CLIC & ATF2 FFS tuning

BDS farewell meeting

28/09/2017

CLIC FFS tuning with $L^* = 6$ m

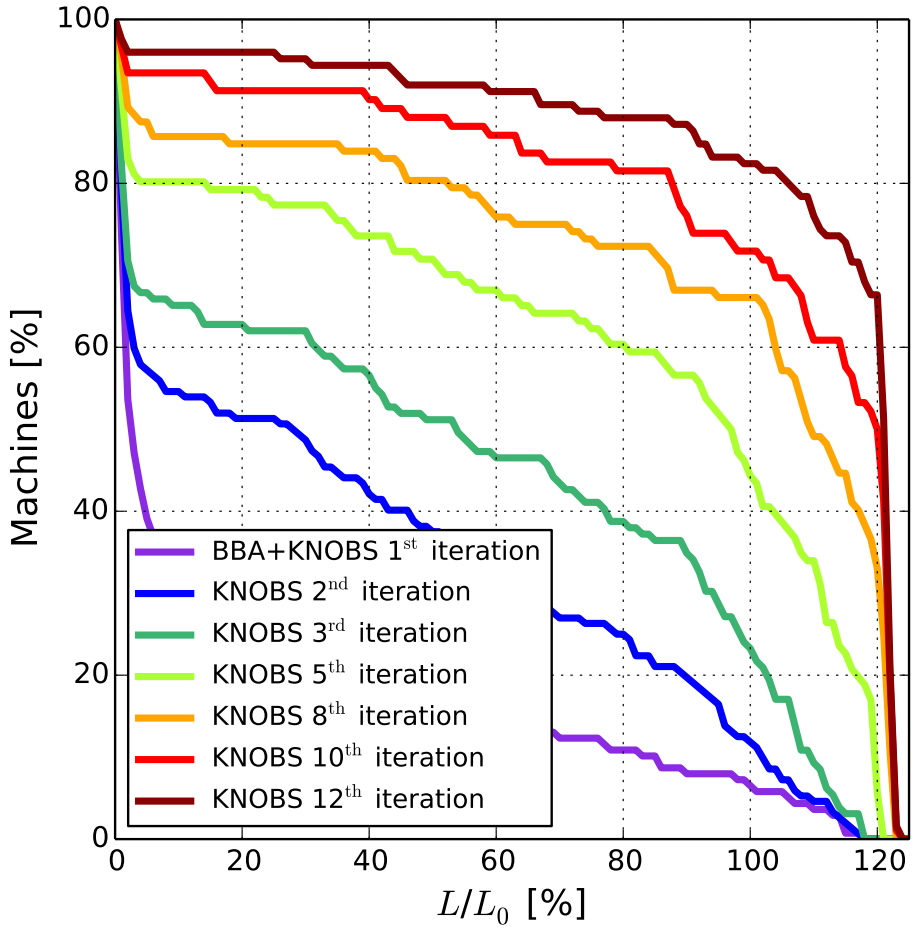
- The imperfections are applied on the Quadrupoles, Sextupoles and BPMs of the FFS

$\Delta_{x,y}$	10 μm
Roll	300μm
Strenght error	0.01%

- **ONLY LINEAR KNOBS APPLIED**

Tuning performance converges to:

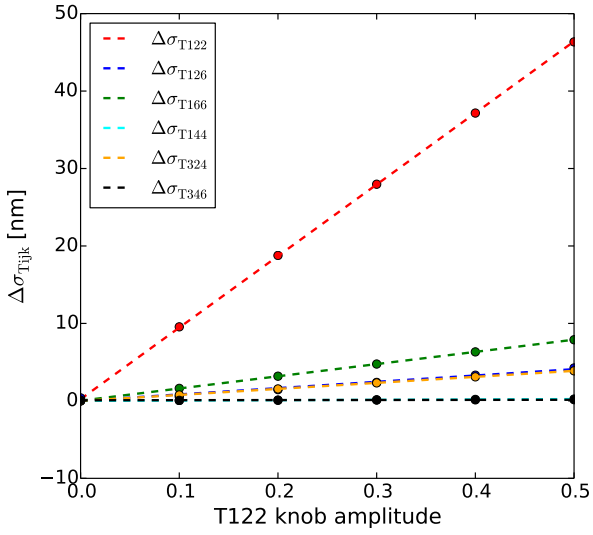
- 72% of the machines reach $\geq$ 110% of $\mathcal{L}_0$ in $\approx$5000 luminosity measurements

