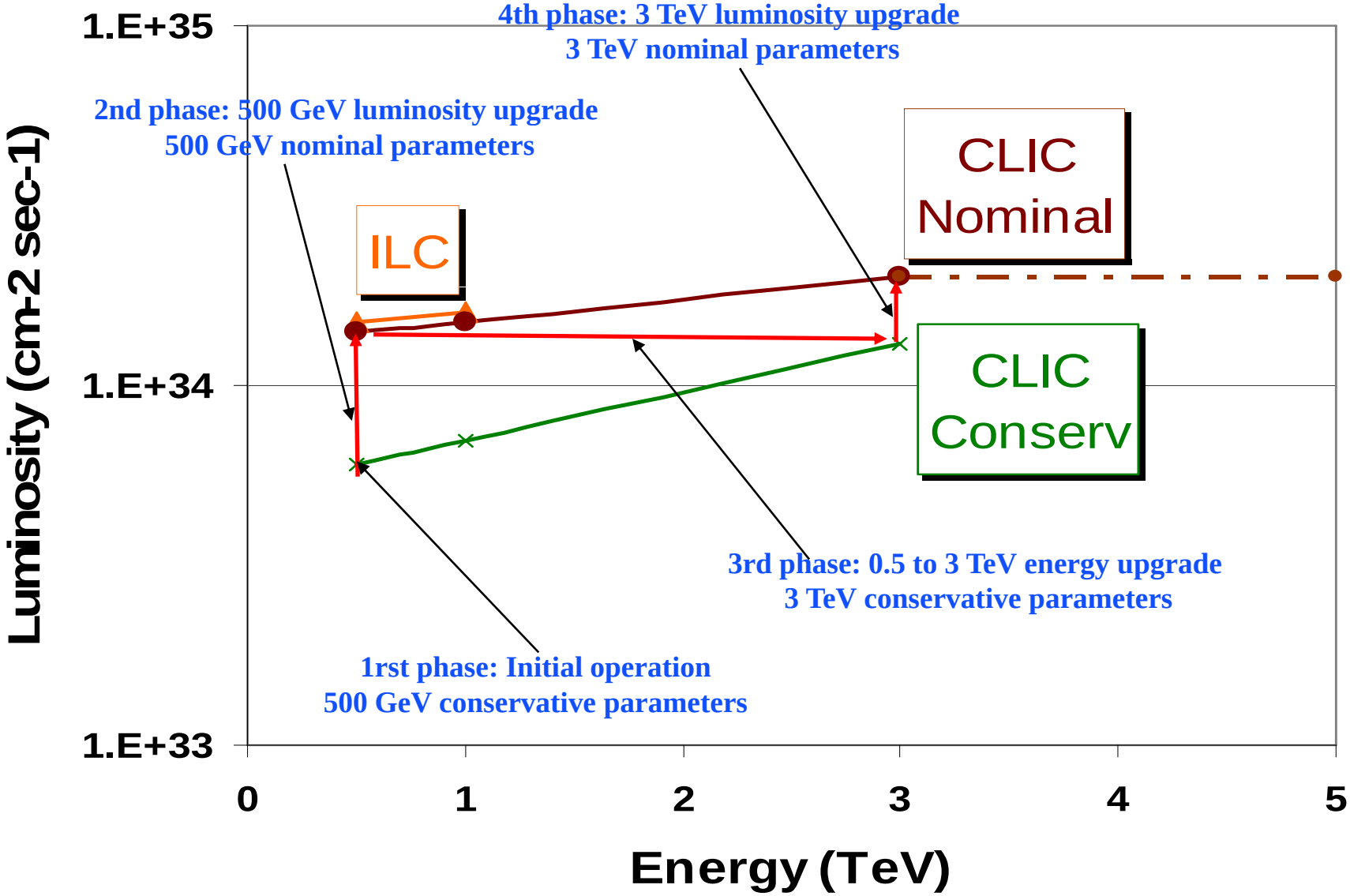
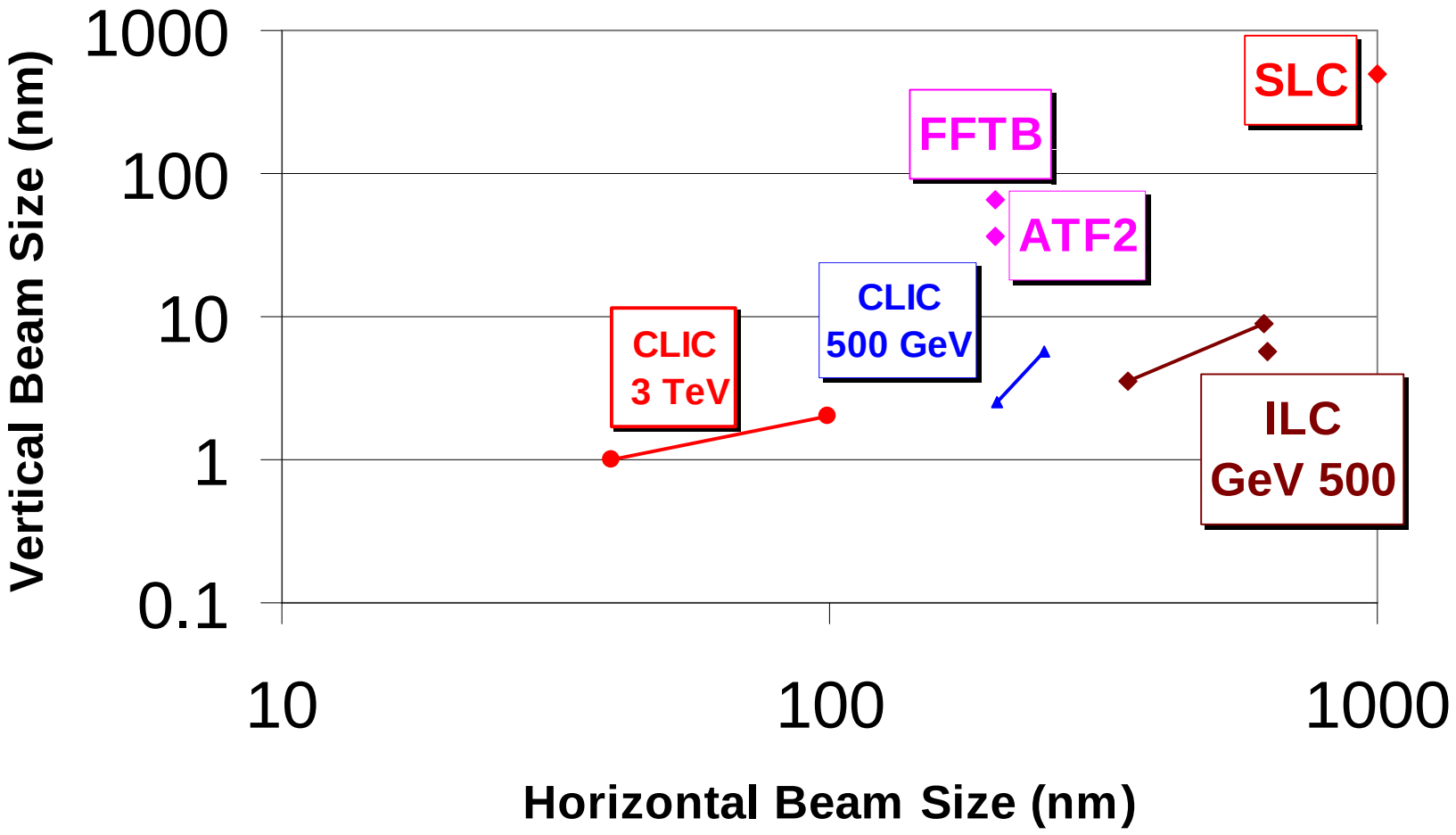
CLIC Parameters and upgrade scenario

