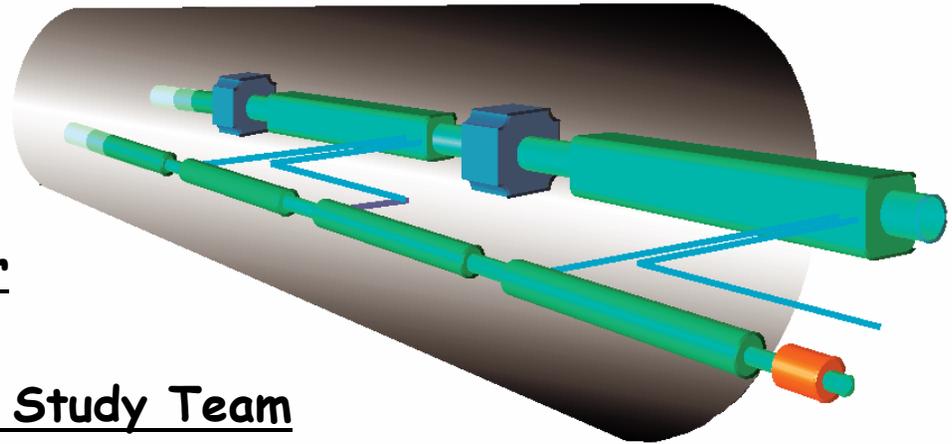


CLIC

THE COMPACT LINEAR COLLIDER (CLIC) STUDY

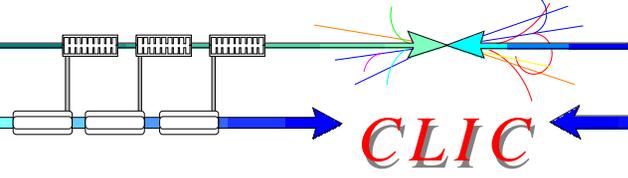


J.P. Delahaye for

The Compact Linear Collider Study Team

The CLIC study is a **site independent feasibility study** aiming at the development of a **realistic technology** at an **affordable cost** for an **e^\pm Linear Collider** in the post-LHC era for Physics in the **multi-TeV** center of mass colliding beam energy range.

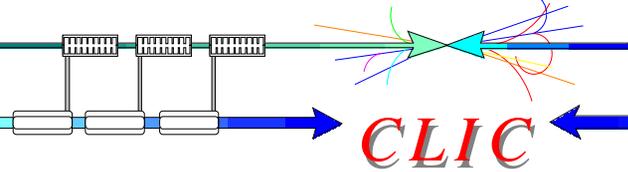
<http://clic-study.web.cern.ch/CLIC-Study/>



World wide CLIC collaboration



- **BERLIN Technical University (Germany)** : Structure simulations GdfidL
- **Finnish Industry (Finland)** : Sponsorship of a mechanical engineer
- **INFN / LNF (Italy)**: CTF3 delay loop, transfer lines & RF deflectors
- **JINR & IAP (Russia)**: Surface heating tests of 30 GHz structures
- **KEK (Japan)**: Low emittance beams in ATF
- **LAL (France)** : Electron guns and pre-buncher cavities for CTF3
- **LAPP/ESIA (France)** : Stabilization studies
- **LLBL/LBL (USA)** : Laser-wire studies
- **North Western University (Illinois)** : Beam loss studies & CTF3 equipment
- **RAL (England)** : Lasers for CTF3 and CLIC photo-injectors
- **SLAC (USA)** : High Gradient Structure testing, structure design, CTF3 drive beam injector design
- **UPPSALA University (Sweden)** : Beam monitoring systems for CTF3



- **A CLIC R&D accelerated programme**
 - **CLIC feasibility demonstration before 2010**
- **A CTF3 multi-lateral collaboration network**
 - **Meetings on 19/05/04 and 28/01/05**
- **ITRP recommendation of super-conducting technology for (sub)-TeV Linear Collider (ILC)**
 - **The consequences for the CLIC study**
- **Plans and schedule**
- **Conclusion**

ORGANISATION EUROPÉENNE POUR LA RECHERCHE NUCLÉAIRE
CERN EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH

Action to be taken

Voting Procedure

For discussion	SCIENTIFIC POLICY COMMITTEE 231 st Meeting 15 and 16 December 2003	-
For discussion	COMMITTEE OF COUNCIL 260 th Meeting 18 December 2003	-

Preliminary Proposal concerning CERN Activities
other than LHC Completion for the Period 2004-2010
from the Director-General Designate

3.3. CLIC and the International Linear Collider

The present situation concerning the definition of a linear electron-positron collider and the perspective of its implementation inside a worldwide international cooperation are such that it is recommended to accelerate the tests of feasibility of the CLIC concept, in order to arrive before 2010 at a firm conclusion on its possible use. This recommendation is based on the following arguments.

