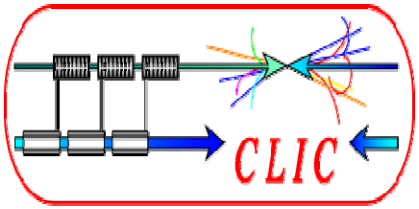


CLIC-ILC Collaboration?

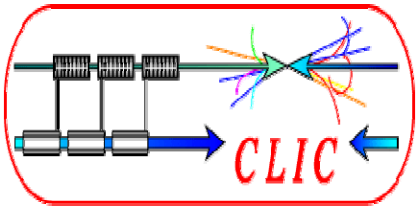
- **Following visit of Barry @ CERN (Nov 07)**

http://www.linearcollider.org/newsline/archive/2007/20071213.html

Independently of US/UK financial crisis, but even more desirable now

- **CLIC-ILC Collaboration meeting (Feb 08)**

http://indico.cern.ch/conferenceDisplay.py?confId=27435



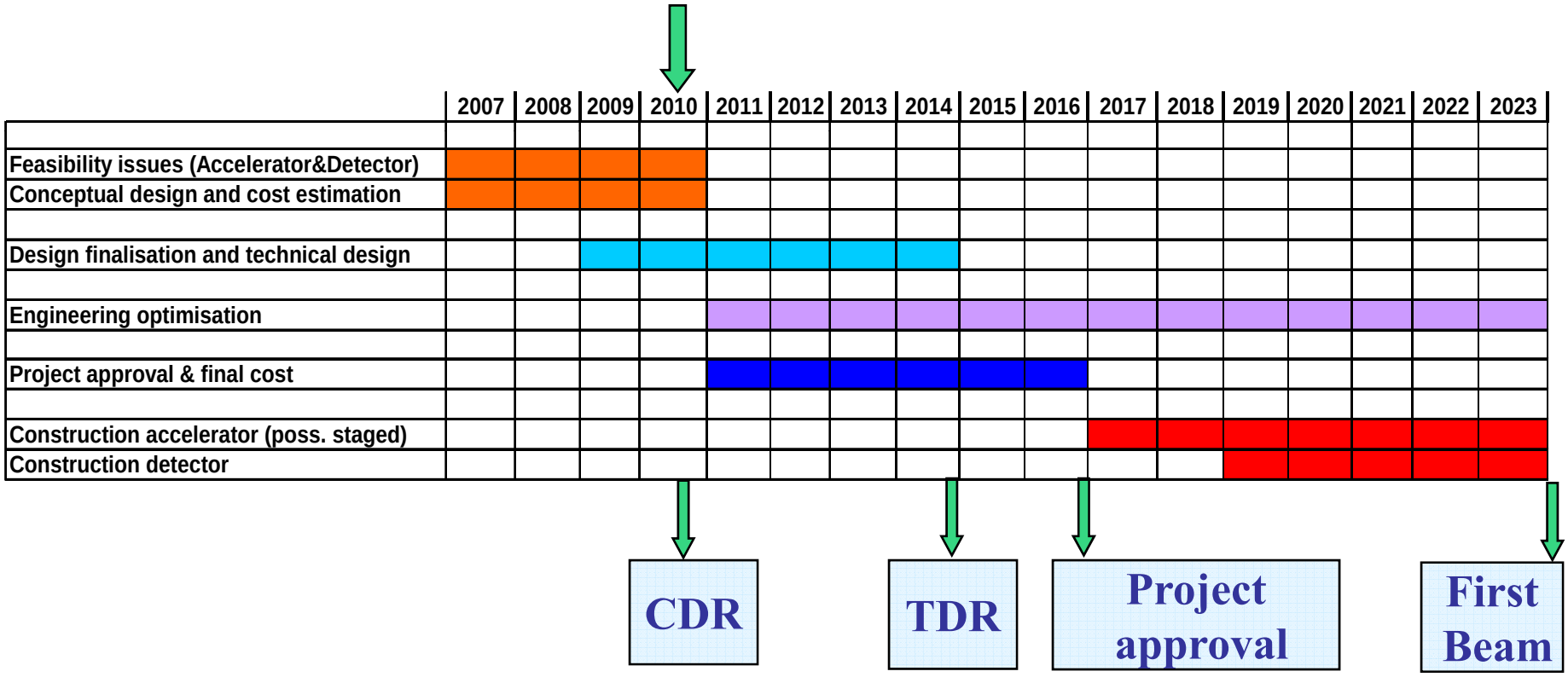
(My) motivations for CLIC/ILC collaboration

- **Lack of resources: (both CLIC and ILC)**
  - **Join resources where useful and avoid duplication**
- **Foster ideas and favor exchanges**
  - **Beneficial to both**
- **Aiming (as much as possible) on common system designs**
  - **similar energy; Ex: BDS, MDI, Detector, Cost….**
  - **Identify necessary differences due to technology and/or energy**
- **Avoid negative image of conflicting teams**
  - **Devastating for HEP**
- **Minimize contradicting presentations in 2010-12 (?):**
  - **Develop common knowledge of both designs and technologies on status, advantages, issues and prospects for the best use of future HEP**
  - **Common preparation of the (unavoidable) evaluation of technology**
  - **Avoid (another) evaluation by external (wise?) body. Better done by this community with technical expertise**
- **Even if ILC technology more mature, timescale not so ≠ :**
  - **Technical Design in 2010-2012 for ILC and 2014 for CLIC**

Tentative long-term CLIC scenario

Shortest, Technically Limited, Success Oriented Schedule (SOS)

Technology evaluation and Physics assessment based on LHC results for a possible decision on Linear Collider funding with staged construction starting with the lowest energy required by Physics



Prospects for Scientific Activities over the Period 2012 - 2016

DG to CERN staff
Jan 08

To be decided in 2010-2011 in light of first physics results from LHC, and designed and R&D results from the previous years. This programme could most probably comprise:

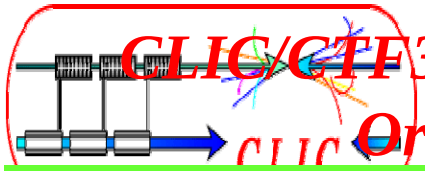
- An LHC luminosity increase requiring a new injector (SPL and PS).

  The total cost of the investment over 6 years (2011-2016: 1000-1200 MCHF + a staff of 200-300 per year. Total budget: ~200-250 MCHF per year.

- Preparation of a Technical Design for the CLIC programme, for a possible construction decision in 2016 after the LHC upgrade (depending on the ILC future).
  Total CERN M + P contribution + ~250 MCHF + 1000-1200 FTE over 6 years.