http://cdsweb.cern.ch/record/1132079/files/CERN-OPEN-2008-021.pdf

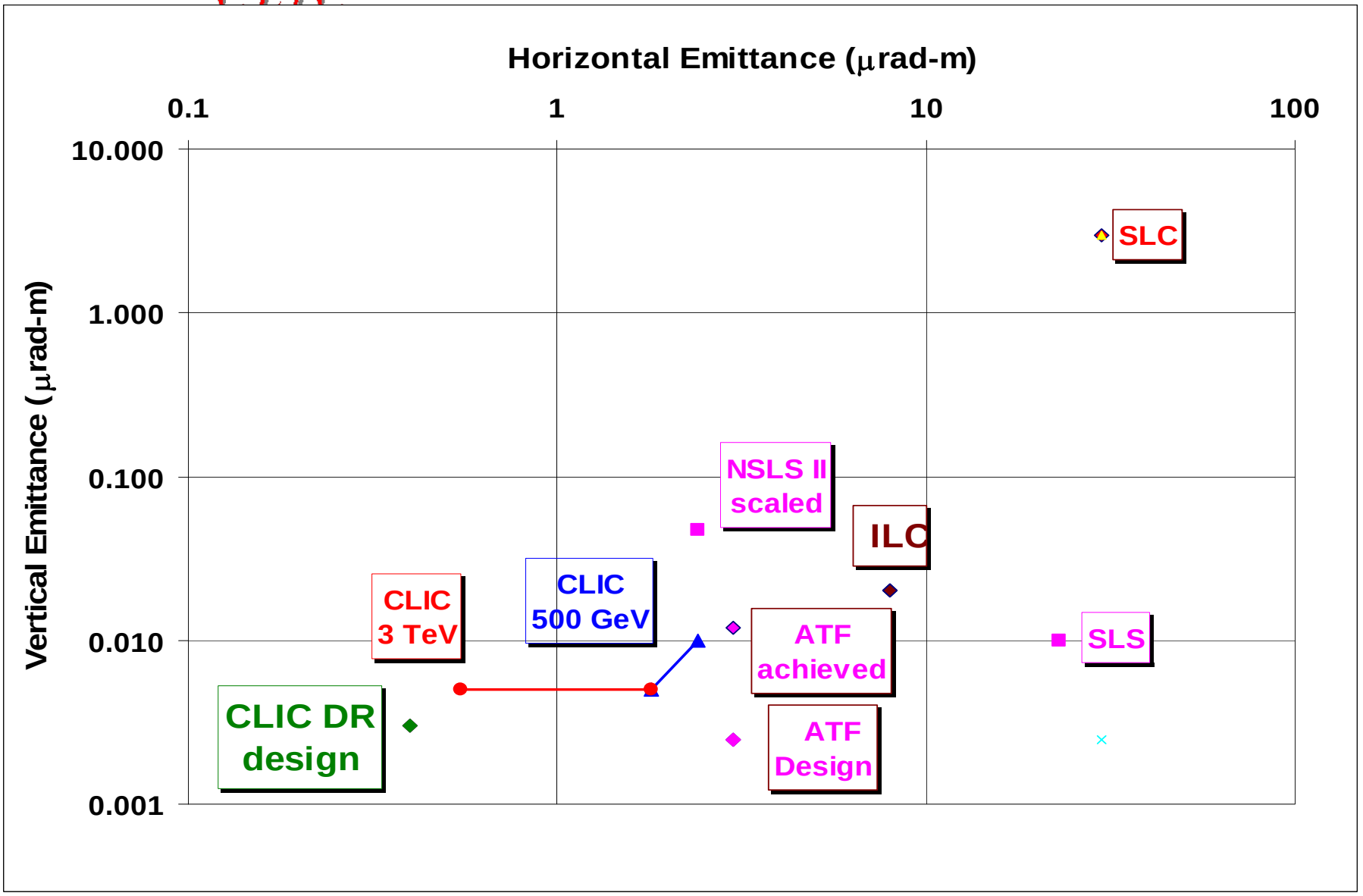


Beam sizes at Collisions

R.M.S. Beam Sizes at Collision in Linear Colliders



Beam emittances at Damping Rings