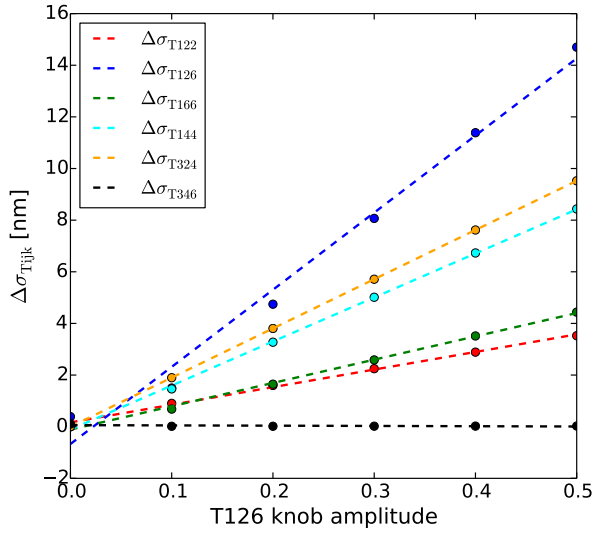


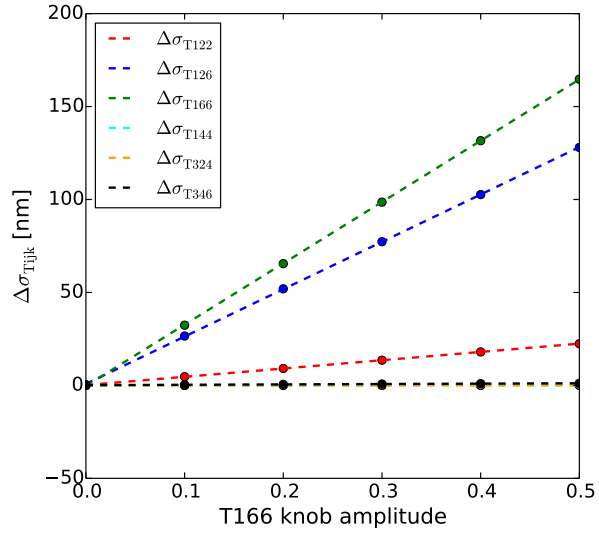
- $\Rightarrow$ **NEED FOR NONLINEAR CORRECTIONS !**

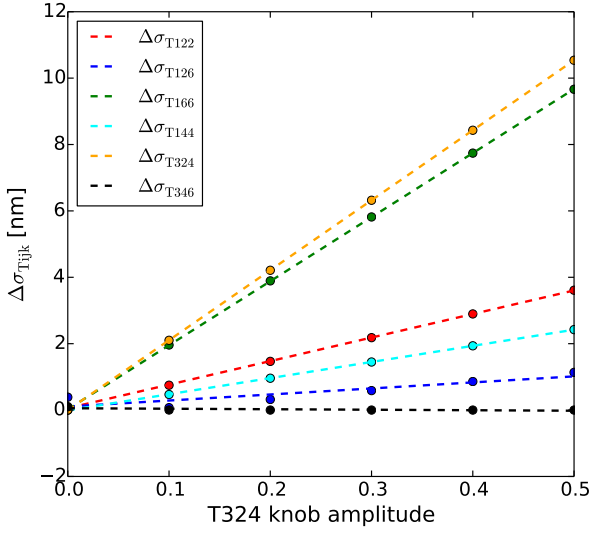
2^{ND} ORDER KNOBS CONSTRUCTION

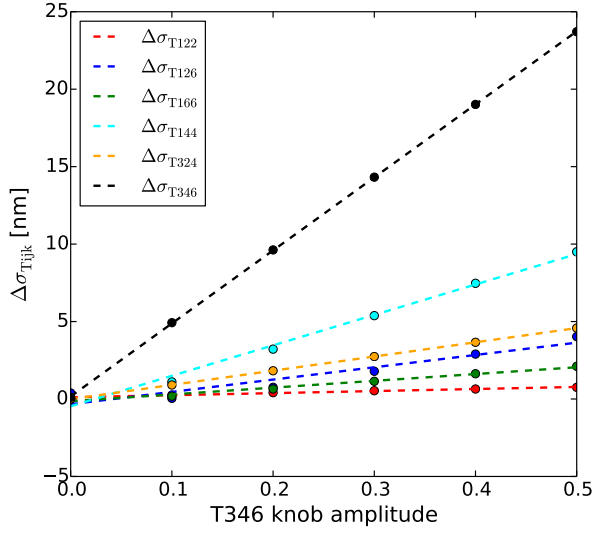
5 knobs constructed using the FFS normal sextupoles:
T_{122}, T_{126}, T_{166}, T_{324}, T_{346}











