High Luminosity LHC

Latest tracking results from CEA

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Thanks to R. De Maria & M. Giovannozzi

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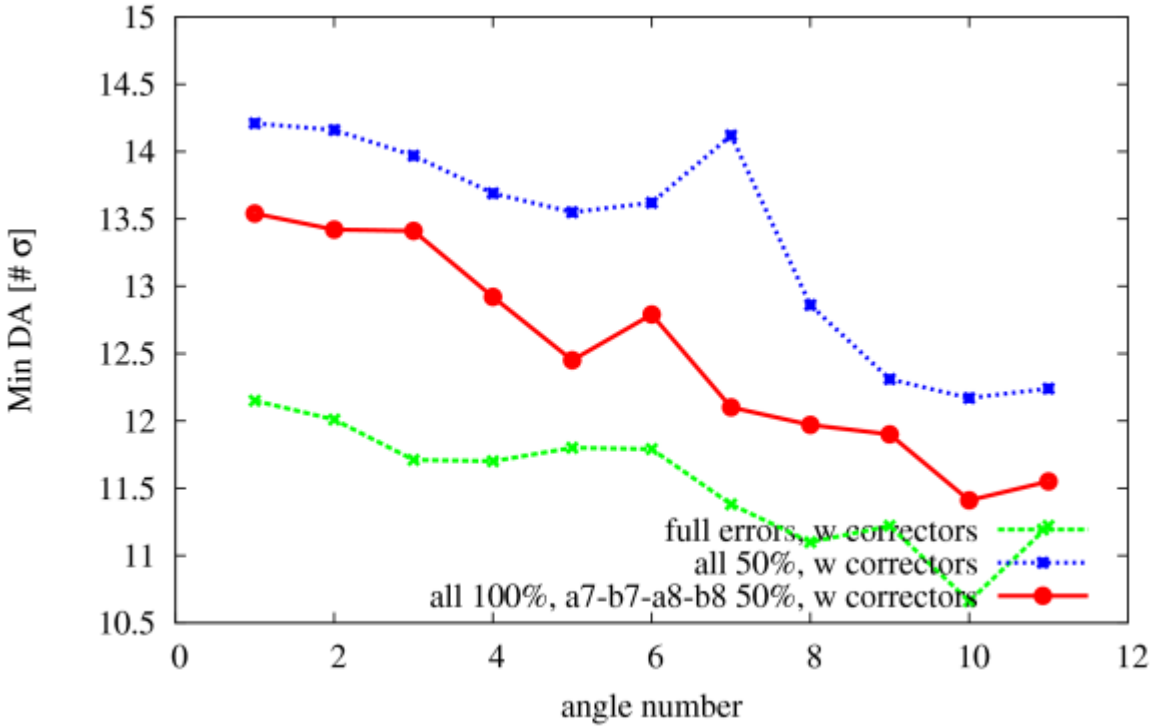
Field Quality Study

- LHC v3.1b @ collision (round beam with $\beta^* = 15$cm)
- Beam normalized emittances 3.75 10^{-6} m.rad
- Momentum : 2.7 10^{-4}, (max allowed 2 10^{-3})
- Search for the error set which gives the largest average of the DA
- Standard errors and corrections for the arcs
- IT errors : slhc/errors/IT_errortable_v2
- Corrections b3, b4, b5, b6, a2, a3, a4, a5, a6 turned on for the IT and D1 (corr_tripD1_v1 S. Fartoukh; M. Giovannozzi, S. Fartoukh, R. De Maria, WEPEA048, IPAC'13)
- The error amplitudes can be divided by 2, at most
- DA for 11 angles $(0,\pi/2)$, 13 amplitudes (10σ, 22σ, step 1σ), 60 particles, 100000 turns, 60 error seeds

