L* considerations

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Goal of March CLIC meeting

Andrei proposed to move the CLIC QD0 out of the detector (double L*) to ease stabilization.

Decide a strategy concerning the L^* in view of the CDR

Comparing design luminosities

lumi per crossing	Andrei's original	Optimized (MAPCLASS)	CLIC (3.5m)
lumi peak	1.2	1.3	1.8
lumi total	2.7	3.0	5.6

After optimizing Andrei's FFS with our code MAPCLASS:

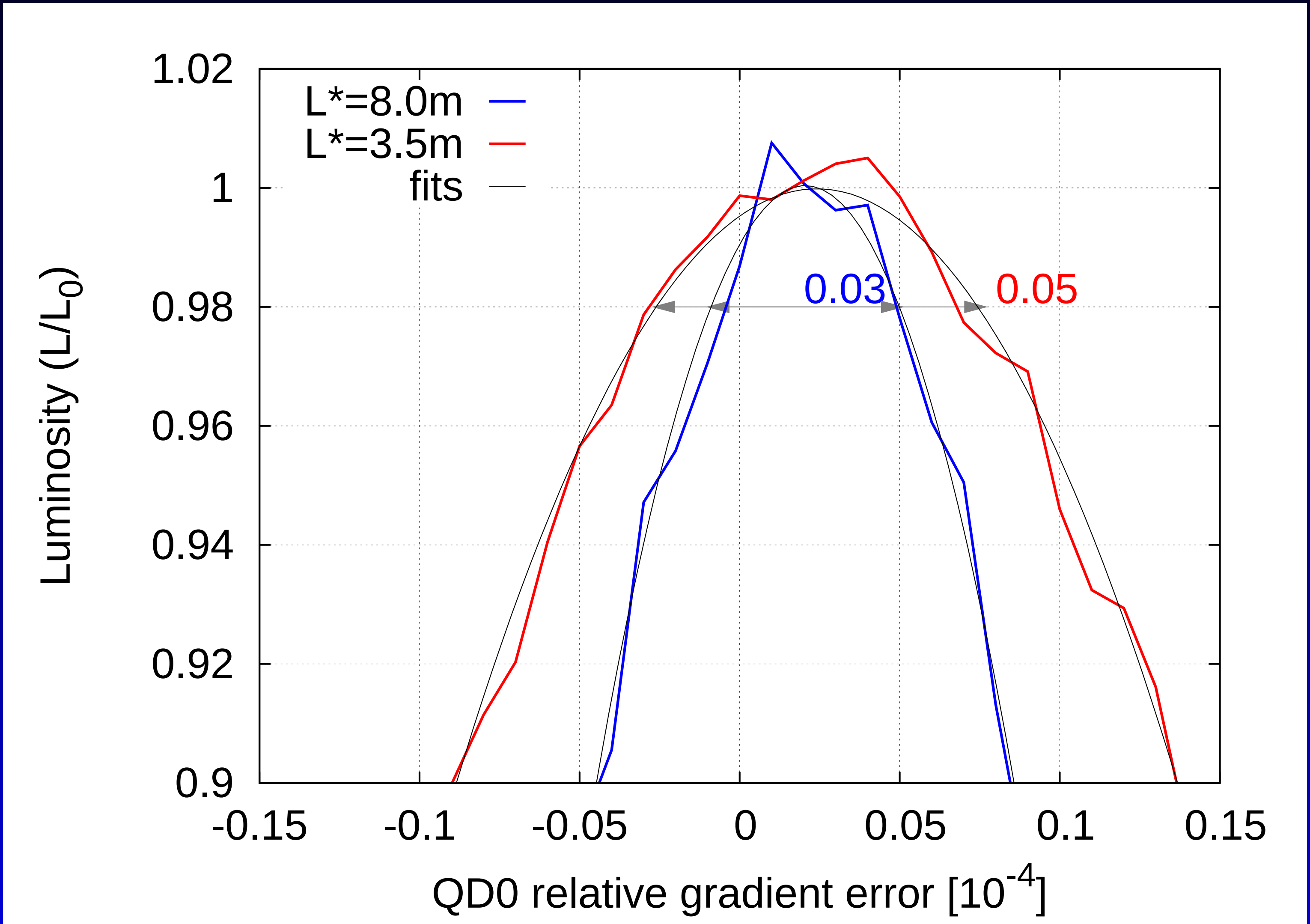
- Peak luminosity is 28% lower than current lattice.
- 4 strong octupoles and 2 strong decapoles are needed.

