FEEDBACK KICKERS in the DESY RINGS

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Abstract

Kickers for feedback systems work in PETRA, DORIS and HERA e and p vertically and horizontally. A beam position signal that is processed electronically drives the kickers from bunch to bunch via one amplifier each.(1kW)
This report shows the kicker design data and the amplifier data.

The kicker places in PETRA, DORIS, HERA e and p and the new feedback kickers in DESY III.

The field build-up time of the kickers between bunches.

How ferrite in the kickers guides the field.

Rf image currents of the beam in kickers necessitate stripe kickers and good wall connections of the stripe chamber to outer vacuum chamber.

The kicker design for a characteristic impedance (50Ω) to achieve a broad band kicker without phase rotation between the sine or rectangular driver power and the kicker field by different frequencies and repetition rates.

1. DESY FEEDBACK KICKER

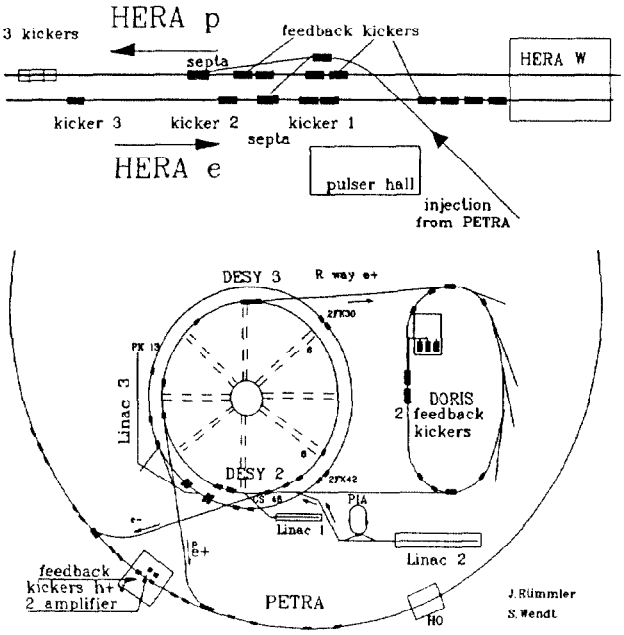


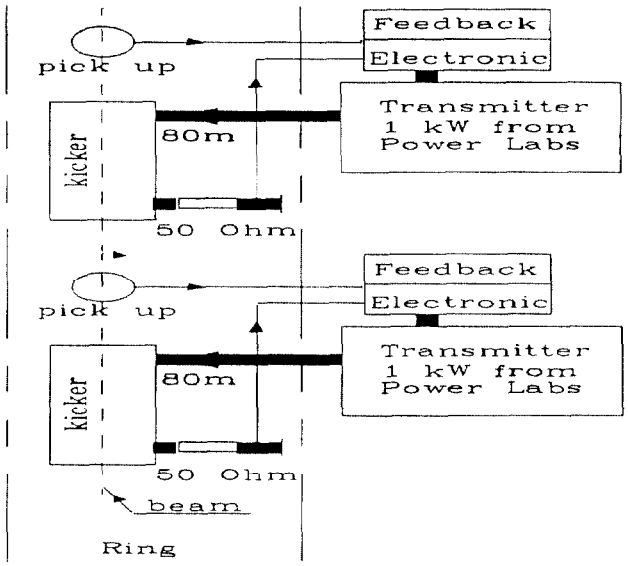
Figure 1. Feedback kickers in the machines

2. INTRODUCTION

In the DESY machines, feedback systems work very successfull and stabilise the beam in a high current mode. Feedback kickers, with their quick acting correcting field, stabilise the beam from bunch to bunch.

This report shows the characteristics of the broad band kicker system.

Figure 2. Kicker system



No. of feedback kickers that pulse	Maschine
2	**DORIS**
4	**DESY III**
2	**PETRA**
4	**HERA p**
4	**HERA e**

They all stabilize the beams in the accelerators and hold much more beam as without them.

