Preliminary tuning studies for CLIC-BDS L*=6m.

Eduardo Marin

LCWS11, Granada, Spain
27 September, 2011

Acknowledgments to G.Zamudio, B.Dalena, A.Latina and R.Tomas

Why L*=6m ?

- Lengthening L* to 6 meters allows to locate QD0 outside the detector.
  - More simple, robust and stable solution.
  - No interference detector-QD0.

Why not a L*=6m ?

- A luminosity loss is unavoidable
- Synchrotron radiation rises up

Luminosity

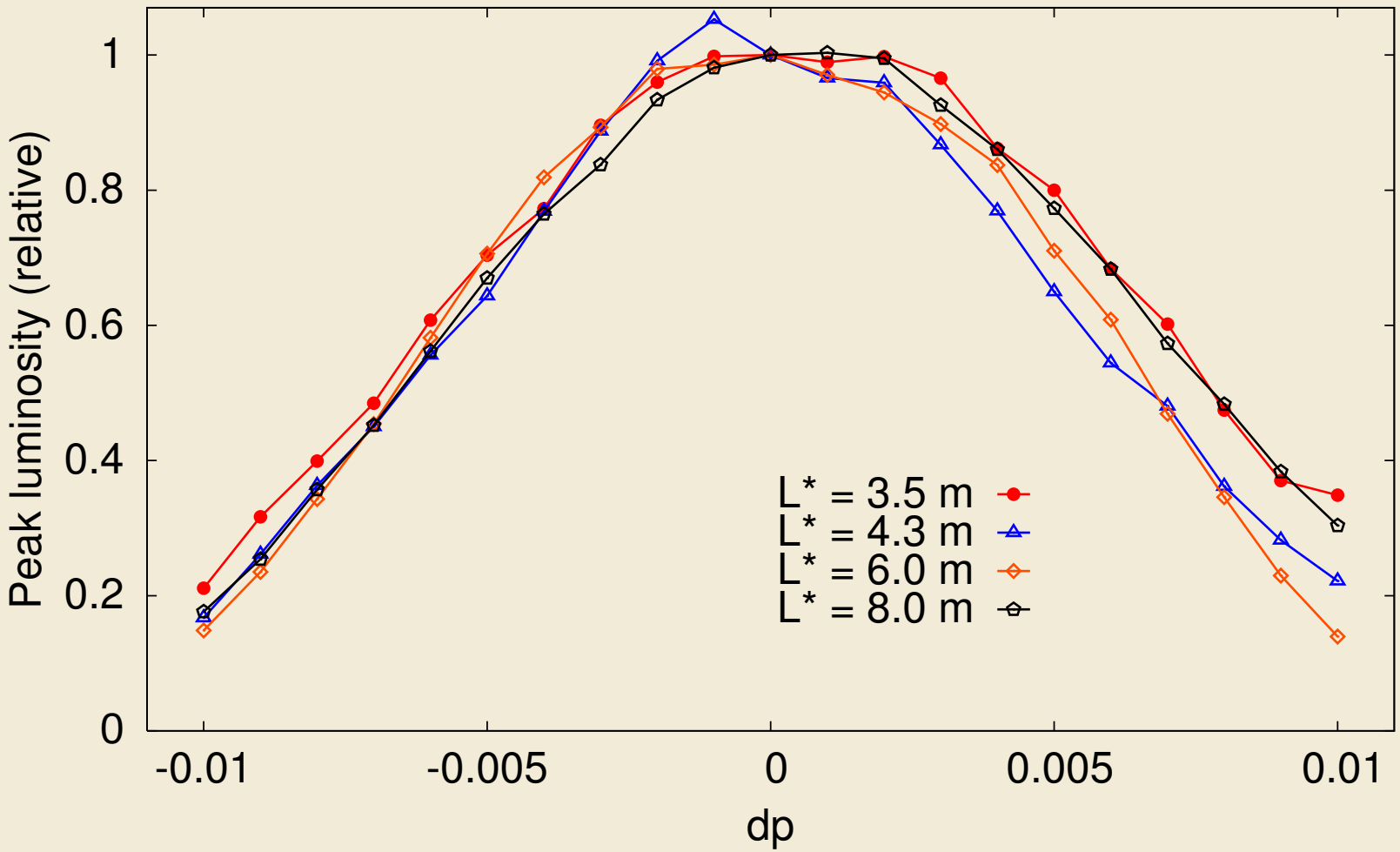
L*	Total Luminosity	Peak Luminosity
[m]	$[10^{34} cm^{-2} s^{-1}]$	$[10^{34} cm^{-2} s^{-1}]$
3.5	6.9	2.5
4.3	6.4	2.4
6.0	5.0	2.1
8.0	4.0	1.7