Comparing QD0s

	Unit	L^*=3.5m	L^*=8m
Gradient	T/m	-575	-211
Length	m	2.73	4.2
Aperture (radius)	mm	3.5	8.5
Outer radius	mm	< 35	< 70
Peak field	T	2.0	1.8
Tolerances			
Field stability	$\frac{\Delta k}{k}[10^{-4}]$	0.05	0.03
Octupolar error	$[10^{-4}$@1mm$]$	7	3

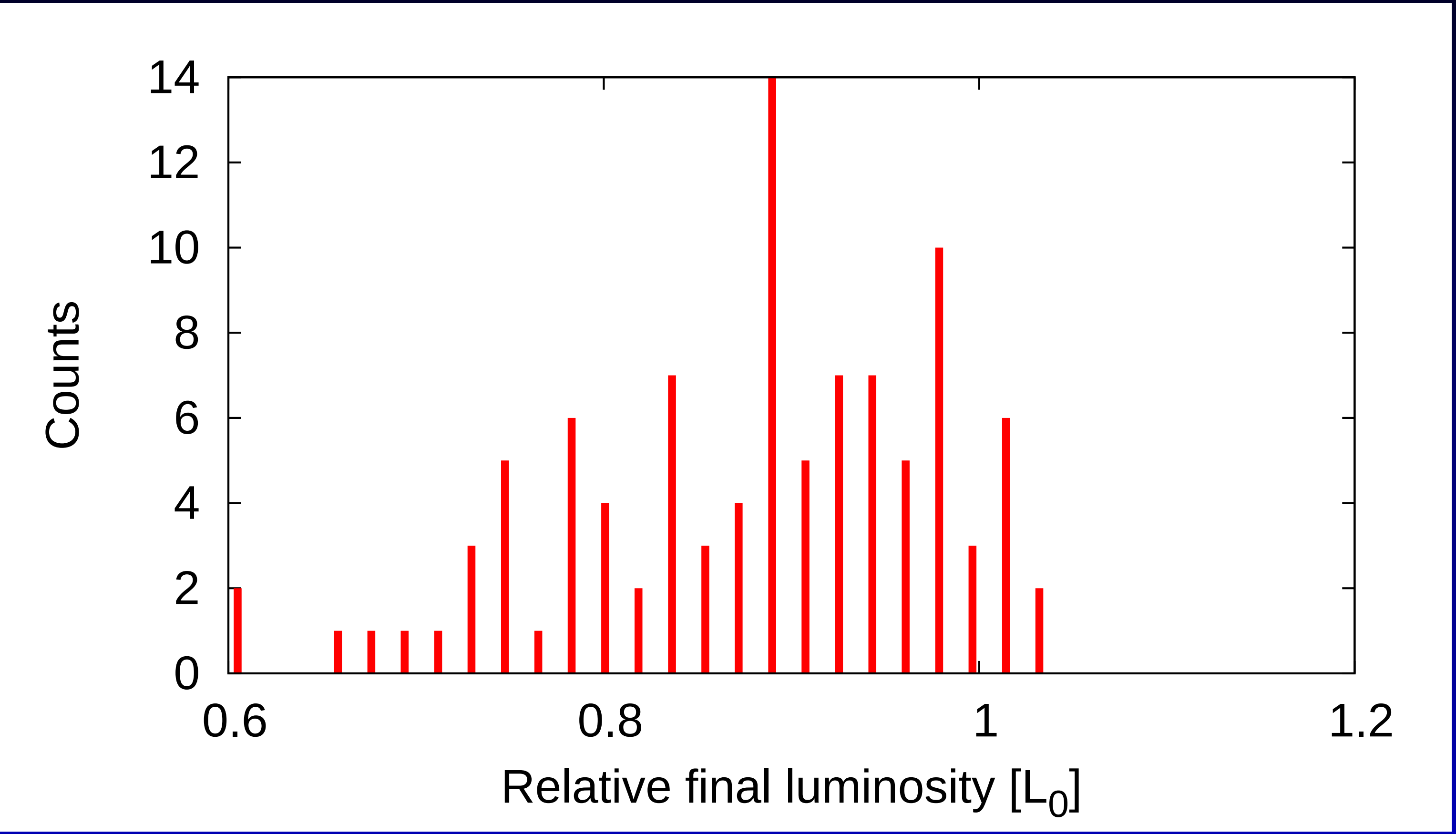
Both cases compatible with permanent magnet tech.

Luminosity versus QD0 gradient error



Do these tolerances discard SC technology?