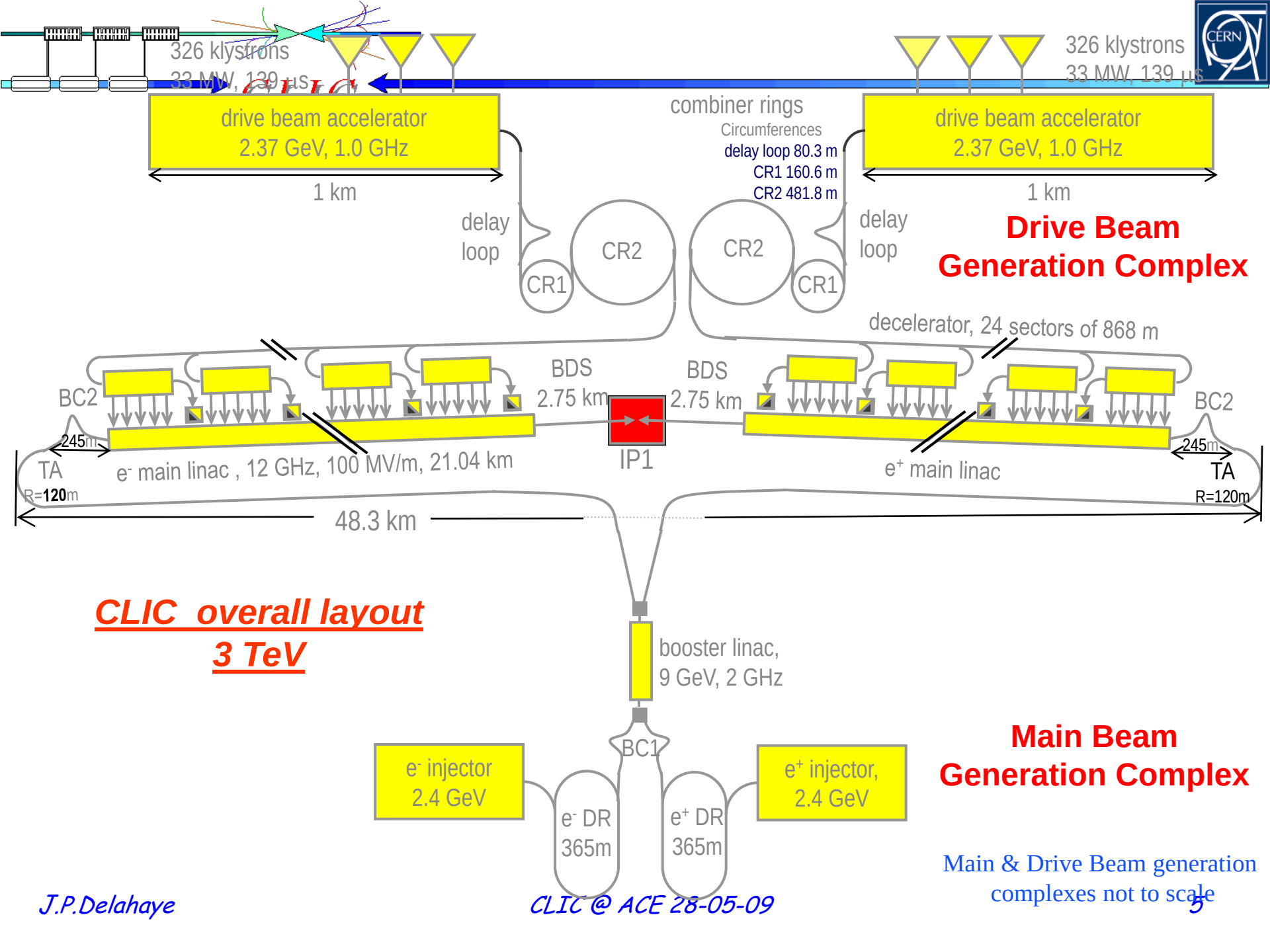


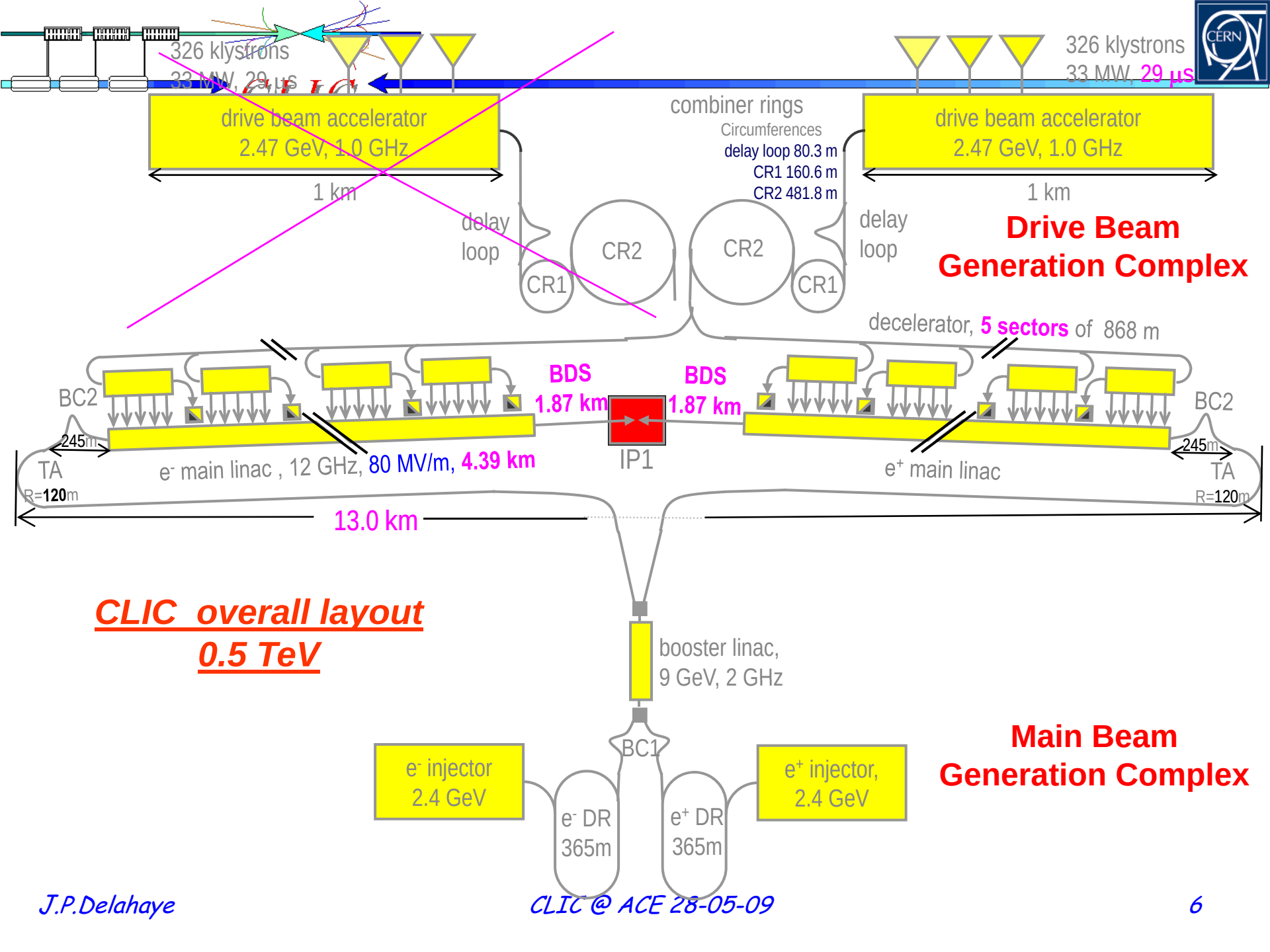
CLIC main parameters

http://cdsweb.cern.ch/record/1132079?ln=fr http://clic-meeting.web.cern.ch/clic-meeting/clictable2007.html

