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Dear Calum, Janeen,

Here are some plots that suggest strategies for tweaking the current damper design to save weight. They show the contribution to the eddy current damping of rings (axial symmetry assumed throughout) within the copper block of radius R at an axial position of Z relative to the centre of the magnet. I've assumed a 10 mm long by 10 mm diameter magnet of the same stuff as the LIGO I magnets. Tube.pdf shows $R > 0.006 \text{ m} = 6 \text{ mm}$ and is relevant to the extent the magnet is in a tube. End.pdf shows $Z > 6 \text{ mm}$ and is relevant to the extent there's an end cap on the tube. If you take the volume under the surface everywhere there's copper you get the total force per axial velocity. Conversely, there's no point putting copper where the surface isn't elevated. Most of the damping is produced in a small volume extending 2-3 mm around the shoulders of the magnet. It's basically the zone where the field lines have diverged enough to point radially but not enough to dilute the field.

So the biggest single thing you could do to save weight would be to go to flatter, more disk-shaped magnets thereby eliminating the waist and all the copper next to it.

Mind you, I have to do some more calculations, but I'm betting that that magnet orientation is not at all optimum. A much better way of getting a strong sideways magnetic field is to turn the magnet sideways and have the flat side moving parallel to a flat plate.

Cheers,

Mark B.



[Tube.pdf](#)



[End.pdf](#)