2.1 Reflections and phase shift in cable and feedback kickers

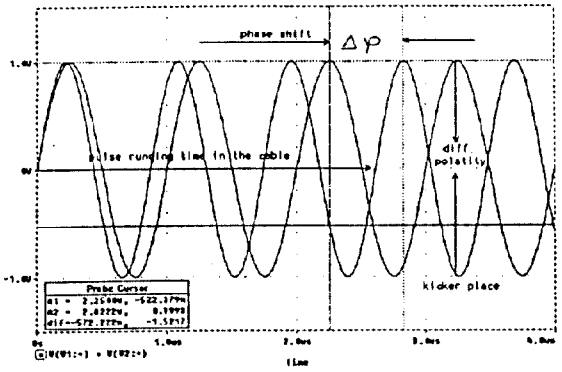
Different frequencies lead, in the long cable, to different phase shifts up to the reverse voltage.

Linear phase shift must be electronically compensated

All the RC cells of the kicker must have Z = 50Ω and work without reflections and nonlinear phase shifts.

Only such kickers give linear and wave free short risetime of the field in the kickers.

Figure 3. Different phase shift and reverse voltage at the kicker.



3. ASPECTS of KICKER DESIGN

In addition to the deflection angle at 7 GeV, following must be mentioned;

The variation of kicker aperture with position according to the beam diameter.

The field build up time and therefore pulse build up time between bunches.

The use of ferrite for field guidance and indaction savings.

The necessity of stripe kickers due to Rf image currents induesd by the beam.

The Design of the kickers for a characteristic impedance of 50 Ω in order to achieve a broad band kicker, without considerable phase rotation between the drive and the kicker field, with the ability to work with low cost transmitter.

4. KICKER DATA

The horz. and vert. feedback kickers in PETRA Ferrite require low pulse currents. The field build-up time in the kicker is shorter, t=30ns. Stripe kickers are needed because of the short bunches.

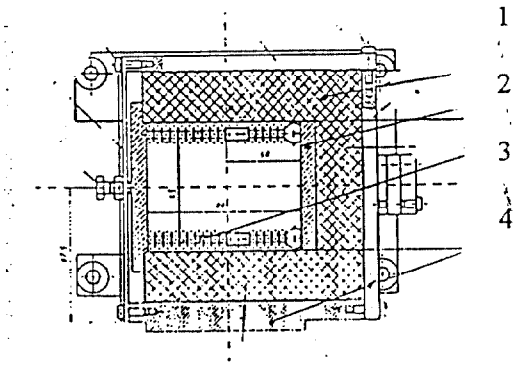
		horz.	vertical
Energy	GeV	7	7
B x l	Gaume	0.98	0.68
Deflection angle	μRad	4.1	2.88
Pulse current	Amp	6.32	6.32
Kicker voltage	Volt	200	200
Pulse power	Watt	1000	1000
Field length	m	0.9	0.9
Zo of the Kicker	Ohm	50	50
Kicker subdivision	Cells	8	8
Pulse travelling time t	ns	30	30
Free aperture	mm	40 x 80	40 x 80
Ferrite aperture	mm	60 x 80	40 x 80

Kicker in vacuum tank

The kicker is connected coaxial to the transmitter and absorber.

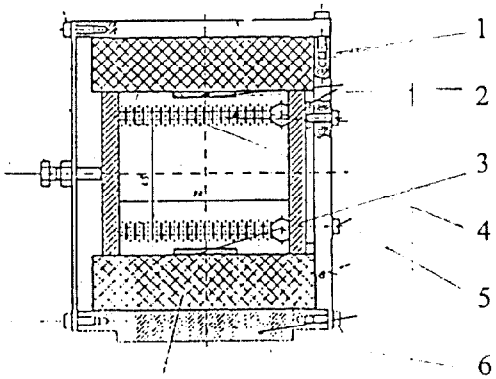
5. Sectional View of the two Kickers

Figure 1. horizontal kicker



.1 C yoke of the ferrite kicker
.2 Conductor up to gap
.3 Stripes as ferrite protection and conductor of the Hf image current of the beam.
.4 Ground conductor leading through the kicker

Figure 2. vertical Kicker



.1 Ferrite plates, top and bottom
.2 Conductor near the ferrite
.3 Spare conductor bottom
.4 Stripe conductor as ferrite protection and rf-line
.5 Ground conductor leading through the kicker as chamber simulation
.6 Magnet holder

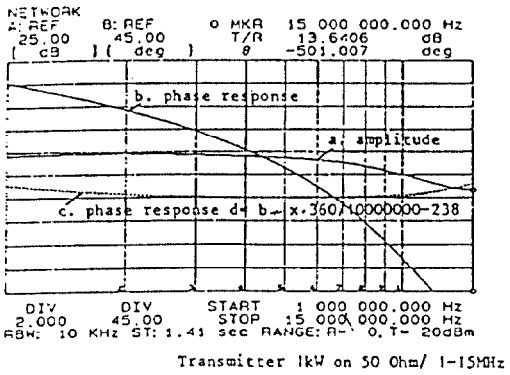
The stripes between the kicker ferrite and the beam lead the rf- mirror current of the beam and protect the ferrite against the heading field of the beam.

