A FAST QUADRUPOLE MAGNET FOR MACHINE STUDIES AT DIAMOND

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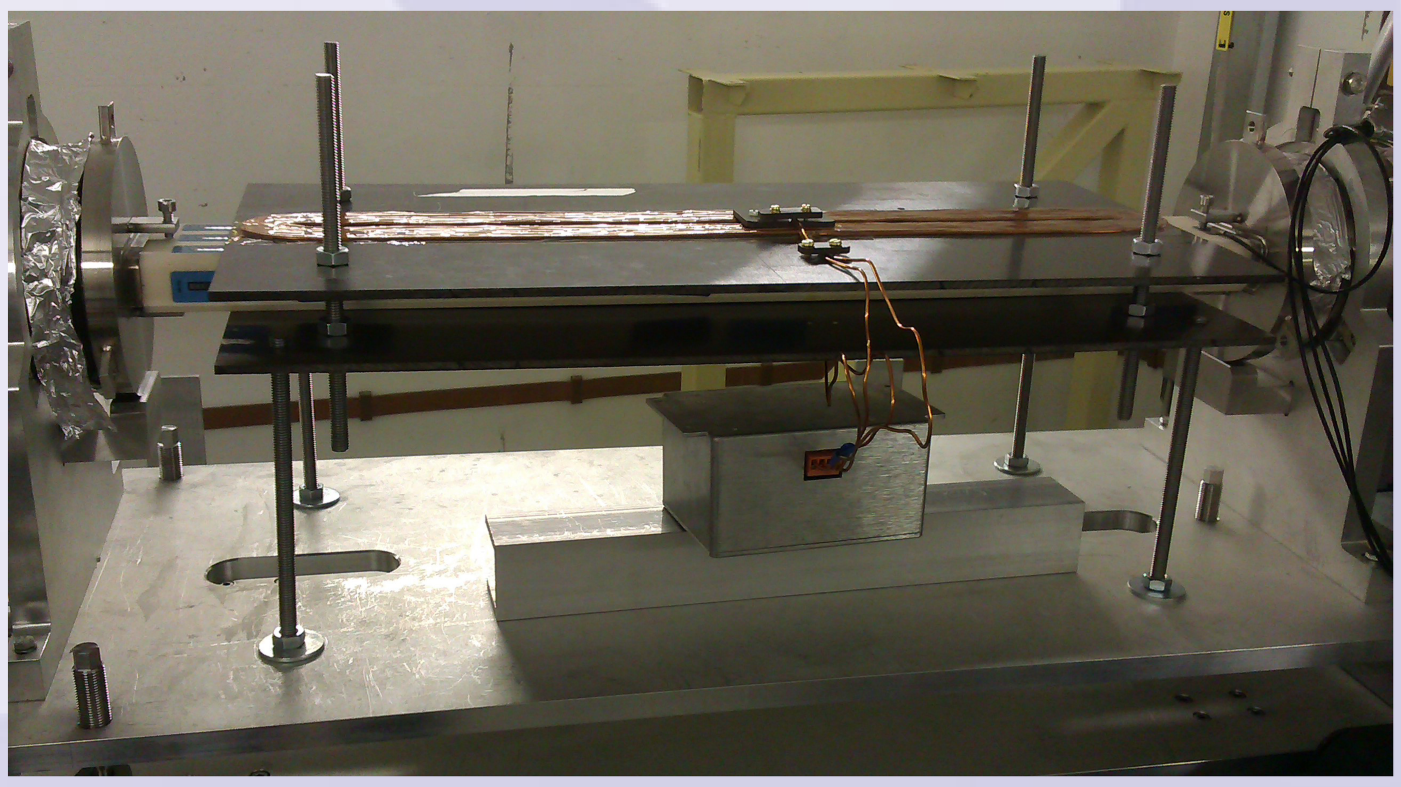
Rational

