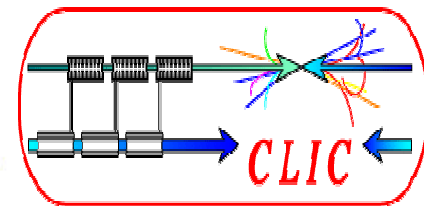


# Risk registry, limitations, solutions and implications

Andrei Seryi, SLAC

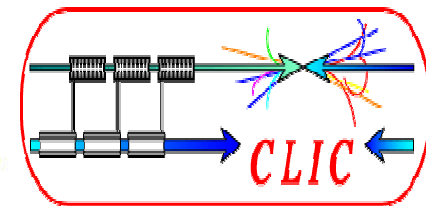
October 14, 2009

CLIC 09 Workshop



1	<b>CLIC FEASIBILITY ISSUES</b>			
2	last update: 2009.07.01			
3	<b>SYSTEMS</b>	<b>Critical parameters</b>	<b>Relevant Facilities</b> <i>Common with ILC in red</i>	
4	Structures	<u>Main Beam Acceleration Structures:</u> Demonstrate high-power operation of nominal CLIC structures with damping features at the design gradient, with design pulse length and breakdown rate .	Average loaded gradient 100 MV/m total/flat-top pulse length 240/160 ns breakdown probability/pulse $< 3 \cdot 10^{-7}$ /m average $a/\lambda > 0.11$ Long range wakefield $< 6V/(pC \cdot m \cdot mm)$	CTF2&3 (2005-2010) Test Stand (2009-10) SLAC/NLCTA SLAC/ASTA KEK/NEXTEF
5		<u>RF Power production structures:</u> Demonstrate high-power operation of nominal PETS with damping features at the design power, with design pulse length, breakdown rate and on/off capability	Generated power 132 MW total/flat-top pulse length 240/160 ns breakdown probability/pulse $< 1 \cdot 10^{-7}$ /m Wakefield $< 9 V/(pC \cdot m \cdot mm)$ On/Off/adjust capability	CTF3 (2005-2010) CTF3/TBTS (2008-10) CTF3/TBL (2009-10) SLAC/ASTA
6	Two Beam	<u>Two Beam Acceleration and module integration:</u> Demonstrate two-beam acceleration and operation in a prototype module equipped with all critical subsystems	Two Beam Acceleration at nominal parameters as given above for individual components Pulse shape accuracy $< 0.1\%$	CTF2&3/TBTS (2004-10)
7	Drive Beam	<u>Drive Beam Production</u> - Beam generation and combination - phase and energy matching - Potential feedbacks	100 A peak current- 590 $\mu C$ total charge 12 GHz bunch repetition frequency, 1 mm rms bunch length 0.2 degrees phase stability at 12 GHz $7.5 \cdot 10^{-4}$ intensity stability	CTF3 (2005-2010) CTF3/TBL (2009-10) Simulations <b>X-FEL</b> <b>LCLS</b>
		<u>RF power generation by Drive Beam</u> <u>RF power extraction</u>	90% extraction efficiency	CTF2/TBL Simulations

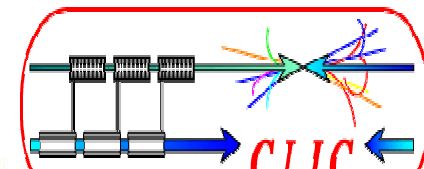
<https://edms.cern.ch/nav/CERN-0000060014/AB-003093>



	A	B	C	D
1	<b><u>CLIC FEASIBILITY ISSUES</u></b>			
2	last update: 2009.07.01			
3		<b>SYSTEMS</b>	<b>Critical parameters</b>	<b>Relevant Facilities Common with ILC in red</b>
9	<b>Beam Physics</b>	<a href="#">Generation and Preservation of Low Emittances</a> Damping Rings, RTML and Main Linacs	Emittances(nm): H= 600, V=5 Absolute blow-up(nm): H=160, V=15	ATF, SLS, NSLSII Simulations LCLS, SCSS
10	<b>Stabilization</b>	<a href="#">Main Linac and BDS Stabilization</a>	Main Linac : 1 nm vert. above 1 Hz; BDS: 0.15 to 1 nm above 4 Hz depending on final doublet girder implementation	CESRTA ATF2
11	<b>Operation and reliability</b>	<a href="#">Operation and Machine Protection</a> Staging of commissioning and construction Machine protection with high beam power	drive beam power of 72 MW @ 2.4 GeV main beam power of 13 MW @ 1.5 TeV MTBF, MTTR	CTF3 Simulations
12	<b>Detector</b>	<a href="#">Conditions for the experiments</a> Detector design and shielding compatible with short bunch interval and breakdown generated by beam beam effects during collisions at high energy	Time stamping: 0.5 nsec bunch interval Beam-Beam background: $3.8 \cdot 10^5$ coherent/1e5 incoherent e+/e- pairs, Hadrons, High muon flux	Simulations



