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02/09/04

Preliminary Result from Cryomodule Damping Test

Explanation:

The following plots show a (not completely fair) comparison between the PZT signatures of December 03 & those taken last week after some effort went into optimizing the damping through the cryomodule (CM). MD time has been allocated to take the "control" case without the optimization corresponding to the current accelerator status. It will happen during the next few shifts.

There are 4 plots for the X/Y response to the X/Y 30 hz PZT's (G0 X/Y PZTs appear to be reversely labeled w.r.t. the 30 hz PZT). The top portion of each shows the 12/03 (red) and 02/04 (blue) PZT orbits for the entire G0 beam path, but with linacs, spreaders & recombiners stripped out. These are **Momentum enhanced** in the sense that they are multiplied by the square root of momenta at each BPM. The middle portion shows the first 30 BPM's, roughly the whole Injector plus beginning of Arc 1 (NL is removed). The bottom portion shows all Hall C BPMs.

Unfortunately as I looked through the AllSave made during Owl shift on Thursday when supposedly all optimization including A). 5 MeV changes to achieve max. damping through the CM, and B) 60 MeV matching to restore downstream optics, Only (A) was saved. The machine after the CM had been inadvertently reverted back to nominal[1]. Thus the orbit seen here up to the 10^{th} BPM reflects the changes aimed at optimization, while that after the 10^{th} BPM really depends on whether this data was taken before or after the said reversion. Thus although it appeared that in many cases the PZT responses seem much reduced compared to last December, I cannot say with 100% confidence that this was due to the downstream matching, or part (B) above. All I can say is that if the damping seems to improve up to the 10^{th} BPM, it can be attributed to this effort. By the same token, if the damping seems to deteriorate after the 10^{th} BPM, it is not necessarily indicating that this effort failed, since the downstream matching might have already been undone before this data was taken during Thursday Owl/Day.

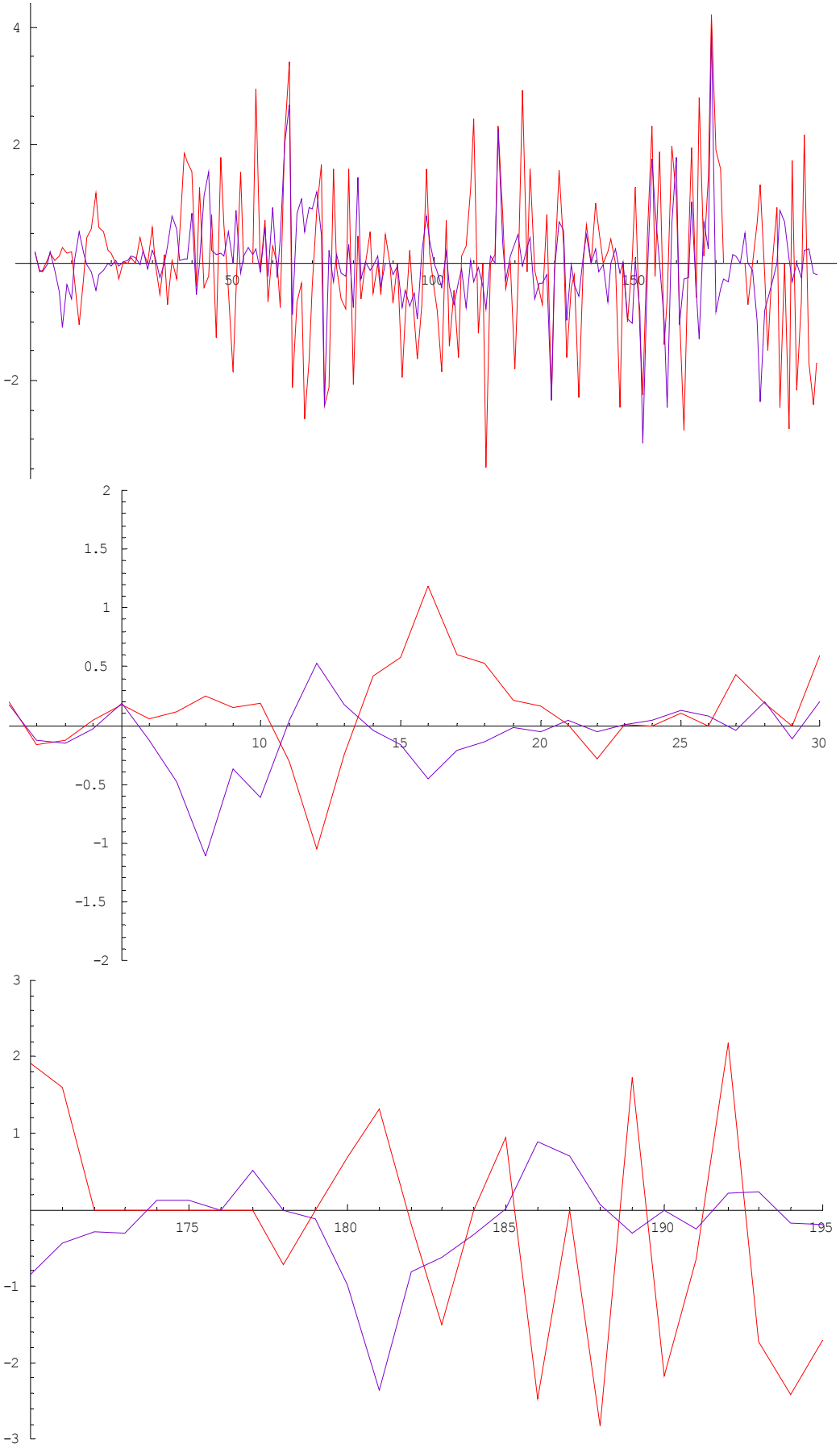
Nonetheless, several points are still worth noting:

1). A lot of time has been devoted to making the Injector 30 hz signal stable by Richard Dickson, Pete Francis and the operators. This was supported by offline analysis. The result was significantly improved signal reproducibility, and my ability to spell out in the test plans exactly what steps to take to achieve this. We should not be hampered by this problem in future tests.
2). Apart from the uncertainty about whether the data says anything beyond 60 MeV, my personal impression is that the effort to optimize damping through the CM did have an effect in reducing the PZT amplitude afterwards.
3). It is quite clear that we are also losing damping in many cases across the cryounit (between 6^{th} & 7^{th} BPMs). This in some cases was remedied by optimizing damping later through the CM.

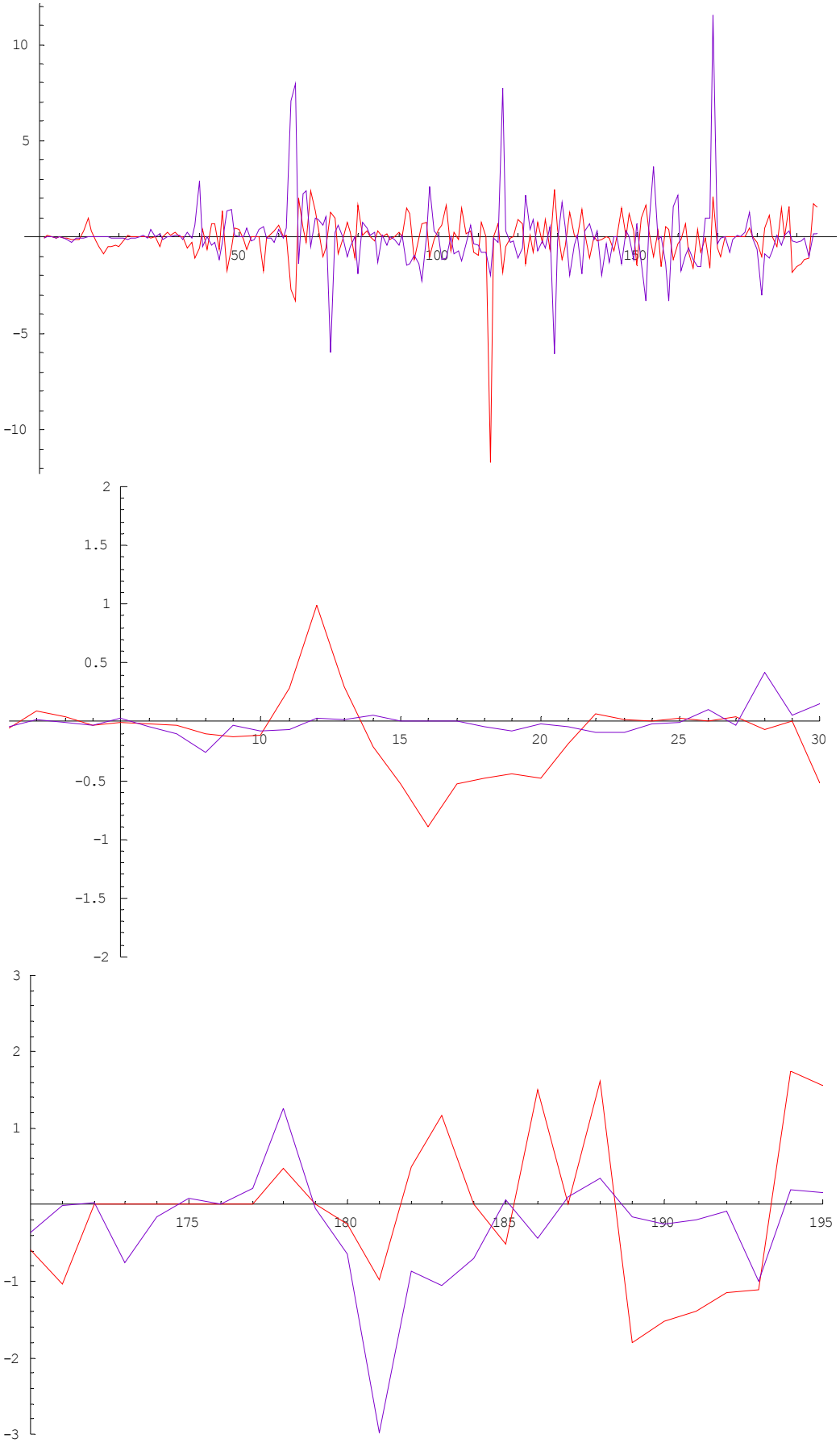
I believe the next step is a dedicated test with concerted effort between G0 and accelerator. Namely, we need to use G0 measurements as final validation (and I'll keep closer look on the quad restoration).