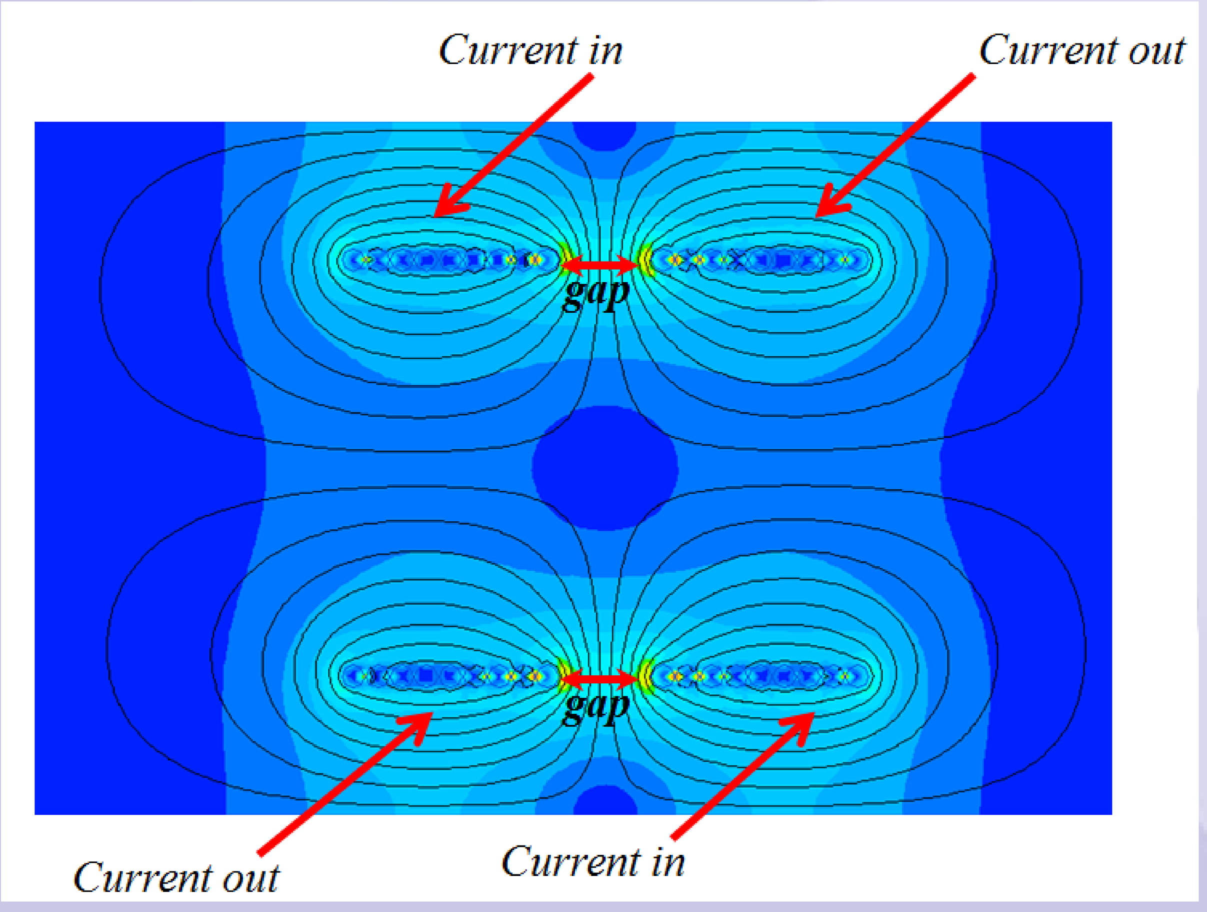
Due to machine upgrades, a ceramic vessel installed in the Diamond storage ring has become temporarily available for use. We decided to take advantage of this situation by designing and installing a simple air core quadrupole magnet.

