First results on erratic beam dump with detailed dump kicker model

R. Assmann, SL/AP

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Work with B. Goddard, E. Vossenberg, E. Weisse
Model: 15 MKD modules
Kick versus time from E. Vossenberg
Total maximum kick: 0.255 mrad (horizontal)
Beta function [m]:

\[
\begin{align*}
\text{BETA(1)} &= 532.8 & \text{BETA(9)} &= 358.9 \\
\text{BETA(2)} &= 510.3 & \text{BETA(10)} &= 340.6 \\
\text{BETA(3)} &= 486.1 & \text{BETA(11)} &= 320.9 \\
\text{BETA(4)} &= 464.6 & \text{BETA(12)} &= 303.6 \\
\text{BETA(5)} &= 441.5 & \text{BETA(13)} &= 285.1 \\
\text{BETA(6)} &= 421.1 & \text{BETA(14)} &= 268.9 \\
\text{BETA(7)} &= 399.1 & \text{BETA(15)} &= 252.7 \\
\text{BETA(8)} &= 379.7
\end{align*}
\]

\(Beta(15) \text{ estimated.}\)

Phase advance: \(\sim 4\) degree over MKD (neglected)
assume \((n+0.5)\pi\) up to collimator

7 TeV, 0.5 nm emittance, 1.05e11 p/bunch, 25 ns bunch spacing

Three failures: 1 module pre-fire + retriggering at max beta
1 module pre-fire + retriggering at min beta
all module pre-fire
Deflection angle versus time: Data re-sampled in steps of 25 ns.

1 module pre-fire

all module pre-fire

Assume re-triggering delay of 1.05 µs in the following...
**Bunch offset versus time:**

Data re-sampled in steps of 25 ns.

1 module pre-fire

all module pre-fire

Now the beta function gets into the game…
Bunch offset versus time:

Data re-sampled in steps of 25 ns.

Now the beta function gets into the game…
Time-projected proton distribution

1 module pre-fire (max beta)

1 module pre-fire (min beta)

All module pre-fire
Proton impact versus re-triggering delay:

![Graph showing the relationship between the number of protons (5-10σ_x) and the delay for retriggering in microseconds. The graph includes lines for minimum and maximum beta and indicates a nominal delay of 15 bunches.](image-url)
**Conclusion:**

Detailed dump kicker model implemented.

Preliminary estimates on erratic dump (LHC Project Note 277) are

OK for pre-fire of all modules: \(5 \text{ b}\)  \(\rightarrow\)  \(5 \text{ b}\)

poor for pre-fire of 1 module: \(6 \text{ b}\)  \(\rightarrow\)  \(12-15 \text{ b}\)
(re-triggering after 1.05 \(\mu\text{s}\))

Time-projected distributions have been calculated.

Loss of protons on collimators is a strong function of re-triggering time.

Functional dependence has been calculated (can we get 0.5 \(\mu\text{s}\)?)