iBump Feedback Tuning

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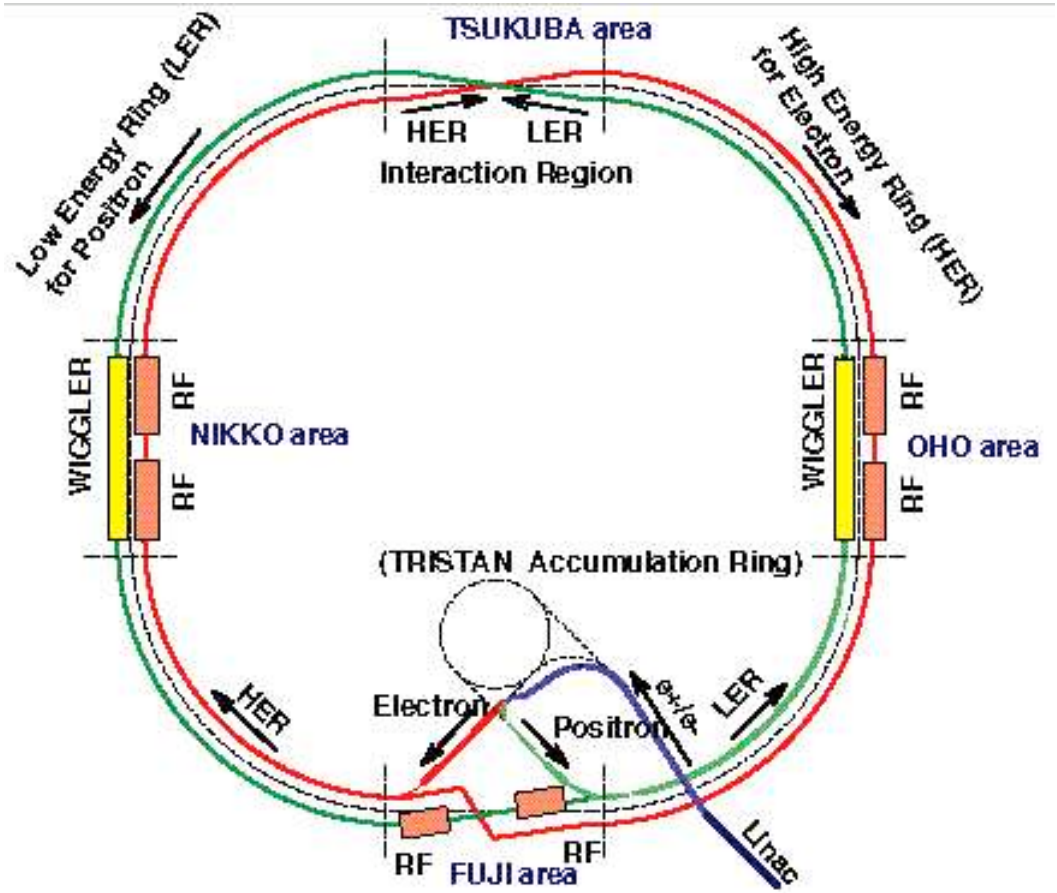
1. Introduction



This system makes a bump in the HER orbit just near the colliding point.

2. iBump Target Tuning

- **In the begging of the KEKB commissioning, we tuned the iBump by setting a target.**
- **At the time, we used this monitor to set the target searching for the high specific luminosity point.**
- **We found a problem with this tuning. The target of the horizontal beam-beam kick changes with beam current.**

