NEW e INJECTION SCHEME WITH FAST STRIPE KICKERS FOR HERA

J. Rümmler, H. Ganske DESY Hamburg, Germany

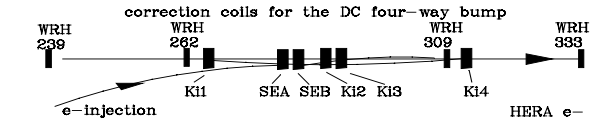
Abstract

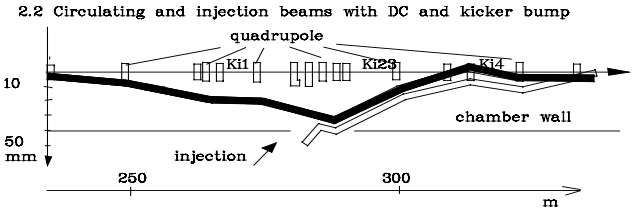
A modified injection system for HERA with two additional kickers has been installed. Bunches, spaced by only 96 nsec, can consecutively be injected having a fast kicker field rise – and fall time.
Together with the existing beam bump method, which makes use of synchrotron radiation damping for the injected beam, the new kickers reduce coherent oscillations, both from betatron motion due to injection and energy offset between HERA and its preaccelerator PETRA. Using the new kickers, better use of the HERA acceptance can be made with simultanions reductions of the gain of the transverse feedback system.

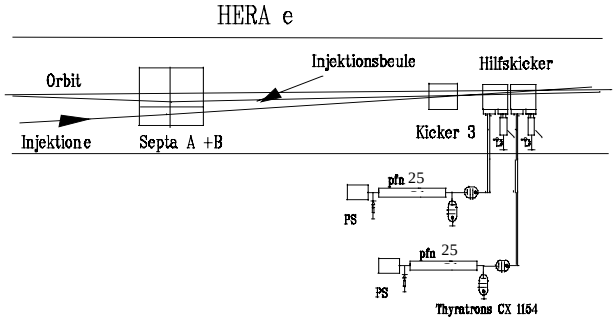
1 INTRODUCTION

The previous injection scheme shown in Fig.1 allows for injection as well as for accumulation. Four kickers and two septa are used. All four kickers produce a 38 µs long half wave pulse. With a balanced kicker beam bump the circu-lating beam is moved horizontally towards the septum.
Which in the old scheme, the kicker bump is not be closed for maximum acceptance, the new scheme allows exactly this.

2 THE OLD INJECTION SCHEME Fig.1







3 THE NEW KICKERS Fig.2

Kicker Data			
Kicker C type, stripe kicker			
Energy		GeV	12
Deflection angle	mrad	0,125	
Ferrite length		mm	400
Ferrite gap height		mm	68
Chamber gap height		mm	40
Chamber gap width		mm	80
Magnet field		mT	11.1
Kicker field filling time	ns	90	
Short pulses are possible			
Ringing after pulse time is cut			

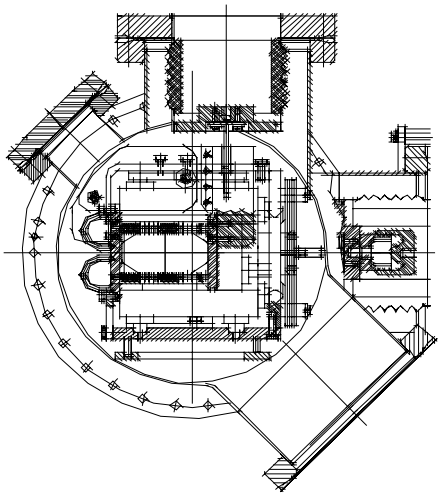
PFN cable	two parallel	
Kicker impedance	ohm	25
load impedance	ohm	25
pulse current	A	
kicker filling time	ns	85
length of pulse	ns	450
Voltage at kicker	kV	12.5
Voltage at cable	kV	25
PS - Voltage	kV	30
PS - circuit	cut down type	