- The scientific community is considering the realization, through international cooperation, of a linear e^+e^- collider with energy around 500 GeV c.m., to be operational in parallel with the LHC. R&D has been performed towards this objective in Germany (via the TESLA project led by DESY) using superconducting cavities for beam acceleration, and in US and Japan, using copper cavities at room temperature.
 - The US Secretary of Energy has recently made public priorities for 28 scientific facilities to be constructed during the next 20 years. These plans envisage that the linear collider would be funded around 2015, well after important results from the LHC are available.
 - This new timing will enable the physics discovered at the LHC to be taken into account when determining the optimal linear-collider c.m. energy range, which might possibly be considerably higher than the 500 GeV energy currently envisaged.
 - The development at CERN of the CLIC concept for the accelerator was initiated more than ten years ago, with the strategic aim of providing a technical solution for a e^+e^- linear collider with c.m. energy in the range from 0.5 to 5 TeV. Energies above 1 TeV are inaccessible to solutions developed elsewhere, and may be necessary to explore the new physics at the high-energy frontier which are expected to be revealed by the LHC.
 - If 2010 is now considered a realistic date for the decision on construction of a linear collider, namely after the first results of LHC become available, it is reasonable to aim at proving the feasibility of the CLIC by the same date. If the CLIC development is successful, this would provide a possible technical solution for a higher-energy collider, should the LHC physics results indicate the need for it.
-
- Should the launching of the linear collider construction occur only after 2010, the previous technical choice of design parameters and concept will certainly be reviewed and reassessed in the light of the LHC results. Therefore, it appears appropriate that the assessment of the CLIC design concept be available at that time, should the need of a higher energy then be recognised.

The above recommendation to complete the CTF-3 facility faster than in the present planning would require additional resources to be committed in 2004 and 2005, which are estimated at 17.2 MCHF and 95 man-years in total.

The present CERN budget cannot provide this level of additional resources. Only cooperation with some institutions in the Member States, including voluntary contributions "a la carte", in kind and/or in manpower, can help to fulfill this strategic goal.

CERN/SPC/841
CERN/2552
Original: English
26 February 2004

ORGANISATION EUROPEENNE POUR LA RECHERCHE NUCLEAIRE
CERN EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH

Action to be taken

Voting Procedure

For Discussion	SCIENTIFIC POLICY COMMITTEE 232 nd Meeting 15-16 March 2004	-
For Discussion	COUNCIL 127 th Session 18 March 2004	-

**CLIC: Summary of Physics Case
and Proposed Accelerated R & D Programme**

12. **CLIC: SUMMARY OF PHYSICS CASE AND PROPOSED ACCELERATED R&D PROGRAMME**

(Item 13 of the agenda) (CERN/SPC/841-CERN/2552)

The Council took note of the information set out in document CERN/SPS/841-CERN/2552 and of the presentations by Professor Engelen and Dr Delahaye.

In line with the conclusion of the Scientific Policy Committee, the Council expressed strong support for accelerating the R&D on CLIC as proposed by the Management in document CERN/SPC/841-CERN/2552.