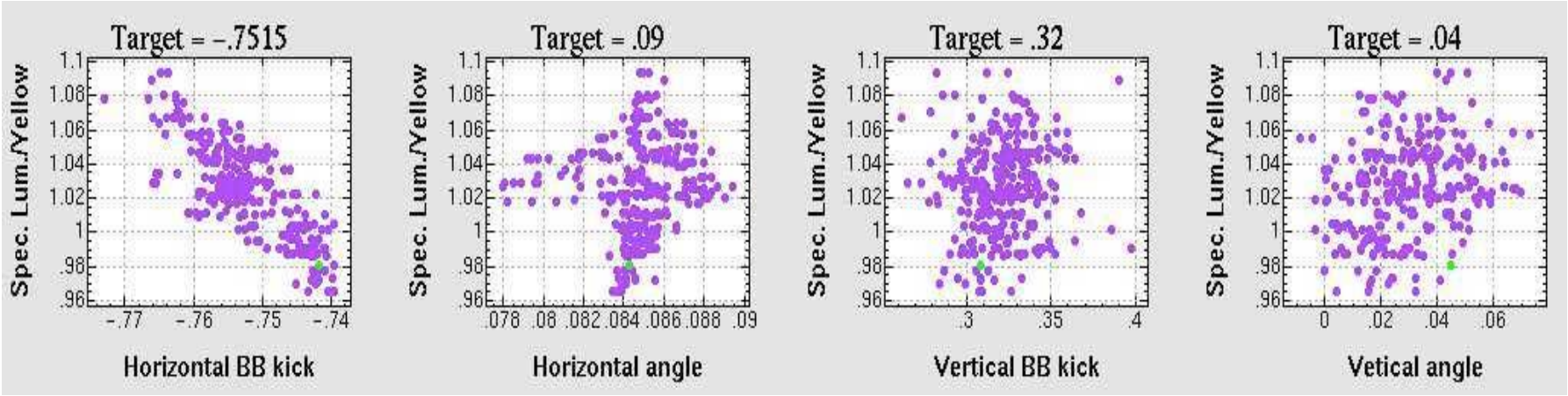


Figure 1: iBump monitor.

3. Programmable H-Target Changer

- **We can set the horizontal target value as a function of the LER beam current.**
- **The pattern of horizontal target had to be changed for almost every fill.**

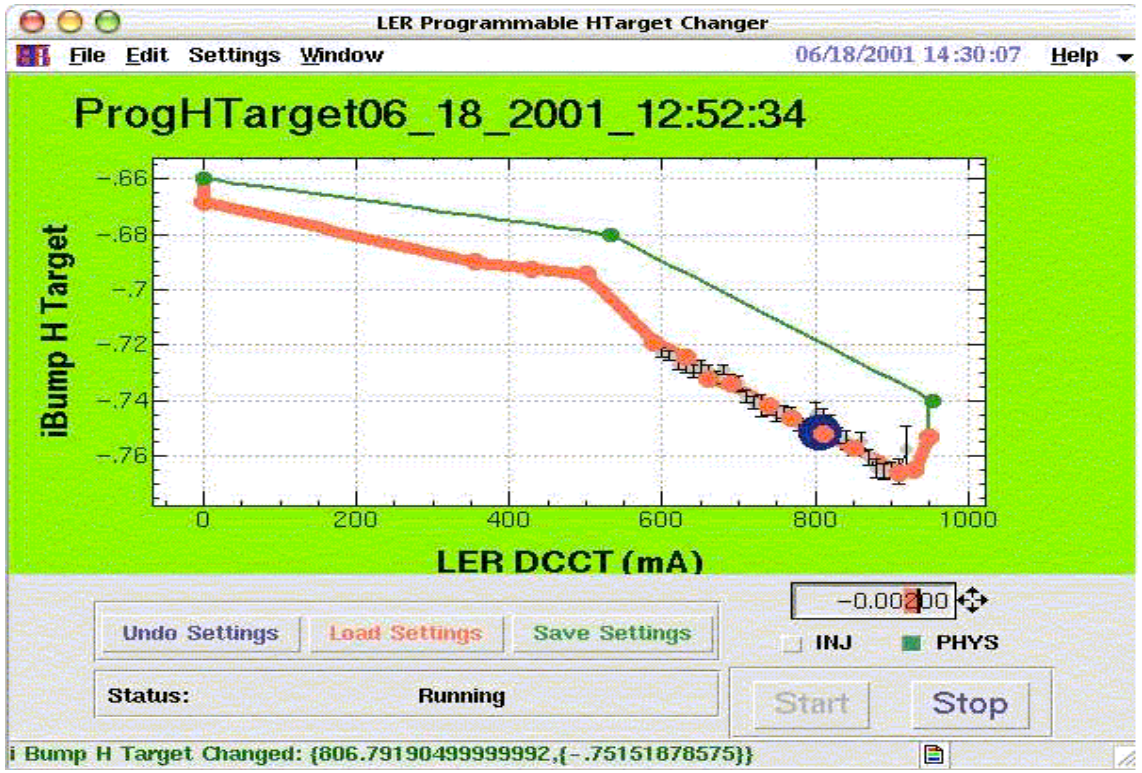


Figure 2: Programmable H-Target Changer

4. Effects of the H-offset tuning on luminosity and beam size

- The change of H-offset induced a change in luminosity, and a simultaneous LER beam size change.

