The CLIC Beam Delivery System

R. Tomás

Thanks to the input of many: D. Angal-Kalinin, G. Burt, B. Dalena, J.L. Fernandez, L. Gatignon, E. Marín, M. Modena, J. Osborne, J. Resta, G. Rumolo, H. Schmickler, D. Schulte, A. Seryi, J. Snuverink, G. Zamudio

IWLC 2010, October 2010

Contents

The BDS CDR chapter

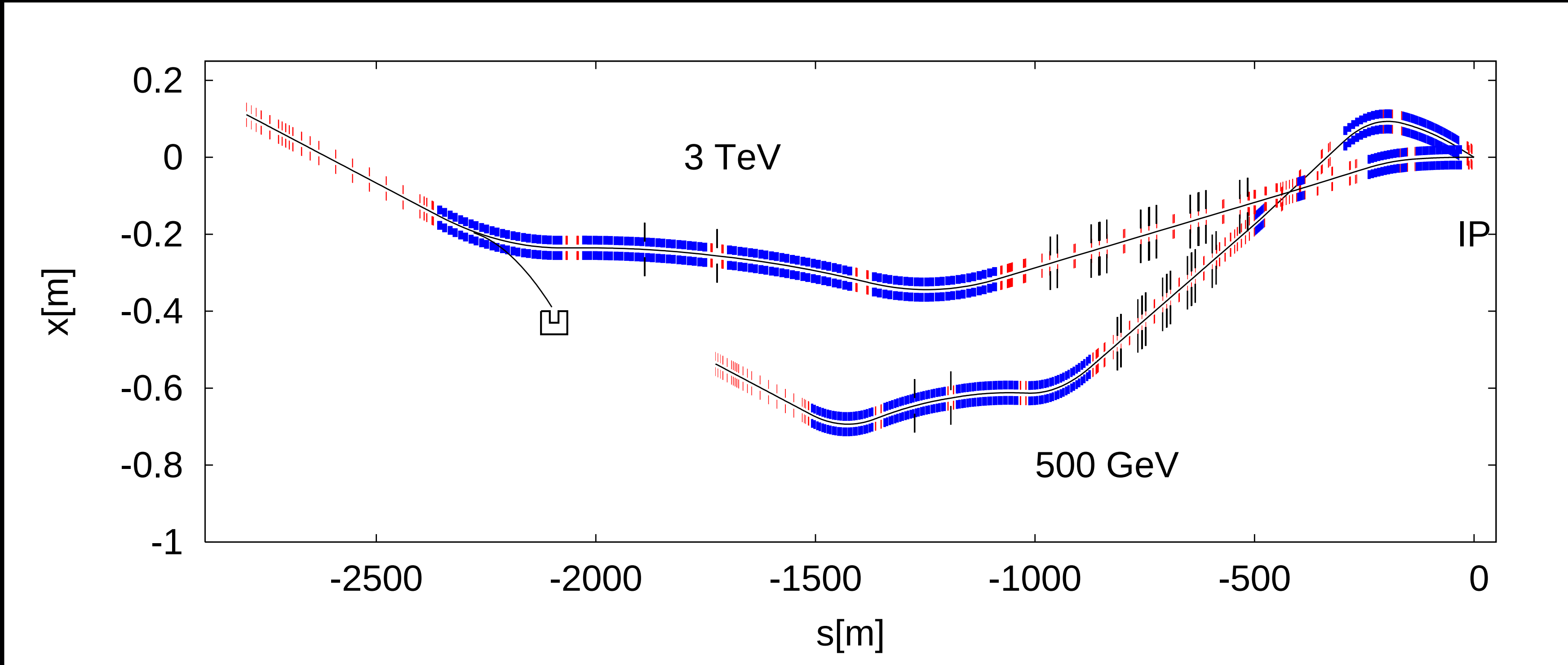
“Live” Draft at:

clicr.web.cern.ch/CLICr/MainBeam/BDS/CDR/TEX

Everybody is welcome to take a look and send criticism to: D. Angal-Kalinin (CI), A. Seryi (JAI) and R. Tomás (CERN)

