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# Electron Beam Dump Issues for Bremsstrahlung Photon Beam

**An e- dump line was originally designed for beam energy up to about 25 GeV, but has been out of service for more than 20 years. The existing hardware is not connected.**

## Basic beam parameters:

- 48.4 GeV electrons at the dump line.
  $5 \times 10^{10}$ electrons/pulse.
  120 pulses/sec.
  47 kW beam power to dump.

## New beam trajectory needed:

- 50 GeV beam will require stronger magnets and smaller deflection angle (7 degrees, rather than 12 degrees).

- Need to find optimum trajectory to minimize interference with other existing hardware. Dump angles greater than 6 degrees can be designed to fit other existing hardware (C37 and sweep magnet).

- Avoid a trajectory that floods ESA with muons (6 degrees is minimum acceptable; 7 degrees is better, per L. Keller).

- Trajectory must accommodate detectors for over-bent degraded electrons in first two bend magnets. (7 degrees is acceptable, per R. Arnold).

- No soft bend magnet is needed, based on analysis by P. Bostad.

**Dipole magnets to deflect spent e- beam to dump.**

- Four existing dump magnets were removed from the BSY on July 31 – August 1, 2001.

- Magnets will require additional coils, to be wound at SLAC, for a total of 6 coils per magnet. Conductor has been procured.

- For 48.4 GeV, each magnet needs 4.93 T m, or about 761 amps. Total for four magnets in series: 426 volts, 325 kW.
  51.6 GeV would require about 855 amps, 479 volts, 410 kW (not counting cable losses).

- Note: With just four coils per magnet, the 48.4 GeV configuration (at 7 degrees dump angle) would require 1142 amps, 488 kW. Compare electric power savings with 6 coils vs 4 coils: difference is 163 kW, or $140K for 12 months of operation at incremental cost of $100/MW·hr.

- LCW connection points are available for dump magnets, but are now capped off. We propose to install shut-off valves in the LCW headers during the coming downtime.

**Dump magnets will require a large power supply.**

- The power supply used for the SLC arcs will work well for this application, but it is permanently installed in Building 136 (near Sector 30 gate). It consists of four transformer/rectifer sets which can be reconfigured to provide a better voltage/current match to the magnets. Only two transformer/rectifier sets are needed.

- A long DC cable run will be required. A cost estimate has been prepared, based on using water-cooled cables from Bldg 136 to MCC, where they will be spliced to existing 500MCM cables that extend from Cableway 3 to the BSY. Suitable aluminum conductor reportedly exists on site.

# Summary of Progress

- Various options for bend angles and sweeping magnets have been studied. A set of parameters acceptable to the experimenters has been defined.

- Original dump magnets have been retrieved from the BSY. Conductor has been procured.

- Original DC cables for dump magnets were located.

- Martin Berndt, retired power supply engineer, has concluded that the SLC arc power supply will work with minor modifications. It can later be easily switched back to the arcs when needed.

# Plan

- The dump magnets will be refurbished in the shops and eventually be re-installed in the BSY.
- EFD staff are refurbishing the goniometer and arranging for the diamond radiator.
- Preliminary layout has been completed, including proposed magnet strengths.
- A magnet suitable for use as a “sweeping magnet” has been located in the B-Line.

# Open Issues

- Engineering and designer resources are currently overbooked.
  Help is needed on many fronts: beam layout, magnets, supports, e- dump, LCW issues, power supplies, cabling, instrumentation….

- No access allowed to the BSY during PEP or FFTB operations. An installation schedule that relies on numerous ROD days has been prepared.

- Completion by December 2003 is still possible if resources are made available.

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# Sweep Magnet for Bremsstrahlung Photon Beam

**A large dipole magnet is needed downstream of the diamond crystal and C37 collimator to remove charged particles from the beam before they reach ESA.**

**Magnetic Field Requirement:**

- 50 kG·m is minimum needed, based on calculations by L. Keller. Stronger is better!

- Existing B34 dipole in B-Line will work well if modified to match other A-Line dipoles.

- With reduced (from 60 mm to 46 mm) gap, magnet will provide 56.7 kG·m at 1000 amps. Voltage drops: approx 90 volts at the magnet terminals, 10 volts in the cables.

- Power supply for quadrupole Q38 is rated for 1200 amps, 120 volts. Four runs of 350 MCM cable per leg run from this power supply to Q38. Nearly perfect fit to the proposed sweeping magnet.

# Plan

- Pull the B34 magnet out of the B-Line during the coming shutdown.
- Refurbish the magnet and add 7 mm plates under each pole piece.
- If spare trim coils can be located, they should be added to make this magnet identical to the other A-Line magnets.