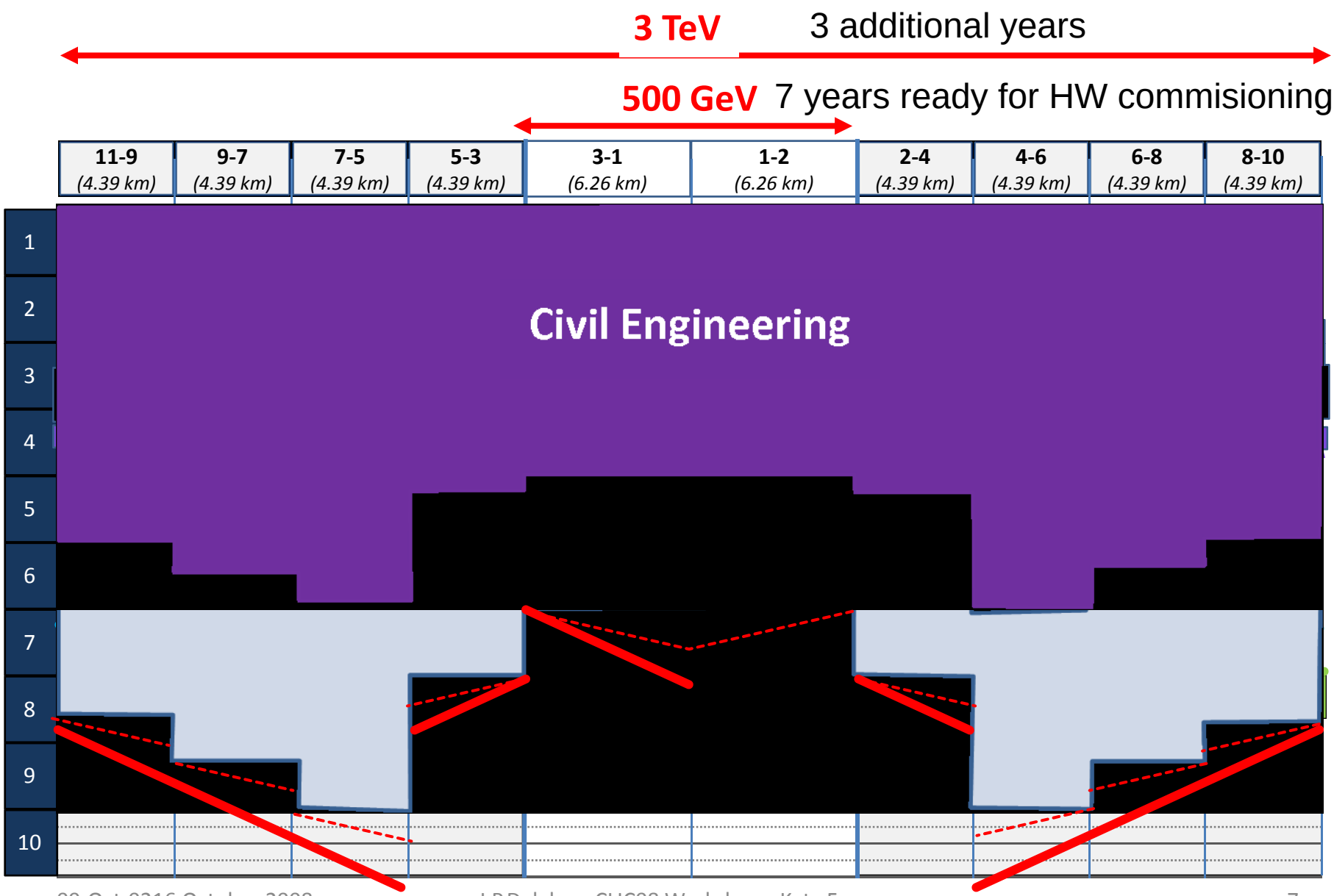
CLIC

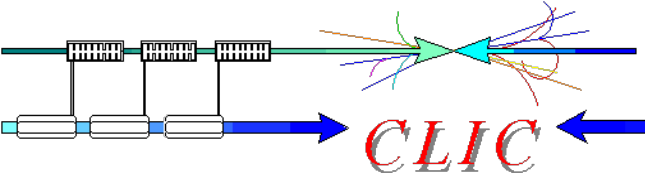
Center-of-mass energy	CLIC 500 G		CLIC 3 TeV	
Beam parameters	Conservative	Nominal	Conservative	Nominal
Accelerating structure	502		G	
Total (Peak 1%) luminosity	$0.9(0.6)\cdot10^{34}$	$2.3(1.4)\cdot10^{34}$	$1.5(0.73)\cdot10^{34}$	$5.9(2.0)\cdot10^{34}$
Repetition rate (Hz)	50			
Loaded accel. gradient MV/m	80		100	
Main linac RF frequency GHz	12			
Bunch charge 10^9	6.8		3.72	
Bunch separation (ns)	0.5			
Beam pulse duration (ns)	177		156	
Beam power/beam (MWatts)	4.9		14	
Hor./vert. norm. emitt ($10^{-6}/10^{-9}$)	3/40	2.4/25	2.4/20	0.66/20
Hor/Vert FF focusing (mm)	10/0.4	8 / 0.1	8 / 0.3	4 / 0.07
Hor./vert. IP beam size (nm)	248 / 5.7	202 / 2.3	83 / 2.0	40 / 1.0
Hadronic events/crossing at IP	0.07	0.19	0.57	2.7
Coherent pairs at IP	10	100	$5\ 10^7$	$3.8\ 10^8$
BDS length (km)	1.87		2.75	
Total site length km	13.0		48.3	
Wall plug to beam transfert eff	7.5%		6.8%	
Total power consumption MW	129.4		415	


326 klystrons
33 MW, 139 μs
drive beam accelerator
2.37 GeV, 1.0 GHz
1 km
combiner rings
Circumferences
delay loop 80.3 m
CR1 160.6 m
CR2 481.8 m
delay loop
CR1
CR2
CR2
CR1
delay loop
drive beam accelerator
2.37 GeV, 1.0 GHz
1 km
326 klystrons
33 MW, 139 μs
Drive Beam Generation Complex
decelerator, 24 sectors of 868 m
BC2
245m
TA
R=120m
BDS
2.75 km
e⁻ main linac , 12 GHz, 100 MV/m, 21.04 km
IP1
BDS
2.75 km
e⁺ main linac
BC2
245m
TA
R=120m
48.3 km
CLIC overall layout
3 TeV
booster linac,
9 GeV, 2 GHz
BC1
e⁻ injector
2.4 GeV
e⁻ DR
365m
e⁺ DR
365m
e⁺ injector,
2.4 GeV
Main Beam Generation Complex
Main & Drive Beam generation complexes not to scale