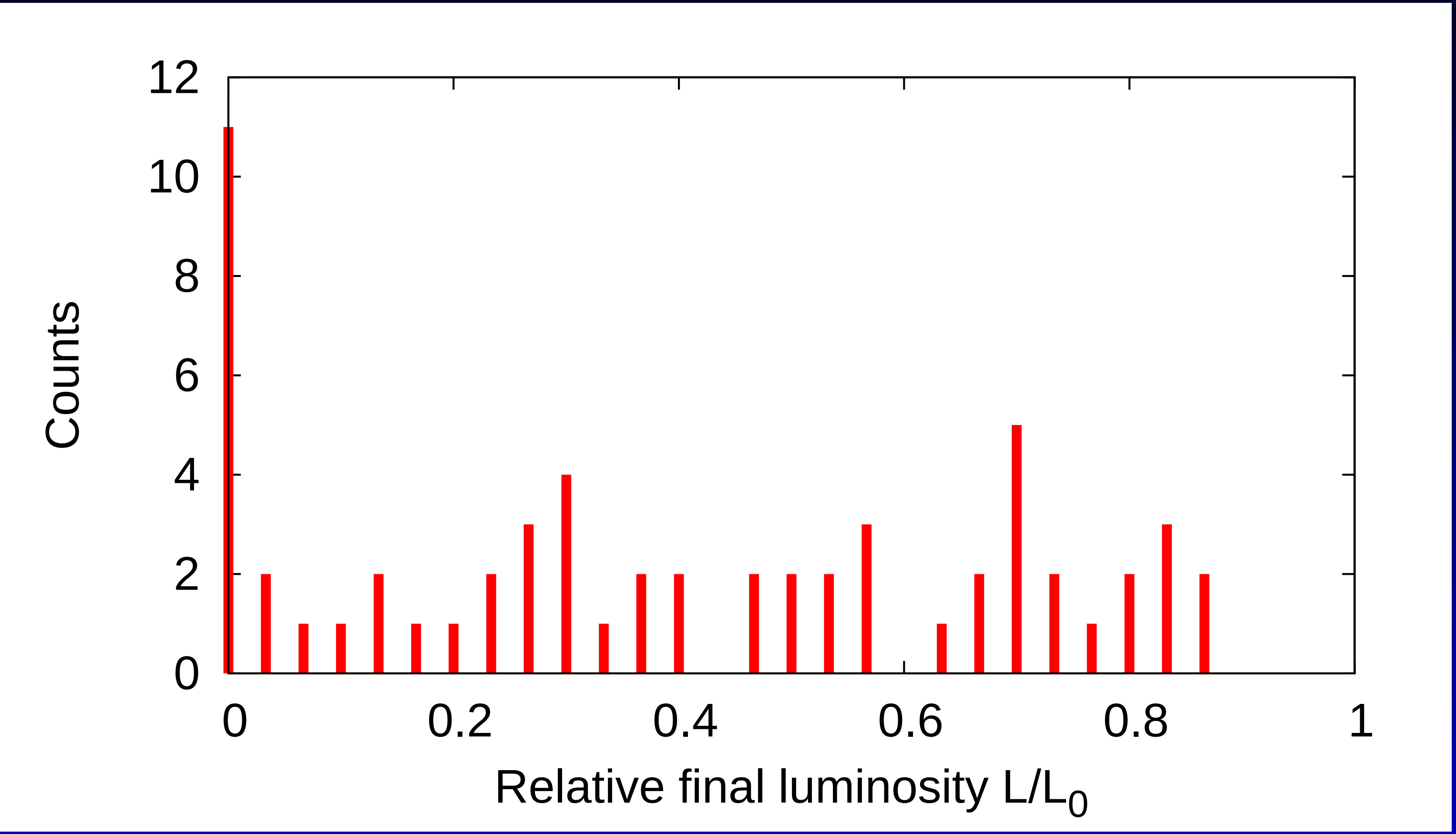
Tuning CLIC nominal



Prealignment assumed to be 10μm

80% of the cases reach 80% of the luminosity in 18000 iterations