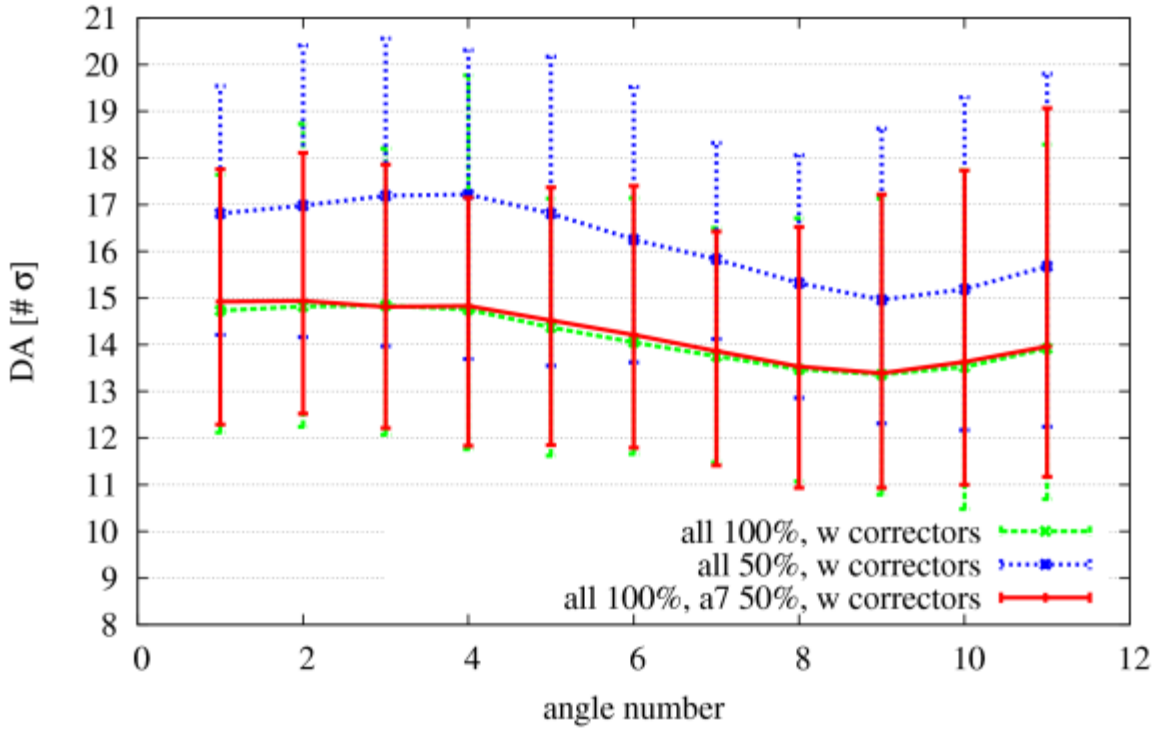
Reduction of the b7, b8, a7, a8 harmonics only



- The reduction of b7, b8, a7, a8 **only** is **not** sufficient to reach the blue curve (we gain ~1-1.5σ).