ORGANISATION EUROPÉENNE POUR LA RECHERCHE NUCLÉAIRE
CERN EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH

HUNDRED AND TWENTY-NINTH SESSION OF COUNCIL

RESTRICTED SESSION

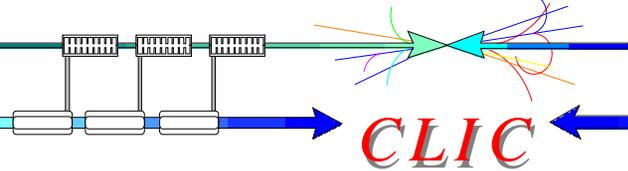
Rome – 19 July 2004

SUMMARY OF CONCLUSIONS

The PRESIDENT presented a draft summary of conclusions, prepared by himself and the two Vice-Presidents of Council during the adjournment, and invited comments and amendments by the delegations. After extensive discussion, the Council agreed that it could go on record with the following statement:

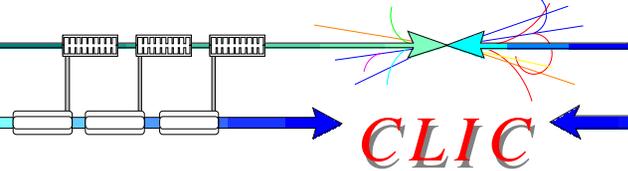
"The Council:

- Confirms that the first priority for the world particle physics community is to complete the LHC and its detectors in order to unveil, as soon as possible, the physics at the new energy frontier;
- Encourages the effort towards the design and development of a linear collider as a unique scientific opportunity at the precision frontier, complementary to the LHC;
- Confirms its endorsement of accelerated R&D activities for CLIC;
- Recognises the overall value for the world particle physics community of a decision to construct a TeV linear collider, and encourages the efforts of the leading players in that direction;
- Takes the view that, in the course of this process, it will be appropriate to take stock of the LHC and accelerator R&D results and produce a new assessment of the physics and the technology by 2010;
- Is of the opinion that, in the initial phase (2004-2007), the organisational structure of the global design initiative, in particular the Central Design Team, should be light."



- **Key issues common to ILC and CLIC studies independently of the technology:**
 - Participation to ILC R&D in the frame of ILC collaboration
 - Collaboration with European Laboratories in the frame of the Coordinated Accelerator R&D in Europe (CARE) project and the EUROTeV "Design Study" funded by EU Framework Programme (FP6)

- **Key issues specific to CLIC technology:**
 - Focus of the CLIC study
 - All R1 (feasibility) and R2 (design finalisation) key issues addressed in new test facility: CTF3
 - CTF3 multi-lateral Collaboration Network

