

BDS Pulsed Magnets RDR Completeness

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- Purpose: collimator protection, rate-limiting
- Parameters from ebds0_2006e_parts.xls, 250 GeV
 - 131 Gauss, 20 mm high, 9x2 m long
- Design logic
 - Field+dimensions+fudges give stored energy
 - Risetime-->power-->pulser-count, which dominates cost
- My assumptions
 - 20 mm wide, 100 ns magnet fill time
 - Vacuum striplines, external matching caps+termination
 - HV coax cable connections to pulsers
 - Pulsers "like" linac modulators (13 MW for 1 ms, 5 Hz)

Abort Kicker Costs

- \$XXXk for 13 MW 1 ms 5 Hz pulser unit
 - From early publicly-available main linac estimates
 - Seems sane for big lab-built box of high-power stuff
 - Just to set scale, unlikely to really use ML modulators
- 2 units per side
 - 33% more power than needed
- \$XXk per 2-m stripline-pair + \$Xk stand x 9 units
- Triangular, +100% –50%.
 - Won't be more certain until real engineering
- \$XX.Xk/side EDIA (mag tech sys internal calc)
 - Only covers "routine" hours, not development!

Abort Kicker Concerns

- Check that beam <u>anywhere</u> in aperture with <u>any</u> parms is cleanly aborted
- Combination of fast rise and long pulse is unusual
 - Possibly costs much more than estimate
 - Possible savings from advanced pulse+sustainer design
- Needs ~man-years of engineering development
 - Not in project budget, not clear if anyone will volunteer
- Tradeoff between kicker+drift length and pulser-cost
 - Longer = less power, but more tunnel+vacuum cost
 - Present design is sane but not optimized
- RDR text assumes gated-DC mode also available
 - Not added to cost, but probably less than the errors

Abort Septum Technical

- Bends kicked beam into separate extraction beamline
- Parameters from ebds0_2006e_parts.xls
 - Thin: 4.1 kG, 10 mm blade, 30 mm high, 2x2 m long
 - Thick: 9.6 kG, 20 mm blade, 30 mm high, 1x2 m long
- Design logic
 - Current density limited by cooling issues
 - Field --> thickness
 - Temp rise, pressure drop require parallel water flow
- My assumptions
 - DC copper "current sheet" + iron flux return
 - 5mm square Cu conductor with 3mm water passages
 - Plumbing nightmare at the ends

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- \$XXk per magnet+coil + \$Xk stand
 - Same fairly conventional iron for 3 types include RTML
 - Two fairly conventional coil types + 1 for RTML
 - Low production volume (share design across ILC!)
 - Special cooling, interlock, coil position, mag-msr issues
- Two thin, one thick per side
- Triangular, +40% –40%
- \$XXk x 2 power supplies per side
 - About 1000A if 5mm square conductor, 2&4 layers
 - Thins are in series
 - Thick is not in series but runs at almost same current
- \$XXk/side EDIA

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Dump Sweeper Technical

- Sweeps train in 30 mm radius circle on dump to avoid boiling a hole through the water
- Parameters from M. Woodley, somewhat piecemeal
 - Small: 560 G, 110 mm diam, (5x+5y) x 1 m long
 - Large: 560 G, 240 mm diam, (5x+5y) x 1 m long
- Design logic
 - Moliere radius --> 30mm, +distance --> angle --> kG-m
 - Mishaps or disruption --> aperture
- My assumptions
 - Ceramic beam pipe, ferrite flux return, air-cooled coil
 - Cap bank, switch, flyback diode
 - 1 ms period bipolar sine pulses, 90° diff between x,y

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Dump Sweeper Costs

- \$XXk per large aperture magnet + \$Xk stand
 - 40 mm thick ferrite flux return for 340 mm diam, 690 G
 - \$X/cc for ferrite, \$XXk for ceramic beam pipe
 - Did not adjust cost (downward!) for present parms
- \$Xk per large sweeper for power supply
 - Scaling \$/J of ML modulators, also \$/J of caps + switch
- \$XXk per unit for small aperture magnet + \$Xk stand
 - Large magnet scaled down by a factor of 4
- \$Xk per small sweeper for power supply
 - Large power supply scaled down by 2
- Triangular +100% –50%
- \$XXk/side EDIA

Dump Sweeper Concerns

- I have no experience with this kind of device
 - I'm least confident in my relative errors here
- Not sure I fully understand/agree-with present parms
- Didn't re-estimate (even scale) for present parms
- Ferrite and ceramic pipe is expensive
 - Should consider copper-coil-in-vacuum magnet design



- No big technical concerns in BDS (unlike DR kickers!)
 - BDS was great about listening, and adjusting optics to avoid making my job (too) hard
- It's timely to do consistency checks to flesh out RDR
 - Note co-authored by optics, vacuum, magnets (me)?
- Kickers, septa, and sweepers are not "commodities"
 - Costs inherently less certain than most other systems
 - Won't be more certain until more engineering gets done
- There are significant cost tradeoffs with tunnel-length
 - What is the forum for deciding such things?