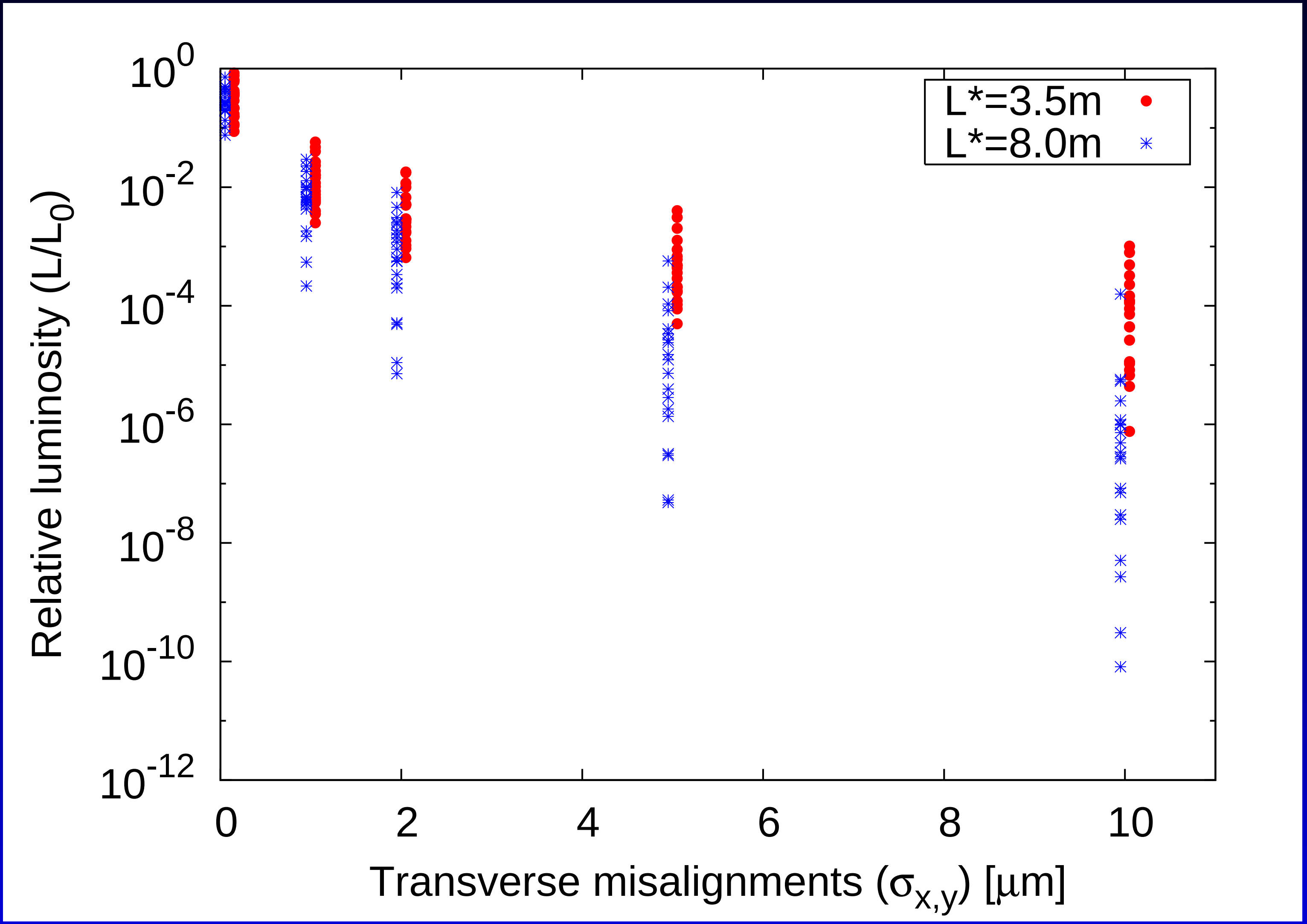
Tuning Andrei's proposal



Catastrophy: 50% of cases reported numerical errors related to very low luminosities