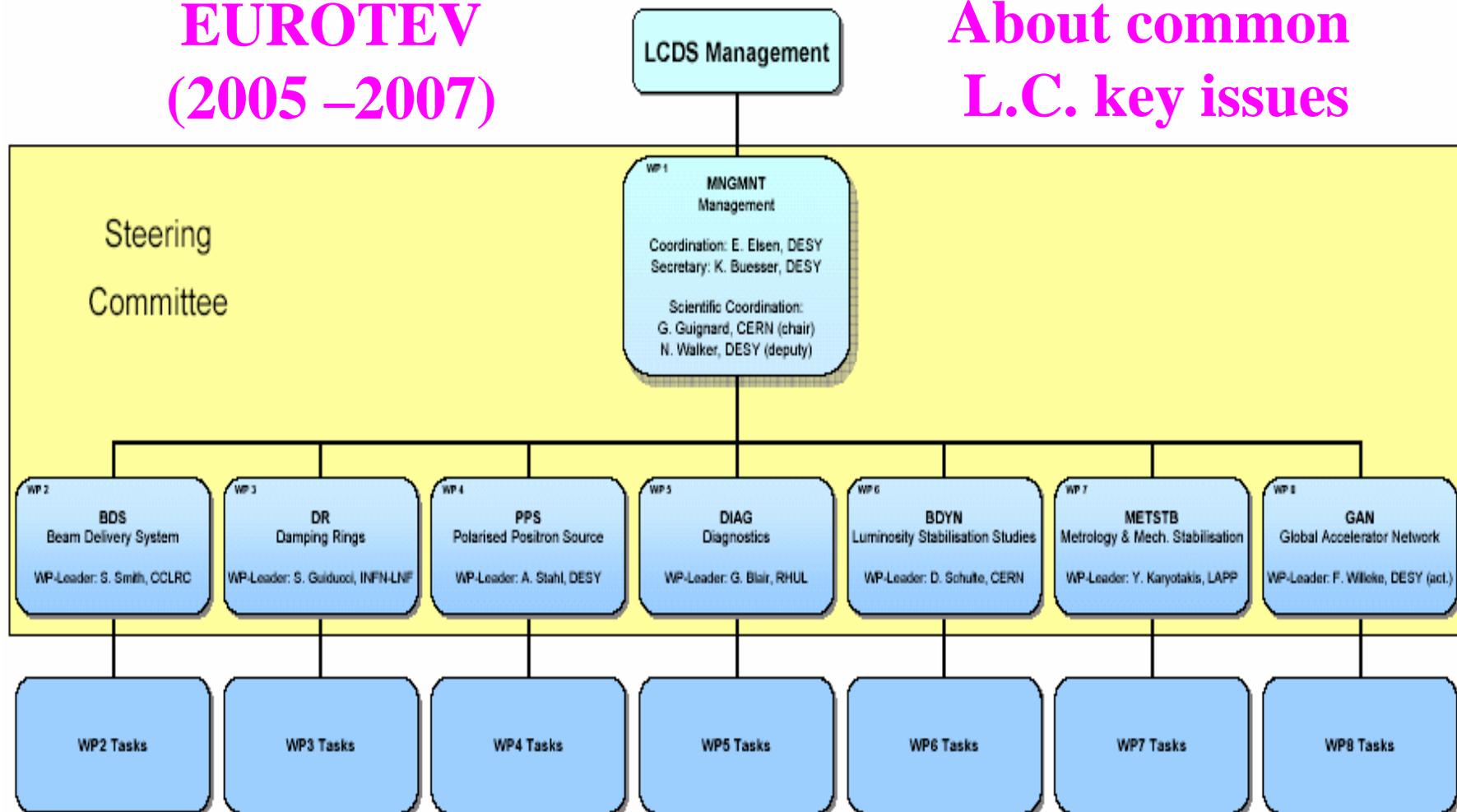


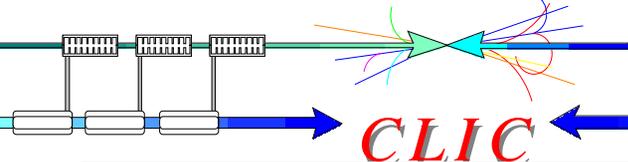
CLIC

Proposal for EU supported Linear Colliders Design Study

**EUROTEV
(2005 –2007)**

**About common
L.C. key issues**

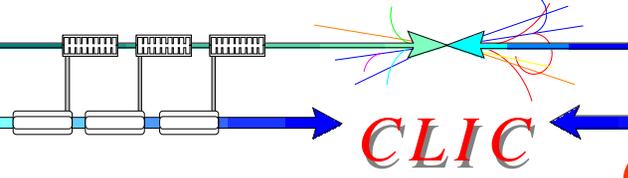




27 collaborating institutes



Institute	WP1: MNGMNT	WP2: BDS	WP3: DR	WP4: PPS	WP5: DIAG	WP6: ILPS	WP7: METSTB	WP8: GANMVL
CCLRC	X	C	X	X			X	
CEA		X						
CERN	C	X	X		X	C		
DESY	C		X	C	X	X	X	C
ELETTRA								X
FHG								X
GSI								X
INFN-LNF	X		C					X
INFN-Mi								X
INFN-Ro2								X
IPPP				X				
LAL					X	X		
LAPP	X						C	
PSI						X		
QMUL		X				X		
RHUL	X				C	X		
TEMF,TUD		X						
UBER				X				
UCAM					X			
UCL					X			
ULANC		X						
ULIV				X				
UMA		X				X		
UMH								X
UNIUD								X
UOXF.DL					X		X	
UU					X	X		