The BDS layouts at 3 TeV and 500 GeV

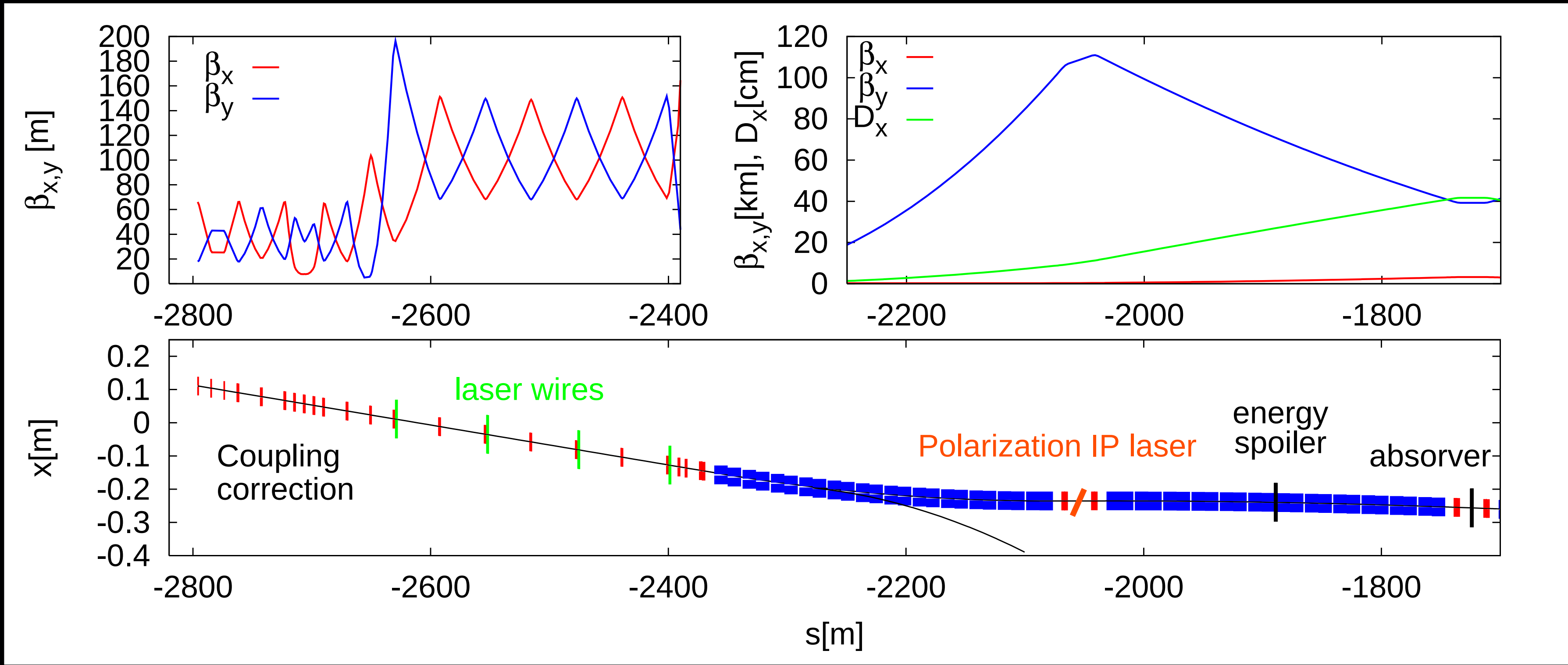
Guillermo Zamudio



3 TeV needs weak dipoles (20-120 G) due to SR. To keep the linac unchanged the IP crossing angle at 500 GeV is reduced to 18.6 mrad.

Both BDS easily fit in same tunnel.