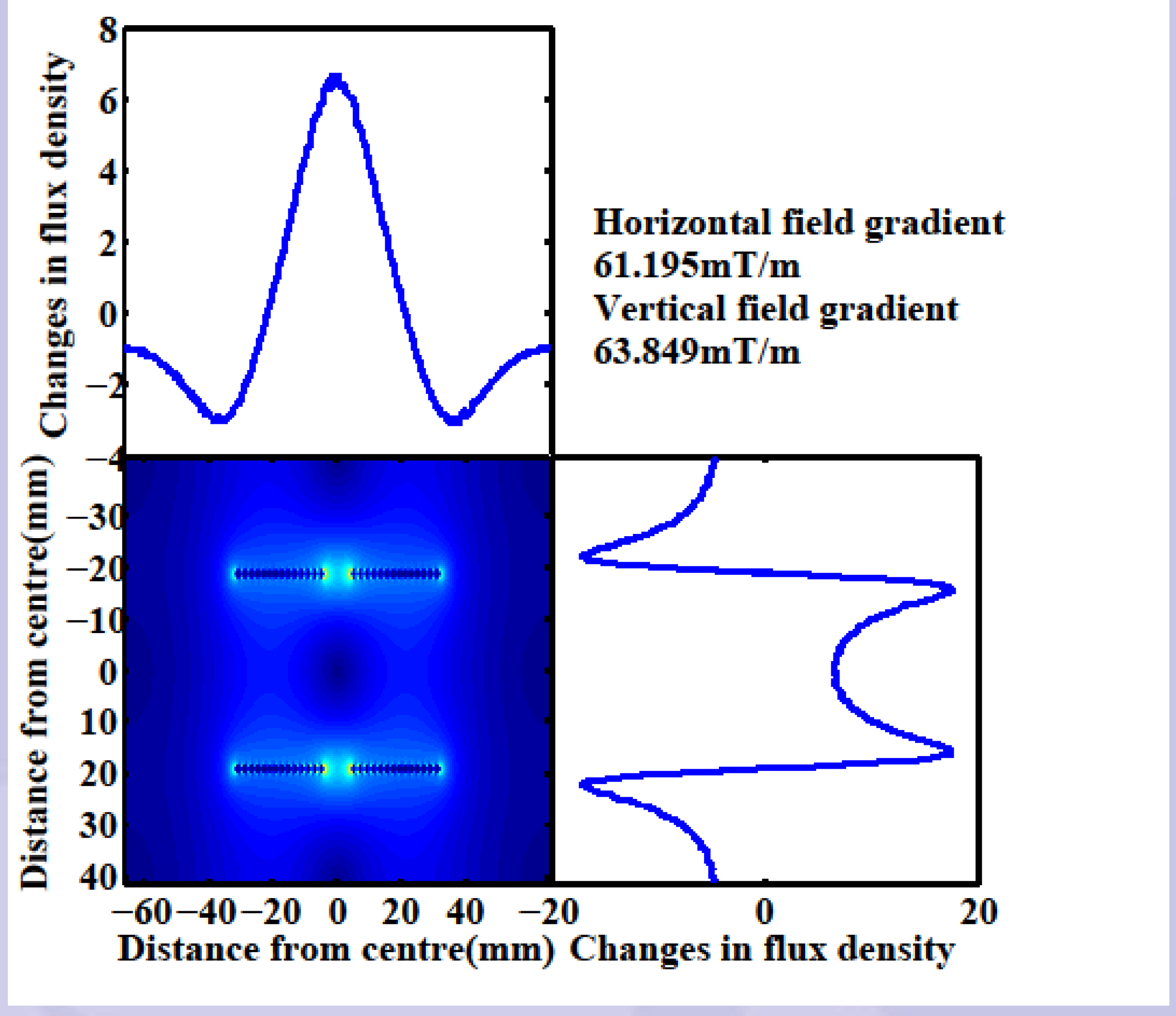
Using this magnet we hope to be able to probe hitherto unexplored behaviours of the Diamond machine with the aim of improving our understanding of non centre of mass motions of the beam.



EM simulation

The magnet is a pair of 14 turn coils with an 8mm centre gap, made of 2mm diameter enamelled copper wire.

