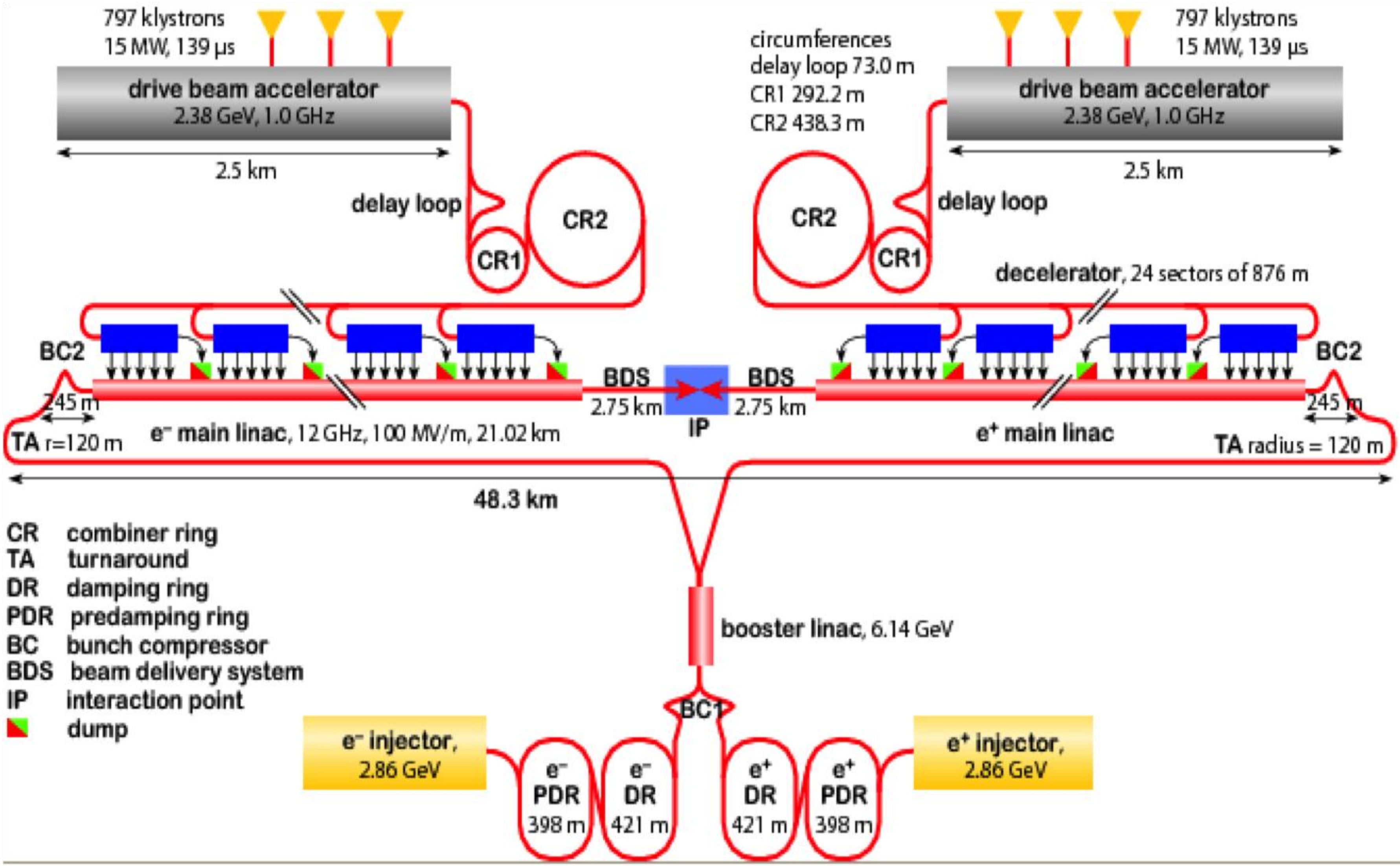
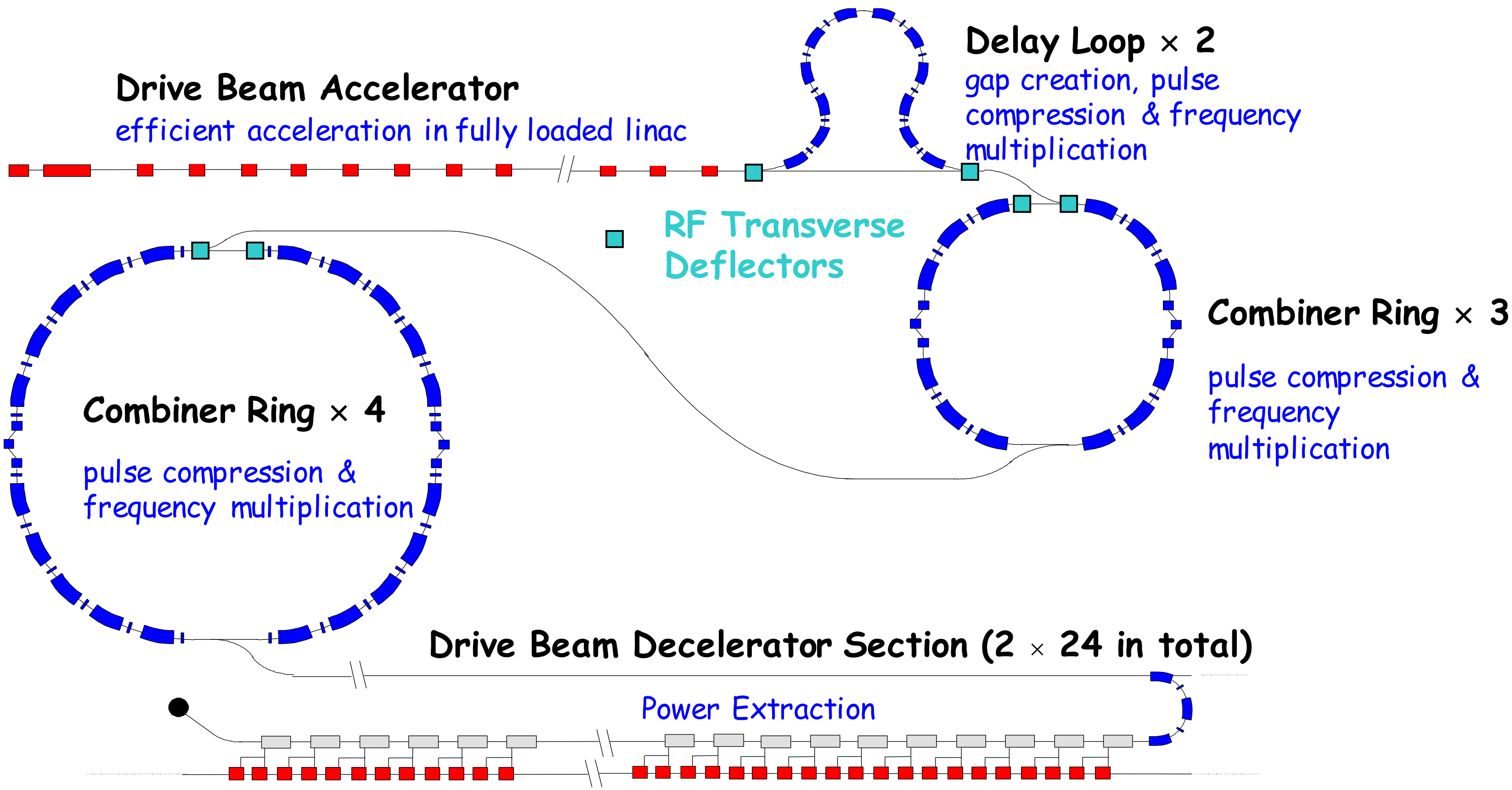
The CLIC project – status and plans

- Outline:
- The CLIC machine concept
- Feasibility studies and CDR status
  - Technical progress
  - The CDR volumes
- Implementation studies
  - Energy flexibility (stages and scans)
  - Physics as function of E_{cm}
  - Power and energy
- Plans 2012-16
  - Plans and collaboration
- Conclusion

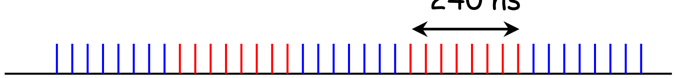
The CLIC layout



CLIC Power Source Concept

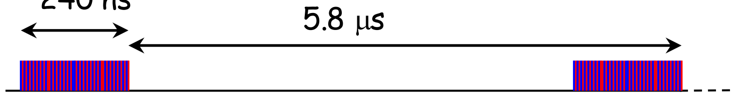


Drive beam time structure - initial



140 μs train length - 24 × 24 sub-pulses
4.2 A - 2.4 GeV – 60 cm between bunches

Drive beam time structure - final



24 pulses – 101 A – 2.5 cm between bunches

Main parameters

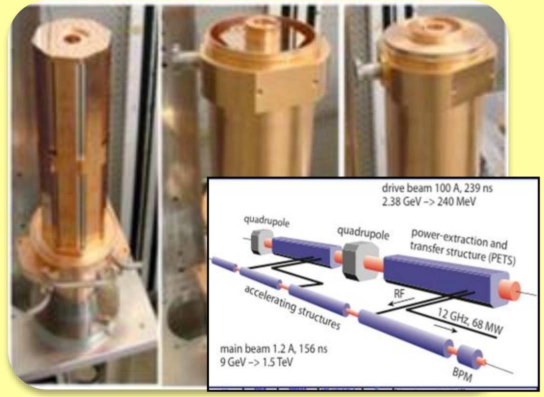
CLIC (Compact Linear Collider)

12 GHz room temperature copper RF structures, powered by intense drive beam

Focus on 3 TeV and a parameter set for 500 GeV, intermediate energy range parameters (1-2 TeV) now being considered, also to study a staged approach.

