

Failure scenario for transverse damper (LHCADT)

In the worst case scenario the transverse feedback (damper) will kick the beam with full-strength during a few turns before the beam can be dumped or the damper be switched off.

Although it is possible to check out the system before the beam is injected the worst case cannot be excluded. The system will indeed allow to kick the beam with maximum strength for example for the purpose of abort gap cleaning and beam measurements. Therefore it cannot be excluded that this mode is applied accidentally. Hardware failures may also contribute to the occurrence of the worst case.

Performance of LHC transverse damper

following equipment performance specification
(no change / see 7th SLTC / 6th LCC / 16th LCC):

choice:	electrostatic kickers (“base-band”)
	aperture 52 mm
kickers per beam and plane	4
length per kicker	1.5 m
nominal voltage up to 1 MHz	+/- 7.5 kV
kick per turn at 450 GeV/c (total)	2 μrad
rise-time 10-90%, $\Delta V = +/- 7.5$ kV	350 ns
rise-time 1-99%, $\Delta V = +/- 7.5$ kV	720 ns
kick voltage at 20 MHz	+/- 600 V

Worst case (at 450 GeV/c)

Kicks add up coherently turn by turn

If beta functions at kicker are equal to maximum beta in arc, i.e. 182 m, then a single worst case kick would correspond to 0.27σ .

Rule of thumb: worst case: 1σ in 4 turns

It is very unlikely that this will sustain over several tens of turns. Probably our pick-up system will notice saturation at about 4σ , which can be used to trigger a “switch-off” and beam dump.
(if pick-up electronics is not part of the problem ...)