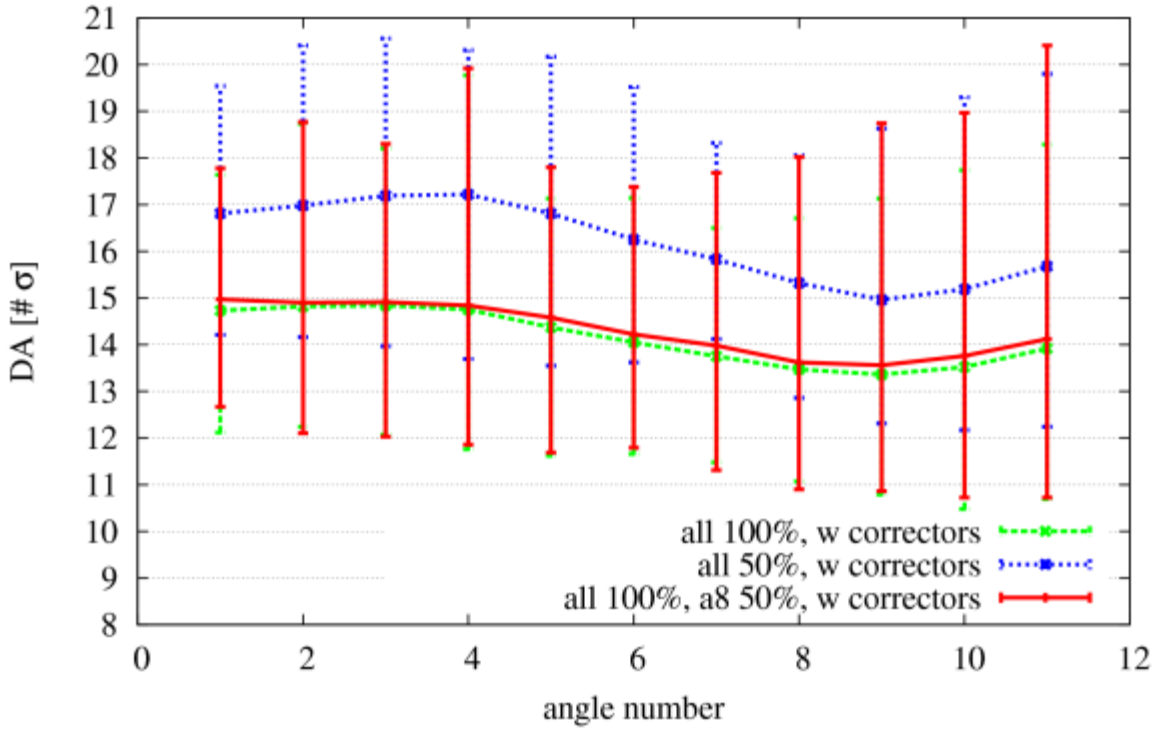
Task.2.3 meeting 07/06/2013

Reduction of the a7 harmonic



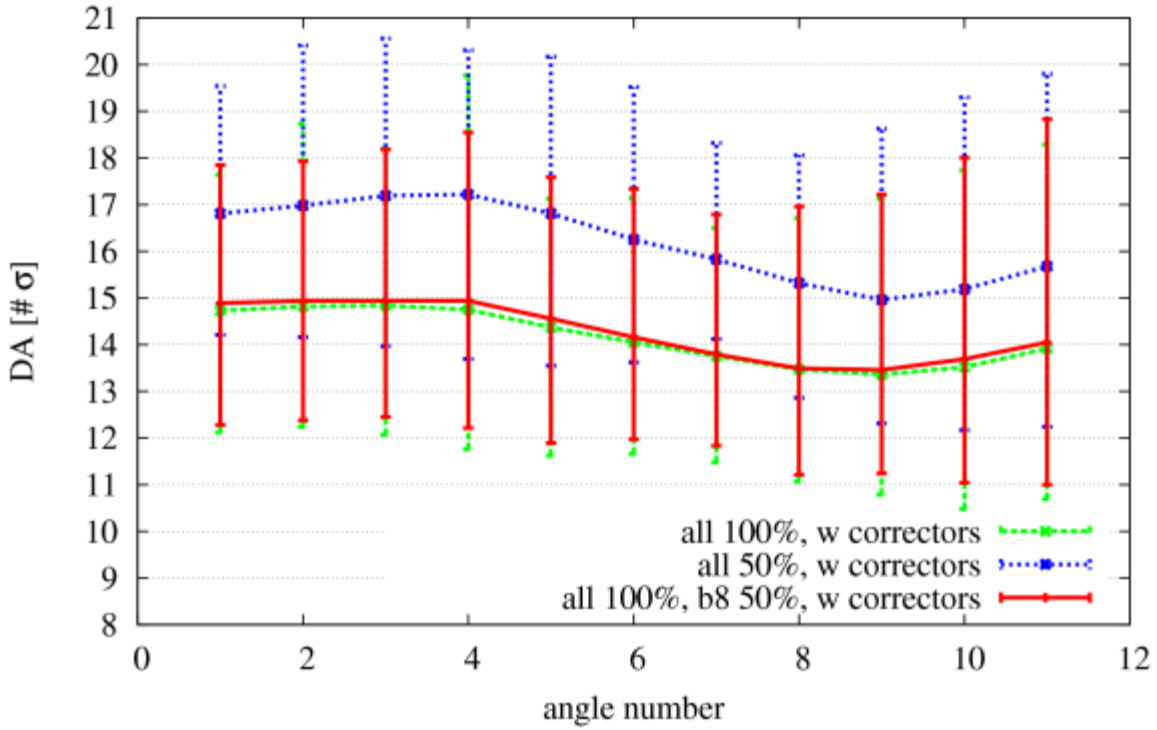
- The contribution to the DA of a7 at 50% alone is very small.