Detector and physics studies carried out for CLIC conditions and adapted detector concepts

parameter	symbol			
centre of mass energy	E_{cm} [GeV]	500	1500	3000
luminosity	$\mathcal{L}$ [10^{34} cm^{-2}s^{-1}]	2.3	3.8	5.9
luminosity in peak	$\mathcal{L}_{0.01}$ [10^{34} cm^{-2}s^{-1}]	1.4	1.5	2
gradient	G [MV/m]	80	100	100
site length	[km]	13	28	48.3
charge per bunch	N [10^9]	6.8	3.7	3.7
bunch length	σ_z [μm]	70	44	44
IP beam size	σ_x/σ_y [nm]	200/2.26	?/?	40/1
norm. emittance	ϵ_x/ϵ_y [nm]	2400/25	660/20	660/20
bunches per pulse	n_b	354	312	312
distance between bunches	Δ_b [ns]	0.5	0.5	0.5
repetition rate	f_r [Hz]	50	50	50
est. power cons.	P_{wall} [MW]	240	340	560



Drive beam generation stability

Issues: Fully loaded acceleration efficiency, beam combination and multiplication, intensity and phase stability

Addressed in CTF3 measurements and operation (see next slide)

Power Extraction Units (PETs)

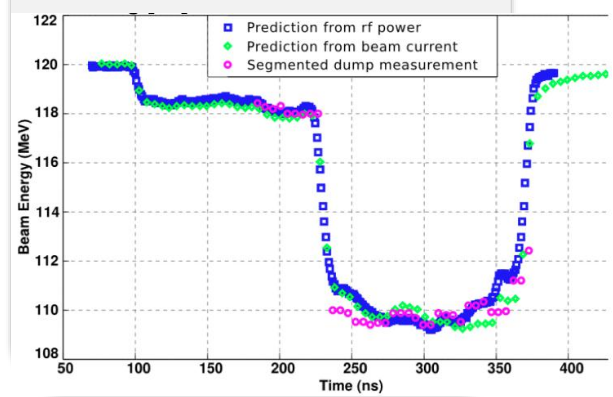
Issues: RF power, pulse-length and breakdown rate, on-off mechanism

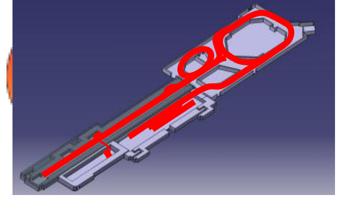
PETS rather easily reaching specifications, tests now for statistics, combined performances and more realistic conditions. On/off mechanics demonstrated.

Drive beam deceleration

Issues: Drive beam to RF efficiency, pulse shape control

Addressed in dedicated CTF3 measurements



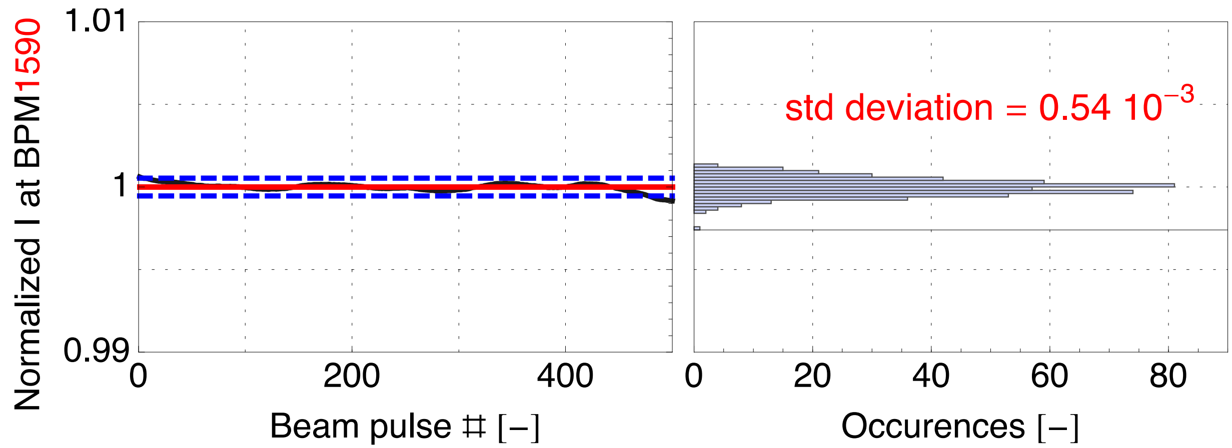


CTF3 drive beam and experiments

Pulse charge measured at end of the linac (figure on the right):

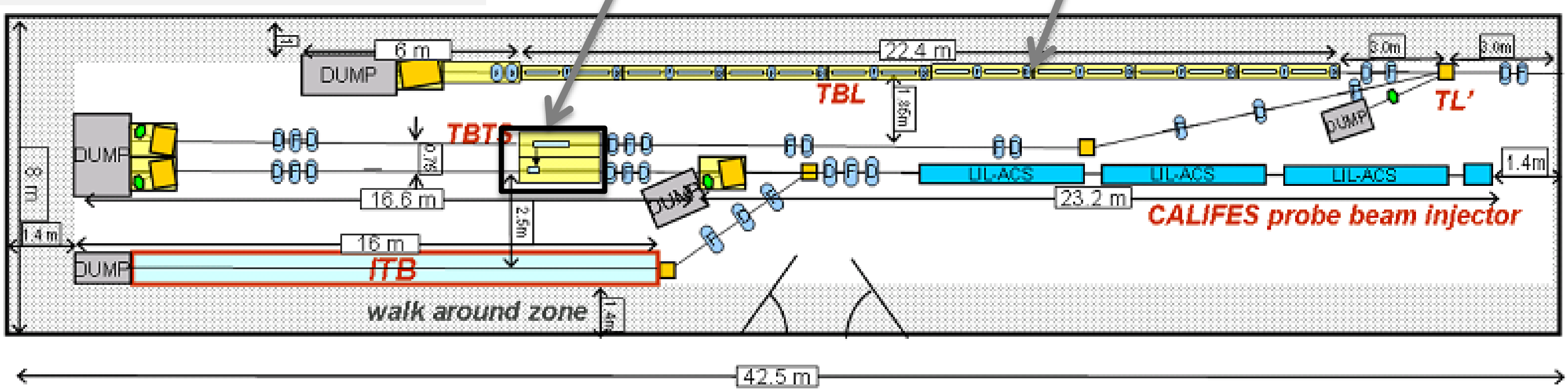
After factor 8 combination ~ 1% jitter, improvements underway, already showing significant improvement in a factor 4 combined beam. The issues are:

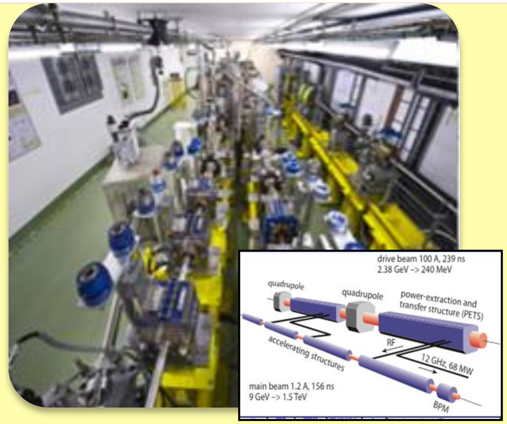
- RF pulse compression
- Beam energy in combiner ring is 5% of that in CLIC
- Geometric emittance 20 times larger
- Instrumentation/calibration

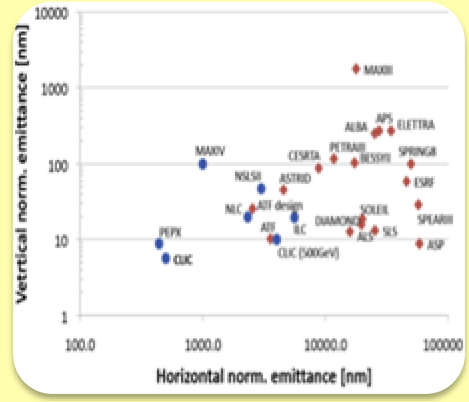


TBTS (two-beam test stand)
- power transfer to main beam
- module design

TBL (test beam line)
- drive beam stability during deceleration







Accelerating structures

Issues: Accelerator field, pulse-duration, breakdown rates, RF to beam efficiency

Tested in dedicated klystron based test-facilities at KEK and SLAC (next slide) and soon at CERN, and also in CTF3. Breakdown dynamics now modeled and simulated, improving predictive abilities significantly.