- Increase the H-offset

  LER beam size decreases along with the luminosity.

  →HAZURE.

- Decrease the H-offset

  LER beam size, and luminosity will increase.

- Decrease the H-offset further

  LER beam size will continue increasing, but the luminosity will quickly decrease.

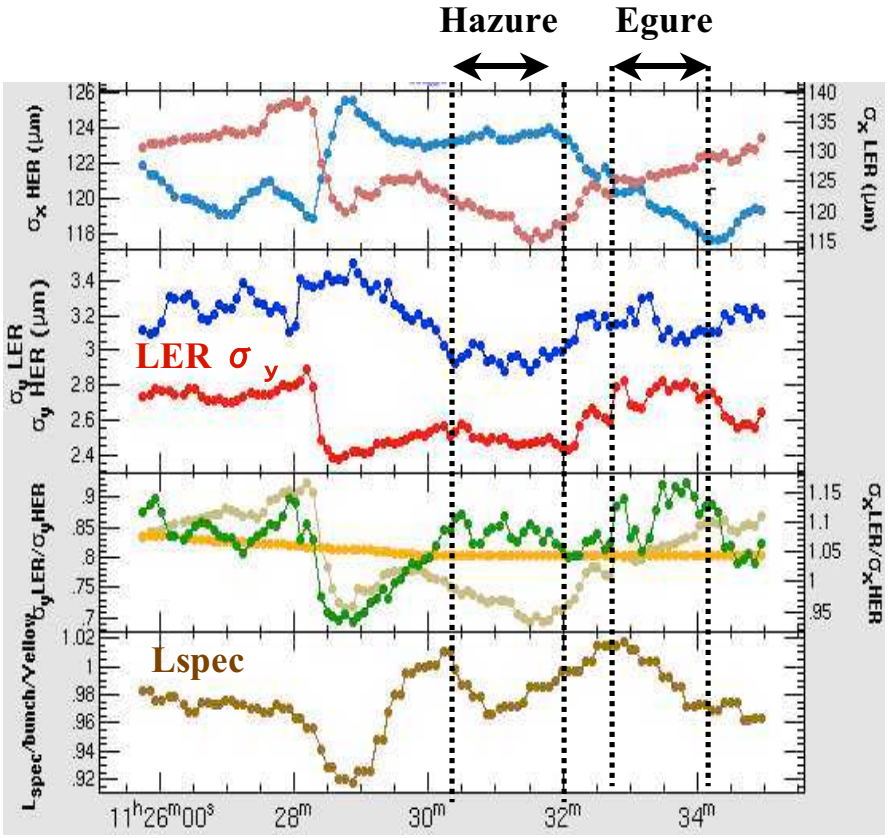


Figure 3: feedback monitor.[3]

5-1. H-Offset Direct Tuning

First, we checked the luminosity and the beam size.

- **Luminosity : low**

  LER beam size : small

  → HAZURE

- **Shift the H-offset value in the minus direction .**

  → LER beam size will increase and the luminosity will also increase.