$L_{total} \approx 17\%$ lower than required. $L_{peak} \approx 7\%$ higher than required.

Beam size at the IP

- σ_x^*=49nm ($\approx$ 22% higher than required)
- σ_x^*=1.06nm ($\approx$ 5% higher than required)

Bandwidth



The bandwidth is comparable to all others designs.

[1] *Plot produced by G.Zamudio*

CLIC-BDS L*=6m

- Transverse misalignment to all BDS components.
- Using quadrupoles and sextupoles as tuning variables.

Pre-alignment	Iterations	Success ratio [%]	
[μm]	[10^3]	80%L_0	80%$L_{0req.}$
5	10	68	75
6	11	91	91
7	12	90	93
8	11	81	92

- 10000 iterations can be afforded by a time luminosity measurement $<$1s.
- A pre-alignment of 8 μm it is challenging to reach.
- The tuning performance is not the appropriate.

Strategy

- Step 1: to apply 1to1 steering for both x and y plane.
- Step 2: to apply DFS steering for both x and y plane.
- Step 3: to scan sextupole tuning knobs

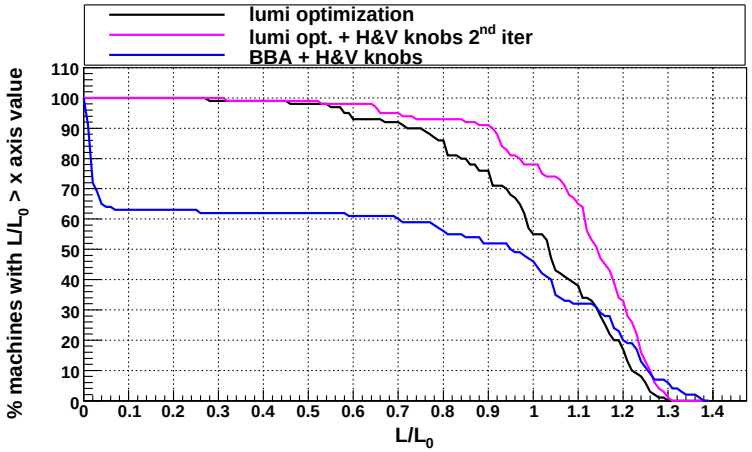
Algorithm features

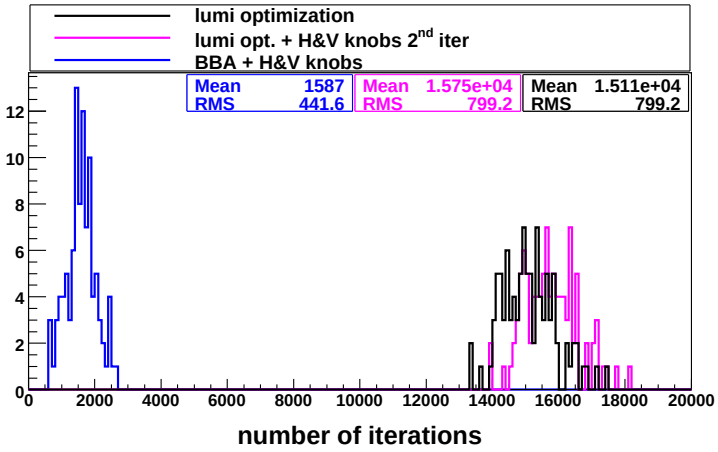
- Each step is characterise by an optimum parameter, which applies the appropriate correction gain.
- A parameter optimisation study needs to be done for each lattice.
- All these steps are iterated until the luminosity convergence is reached.

