

possible, simple timing adjustment of eight kickers was made and the beam loss of the extraction system was controlled at a relatively small level. Firstly, the relative timing of different kickers was adjusted and the relative timing errors were controlled at a small level. Figure 4 shows the current curves of eight kickers after the relative timing adjustment of eight kickers. It can be seen that the relative timing errors of different kickers were small and reasonable. Secondly, the overall timing adjustment of eight kickers was made and the beam loss of the extraction system was relatively small. Figure 5 shows the two extracted bunches which set at different positions of the current curves of eight kickers. It can be found that, by the overall translation of the current curves of eight kickers, the two extracted bunches can be placed on the flat tops of the eight current curves, as shown in the sub graph (c) of Fig. 4. After that, the two bunches can be extracted from the RCS smoothly.

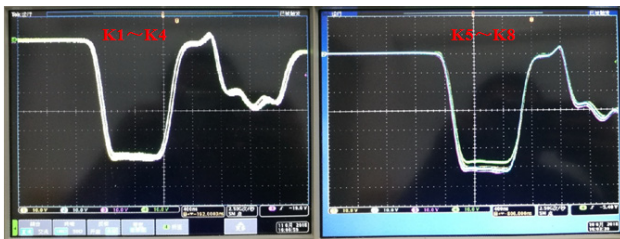


Figure 4: Current curves of eight kickers after the relative timing adjustment of eight kickers.

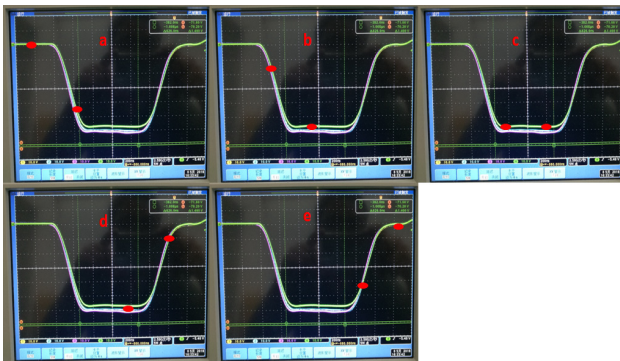


Figure 5: Two extracted bunches which set at different positions of the current curves of eight kickers.

During the beam commissioning, if one extracted bunch or two extracted bunches are not placed on the flat tops of the current curves of some kickers, the two extracted bunches would have different extraction coordinates which can be measured by the BPMs on the beam transport line from the RCS to the target (RTBT). In addition, there may be large beam loss on the RTBT which can be detected by the BLMs. In order to reduce the beam loss and make the two extracted bunches have the same extraction coordinates, the independent timing adjustment of different kickers was studied and made. Figure 6 shows the two extracted bunches which set at different positions of the kicker current curve. It can be found that, by the translation of the kicker current curve, the two extracted bunches can be placed on the flat tops

of the kicker current curve, as shown in the sub graph (c) of Fig. 6. If the two extracted bunches can be placed on the flat tops of the current curves of eight kickers, they would have the same extraction coordinates and can be extracted from the RCS smoothly. Figure 7 shows the beam loss display of the RCS and RTBT. It can be known that the beam loss of the extraction system is very small.

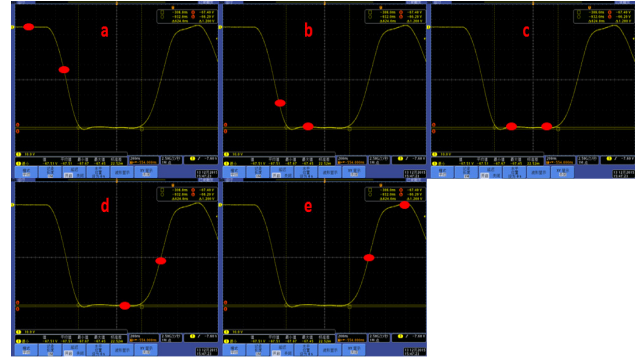


Figure 6: Two extracted bunches which set at different positions of the kicker current curve.

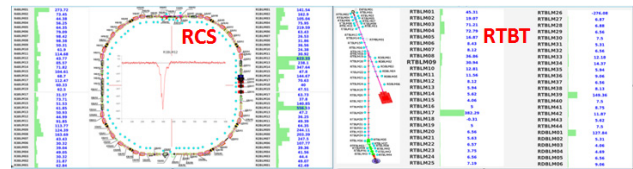


Figure 7: Beam loss display of the RCS and RTBT.

A METHOD TO CALIBRATE THE KICKER CURRENT CURVES

By adjusting the timing of the kicker, the current curve of the kicker would be translation. Then, the extracted bunch can be placed on different positions of the current curve and the BPM (such as RTBPM01) on the RTBT can measure different position information of the bunch. Therefore, after adjusting the timing of the kicker, by using the position information measured by the BPM on the RTBT, the kicker current curve can be calibrated.

During the calibration experiment of the kicker current curves, the timing of eight kickers should be adjusted well firstly. In addition, to make the experiment simple, single bunch mode would be selected, as shown in Fig. 8. By measuring the position information of the bunch, the position of the kicker current curve where the bunch placed on can be calculated. Figure 9 shows the single extracted bunch which sets at different places of the kicker current curve. It can be found that, if all the positions of the kicker current curve are calculated, the kicker current curve can be calibrated. This calibration method can be applied for all the eight kickers and will be confirmed in the future beam commissioning.

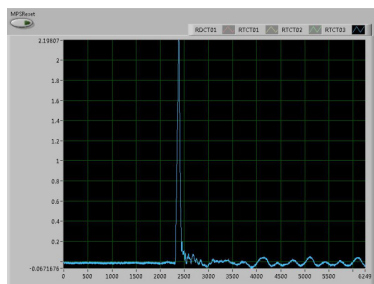


Figure 8: Display of the single extracted bunch measured on the RTBT.

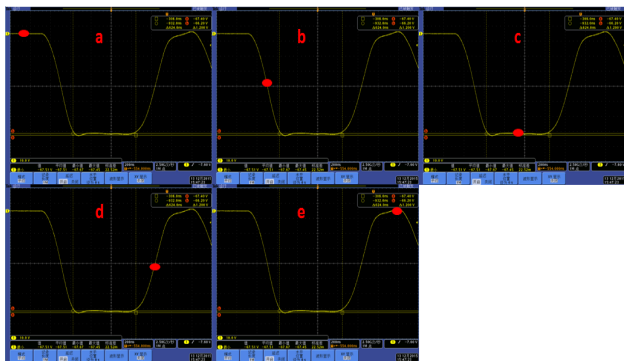


Figure 9: Single extracted bunch which sets at different positions of the kicker current curve.

CONCLUSIONS

During the beam commissioning, the timing adjustment of eight kickers is a very important problem. It consists of two parts: the overall timing adjustment of eight kickers and the independent timing adjustment of different kickers.

In the early stage of beam commissioning, the beam power and extraction beam size are relatively small. In order to extract the beam from the RCS as soon as possible, simple timing adjustment of eight kickers, including the relative timing of different kickers and the

overall timing adjustment of eight kickers, should be made which can also make the beam loss of the extraction system at a relatively small level. Latter, in order to reduce the beam loss and make the two extracted bunches have the same extraction coordinates, the independent timing adjustment of different kickers was studied and made.

During the timing adjustment of the kickers, by using the position information measured by the BPM on the RTBT, a possible method to calibrate the kicker current curves was developed. This calibration method would be confirmed in the future beam commissioning.

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