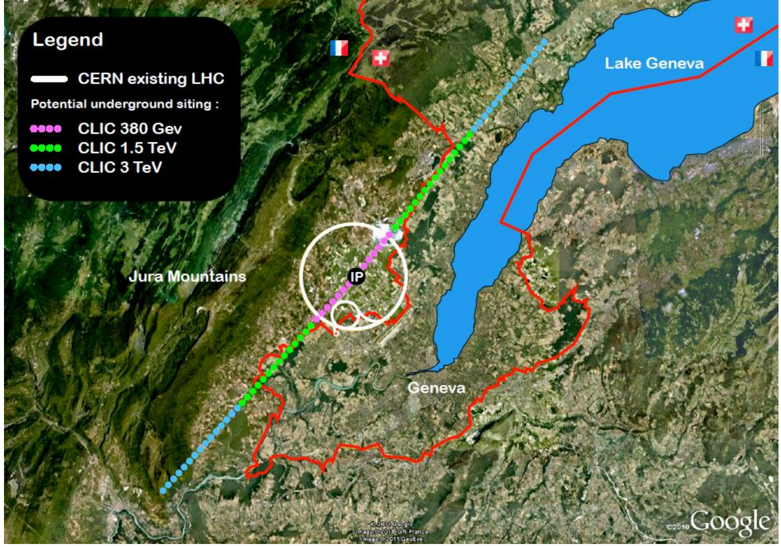
The CLIC review intro

Outline:

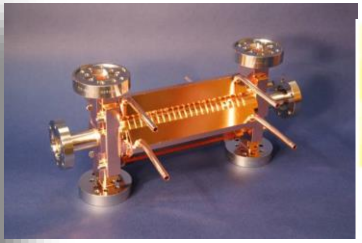
- Reminders (2004 -> CDR 2012, strategy, project timeline – slides 1-4
- Key R&D areas and open questions – slides 5-6
- Project main activities, organization and yearly reviews - slides 7-10
- Collaboration and international situation - slides 11-13
- Todays agenda and Summary– slides 14-15

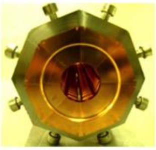


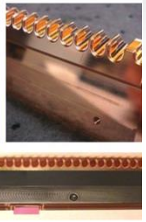
Key features:

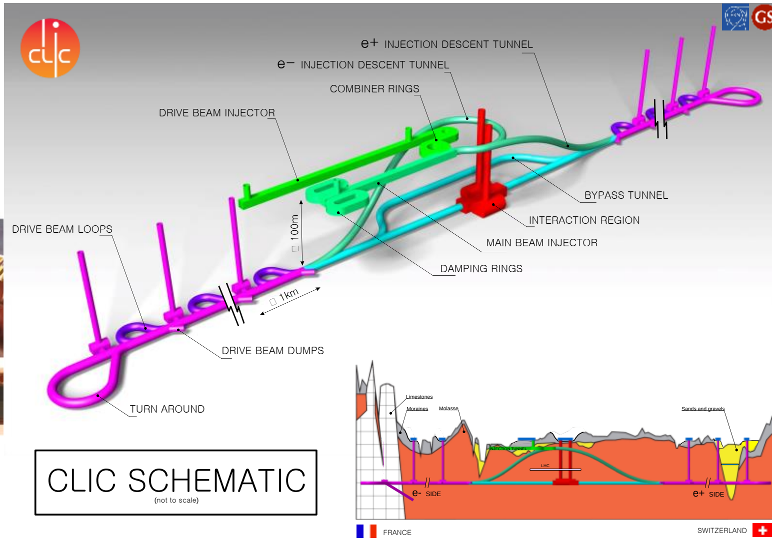
- High gradient (energy/length)
- Small beams (luminosity)
- Repetition rates and bunch spacing (experimental conditions)

Parameter	Unit	380 GeV	3 TeV
Centre-of-mass energy	TeV	0.38	3
Total luminosity	$10^{34}cm^{-2}s^{-1}$	1.5	5.9
Luminosity above 99% of √s	$10^{34}cm^{-2}s^{-1}$	0.9	2.0
Repetition frequency	Hz	50	50
Number of bunches per train		352	312
Bunch separation	ns	0.5	0.5
Acceleration gradient	MV/m	72	100
Site length	km	11	50









Looking back

Approval of accelerated CLIC R&D by the CERN Council in 2004.
Start date July 2004 with goal a CDR 2011-2012 demonstrating feasibility.
Addition of CLIC det & phys group from 2008

The CLIC CDR documents

Vol 1: The CLIC accelerator and site facilities
- 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

measured with high precision,

rategy process, including possible
s well as costing and cost-drives
CDR phase (2012-16)

In addition a shorter overview document was submitted as input to the European Strategy update, available at: http://arxiv.org/pdf/1208.1402v1

