R. Corsini, CLIC Collaboration
Working Meeting, 9 May 2012

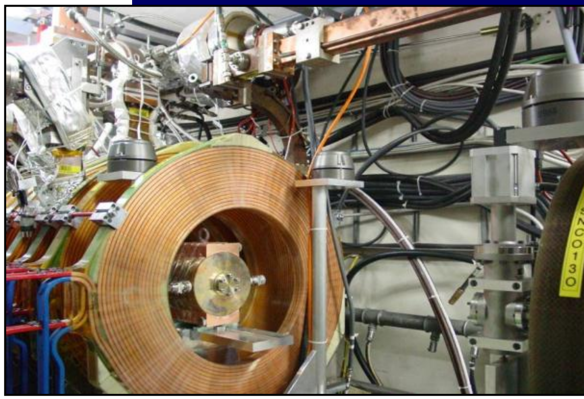
CLIC Zero front-end

2012-2016

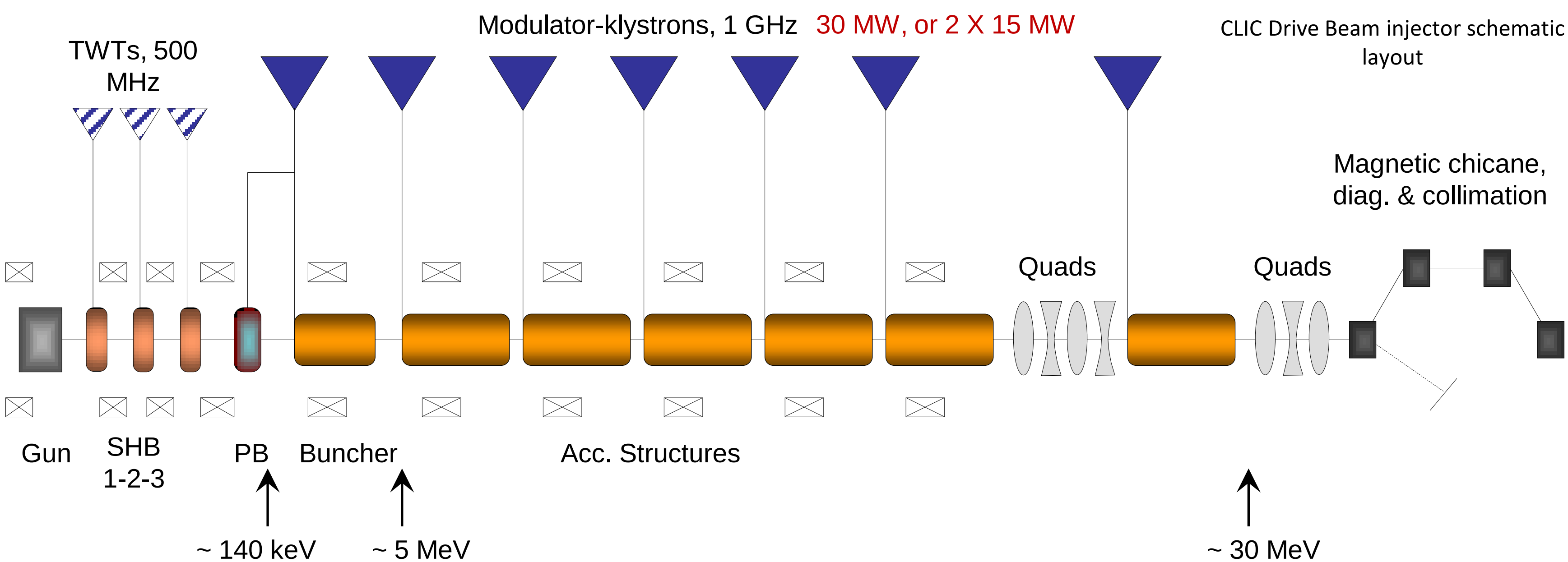
Initial plan

Build and commission 30 MeV Drive Beam front-end with nominal CLIC parameters

- Build and commission 30 MeV Drive Beam injector with nominal CLIC parameters
- Build and commission a few Drive Beam accelerator nominal modules
- Contribution to Technical Design of full CLIC Zero facility

