# *Abort kicker system for ILC BDS*

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# BDS Beam Abort System

## Requirement of ILC abort kicker

8.3.1.4 Tune-up and Emergency Extraction System

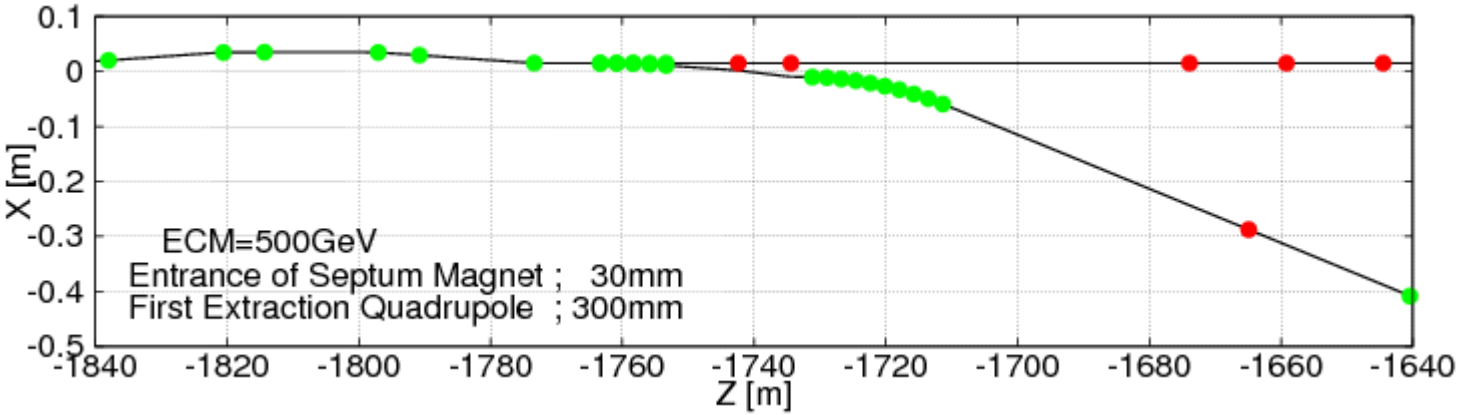
The pulsed extraction system is used to extract beams in the event of an intra-train Machine Protection System (MPS) alarm. It is also used at any time when beams are not desired in the collimation, final-focus, or IR areas, for example during commissioning of the main linacs. The extraction system includes both fast kickers which can rise to full strength in the 300 ns between bunches, and pulsed bends which can rise to full strength in the 200 ms between trains. These are followed by a transfer line with ±10 % momentum acceptance which transports the beam to a full-beam-power water-filled dump. There is a 125 m drift which allows the beam size to grow to an area of $2\pi mm^2$ at the dump. A set of rastering kickers sweep the beam in a 6 cm-radius circle on the dump window. By using the nearby and upstream BPMs in the polarimeter chicane and emittance sections, it is possible to limit the number of errant bunches which pass into the collimation system to 1–2.

***800us flat-top***

***Requirement of kickers for emergency extraction (ECM=500GeV) , proposed at ALCW15***

- *9 kickers to abort -> 4kickers*
- *Magnetic field of 1.3kG. - > 0.85kG*
- *Pulse length of 800us*
- *300ns rise time to full strength for emergency abort.*