CLIC

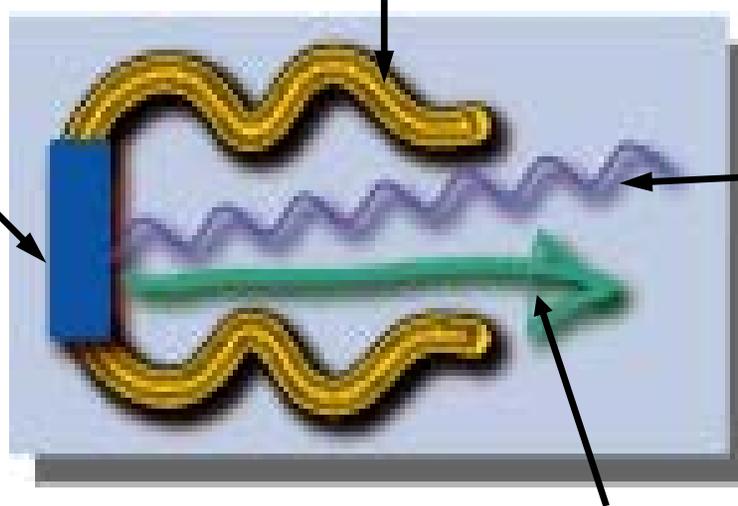
The Photo-Injector

a performing e^- source for CTF3

CERN

Photocathodes
+
Timing
RF power
Laser beam transport
Installation
Monitoring ...

LAL (F)
3 GHz RF gun



RAL (GB)
High power
Laser

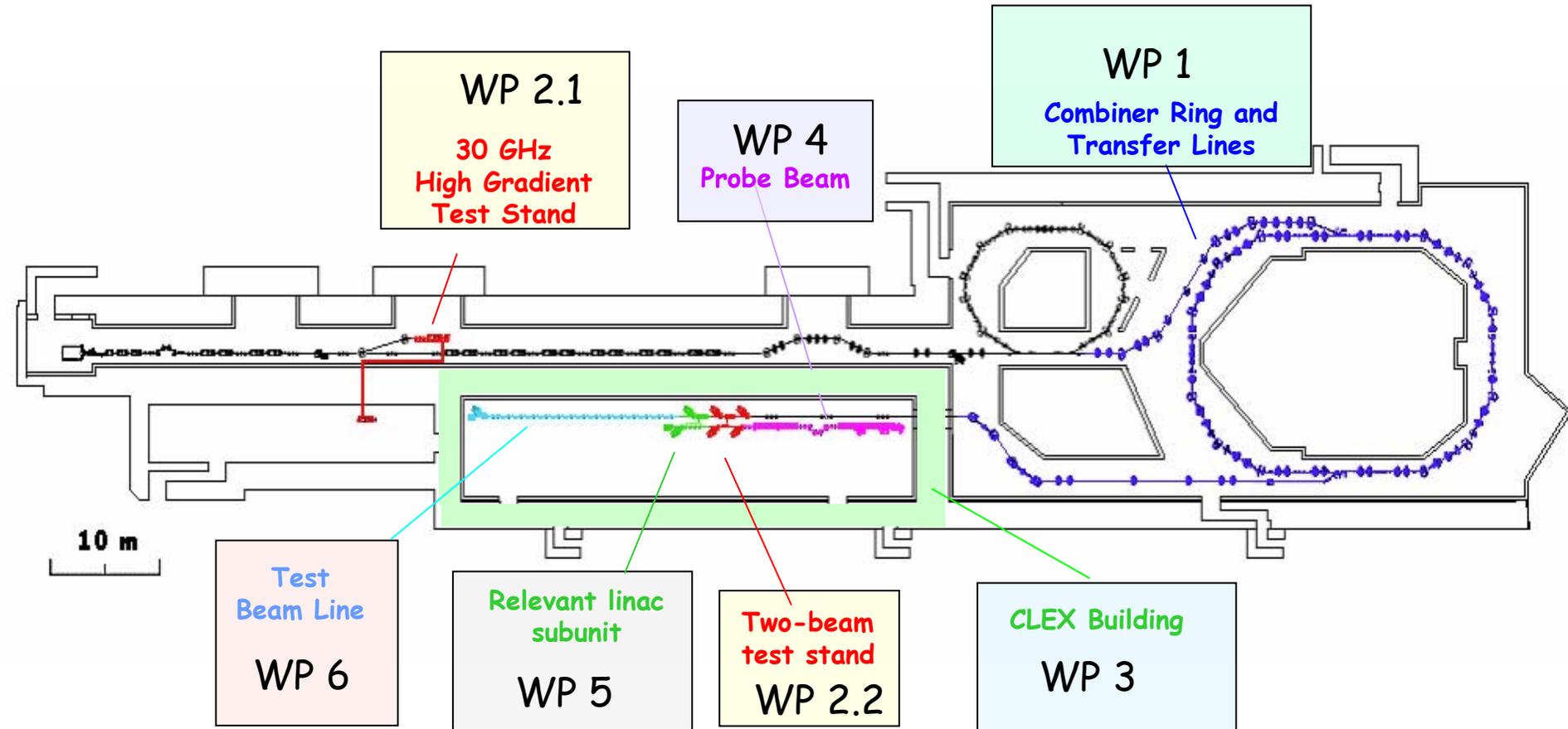
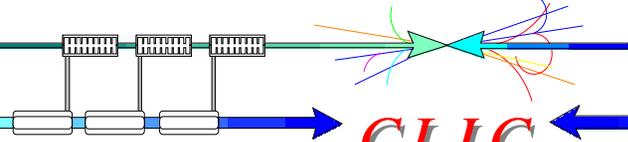
2332 e^- pulses distant from 667 ps ; $\sigma = 4$ ps ; $Q_{\text{pulse}} = 2.33$ nC