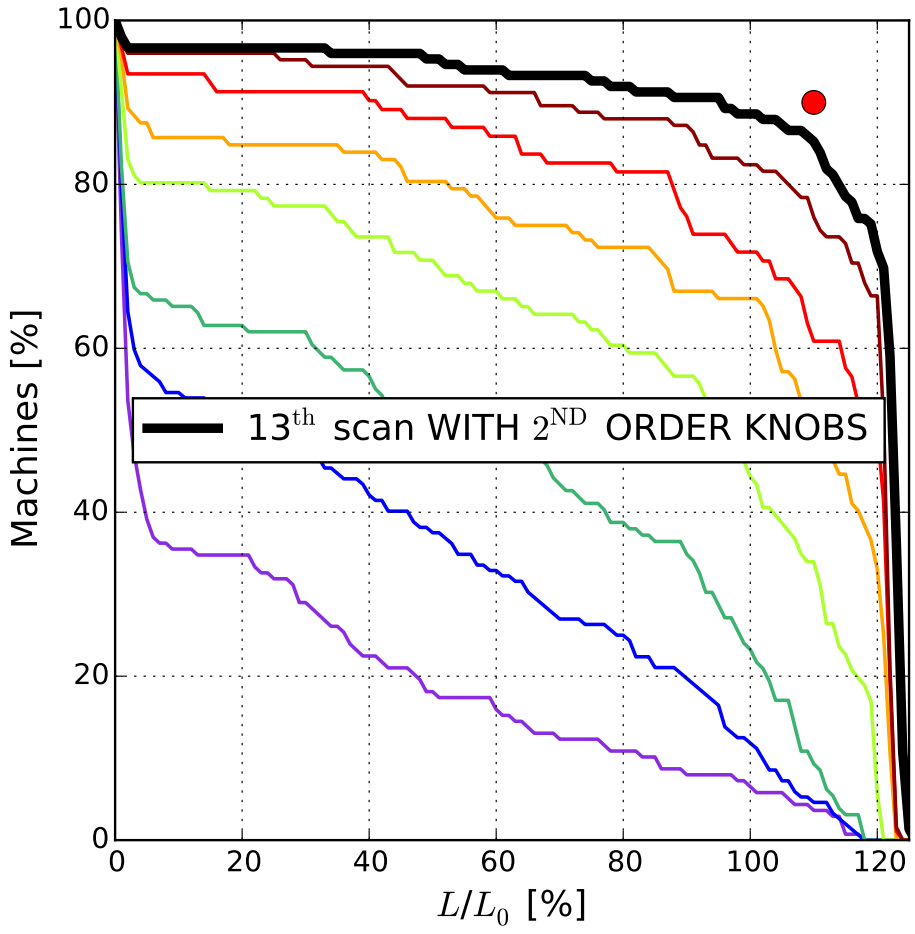
CLIC FFS tuning with $L^* = 6$ m

$\Delta_{x,y}$	10 μm
Roll	300μm
Strenght error	0.01%

- **LINEAR KNOBS + 2ND ORDER KNOBS APPLIED**

Tuning performance improved:

- 85% of the machines reach $\geq$ 110% of $\mathcal{L}_0$



- $\Rightarrow$ **2nd order knobs are efficient !**
- $\Rightarrow$ Restart tuning study from the 1^{st} iteration by applying L+NL knobs... Work in progress

CLIC 380 GeV tuning with $L^* = 4.3$ m and $L^* = 6$ m

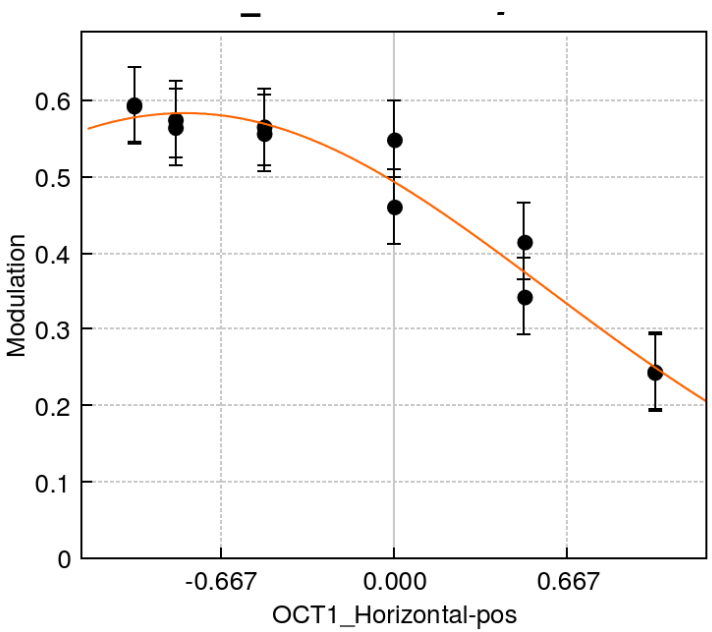
Changes on the FFS optics and parameters have been recently applied
BDS with $L^* = 4.3$ m and $L^* = 6$ m are fully optimized