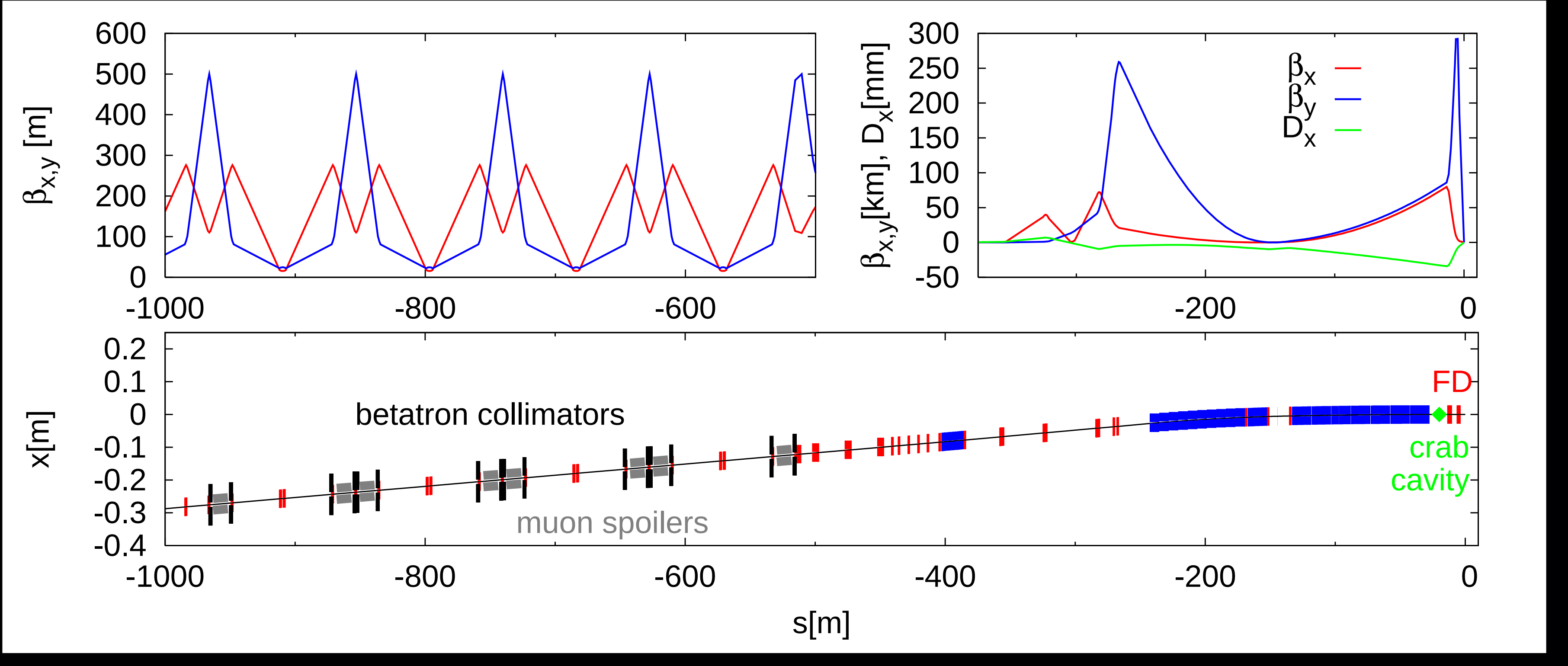
Diagnostics and Energy collimation



$\sigma_y = 1\mu$m at laser wires.