- Enhanced infrastructure consolidation: 30 MCHF + 40 FTEs from 2011.

NB: Over the period 2012-2016. Effective participation of CERN in another large programme (ILC or a neutrino factory) will not be possible within the expected resources if positive decisions taken on LHC upgrade and CLIC Technical Design. This situation could totally change *if none of the above programmes is approved* or if a new, more ambitious level of activities and support is envisaged in the European framework.



CLIC/CTF3 Multi-Lateral Collaboration of Volunteer Institutes Organized as a Physics Detector Collaboration

19 members represent. 24 institutes involving 16 funding agencies from 13 countries

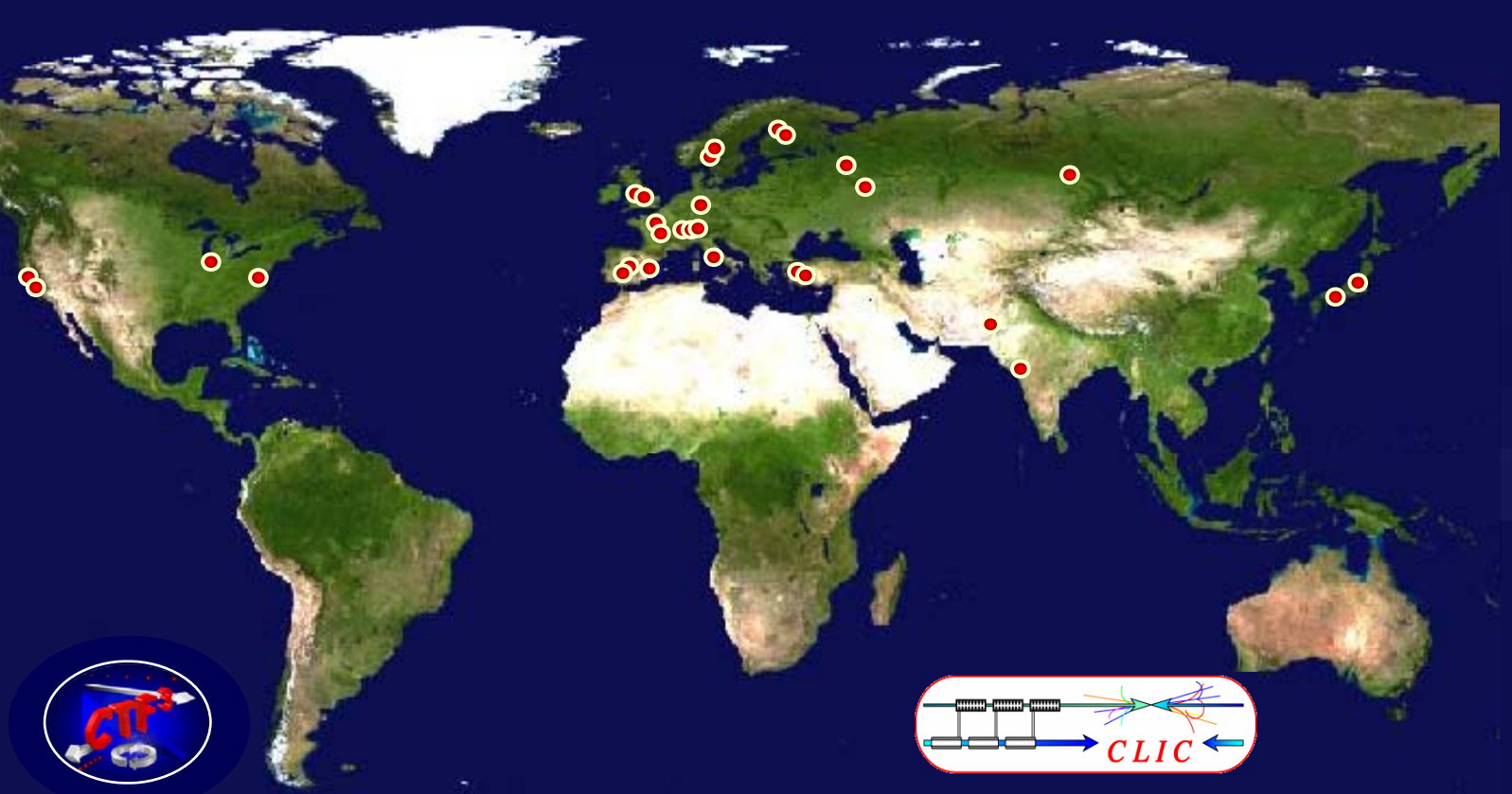
http://clic-meeting.web.cern.ch/clic-meeting/CTF3_Coordination_Mtg/Table_MoU.htm

Collab. Board: Chairperson: M.Calvetti/INFN; Spokesperson: G.Geschonke/CERN

MoU with addenda describing specific contribution (& resources)

Countries	Funding Agencies	Laboratory	Representatives & Advisorsy	MoU_Addenda
CERN	CERN	CERN	J-P. Delahaye, G. Geschonke	Link to pdf
FINLAND		Helsinki Inst of Phys (HIP)	D.O. Riska, K. Österberg	Link to pdf
FRANCE	CEA/DSM-Saclay	DAPNIA	G. Fioni, J. Zinn-Justin	Link to pdf
	CNRS/IN2P3	LAL, LURE	G. Wormser	Link to pdf
		LAPP	Y. Kariotakis	
INDIA*	Indian DAE	RRCAT, Indore	V. Sahni, P. Shrivastava	Link to pdf Add. T1 pdf Add. M2 pdf
ITALY	INFN	LNF	M. Calvetti, A. Ghigo	Link to pdf
PAKISTAN		National Centre for Physics (NCP)	H. Hoorani, S. Ahmad	Link to pdf
RUSSIA		Budker Inst (BINP)	A. Skrinski	Link to pdf - Draft Amendt pdf
		IAP	A.G. Litvak	Link to pdf
	Dubna	JINR	V. Samoilov	Link to pdf
SPAIN	Ministry of Education & Science (MEC)	CIEMAT, UPC, IFIC	J. Fuster, L. Garcia-Tabares	Link to pdf
SWEDEN	Swedish Research Council	Uppsala Univ and Svedberg Lab (TSL)	T. Ekelof, V. Ziemann	Link to pdf
	Wallenberg Foundation			Link to pdf
SWITZERLAND		Paul Scherrer Inst (PSI)	L. Rivkin, T. Garvey	Link to pdf
TURKEY		Ankara Univ & Gazi Univ	A.K. Ciftçi	Link to pdf
UNITED-KINGDOM	STFC	J. Adams Institute for Accelerator Science	G. Blair, K. Peach	Link to pdf
USA	DOE	Northwestern Univ Illinois (NWU)	M. Velasco	Link to pdf
		SLAC	R. Ruth, S. Tantawi	Link to pdf
		Jefferson Laboratory (JLAB)	A. Hutton	Link to pdf