An input document to Snowmass 2013 have also been submitted: http://arxiv.org/abs/1305.5766 and http://arxiv.org/abs/1307.5288

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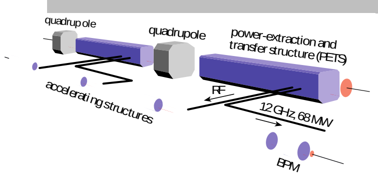
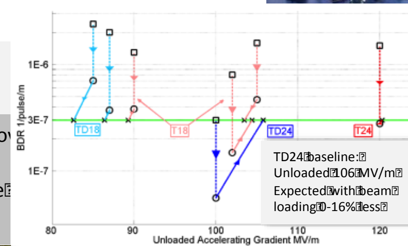
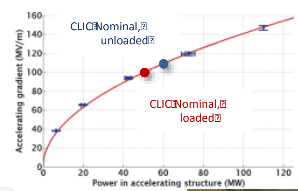
Conclusion of the accelerator CDR studies

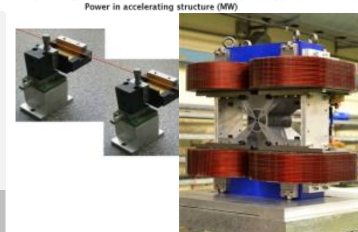
Main linac gradient	–	Ongoing test close to or on target
	–	Uncertainty from beam loading being tested
Drive beam scheme	–	Generation tested, used to accelerate test beam abo specifications, deceleration as expected
	–	Improvements on operation, reliability, losses, more deceleration studies underway







Luminosity	–	Damping ring like an ambitious light source, no show stopper
	–	Alignment system principle demonstrated
	–	Stabilisation system developed, benchmarked, better system in pipeline
	–	Simulations on or close to the target
Operation & Machine Protection	–	Start-up sequence and low energy operation defined
	–	Most critical failure studied and first reliability studies
Implementation	–	Consistent three stage implementation scenario defined
	–	Schedules, cost and power developed and presented
	–	Site and CE studies documented



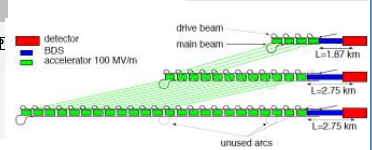
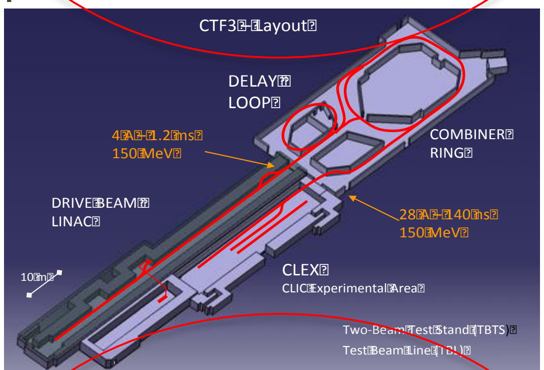


Fig. 3.6: Simplified upgrade scheme for CLIC staging scenario B.

Looking forward

2013-18 Development Phase

Develop a Project Plan for a staged implementation in agreement with LHC findings; further technical developments with industry, performance studies for accelerator parts and systems, as well as for detectors.



2018-19 Decisions

On the basis of LHC data and Project Plans (for CLIC and other potential projects as FCC), take decisions about next project(s) at the Energy Frontier.

Accelerator collaboration with ~50 institutes
Detector collaboration operative with ~27 institutes

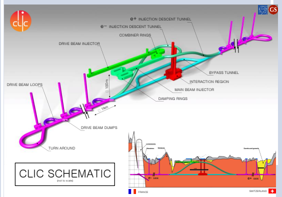
- European Strategy points addressed: High Gradient acceleration, machine studies for high energy frontier e+e- (CLIC), ILC and general accelerator and detector R&D
- Common work with ILC related to several acc. systems as part of the LC coll., also related to initial stage physics and detector developments
- Common physics benchmarking with FCC pp and common detect. challenges (ex: timing, granularity), as well as project implementation studies (costs, power, infrastructures …)

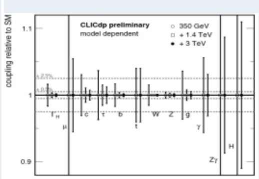
Strategy and strategic thinking

"CERN should undertake design studies for accelerator projects in a global context, with emphasis on proton-proton and electron-positron high-energy frontier machines. These design studies should be coupled to a vigorous accelerator R&D programme, including high-field magnets and high-gradient accelerating structures, in collaboration with national institutes, laboratories and universities worldwide."