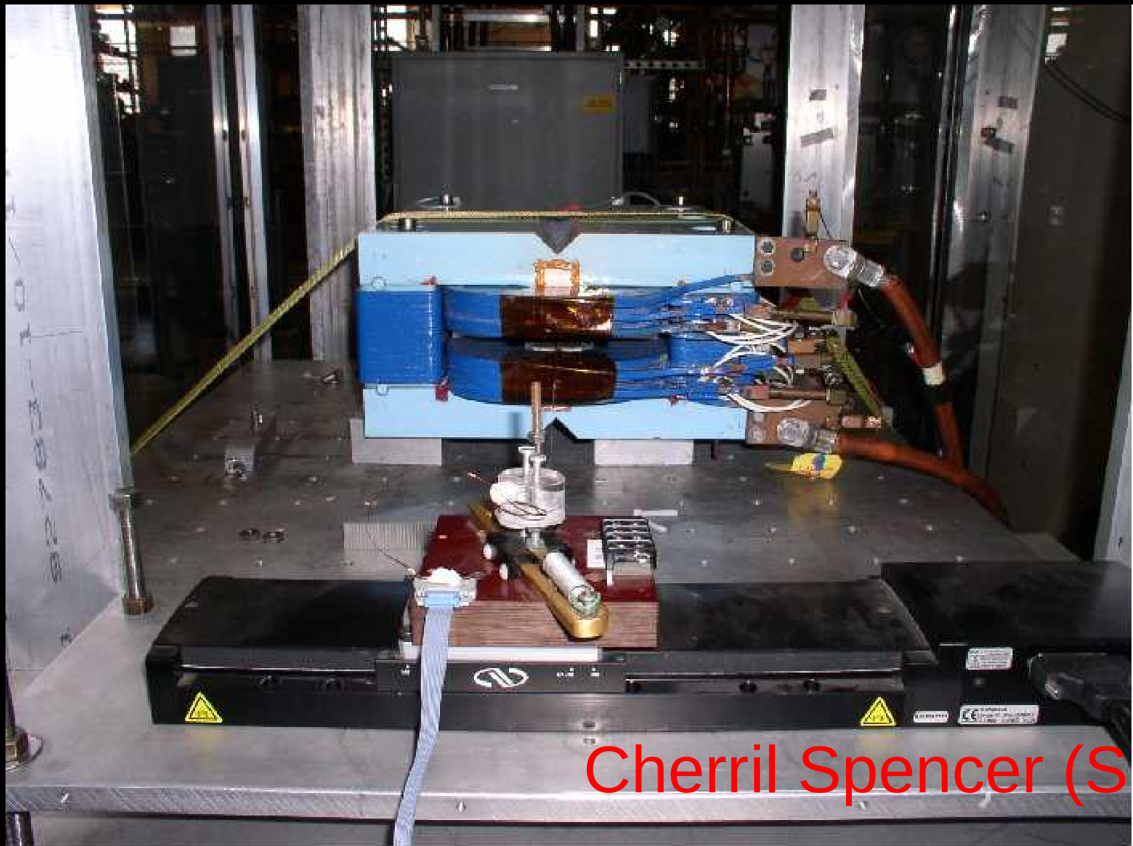
Energy spoiler must survive a full train impact.

Transverse collimation and FFS



Betatron collimators are consumable.
Muon spoilers reduce the muon flux in the detector.
Crab cavity restores the luminosity loss from a 20 mrad crossing.

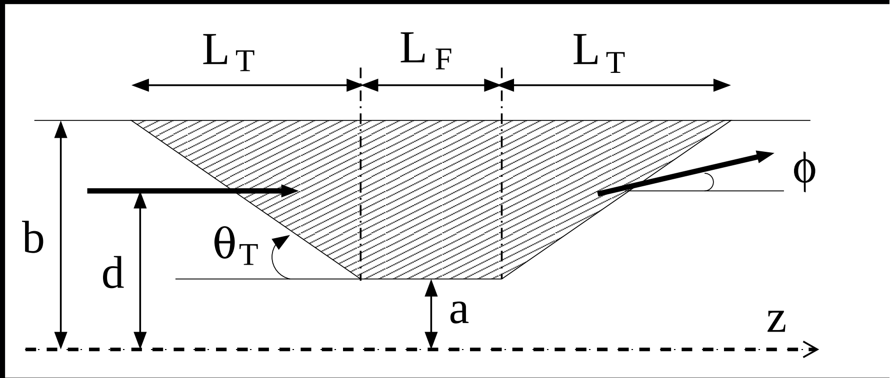
Low field dipoles



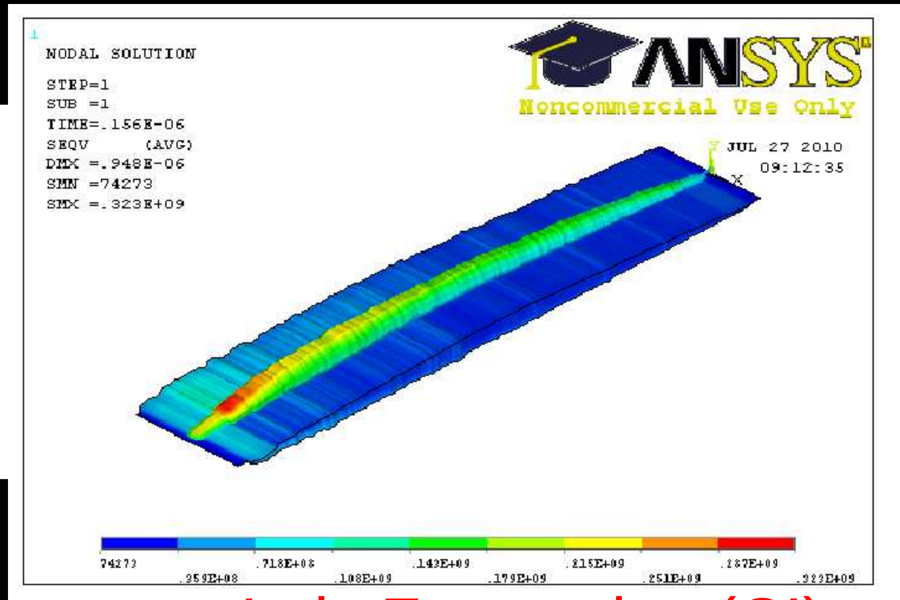
Cherril Spencer (SLAC)