See the reference of reports

6. Transmitter for the kicker drive

The diagramms show amplitude- and phase shifts. The phase shift also after the frequency correction.

Figure 3. Frequency responses of the transmitter



7. Frequency Responses of the kickers

Figure 4. horiz. kicker

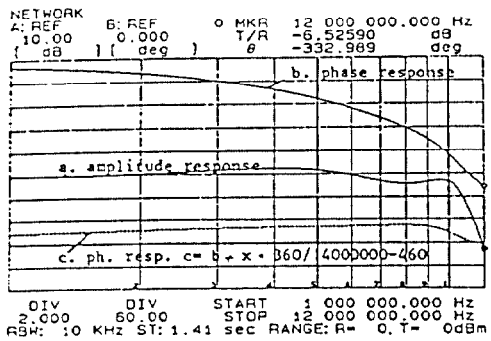


Figure 5. Transmitter and horiz. kicker (1kW)

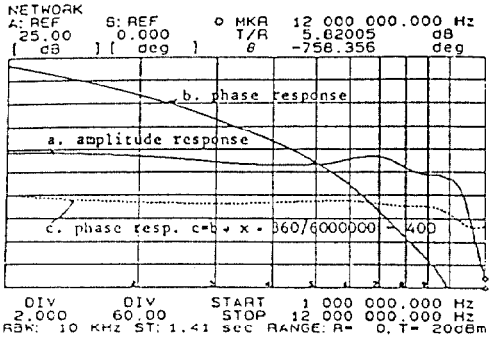


Figure 6. vert. kicker

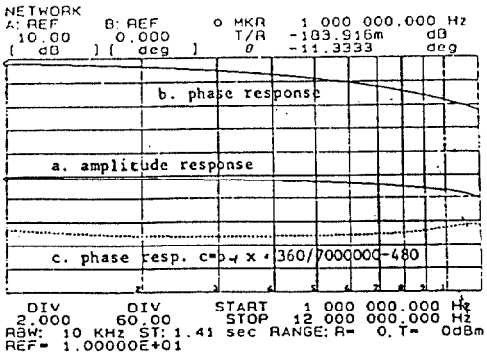


Figure 7. Transmitter and vert. kicker (1 kW)

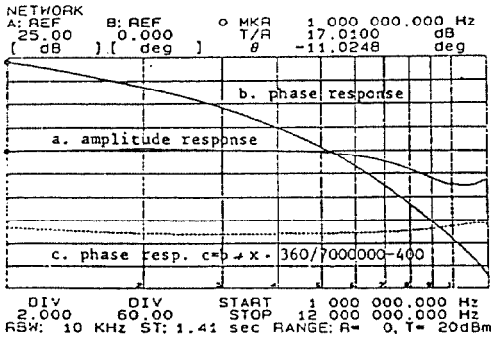
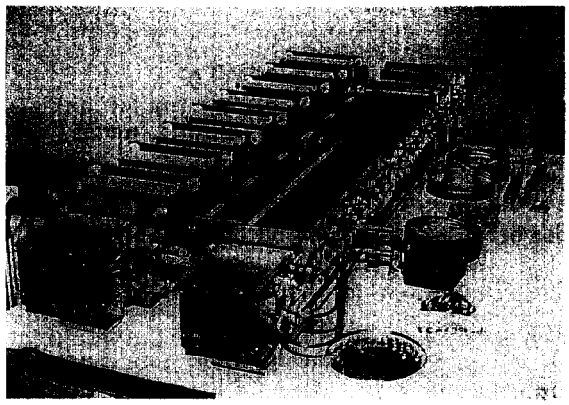


Figure 8. Both kickers without tank.



References

(1) J.Rümmler,"Pilot Bunch and Long Pulse Ejektion (t = 7.6μs) with Stripe Kickers out of PETRA for the Path to HERA." EPAC 90 NICE

(2) R.D.Kohaupt DESY 91 - 071