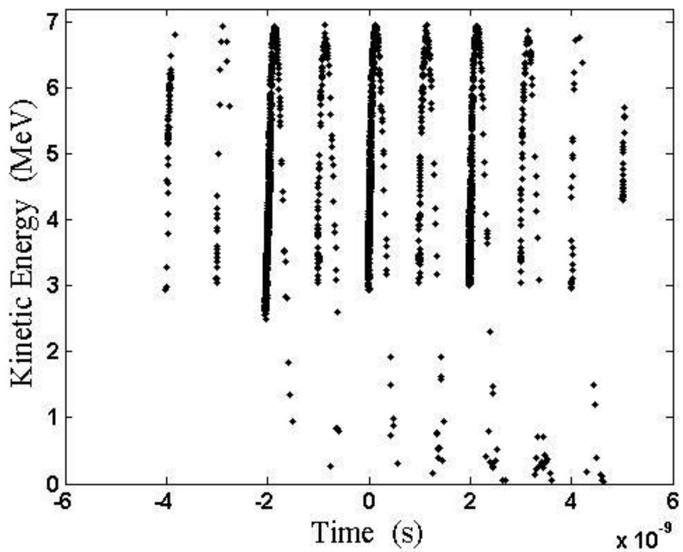


CTF3 Injector

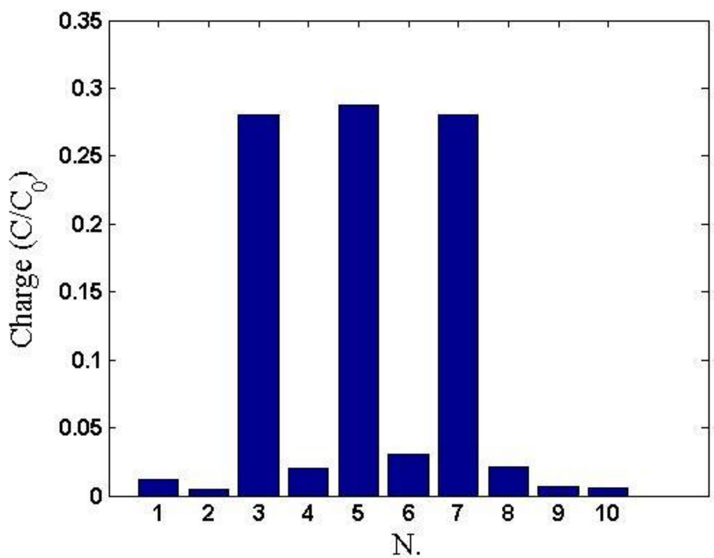


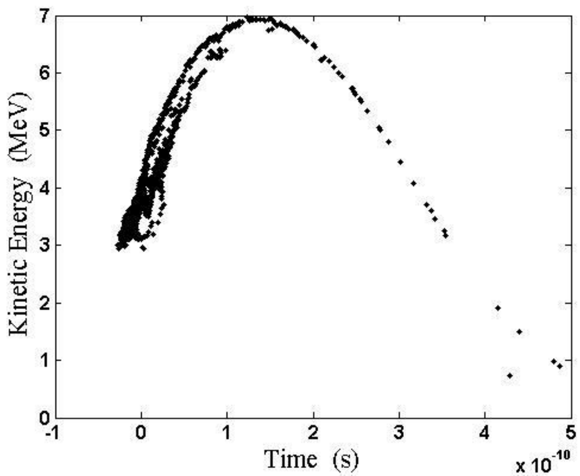
CLIC Drive Beam injector schematic layout

Buncher



Parameter	Unit	Value
Phase velocity:		
First 12 cells	c	0.68-0.99
Last 6 cells	c	1
Phase advance/cell	π	2/3
Total length	m	1.681
Accelerating field	MV/m	4.2
Beam aperture radius	cm	4.7