Measurements show no enhancements of multi-poles at 1/140 of the design current. Insulation from stray fields?

Collimation



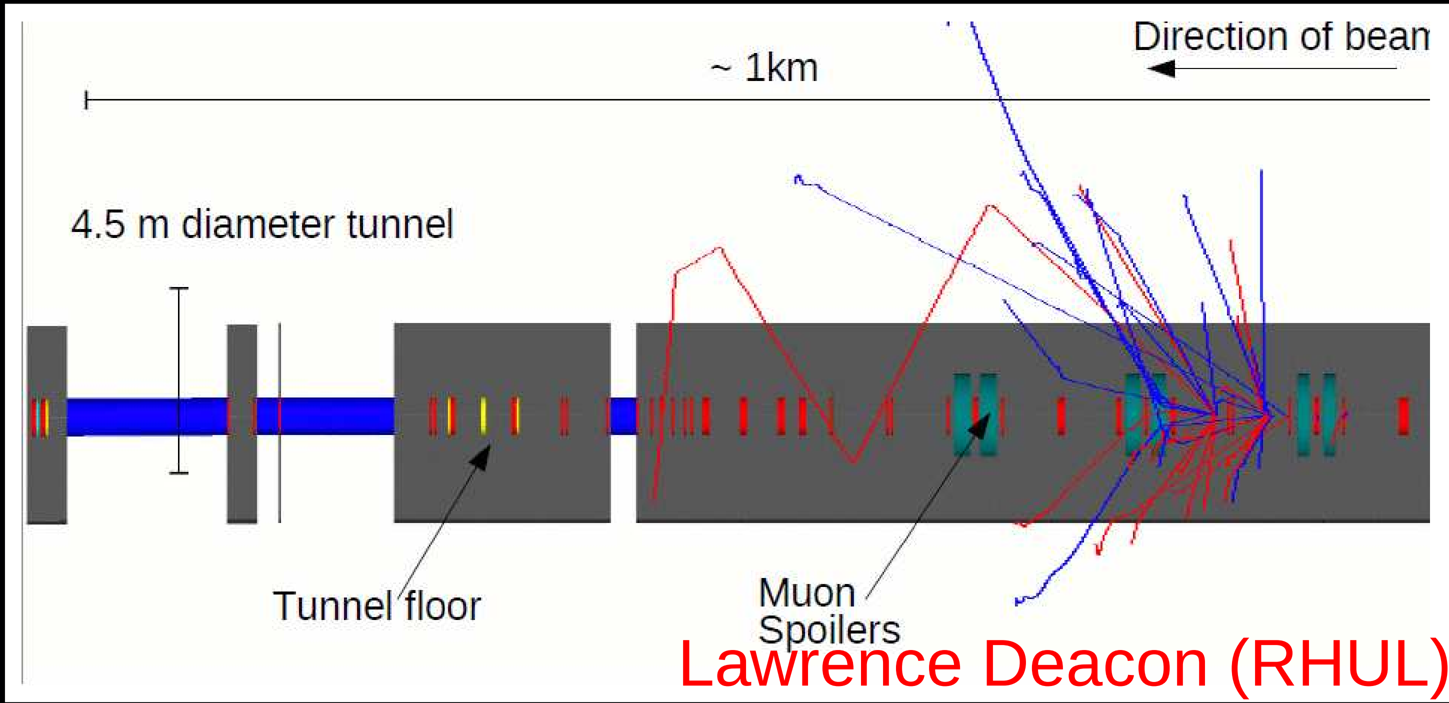
Javier Resta (Oxford)



Luis Fernandez (CI)