326 klystrons
33 MW, 29 μs
drive beam accelerator
2.47 GeV, 1.0 GHz
1 km
combiner rings
Circumferences
delay loop 80.3 m
CR1 160.6 m
CR2 481.8 m
delay loop
CR2
CR1
CR2
CR1
delay loop
326 klystrons
33 MW, 29 μs
drive beam accelerator
2.47 GeV, 1.0 GHz
1 km
Drive Beam Generation Complex
decelerator, 5 sectors of 868 m
BC2
245m
TA
R=120m
BDS
1.87 km
BDS
1.87 km
e⁻ main linac , 12 GHz, 80 MV/m, 4.39 km
IP1
e⁺ main linac
BC2
245m
TA
R=120m
13.0 km
CLIC overall layout
0.5 TeV
booster linac,
9 GeV, 2 GHz
BC1
e⁻ injector
2.4 GeV
e⁻ DR
365m
e⁺ DR
365m
e⁺ injector,
2.4 GeV
Main Beam Generation Complex

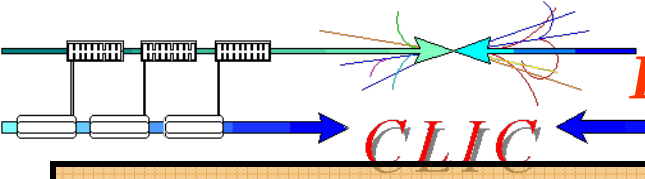
CLIC – Main tunnel Schedule& Machine installation





Upgrade strategy

- **Build "First Phase (500 GeV?)" facility for nominal parameters.**
- **Adiabatic Luminosity upgrade by better tuning (emittance preservation) and stronger beam focusing at IP (*2).**
- **Upgrade to 3 TeV**
  - Tunnel extension (in parallel with first phase operation
  - move of 5 (first phase) sectors to beginning of linac with replacement of accelerating structures
  - adaptation of BDS (higher energy, smaller betas, longer length)
  - adaptation of main beam injector injector to lower charge (?)
  - damping ring upgrade (smaller emittance with lower charge = more wigglers?)
  - second drive beam injector complex
- **Adiabatic Luminosity upgrade by better tuning (emittance preservation) and stronger beam focusing at IP (*2).**