- **Continue this procedure.**

  →Luminosity : quickly drop

  LER beam size : continue increase. →EGURE state

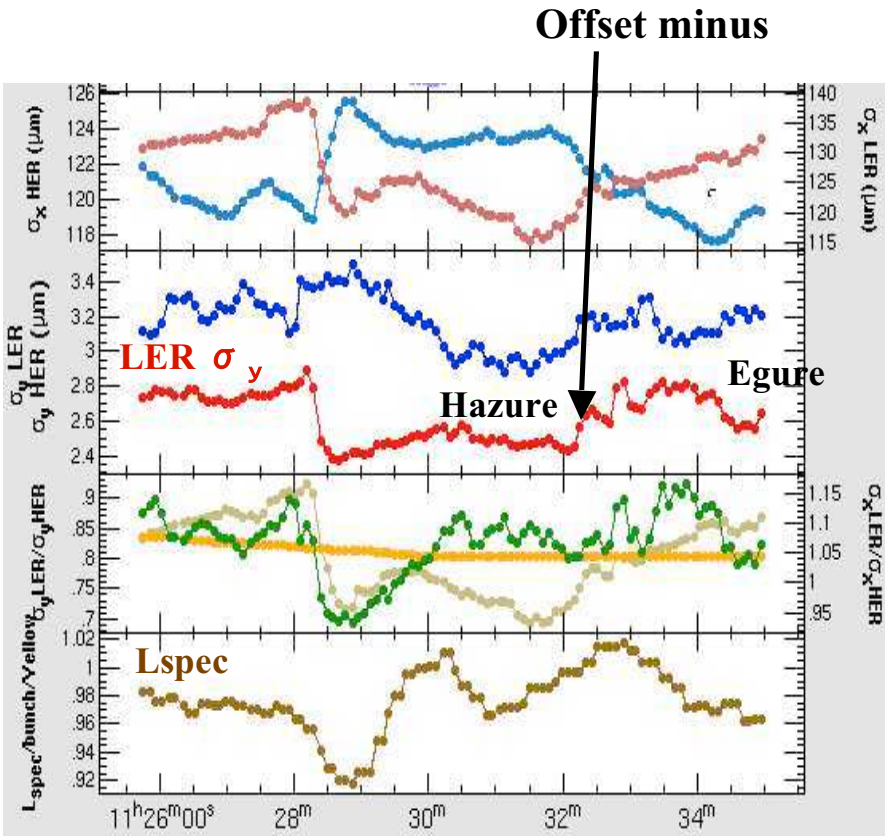


Figure 4-1: iSize Feegback Monitor.

5-2. H-Offset Direct Tuning

- **Encounter the EGURE state, even if we increase the H-offset in the HAZURE direction, we can not recover the luminosity and beam size.**
- **Set a large value, about ten times the usual value, in the plus direction to decrease the LER beam size.**

  →EGURE-HAZUSHI.
- **The best tuning point of the H-offset should be just before the EGURE position.**
- **Since the tuning guideline was not clear, the tuning point varied for different operators.**

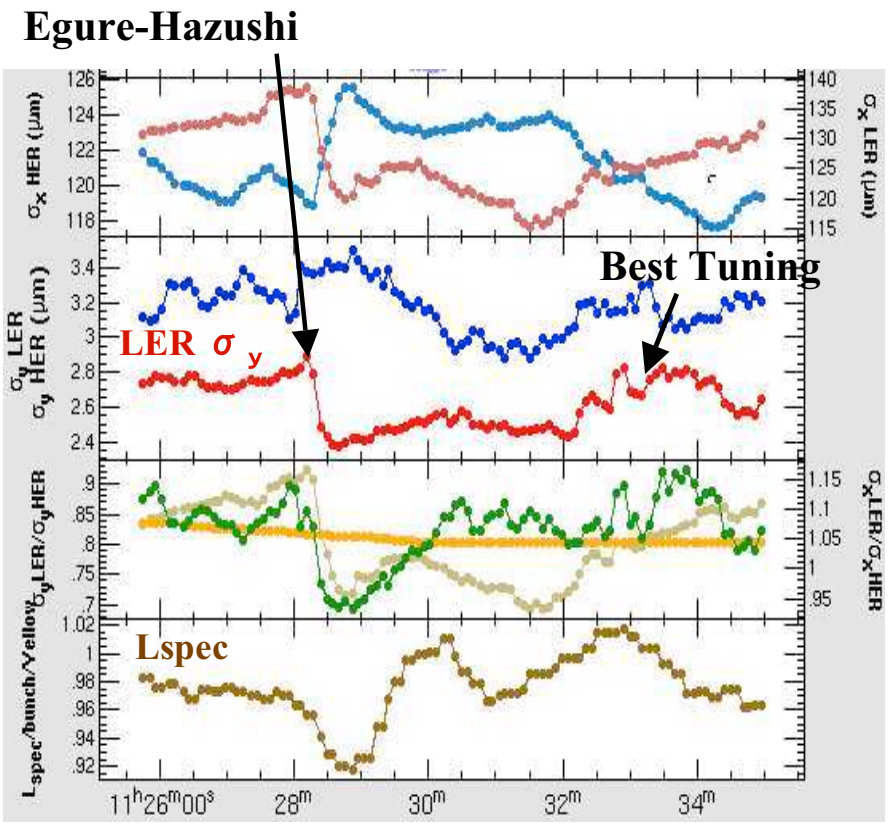


Figure 4-2: iSize Feegback Monitor.

