CLIC plans for the next phase

R. Corsini for the CLIC/CTF3 Collaboration
and the CLIC TDR Task Force

Jean-Pierre Delahaye, Steffen Doebert, Gunther Geschonke,
Alexei Grudiev, Philippe Lebrun, Hermann Schmickler,
Daniel Schulte, Steinar Stapnes, Igor Syratchev,
Walter Wuensch, Frank Tecker

Talk outline

- Introduction – the CLIC roadmap
- Outline of the next phase
  - RF structures development
  - Technical development, prototyping
  - Test facilities
  - Other activities
- Resources

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Slide from CLIC '09 Workshop presentation

Work Plan until 2010:

- Demonstrate feasibility of CLIC technology (R&D on critical feasibility issues)
- Design of a linear Collider based on CLIC technology
  http://clic-study.web.cern.ch/CLIC-Study/Design.htm
- Estimation of its cost (capital investment & operation)
- CLIC Physics study and detector development
  http://clic-meeting.web.cern.ch/clic-meeting/CLIC_Phy_Study_Website/default.html

Conceptual Design Report to be published in 2010 including:

- Physics, Accelerator and Detectors
- Results of feasibility study
- Preliminary performance and cost estimation

R&D Issues classified in three categories:

- critical for feasibility → fully addressed by specific R&D to be completed before 2010; results in CDR
- critical for performance
- critical for cost

→ being addressed now by specific R&D to be completed before 2016; first assessments in CDR; results in Technical Design Report (TDR) with consolidated performance & cost

Slide from CLIC '09 Workshop presentation

Tentative long-term CLIC scenario

Shortest, Success Oriented, Technically Limited Schedule

CERN Council decision on Technical Design Phase

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
R&D on Feasibility Issues																		
Conceptual Design																		
R&D on Performance and Cost issues																		
Technical design																		
Engineering Optimisation&Industrialisation																		
Construction (in stages)																		
Construction Detector																		

Conceptual Design Report (CDR)

Technical Design Report (TDR)

Project approval ?

First Beam?

Present status

- CDR basically on track. First "good" draft end of the year, final publication in 2011.
- CTF3 fire ⇨ final results on Two-Beam feasibility issues mid 2011
- Final results on other feasibility issues by 2012

New boundary conditions: new CERN MPT 2010

- Previous CERN Medium Term Plan (MTP) included a (potential) large increase in CLIC resources, starting from 2011.
- Due to financial constraints, the new MTP approved in August 2010 by the CERN Council had substantially "reduced such increase".
- Still, CLIC material budget @ CERN should almost double over the next 3 years (while manpower should remain basically constant).
- We are presently re-evaluating the plans for the next phase – need to:
  - Revise, improve and better refine the technical plan.
  - Define the needed resources (and eventually secure them).

Help from Collaborating Institutes needed for both!

The new MTP

Fact Sheet	Old fact sheet number	(in MCHF, 2010 prices, rounded off)	2010 Revised budget	2011	2012	2013	2014	2015	2011-2015 Total
		Projects	105.2	134.4	133.4	123.4	120.9	98.9	611.0
24	16.a	CLIC / Linear collider	24.2	27.0	28.7	29.9	29.9	29.9	145.4
		Personnel	12.8	14.2	11.9	11.1	10.9	10.9	58.8
		Materials	11.3	12.9	16.8	18.8	19.0	19.0	86.6

MTP August								
Yearly		2010	2011	2012	2013	2014	2015	2016
	Total	24.2	27	28.7	29.9	29.9	29.9	29.9
	Personnel	12.8	14.2	11.9	11.1	10.9	10.9	10.9
	Material	11.3	12.9	16.8	18.8	19	19	19
Integrated from 2011	Total		27	55.7	85.6	115.5	145.4	175.3
	Personnel		14.2	26.1	37.2	48.1	59	69.9
	Material		12.9	29.7	48.5	67.5	86.5	105.5

Old MTP had 160 MCHF!

- What can be done until 2016 with the available resources?
  - Assume 105 MCHF integrated CERN contribution (2011-2016) for material budget
  - Assume an additional 50% from the Collaboration > total ~150 MCHF
  - Check consistency with Personnel Resources (how much from Collaborators?)

Work Plan for the next years:

Before 2011

CDR (2011), CLIC feasibility established

2011-2016 – Project Preparation phase

This is the current focus for planning in the collaboration, with main activities covering:
- review of the CLIC baseline design, taking into account CDR results and including:
  - cost & power consumption optimization
  - energy staging
  - technical risks and performance risks
- technical developments and test of critical component prototypes, using several facilities across the collaboration
- exploitation and upgrade of CTF3 to CTF3+, construction and commissioning of CLIC drive beam injector
- detector and physics studies
- site studies
- preparation of a Project Implementation Plan (PIP) for CLIC

This phase will culminate with a document, or several, covering the points above, with a detailed plan for the next phase

After 2016 – Project Implementation phase, including an initial period to lay the grounds for full approval

Considering the preparation steps foreseen and the resources situation it is clear that several key tasks will need further effort before the project can move into construction:
- finalization of the CLIC technical design, taking into account:
  - results of technical studies done in the previous phase
  - final energy staging scenario based on the LHC Physics results, which should be fully available by the time
- possible construction of CLIC Zero as first CLIC phase
- industrialization and pre-series production of large series components with validation facilities
- further detector and physics studies, with increased emphasis on technical coordination issues and integration
- revision of the Project Implementation Plan (PIP) of CLIC, following the energy staging strategy and detailed resource discussion with all partners – providing the basis for a staged or full approval, and subsequent construction start up

During this initial period we will need to produce the necessary documents to support a proposal for CLIC construction start-up

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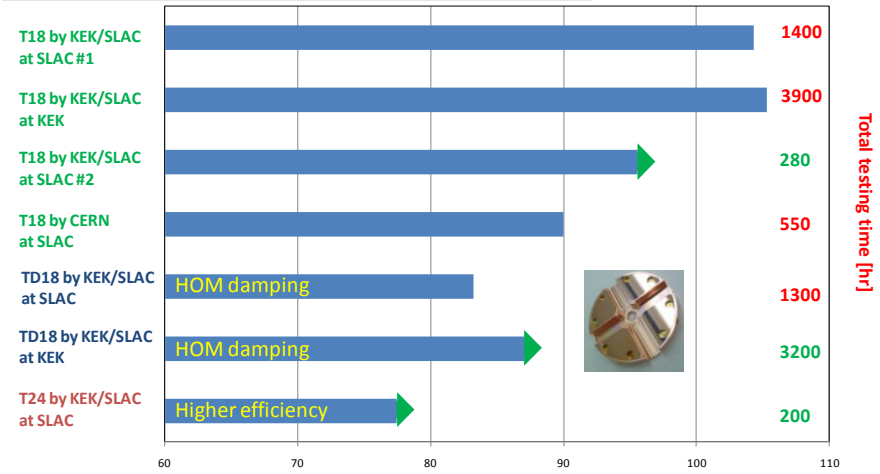
RF structures & High-power tests

- Basic feasibility ⇨ ~ **OK**
  (for both accelerating structures & PETS)

Still to be done (2011-2016):

- Implement full features
  (damping material, wake-field monitors, vacuum, cooling, PETS on-off …)
- Increase statistics, long-term running
- Optimization of fabrication techniques for cost/performance
- Start industrialization/large-series production
- Explore potential for further improvements

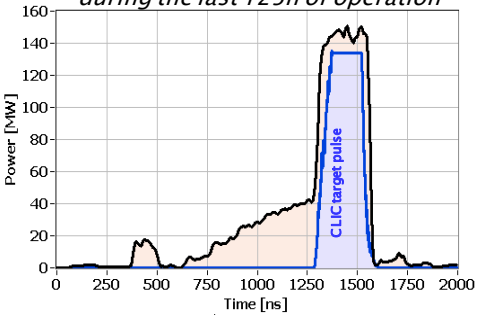
Resume of CLIC acc. structure performance