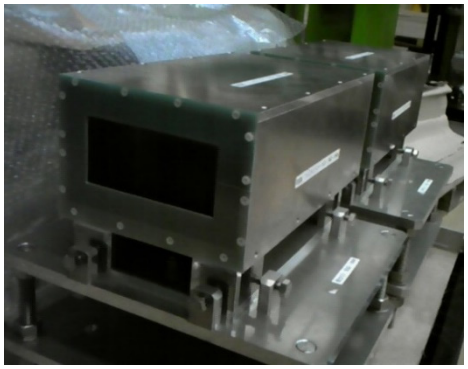
***ECM=500GeV***



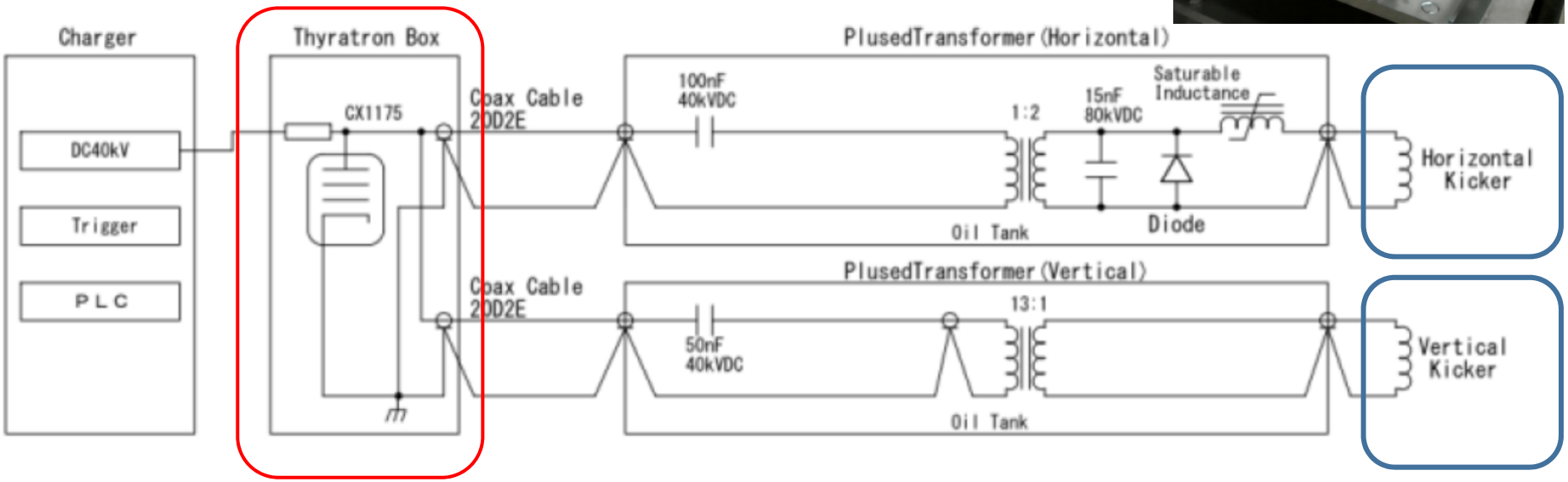
# *Introduction of the abort kicker system for superKEKB*

# *Abort kicker circuit for SuperKEKB*

*Fire 4 horizontal kickers and 1 vertical kicker by using single thyratron in order to synchronize the kicker timing and avoid the misfiring.*



- *Horizontal kicker is using for the beam extraction.*
- *Vertical kicker is using to sweep the beam on dump.*