6. Guideline for H-Offset Setting

We have found that there was a correlation between the kick angle of a steering magnet ZHQC2LE at near interaction point and the H-offset.

- **The ratio of H-offset to the KRB is some constant the luminosity is high.**
- **The luminosity decreases due to EUGRE or HAZURE.**

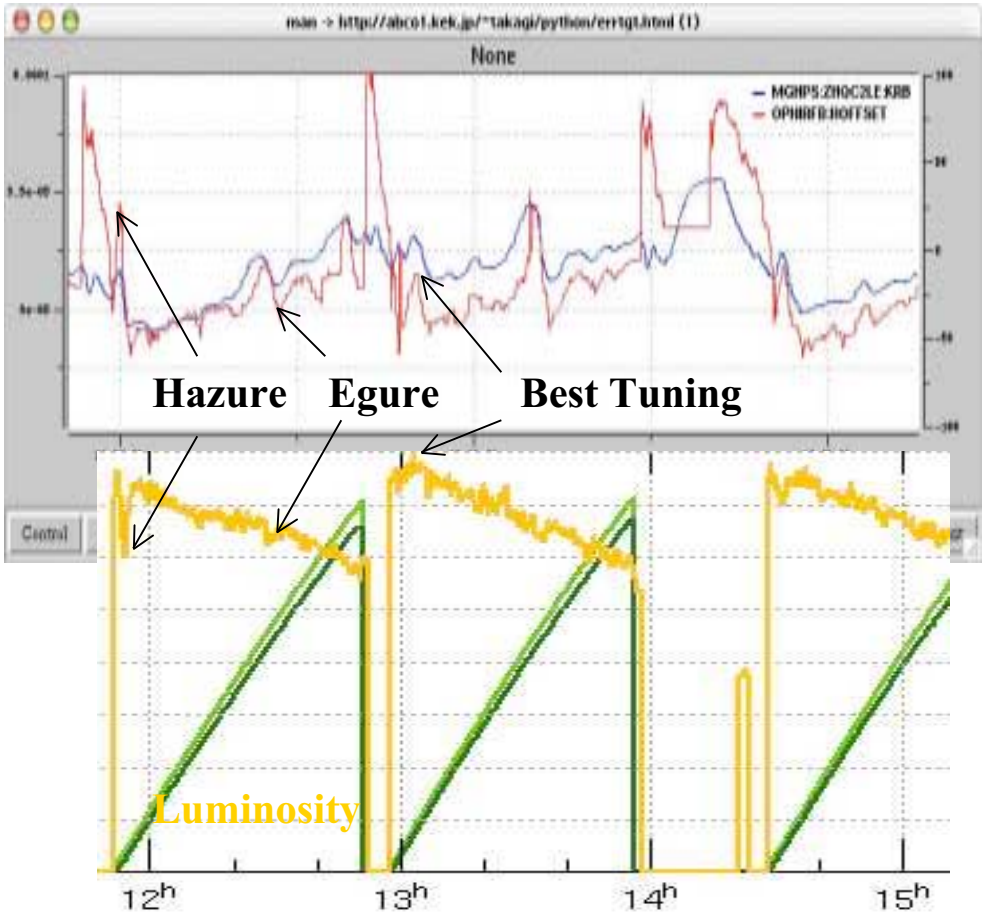


Figure 5: Relation between the KRB of the ZHQC2LE, the H-offset value and the

7. H-Offset Easy Feedback System

We introduced a tool to keep this ratio at the optimum value .

