

# CTF3 consolidation & upgrades

Workpackage CTF3-001



Frank Tecker - BE/OP  
for the CTF3 Team

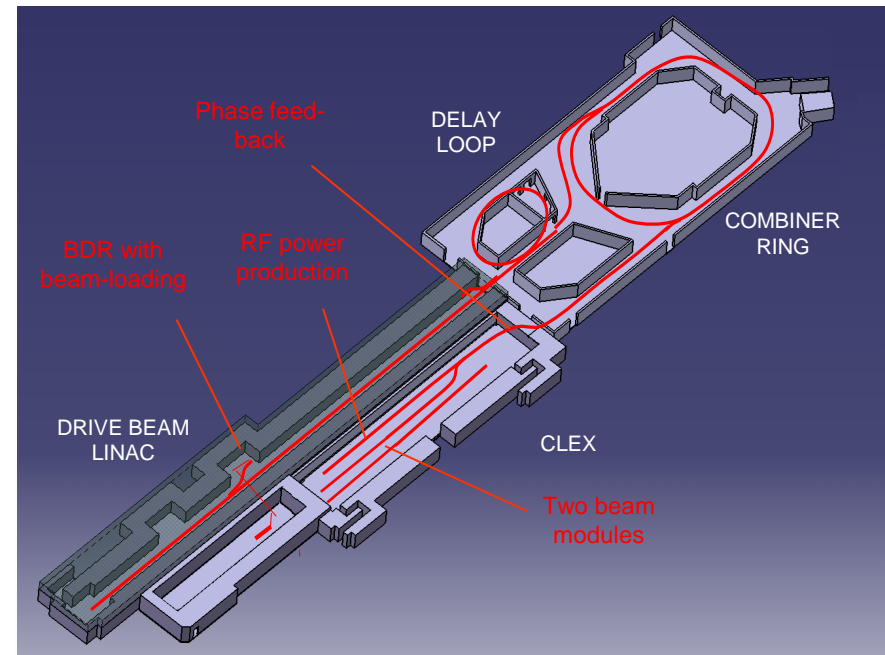
- Introduction
- Consolidation, stability, operation
- Energy upgrade
- Repetition rate upgrade
- Beam-loading effect on breakdown rate



# Motivation



- Goal: fully exploit potential of CTF3
- Consolidate performance in view of CLIC requirements (we have been mainly pushing for current and power)
- improve operational experience
- **phase feed-back** / feed-forward
- **BDR with beam loading**
- **high-power RF testing:** demonstrate operation of a drive-beam driven power source
- **CLIC module tests** with beam as close as nominal as reasonable





# Consolidation + Upgrade



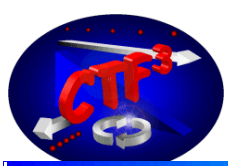
- Certainly need consolidation for aging equipments
- **energy upgrade** will ease the operation, required for full TBL
- **repetition rate upgrade** will decrease conditioning times required for TBL+ RF testing
- continue efforts on further stabilizing the machine feedbacks on current and energy
- finalize the feasibility demonstration in terms of
  - stability
  - emittance
  - pulse shape
  - routine operation
  - ...



# Consolidation/operation needs



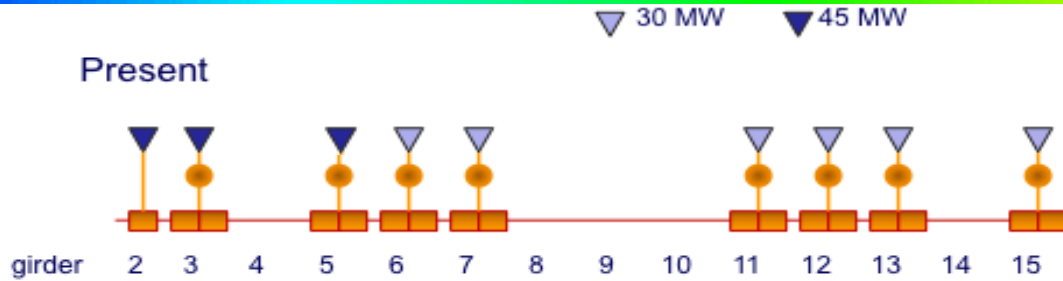
- 1.5 GHz RF bunching system, 40 kW TWT
  - need spares and replacement
- 3 GHz RF system
  - needs regular klystron maintenance and replacement
  - control system upgrade to PLC system (replace CAMAC)
- Beam stability
  - manpower for studies and implementation of feed-backs
- Operation
  - manpower for beam studies and running
  - manpower for programming support software (had collaborator from RRCAT, India in the past)
  - control system maintenance and improvements
  - diagnostics & instrumentation support and developments