World-wide CLIC&CTF3 Collaboration

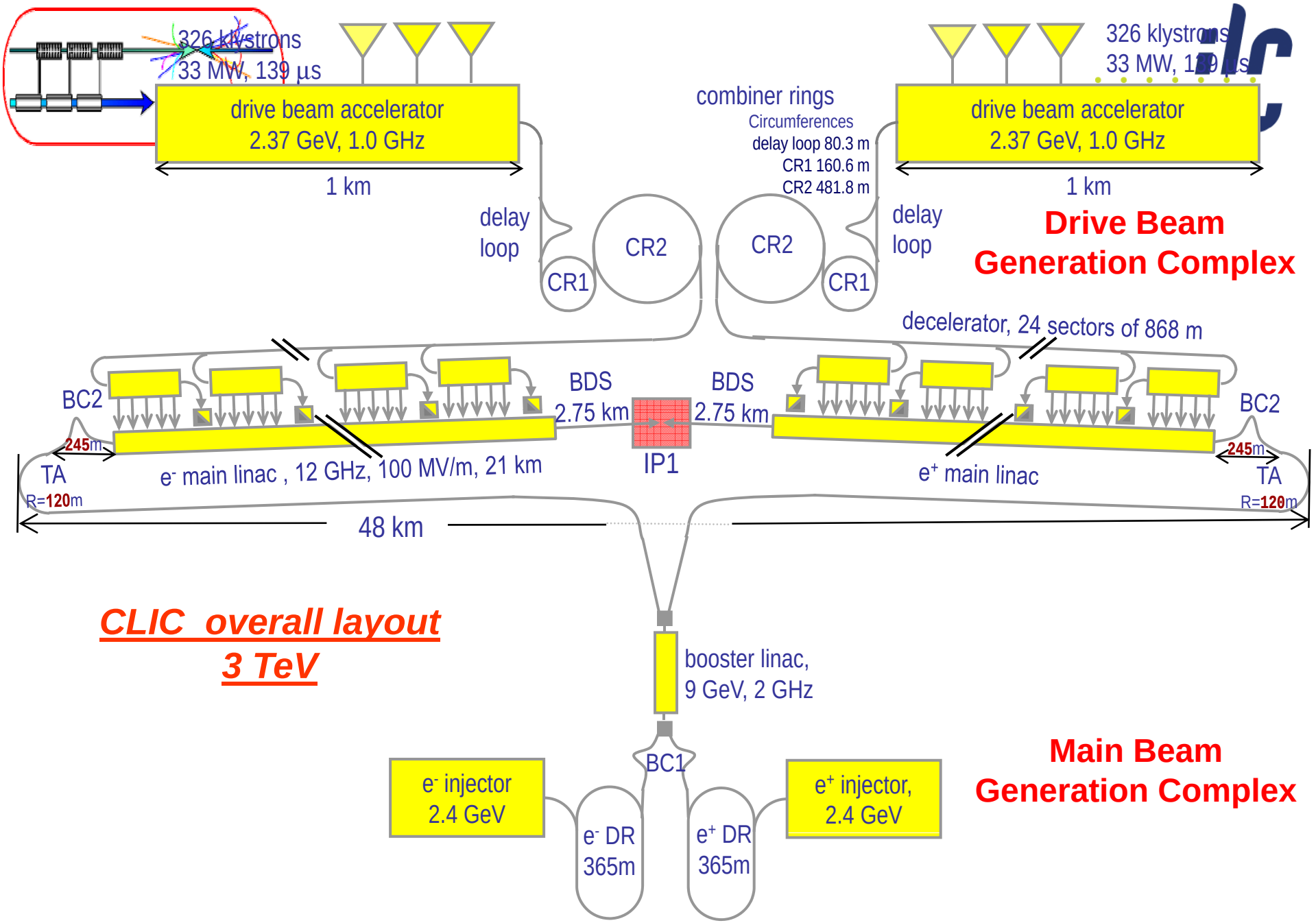


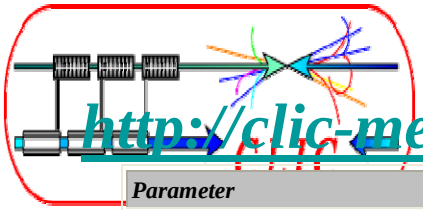
Ankara University (Turkey)
Berlin Tech. Univ. (Germany)
BINP (Russia)
CERN
CIEMAT (Spain)
DAPNIA/Saclay (France)
RRCAT-Indore (India)

Finnish Industry (Finland)
Gazi Universities (Turkey)
Helsinki Institute of Physics (Finland)
IAP (Russia)
Instituto de Fisica Corpuscular (Spain)
INFN / LNF (Italy)
J. Addams Institute (UK)

JASRI (Japan)
Jefferson Lab (USA)
JINR (Russia)
KEK (Japan)
LAL/Orsay (France)
LAPP/ESIA (France)
LLBL/LBL (USA)

NCP (Pakistan)
PSI (Switzerland)
North-West. Univ. Illinois (USA)
Polytech. University of Catalonia (Spain)
RAL (UK)
SLAC (USA)
Svedberg Laboratory (Sweden)
Uppsala University (Sweden)

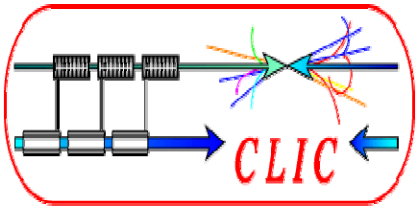

326 klystrons
33 MW, 139 µs
drive beam accelerator
2.37 GeV, 1.0 GHz
1 km
combiner rings
Circumferences
delay loop 80.3 m
CR1 160.6 m
CR2 481.8 m
delay loop
CR1
CR2
CR2
CR1
delay loop
drive beam accelerator
2.37 GeV, 1.0 GHz
1 km
326 klystrons
33 MW, 139 µs
Drive Beam
Generation Complex
decelerator, 24 sectors of 868 m
BC2
245m
TA
R=120m
BDS
2.75 km
e- main linac , 12 GHz, 100 MV/m, 21 km
IP1
BDS
2.75 km
e+ main linac
BC2
245m
TA
R=120m
48 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



CLIC & LC parameters @ 500 GeV

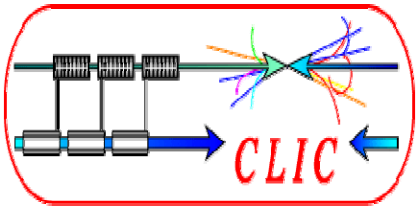
http://clic-meeting.web.cern.ch/clic-meeting/ComparisonTable.html

