Timing improvements
- Monitoring
- Conclusion

LHC injection scheme

sd LHC Injection

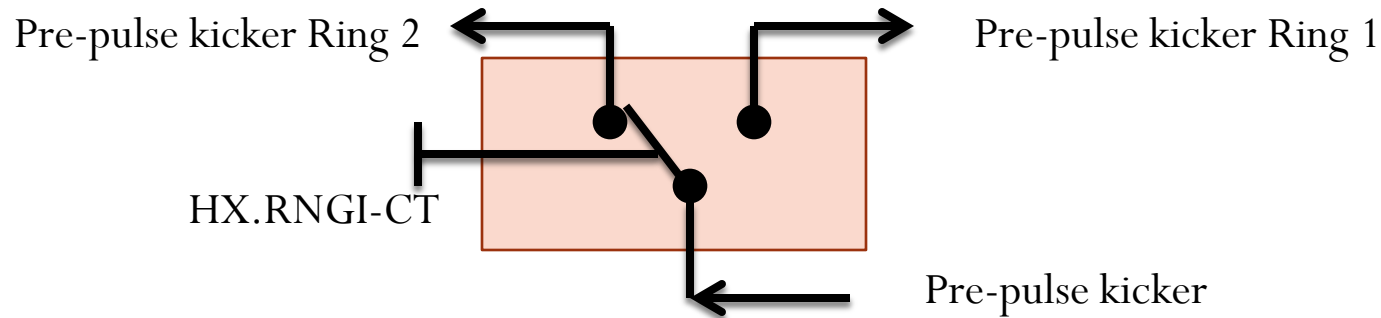


Issue detected on Friday 30 November 2012 (1)

- Issue description:
 - The LHC sequencer requested a beam to Ring1.
 - The SPS produced correctly the beam with a destination set to TI2 and the beam was well extracted.
 - Unexpectedly, the kicker for the LHC injection on ring 2 fired instead of the ring 1 kickers

Issue detected on Friday 30 November 2012 (1)

- Cause :
 - The selection of the injected ring is managed by a pre-pulse switch
 - The switch is controlled by the event HX.RNGI-CT witch contains in its payload the LHC destination