Currently the world's leading laboratory at the high-energy frontier, CERN is Europe's greatest asset in particle physics. Pushing further the high-energy frontier has been essential to tackling many of the most exciting questions in particle physics, and it is likely to remain so in the future. To stay at the forefront of particle physics, Europe needs to be in a position to propose an ambitious post-LHC accelerator project at CERN by the time of the next Strategy update. The process of preparing for future decisions on the next large project at CERN must be started now, even though the physics output of the 2015-2017 full-energy run of the LHC will be essential to such decisions. The two most promising lines of development towards the new high-energy frontier after the LHC are proton-proton and electron-positron colliders. Focussed design studies are required in both fields, together with vigorous accelerator R&D supported by adequate resources and driven by collaborations involving CERN and national institutes, universities and laboratories worldwide. The Compact Linear Collider (CLIC) is an electron-positron machine based on a novel two-beam acceleration technique, which could, in stages, reach a centre-of-mass energy up to 3 TeV. A Conceptual Design Report for CLIC has already been prepared. Possible proton-proton machines of higher energy than the LHC include HE-

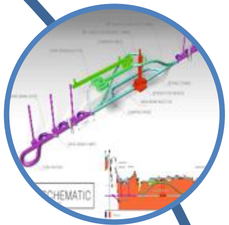
Rationale for main R&D choices

Activity groups		CDR status/concerns (around 2012-13)	Main on-going activities – achieved or in progress (aiming for next ESU 2018-19)
Parameters and Design, Implementation		Not optimized except at 3 TeV and not adjusted for Higgs discovery, not optimized cost, first power/energy estimates, limited industrial costing	Design and Parameters cost and power optimized at all stages (380 GeV, 1.5 and 3 TeV) – to be adapted to LHC results as needed, including klystron option for first stage. Power reduction studies (magnets, klystrons, design, overheads), cost review and reduction studies Industrial quotes/experience for main items Schedule/layout near CERN, plans for preparation phase 2019-2025
X-band technology		Single elements demonstrated – limited by test-capacity, commercial klystron just becoming available in 2012-13 opening for test-facilities, FEL linac use, klystron driven modules	Three new test-stands at CERN with commercial RF Units. Statistics for gradient and design optimization (x5), increased industrial capacity of complete structures Optimize structure choice and other X-band elements. Use in smaller machines at FEL linacs (new or upgrades) with commercial RF units. High efficiency RF studies (X-band as well as L-band)

Activity groups		CDR status/concerns (around 2012-13)	Main on-going activities – achieved or in progress (aiming for next ESU 2018-19)
System-tests	 	CTF3 results first phase documented, ATF and FACET very little done, no convincing strategy for further system verification and high power drive beam facility	Complete system-tests at CTF3 (module, phase stab., wakefield, etc). Pursue FACET and ATF system tests for nano-beams. Strategy for further system verification before construction (in FEL linacs, connected to light-sources, further drive-beam verifications) or as part of initial machine strategy. Demonstrator of drive beam FE and RF power unit based on industrial capacity – for larger facilities beyond 2019 if needed. Studies of the use of the CALIFES beamline beyond CTF3 (2017 onwards).
Technical Develop ments		Alignment/stability partly covered, BBA assumed, no complete module, limited magnet prototyping	Components needed for: System-tests (example magnets, instrumentation, modules). Machine performance (example alignment, stabilization, DR studies) Cost or power reduction (example magnets, klystrons, modules)
Physics and Detectors		Higgs just being announced, BSM open field, R&D in initial phase	Physics studies (Higgs, Top, BSM) – diphoton ? Optimised detector model and simulations Detector R&D (low mass vertex, high granularity)

Main activities

http://clic-study.web.cern.ch/content/clic-accelerator-activities



Parameters, Design and Implementation

- Integrated Baseline Design and Parameters
- Integrated Modeling and Performance Studies
- Feedback Design, Background, Polarization
- Machine Protection & Operational Scenarios
- Electron and positron sources, Damping Rings, Ring-To-Main-Linac, Main Linac - two-Beam Acceleration, Beam Delivery System
- Machine-Detector Interface (MDI
- Drive Beam Complex

X-band Technologies

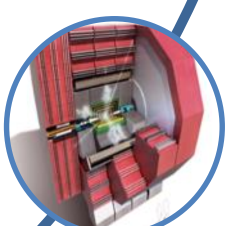
- X-band Rf structure Design
- X-band Rf structure Production
- X-band Rf structure High Power Testing
- Novel RF unit developments (high efficiency)
- Installation and Operation of High power Testing Facilities
- Basic High Gradient R&D

Experimental verification

- CTF3 Consollidation & Upgrades
- Drive Beam phase feed-forward and feedbacks
- Two-Beam module string, test with beam
- Drive-beam front end including modulator development and injector
- Modulator development, magnet converters
- Drive Beam Photo Injector
- Low emittance ring tests
- Accelerator Beam System Tests (ATF and FACET, others)

Technical Developments

- Damping Rings Superconducting Wiggler
- Survey & Alignment
- Quadrupole Stability
- Warm Magnet Prototypes
- Beam Instrumentation and Control
- Two-Beam module development
- Beam Intercepting Devices
- Controls
- Vacuum Systems