Parameter	Symbol	CLIC	CLIC	CLIC	ILC	NLC	Unit
Center of mass energy	E_{cm}	3000	1000	**500**	**500**	**500**	GeV
Main Linac RF Frequency	f_{RF}	12	12	**12**	**1.3**	**11.4**	GHz
Luminosity	**L**	**5.9**	**2.25**	**2.24**	**2**	**2**	**10^{34} cm^{-2} s^{-1}**
Luminosity (in 1% of energy)	$L_{99\%}$	2	1.08	**1.36**			10^{34} cm^{-2} s^{-1}
Accelerating gradient (unloaded)	**G_{acc}**	**100**	**100**	**100**	**30**	**50**	**MV/m**
Linac repetition rate	f_{rep}	50	50	**100**	**5**	**120**	Hz
No. of particles / bunch	N_b	3.72	3.72	**3.72**	**20**	**7.5**	10^9
No. of bunches / pulse	k_b	312	312	**312**	**2670**	**192**	
No. of drive beam sectors / linac	N_{unit}	24	8	**4**	**-**	**-**	-
Overall two linac length	l_{linac}	41.7	13.9	**6.9**	**22**	**14**	km
Proposed site length	**l_{tot}**	**47.9**	**19.5**	**12**	**31**	**19**	**km**
DB Pulse length (total train)	τ_t	139	46	**23**	**-**	**-**	μs
Beam power / beam	P_b	14	4.6	**4.6**	**10.8**	**6.9**	MW
Wall-plug power to beam efficiency	$\eta_{wp\text{-}rf}$	8.7	6.1	**6.1**	**9.4**	**7.1**	%
Total site AC power	**P_{tot}**	**322**	**~150**	**~150**	**230**	**195**	**MW**
Transverse horizontal emittance	$\gamma\varepsilon_x$	**660**	**660**	**660**	**10000**	**3600**	nm rad
Transverse vertical emittance	$\gamma\varepsilon_y$	**20**	**20**	**20**	**40**	**40**	nm rad
Nominal horizontal IP beta function	β^*_x	4	20	**15**	**20**	**8**	mm
Nominal vertical IP beta function	β^*_y	0.09	0.1	**0.1**	**0.4**	**0.11**	mm
Horizontal IP beam size before pinch	σ^*_x	**40**		**142**	**640**	**243**	nm
Vertical IP beam size before pinch	σ^*_y	**1**		**2**	**5.7**	**3**	nm
Beamstrahlung energy loss	δ_B	29	11	**7**	**2.4**	**5.4**	%
No. of photons / electron	n_γ	2.2	1.2	**1.1**	**1.32**	**1.3**	-
No. of pairs (p_T^{min}=20MeV/c, $\hat{I}_{,min}$=0.2)	N_{pairs}	45	17.1	**11.5**			-
No. of coherent pairs	N_{coh}	38	0.07	**0.0001**			10^7
No. of incoherent pairs	N_{incoh}	0.44	0.09	**0.05**			10^5
Hadronic events / crossing	N_{had}	3.2	0.29	**0.1**			-



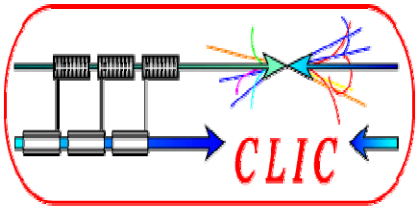
Subjects with strong synergy

1. **Civil Engineering and Conventional Facilities**
2. **Beam Delivery Systems & Machine Detectors Interface**
3. **Detectors**
4. **Cost and Schedule**
5. **Beam Dynamics & Beam Simulations including Low Emittance Transport**



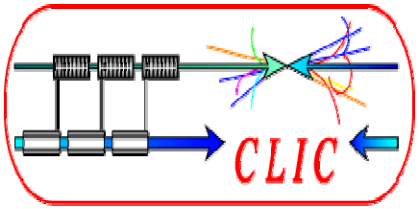
Other subjects

- **Positron generation based on Compton Scattering**
- **Damping Rings,**
- **Klystrons (L band) & Modulators with long pulses and high efficiency**
- **High power beam dumps**
- **Operational & reliability issues**
- **Machine Protection System**
- **Others?**



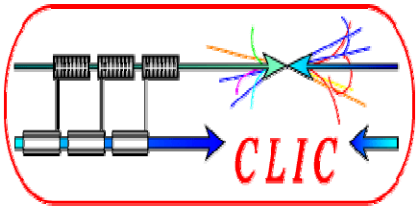
(CLIC/CERN) limitations

- **CERN resources dedicated to ILC very limited:**
  - **Man-Power: 1.2 FTE; Mat Budget: 40 kCHF**
- **Available resources allocated to CLIC study by CLIC/CTF3 collaboration**
  - **24 Institutes from 13 Countries**
  - **Broad overlap between CLIC and ILC collaborating Inst.**
- **Possible use of CLIC resources on ILC study at the strict condition that final result is beneficial to CLIC study**
  - **And vice-versa**



Method?

- **Presently (for each sub-system):**
  - **ILC team working on ILC system with ILC beam at 500 GeV**
  - **CLIC team working on CLIC system with CLIC beam at 3 TeV and scaling down to 1 TeV and 500 GeV**
  - **Fruitful exchanges between technical experts**
  - **Different designs of sub-systems for (not always) good reasons**
- **Possible future**
  - **CLIC & ILC teams working together on CLIC and ILC systems at 500 GeV**
  - **Identify together if same design/technology can be used or not**
    - **understand why and what necessary differences**
  - **Define together necessary modifications of the sub-system for the upgrade in energy to 1 TeV for ILC and 3 TeV for CLIC**



CLIC/ILC Collaboration Meeting: 08/02/08 (Accelerators and Detectors)