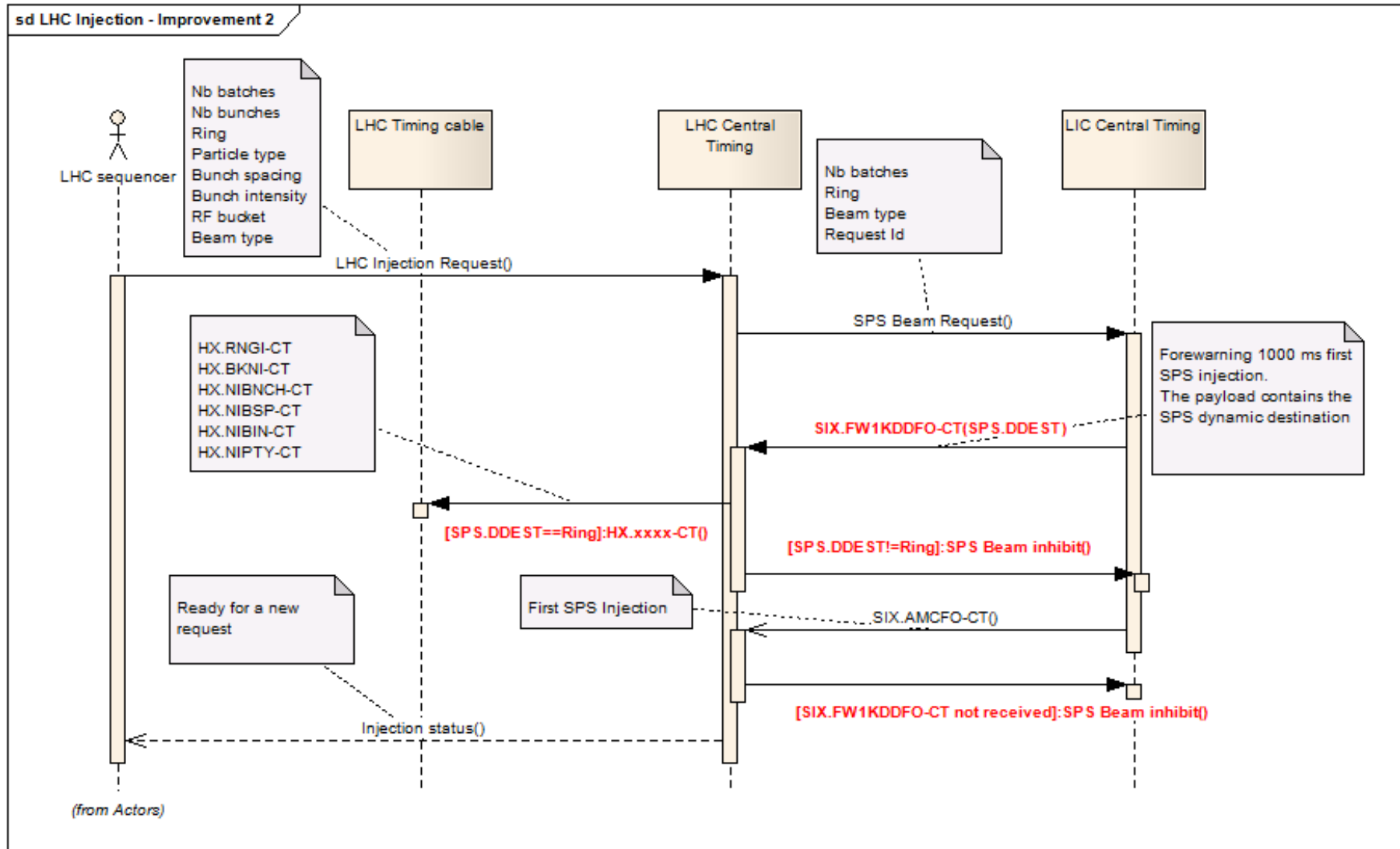


- **The event HX.RNGI-CT was not sent because the following constraint has not been respected:**
 - SPS.LHCSEQE.NLHCINJ and SIX.FW1KFO-CT must arrive in the same basic period.
- The switch remained in the position it was when the last HX.RNGI-CT arrived

Improvements (1)

- Constrain the LIC central timing not to let the first SPS injection to occur later than 990ms.
 - This constraint will be applied on all SPS beams
 - Does not solve the problem if we have to inject later in the SPS
- Modify the LHC injection scheme
 - Main goal:
 - Allow to inject in the SPS later
 - Secure the injection sequence

Improvements (2)



Improvements(3)

- Modify the LHC injection scheme (2)
 - More flexible. The forewarning can cross the cycle (Previous/Current)
 - Delay a little bit the returned status of the LHC injection request: **May delay the next LHC injection request.**
 - Implementation could be done during LS1

Monitoring

- Improvements on the timing part are not enough. We may have to deal with :
 - Unexpected failure in the central timing (LIC or LHC)
 - Timing distribution failures :
 - Timing repeaters down (hardware failure or power cut)
 - Timing cable cut
 - Event lost (noise)
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Monitoring (2)

- Monitoring with SIS
 - It could simply verify that the injection sequence is respected. If something is going wrong, the SPS beam should be dumped.
 - It does not guarantee that the timing distribution works well
- Monitoring the timing distribution close to the equipments
 - Case-by-case action
 - Similar things are already done to dump the SPS beam when :
 - A bad timing reception is detected (ms frame missing)
 - The LIC central timing software crashes (a watchdog frame is sent automatically by the hardware)

Conclusion

- The issue is well understood
- Improvements can be done in the timing system
- A monitoring can be done with SIS
- Equipment specialists must not rely on the timing distribution. They have to protect their equipments.