[1] One suspect for this was the Multiharp Tool which restores all quads upon exit, even if they have been deliberately changed. This problem will be corrected. Other possibilities could involve any BURT restore to an earlier configuration without my knowledge. This optimization activity was scattered over the entire Owl & part of Day shifts amidst machine restoration.

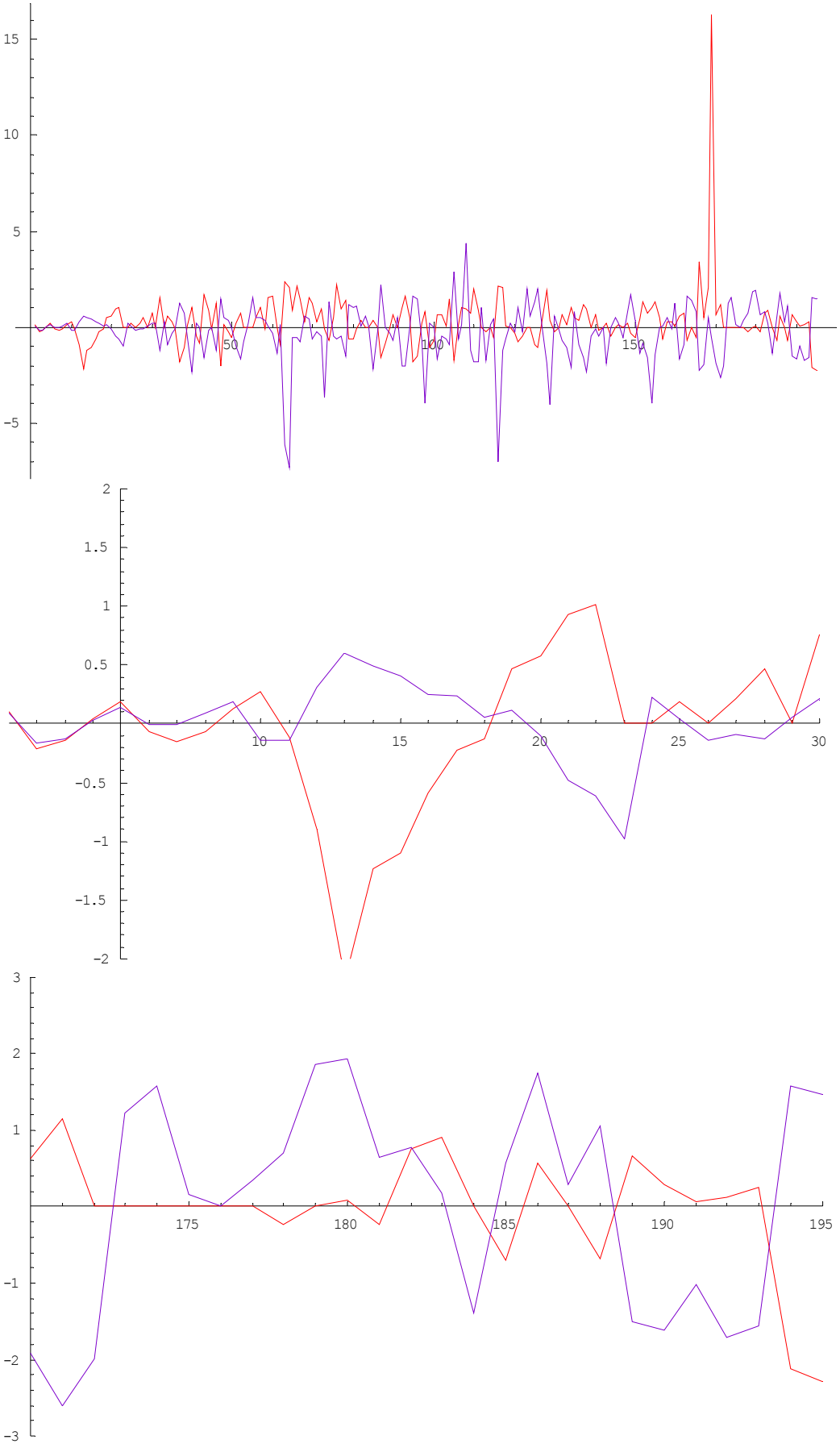
X resp. to Y PZT: Global, Inj. & Hall C (Red 12/03. Blue: 02//04) **Momentum enhanced**



X resp. to X PZT: Global, Inj. & Hall C (Red 12/03. Blue: 02/05/04) **Momentum enhanced**



Y resp. to X PZT: Global, Inj. & Hall C (Red 12/03. Blue: 02/05/04) **Momentum enhanced**



Y resp. to Y PZT: Global, Inj. & Hall C (Red 12/03. Blue: 02/05/04) **Momentum enhanced**