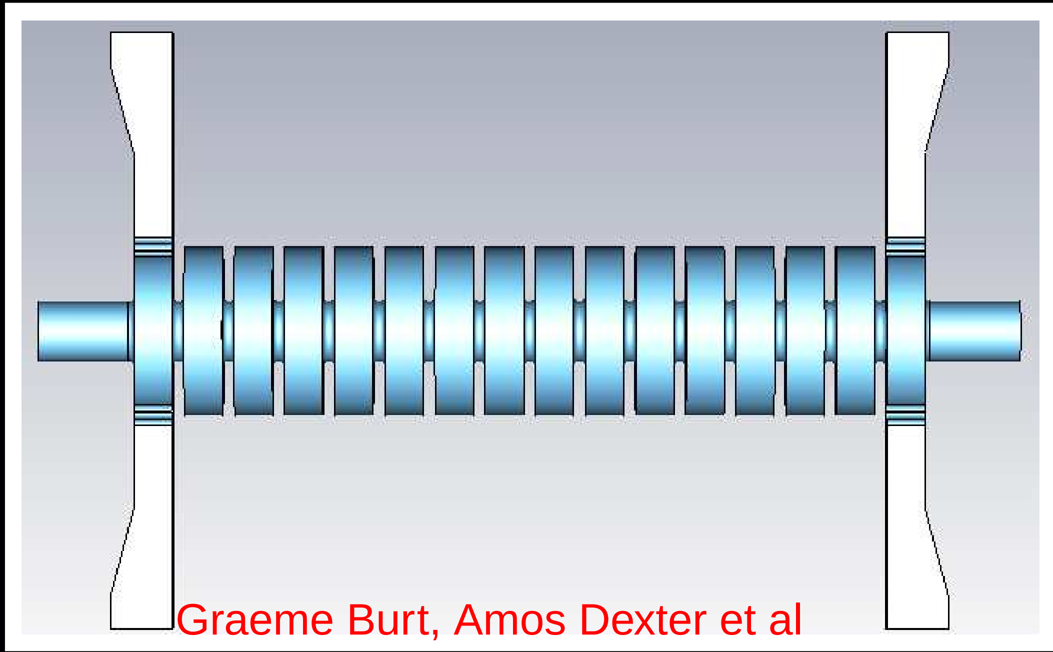
Simulation galore confirming: collimation efficiency, moderate wakefileds effects, survivability of 1$^{\rm st}$ spoiler (temperature & stress), etc.

Muons



A factor 10 reduction in muon flux with 83 m of magnetized iron (outer radius 55 cm).

Crab Cavities



Tight phase stability specs and high order mode damping.

Recently found that by design (optics) there is $\approx$5% lumi loss!

The FFS: CLIC Vs ILC

CLIC	ILC
20% lumi loss from SR	Negligible SR
$\sigma_y \approx$ 1 nm	$\sigma_y \approx$ 6 nm
$\beta_y = 70\ \mu$m	$\beta_y = 400\ \mu$m
Chroma. $\approx\ 6.3 \times 10^4$	Chroma. $\approx\ 1.5 \times 10^4$
IP D$'_x$= 1.4 mrad	IP D$'_x$= 9 mrad
Energy spread $\approx$ 0.3%	Energy spread $\approx$ 0.1%

CLIC FFS is considerably more challenging in every aspect. ATF2 is the common playground but CLIC requires Ultra-low IP β (see E. Marín's talk).

L* alternatives and performance

L* m	total lumi 10^{34}cm^{-2}s^{-1}	peak lumi 10^{34}cm^{-2}s^{-1}
3.5	6.9	2.5
4.3	6.4	2.4
6	5.0	2.1
8	4.0	1.7

Tuning performance for different L*

B. Dalena & G. Zamudio

L* [m]	prealignment [μm]	relative success [%]	absolute success [%]
3.5	10	65	87*
4.3	10	80	100
6	8	80	90
8	2	80	46

* Recently improved by a better design and the use of knobs

Summary & outlook

- CLIC BDS CDR chapter well advanced (waiting for your feedback!)
- No major problem...
- Thanks to excellent international collaborations!
- Alignment and tuning remains as the biggest challenge $\rightarrow$ lots to learn in ATF2!
- For the TDR phase:
  - New designs that consider tuning and CCs from the start?
  - wakefields in FACET