Two beam acceleration

Issues: Power production and beam acceleration (next slide), beam timing stabilities

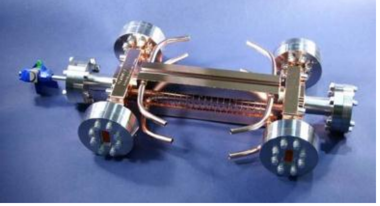
Integration into modules underway:

Main beam qualities

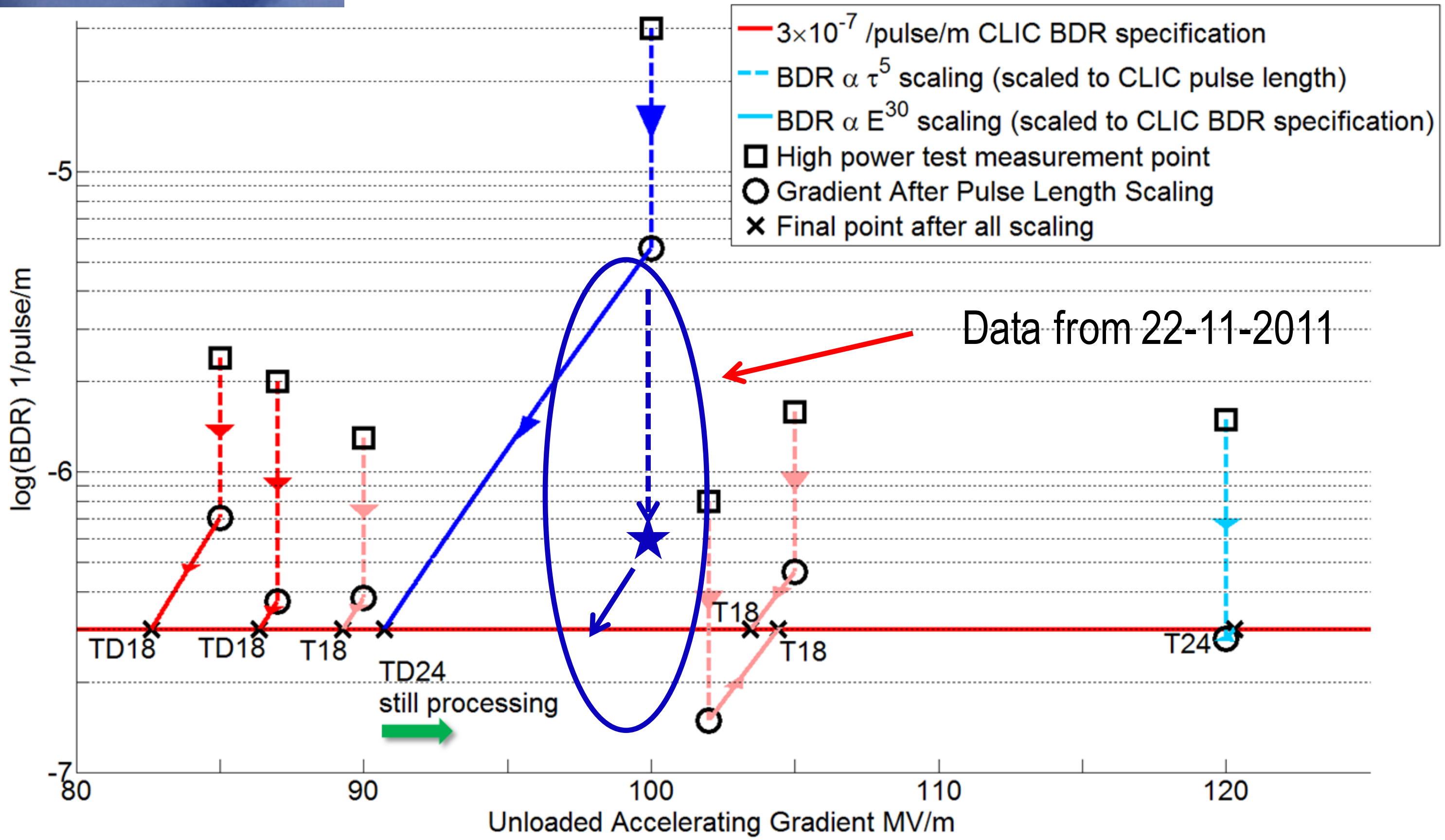
Issues: Emittance generation and preservation, focussing and beam-sizes at IP

Addressed in ATF (KEK), in collaboration with light source projects (e.g. TIARA-SVET), simulations and hardware developments

CLIC @3 TeV would achieve 40% of luminosity with ATF performance (3800nm/15nm@4e9), ok for CLIC@500 GeV



Achieved Gradient



Measurements scaled according to:

$$p \propto G^{30}\tau^{5}$$

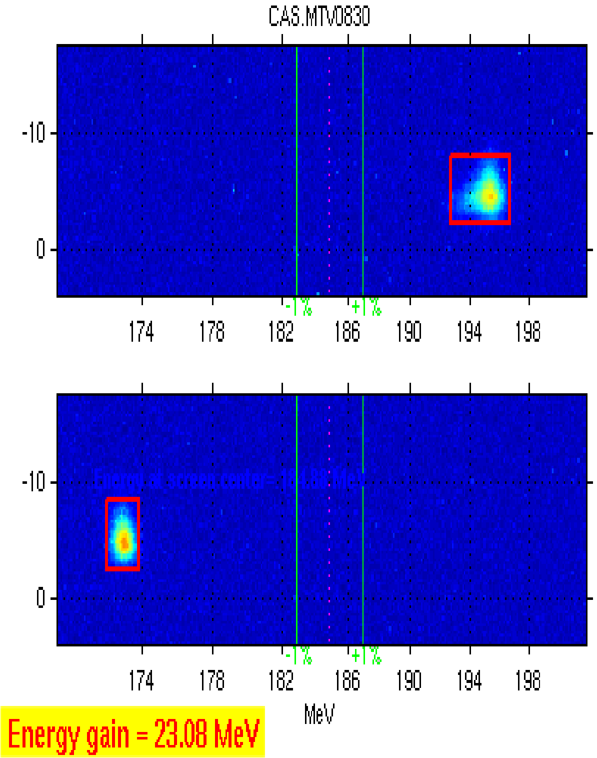
Require breakdown probability 1% per pulse i.e. $\leq 3\times10^{-7}$ m^{-1}pulse^{-1}

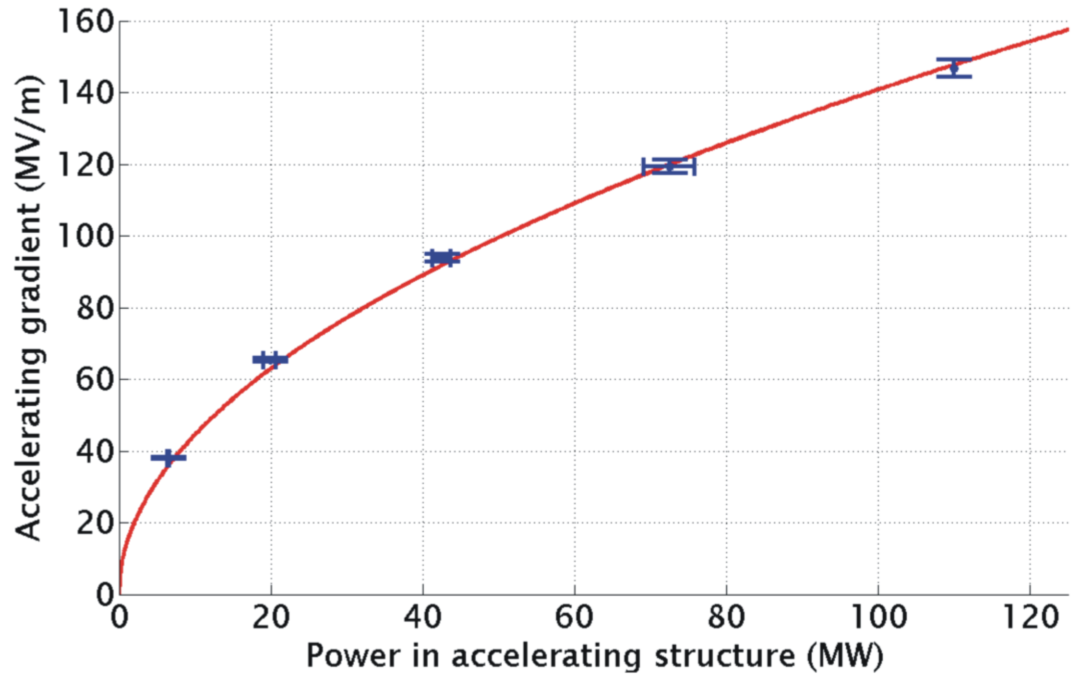
TD24:

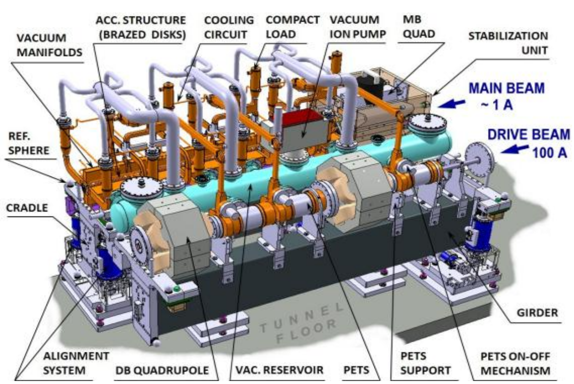
- September 15th @ KEK
- Mid-November @ SLAC
- Soon @ CERN

	Simple early design	More efficient fully optimised structure
No damping waveguides	T18	T24
Damping waveguides	TD18	TD24 = CLIC goal

TBTS: Two Beam Acceleration

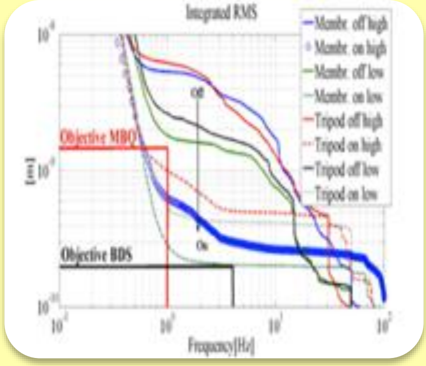


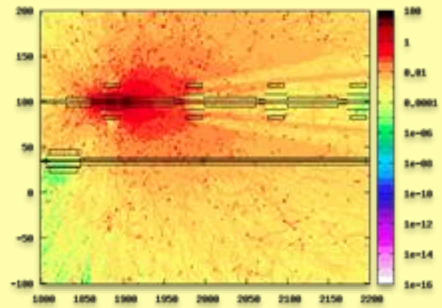


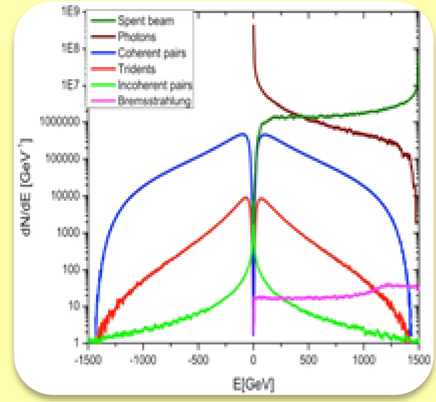


Maximum gradient
145 MV/m

Consistency between
- produced power
- drive beam current
- test beam acceleration