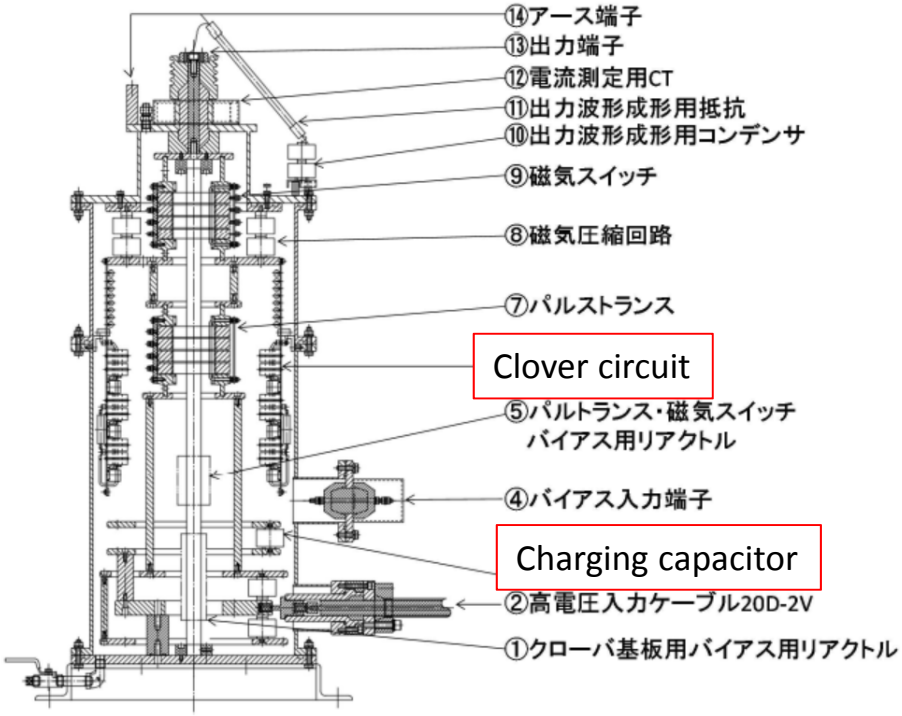


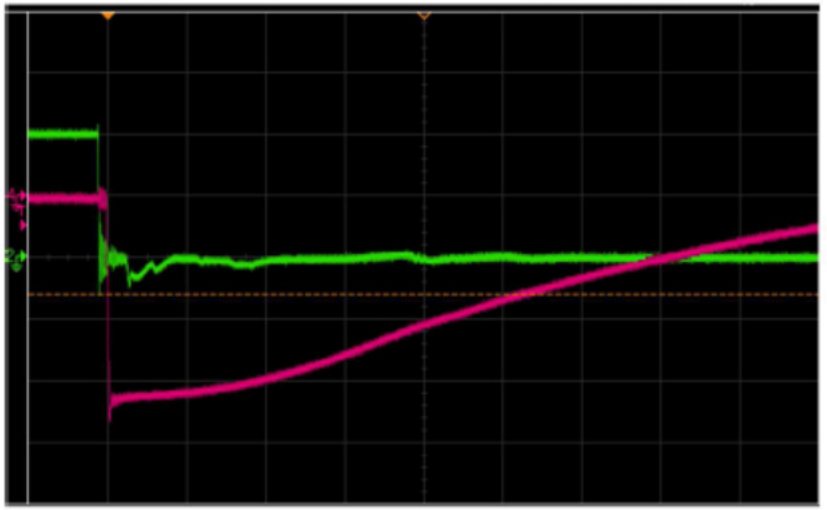

*The power is always stored in the capacitors ,*
*we can generate the single kicker pulse, when the thyratron will be fired.*

# Horizontal kicker system

*Kick angle ; 500 gauss (the ferrite kicker is OK up to 1300 gauss)*
*Rise time for horizontal kicker ; 200 ns*
*Pulse width for horizontal kicker ; 10 us*