# Critical issues (Selected BDS related)



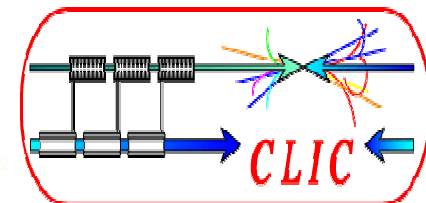
## LIST OF CRITICAL ISSUES

EDMS#: 918791

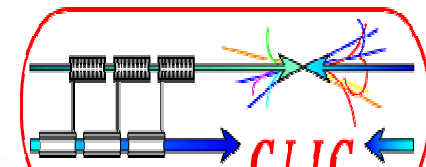
last update: 2009.07.01

SYSTEMS (level n)		Critical parameters	Parameter specification	Crucial design choice or feasibility issue	Performance issue	Cost issue	Relevant Facilities Common with ILC in red	Working group/Review/Committee
Beam physics	Spent beam line design	NA	In progress D. Schulte E. Tsesmelis			X		BPWG
Magnet systems	Final focus doublet Only old permanent magnet design exists	NA	In progress R. Thomas		X			CTC
Vacuum systems	BDS Probably 0.1torr required Space constraints in some magnets	NA	EDMS# 971530 G. Rumulo		X	X		CTC
Dumps and collimators	BDS	NA	In progress B. Jeanneret (collimator survival) R. Tomas		X			CTC (D. Schulte)
	Tune-up dumps	NA	No to be defined			X		CTC
Stabilization	<a href="#">Main Linac and BDS Stabilization</a>	Main Linac : 1 nm vert. above 1 Hz; BDS: 0.15 to 1 nm above 4 Hz depending on final doublet girder implementation	EDMS# 971672 D. Schulte, R. Nousiainen	X	X	X	CESRTA ATF2	CTC (synergy with CMWG and stabilization WG)

CRITICAL ISSUES / FEASIBILITY ISSUES / BDS ISSUES



<b>LIST OF CRITICAL ISSUES</b>		<b>EDMS#: 918791</b>							
last update: 2009.07.01									
SYSTEMS (level n)		Critical parameters	Parameter specification		Crucial design choice or feasibility issue	Performance issue	Cost issue	Relevant Facilities Common with ILC in red	Working group/Review/Committee
<b>Stabilization</b>	<a href="#">Main Linac and BDS Stabilization</a>	Main Linac : 1 nm vert. above 1 Hz; BDS: 0.15 to 1 nm above 4 Hz depending on final doublet girder implementation	EDMS# 971672	D. Schulte, R. Nousiainen	X	X	X	CESRTA ATF2	CTC (synergy with CMWG and stabilization WG)
Design of combined stabilization and alignment	Active alignment system, pulse to pulse feedback	NA	In progress	D. Schulte, J. Pfungstner, H. Schmickler		x			Beam Physics WG, collaboration with Stabilization WG
<b>Detector infrastructure</b>	Conditions for the experiments Detector design and shielding compatible with short bunch interval and breakdown generated by beam beam effects during collisions at high energy	Time stamping: 0.5 nsec bunch interval Beam-Beam background: 3.8 108 coherent e+/e- pairs High muon flux	No	to be defined	X	X	X	Simulations	MDI



October 14, 2009, 15:30 CET

Area	Concern	Present risk	Expected risk	Mitigation	Alternatives
BDS		Feasibility			
BDS		High			
BDS		Moderate			
BDS	Survivability of spoilers	High	?Moderate	?Beam test	Consum. spoilers; Nonlinear coll.; etc
BDS	Cleanness of collimation	Moderate			
BDS	Too high incoming jitter	High			
BDS	Collimation wakes underestimated	Moderate			
BDS	Crab cavity phase stability not met	Feasibility			
BDS	FD stabilization 100nm=>0.3nm	Feasibility	High	Prototype	Longer L* scheme
BDS	FD stabilization 3nm=>0.3nm	High	Moderate	Prototype	
BDS	Too high losses in extraction	High			
BDS	Survivability of large beam dump window	Feasibility			
BDS	Background from extraction line	High			
BDS	Fast meas. of beamstrah. photons in the dump	Feasibility			
BDS	Reuse of 500GeV layout cost prohibitive for 3TeV	Moderate	Low		Insert reverse bend & dogleg; or same layout
BDS	Very low field (~40Gs) bends in BDS	High			
BDS	Compatibility of PM FD & stabiliz. w. anti-solenoid	High			
BDS	Ion effects with field ionization	Moderate	Low	Simulations	
BDS	Collective effects	Moderate		Analysis	
BDS	Collim. efficiency and E-beta order	Moderate	Low	Analysis	
BDS	Plan to run at lower energy	Moderate			