Detector and Physics

- Physics studies and benchmarking
- Detector optimisation
- Technical developments

Goals 2018-19

Goal for next strategy update (2018-19): Present a CLIC project that is a "credible" option for CERN beyond LHC, a Project Implementation Plan (PIP). Guidelines used internally:

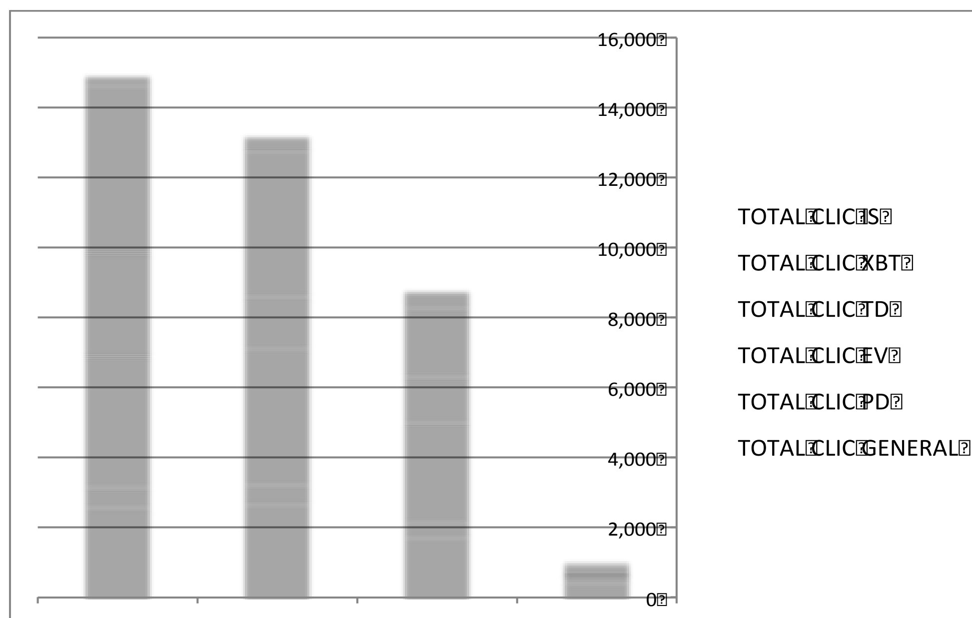
- Adapt to physics results – LHC mostly - taking into account LHC-14 TeV as results become available (be flexible)
- Physics no later than 2035, solid luminosities from Higgs/top at 380 GeV to 3 TeV (staging)
- Initial costs compatible with current CERN budget level (order LHC+50%) (staging)
- Upgradable in 2-3 stages over a 20-30y period, without major (max 3-4 years) operational breaks, and with upgrade costs also in reasonable agreement with current budget level.

Documentation foreseen:

1. Summary project plan document (physics, machine parameters, cost, power, site, staging, construction schedule, brief summary of main tech. issues, prep. phase (2019-2025) summary (see point2 below), detector studies (document 50-80p) – plus short versions
2. Preparation phase plan document (critical parameters, status and next steps 2019-2025 - what is needed before project construction start up, strategy, risks and how to address them, inside and outside CERN, in industry (document)
3. Detailed documentation across project: EDMS/WBS based (exists but need update, already used for cost, power), review and improve. Use by 2018 for consistent technical documentation, tender/commercial documents (protected), results, notes/publication for each WP and/or activity.
4. Techno transfer/spin-off paper including training (ph.d and fellows) (can be done earlier)
5. Comprehensive physics and detector documentation (part of which will be summarized in document 1 above). Summary of several paper planned in the period 2015-2018 covering physics topics, detector studies and R&D.

Budget – more in last talk

	2012	2013	2014	2015	2016			2017	2018	2019	Total Activity 2017-2019	
Description	Charged	Charged	Charged	Charged	Charged	Committed	Foreseen	Foreseen	Foreseen	Foreseen		
TOTAL CLIC GENERAL	1'206	2'336	2'137	1'404			2'662	2'750	1'800	500	5'050	TOTAL CLIC GENERAL
TOTAL CLIC PD	331	316	290	253			578	564	428	54	1'046	TOTAL CLIC PD
TOTAL CLIC EV	2'760	2'742	4'444	2'719			3'754	3'890	2'850	150	6'890	TOTAL CLIC EV
TOTAL CLIC TD	4'727	5'048	3'162	3'235			2'949	1'480	1'330	0	2'810	TOTAL CLIC TD
TOTAL CLIC XBT	3'469	3'682	7'101	2'823			4'775	4'160	1'966	300	6'426	TOTAL CLIC XBT
TOTAL CLIC IS	171	15	112	83			250	400	450	50	900	TOTAL CLIC IS
Carry forward items from 2015							3484					
TOTAL	12'664	14'139	17'246	10'518	1'100	9'300	18'452	13'244	8'824	1'054	23'122	REQUEST GRAND TOTAL (2017-2019)
MTP 2016-2020 (CERN/FC/5932) - incl. Carry Forward 2015 into 2016							15'819	12'900	8'900	1'200	23'000	MTP GRAND TOTAL (2017-2019)
							-2'633	-344	76	146	-122	DIFFERENCE