*Pulse shape was adjusted by using the pulse clover circuit.*

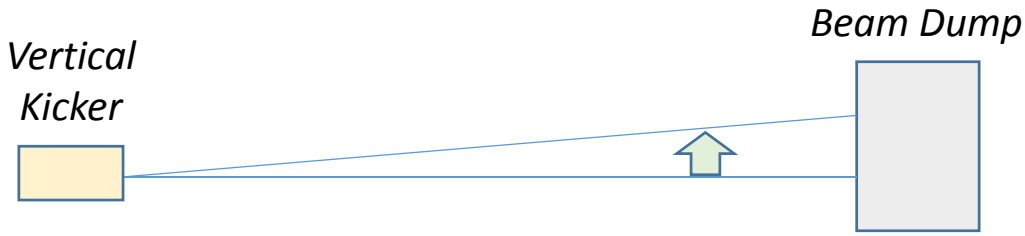


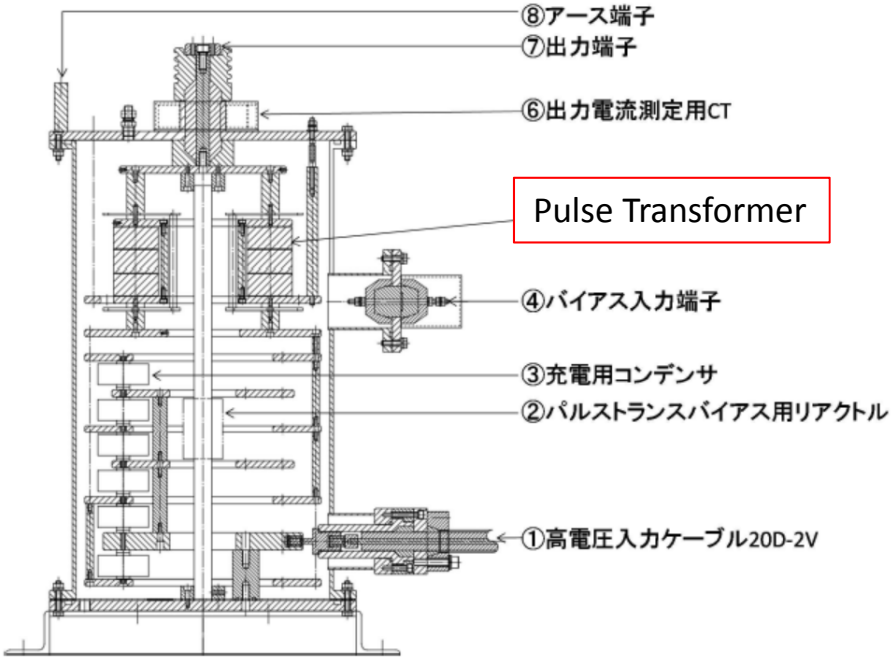
Red : OutputCurrent 500A/div
Green:THY Charge Voltage 20kV/div
TimeRange:5usec/div

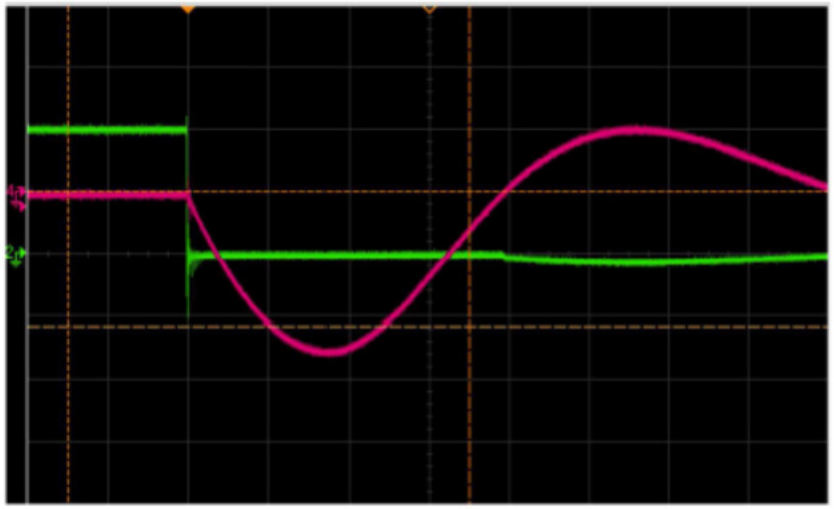
# Vertical kicker system

*Vertical kicker is using to sweep the beam on dump*




*Rise time for vertical kicker ; 10 us*



**Red : OutputCurrent 500A/div**
**Green:THY Charge Voltage 20kV/div**
**TimeRange:10usec/div**

# *Capable pulse length for superKEKB type abort kicker*

*The specification of KEKB abort kicker is 10us,*
*because the circumference of KEKB ring is 3km.*