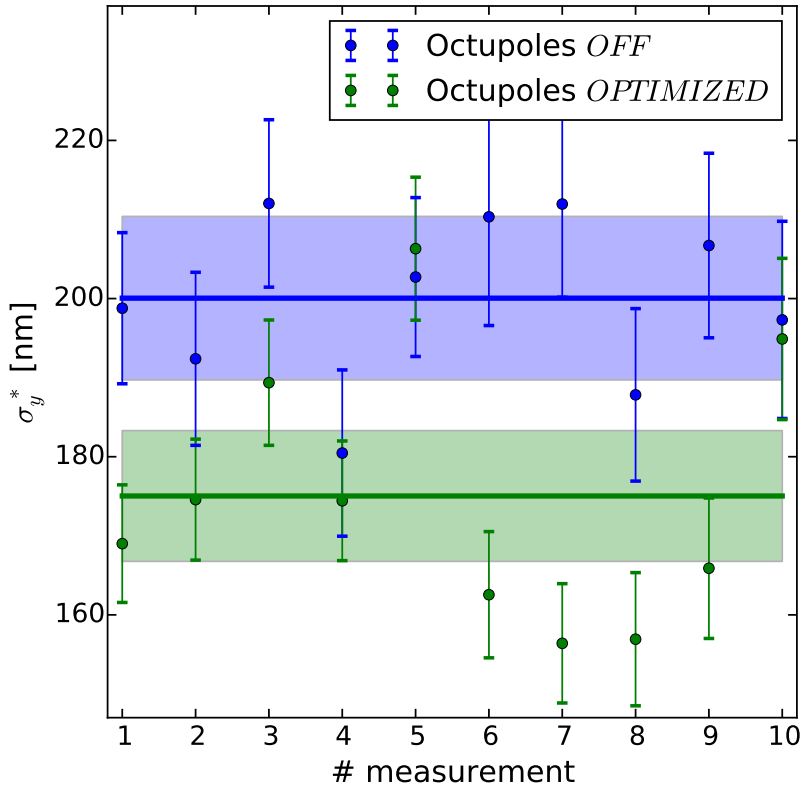
2^{nd} order knobs contrusted for both L^* options

TUNING ONGOING $\Rightarrow$ Updates will be given at LCWS17

ATF2: OCTUPOLES EFFICIENCY TESTING, THE FIRST STEP TOWARDS ULTRA-LOW β_y^*

- In June 2017: Octupoles were used for the $10\beta_x^* 1\beta_y^*$ optics tuning:





- After 4 consecutive tuning shifts, σ_y^* was still large ($\approx$ 200 nm)
- After Octupole tuning $\Rightarrow$ σ_y^* was reduced to $\approx$ 175 nm)
- σ_y^* reduction after horizontal scan of OCT1FF $\Rightarrow$ **Possible correction of normal sextupole components due to optics mismatch**

ATF2:TOWARDS THE WORLD LOWEST BEAM SIZE EVER

- In November 2017: $10\beta_x^* 1\beta_y^*$ optics tuning study will focus on **understanding the current beam size limitation** ($\sigma_y^* \approx 200$ nm) **and octupoles will be used in the tuning procedure** (22 shifts during 4 weeks of operation)

- In December 2017: **Dedicated week on ultra-low β_y^* optics tuning**
  - **12 consecutive shifts (96 hours) $\Rightarrow$ FIRST TIME !**
  - A trained team from CERN will come for additional support for this special week :
    Jonas, Vera, Pierre, Doug, Andrea, Edu and Fabien
    Help also from Renjung and Philip (LAL) and ATF collaborators at KEK
  - **Detailed Actions Plan is being elaborated** (ATF2 tuning meeting the 05/10/2017)

Very exciting results are forseen by the end of 2017 !