PEP II Transverse Feedback System

Ron Akre
David Anderson
Anatoly Krasnykh
Vojtech Pacak
Uli Wienands
Andrew Young

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The PEP TFB system takes the vector sum of 2 BPMs, delays the signal by the remainder of 1 turn and delivers a kick to the beam the next time around. Two stripline kickers, one for X and one for Y, are used.
TFB Run Summary

• Only One Section in One Power Amplifier Failed
  – LBNL Digital Delays Working Well
    • Reduction of Power in Amplifiers
    • Greater Feedback Overhead
    • Greater Reliability

• Two GaGe Card Failures in Diagnostic System

• Two Filter Failures
  – Not noticed until after run.
  – Caused low power operation.
Failed during Last Run

- Two fans in ASP (LER and HER)
- One front end BPM 6dB attenuator
- One amplifier cell
- Two voltage cell regulators
- Two LP filters (Caused low signal operation)
- Two GaGe boards
GaGe Board Systems

Two Boards Failed

1. Data was corrupted intermittently when the board warmed up. Board was repaired by the manufacturer.

2. Trigger on board failed – repaired by manufacturer

Two new systems to be installed – Will have 1 spare board.
Modified LER X-Plane Kicker
Ceramic pins added to correct sagging electrodes

Before Pins Added

After Pins Added

Diagram showing Ceramic Pins, Electrode Paddles, Vacuum Feedthrough, Housing, Electrodes, and End Piece.
Result of Cold Measurement for modified LER horizontal TFB kicker

Intrinsic TFB Kicker Loss with Mo Electrodes

![Graph showing Intrinsic TFB Kicker Loss with Mo Electrodes](image-url)
Result of TDR Measurements (cont.)

Reaction on the kicker ends
34Ω Minimum to 64 Ω Electrodes
Evaluation of LER High Current Mode Operation

Average kicker beam impedance is $Z_\parallel = 34\ \text{Ohm}$ for $(59.5-2380)\ \text{MHz}$

From simulation and measurement the evaluated HOM power dissipation will be $\sim 310\ W$ for 3A stored beam $\sim 550W$ for 4A beam

LER (Y+) HOM Power
4.3MV, 1500mA (0:3442:2 f.p. by 2)

P1=17.6W per port, $\sim 70.5W$ total in 4 ports at 1.5A
Estimated Moly Temperature


At 4 Amps in LER at shorter bunch lengths the temperature is expected to be between 500ºC and 600ºC.

Thermal Expansion of Moly 4.8ppm/ºC
24” x 4.8ppm/ºC x 600ºC = 70 mils
35 mils each side
Air gap at room temperature is ~230 mils each side

Red: All beam induced power dissipated in electrode

Green: Half the Beam induced power dissipated in electrode
New Diode Detectors – Diagnostics Only, Currently No Interlocks

LER CURRENT

LER Y ~ 240W
LER X ~ 150W
HER Y ~ 150W
HER X ~ 180W – peaks above 300W

Numbers Scaled to power at Kickers
High Power Attenuators flat to 4GHz

Load Power for LER Y- 10 days
20% higher for 2 days.

HER X+ 7 Months
Shows 2 weeks of higher power
Summary

• Kickers Loads currently see power levels of 240W with peaks over 300W.
  – With beam currents 1.6 times higher, beam power 2.5 times higher, loads are within the 1kW specification, but the frequency specification of the loads is only to 2.5GHz.
  – May need fans on all loads.
• Simulations show ~550W dissipated in kicker at 4A.
  – Moly Electrodes Should Handle 550W dissipated.
• Filters will need to handle 2.5 times the beam power
  – Will need to monitor power levels and functionality
• BPM attenuators will need to handle 2.5 times the power
  – Will look into higher power units
• GaGe diagnostic System has Spares
END
Further Reduction of Longitudinal Beam Impedance

TFB Kicker Beam Impedance Comparison

Beam Impedance Ratio for the (59.5-1725.5) MHz range is

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\frac{Z_{\text{original}}}{Z_{\text{fenders}}} = 1.64
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i.e. expected HOM power reduction from 310 W down to ~200 W at 3A
Kicker End HOM Absorbers
(a proposed way to help LP filter and amplifier work)

Partial HOM Dump to AlN-Composite Loss Ceramic