# Energy upgrade

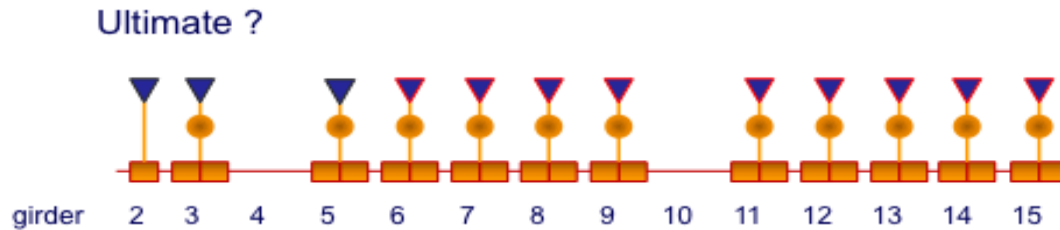


R.Corsini



About 120 MeV  
for final beam current of  
about 28 A

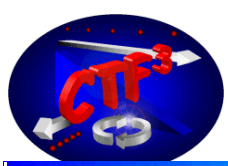
Total beam power 3.3 GW  
e.g., enough to feed  
24 accel. structures  
(final drive beam energy 50 MeV)



About 200 MeV  
for final beam current of  
about 28 A

Total beam power 5.7 GW  
e.g., enough to feed  
50 accel. structures  
(final beam energy 50 MeV)

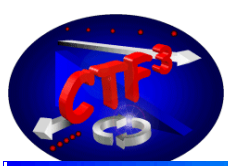
- will ease the operation, required for full TBL
- upgrades to 45 MW klystron tubes and girder 14 planned
- RF pulse compressor cavities (1 LIPS / 1 BOC) available
- 4 accelerating structures available
- need 2 additional modulators/klystrons (MKS)



# Repetition rate upgrade



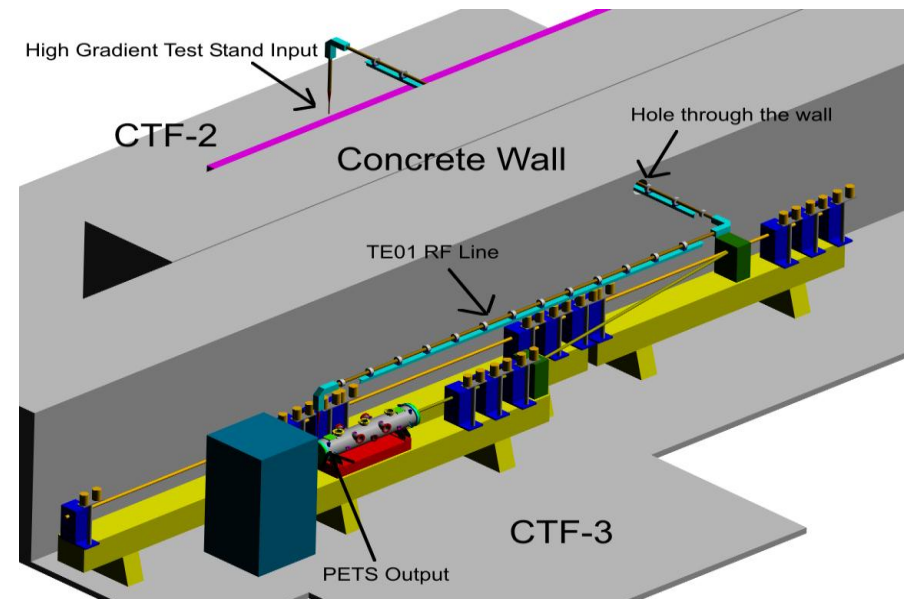
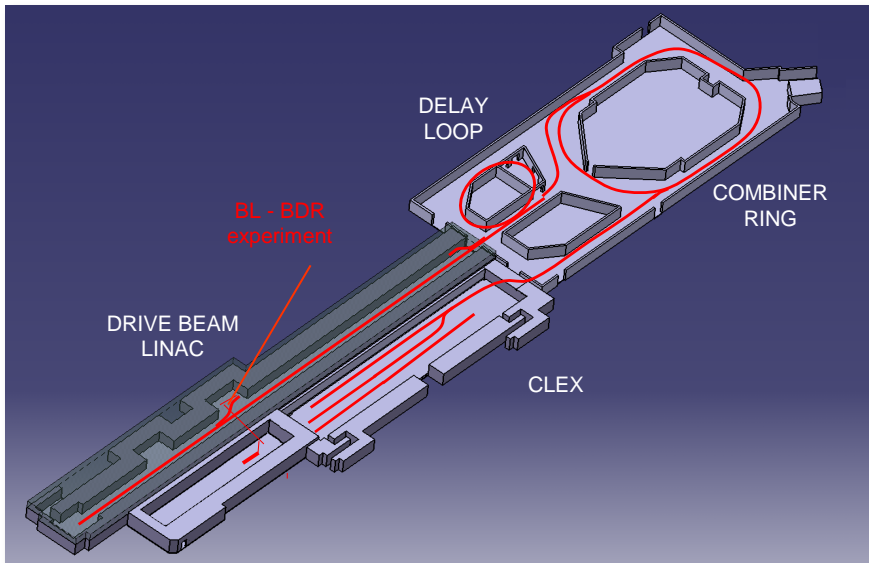
- required for RF structure conditioning and BDR statistics
- presently limited to 5 Hz by two klystrons (MKS11/MKS15)  
=> need additional **charging power supplies**
- test with 4x combined beam up to TL2 done already last year
- practically limited by radiation losses
  
