LHC phase 1 upgrade: news

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Multipole errors for the final focus

For the new quadrupoles a random distribution is generated using the geometric average of the random multipole errors of MQXA and MQXB. The systematic part is always much smaller than the random because the design process is able to elimate them.
This average is scaled accordingly to the maximum aperture allowed by the gradient and the assumed peak field:

$$b_n \rightarrow b_n (a_{old}/a_{new})^{n-1}$$

at the same reference radius.
A further scaling is applied due a forseen increase in the relative precision in the coil positioning because of the larger aperture. The results is then

$$b_n \rightarrow b_n (a_{old}/a_{new})^{n}$$

at the same reference radius.

Multipole errors for the separation magnet

The errors are not taken into account. A design of such magnet does not exist yet. It is still debated if D1 should be warm (very good field quality) or cold.

Tracking

A mask file for all the options is ready and some results are available.
They use the machine as installed with a random distribution generated by the uncertainty in the measures.
The implementation of the final focus distribution is done in two ways:
putting an externaly distribuition of the errors in the measured error tables and use the same reference radius;
generating a distribution directly in the mask using a different reference radius accordingly to the different aperture of the magnets.
The second way should give a bit more flexibility and it is a good sanity check for the first one.
No multipole correction and coupling correction is performed. No beam-beam effect is included.

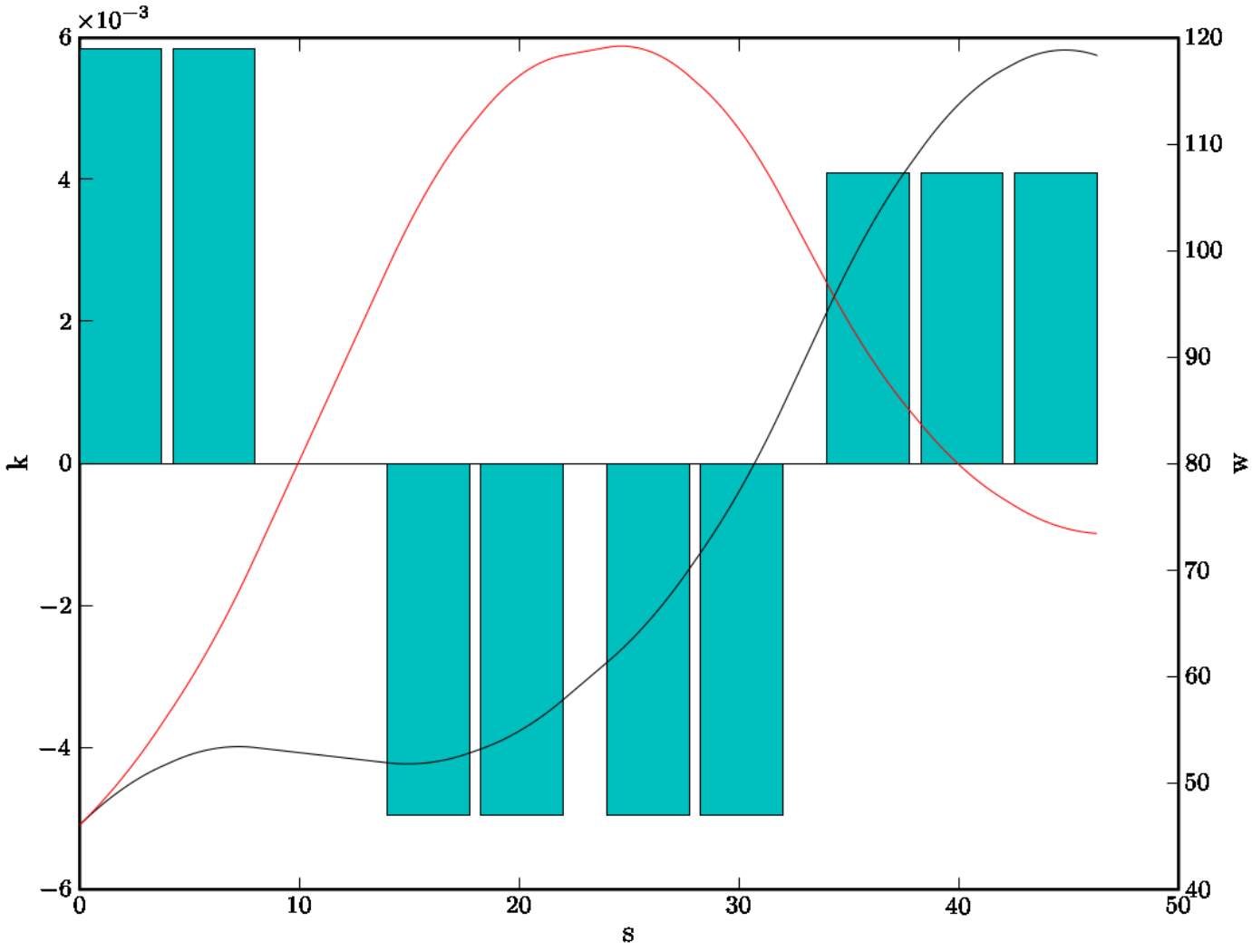
DA results

The results are still to be understood completely. There are some unconsistency to be understood.
The DA anyway seems very good for all the options and possibly compatible with the absence of a multipole corrector package ($> 12\sigma$ is enough?).
The DA seems to be almost the same for compact and lowbetamax.

New modular option

The modular option has some drawbacks. The beam-beam effect is worse due its quadruplet nature. The DA seems worse too.
It is possible to modularised the compact or the lowbetamax option, but I'm attempting to redesign the modular with in mind the beam-beam effect since the beginning.
The idea is to use a first quadrupole, then a strong orbit corretor and then a doublet.
The first orbit corrector should be able to separate the beam at the following long range interaction. The increase of required aperture should be absorbed by the aperture margins of the quadrupoles.

New modular option



k1=136T/m k2=115T/m k3=95T/m betamax=12.4km l=3.75m

New modular option