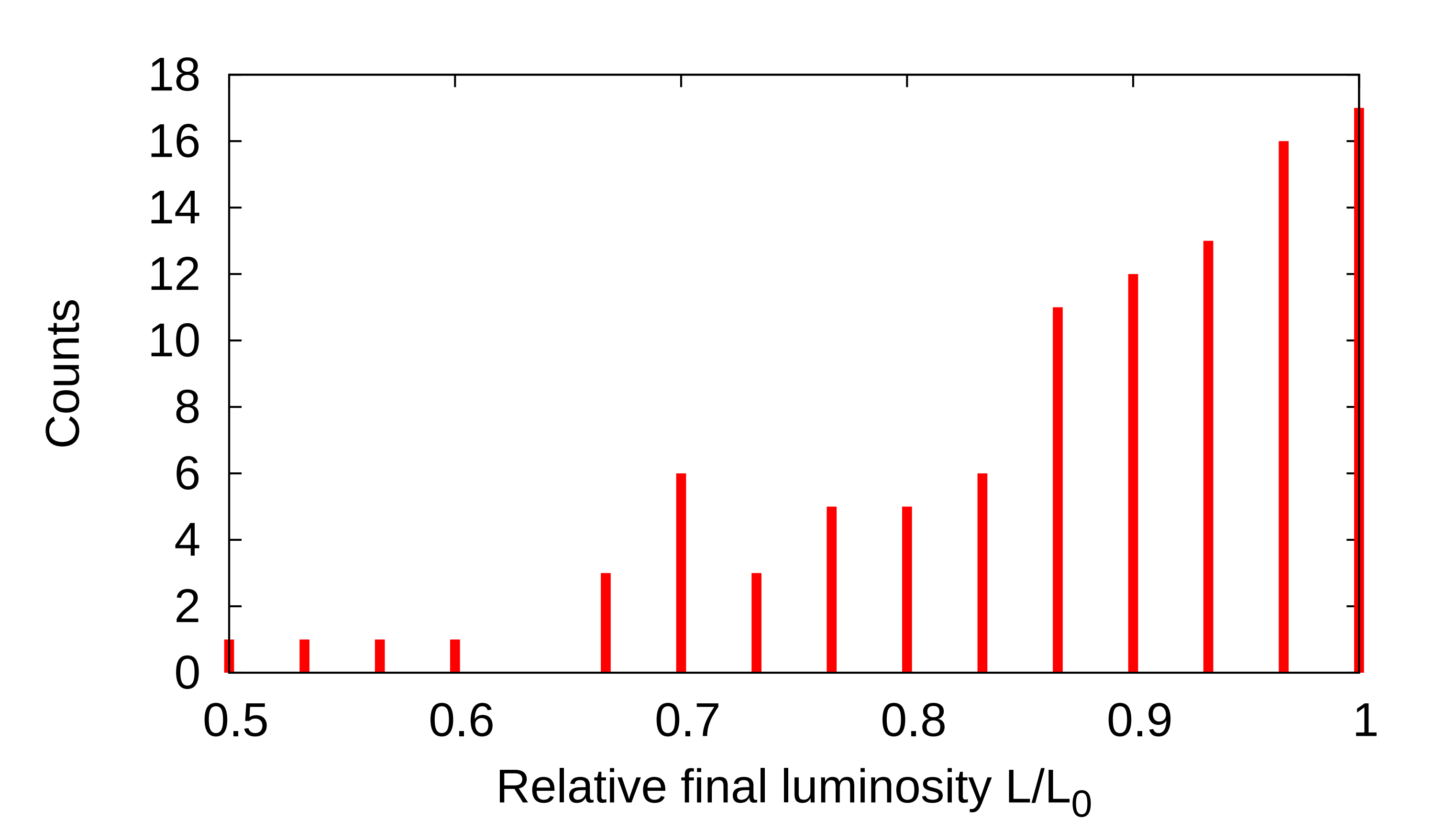
7% of the seeds reach 80% Lumi.

Luminosity versus prealignment



L*=8m needs ≈4 times better prealignment!

Tuning CLIC L*=8m (prealignment 2μm)



80% of the cases reach 80% of the luminosity, equivalent to L*=3.5m with 10μm prealignment.