Reduction of the a8 harmonic



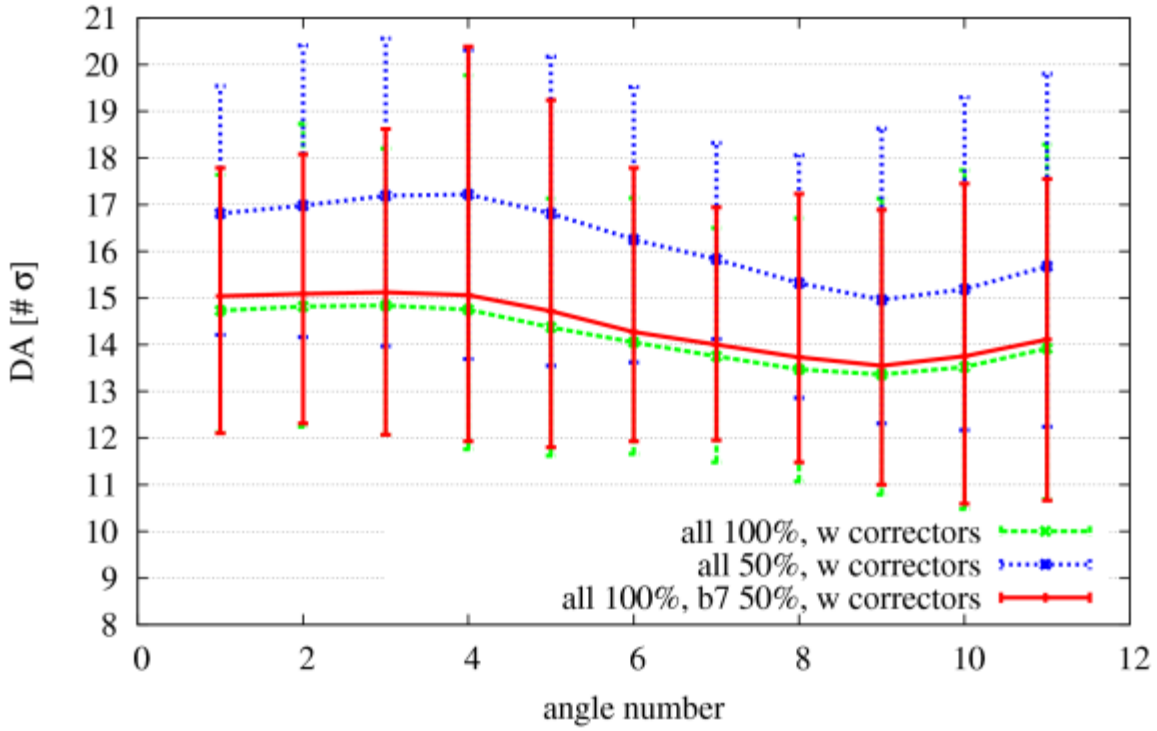
- The contribution to the DA of a8 at 50% alone is visible at large angles.

Reduction of the b8 harmonic



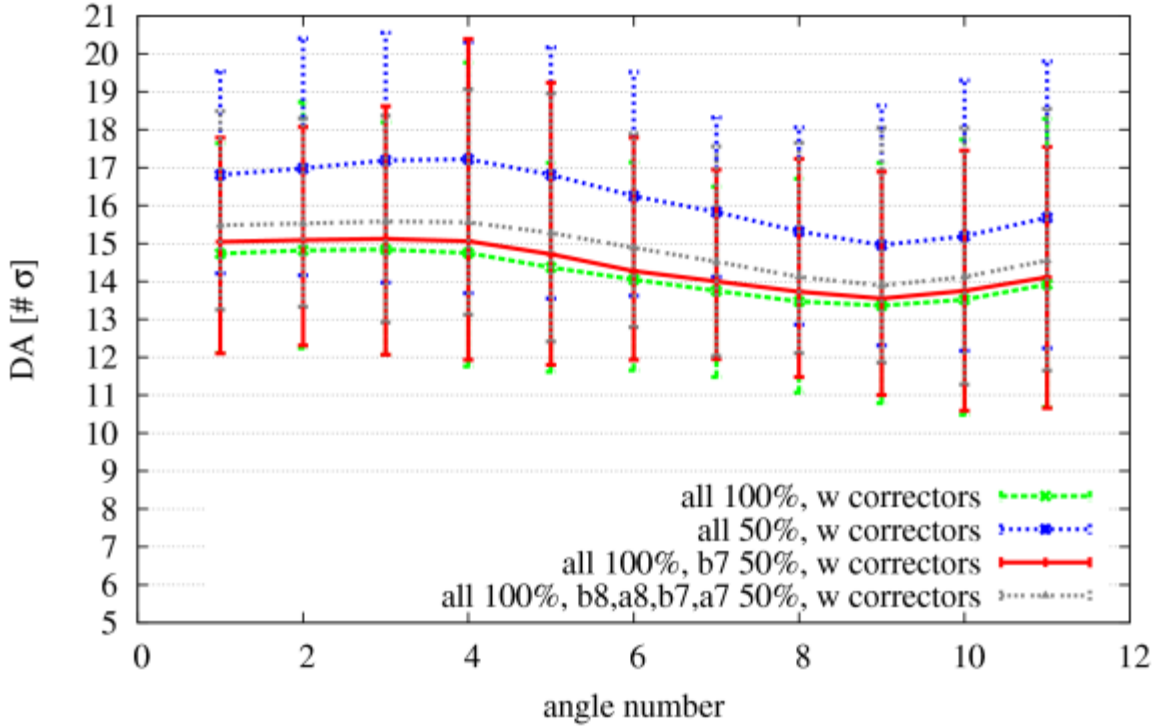
- The contribution to the DA of b8 at 50% alone is small.