- **This panel controls the KRB of ZHQC2LE and the H-offset value to keep the optimum ratio.**
- **Every operator could maintain stable luminosity with small EGURE or HAZURE.**
- **Same problem as in the case of the programmable H-target changer although the variation of the luminosity is much smaller.**

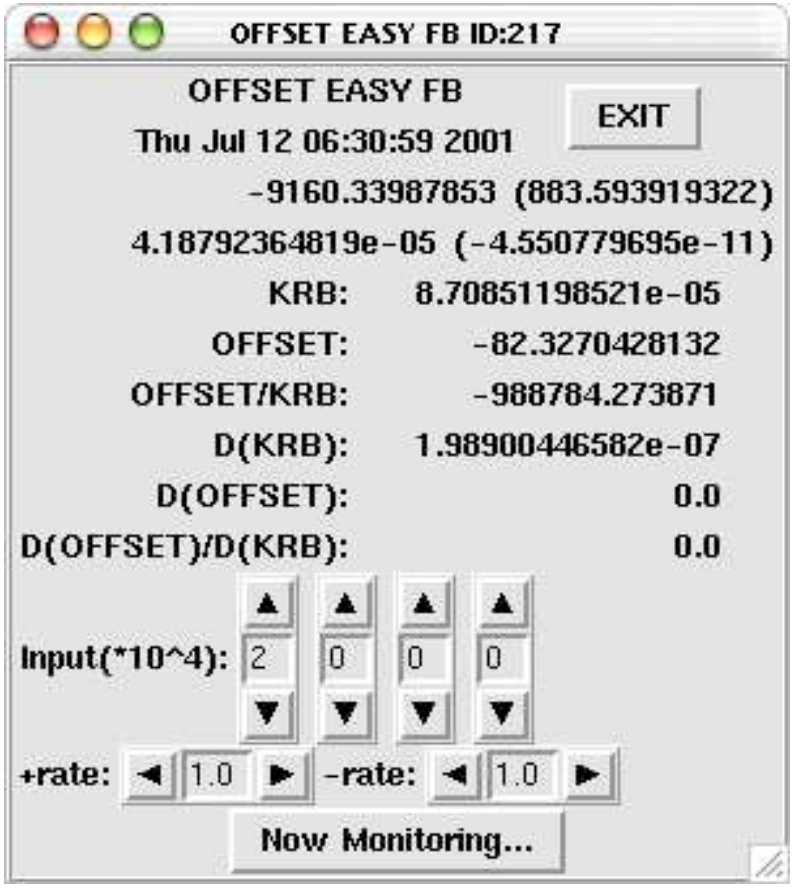


Figure 6: H-offset easy feedback panel.

8. H-Offset Beam Size Feedback System

We will return to the use of beam size as a tuning parameter.

- **The H-offset is searched and set automatically to realize the target beam size.**
- **The target size can be automatically incorporating with the beam size changer.**
- **Now, we are mainly using this feedback system during the fill.**