Yearly review/follow up

- Early in year
  - Closing of books, last year -> current year transfers
  - Distribute on WPs according to planning made the year before
- After MTP numbers are known (mid year)
  - Review critical items and goals: example talk of Daniel in 2015 retreat: https://indico.cern.ch/event/405901/contribution/2/attachments/812474/1113535/issues.pptx
  - Review spending and needs from today to 2019 for the material budget. Outcome: yearly budget to its end for each WP
  - Review/discuss with key responsible personnel situation and needs (key WP people, section and group leaders as and when needed)
- Towards end of the year: attempt to get invoiced processed in time

- Bi-weekly CET reports covering charged, committed, pipeline, fraction of budgeted per WP…)

Snapshot collaborations, mid 2015

Country	Institutes	Type	Fiield
UK	Oxford, RHUL, Lancaster, STFC-Dundee	Four R&D contracts	BDS,ATF, instrumentation for CTF3, CTF3 measurements 2015-16
Finland	Helsinki Institute of Physics	R&D contract	Xband structure studies and post-mortem measurements, breakdown studies, CLIC module development
Norway	University of Oslo	R&D contract	CTF3 hardware and measurements, Wakefield and Emittance
Spain	ALBA-CELLS, CIEMAT, IFIC	Three R&D contracts	Acc. structure and magnets, damping ring studies, instrumentation and kicker, beam position monitor development, Xband test facilities at CERN and IFIC
Germany	University of Karlsruhe	R&D contract	Development and test of CLIC …
France	IRFU		
	CEA/CESTA		
Switzerland	ETH Zurich		
	ETH Zurich		
	PSI Villingen		
Sweden	Uppsala University		
Japan	KEK	Several… appendixes to ICA-JP-0103	… structures, testing of X band structures including also from Tsinghua and SINAP. ATF2 hardware and operation, CERN office at KEK, Detector and Physics studies
China	SINAP	CERN P118 and MoU addendum	High-gradient X-band accelerating structures for XFEL and CLIC: design and prototype fabrication, to be tested at KEK and CERN 2016-19
China	Tsinghua	MoU addendum	CLIC Baseline Accelerating Structure based on choke-mode damping, fabrication and assembly of prototype High-Gradient X-band structures, general X-band R&D, testing at KEK and CERN, work in the

Turkey	Ankara University/Institute of Accelerator Technologies	MoU addendum	CLIC main beam sources (also relavant for a FEL)/Drive Beam Complex and Feedback Design and Background
Pakistan	National Center	MoU	Protocol to Cooperation agreement
		MoU addendum	Participation to CTF3 operation and beam experiment
LCC and ILC specific	All LC "stakeholders"	MoUs FALC and LCB, specific ILC studies	LCC common fund, specific projects (currently tuners and CE, others in 2014)
PACMAN MC project	CERN, Valencia, LAPP, Symme, ETH, Univ. of Sannio, Pisa, Delft, Cranfield…	Marie Curie network	Precision mechanics, stabilation, alignment, magnets, instrumentation
	SINCROTRONE Trieste	MoU addendum	Installed and operational X-band linearizer in FERMI. X-band equipment built in collaboration. X-band system design for XFEL upgrade.
France	LAL	R&D contract	ATF2 and BDS (common Ph.D student)
	LAPP	Convention cadre CERN et Haute-Savoie	ATF2 hardware, stabilastion studies, PACMAN
Germany	DESY	informal	X-band systems for advance electron linacs at DESY including FLASH, ARES
China	Shandong University	MoU addendum	CLIC RTML