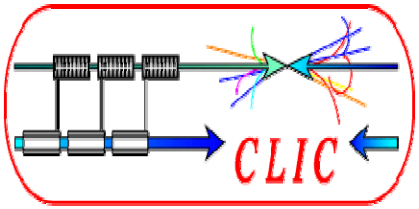
Marc Ross, Nick Walker, Akira Yamamoto

ILC-GDE Project Managers

J.P.Delahaye

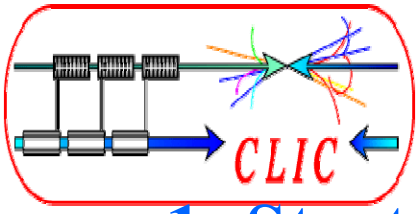
CLIC Study Leader and ILC-GDE member

http://indico.cern.ch/conferenceDisplay.py?confId=27435



Objectives of the meeting

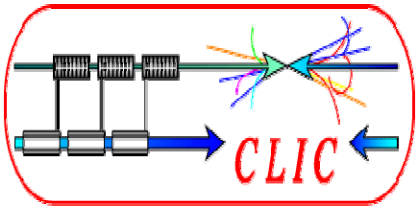
- **review selected subjects and define tasks which serve common interests –**
  - **ILC and CLIC studies.**
  - **(or which are close enough to yield useful direct exchange)**
- **Once defined, nominate contact persons for each subject (convenors)**
  - **Who prepared the discussions for today's meeting**
  - **And will follow-up afterwards on listed tasks**



Meeting Format

1. **Start with a plenary session:**
   - **the framework of the collaboration**
   - **(motivation, constraints...)**
2. **Split in small working groups each one dedicated to a specific activity**
   - **Agenda arranged by convenors prior to the meeting**
   - **Goal: Prepare the task list and develop written plan**
3. **End with a plenary session:**
   - **Present reports, discuss issues**
   - **Specific plans; or preparation of process**

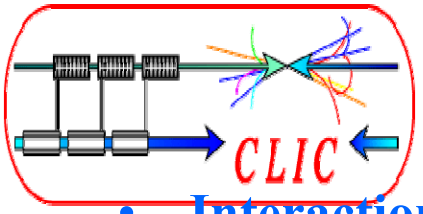
http://indico.cern.ch/conferenceDisplay.py?confId=27435



CLIC-ILC CFS

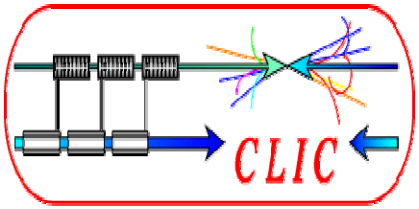
John Andrew Osborne (CERN) , Claude Hauviller (CERN) ,
Atsushi Enomoto (KEK) , Vic Kuchler (FNAL) ,

Wilhelm Bialowons (DESY)



Conclusions - CFS

- Interaction Area is obvious area where resources can be shared
- Civil Engineering models can be worked on 'in parallel' for ILC & CLIC.
- Other possible areas of collaboration in the TS area : Ventilation, Electricity, Handling….
- Resources to be defined, if limited, then perhaps Joint 'Value Engineering' exercises could be the way forward, rather than full blown studies…..
- First milestone : At Sendai meeting develop deliverables for 2008 for ILC Value Engineering and ILC/CLIC common efforts
- Identify link persons for highlighted areas
- CFS Video meetings will continue with possible CLIC input on specific subjects



CLIC-ILC BDS & MDI work

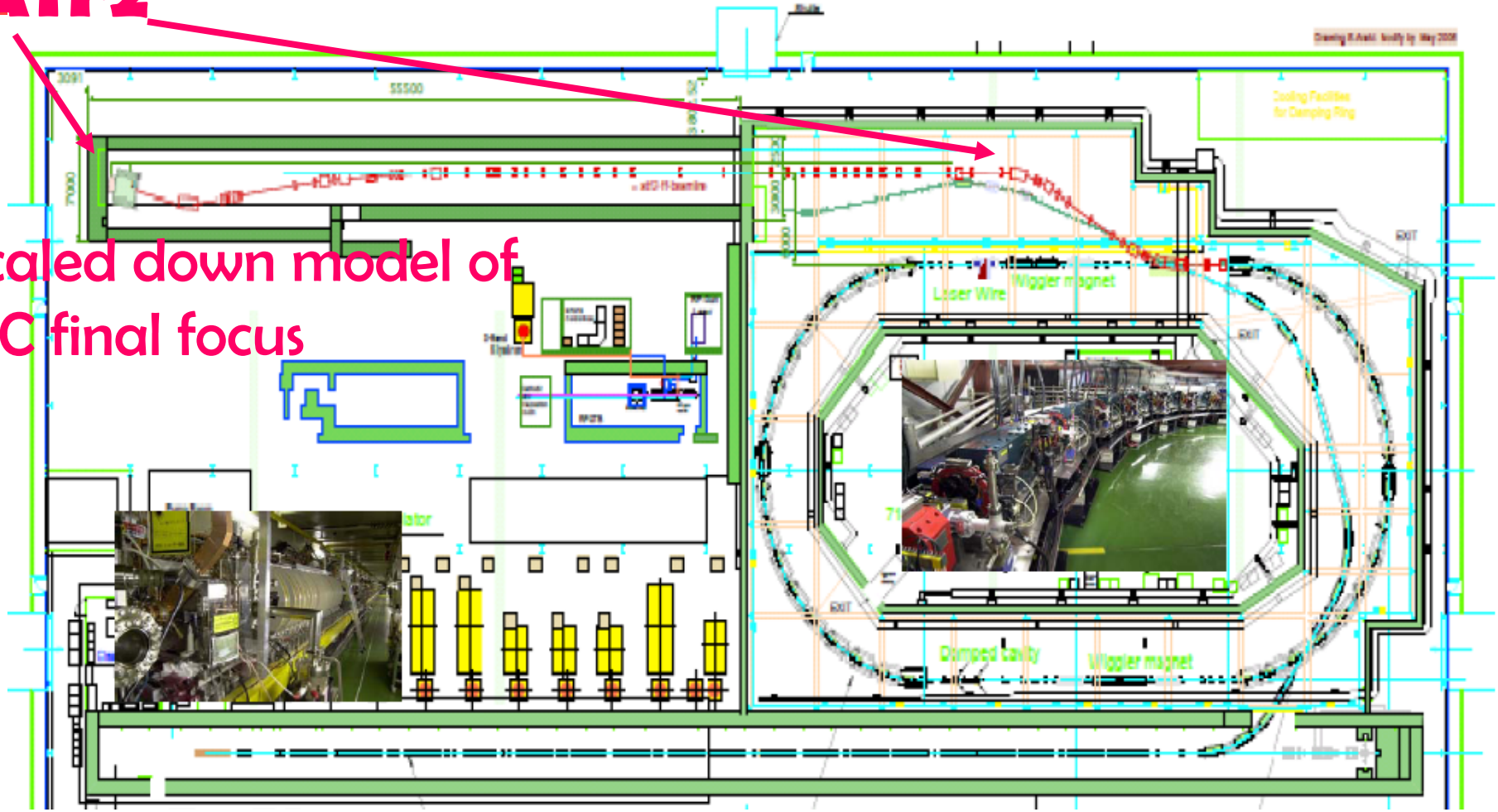
Rogelio Tomas (CERN) , Daniel Schulte (CERN) ,