Alignment and Stabilisation

Issues: A/S or for main linac and beam deliver components

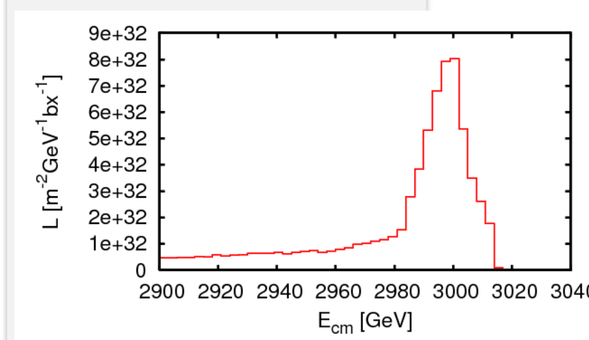
Addressed by models (ground-motivation), hardware development of alignment, stability and feedback systems, as well as simulations – inputting the models and HW results (example next slide)

Operation and Machine Protection System

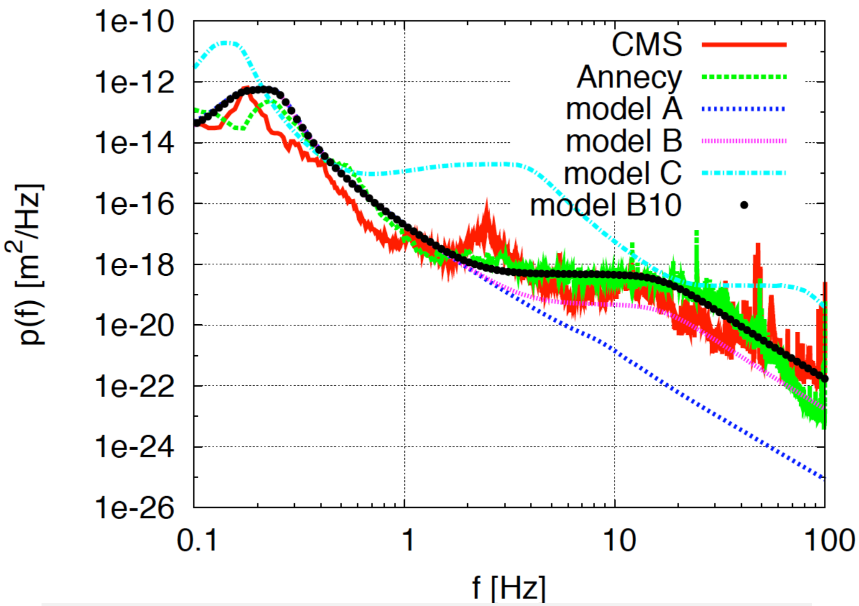
Issues: Drive beam power and main beam power

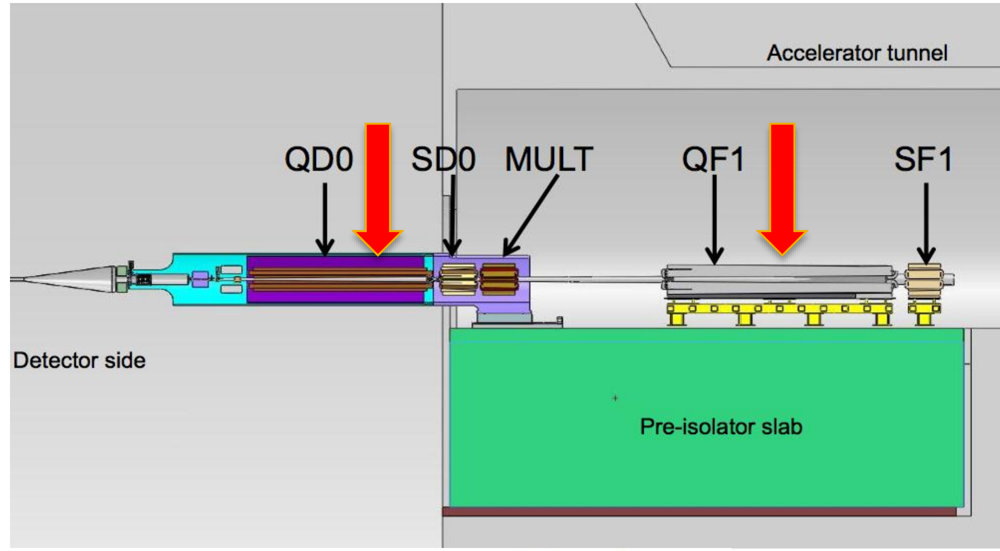
Experimental conditions

Issues: Operational and background conditions for the experiments

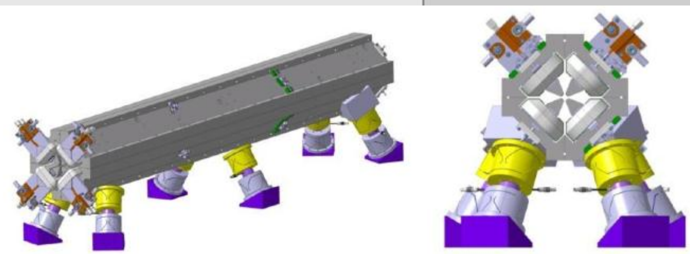


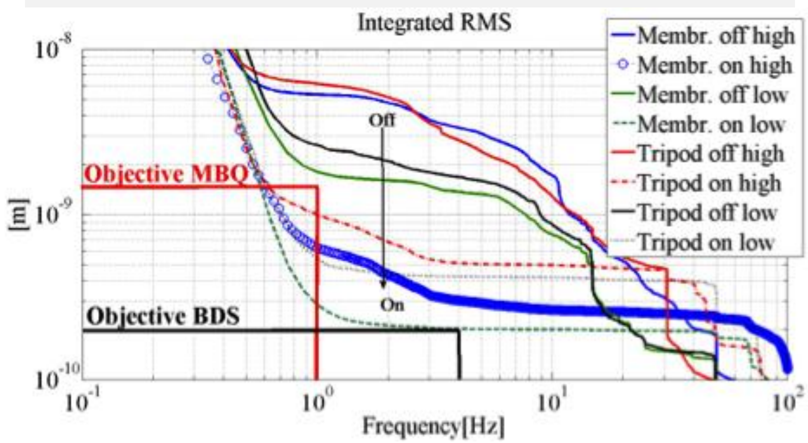
Stability: Ground Motion & Mitigation





Natural ground motion: typical quadrupole jitter tolerance O(1nm) in main linac and O(0.1nm) in final doublet



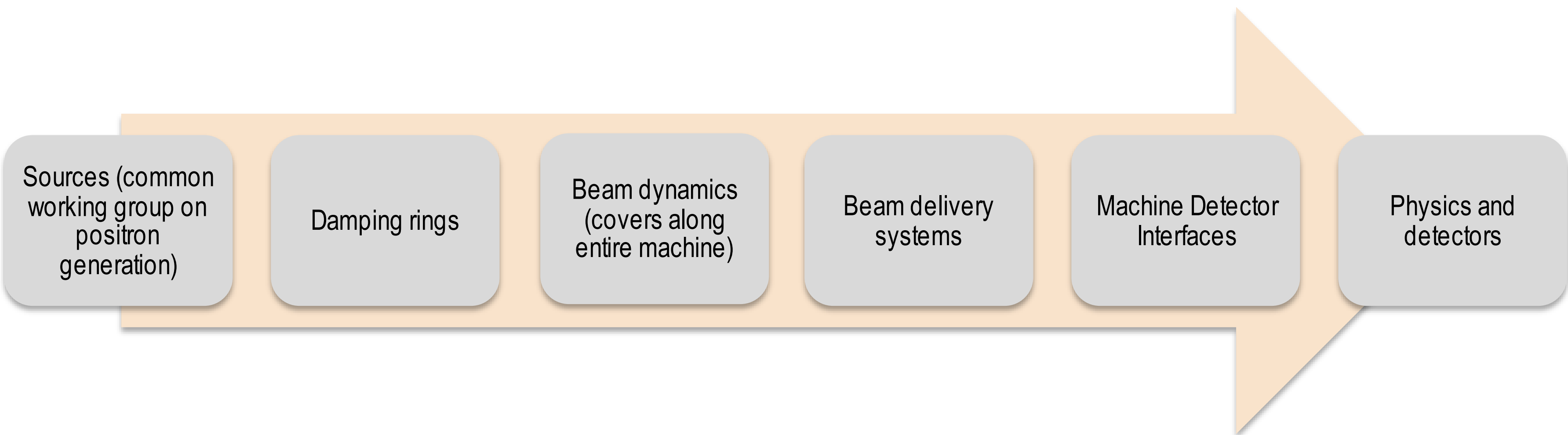


Luminosity achieved/lost [%]

	A	B10
No stab.	119%/2%	53%/68%
Current stab.	116%/5%	108%/13%
Future stab.		118%/3%

LC common studies

Many common problems and solutions even though the basic core acceleration methods differ, and the parameters to be achieved by the systems below differ – in some cases leading to different solutions



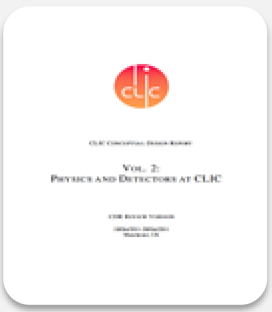
In addition common working groups on: Cost and Schedule, Civil Engineering and Conventional Facilities – and a General Issues Working Group

The CDRs

Vol 1: The CLIC accelerator and site facilities (H.Schmickler)

- CLIC concept with exploration over multi-TeV energy range up to 3 TeV
- Feasibility study of CLIC parameters optimized at 3 TeV (most demanding)
- Consider also 500 GeV, and intermediate energy range
- Complete by end of 2011, present in the SPC In March 2012

http://project-clic-cdr.web.cern.ch/project-CLIC-CDR/



Vol 2: The CLIC physics and detectors (L.Linssen)