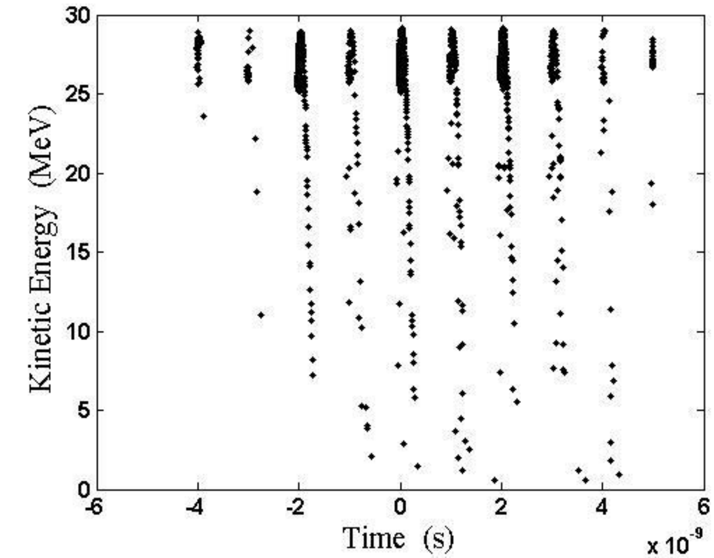




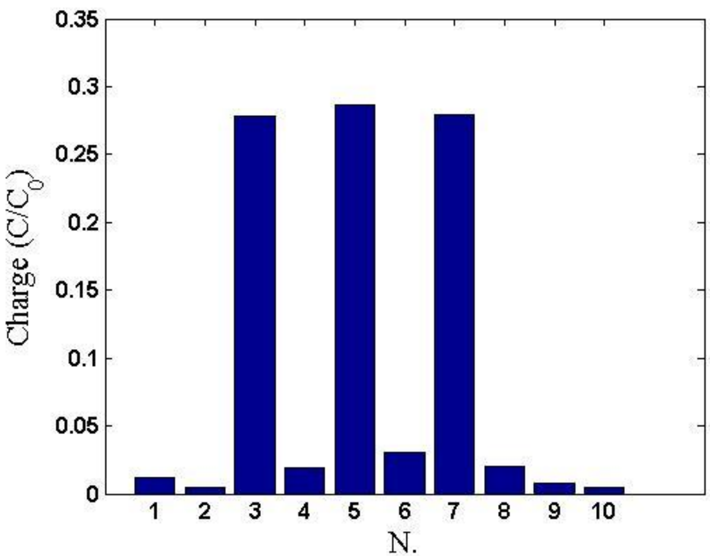
Energy = 4.20 MeV; σ_E= 1.01 MeV; σ_t= 55.89 ps.

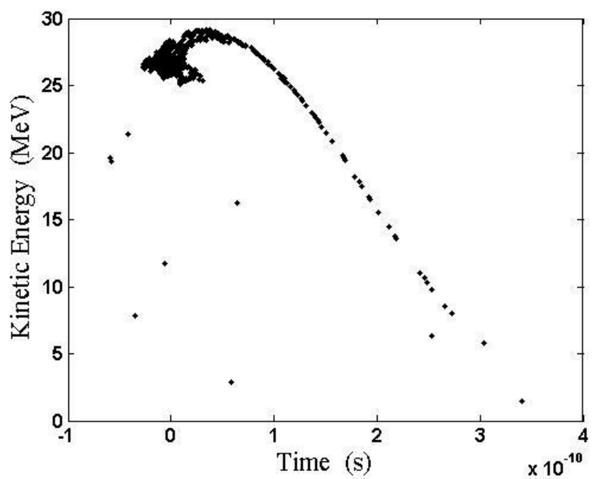
S. Bettoni, A. Vivoli

Before cleaning chicane



Accelerating cavities parameter	Unit	Value
Phase velocity	c	1
Number of cells		10
Phase advance per cell	π	2/3
Total length	m	0.9998
Voltage	MV	4.8
Beam aperture radius	cm	4.7





Energy = 26.34 MeV; σ_E= 2.16 MeV; σ_t= 36.58 ps.