Reduction of the b7 harmonic



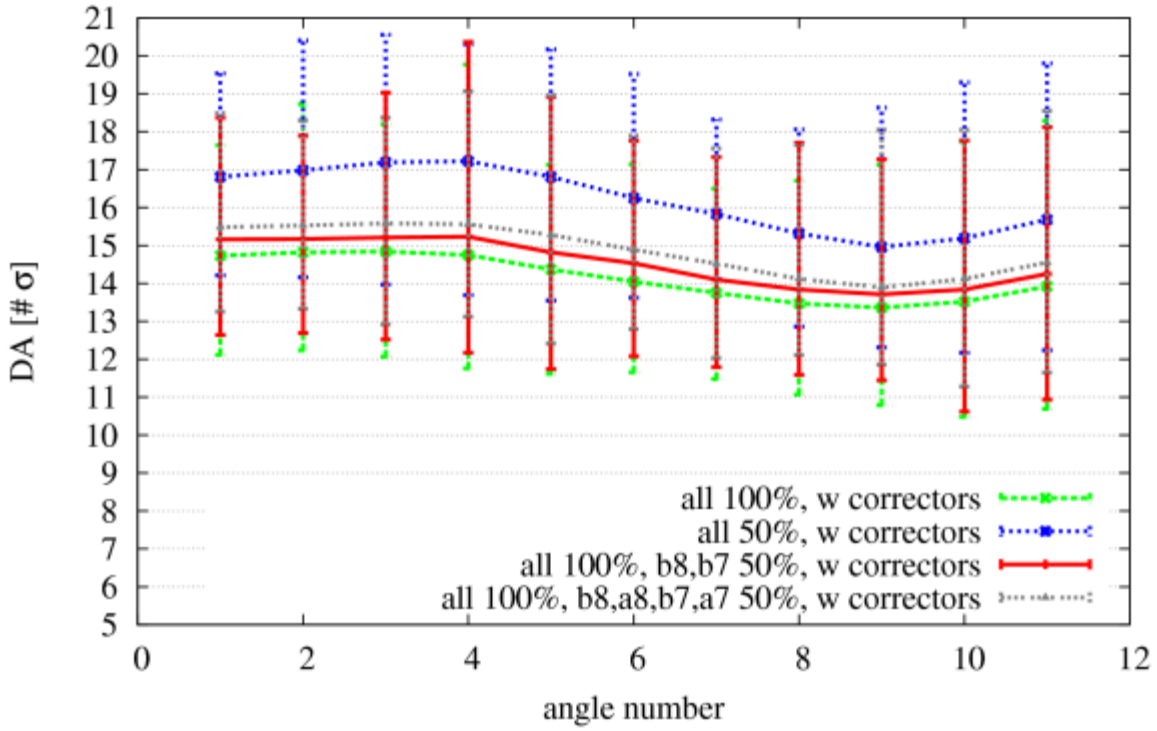
- The gain on the average DA given by b7 at 50% alone is the most important.

Reduction of the b7, b8, a7, a8 harmonics



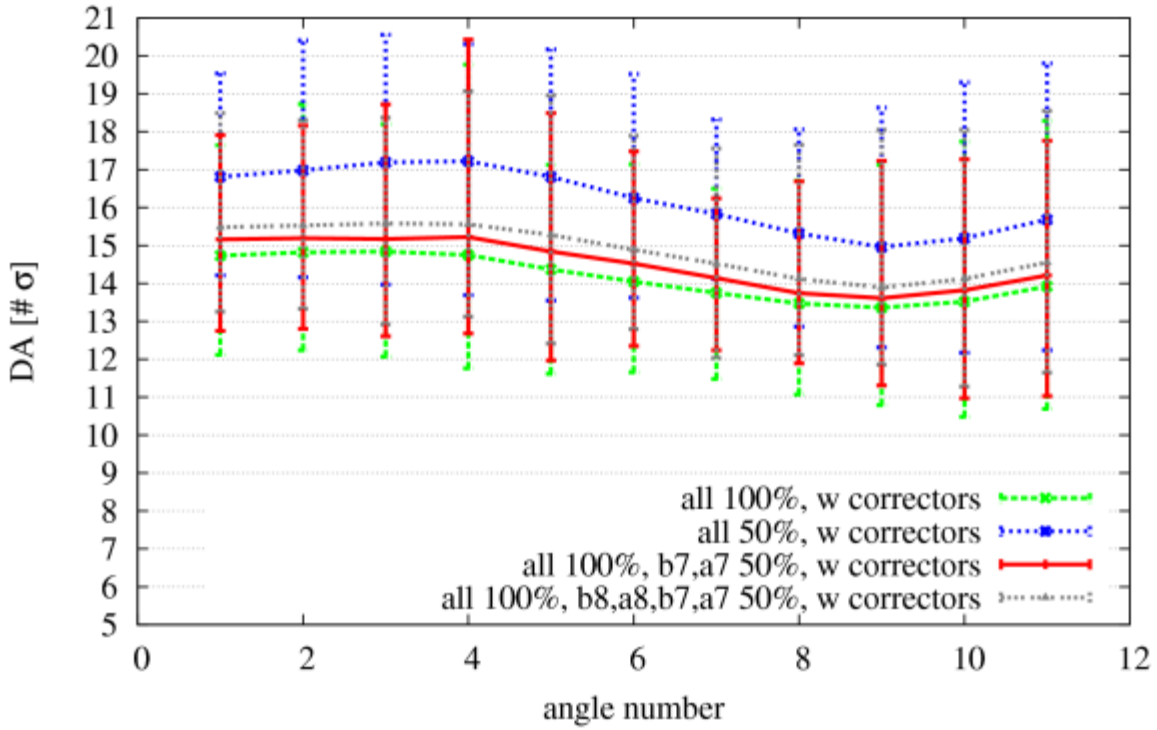
- The gain on the average DA is about 1σ with b8, a8, b7, a7 at 50%.
- b7 alone at 50% gives the most visible effect on the average DA with respect to the other ones.