- Physics at a multi-TeV CLIC machine can be measured with high precision, despite challenging background conditions
- Work and review procedure described in Juan Fuster's talk.
- Completed and ready for print end 2011, presented in SPC in December 2011

http://lcd.web.cern.ch/LCD/CDR/CDR.html#Overview

Vol 3: CLIC study summary (S.Stapnes)

- Summary and available for the European Strategy process, including possible implementation stages for a CLIC machine as well as costing and cost-drives
- Proposing objectives and work plan of post CDR phase (2012-16)
- Summer 2012: Vol 3 ready for the European Strategy Open Meeting

- Main information page: http://clic-study.org/accelerator/CLIC-ConceptDesignRep.php
- A link providing the opportunity to subscribe as a signatory for the CLIC CDR can be found on the main information page: https://indico.cern.ch/conferenceDisplay.py?confId=136364

Accelerator CDR status – snapshot

The linked documents (in blue) are all the drafts

Still un-submitted parts
Help needed on the editorial side

Status of Contributions	Colour Code	Statistics (as of 31/10/2011)
Not Received		4
Draft Received		14
Final version Received		3
With IEB		20
With Copy Editing		10
Final		

Chapter	Section	Responsible Author	Status
Foreword	Foreword	S. Stapnes	With IEB
The CLIC concept: Key Issues and feasibility	Introduction	J.P. Delahaye	With Copy Editing
The CLIC concept: Key Issues and feasibility	CLIC scheme overview	J.P. Delahaye	With Copy Editing
The CLIC concept: Key Issues and feasibility	CLIC key issues	J.P. Delahaye	With Copy Editing
The CLIC concept: Key Issues and feasibility	Explanation of the CLIC two-beam acceleration scheme	G. Geschonke	With Copy Editing
The CLIC concept: Key Issues and feasibility	Creation of ultra low emittance beams	Y. Papaphilippou	With Copy Editing
The CLIC concept: Key Issues and feasibility	Highest Luminosity; Preservation of ultra-low emittances	D. Schulte	With Copy Editing
The CLIC concept: Key Issues and feasibility	Drive Beam generation and Main Beam RF power production	R. Corsini	Draft Received
The CLIC concept: Key Issues and feasibility	X-band RF structures (Accelerating and PETS)	W. Wuensch	With Copy Editing
The CLIC concept: Key Issues and feasibility	Machine Protection	M. Jonker	With Copy Editing
The CLIC concept: Key Issues and feasibility	Other critical technology items	H. Schmickler	Received
The CLIC concept: Key Issues and feasibility	Present level of achievement and outlook for the next years	J.P. Delahaye	Draft Received
Accelerator Physics description of the Main Beam complex	Injectors	S. Doebert	With Copy Editing
Accelerator Physics description of the Main Beam complex	The Damping Rings Complex	Y. Papaphilippou	Draft Received
Accelerator Physics description of the Main Beam complex	Ring to main linac transport (RTML)	F. Stulle	With IEB
Accelerator Physics description of the Main Beam complex	Main linacs	D. Schulte	With Copy Editing
Accelerator Physics description of the Main Beam complex	Beam delivery systems	R. Tomas Garcia	Draft Received
Accelerator Physics description of the Main Beam complex	Machine detector interface	L. Gatignon	With IEB
Accelerator Physics description of the Main Beam complex	Post-collision line	E. Gschwendtner	With IEB
Accelerator Physics description of the Drive Beam complex	Drive Beam Accelerators	R. Corsini	Draft Received
Accelerator Physics description of the Drive Beam complex	Frequency multiplication	C. Biscari	Draft Received
Accelerator Physics description of the Drive Beam complex	Beam Transport	B. Jeanneret	Draft Received
Accelerator Physics description of the Drive Beam complex	Decelerator	E. Adli	With IEB
Accelerator Physics description of the Drive Beam complex	Dump Lines	B. Jeanneret	With IEB
Technical description of the accelerator components	Sources	S. Doebert	With IEB
Technical description of the accelerator components	Warm Magnets	M. Modena	With IEB
Technical description of the accelerator components	Superconducting magnets	S. Russenschuck	With IEB
Technical description of the accelerator components	Radio Frequency systems	E. Jensen	Draft Received
Technical description of the accelerator components	Main Linacs Radio Frequency systems (X-Band)	W. Wuensch	Received
Technical description of the accelerator components	Two-Beam Module	G. Riddone	With IEB
Technical description of the accelerator components	Vacuum systems	M. Jimenez	Draft Received
Technical description of the accelerator components	Powering CLIC	S. Pittet	With IEB
Technical description of the accelerator components	Beam Instrumentation	T. Lefevre	With IEB
Technical description of the accelerator components	Beam Transfer	B. Goddard	Draft Received
Technical description of the accelerator components	Beam intercepting devices	R. Losito	Not Received
Technical description of the accelerator components	Machine detector interface	L. Gatignon	With IEB
Technical description of the accelerator components	Controls	M. Draper	Draft Received
Technical description of the accelerator components	Fine Time Generation and Distribution	J. Serrano	With IEB
Technical description of the accelerator components	Real-time Feedback Systems	G. Morpurgo	Draft Received
Technical description of the accelerator components	Machine protection	M. Jonker	With IEB
Technical description of the accelerator components	Active pre-alignment systems	H. Mainaud Durand	With IEB
Technical description of the accelerator components	Main Beam quadrupole stabilization equipment	K. Artoos	With IEB
Technical description of the accelerator components	Total Power Consumption	P. Lebrun	Draft Received
Civil engineering and technical services	Civil engineering	J. Osborne	With IEB
CLIC technologies demonstrated in CTF3	CLIC technologies demonstrated in CTF3	R. Corsini	Draft Received
Energy scanning	CLIC Operation at Low Energies	D. Schulte	With IEB
Staged Construction	Motivation and possible scenarios for staged construction	P. Lebrun	Not Received
Staged Construction	Prelimary design of a 500 GeV accelerator	D. Schulte	With IEB
Staged Construction	Parameter space for other intermediate energies	D. Schulte	Not Received
Staged Construction	Construction Schedules	K. Foraz	Not Received
CLIC Parameters	CLIC Parameter Tables	F. Tecker	Received

CDR Signatories List

Subscribe here

List of signatories

CLIC website

Linear Collider Detector @ CERN

CLIC CDR Vol. 1 - Accelerator

CLIC CDR Vol.2 - Physics and Detectors

CDR signatories support

CDR Signatories Subscription Fo
Registration period: 08/09/2011 - 30/1

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CLIC website

Linear Collider Detector @ CERN

CLIC CDR Vol. 1 - Accelerator

CLIC CDR Vol.2 - Physics and Detectors

The CLIC Conceptual Design Report (CDR) summarizes the c
on the CLIC technology, its physics case and the expected p
physics detectors. Draft versions of the CDR Volume 1 (CLIC
(Physics and Detectors) are available (links in the menu on t

You are cordially invited to subscribe to the CDR Signatories List.

- If you have made contributions to the CLIC accelerator or the Linear Colliders Physics and Detector studies, or intend to contribute in the future,

OR / AND

- If you wish to express support to the physics case and the study of a multi-TeV Linear Collider based on the CLIC technology, and its detector concepts[1].

1 Note that signing the CDR does not imply an expression of exclusive support for CLIC versus other major collider options under development.

https://indico.cern.ch/conferenceDisplay.py?confId=136364

Dates: from 08 September 2011 08:00 to 30 November 2011 00:00

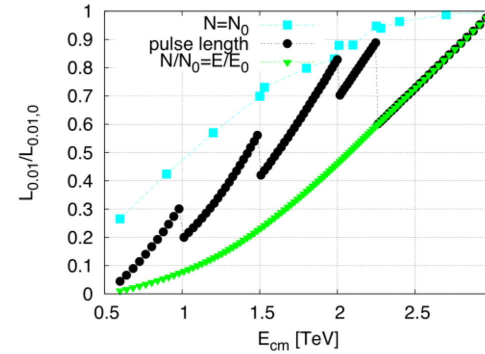
Timezone: Europe/Zurich

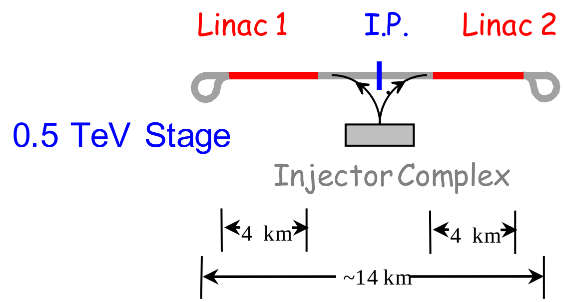
Location: *CERN*

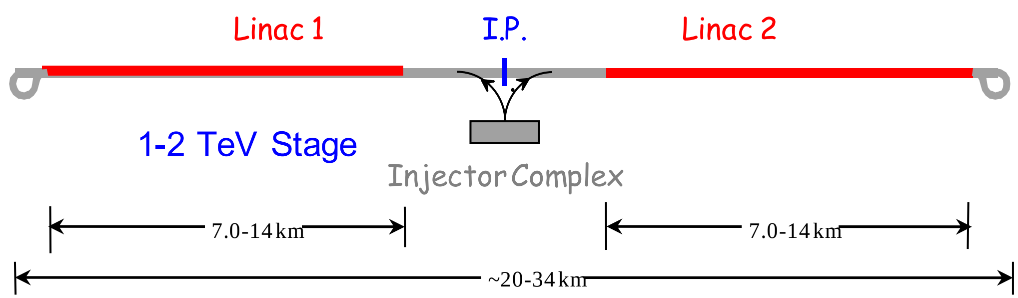
CLIC implementation – in stages?