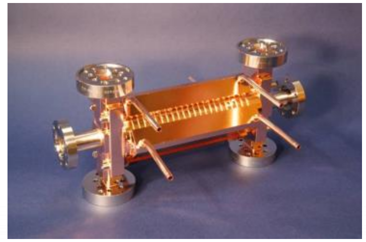
Denmark	Aarhus University	MoU addendum	QED processes in a strong field and in the beam-beam simulation Guinea Pig
Estonia	University of Tartu	MoU addendum	Surface physics and breakdown studies. EC Twinning proposal under preparation.
Greece	National Technical University of	MoU addendum	Beam Instrumentation, Mechanical studies and construction, digital electronics, control systems, MDI
India	RRCAT Indore		CLIC two beam module studies, control systems, informatics applications
		Addendum SSPA.1	20kW 500MHz amplfier
		Addendum P.1	PETs and Vacuum chambers
Iran	IPM	MOU	RF design of a travelling wave buncher for the CLIC Drive Beam and injector design
Israel	Racah Institute of Physics at the Hebrew University	MoU addendum	Surface physics, breakdown studies and advanced microscopy. Theortical studies, high-voltage system and sample microscopy
Netherlands	NIKHEF and TU Eindhoven	MoU addendum	Development of pre-alignment solutions, discuss further effort with TU-Eindhoven with relevance for a local machine to be installed in Amsterdam.
Poland	National Center for Nuclear Research (NCBJ)	MoU	Beams dynamics study of a satellite removal system for the CLIC DB injector, RF and mechanical design + manufacturing of a prototype Drive Beam accelerating structure
Russia	BINP	Contract via …	Wiggler NbTi
		… CERN- …	Personnel in several araes, most significant acc. structures, module development and CTF3 being phased out, one real project with alignment specialists in Dubna: Fiducialisation and initial alignment of components based on laser systems including a precision laser inclinometer.
			Physics and Detector (only partly a part of the accelerator project)
			RF breakdown studies and high-gradient experimental set-up. Currently working under DFFD grant, new one applied for
			Breakdown plasma, DC spark setup
			Numerous addenda: klystron supply and repair, modulator design, prototype structures, high-power testing, kicker study, BBA studies at FACET
		…ract	Beam instrumentation and measurement programme in CeSRTa
			Beam instrumantation
			Two-beam and high-gradient test facility, positron source studies (linked to LC)
			Application, OptiCLIC, made to Bundesministerium fur Bildung und Forschung made for combined rf design and machining orptimization for CLIC cells.
Germany	Wuppertal	informal	High-field testing of copper samples using system for superconducting cavity development
Japan	Tokyo Univ	informal and also in EJADE	X-band applications including industrial linacs and Comton scattering sources
Belarus	Joint Institute for Nuclear Research (SOSNY)	MoU addendum	PJAS in beam-instrumentation
Madagascar	University of Antananarivo	MoU addendum	Re-parametrization of the hadronic background generation using Guinea Pig and Pythia and study of the impact of beam-induced background on the measurement precision of a physcs process at CLIC
Canada	Laval University	R&D contract, not yet signed	DB modulator
UK	Nottingham University	R&D contract	DB modulator grid studies

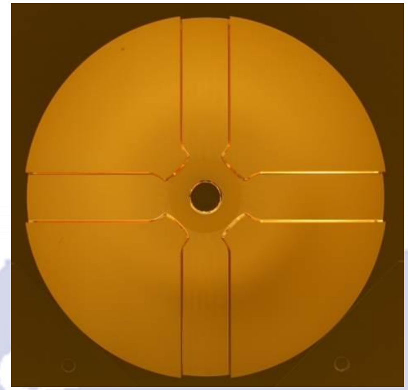
Key existing commitments in the accelerator area (internal overview made April 2015):

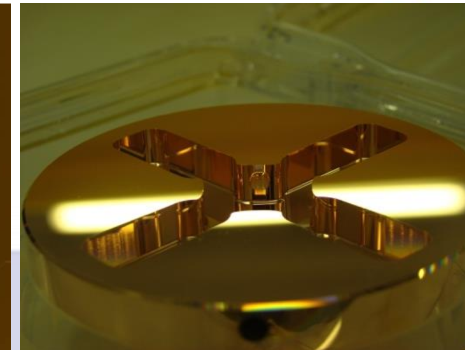
- R&D contract, MoU + addenda, Co-operation agreements with addenda, TT agreements ..
- Many linked to Xband development and acc. structure testing 2014-8 or the CTF3 programme the next year two years, including hardware developments for these experimental facilities.
- Most of the agreements cover 2014(5)-2017(8).
- Around 80 PhD students reported in this overview (accelerator area)
- Not included: collaboration for high efficiency klystrons with ten inst. and companies - seed funded by LC budget (covers also FCC and ESS)

X-band structures and testing – see next talk

X-band Technologies:
- High gradient structures and high efficiency RF (structure prod. in green)
- X-band High power Testing Facilities (x3 increase) (in red)
- Use of X-band technologies for FELs

