

As stated in my last email, all the numbers presented as outcome of the steering configuration optimization need to be put in the context of plots for residual orbits, which, together with cost estimates, I feel are necessary for a logical decision on what to do. It is cumbersome to present all 50 graphs as the basis for making this decision. So I try to distill the information from these plots into the following points, hoping that they capture the essence of each type of change invoked.

I also mentioned that the higher arcs as I went seemed to behave better. It turned out that this happened even earlier, but escaped me in the frenzy. Basically the 3σ residual orbits I quoted were more true for Arcs 1 & 2, and somewhat pessimistic for higher arcs in Y. A single number signifying the peak value also didn't do justice to the global trend. So let me try to present a more complete picture with the following points.

- The “net” changes quoted are used to address major configuration defects, be it blind spots or singularity. Their effects are significant. We are unlikely to get around them.
- In the [horizontal](#) plane the optimized configuration, with roll error σ at 1 mrad, presents the following picture:
 - In [arc proper](#), basically all 3σ residual orbits are below 1 mm.
 - In S/R the major isolated 3σ peaks, after configuration correction, are at 1.2-1.6 mm. My quote of 1.8 mm was off by varying amounts depending on the arc.
- The BPM shifts are all used to address [vertical](#) orbits in the arcs. Their effects are described below.
 - In Arcs 1 & 2, the BPM moves bring the vertical 3σ peaks from 3.5 mm to 2.5 mm as I said yesterday, if the roll error σ is 1 mrad.
 - In Arcs 3 and up, there used to be the before/after vertical 3σ peak numbers of 1.2 mm \rightarrow 0.4 mm with roll error σ at 0.267 mrad. With roll error at 1 mrad, this is close to something like 2.5 mm \rightarrow 1.5 mm, not as bad as Arcs 1 & 2. The structure of the peaks also becomes quite different.
 - The above description is confined to the arc proper, while one can still have \sim 2.0 mm vertical peaks after optimization in the S/R, such as in Arc 4.
 - A typical example of Arc 8 is given below graphically to give you what numbers alone can't. Case of roll error σ at 0.267 mrad is also included.
 - Thus one can conceivably argue that the BPM shifts produce great gain with roll error σ at 0.267 mrad, and less dramatic, while still considerable, gain with roll error σ at 1 mrad. For Arcs 4 and up the final peaks are at 1.5 – 2.0 mm level.
- The corrector strengths needed to handle 3σ errors stand until reality check is concluded. One may argue however that since the 3σ orbit errors are smaller now in some cases, one may be able to allow a corrector to max out without making the orbit too much worse. But I don't know how to estimate this other than using simulation.

The orbit picture thus may be less harsh than presented yesterday with catch-all numbers. If the above is still not enough for reaching a decision (together with costs of course), then maybe we need to look at the graphs one by one in detail.

Example of ARC 8 Vertical Optimization (note different scales)