Reduction of the b7, b8 harmonics



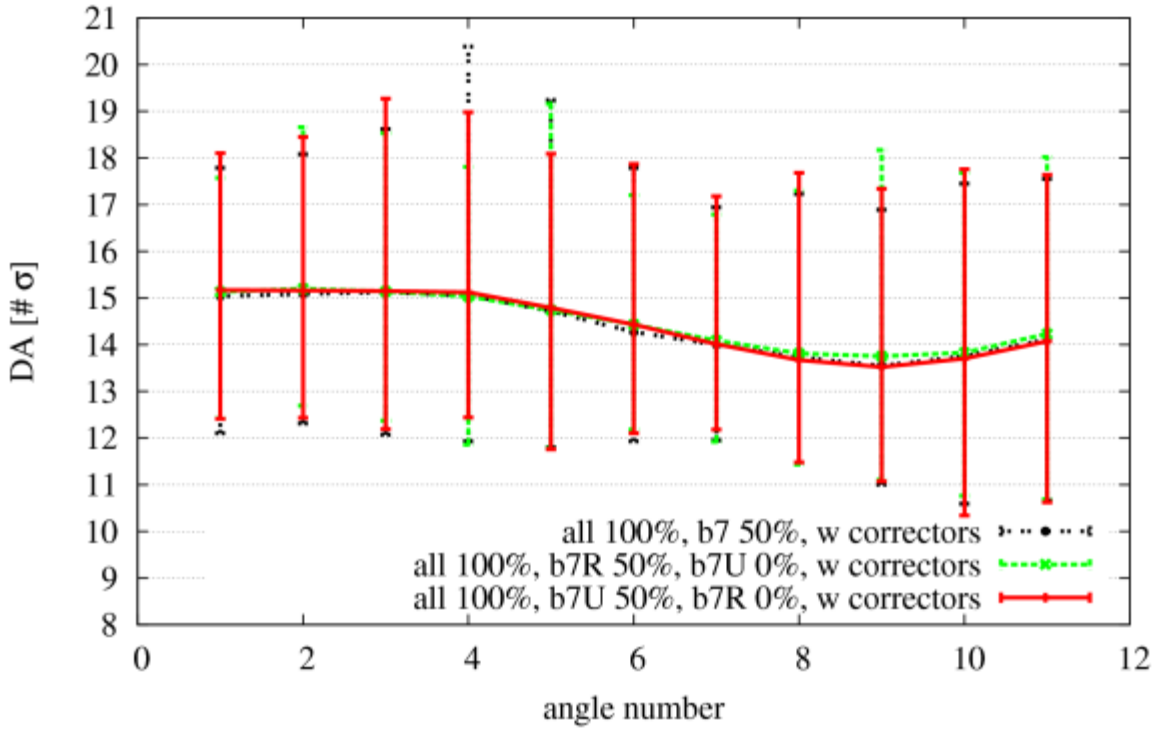
- The combination of b7 and b8 at 50% gives about half of the gain obtained with b7, b8, a7, a8.