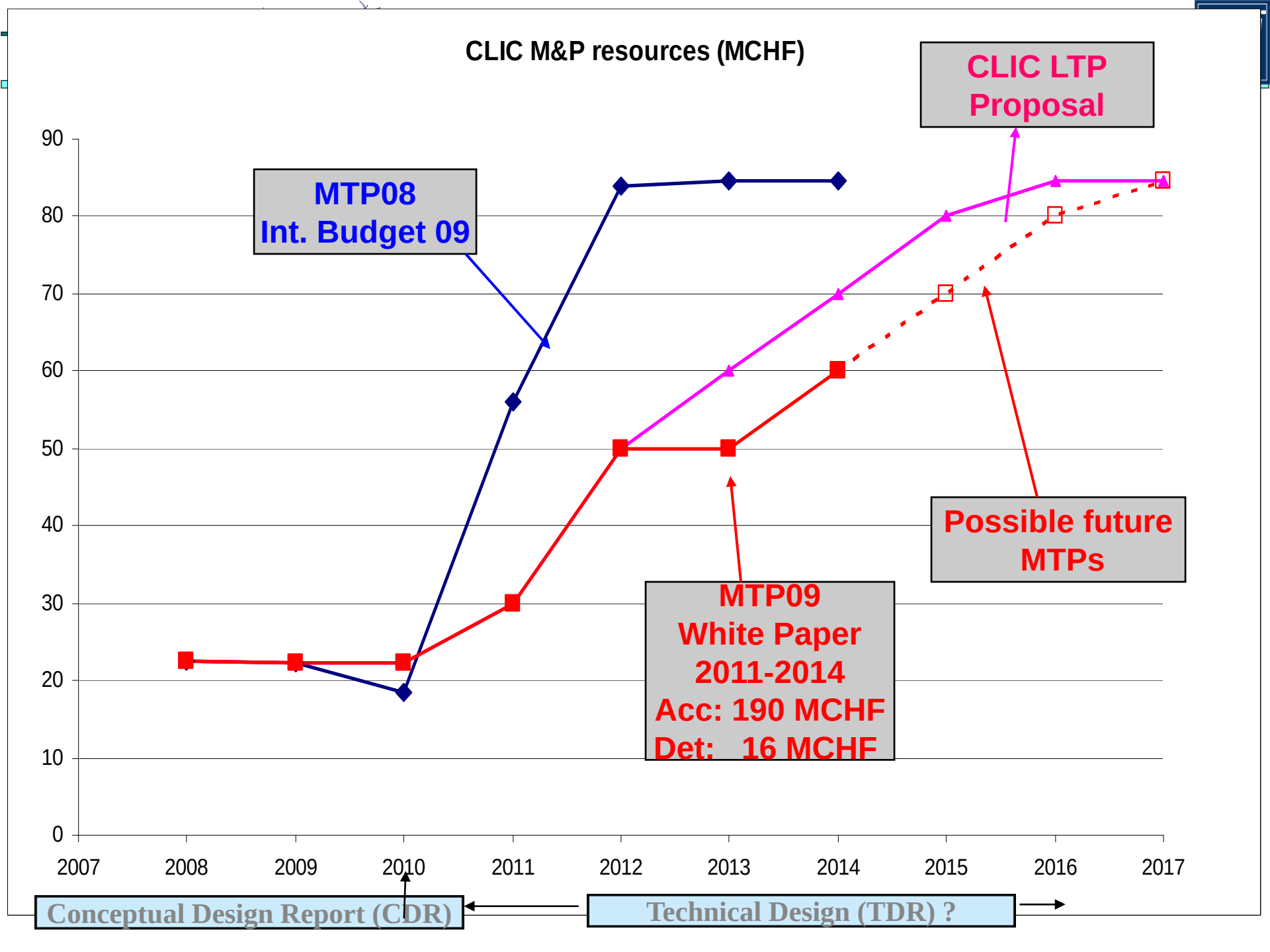
LC 500 GeV Main parameters

Center-of-mass energy	ILC	CLIC Conserv.	CLIC Nominal
Total (Peak 1%) luminosity	$2.0(1.5)\cdot10^{34}$	$0.9(0.6)\cdot10^{34}$	$2.3(1.4)\cdot10^{34}$
Repetition rate (Hz)	5	50	
Loaded accel. gradient MV/m	33.5	80	
Main linac RF frequency GHz	1.3 (SC)	12 (NC)	
Bunch charge10^9	20	6.8	
Bunch separation ns	176	0.5	
Beam pulse duration (ns)	1000	177	
Beam power/linac (MWatts)	10.2	4.9	
Hor./vert. norm. emitt ($10^{-6}/10^{-9}$)	10/40	3 / 40	2.4 / 25
Hor/Vert FF focusing (mm)	20/0.4	10/0.4	8/0.1
Hor./vert. IP beam size (nm)	640/5.7	248 / 5.7	202/ 2.3
Soft Hadronic event at IP	0.12	0.07	0.19
Coherent pairs/crossing at IP	10?	10	100
BDS length (km)	2.23 (1 TeV)	1.87	
Total site length (km)	31	13.0	
Wall plug to beam transfer eff.	9.4%	7.5%	
Total power consumption MW	216	129.4	