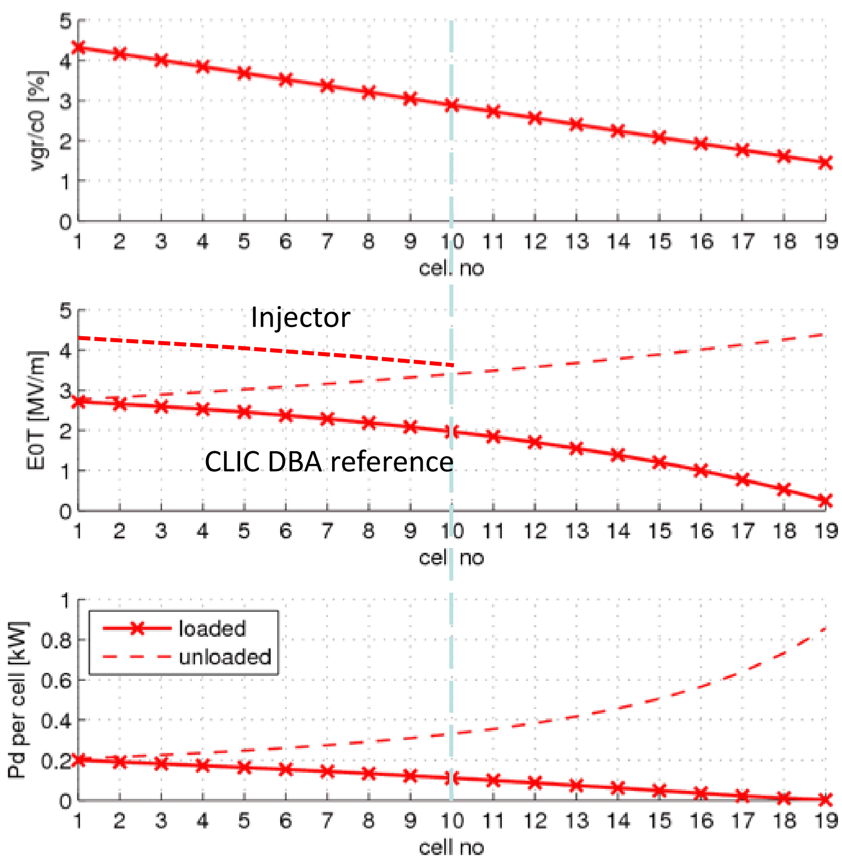
S. Bettoni, A. Vivoli

CLIC Drive Beam Injector CDR design values

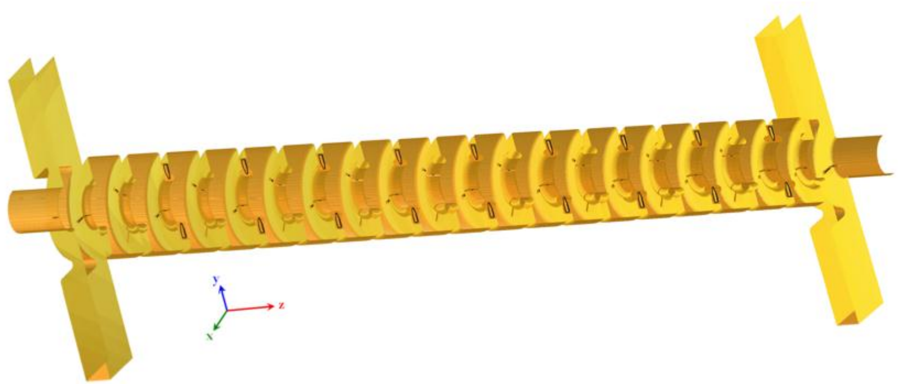
Accelerating cavities parameter	**Unit**	**Value**
Phase velocity	c	1
Number of cells		10
Phase advance per cell	π	2/3
Total length	m	0.9998
Voltage	MV	4.8
Beam aperture radius	cm	4.7

In order to have a fast acceleration (minimize space charge effects) in the 1st iteration, it was assumed to use structures with ½ length w.r.t. the nominal CLIC DBA structures, powered with twice the power.

- Total loaded voltage: 4.8 MV, therefore 0.16 MV/MW (about 4 MV/m average loaded gradient)
- CLIC DBA reference: 3 .4 MV, therefore 0.226 MV/MW (1.48 MV/m average loaded gradient)