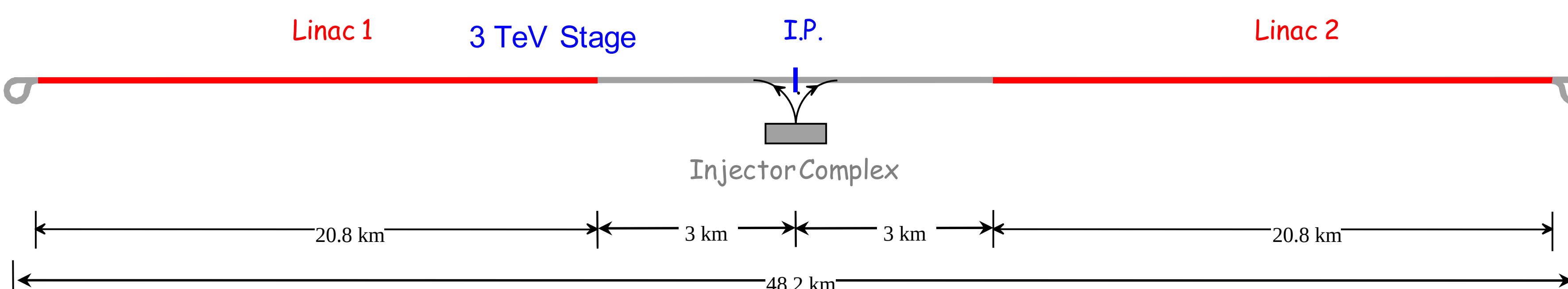
CLIC two-beam scheme compatible with energy staging to provide the optimal machine for a large energy range

Lower energy machine can run most of the time during the construction of the next stage. Physics results will determine the energies of the stages

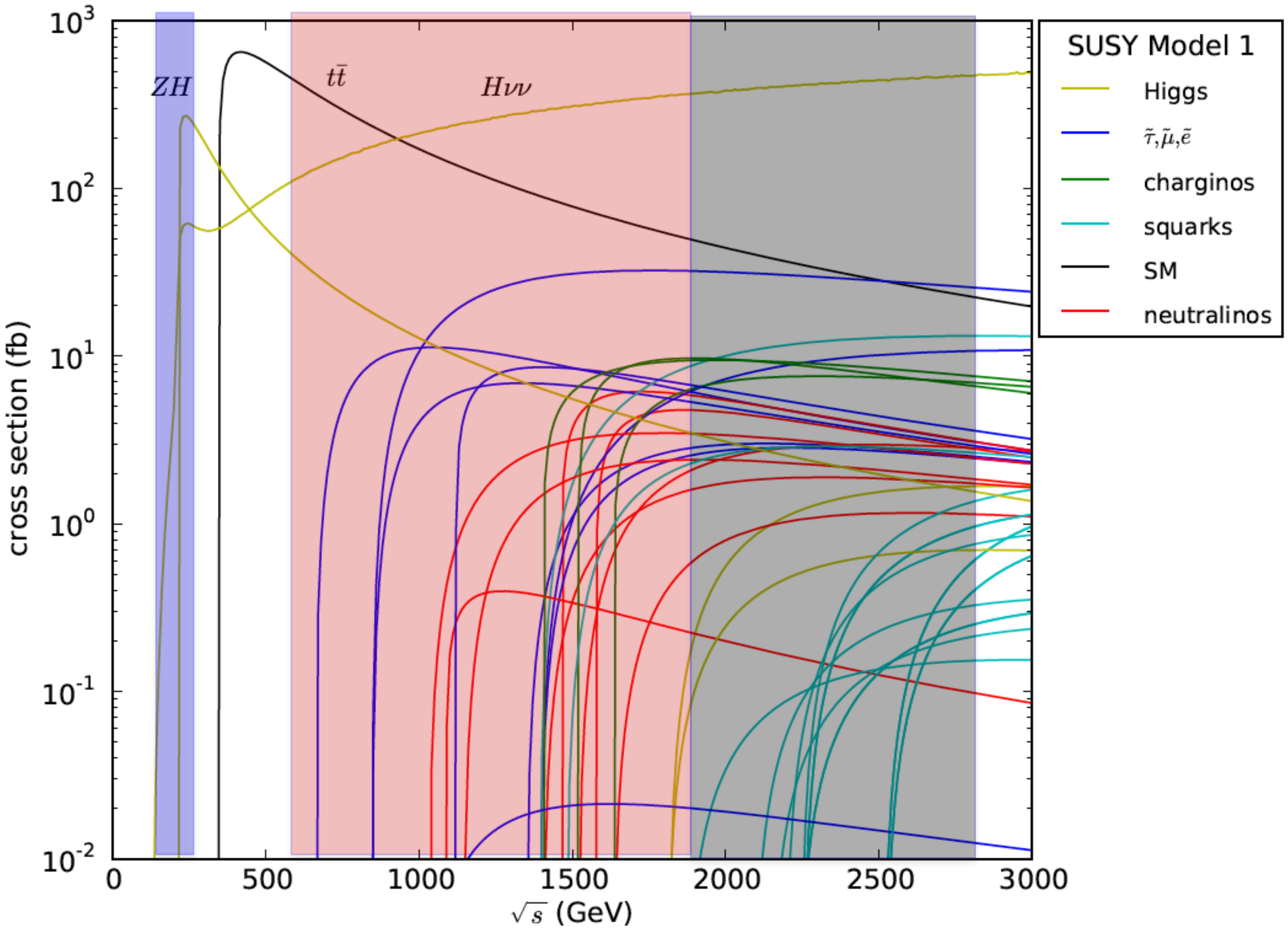








A very rich physics to be addressed
…. energy flexibility needed



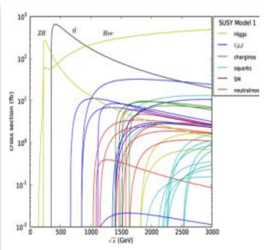
LHC is currently probing the low energy part (SM Higgs or similar) – possibly providing justification for a "low" energy machine

LHC is also addressing a large number of other possible models, in particular a part of the SUSY parameter space and could provide a higher energy scale as well.

Furthermore, intermediate energy scales can also open up at LHC (directly or through cascade decays)

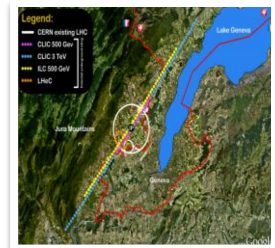
.. or something very different ?

Consequences of a staged approach



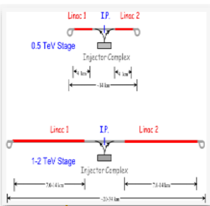
Physics - how do we build the optimal machine given a physics scenario (partly seen at LHC ?):

Understand the benefits of running close to thresholds versus at highest energy, and distribution of luminosities as function of energy

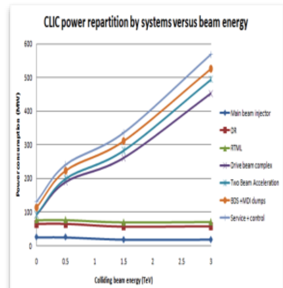


Construction scenario (and approval scenario):

Explore how we in practice will do the tunneling and productions/installation/movement of parts in a multistage approach ?

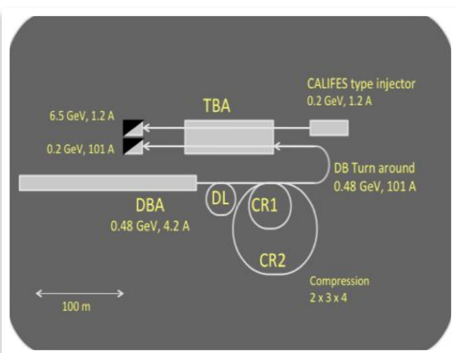


Costs - Initial machine plus energy upgrade: External cost review 21-22.2.2012, costs will be discussed in volume 3 of the CDR



Power and energy development.

Have started to work on energy estimates (not only max power at max luminosity and the highest energy) based on running scenarios and power on/off/standby estimates (next two slides)

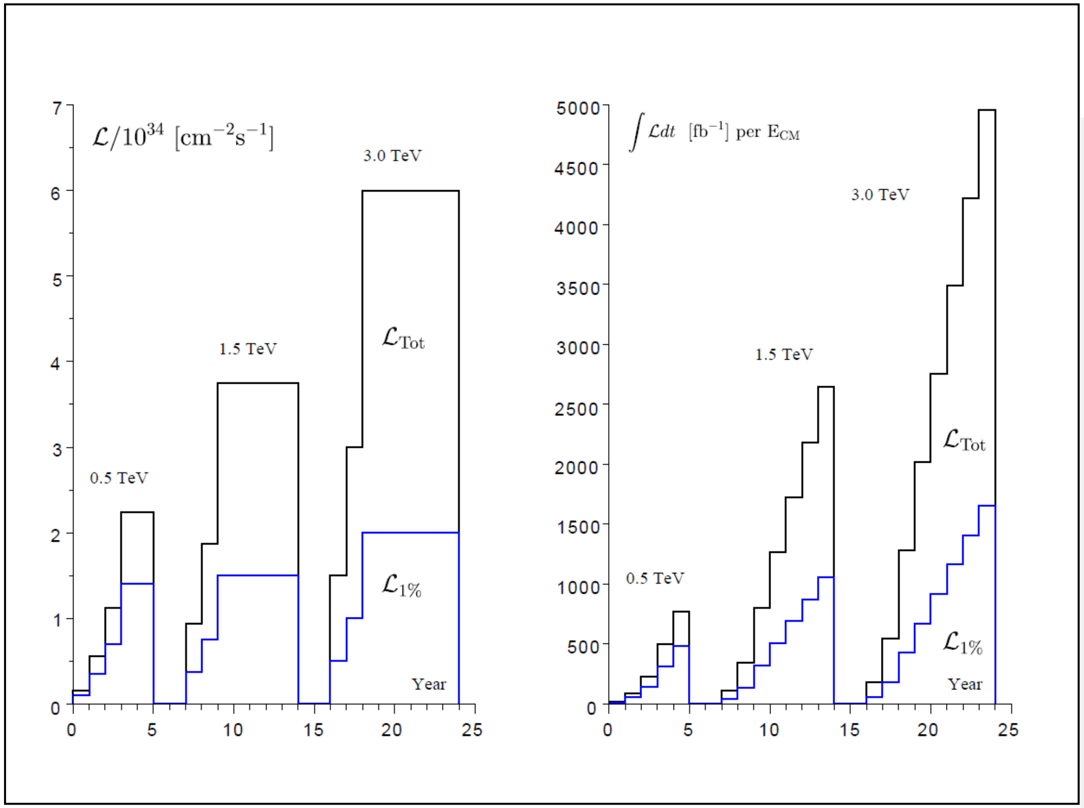


Timescale/lifecycle for project re-defined: Buildup of drive beam (CLIC zero), stages one – physics, more stages/extensions

Parameters: energy steps and scans, inst. and int. luminosities, commissioning and lum. ramp up times.