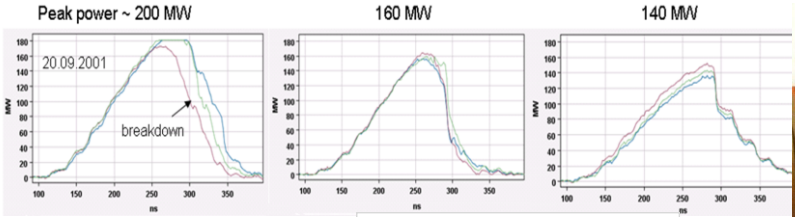


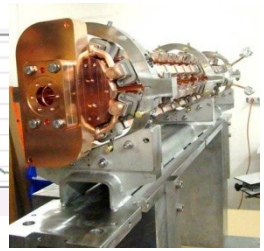
PETS @ASTA - SLAC, klystron powered

BDR <1.2 x 10^{-7}/pulse/PETS

Typical RF pulse shape in ASTA during the last 125h of operation







PETS @ CTF3 – TBTS, beam powered

RF structures

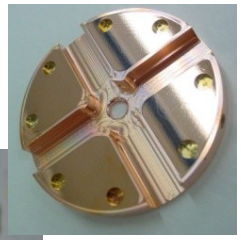
Design and fabrication of 12 GHz accelerating structures & PETS for high-power and beam testing and associated R&D

Core activity – critical for cost and performance

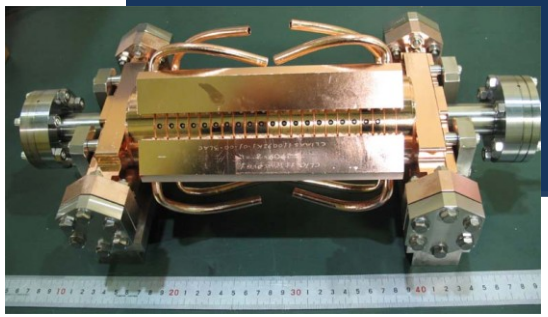
- Improve infrastructure for manufacturing, brazing , assembly procedures and quality control
  - Precision machining center and metrology at CERN
  - Diffusion bonding furnace at CERN
- Build and test about 100 "baseline " accelerating structures
  - A few generations of reference structures
  - Optimization of damping material, cooling, vacuum, tolerances, cost, preparation of industrialization
  - Parallel testing for more statistics on performance, long-term testing
- Build and test about 20 "alternative" accelerating structures
  - Explore alternatives for improved cost/performance
  - RF design, materials, fabrication techniques
- Build and test about 10 PETS prototypes
  - Alternative designs for cost/performance
- Basic studies on breakdown physics

N.B.: more structures and PETS will be built and installed in CLIC modules, most of which will be tested with beam in CTF3

Accelerating structure disk

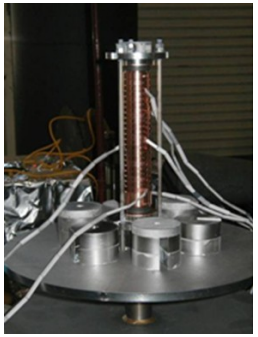


Stacked disks

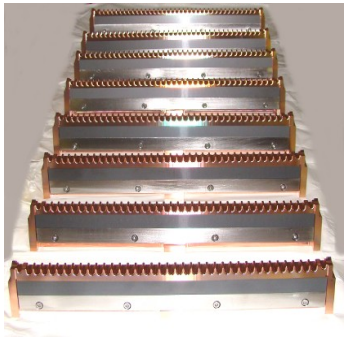


Structure ready for test

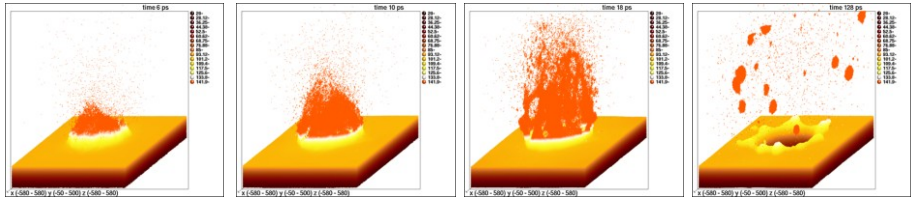
PETS ready for test



Temperature treatment for high-gradient



PETS bars



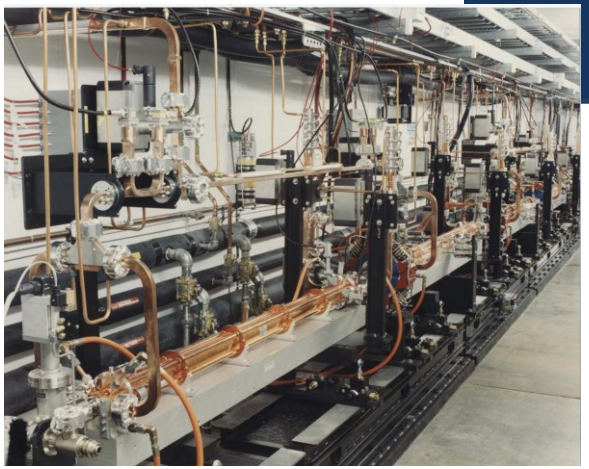
Multi-scale simulation of breakdown – Helsinki Univ.

RF Test areas

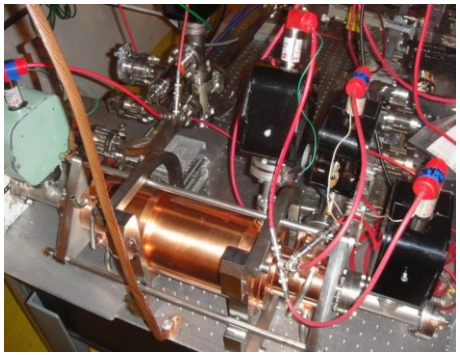
Building, commissioning and operation of high-power Klystron-based RF test stands

Core activity – critical for cost and performance

- Continued support for high-power testing at 11.4 GHz at KEK and SLAC
- Build four new 12 GHz klystron-based high-power test stations from 2011 to 2016, at CERN and elsewhere
  - Eventually about two slots per station
  - Compatible with planned number of structures/PETS
- Contribution to high-power testing , including CTF3+
  - Measurements, operation, data analysis



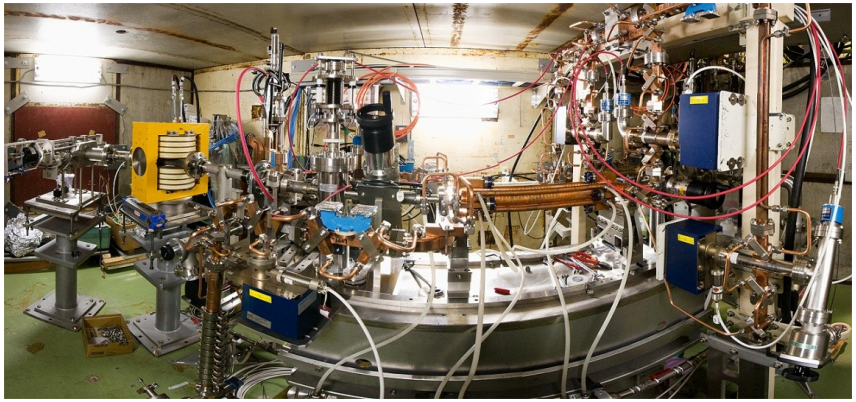
NLCTA - SLAC

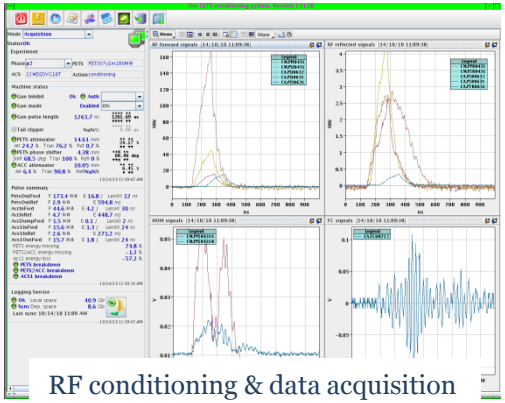


PETS under test at ASTA - SLAC

12 GHz klystron and pulse compressor for CERN high-power test stand

Nextef - KEK

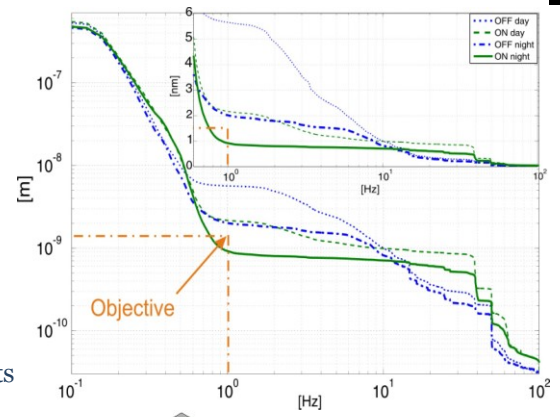




RF conditioning & data acquisition for CTF3 - TBTS

Technical development, prototyping

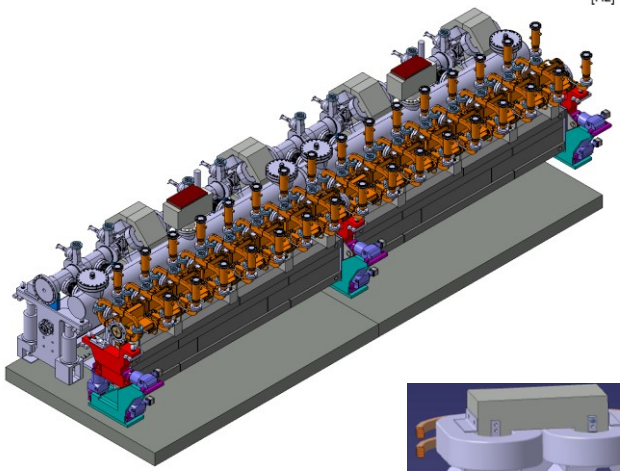
- Conceptual design of technical systems ⇨ **CDR** (including basic feasibility)