Emmanuel Tsesmelis (CERN) , Andrei Seryi (SLAC)

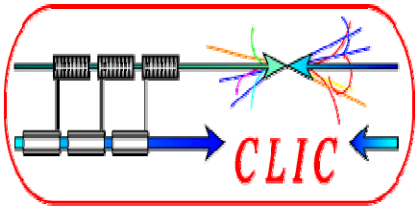
ATF
Accelerator Test Facility
at KEK

ATF2

Scaled down model of
ILC final focus

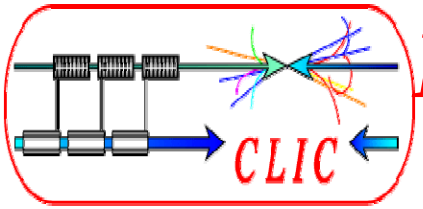


The ATF international collaboration include more than 200 researchers and the ATF MOU is signed by 20 institutions from all over the world



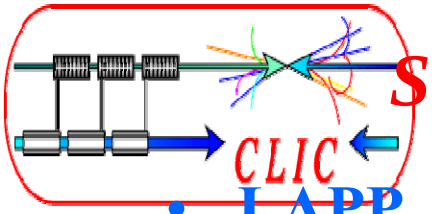
Conclusions: BDS

- **Topics:**
  - **Optics Design and Optimization**
  - **Collimation**
  - **Detector Integration**
  - **Crab**
  - **ATF2**
  - **Instrumentation**
  - **MDI**
  - **Background**
  - **Stabilization**
  - **Radiation – surface/muons**
- **Strong list**



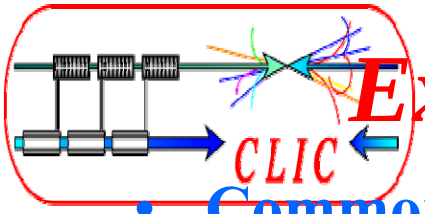
Machine Detector Interface

- Many institutions
- General layout and integration
  - Common meeting/review required
  - Common engineering tools for detector design in preparation (DESY, CERN, IN2P3, FP7)
- Background and luminosity studies
  - Strengthen support
- Masking system
  - Constraints on vertex detector
- Detector field
  - Need a field for CLIC
- Magnet design
- Common simulation tools for detector studies
  - Need to review what is available
- Low angle calorimeter
- Beam pipe design (LHC)
- Vacuum etc. (LHC)



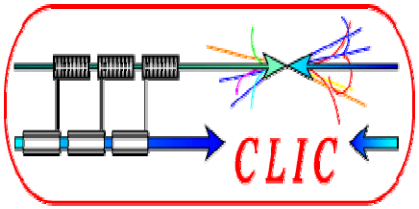
Support, Stabilization and Alignment

- **LAPP, Oxford, CERN, FP7, BNL, SLAC, …**
  - **Other please join**
- **Low-noise design**
  - **Noise level measurements (DESY, CERN)**
    - **Among others, measurements at LHC**
  - **Component design**
- **Mechanical design of quadrupole support**
- **Final quadrupole design**
- **Stabilization feedback design**
  - **Sensors**
  - **Actuators**
  - **Interferometers**



Experimental Area Integration

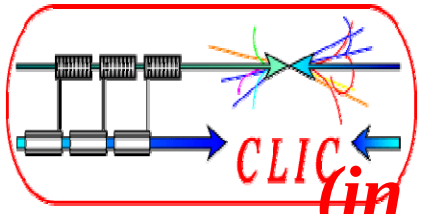
- Common definitions
- Infra-structure
  - Work is quite generic
    - No large differences expected for CLIC detector to some ILC detector
  - Collaboration has started
  - LHC expertise
- Push-pull
  - Is an option for both projects
  - A collaboration has started
  - Brings ILC/CLIC/LHC expertise
- Crossing angle
  - Investigate requirements
  - Then study benefits to find a common crossing angle



CLIC-ILC Detector

Dieter Schlatter (CERN) , Albert De Roeck (CERN) ,
Lucie Linssen (CERN) , Sakue Yamada (KEK) ,

François Richard (LAL-IN2P3)



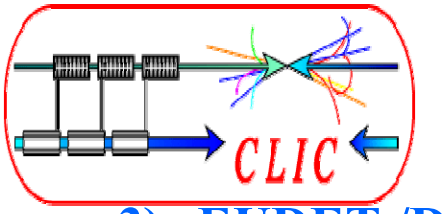
Detector issues
(in addition to those covered under MDI)

Topics for collaboration:

CLIC detector work at CERN is resuming, good reason for collaboration with ILC community.

1) Define a CLIC detector concept at 3 TeV.
(update of 2004 CLIC Study) based on ILC detector concepts.

2) Detector simulations
- Simulation tools to be used by ILC and CLIC (WWS software panel)
- Validation ILC detector options for CLIC at high energy, different time structure and different backgrounds
- 1 TeV benchmark studies to provide overlap
- compare performance using defined benchmark processes (e.g. WW/ZZ separation)



Detectors cont.

3) EUDET /DEVDET (infrastructure for LC detector R&D, with associated non-EU groups)

- microelectronic tools
- 3D interconnect technologies (for integrated solid state detectors)
- simulation and reconstruction tools
- combined test with magnet and LC sub-detectors

4) TPC

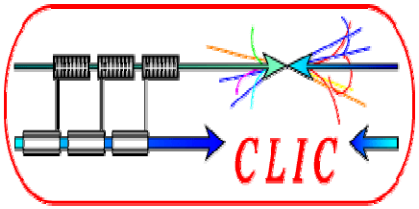
- TPC performance at high energies (>500GeV).
- TPC read out electronics

5) Calorimetry

- Dual Readout Calorimetry (feasible at LC?)