Initial conditions

- Synchrotron radiation is activated.
- All BDS components (except bendings) are randomly misaligned by σ =10μm.
- The study is formed by 100 machines.
- Both electron and positron machines are identically misaligned.

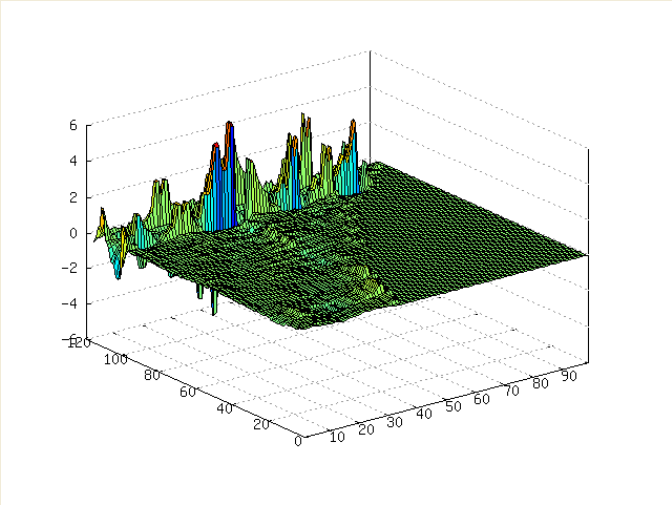
CLIC-BDS L*=3.5m





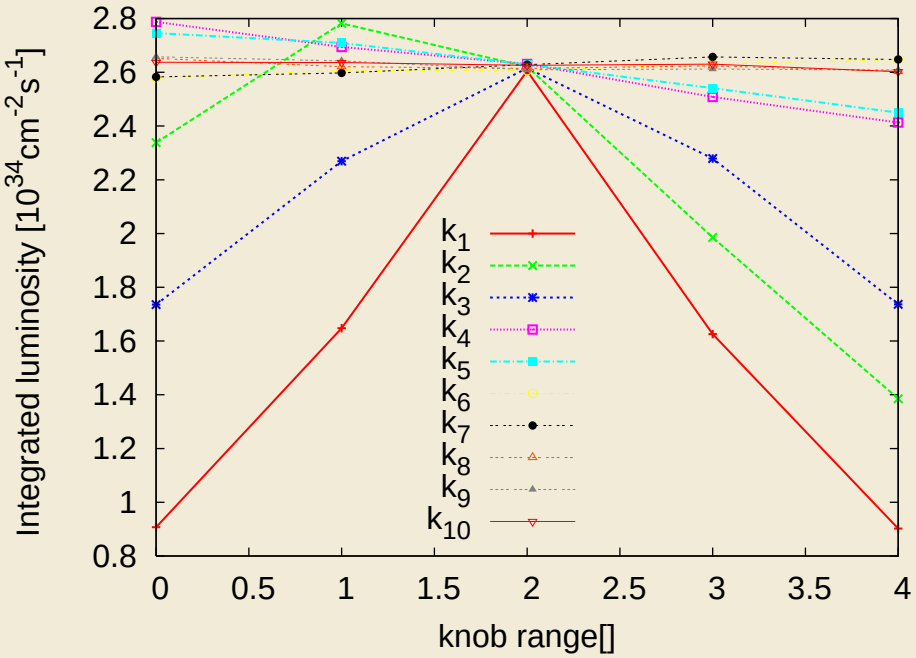
Tun.Algorithm	L/L_0 for 90% machines	Iterations
	[%]	[10^3]
Simplex	86	17
Simplex + Knobs	93	18
BBA + Knobs	55	1.8