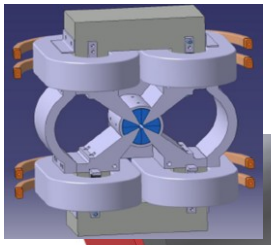
April 2010 – nm stabilization results

Still to be done (2011-2016):

- Technical design, prototypes and beginning of industrialization for all large-series items (critical for cost, performance and schedule)
  - Nominal two beam modules with all features this includes accelerating structures & PETS
  - Drive beam accelerator units (modulator, klystron, RF network, accelerating structure)
- Technical design and working prototypes for all items critical for performance and cost
- Ensure technical feasibility of all components

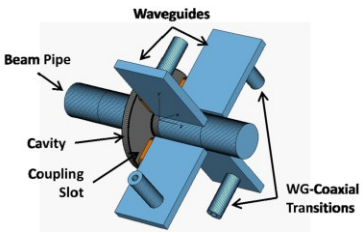


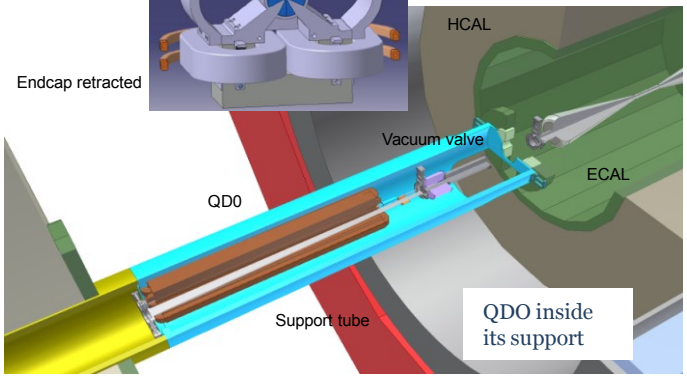
CLIC two-beam modules



CLIC FF QDO prototype

CLIC cavity BPM



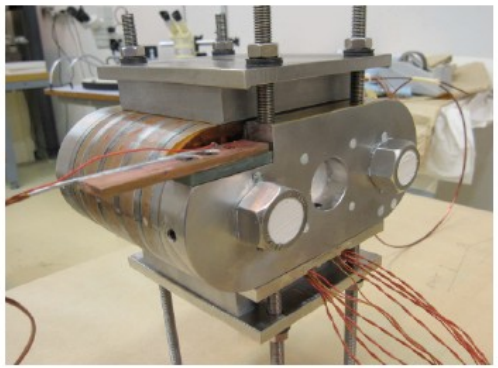


Technical development, prototyping

Technical R&D – design, build and test prototypes of CLIC critical components

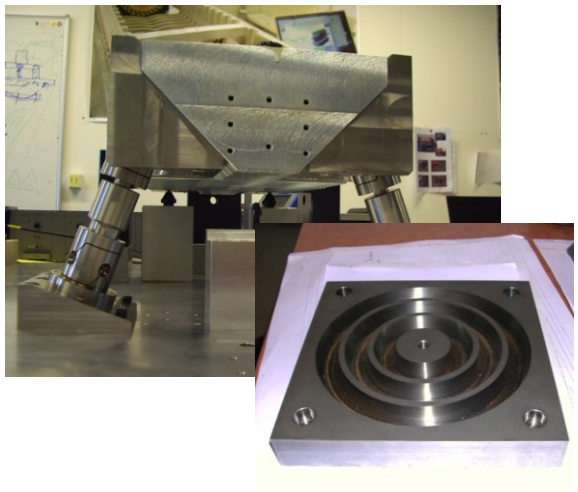
Technical design and prototypes for all components critical for cost or performance and
and beginning of industrialization for large-series items

- Development of 15 MW 1 GHZ MBK and modulators
- R&D and prototypes of CLIC two-beam modules , including alignment and stabilization systems
- Prototypes of FF QDO quadrupole and stabilization system
- R&D and prototyping of critical beam instrumentation
- Prototypes and tests of critical equipment for DRs:
  - SC wiggler
  - Vacuum components
  - Fast extraction kickers
- Dynamic vacuum assessment
- Prototype installation of fs timing system
- Magnet prototypes, power supplies
- Design and studies of machine protection system
- ...



DR superconducting wiggler prototype

nm active stabilization systems



Draft program for technical developments

domain	deliverable
development of 15 MW 1 GHZ MBK	1 working prototype/firm
development of modulators for above	3 prototypes
prototypes of stabilized MB quads	at least one T1, T2, T3, T4
alignment system	400m working demonstrator in TZ32
alternative alignment system	prototypes
prototype for FF quad (including stabilization)	Short and long prototype
Validation of quad stability through beam experiments	validation
Prototypes of critical beam instruments	experimental validation; BPMs, ODR
Prototype installation of fs timing system	24 km transport of 10 fs timing reference
prototypes of fast kickers	10-4 jitter kicker in lab; beam tests
various magnet prototypes with power supplies	preparation of industrial production
Critical equipment for DRs: vacuum, SC wiggler	prototypes, verification in light sources
dump, masks	studies, designs, material tests

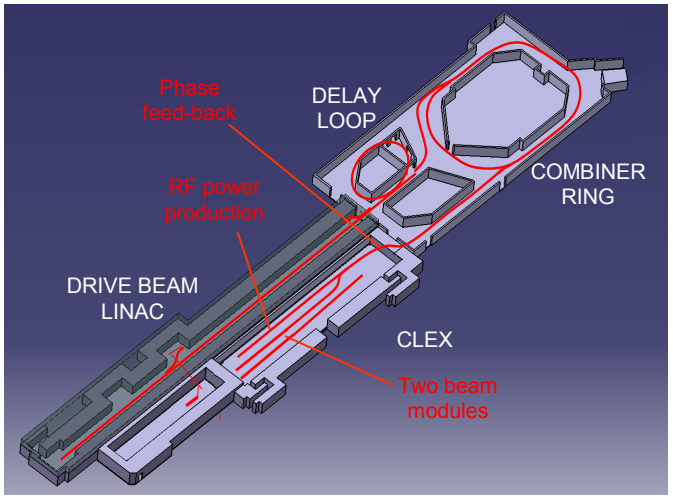
Test facilities

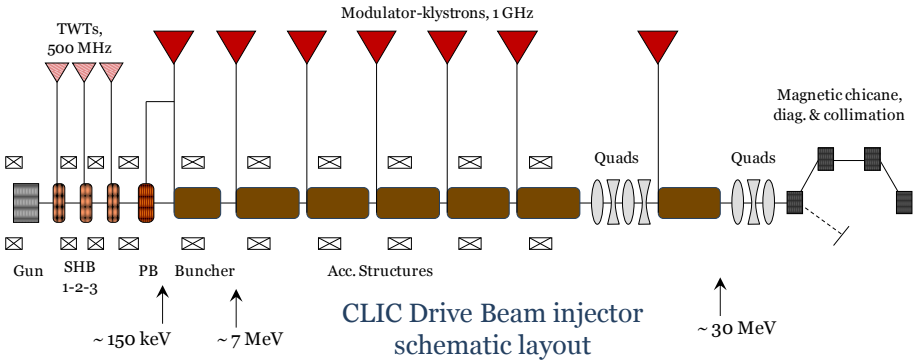
- Feasibility demonstration in CTF3 ⇨ **Mid 2011**
  (present experimental program of CTF3 completed by 2012)

Outlook for (2011-2016):

- Consolidation/upgrade of CTF3 to fully exploit its potential
  - Verify stability/reliability performance in view of CLIC requirements , improve operational experience
  - Contribute to high-power RF testing, demonstrate operation of a drive -beam driven power source
  - Test with beam CLIC two-beam modules
- New drive beam injector facility, at nominal CLIC parameters
  - Final proof of drive beam performances, long-pulse, high -power operation
  - provides a focus for development and pre-industrialization of drive beam components – all hardware reusable
- Pursue and intensify experimental program in other facilities
  - ATF II
  - CesR-TA, SLS, ATF I, ANKA...
  - Asset
  - ...