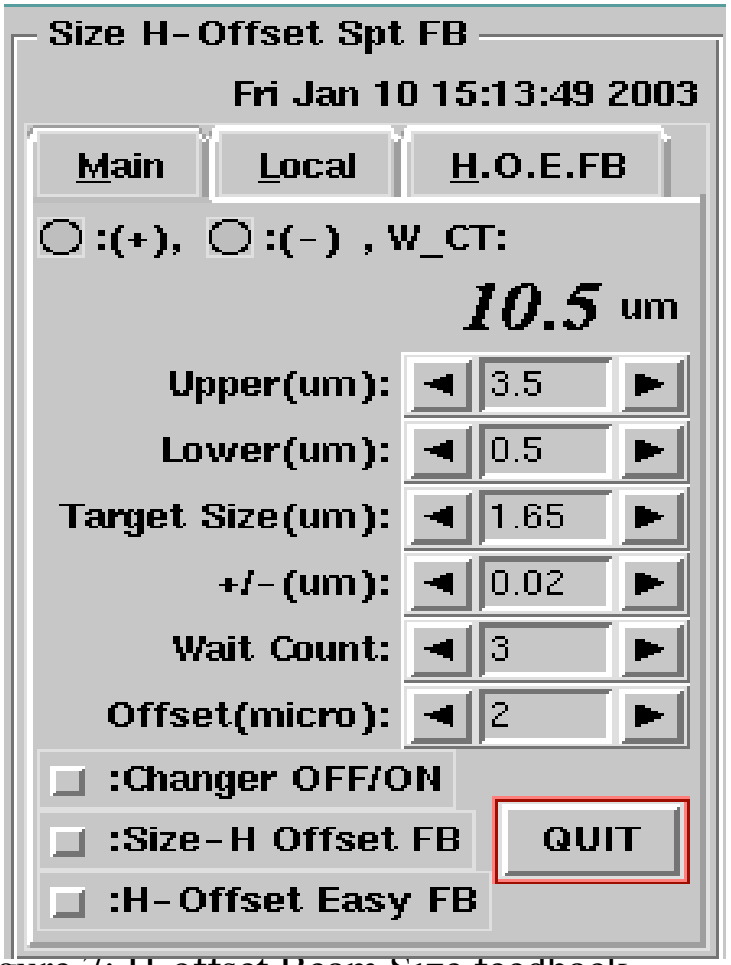


Figure 7: H-offset Beam Size feedback panel

9. H-Offset Life Feedback System

Usually we encountered crucial LER beam life loss during these first ten minutes.

- **If we start to decrease the H-offset value to obtain high luminosity without attention to this beam life loss. This tuning will be a trigger for an undesired beam loss.**

- **We have also introduced another H-offset feedback tool to maintain beam life.**

- **The H-offset value is changing automatically by this tool to realize the target lifetime .**