2004 - 2006 : construction and installation of the photo-injector included in the European program CARE (FP6)

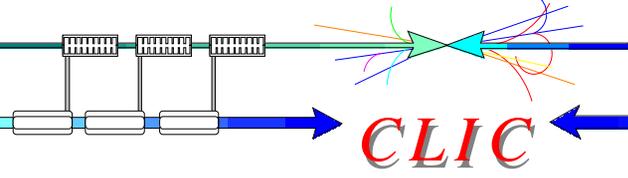
E.U. funding: 90 % of the request ≈ 2 MCHF

Work packages

CLIC

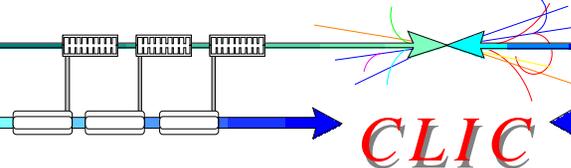


Extended collaboration



- **Laboratories and Institutions are invited to contribute to this programme by:**
 - ✓ **taking full responsibility** for part, complete of one or several work-packages
 - ✓ **providing voluntary contributions** “a la carte” in cash, in kind and/or in man-power
- **Multilateral collaboration network** of volunteer institutes (from which CERN is one of them) participating jointly to the technical coordination and management of the project.
- **Expression of Interest from 12 Institutes at CLIC Collaboration Meeting (19/05/04)**
- **Commitment at CLIC collaboration meeting on 28/01/05 with agreement on MoU**

Schedule with extra resources



	2004	2005	2006	2007	2008	2009
Drive Beam Accelerator	█					
30 GHz power test stand in Drive Beam accelerator	█	█				
30 GHz power testing (4 months per year)		█	█	█	█	█
R1.1 feasibility test of CLIC structure				█		
Delay Loop	█	█				
Combiner Ring	█	█	█			
R1.2 feasibility test of Drive beam generation				█		
CLIC Experimental Area (CLEX)		█	█			
R1.3 feasibility test PETS				█		
Probe Beam			█	█		
R2.2 feasibility test representative CLIC linac section					█	
Test beam line		█	█	█	█	
R2.1 Beam stability bench mark tests					█	█