A possible energy/luminosity scenario

parameter	symbol		
centre of mass energy	E_{cm} [GeV]	500	3000
luminosity	$\mathcal{L}$ $[10^{34}\ \mathrm{cm^{-2}s^{-1}}]$	2.3	5.9
luminosity in peak	$\mathcal{L}_{0.01}$ $[10^{34}\ \mathrm{cm^{-2}s^{-1}}]$	1.4	2
gradient	G [MV/m]	80	100
site length	[km]	13	48.3
charge per bunch	N $[10^9]$	6.8	3.72
bunch length	σ_z [μm]	70	44
IP beam size	σ_x/σ_y [nm]	200/2.26	40/1
norm. emittance	ϵ_x/ϵ_y [nm]	2400/25	660/20
bunches per pulse	n_b	354	312
distance between bunches	Δ_b [ns]	0.5	0.5
repetition rate	f_r [Hz]	50	50
est. power cons.	P_{wall} [MW]	240	560

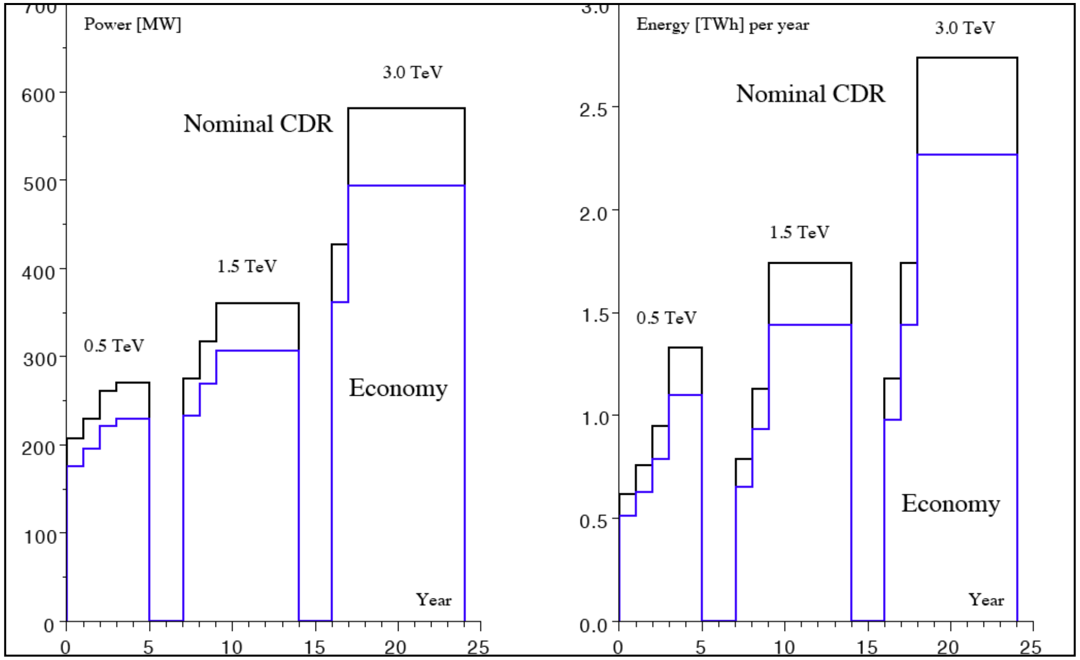


With a model (see figure for one example) for energies and luminosities, and assumptions about running scenarios (see below), one can extract power and energy estimates as function of time (next slide).

For each value of CM energy:

- 177 days/year of beam time
- 188 days/year of scheduled and fault stops
- First year
  - 59 days of injector and one-by-one sector commissioning
  - 59 days of main linac commissioning, one linac at a time
  - 59 days of luminosity operation
  - Quoted power : average over the three periods
  - All along : 50% of downtime
- Second year
  - 88 days with one linac at a time and 30 % of downtime
  - 88 days without downtime
  - Quoted power : average over the two periods
- Third year
  - Still only one e+ target at 0.5 TeV, like for years 1 & 2
  - Nominal at 1.5 and 3 TeV
- Power during stops (scheduled, fault, downtime) :
  - (40 MW, 45 MW, 60 MW) at (0.5, 1.5, 3) TeV, respectively

Power/energy



Other models can be envisaged (this is one out of many), and one should also keep in mind that reducing the instantaneous luminosity at the highest energies reduced both power and yearly energy, and finer energy scans might well be needed within one stage

The possible « economy » (see blue curves):

Sobriety

- Reduced current density in normal-conducting magnets
- Reduction of heat loads to HVAC
- Re-optimization of accelerating gradient with different objective function

Efficiency

- Grid-to-RF power conversion
- Permanent or super-ferric superconducting magnets

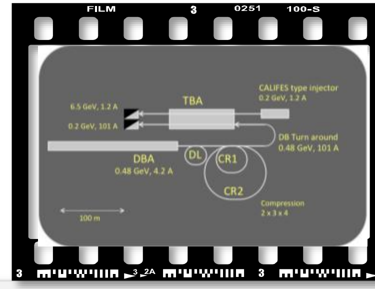
Energy management

- Low-power configurations in case of beam interruption
- Modulation of scheduled operation to match electricity demand: Seasonal and Diurnal

Waste heat recovery

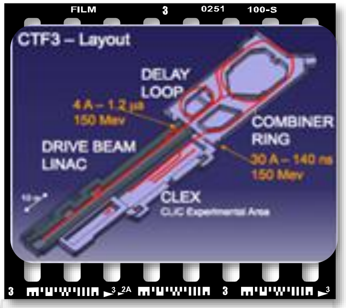
- Possibilities of heat rejection at higher temperature
- Waste heat valorization by concomitant needs, e.g. residential heating, absorption cooling

CLIC project time-line



From 2016 – Project Implementation phase, including an initial project to lay the grounds for full construction:

- CLIC 0 – a significant part of the drive beam facility: prototypes of hardware components at real frequency, final validation of drive beam quality/main beam emittance preservation, facility for reception tests – and part of the final project)
- Finalization of the CLIC technical design, taking into account the results of technical studies done in the previous phase, and final energy staging scenario based on the LHC Physics results, which should be fully available by the time
- Further industrialization and pre-series production of large series components with validation facilities

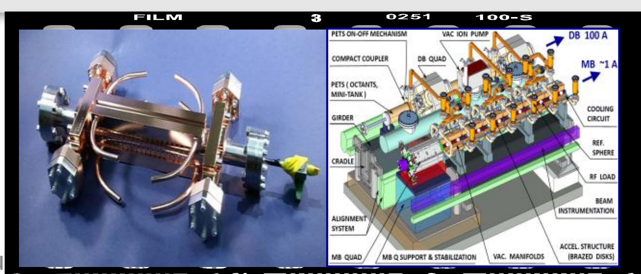


Final CLIC CDR and feasibility established, also input for the Eur. Strategy Update

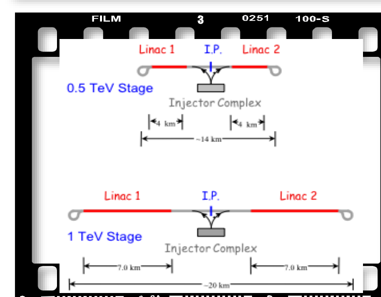
2004 - 2012	2012 - 2016	2016 - 2020	~ 2020 onwards

2011-2016 – Goal: Develop a project implementation plan for a Linear Collider:

- Addressing the key physics goals as emerging from the LHC data
- With a well-defined scope (i.e. technical implementation and operation model, energy and luminosity), cost and schedule
- With a solid technical basis for the key elements of the machine and detector
- Including the necessary preparation for siting the machine
- Within a project governance structure as defined with international partners



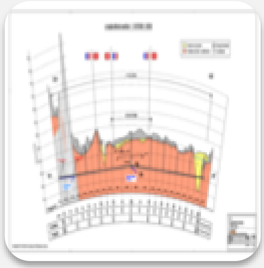
CLIC project construction – in stages, making use of CLIC 0



The objectives and plans for 2012-16

In order to achieve the overall goal for 2016 the follow four primary objectives for 2011—16 can defined:

- These are to be addressed by activities (studies, working groups, task forces) or work-packages (technical developments, prototyping and tests of single components or larger systems at various places)



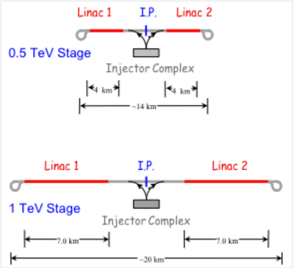
Define the scope, strategy and cost of the project implementation.

Main input:

The evolution of the physics findings at LHC and other relevant data

Findings from the CDR and further studies, in particular concerning minimization of the technical risks, cost, power as well as the site implementation.