CLIC resources in MTP09
Medium Term Plan (2009-2014)

Table 5: Projects

Fact Sheet	(in MCHF, 2009 prices, rounded off)	2009 Revised budget	2010	2011	2012	2013	2014	2010-2014 Total
	Projects	147.6	151.7	206.2	244.6	228.4	336.9	1 167.8
16.a	CLIC	22.3	22.2	30.0	50.0	50.0	60.0	212.2
	Personnel	12.2	12.2	15.0	24.0	24.0	28.8	104.0
	Materials	10.1	10.0	15.0	26.0	26.0	31.2	108.3
16.b	Linear collider detector	0.1	2.1	3.5	4.1	4.1	4.1	17.9
	Personnel	0.1	1.5	2.6	3.0	3.0	3.0	13.0
	Materials	0.0	0.6	0.9	1.1	1.1	1.1	4.9


CLIC M&P resources (MCHF)
CLIC LTP Proposal
MTP08 Int. Budget 09
Possible future MTPs
MTP09 White Paper 2011-2014 Acc: 190 MCHF Det: 16 MCHF
90
80
70
60
50
40
30
20
10
0
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
Conceptual Design Report (CDR)
Technical Design (TDR) ?

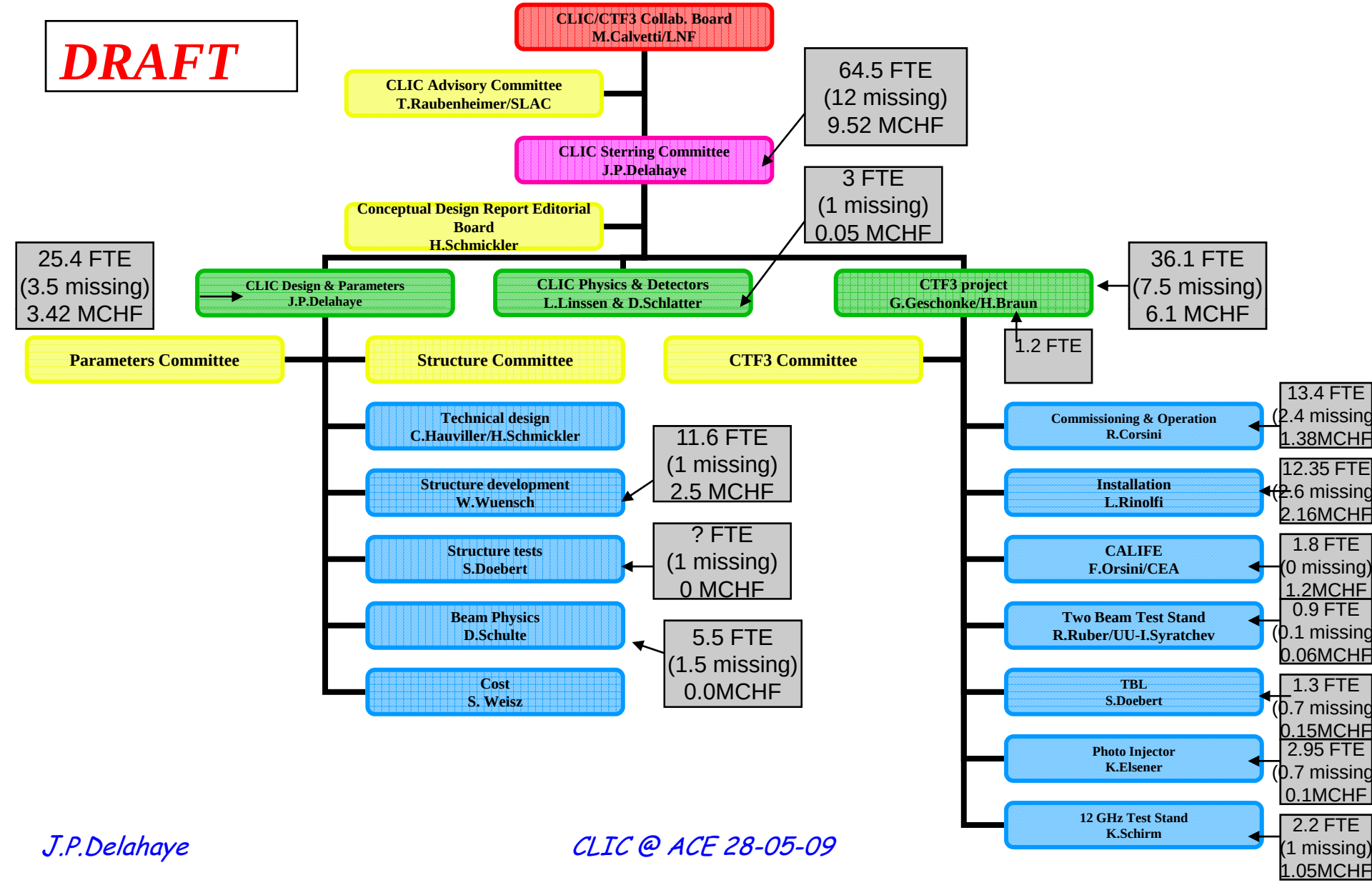
CLIC resources (mid 2008)