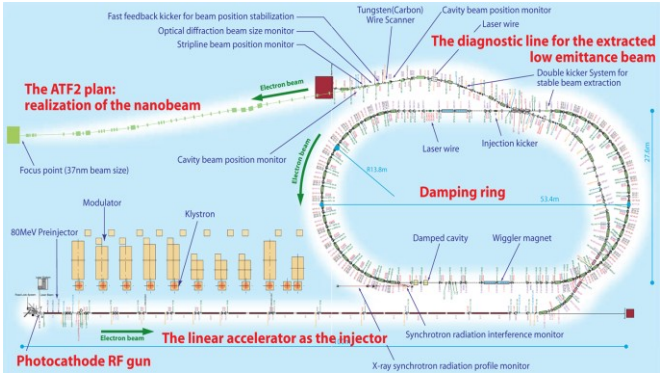
CTF3+





CLIC Drive Beam injector schematic layout

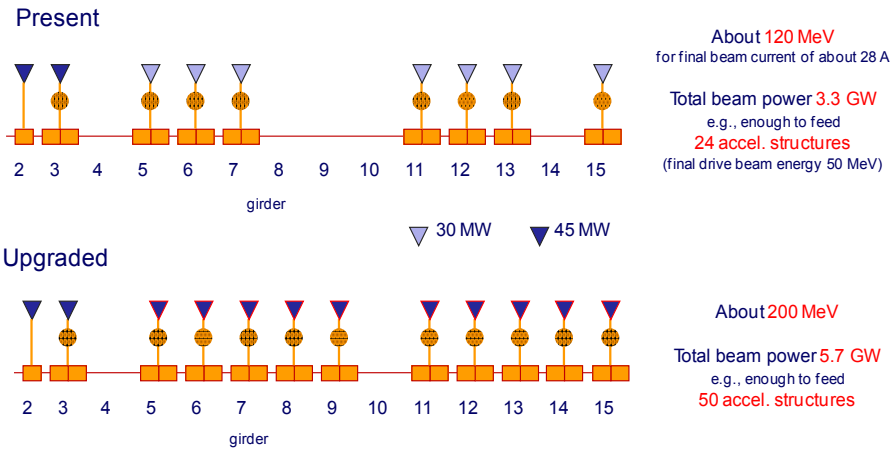
ATF - KEK



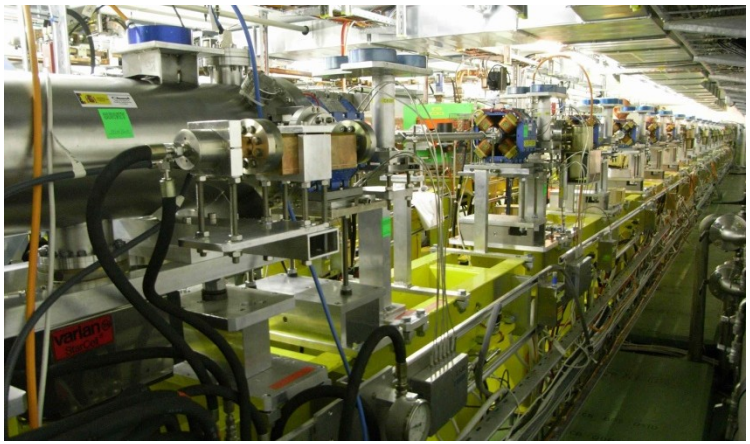
Test facilities – CTF3+

CTF3 consolidation and upgrade

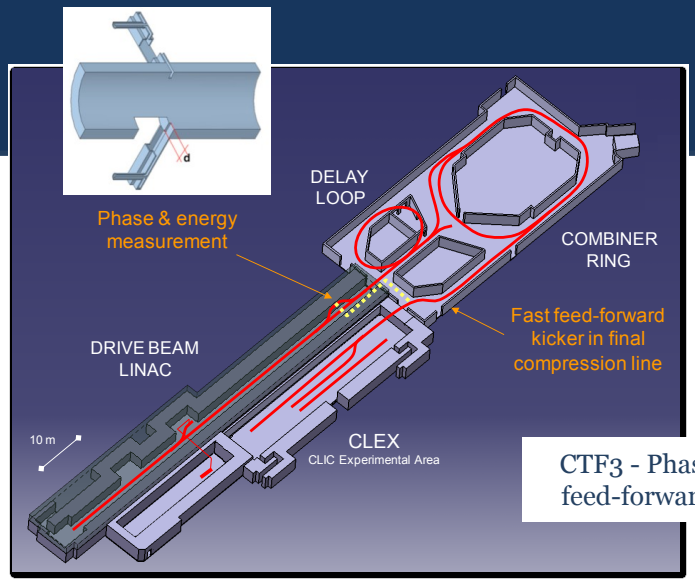
- Consolidation and upgrade (higher energy, stability, reliability, rep. rate)
- Drive beam phase feed-forward experiments
- Upgrade and operate TBL as 12 GHz power production facility
- Operation with beam of a long string of CLIC two-beam modules