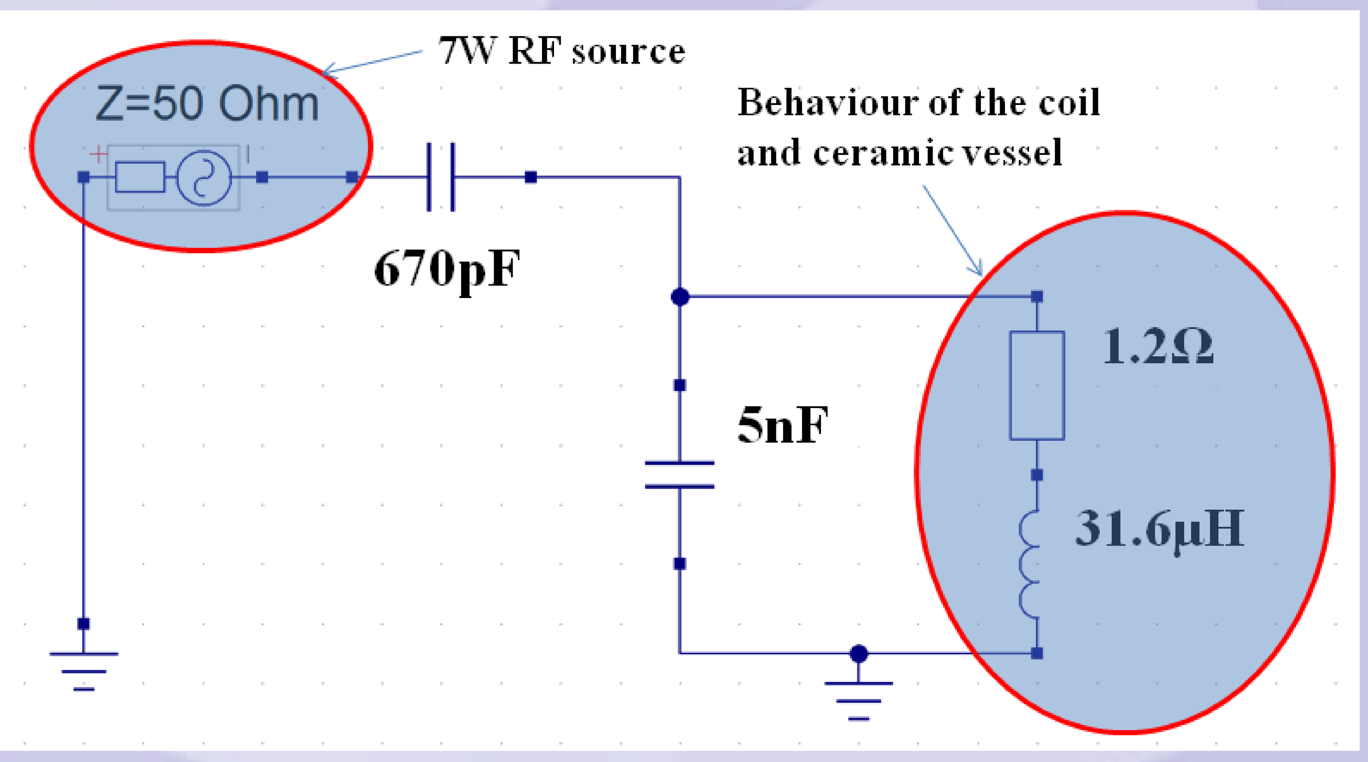




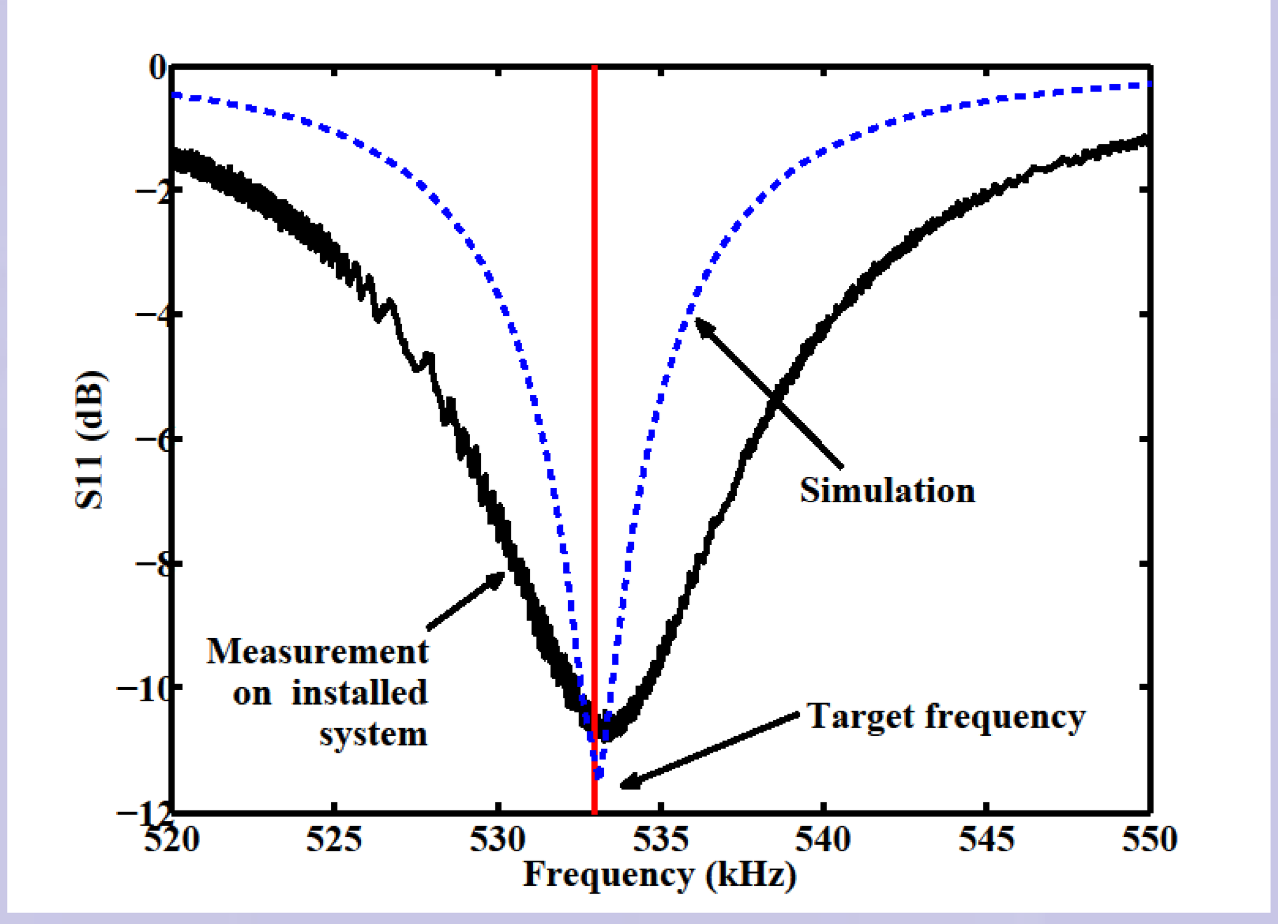
Realisation

The magnet is driven as part of a resonant circuit. There are currently 3 separate resonators each tuned to a different resonance of interest. The horizontal quadrupolar resonance (217kHz), the vertical quadrupolar resonance (384kHz), and the revolution frequency of the machine (533kHz).