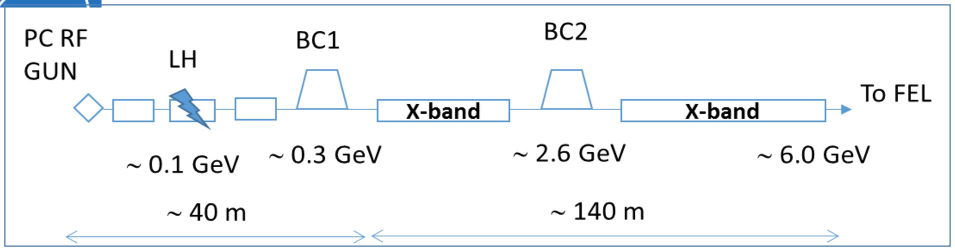


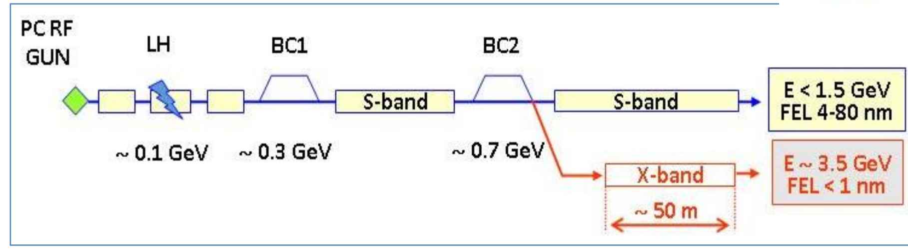




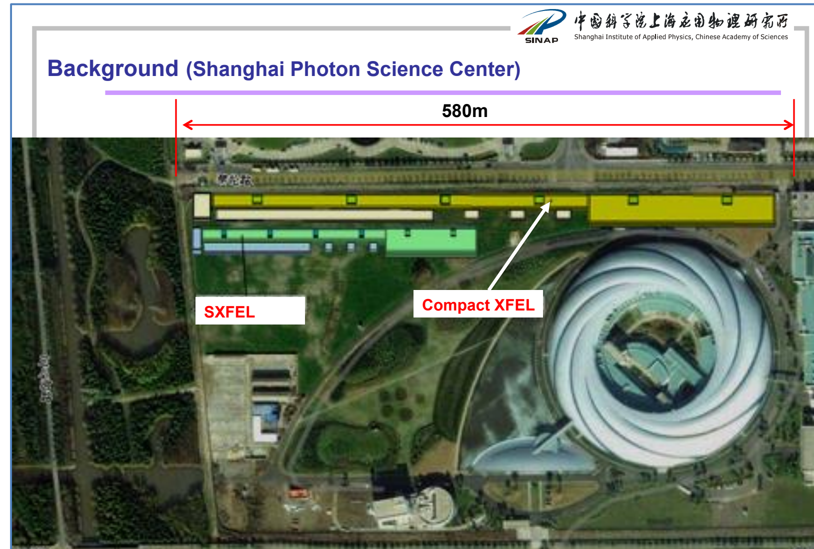
Institute	Structure	Status
KEK	Long history – latest TD26CC	Mechanical design
Tsinghua	T24 - VDL machined, Tsinghua assembled, H bonding, KEK high-power test	At KEK
	CLIC choke	manufacturing tests
SINAP	XFEL structure, KEK high-power test	rf design phase
	T24, CERN high-power test	Agreement signed
	Four XFEL structures	H2020 proposal
CIEMAT	TD24CC	Agreement signed
PSI	Two T24 structures made at PSI using SwissFEL production line including vacuum brazing	Mechanical design work underway
VDL	XFEL structure	H2020 proposal
SLAC	T24 in milled halves	machining
CERN	Structures and Test-stands	
	KT (Knowledge Transfer) funded medical linac	machining

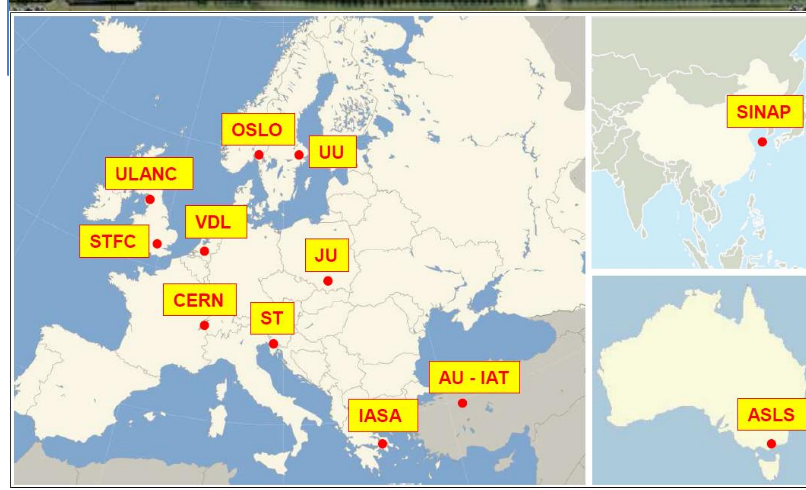
Xband facilities - FELs





- X-band technology appears interesting for compact, relatively low cost FELs – new or extensions
  - Logical step after S-band and C-band
  - Example similar to SwissFEL: E=6 GeV, Ne=0.25 nC, s_z=8mm
- Use of X-band in other projects will support industrialisation
  - They will be klystron-based, additional synergy with klystron-based first energy stage
- Started to collaborate on use of X-band in FELs
  - Australian Light Source, Turkish Accelerator Centre, Elettra, SINAP, Cockcroft Institute, TU Athens, U. Oslo, Uppsala University, CERN
- Share common work between partners
  - Cost model and optimisation
  - Beam dynamics, e.g. beam-based alignment
  - Accelerator systems, e.g. alignment, instrumentation…
- Define common standard solutions
  - Common RF component design, -> industry standard
  - High repetition rate klystrons (200->400 Hz now into test-stands)





