Acceptance analysis method for the scheme design of multipole kicker injection

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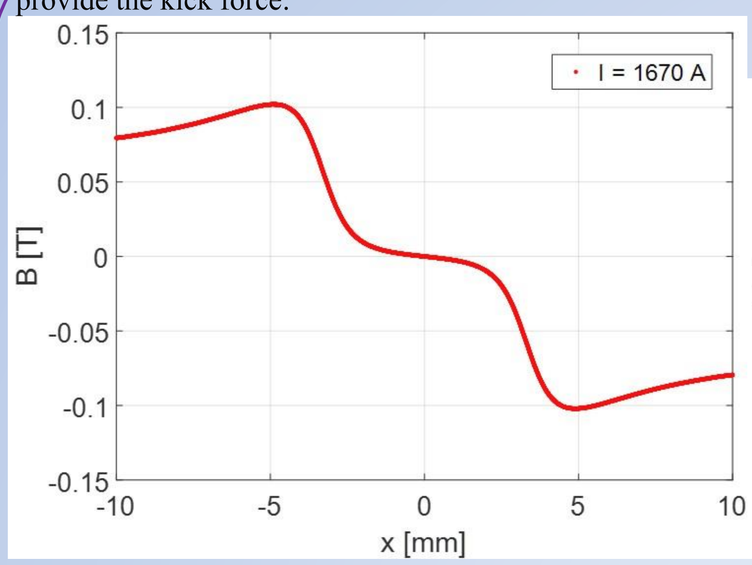
BACKGROUND

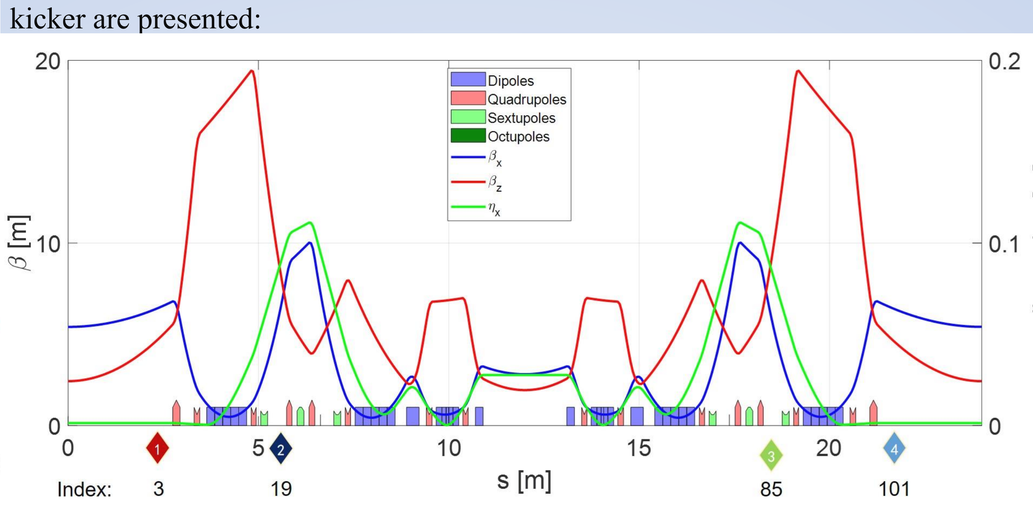
- In recent years, pulsed multipole kicker injection scheme has been proposed.
- Pulsed multipole kicker has zero magnetic field at the center, consequently, this injection scheme can be transparent to the stored beam.
- In this paper, a new acceptance analysis method based on multi-particles tracking for the scheme design of multipole kicker injection is proposed.

ACCEPTANCE ANALYSIS METHOD

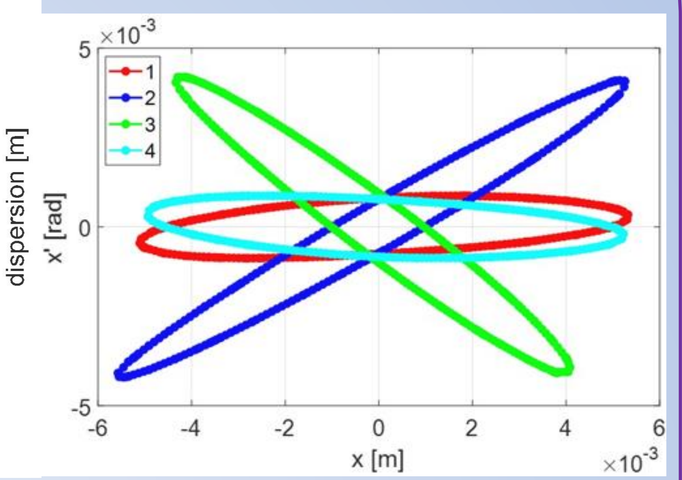
In the simulation, nonlinear kicker [1] is adopted to provide the kick force:



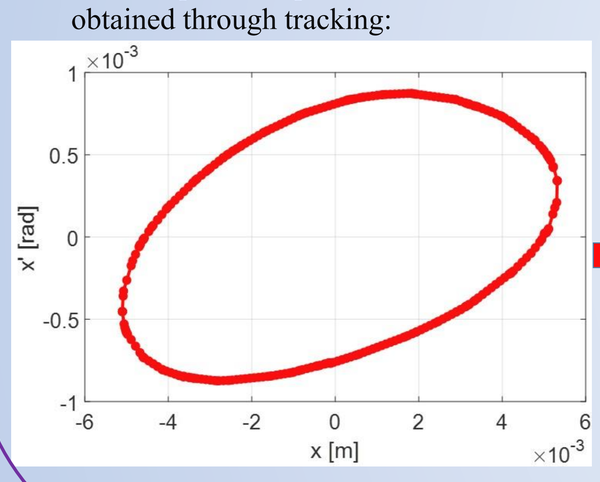
An application of this method is presented to the lattice of the HALF 2.2 GeV storage ring [2]. Lattice functions of this lattice and four possible positions to install kicker are presented:



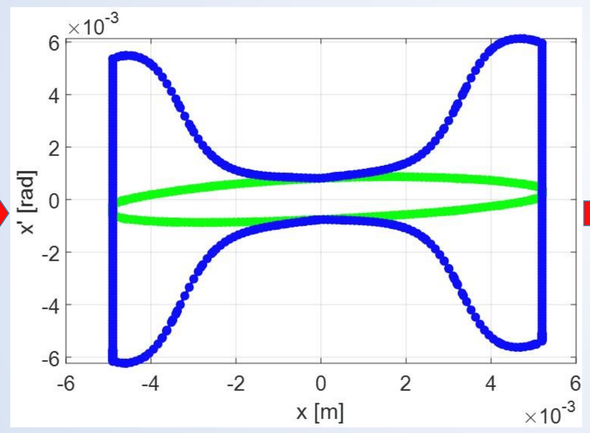
By comparing acceptance of different positions, it can be concluded that these positions have enough acceptance for installing kickers:



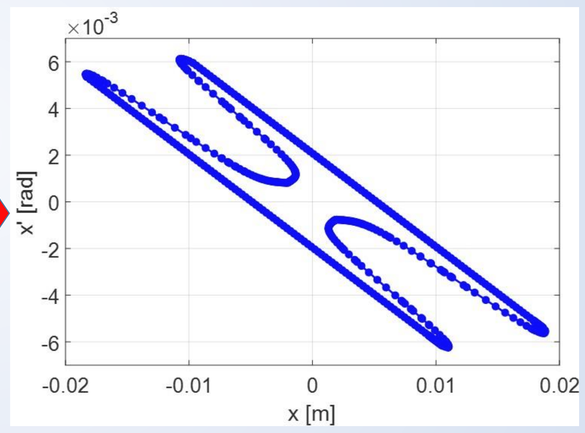
The acceptance at position of kicker is obtained through tracking:



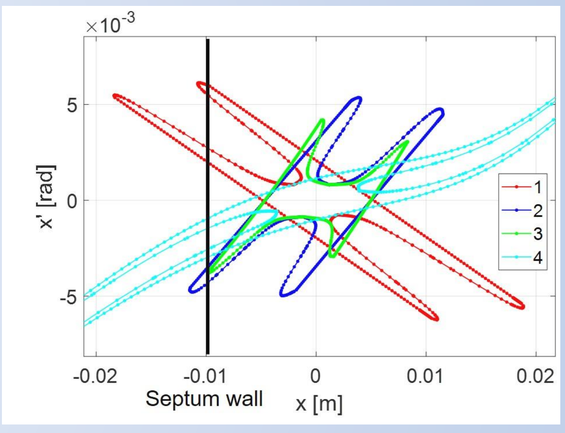
The effect of the kicker enlarges this acceptance to a new one in which the beam can be kicked into the original acceptance:



The acceptance at the injection point is obtained through conversely tracking:

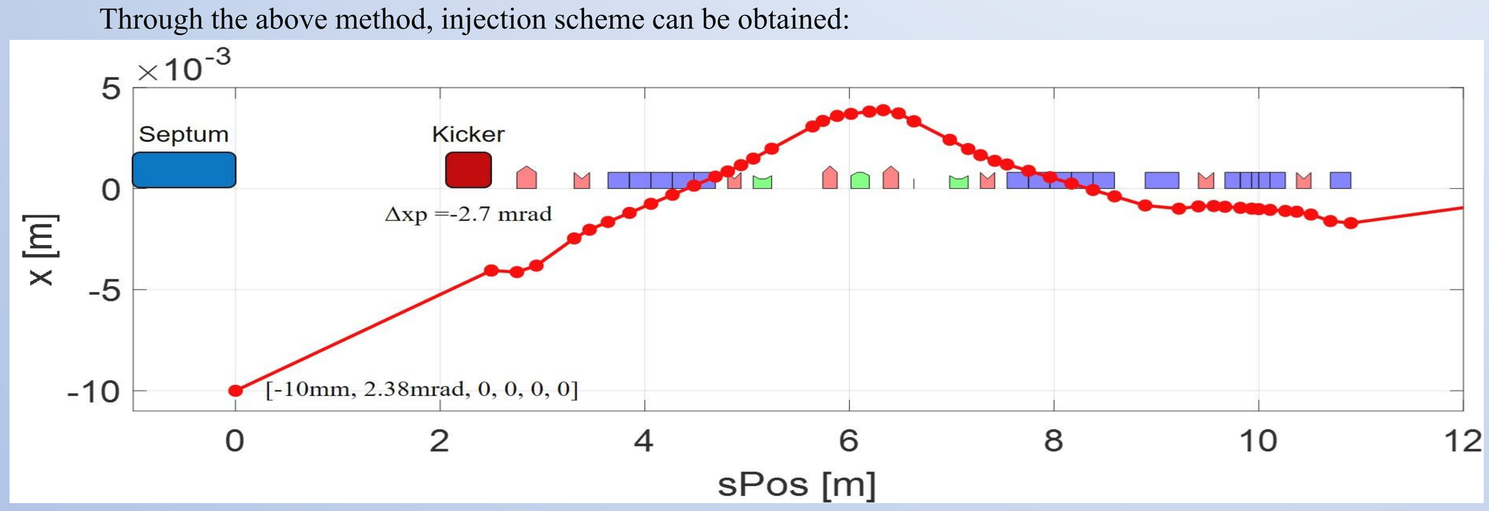


By comparing results of four schemes, scheme 1 is selected as the best scheme:

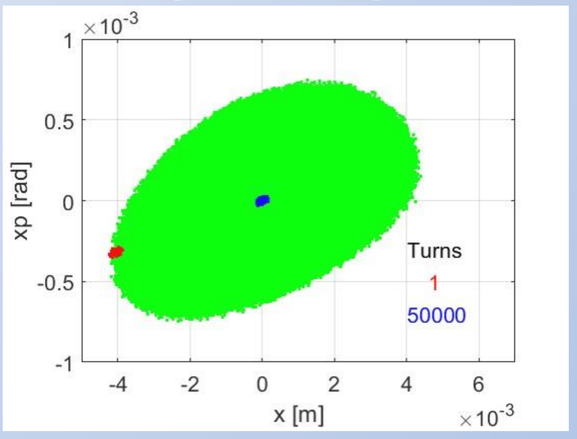


RESULTS

Through the above method, injection scheme can be obtained:



And the simulation result of injection beam accumulation process are also presented:



CONCLUSIONS

- We have presented a novel acceptance analysis method to obtain pulsed multipole injection scheme for small aperture electron storage rings.
- In this method, we got several alternative injection schemes through particles tracking, then select the best one by acceptance analysis and verify its feasibility at last.
- Through this method, suitable pulsed multipole injection scheme can be easily obtained for not only existing storage ring but also the next-generation light source.
- We applied this method on the lattice of HALF storage ting to get a MKI injection scheme and verify that its injection efficiency is within our tolerance.
- Future studies of this method, mainly error analysis including bunch error and storage ring error, are in progress.