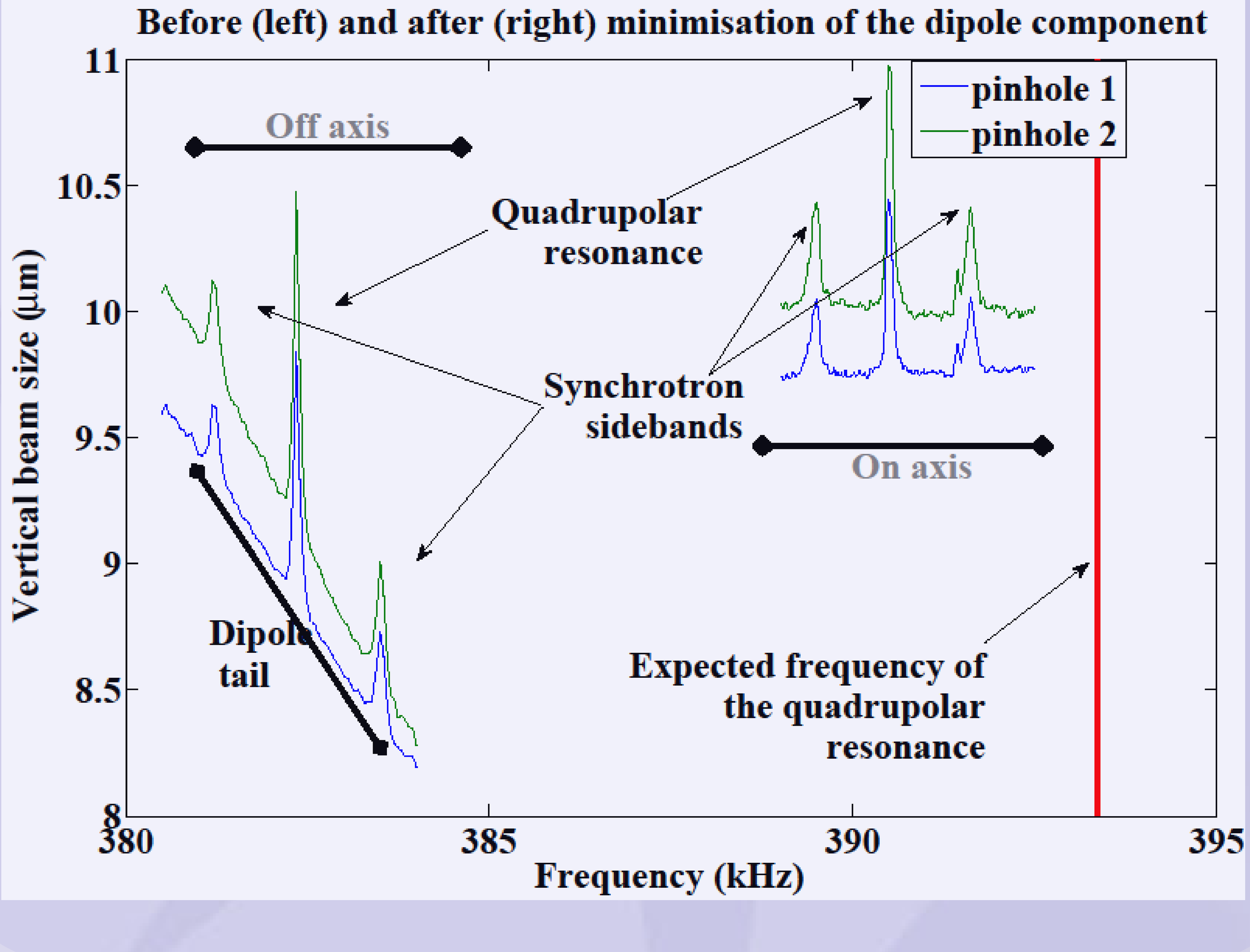
One of the resonator circuits



Verifying the magnet behaviour



Initial results



Future work

Our planned investigations broadly fall into two categories.

1) Determining how the quadrupolar tunes react to changes in machine parameters, notably current, and how this behaviour differs from the dipolar tune behaviour.

2) Apply a chirp to the beam so that each bunch has a slightly different resonant frequency to its neighbour. Thus we aim to reduce the effect of coupled bunch instabilities and increase the instability thresholds.