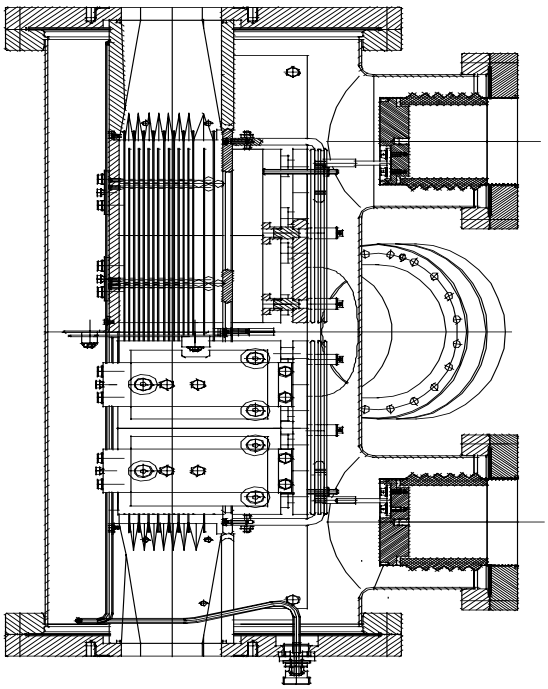
4 KICKER DESIGN

Ferrite kickers in the HERA electron ring must be protected against heating by wall currents. The external chamber wall of the kicker, which is metal, lead right through the kicker, guides the rf of the beam without reflection and also blocks off the synchrotron radiation.

Stainless steel stripes above and below in the kicker gap are joined to the chamber alternatively to the left and right. Their capacitance close the chamber electro-magnetically to protect the kicker ferrite from the beam fields. For the kicker field, the stripe- capacitance's are in series to prevent the kicker field from being shorted. All inner parts are tapered.

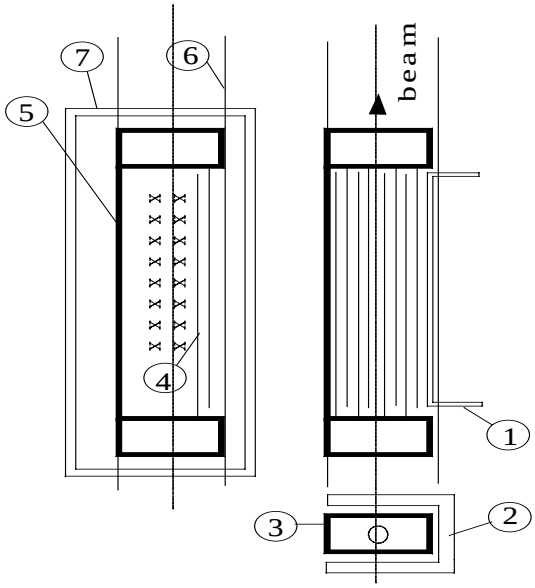
4.1 CROSS-SECTION OF THE KICKER Fig.3



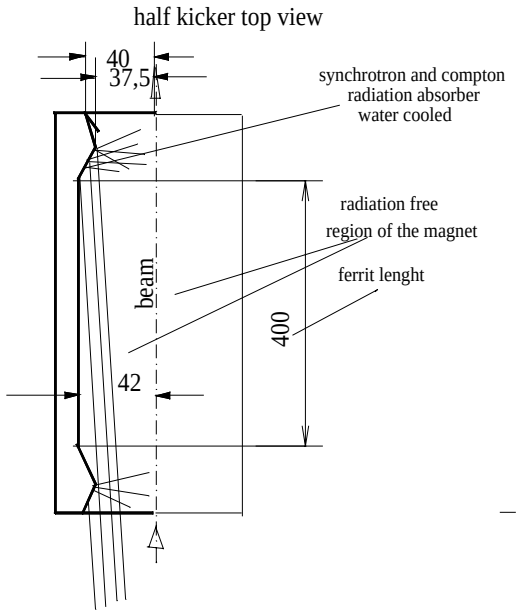


4.2 KICKER Fig. 4

1. pulse current conductor
2. C – yoke of the kicker, made of ferrite
3. protective stripe chamber
4. protective stripes
5, Synchr. and compton radiation absorber
5. HERA chamber
6. kicker tank