A Governance Model as developed with partners.



parameter	symbol		
centre of mass energy	E_{cm} [GeV]	500	3000
luminosity	$\mathcal{L}$ [10^{34} cm^{-2}s^{-1}]	2.3	5.9
luminosity in peak	$\mathcal{L}_{0.01}$ [10^{34} cm^{-2}s^{-1}]	1.4	2
gradient	G [MV/m]	80	100
site length	[km]	13	48.3
charge per bunch	N [10^9]	6.8	3.72
bunch length	σ_z [μm]	70	44
IP beam size	σ_x/σ_y [nm]	200/2.26	40/1
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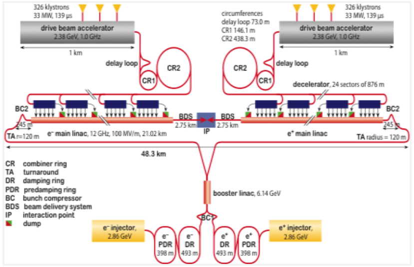
distance between bunches	Δ_b [ns]	0.5	0.5
repetition rate	f_r [Hz]	50	50
est. power cons.	P_{wall} [MW]	240	560

Define and keep an up-to-date optimized overall baseline design that can achieve the scope within a reasonable schedule, budget and risk.

Beyond beam line design, the energy and luminosity of the machine, key studies will address stability and alignment, timing and phasing, stray fields and dynamic vacuum including collective effects.

Other studies will address failure modes and operation issues.

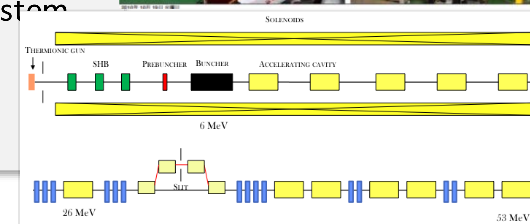


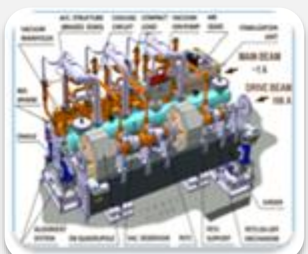
The objectives and plans for 2012-16

Identify and carry out system tests and programs to address the key performance and operation goals and mitigate risks associated to the project implementation.

The priorities are the measurements in: CTF3+, ATF and related to the CLIC Zero Injector addressing the issues of drive-beam stability, RF power generation and two beam acceleration, as well as the beam delivery system.

Technical work-packages and studies addressing system performance parameters

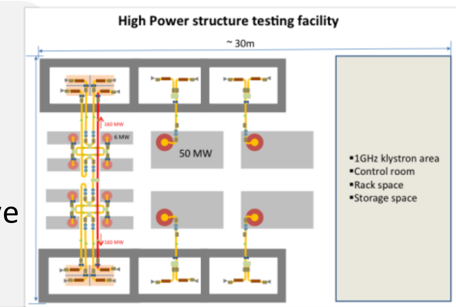




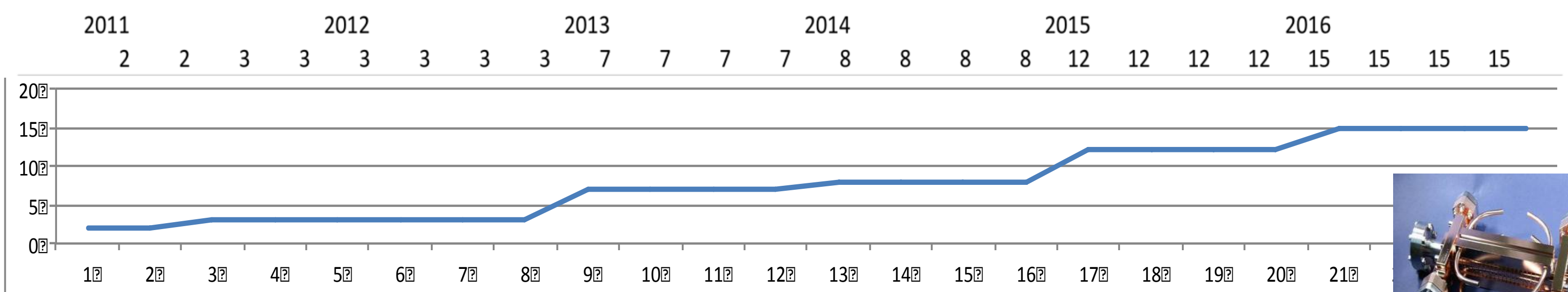
Develop the technical design basis. i.e. move toward a technical design for crucial items of the machine and detectors, the MD interface, and the site.

Priorities are the modulators/klystrons, module/structure development including testing facilities, and site studies.

Technical work-packages providing input and interacting with all points above



number of rf ports



World-wide CLIC&CTF3 Co

Several others in the process of being added or being linked to the CLIC efforts through common technical developments

CLIC multi-lateral collaboration - 43 Institute

ACAS (Australia)
Aarhus University (Denmark)
Ankara University (Turkey)
Argonne National Laboratory (USA)
Athens University (Greece)
BINP (Russia)
CERN
CIEMAT (Spain)
Cockcroft Institute (UK)
ETH Zurich (Switzerland)
FNAL (USA)
Gazi Universities (Turkey)
Helsinki Institute of Physics (Finland)
IAP (Russia)
IAP NASU (Ukraine)
IHEP (China)
INFN / LNF (Italy)
Instituto de Fisica Corpuscular (Spain)
IRFU / Saclay (France)
Jefferson Lab (USA)
John Adams Institute/Oxford (UK)
Joint Institute for Power and Nuclear Research SOSNY /Minsk (Belarus)
John Adams Institute/RHUL (UK)
JINR (Russia)
Karlsruhe University (Germany)
KEK (Japan)
LAL / Orsay (France)
LAPP / ESIA (France)
NIKHEF/Amsterdam (Netherland)
NCP (Pakistan)
North-West. Univ. Illinois (USA)
Patras University (Greece)
Polytech. Univ. of Catalonia (Spain)
PSI (Switzerland)
RAL (UK)
RRCAT / Indore (India)
SLAC (USA)
Sincrotrone Trieste/ELETTRA (Italy)
Thrace University (Greece)
Tsinghua University (China)
University of Oslo (Norway)
Uppsala University (Sweden)
UCSC SCIPP (USA)

Work-packages and responsibilities

	Name	Name	WP Holder	Collaboration input
General		CLIC General	S. Stapnes	
Parameters and design Daniel Schulte	CD-BASE	Integrated Baseline Design and Parameters	D. Schulte	29 submissions of ongoing or planned contributions to these work-packages from collaborators outside CERN
	CD-SIM	Integrated Modelling and Performance Studies	A. Latina	
	CD-LUMI	Feedback Design	D. Schulte (interim)	
	CD-OP	Machine Protection & Operational Scenarios	M. Jonker	
	CD-BCKG	Background	D. Schulte (interim)	
	CD-POL	Polarization	-	
	CD-ESRC	Main beam electron source	S. Doebert	
	CD-PSRC	Main beam positron source		
	CD-DR	Damping Rings	Y. Papaphilippou	
	CD-RTML	Ring-To-Main-Linac	A. Latina	
	CD-ML	Main Linac - Two-Beam Acceleration	D. Schulte (placeholder)	
	CD-BDS			
	CD-MD			
	CD-DRV			
Experimental verification Roberto Corsini	CTF3-00			ckages from
	CTF3-00			
	CTF3-00			
	CTF3-00			
	CLIC0-0			
	CLIC0-0			
	BTS-00			
	BTS-00			
Technical Developments Hermann Schmickler	CTC-WI			ckages from
	CTC-SU			
	CTC-QU			
	CTC-TB			
	CTC-WI			
	CTC-BD			
	CTC-PC			
	CTC-CO			
	CTC-RF			
	CTC-EP			
	CTC-VA			
	CTC-MN			
	CTC-BT	Beam Transport Equipment	M. Barnes	
	CTC-MME	Creation of a "CLIC technology center@CERN"	F.Bertinelli	
X-band Technologies Walter Wuensch	RF-DESIGN	X-band Rf structure Design	A.Grudiev, I. Syratchev	20 submissions of ongoing or planned contributions to these work-packages from collaborators outside CERN
	PRODUCTION	X-band Rf structure Production	G.Riddone	
	TESTING	X-band Rf structure High Power Testing	S.Doebert	
	TEST AREAS	Creation and Operation of x-band High power Testing Facilities	E.Jensen (placeholder)	
	HIGH-GRADIENT	Basic High Gradient R&D	S.Calatroni	
Implementation studies Philippe Lebrun	IS-CES	Civil Engineering & Services	J. Osborne	
	IS-PIP	Project Implementation Studies	P.Lebrun	

The programme combines the resources of collaborators inside the current collaboration, plus several new ones – and also involves around 20 CERN groups:

- Have ~75 submitted descriptions of ongoing or planned efforts linked to these work-packages 2012-16 from groups outside CERN (result of CLIC working meeting 3-4.11: https://indico.cern.ch/conferenceOtherViews.py?view=standard&confId=156004 (still open for more interests)

- Description of contributions, link-persons, planned personnel and material resources at home and at CERN for the period

Main messages

- Feasibility studies have made significant progress and also CDR volumes progressing well – most the CDR writing done but significant efforts still needed on the editorial and final editing side, and volume 3 still ahead

- Large increased focus on "energy flexibility" (staging and scanning linked to physics and implementation studies) and energy/power/cost studies – to be better prepare for real implementation questions

- Planning and initial work for 2012-16 have made large steps forward (overall planning and an impressive collaboration input) – we are now re-iterating the collaboration input and in parallel work to define the CERN group efforts in more details, as needed for CERNs internal planning

- Finally – thanks to the entire CLIC collaboration (and others) who have provided the efforts and information summarized in this talk