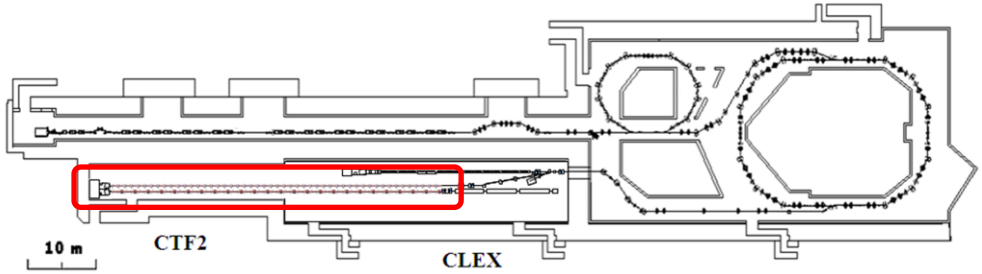
CTF3 energy upgrade



TBL - CLEX



CTF3 - Phase feed-forward

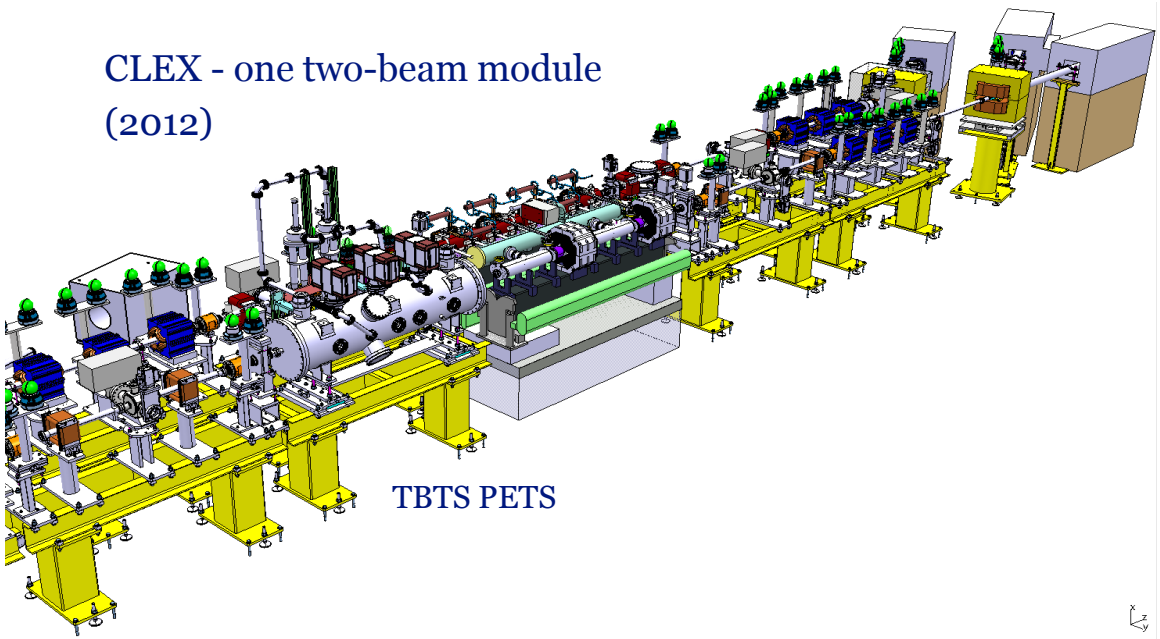


Two-Beam modules in CTF3

CTF3+

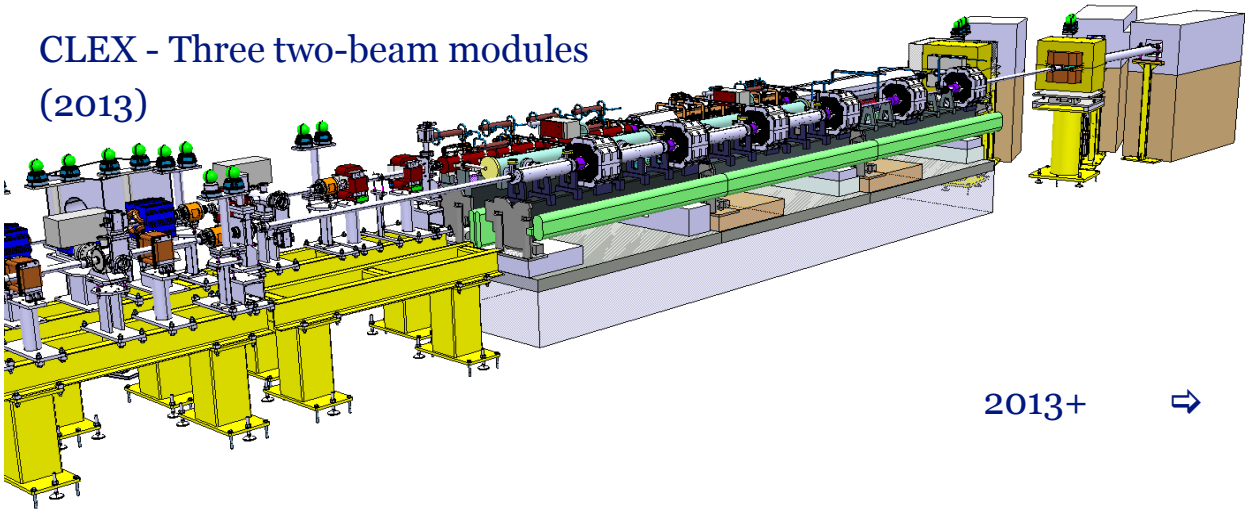
CLEX – TBTS (until 2011)

CLEX - one two-beam module (2012)



TBTS PETS

CLEX - Three two-beam modules (2013)

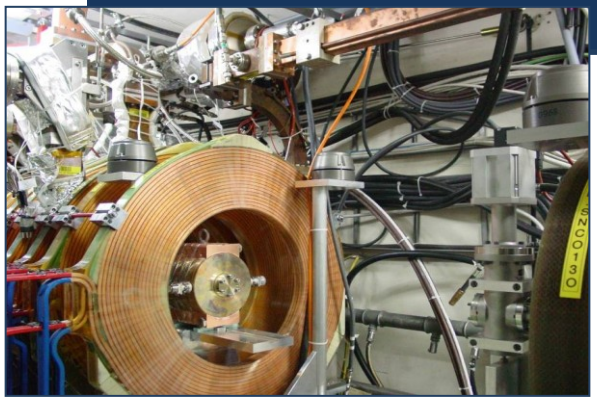


2013+ ⇨ N modules (N < 20)

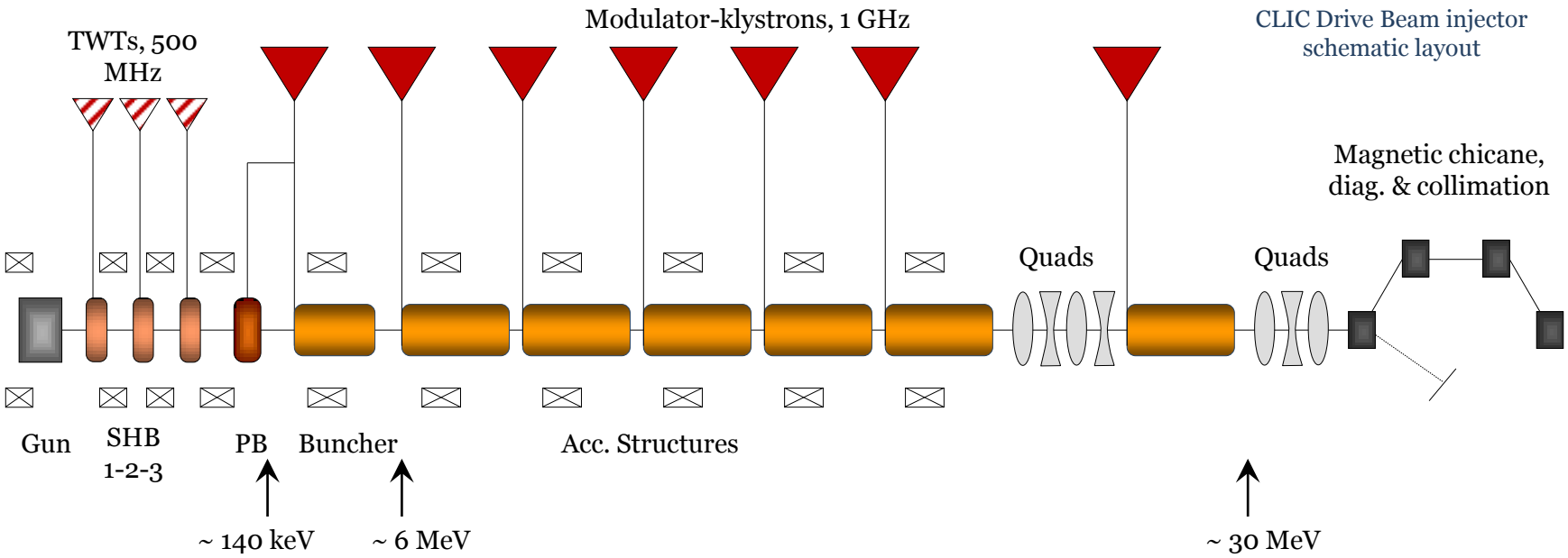
Test facilities – CLIC Drive Beam Injector

Build and commission 30 MeV Drive Beam injector 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

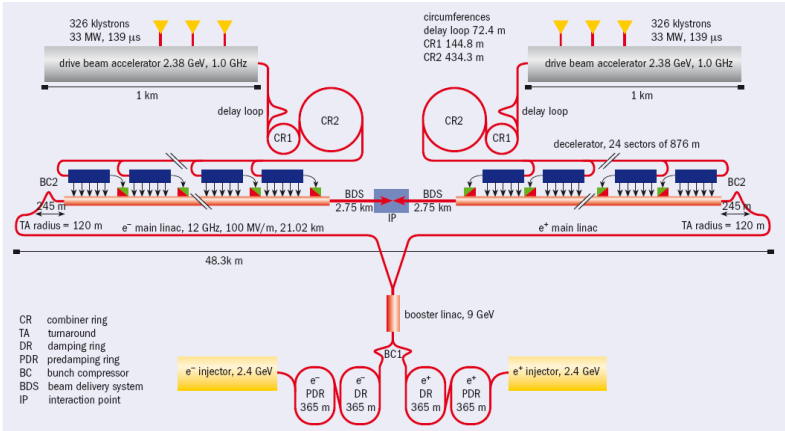
Other activities

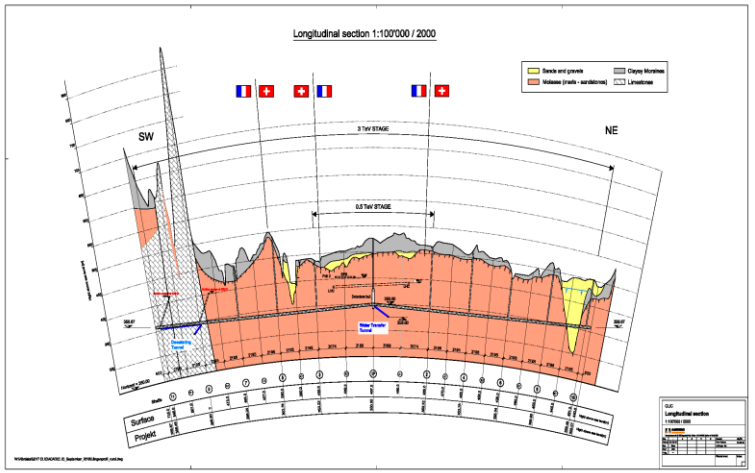
- CLIC 3 TeV conceptual design, cost estimate ⇨ **CDR**