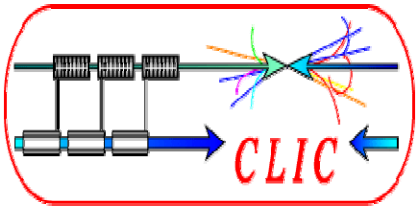
6) General

- increased CLIC participation in future ECFA workshops (2008 Warsaw) on LC detectors



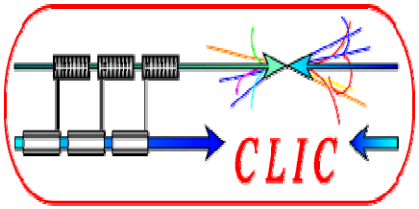
Interaction Region

- **ILC RDR and CLIC Interaction Regions are identical**
- **CMS philosophy has been considered, recent LHC experience gained should not be lost**
- **Two detectors are moved using 'Push-Pull' concept, very similar to the CMS concrete shaft cover**
- **Useful dialogue has already started on optimising the IR layout and services and developing common criteria**
- **Workshop at IRENG07 in SLAC in September 07**



Summary of Cost & Schedule Working Group

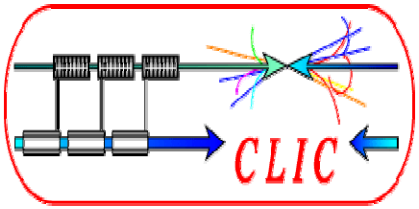
Hans Braun/CERN, John Carwardine/ANL, Katy Foraz/CERN, Peter Garbincius/FNAL, Tetsuo Shidara/KEK, Sylvain Weisz/CERN



Highlights

- **First time the groups had got together**
- **Discussions were very positive and constructive.**
- **Strong interest in continuing discussions and find ways to work together.**

- **Some specific items have been identified that we can work on together.**

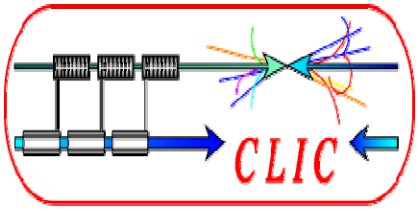


Tools

- **Both groups have so far used Excel as primary costing tool.**

- **Both groups are looking for tools for integrating cost estimate data and to do parametric analyses, eg**
  - **Raw material costs, inflation rates, effort costs, etc**
  - **Changes in scope or requirements.**
  - **Consensus that Project Management cost/scheduling tools are not inherently the right tools for managing and analysing the cost estimates.**

- **ILC is planning to migrate to enterprise project management tools during ED phase (Primavera)**

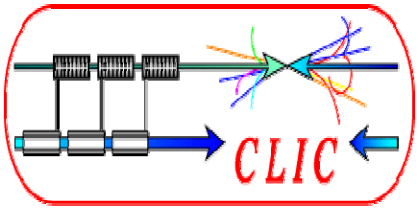


Next steps…

- **Establish a certain functionality for cost data analysis, eg parametric studies, risk assessment**
  - **Aim to develop and share tools together**
  - **Start small, migrate towards enterprise tools.**

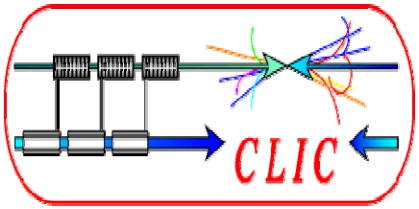
- **See benefit in comparing costs for certain items, eg**
  - **Modulator costs.**
  - **(confidentiality means we will need management approval)**

- **Compare high level methodologies & assumptions**
  - **Understand each others' methodology.**
  - **Understand how to compare cost estimates in a straight forward way.**
  - **Avoid unnecessary duplications of effort.**



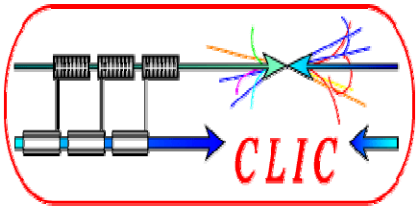
CLIC-ILC Beam Dynamics

Daniel Schulte (CERN) , Andrea Latina (CERN) , Nick Walker (DESY)



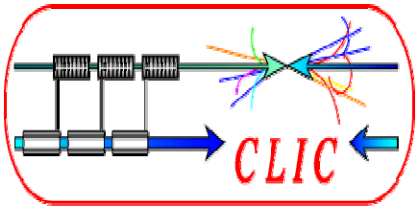
Common Standards

- **On going collaboration**
  - **Benchmarking**
  - **Fast application of simulation tools on the other project**
  - **Reduces the likelihood of errors**
  - **Reduced resources requirements=**
- **Machine models**
  - **AML is supported by both projects**
- **Imperfection models**
  - **A set of models is being developed for the ILC**
  - **CERN is contributing**
- **Interfaces**
    - **E.g. beam model to allow use of chain of codes**



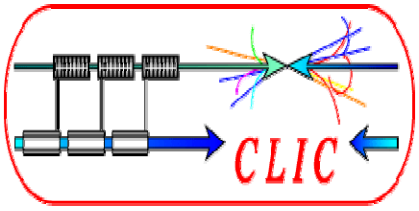
Common Codes

- **A number of codes is needed**
  - **Tracking and correction procedures (too many, but more detail needed)**
  - **Background and losses (about OK, more benchmarking and more details may be needed)**
  - **Beam-beam (about OK, more detail needed)**
- **Benchmarking of codes is essential**
  - **Need to have at least two**
  - **Very time consuming**
    - **In particular creates a competition between more results and more certain results**
- **In this area strong collaboration already exists**



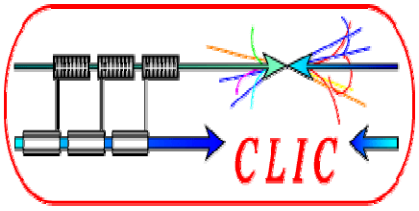
Common studies

- **For ILC a supporting second study is required for all critical results**
  - **Will do the same for CLIC at some point**
- **Serious work is needed to establish specifications for hardware**
  - **Many questions to be answered day to day**
  - **Seems project specific**
- **Seems reasonable to work together on the supporting studies**
  - **Less tight schedule**
- **Common workshops would be a first step**



CLIC-ILC management

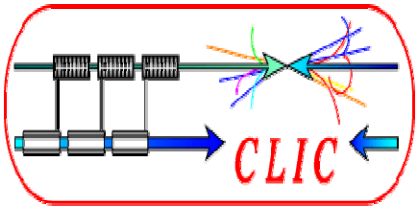
Jean-Pierre Delahaye (CERN) , Marc Ross (FNAL)
Akira Yamamoto (KEK) , Nick Walker (desy) ,



General remarks

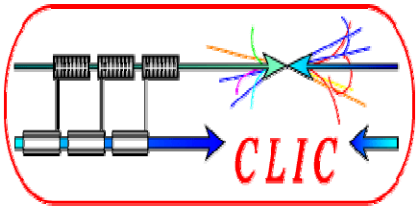
- **Often first time groups were meeting together**
- **Exploratory meeting but large number of common issues identified in very short time with common interest**
- **Common studies not limited by number of subjects but by available resources**
- **LHC experience extremely useful for ILC and CLIC**
- **Review and adoption of common tools:**