Today – key activities and talks

From goals established 2012-13:

- Three new test-stands at CERN with commercial RF Units. Statistics for gradient and design optimization (x5), increased industrial capacity of complete structures. Optimize structure choice and other X-band elements. Use in smaller machines at FEL linacs (new or upgrades) with commercial RF units. **Talk of Walter**
- High efficiency RF studies (X-band as well as L-band). **Igor.**
- Complete system-tests at CTF3 (module, phase stab., wakefield, etc). Roberto.
- Pursue FACET and ATF system tests for nano-beams. Roberto and Daniel.
- Strategy for further system verification before construction (in FEL linacs, connected to light-sources, further drive-beam verifications) or as part of initial machine strategy. **Roberto, Walter and Daniel.**
- Demonstrator of drive beam FE and RF power unit based on industrial capacity – for larger facilities beyond 2019 if needed. **Steffen I**
- Studies of the use of the CALIFES beamline beyond CTF3 (2017 onwards). **Erik.**
- Design and Parameters cost and power optimized at all stages (380 GeV, 1.5 and 3 TeV) – to be adapted to LHC results as needed, including klystron option for first stage. **Daniel.**
- Power reduction studies (magnets, klystrons, design, overheads), cost review and reduction studies. **Daniel, Igor, Hermann.**
- Industrial quotes/experience for main items. **Across speakers**.
- Schedule/layout near CERN, plans for preparation phase 2019-2025. **Planned update for 2018-19.**
- Technical developments/components needed for:
  - System-tests (example magnets, instrumentation, modules). **Hermann and Steffen II**
  - Machine performance (example alignment, stabilization, DR studies). **Hermann, Daniel.**
  - Cost or power reduction (example magnets, klystrons,

Tuesday, 1 March 2016

Time	Session
09:00 - 09:10	Introduction and mandate *10'* Speaker: Maurizio Vretenar (CERN) CLIC Review - Autu... CLIC Review - Autu...
09:10 - 09:40	Project overview: structure and status, objectives for 2018, long-term *30'* *Presentation 20' + Questions 10'* Speakers: Steinar Stapnes (CERN), Philip Burrows (Oxford University)
09:40 - 10:10	Status and plans of X-band test-stands and structures *30'* *Presentation 20' + Questions 10'* Speaker: Walter Wuensch (CERN)
10:10 - 10:40	Status and plans of klystron developments, including high-efficiency *30'* *Presentation 20' + Questions 10'* Speaker: Igor Syratchev (CERN)
10:40 - 11:00	Coffee Break
11:00 - 11:30	Status and plans of drive beam components design and test *30'* *Presentation 20' + Questions 10'* Speaker: Steffen Doebert (CERN)
11:30 - 12:00	Completion of CTF3 program in 2016 and further CLIC experimental verification activities *30'* *Presentation 20' + Questions 10'* Speaker: Roberto Corsini (CERN)
12:00 - 12:30	CLIC performance, ongoing verifications and remaining concerns *30'* *Presentation 20' + Questions 10'* Speaker: Daniel Schulte (CERN)
12:30 - 13:30	Lunch
13:30 - 14:00	Status and plans for CLIC advanced technical components *30'* *Presentation 20' + Questions 10'* Speaker: Hermann Schmickler (CERN)
14:00 - 14:30	Status and plans of the module development programme *30'* *Presentation 20' + Questions 10'* Speaker: Steffen Doebert (CERN)
14:30 - 15:00	Proposal for the future operation of the CALIFES linac *30'* *Presentation 20' + Questions 10'* Speaker: Erik Adli (University of Oslo (NO))
15:00 - 15:15	CLIC resource plans until 2018 *15'* Speakers: Steinar Stapnes (CERN), Hermann Schmickler (CERN)
15:15 - 15:45	Coffee and questions time
15:45 - 18:00	Closed session (Reviewers only) *2h15'*

Summary

The goals and plans for 2016-19 are well defined for CLIC, focusing on the high energy frontier capabilities – well aligned with current strategies – also preparing to align with LHC physics as it progresses in the coming years.

Collaboration programme for the current period established 2012-13 and has been adjusted/aligned – but modestly – yearly as needed since then

- Most large investments made (klystrons, modulators, test-stands, module components, etc …. see next talks)

Collaboration agreements covering next period in place

- Many commitments related to Xband structure and testing plus the CTF3 programme in the years 2015-2017, easing up somewhat in 2018-19. These commitments are covered by numerous R&D contracts and MoU annexes covering personnel and hardware, exchange/test of equipment being built in the collaboration, and around 80 ph.d students

The fact that CTF3 is closed down by end 2016, and that there is no overall LC planning or activity foreseen at CERN after 2018-19 is a significant concern for the collaboration