ITRP



Linear Collider Technology Recommendation

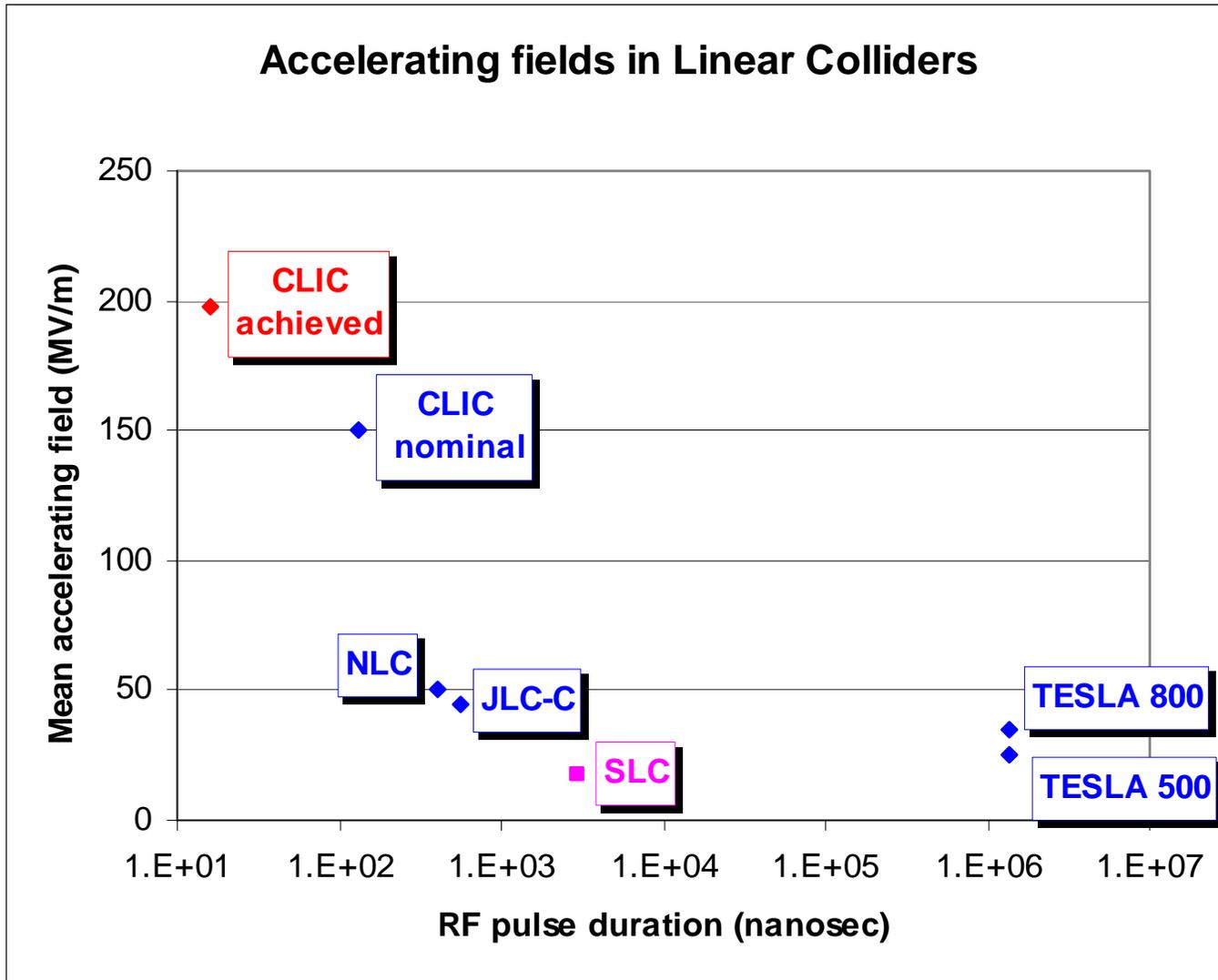
**Barry Barish
ILCSC/ICFA Special Meeting
IHEP, Beijing
19-Aug-04**