Budget	(MCHF)	2008	2009	2010	Total
Material	MTP (CERN/2796)	10.1	9.2	7.9	15.22
Manpower	MTP (CERN/2796)	12.3	10.4	9.9	32.6
	Staff foreseen spending (APT)	8.27	8.03	7.56	23.86
	Fellows foreseen spending	1.40	1.40	1.40	4.20
	Available for new positions	2.63	0.97	0.94	4.54

CLIC missing man-power

Dep/Group	Job title	Cat.	Comment	# (FTE*Years)	kCHF/y	kCHF
AB/RF	Electronic expert	E		1*2.5	150	375
AB/ABP	CTF3 modelling & commisioning	E		1*2.5	150	375
AB/RF	RF & Electronic	E		1*2.5	150	375
AB/ABP	Beam dynamics: Placet & Drive beam	E		1*2.5	150	375
AB/RF	Klystron & Modulators	D		1*2.5	130	325
AB/RF	RF structure test	E		1*2.5	150	375
AB/BI	CLIC/CTF3 instrumentation	D-E		1*2.5	140	350
AB/RF	CTF3 Inst & Techn. support	B		1*2	100	200
AT/VAC	CTF3 Vacuum	C		1*2	115	230
AB/RF	Klystron & Modulators	D		1*2	130	260
AB/ABP	Beam dynamics	E		1*2	150	300
AB/ATB	Lasers	E		1*2	150	300
AB/BT	CLIC/CTF3 kickers	D-E		1*2	140	280
Total new				**29.5**		**4120**

CLIC Chart


DRAFT
CLIC/CTF3 Collab. Board
M.Calvetti/LNF
CLIC Advisory Committee
T.Raubenheimer/SLAC
64.5 FTE
(12 missing)
9.52 MCHF
CLIC Sterring Committee
J.P.Delahaye
3 FTE
(1 missing)
0.05 MCHF
Conceptual Design Report Editorial Board
H.Schmickler
25.4 FTE
(3.5 missing)
3.42 MCHF
CLIC Design & Parameters
J.P.Delahaye
CLIC Physics & Detectors
L.Linssen & D.Schlatter
CTF3 project
G.Geschonke/H.Braun
36.1 FTE
(7.5 missing)
6.1 MCHF
1.2 FTE
Parameters Committee
Structure Committee
CTF3 Committee
Technical design
C.Hauviller/H.Schmickler
Structure development
W.Wuensch
11.6 FTE
(1 missing)
2.5 MCHF
Structure tests
S.Doebert
? FTE
(1 missing)
0 MCHF
Beam Physics
D.Schulte
Cost
S. Weisz
5.5 FTE
(1.5 missing)
0.0MCHF
Commissioning & Operation
R.Corsini
13.4 FTE
(2.4 missing
1.38MCHF
Installation
L.Rinolfi
12.35 FTE
(2.6 missing
2.16MCHF
CALIFE
F.Orsini/CEA
1.8 FTE
(0 missing)
1.2MCHF
Two Beam Test Stand
R.Ruber/UU-I.Syratchev
0.9 FTE
(0.1 missing
0.06MCHF
TBL
S.Doebert
1.3 FTE
(0.7 missing
0.15MCHF
Photo Injector
K.Elsener
2.95 FTE
(0.7 missing
0.1MCHF
12 GHz Test Stand
K.Schirm
2.2 FTE
(1 missing)
1.05MCHF