  Beam dynamics, Cost…



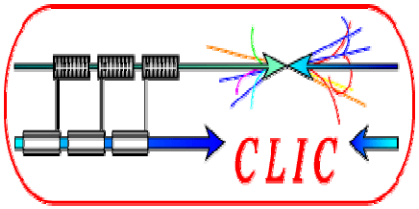
CLIC – ILC Collaboration Strategy

- **Connect the 2 communities so that their projects are *comparable***
  - **There will be competition / collaboration**
  - **This is the nature of alternative technology development)**
- ***Define* (as much as we can)**
  - **where we agree and disagree**
  - **what are the criteria of comparison**
- **Components – working together on pieces**
  - **There will be much in common – starter projects kept small.**
- **Plug compatibility:**
  - **One person/team develops a component that would work for both.**
  - **Starting at the same energy.**
- **The credibility of each, through the broader community, will be facilitated through communication.**



Meetings

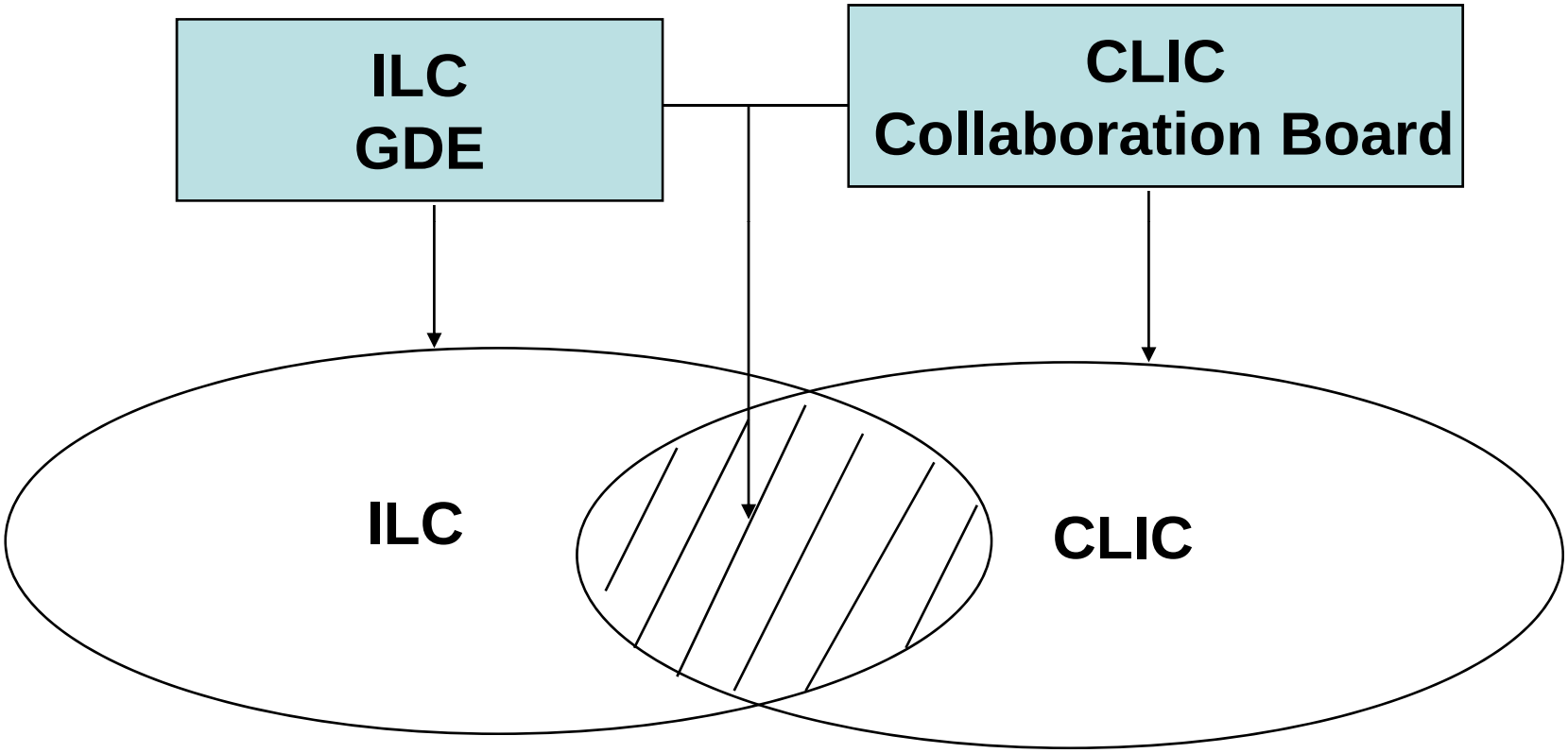
- **Goal: Break down barriers. – this has to be done at a high level so to have a global viewpoint.**
- **No additional meetings…**
- **Overlap in each other's meetings.**
  - **Working group agendas and attendance**
  - **Sharing experts**
  - **CLIC members participating to ILC meetings**
  - **ILC members participating to CLIC meetings**
    - **Next CLIC08 Workshop on October 14-17,2008**
- **LCWS could/should be more generic – and include the CLIC community explicitly**

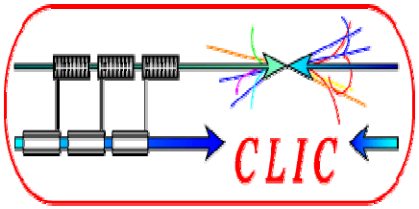


Still to be done

- **Identify Contact Persons from each study for each activity**
- **Define reasonable plan of action with deliverables for each study**
- **At long(er) term, prepare presentation of options in a credible and strong common basis.**
  - **Define the criteria of comparison.**

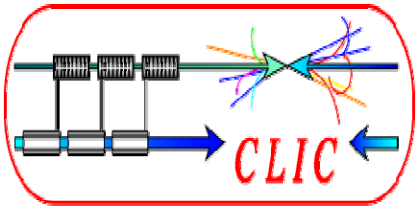
Management?





Define contact persons

	CLIC	ILC
CFS		
BDS & MDI		
Detectors		
Cost & Schedule		
Beam Dynamics		
Others?		
Positron source?		
…..		



Conclusion

- **CLIC/ILC collaboration on subjects with strong synergy**

  Win –Win for both studies and for HEP

- **Ambitious but Realistic and Practical approach**
  - **starting on limited number of subjects**
  - **contact persons to define plan of (limited) actions**
- **Most efficient use of limited resources**
- **Provide credibility to Linear Collider community by:**
  - **minimizing the resources**
  - **mutual understanding of status, advantages, issues of both tech**
  - **responsible preparation of the future comparison of possible options for HEP with agreed pro&cons and criteria**

Collaborative / Competition and / or Competitive / Collaboration