*But, the pulse length of ILC is longer than 800us.*

*Therefore, I asked to KEK abort kicker group*
*how long can we extend the pulse length for abort kicker system?*

*They answered (private communication, not official )*

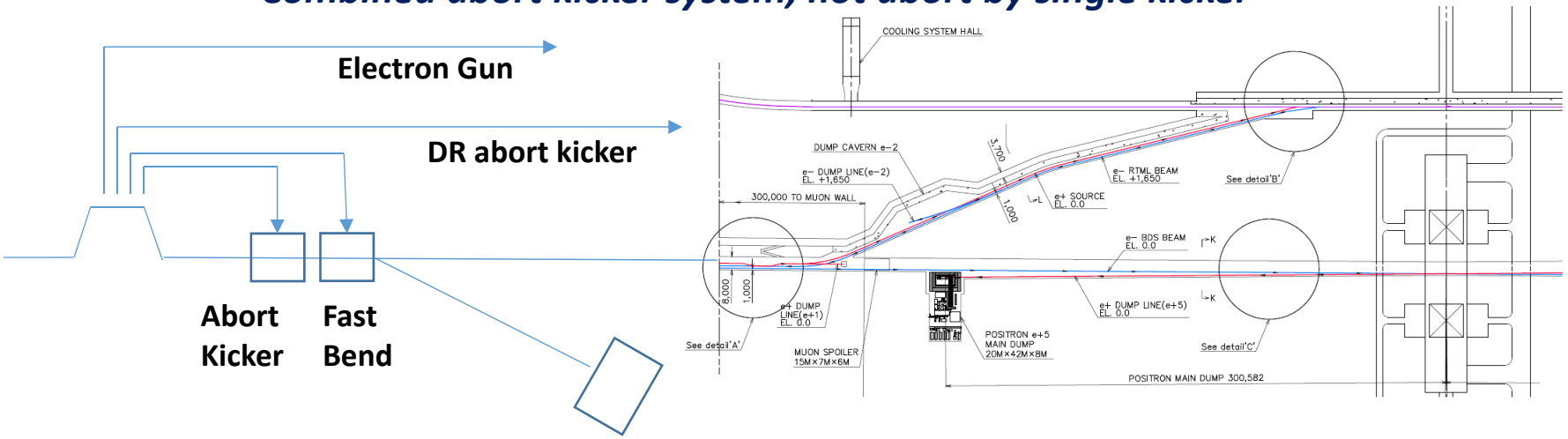
*it is maybe possible to extend the pulse length up to 100us*
*by modifying the clover circuit and capacitors,*

*but 800us is impossible by using the same philosophy of the kicker system.*

# Proposal of the abort system

*The total pulse length of ILC is more than 700us,*
*but the pulse length stored in RTML and ML is almost 100us.*

## *Combined abort kicker system, not abort by single kicker*




- ***Abort kicker in BDS (100us)***
  *kick out the beam stored in ML and RTML,*
  *when we detected some trouble in BDS diagnostic section.*

- ***Extraction kicker trigger is off , then abort the beam to DR abort system***
  *kick out the beam stored in DR,*
  *when we detected some trouble in BDS diagnostic section.*

- ***Beam off***
- ***DRRF off or dump in DR***
- ***BDS fast bend will be turned on***
  *The beam in next pulse will not be deliver to the BDS.*

# *Summary*

*I presented one of the possibilities of the abort kicker system.*

*Since this is related to the policy of the safety system,*
*we must carefully decide by taking account of many point of view.*

*Furthermore, the kicker lengths for the deck is 2m-long.*

*Therefore, it is difficult to achieve 300ns rise time.*

*We should shorten the lengths of individual kickers, if we adopt the system.*

*- We need a small modification to the optics deck,*
*but I believe the total beamline length will not be changed.*