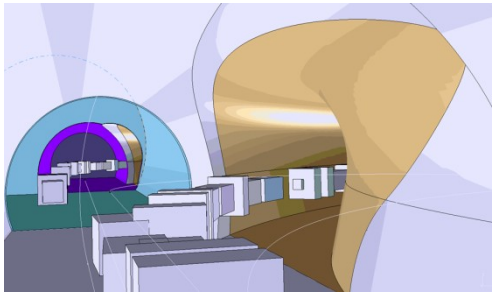
Still to be done (2011-2016):

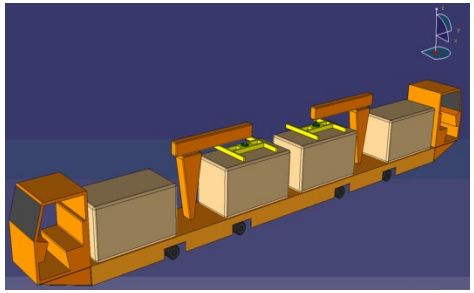
- Beam Physics - review of the CLIC baseline design, taking into account CDR results:
  - Re-optimize for cost & power consumption
  - Define energy staging
  - Assess performance risks
  - Participate to beam studies in test facilities, at CERN and elsewhere

- Civil Engineering, Implementation and Cost studies
  - Update cost model for new baseline
  - Site studies
  - Preparation of a CLIC Project Implementation Plan



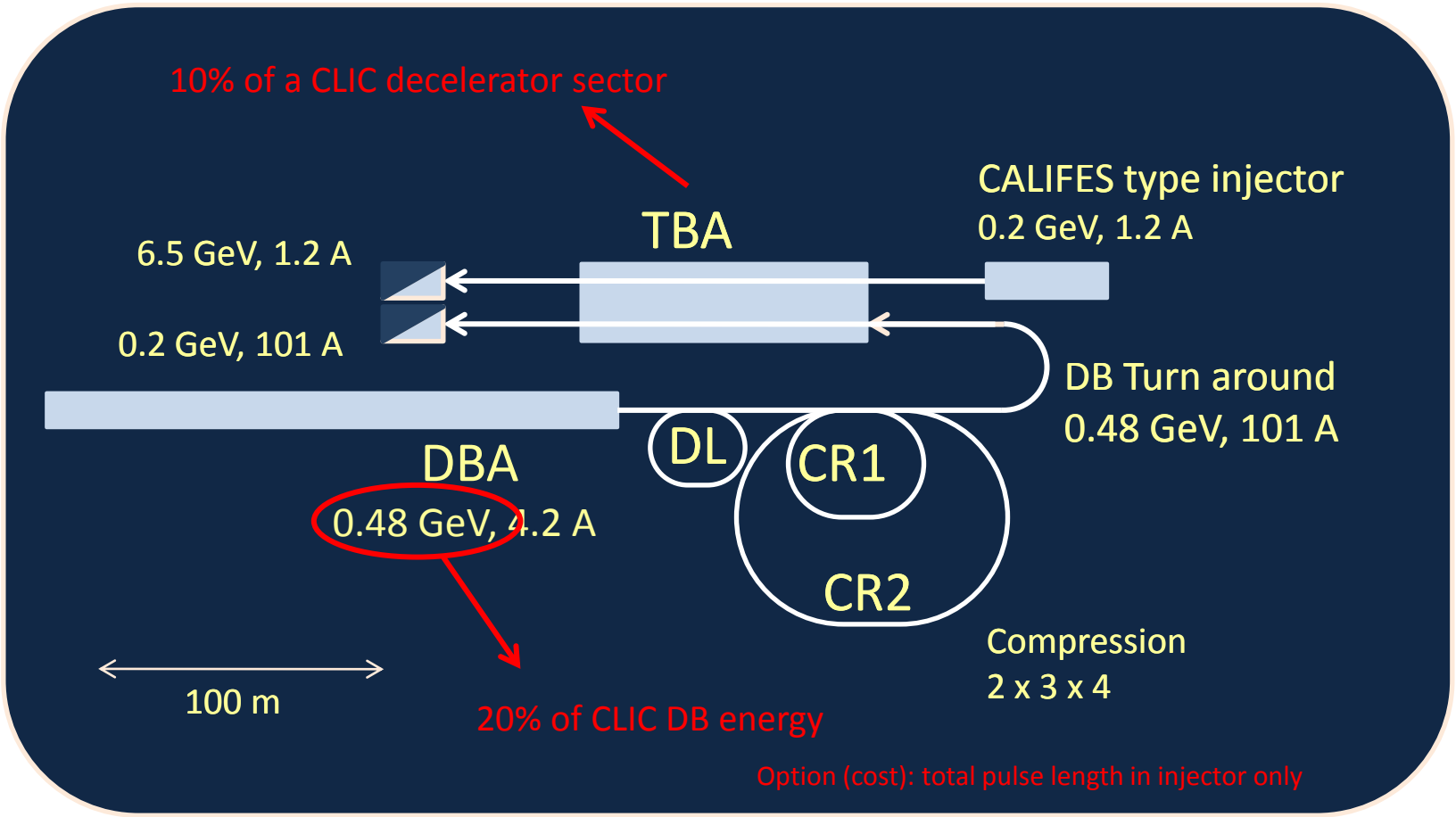






Outlook after 2016

CLIC Zero



All other parameters nominal - all components nominal and re-usable for CLIC

CLIC plans for the next phase

R. Corsini for the CLIC/CTF3 Collaboration
and the CLIC TDR Task Force

Jean-Pierre Delahaye, Steffen Doebert, Gunther Geschonke,
Alexei Grudiev, Philippe Lebrun, Hermann Schmickler,
Daniel Schulte, Steinar Stapnes, Igor Syratchev,
Walter Wuensch, Frank Tecker

Talk outline

- Introduction – the CLIC roadmap
- Outline of the next phase
  - RF structures development
  - Technical development, prototyping
  - Test facilities
  - Other activities
- Resources

Activity	Description	Deliverables (2016)	Total material budget
CTF3 +	CTF3 consolidation and upgrade	• Consolidation and upgrade (higher energy, stability, reliability) • Drive beam phase feed-forward experiments • Upgrade and operate TBL as 12 GHz power production facility • Operation with beam of a long string of CLIC two-beam modules	43 MCHF
CLIC Zero	Injector for the CLIC drive beam generation complex	• Build and commission 30 MeV Drive Beam injector with nominal CLIC parameters • Build and commission a few Drive Beam accelerator nominal modules • Participation to Technical Design of full CLIC Zero facility	42 MCHF
RF Structures	design and fabrication of 12 GHz accelerating structures & PETS and associated R&D	• Build and test about 120 accelerating structures • Build and test about 10 PETS prototype • Establish quality control, brazing and assembly procedures for structure fabrication at CERN • Precision machining center at CERN	29 MCHF
RF test infrastructure	Building, commissioning and operation of high-power RF test stands	• Four 12 GHz klystron-based RF high-power test stations, for about 8 slots, running before 2016 • Continue high-power testing at 11.4 GHz (KEK and SLAC) • Contribution to high-power testing in CTF3+ (TBL)	13 MCHF
Prototypes of critical components	Technical R&D – design, build and test prototypes of CLIC critical components	• R&D and prototypes of two-beam modules alignment and stabilization systems • Prototype of final focus QD) quadrupole and stabilization system • Several nominal CLIC two-beam modules, mechanically tested, possibly beam tested • R&D and prototyping of critical beam instrumentation • Design and studies of machine protection system • DR superconducting wiggler prototypes, test with beam • DR extraction kickers prototypes • Dynamic vacuum assessment • Contribution to the CLIC Zero TDR • …	40 MCHF
Cost studies, Civil engineering, Proj, Implementation	Update and improve CLIC cost model & civil engineering studies	• Technical Design (TD) and Project Implementation Plan (PIP) of CLIC Zero • Improved cost model, feedback to CLIC baseline review	4 MCHF
Beam physics studies	Beam physics and overall design	• Review of the CLIC baseline design • Contribution to the TDR of CLIC Zero	3 MCHF