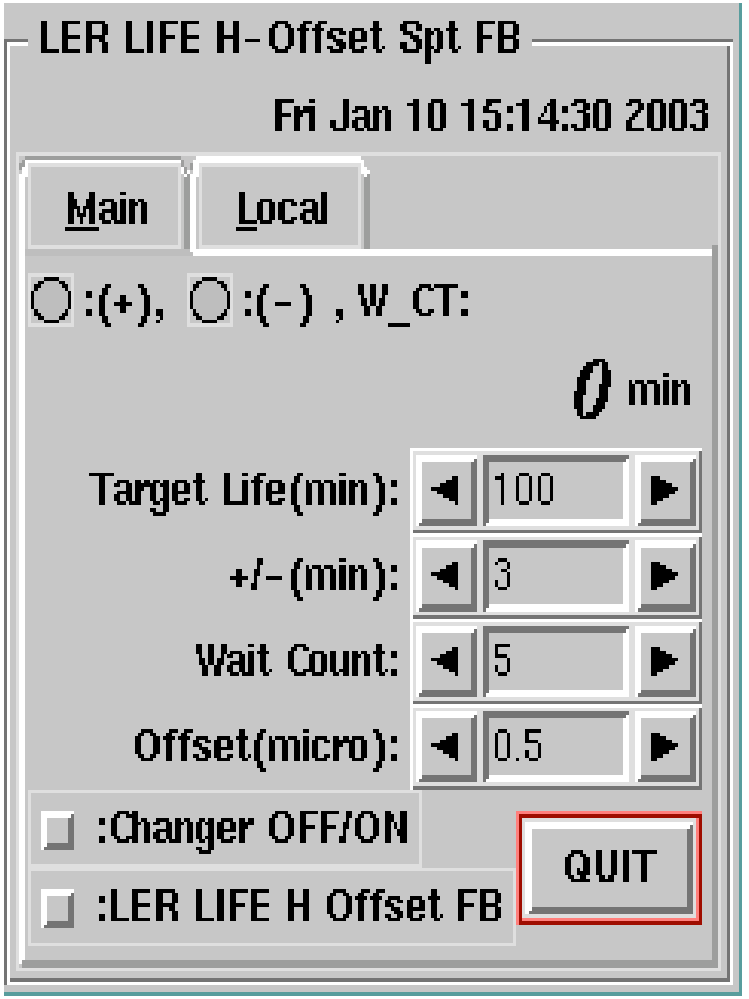
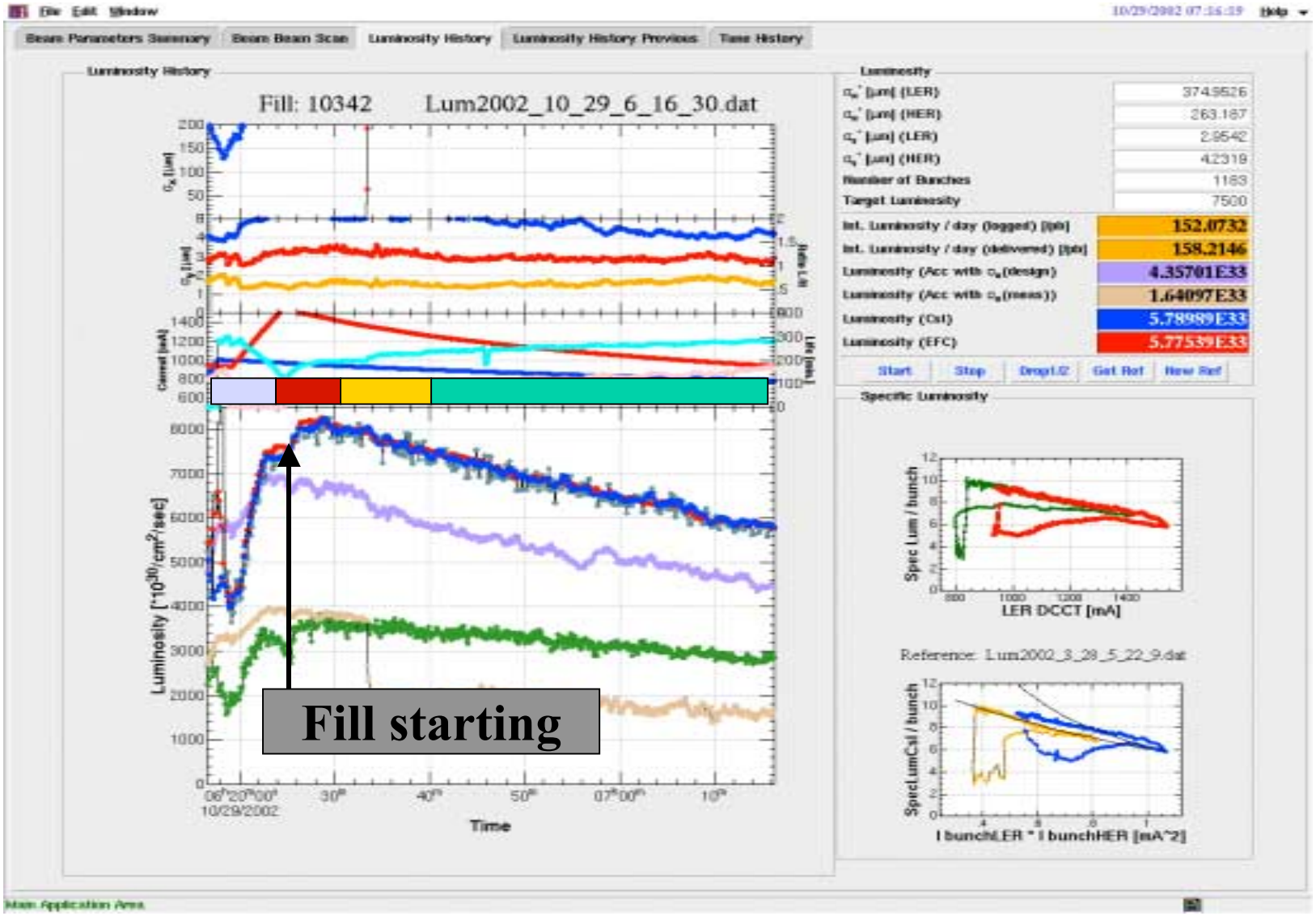


Figure 8: H-offset Life feedback panel.

10-1. Summary



Injection | **DirectTuning** | **Life Feedback** | **Size Feedback**

Figure9. Luminosity history

10-2. Summary

- **In the important first five minutes of the experiment,we must tune the iBump very carefully, using luminosity, beam size and beam life information.**

- **We can not use any feedback tools.At present we still have to use the direct tuning method in the first five minutes.**

- **Since operator experience is very important in this tuning, this method is not easy for everyone.**

- **We must establish clearly guidelines for iBump tuning.**