- Identify shielding / zone classification as a function of rep rate and operation mode (4x/8x)  
=> **manpower for the studies** needed
- Identify hardware changes as function of rep rate



# BDR with beam loading



- Beam loading reduces field => BDR lower?
- CLEX probe beam current limited => use CTF3 drive beam and klystron-driven X-band structure in the old '30 GHz PETS' line
- 30 GHz **waveguide network** has to be converted to X-band
- Interface to regular structure test area and switchable connection to klystron
- RF instrumentation from stand-alone power source
- need **manpower for the software and analysis**





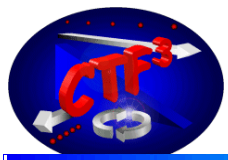
- various items can be studied at CTF3 to improve the performance and test concepts and hardware for CLIC
- some interesting topics for collaborations...
  - optimize RF deflector bump configuration
  - decoupling the CR septa
  - test algorithms for CLIC machine commissioning (safe beam)
  - machine protection concepts
  - loss monitors
  - test alignment in the accelerator environment
  - CLIC specific beam instrumentation
  - any tests in view of CLIC0 (injector)
  - sextupoles in the CR deflector bump
  - ...





# CTF3-001 Summary

WP: CTF3-001 CTF3 consolidation & upgrades		Purpose/Objectives/Goals: Enable CTF3 continued operation until 2016 with performances compatible with the experimental program (system performance)			Deliverables		Schedule	
Energy upgrade		Required for long string of modules. Useful for TBL deceleration demonstration, TBL+ high power testing, drive beam transport in modules, beam tests.			2 new modulators/klystrons (3GHz, 45 MW) and associated infrastructure. <b>M budget: 2.5 MCHF</b>		1 <sup>st</sup> MDK: 2012 – 4Q 2 <sup>nd</sup> MDK: 2013 – 3Q	
Repetition rate upgrade		Required for TBL+ high power testing. Useful for operation and breakdown rate studies.			Additional shielding, pulsed charge power supplies for MKS, interlocks. <b>M budget: 3.5 MCHF</b>		Interlocks: 2011 – 3Q MKS PS: 2012 – 2Q Shielding 2013 – 1Q	
Consolidation, stability, operation		Required for continued CTF3 operation 2012-2016.			Consumables (klystrons), spares (TWTs), feed-backs, diagnostics and control system maintenance and improvements, operating support. <b>M budget: 9 MCHF</b>		Distributed 2012-2016	
Effect of beam-loading on breakdown		Assess the breakdown rate behaviour in beam-loaded X-band structures			Re-furbish CTF3 dog-leg, RF network Experiment report. <b>M budget: 0.5 MCHF</b>		2012 – 1Q 2013 – 1Q	
Link to other WPs/activities: This WP is integrated to WPs CTF3-002, CTF3-003 and CTF3-004 (see above)								
Lead collaborator(s): CERN: BE/RF, BE/BI, BE/ABP, BE/OP								
Resources:		2011	2012	2013	2014	2015	2016	Total
Material (kCHF):			3750	3750	3000	3000	2000	15500
Personnel (FTE):			20	20	15	15	15	85
Most resources will necessarily come from CERN. Basically <b>uncompressible</b> if any CTF3 program is to be preserved.								



- Thank you very much for your attention!
- Thanks to everyone for the input to this talk.