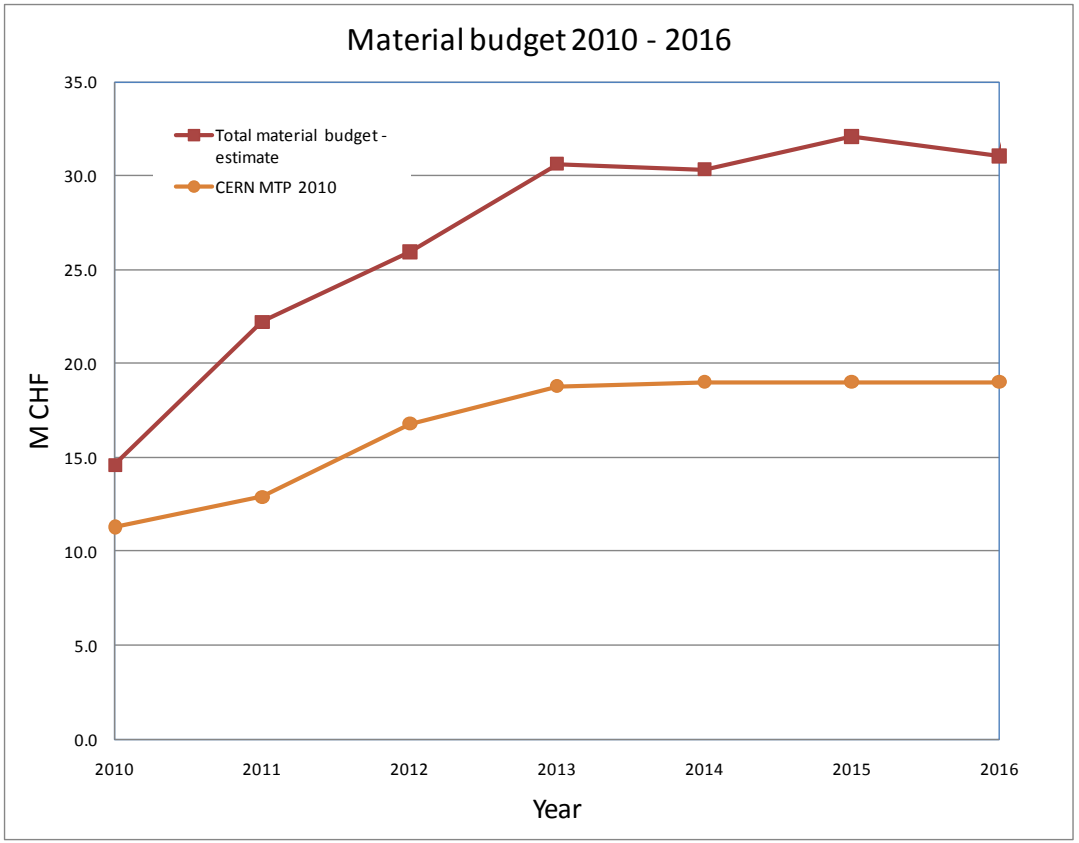
Material

- Ramp-up to about 30 MCHF in 2013
- Total integrated 2011-2016 ⇨ 175 MCHF

Assuming planned CERN contribution (MTP 2010 – about 105 MCHF)

⇨ need from collaborators 70 MCHF

Material contributions from outside CERN should rise from 20-25% (present level) up to more than 1/3



Manpower

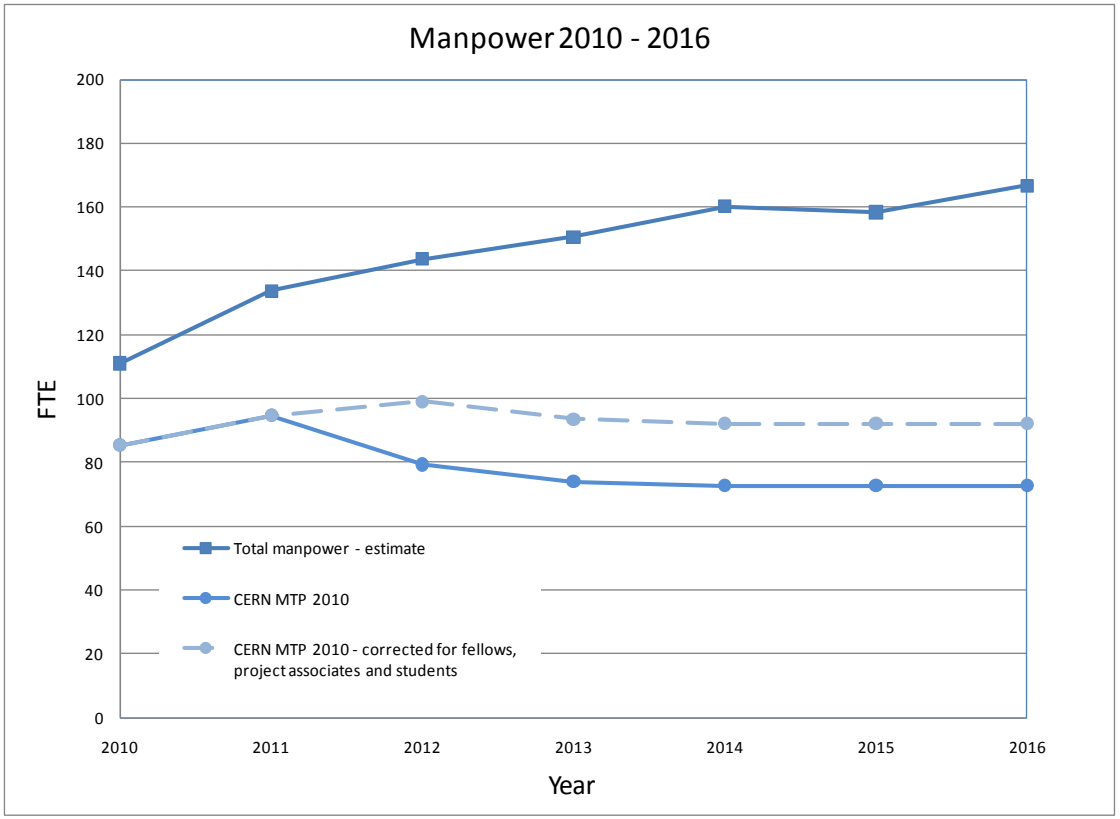
- Ramp-up from about 110 to 170 FTE

Planned CERN contribution (MTP 2010) slightly decreasing!

However, in the MTP after 2011/2012 most of non-staff manpower is not accounted for

Taking this into account, the CERN manpower is substantially flat (however, a fraction of this will have to be provided by a material-to-personnel transfer)

⇨ need from collaborators up to ~ 50 *additional* FTEs



Conclusions

- CLIC feasibility is going to be demonstrated and documented by 2011
- Since some time we are preparing the plans for the next phase (Project Preparation phase, 2011-2016)
  - "Reduction of the increase" in CERN resources has forced us to review such plans
  - Still, the planned increase in material budget over the next few years should enable us to pursue the most critical R&D
  - A complete program is under study, needs larger resources (from outside CERN?)
- We need the help of present – and new – collaborators, in order to:
  - Revise, improve and better refine the technical plan
  - Provide additional resources

Review per activity - RF structure development & High power testing

Manpower (FTEs per year over whole period, CERN and collaborators)			Period: 2011-2016
	staff (including coll.)	fellows and students	
Design	6	10	
Production	7	7	180
Test areas and testing	6	6	72
Subtotal			**252**

Integrated material budget					
item		Unit cost	Number	Total cost	(kCHF)
Laboratory-based manufacturing					
	Machining center	1000	1	1000	
	H2 diff. bonding furnace	500	1	500	
	Infrastructures	2000	1	2000	
	Exploitation	2500 /y		15000	
Accelerating strucures					
	Baseline made by industry for test	75	100	7500	
	New/alternative design	100	20	2000	
PETS					
	New/alternative design	75	10	750	28750
Klystron-based test areas (incl. 1 for long-running test)					
	Klystron	750	4	3000	
	modulator	550	4	2200	
	Pulse compressor, waveguide, instrumentation	1000	4	4000	
	Infrastructures	1000	1	1000	
	Exploitation	500 /y		3000	
Beam-based power sources					13200
	not included here				
Subtotal				**41950**	
Total				82000	

structures

test areas

Structures

- Build and test about **120** accelerating structures
- Build and test about **10** PETS prototypes (others for CTF3+, both TBL & modules)
- Establish quality control, brazing and assembly procedures for structure fabrication at CERN
- Precision machining center at CERN

Test areas

- Four 12 GHz klystron-based RF high-power test stations, for about 8 slots, running before 2016
- Continue high-power testing at 11.4 GHz (KEK and SLAC)
- Contribution to high-power testing in CTF+ (TBL)