Reduction of the b7, a7 harmonics



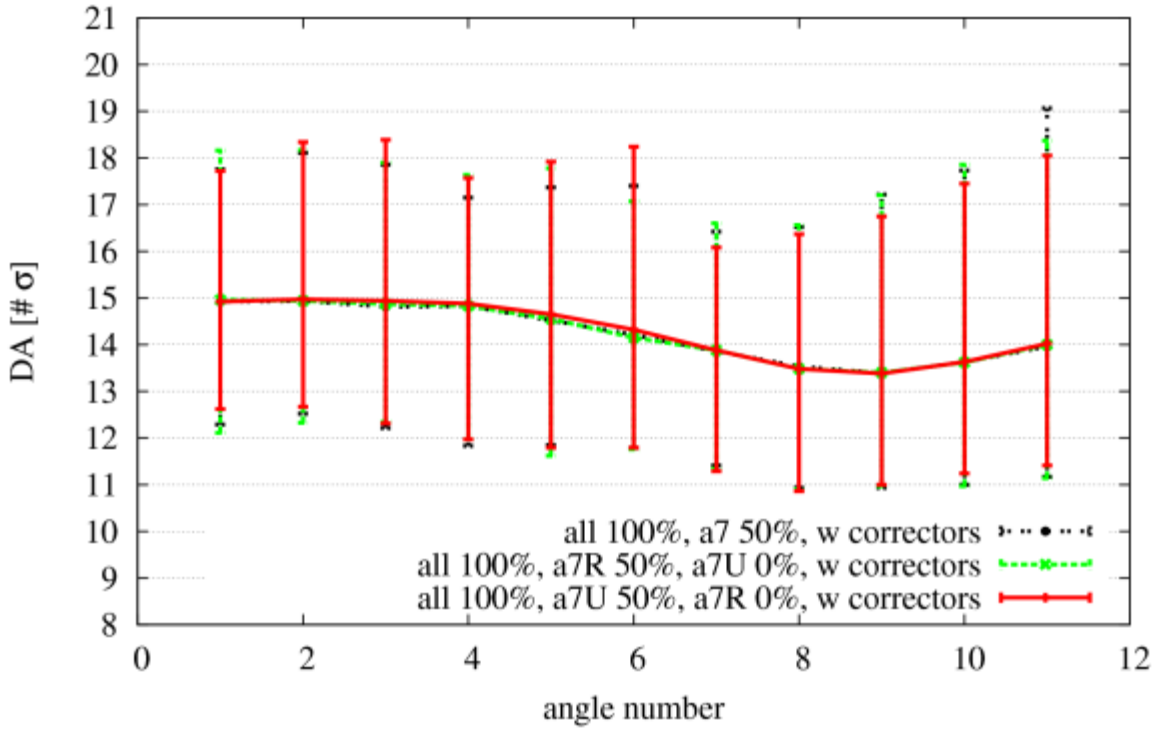
- The combination of b7 and a7 at 50% gives about the same gain as b7 and b8 together.
- The combination of the harmonics adds not linearly.

Error components of the b7 harmonics



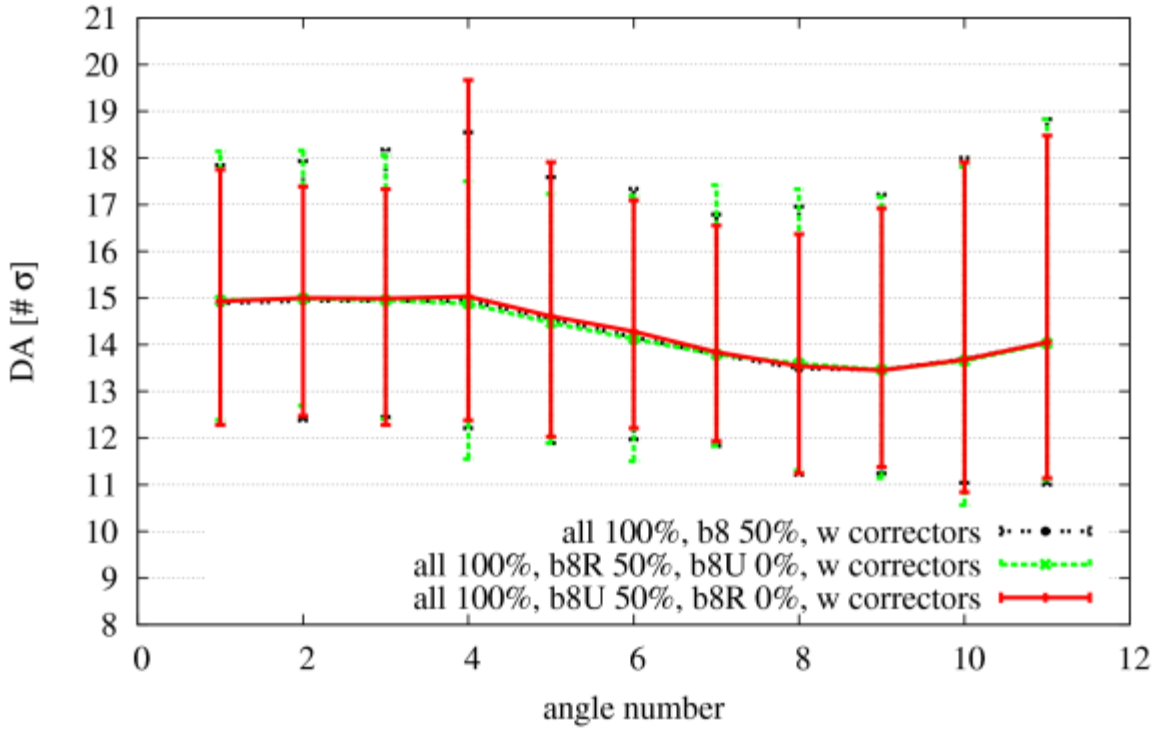
- $b_7 = \xi_U \frac{0.168}{1.5} + \xi_R 0.168$, where U applies to all magnets of a given class, R changes from magnet to magnet for a given seed.
- There is no clear difference between the U and R contribution, moreover each of them is very similar to their combination (…?...)