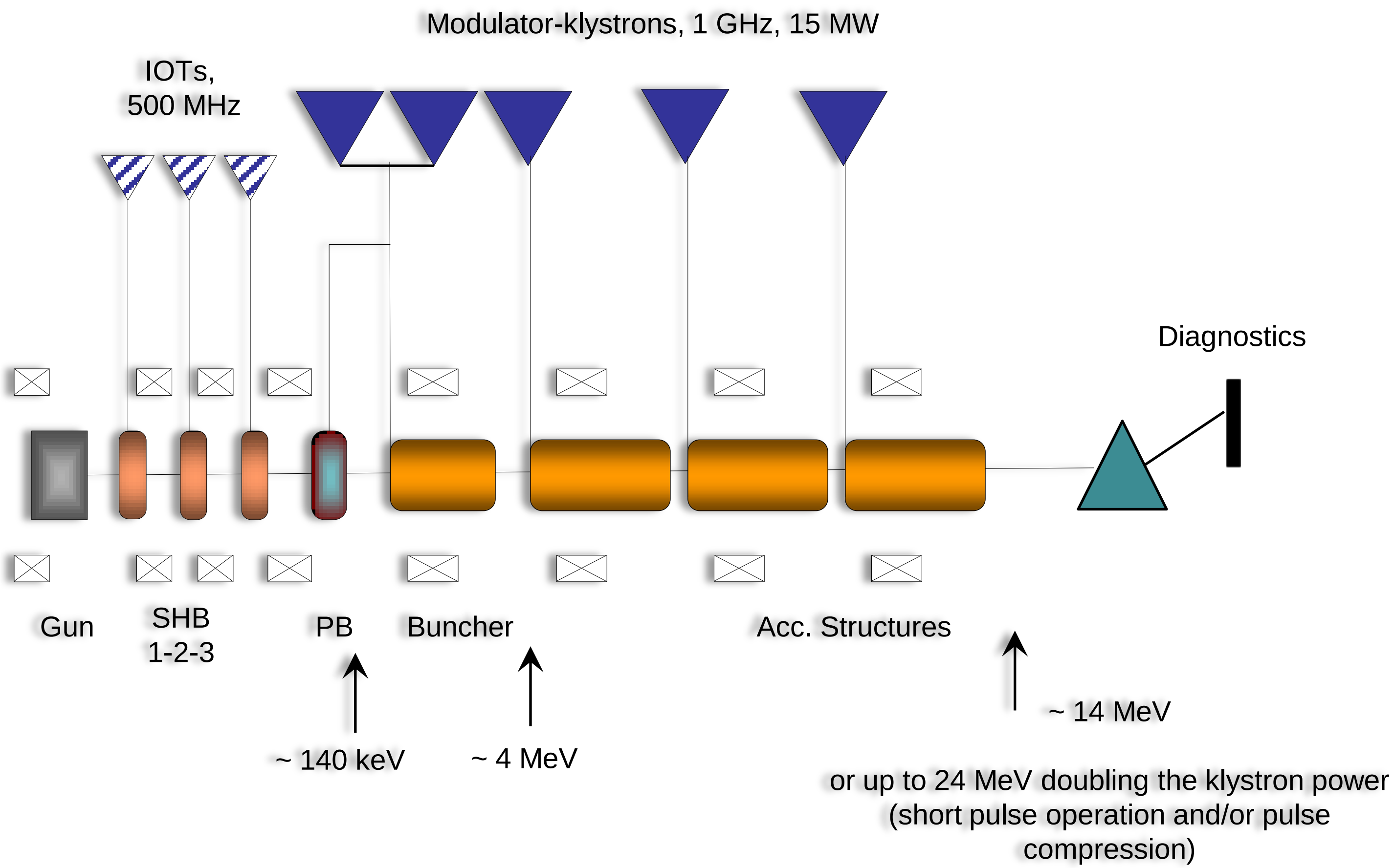


The accelerating gradient and the losses of each cell are given in Figure 4 for the loaded and the unloaded case. The total accelerating voltage of one structure is 3.4 MV (on crest).



CLIC DBA reference from CDR

- Need to check beam dynamics to verify if we can use standard CLIC DBA structures after the buncher (alternative: reduce aperture)
- In such a case, we can make a much more efficient use of the power (5.1 MeV rather than 3.6 MeV from every couple of 15 MW klystrons)
- May be able to substantially increase the energy for short pulse operation



Short/medium term goals (2012-2013):

- Review Beam Dynamics and basic design, considering:
  - New RF design of bunching system elements
  - Satellite minimization (e.g., interleaving PB and 3rd SHB "a la Urschuetz")
  - Check if slower acceleration (higher loading) is acceptable for bunch length and emittance
  - Improved longitudinal phase space
- In parallel:
  - Define modulator/klystron parameters and strategy (single-beam > scaled X-FEL multi-beam ? > ultimate high-efficiency klystron, modulator modularity and voltage flexibility, use of RF compression/short pulse)
  - Define "minimum" test program (objectives, short & long pulse tests, initial & final requirements)
  - Start defining ancillary components (diagnostics, vacuum…) in order to have a detailed plan of resources and time scale
  - Identify a space @ CERN (lower requirements? temporary?), prepare a fall-back solution integrated in CTF3 complex (CLEX?, CTF2?)
  - Start procurement process of hardware on the critical path (klystrons & other RF sources, modulators, gun components – gun test facility?)