Review per activity – Technical R & D

CTC driven technical development											
		year	2010	2011	2012	2013	2014	2015	2016		Total (MCHF)
domain	**deliverable**										
development of 15 MW 1 GHZ MBK	1 working prototype/firm			160	1000	1000	1000	1000	1000		5.2
development of modulators for above	3 prototypes			250	450	800	800	1000	1000		4.3
prototypes of stabilized MB quads	at least one T1, T2, T3, T4			750	750	100	100	100	750		2.6
alignment system	400m working demonstrator in TZ32			1000	1000	100	100	100	1000		3.3
alternative alignment system	prototypes			300	300	800	800	800	300		3.3
prototype for FF quad (including stabilization)	Short and long prototype			500	500	1000	1000	1000	500		4.5
Validation of quad stability through beam experiments	validation			200	200	200	200	200	200		1.2
Prototypes of critical beam instruments	experimental validation; BPMs, ODR			800	800	800	800	800	800		4.8
Prototype installation of fs timing system	24 km transport of 10 fs timing reference			200	200	500	500	500	200		2.1
prototypes of fast kickers	10-4 jitter kicker in lab; beam tests			400	400	400	400	400	400		2.4
various magnet prototypes with power supplies	preparation of industrial production			800	800	800	800	800	800		4.8
Critical equipment for DRs: vacuum, SC wiggler	prototypes, verification in light sources			1500	500	500	500	500	500		4.0
dump, masks	studies, designs, material tests			700	700	700	700	700	700		4.2
general				500	500	1500	1500	1500	500		6.0
part of CTF3+ program											
complete and fully integrated 2 beam modules	part of CTF3+ program										
prototyping for phase measurement and feed-forward	part of CTF3+ program										
Prototype of machine protection system	part of CTF3+ program										
total M:				8060	8100	9200	9200	9400	8650		52.6
CERN M:				6200	5786	6133	6133	6267	5767		36.3
in CERN M contained for M-->P				1240	1446	1533	1533	1567	1442		8.8
pure CERN M				**4960**	**4339**	**4600**	**4600**	**4700**	**4325**		27.5
total pure M				6820	6654	7667	7667	7833	7208		43.8
plan				6500	6100	6900	6900	7100	6500		40.0

Review per activity – CTF3 +

		2011	2012	2013	2014	2015	2016	tot
Operation, consol, upgrade	material	2000	2000	3000	3000	3000	3000	16000
	manpower	3000	3000	3000	3000	3000	3000	18000
	total	5000	5000	6000	6000	6000	6000	34000
TBL+	material	0	1000	1000	1000	1000	0	4000
	manpower	0	1000	1000	1000	1000	500	4500
	total	0	2000	2000	2000	2000	500	8500
Phase feedback	material	0	1000	1000	1000	0	0	3000
	manpower	500	500	500	500	500	500	3000
	total	500	1500	1500	1500	500	500	6000
TBL	material	2000						2000
	manpower	600						600
	total	2600	0	0	0	0	0	2600
Modules CTF3	material	1500	2500	4500	4000	4000	1500	18000
	manpower	500	1000	1000	1000	1000	0	4500
	total	2000	3500	5500	5000	5000	1500	22500
		2011	2012	2013	2014	2015	2016	tot
ALL	material	5500	6500	9500	9000	8000	4500	43000
	manpower	4600	5500	5500	5500	5500	4000	30600
	total	10100	12000	15000	14500	13500	8500	73600

(kCHF)

- Consolidation and upgrade (higher energy – three more MKS, rep. rate, stability, reliability)
- Drive beam phase feed-forward experiments (phase monitor - EU7, kickers, amplifiers…)
- Upgrade and operate TBL as 12 GHz power production facility (up to 8 testing slots, increased rep. rate)
- Operation with beam of a *long string* of CLIC two-beam modules

Main question during discussion: what is the added value of a long module string in CTF3?

Comparison of resources between minimum and maximum scenario (N.B.: about 850 kCHF per module – G. Riddone 20 May 2010)

Present program (up to 6 modules)	material	4750	5750	3875	3875	2875	1875	23000
	manpower	3475	4375	3375	3375	3375	2875	20850
	total	8225	10125	7250	7250	6250	4750	43850
Addition for up to 20 modules	material	750	750	5625	5125	5125	2625	20000
	manpower	1125	1125	2125	2125	2125	1125	9750
	total	1875	1875	7750	7250	7250	3750	29750

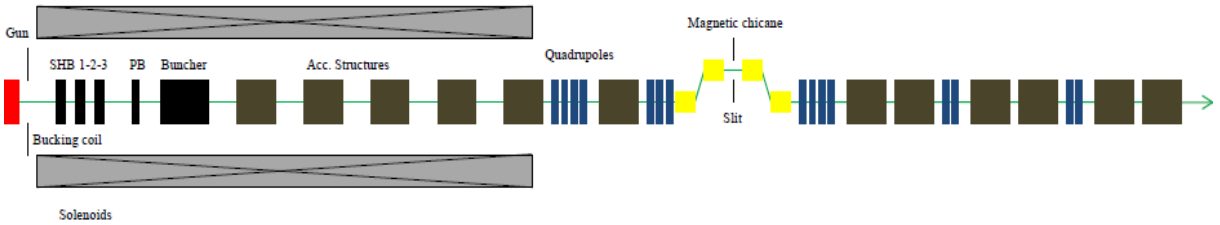
(kCHF)

(kCHF)

Review per activity – DBA Injector / CLIC Zero

Injector		
Energy	30	Mev
Current	4	A
Power	120	MW
Total P.	133	MW
Unit power	15	MW
N. Units	12	
cost/RF unit	1300	kCHF
total cost RF	15600	
N. structures	6	
cost/structure	200	kCHF
structures	1200	
add. Equipment cost	8400	
total injector	25200	
infrastructure	3000	
construction		
Manpower/year	12	FTE
Duration	5	years
Cost/FTE	150	kCHF
manpower cost /year	1800	
manpower (constr. only)	9000	
operation		
Manpower/year	5	FTE
Duration	5	years
Cost/FTE	150	kCHF
manpower cost /year	750	
manpower (op. only)	3750	
total inj, mat.	28200	MCHF
total inj. Manpower	12750	MCHF
total	40950	MCHF

- Build and commission 30 MeV Drive Beam Injector with nominal CLIC parameters
- Build and commission a few (2 to 4) Drive Beam accelerator nominal modules
- Start construction of DBA linac (mainly civ. eng.)
- Participation to Technical Design of full CLIC Zero facility



	2010	2011	2012	2013	2014	2015	2016
inj		0.05	0.1	0.2	0.3	0.35	
civ. eng.lin		0.04	0.06	0.04	0.03	0.05	0.42
linac					0.01	0.01	0.05
	2010	2011	2012	2013	2014	2015	2016
material	0	1960	3570	5740	8925	10535	11549
manpower	0	863	1313	2438	3225	2963	4200

Work Package preparation – CTF3 +

WP Name	WP description	CLIC linkperson				
	CTF3 consolidation and upgrades					
				total resources		
	tasks	deliverables	time span	P	M	collaboration (established or potential)
	Energy upgrade	2 new modulators/klystrons (3GHz, 45 MW) and associated infrastructure modifications. Optional: additional modulator/klystron, two additional structures	2011-2013			
	Repetition rate upgrade	Additional shielding, pulsed charge power supplies for MKS, interlocks	2011-2013			
	Consolidation, stability, operation	Consumables, spares, feed-backs, diagnostics and control system improvements, operating support	2011-2016			

WP Name	WP description	CLIC linkperson				
	TBL+					
				total resources		
	tasks	deliverables	time span	P	M	collaboration (established or potential)
	Upgrade of TBL drive beam line	Up to 8 PETS with input couplers, waveguide network, supports and cables	2011-2013			
	RF Test stands	waveguide network, supports and cables, instrumentation and control	2011-2013			
	Operation	Operating support	2011-2016			

WP Name	WP description	CLIC linkperson				
	Drive Beam phase feedforward and feedbacks					
				total resources		
	tasks	deliverables	time span	P	M	collaboration (established or potential)
	Drive Beam phase monitors	Drive Beam phase monitor prototype(2012) , phase monitor small series (2013-1014), electronics and acquitition	2011-2014			
	Feedforward kickers	two stripline kickers, installation, cabling	2011-2014			
	Feedforward pulsers	fast pulsers for the two kickers	2011-2014			

WP Name	WP description	CLIC linkperson				
	Two-Beam module string					
				total resources		
	tasks	deliverables	time span	P	M	collaboration (established or potential)