4.3 HALF KICKER TOP VIEW Fig 5

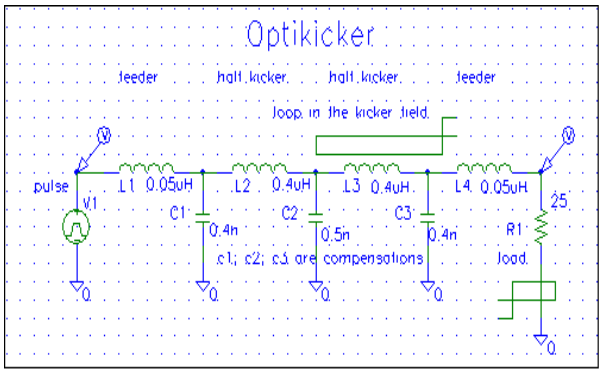


4.4.POWER LOSS (radiation) Fig. 6

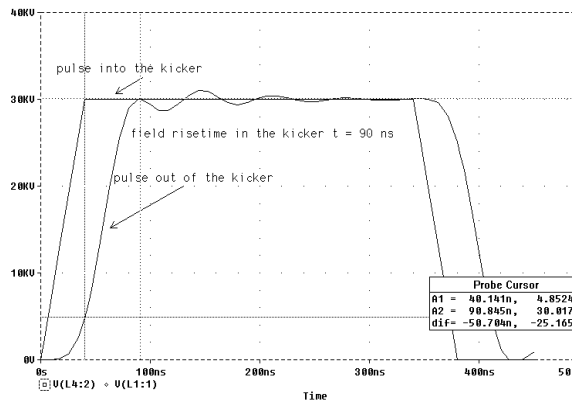
$$P = \frac{1.41 \times 10^4 \times E(GeV) \times I(a) \times da}{r}$$

(da) is the aperture angle for the synchrotron radiation in the shadow of the kicker for remotly located dipole magnets.

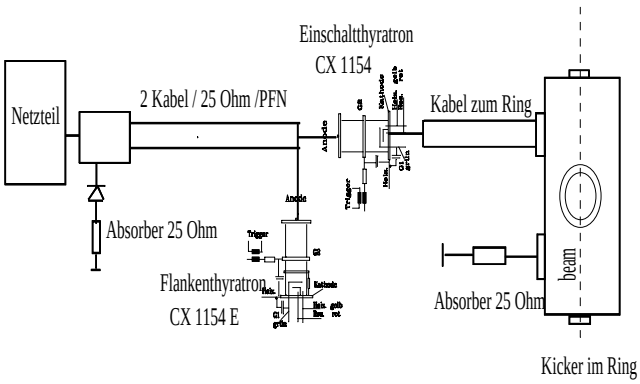
4.5 KICKER MAGNET SIMILATION Fig.7



4.6 SIMULATION RESULTS Fig.8



5 KICKER SYSTEM Fig.5



Kicker im Ring

1. power supply
2. discharge cable 2 x 50 Ω parallel
3. reflection resistor
4. main thyratron cx 1154 EEV
5. cable to the HERA ring
6. kicker magnet
7. pulse absorbtion
8. pulse width cutter cx 1154 EEV
9. The CX 1154 must have
   U_H = 6.3 V U_R = 5.8 V

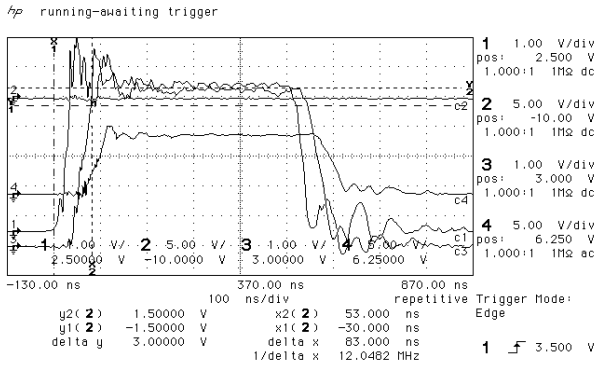
5.1 TEST OF THE KICKERSYSTEM

Like in the simulation, the kickers and the pulsers are tested separate by and finally together. The two curves show the in- and outgoing pulses of the kicker. From the time difference of both pulses the fill time of the kicker can be seen.

Trace 1 pulse in Trace 2 pulse out

Trace 4 pulse current

Time difference between in and out t = 65ns



CONCLUSIONS

The kickers run after shut down for HERA injection.

The author wish to thank Dr. N. Holtkamp for his suggestions and discussions.

REFERENCES

(1.) J.Rümmler, "Pilot- Bunch and Long Pulse Ejektion (t = 7,6 µs) with Stripe Kickers out of PETRA for the path to HERA" EPAC 90 Nice

(2.) J.Rümmler, " HERA e- injection with septa and kicker technology" EPAC 92 Berlin

(3) www.desy.de/~ruemmler/pc/Inj.html