Error components of the a7 harmonics



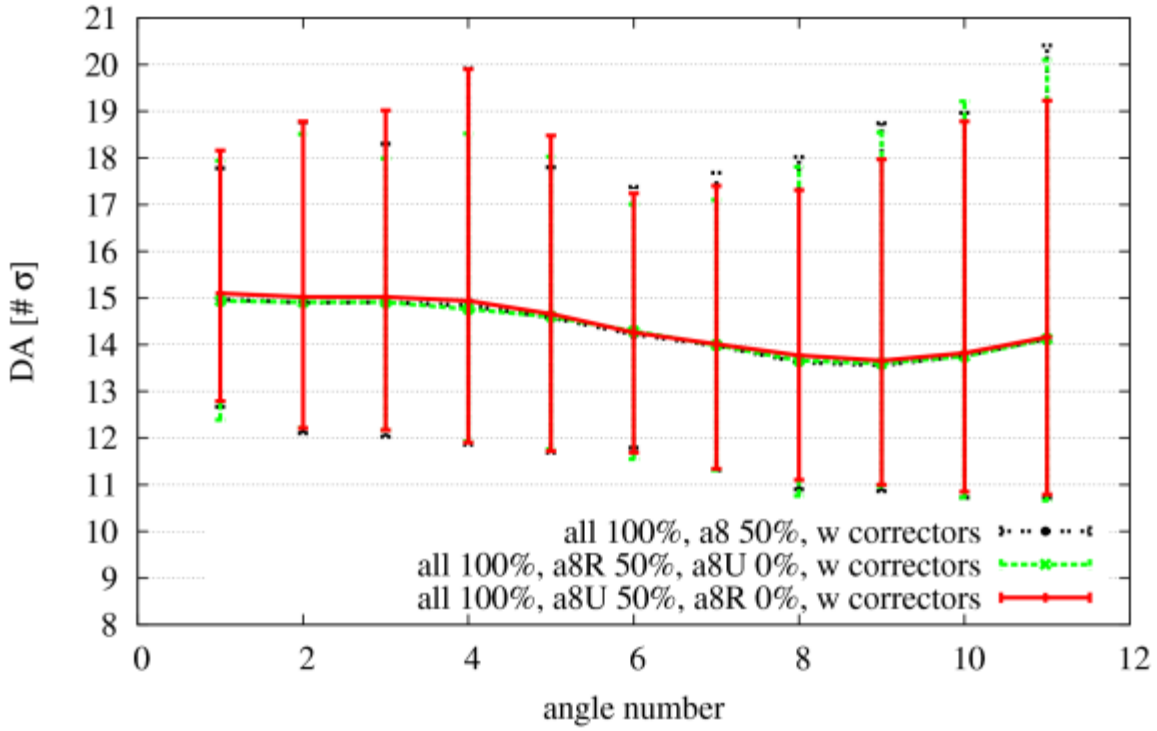
- $a_7 = \xi_U \frac{0.168}{1.5} + \xi_R 0.168$
- Same behavior as before

Error components of the b8 harmonics



- $b_8 = \xi_U \frac{0.128}{1.5} + \xi_R 0.128$
- Same behavior as before

Error components of the a8 harmonics



- $a_8 = \xi_U \frac{0.128}{1.5} + \xi_R 0.128$
- Same behavior as before

Summary

- The reduction of the harmonics b7,a7,b8,a8 up to 50% together gives a gain of ~1 σ on the average DA.
- b7 alone seems to give the most important contribution to the DA gain but the addition of the harmonics enhances their singular behavior .
- The contribution of the U and the R components alone (b8,a8,b7,a7) on the DA is the same and is the same of their total as well.

To do

- Determination of the minimum reduction to these multipole leading to a sensible increase of the DA (0.25σ, 0.5σ,… ?)
- Check the IT_errortable_v3
- Switch to HLLHCV1.0 lattice

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