Response matrices



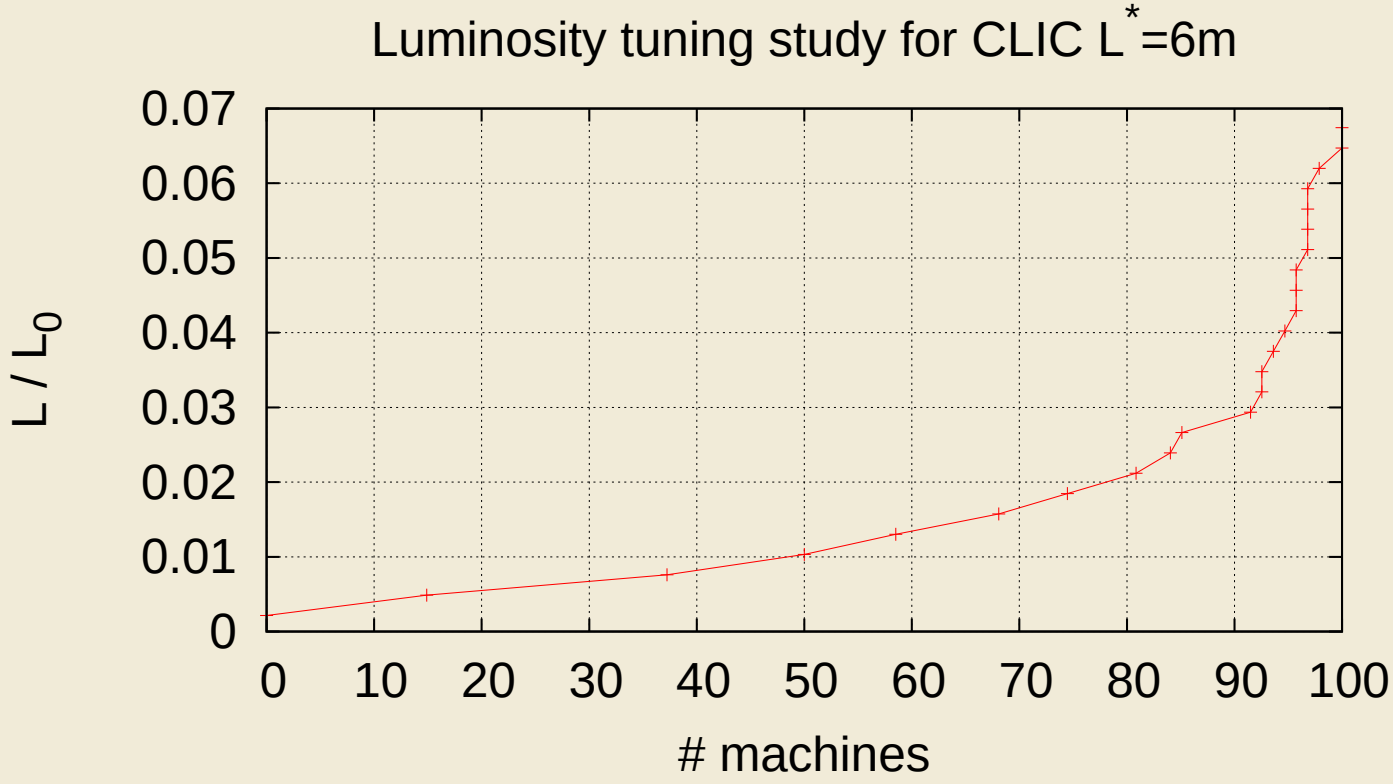
- The response matrices $R_{xx}, R_{yy}, R_{\eta_x}, R_{\eta_y}$ are evaluated to apply 1to1 and DFS steering.

Sextupole Knobs



- These knobs are obtained applying an SVD analysis.

Preliminary results after 1 iteration



- The optimum parameters used in the L*=3.5m tuning, have been implemented.
- 50% of the machines reach $1\%L_0$ after the first iteration.

Conclusions

- The blind algorithm could be implemented with a fast luminosity measurement.
- For CLIC-BDS L*=6m, the BBA tuning algorithm is ≈10 times faster than the blind algorithm, however the reached luminosity is almost the half.
- Preliminary results for the L*=6m tuning study, shows that an optimisation parameter it is crucial to run successive iterations, in order to reach successful luminosities.

Future plans

- To find out the optimum parameters for each tuning step in order to run a complete BBA tuning algorithm.
- To run the Simplex tuning algorithm with a misalignment of 10μm.