Summary of facts

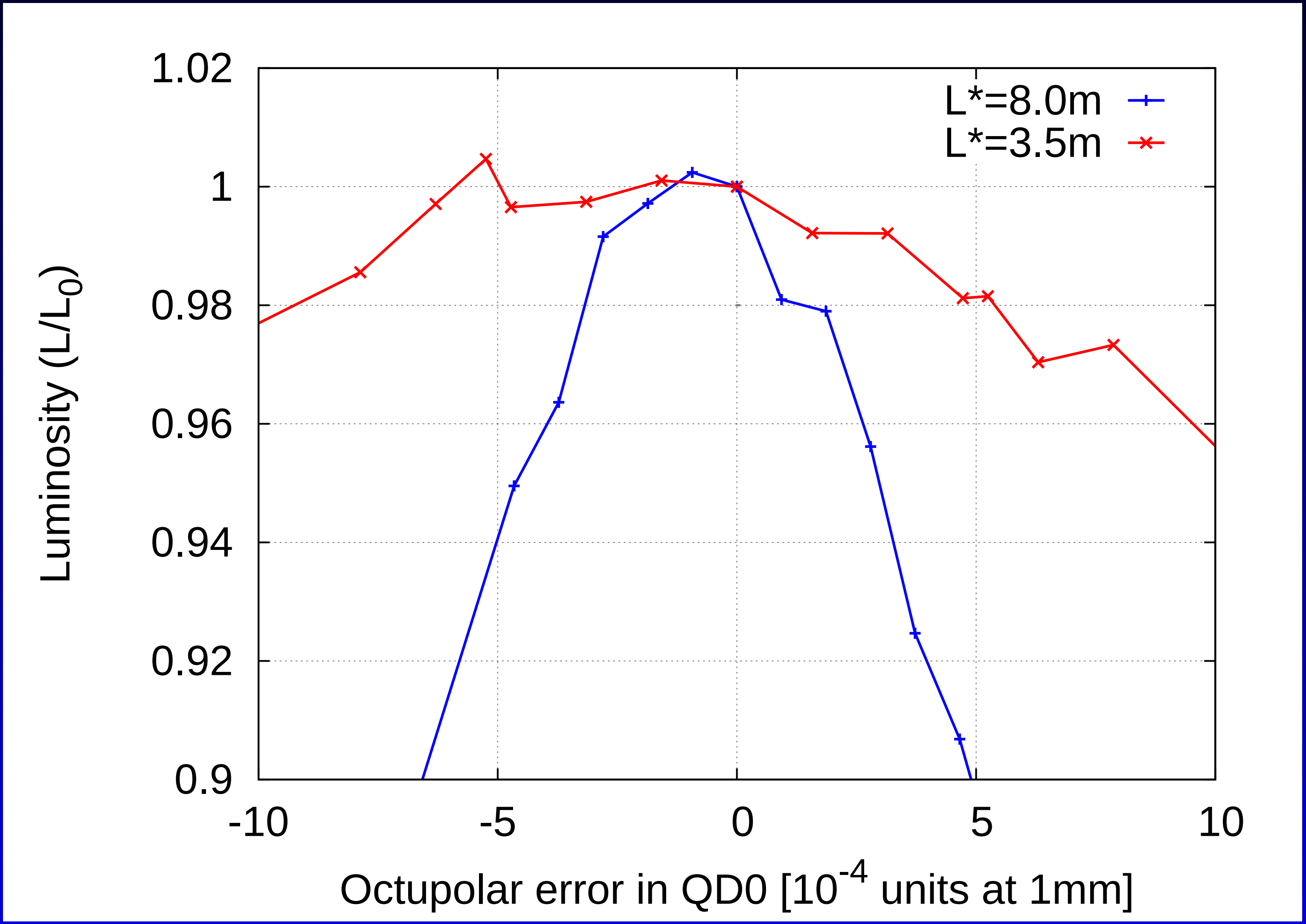
	L*=3.5m	L*=8.0m
Luminosity	L_0	$0.72L_0$
β_y	0.07mm	0.1mm
QD0 jitter	0.15nm	0.18nm
QD0 supp.	detector	ground
QD0 tech.	PM	PM
QD0 grad tol.	5×10^{-6}	3×10^{-6}
FFS length	400m	800m
Chromaticity	ξ	2ξ
Prealignment	10μm	2μm

Strategy?

- During the CLIC meeting in March 2009 it was suggested to keep L*=3.5m as nominal design and 8m as an alternative, for 3TeV and 500GeV.
- Further work on tuning simulations, comparisons and assumptions is anyway required.
- L*=8m could become nominal if it is proved that the QD0 jitter tolerance cannot be reached within the detector. Further research on pre-alignment would then be required.

Support slides

Luminosity versus QD0 octupolar error

- 

ATF2 and ATF2 ultra-low β studies

From ATF2 simulations:

case	Max. tuning time	Ratio of success
β_y=0.1mm	5.5 days	100%
β_y=0.05mm	8 days	90%
β_y=0.025mm	10 days	80%

Tuning time and failure ratio increase with chromaticity

Chromaticity philosophy

Project	Status	β_y^* [mm]	L* [m]	L*/β_y^*	ξ_y
FFTB	Measured	0.167	0.4	2400	10000
ATF2	Design	0.1	1.0	10000	19000
ATF2 ultra-low β	Proposed	0.025	1.0	40000	76000
CLIC	Design	0.08	3.5	39000	63000
Andrei's prop.	Proposed	0.1	8.0	80000	120000

ATF2 can, on paper, prove CLIC chromaticity levels but would need important hardware changes to even consider reaching Andrei's chromaticity.