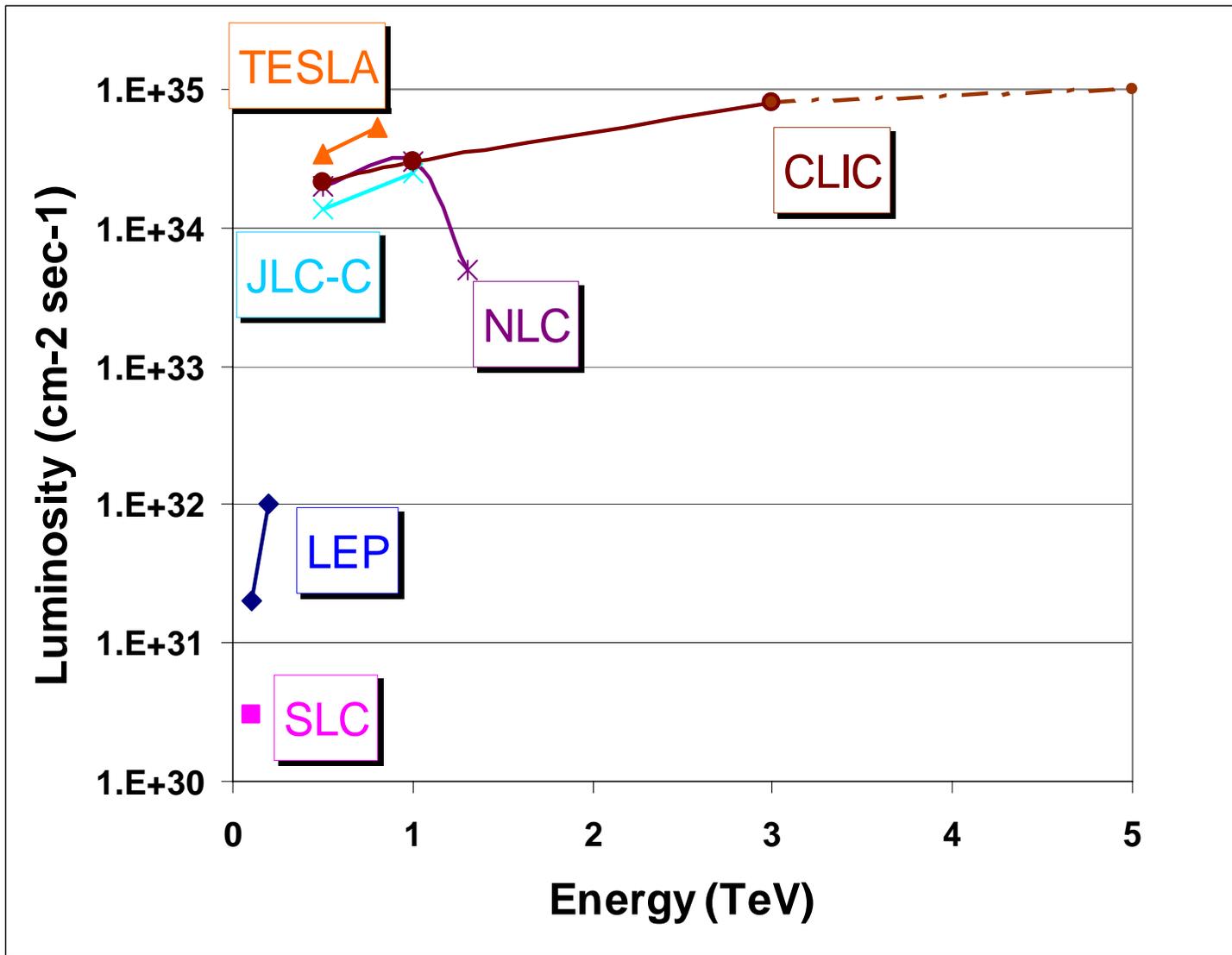
Why ITRP?

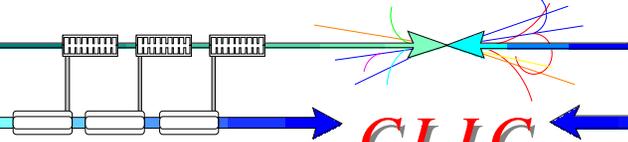
- **Two parallel developments over the past few years (the science & the technology)**
- **The precision information from LEP and other data have pointed to a low mass Higgs; Understanding electroweak symmetry breaking, whether supersymmetry or an alternative, will require precision measurements.**
- **There are strong arguments for the complementarity between a ~0.5-1.0 TeV LC and the LHC science.**
- **Designs and technology demonstrations have matured on two technical approaches for an e^+e^- collider that are well matched to our present understanding of the physics. (We note that a C-band option could have been adequate for a 500 GeV machine, if NLC/GLC and TESLA were not deemed mature designs).**

The Recommendation

- **We recommend that the linear collider be based on superconducting rf technology** (from Exec. Summary)
 - This recommendation is made with the understanding that we are recommending a technology, not a design. We expect the final design to be developed by a team drawn from the combined warm and cold linear collider communities, taking full advantage of the experience and expertise of both (from the Executive Summary).
 - We submit the Executive Summary today to ILCSC & ICFA
 - Details of the assessment will be presented in the body of the ITRP report to be published around mid September
 - The superconducting technology has features that tipped the balance in its favor. They follow in part from the low rf frequency.







Tentative long-term CLIC scenario

Shortest and technically limited schedule

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



	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
CLIC																
Feasibility issues R1																
R&D issues R2 & CDR																
R&D issues R3,R4 & TDR																
Engineering Optimisation-Project approval																
Construction (in stages)&Beam											Construction					Beam
EUROTEV - CARE																
ILC	CDR	TDR			Site&Approb		Construction				Beam					