

EU Sponsored CLIC Activities, Present and Future

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EU sponsored CLIC activities

INTRODUCTION

EU's interest to support research

From ftp://ftp.cordis.europa.eu/pub/fp7/docs/ec_fp7_amended_en.pdf

- (1) The Community has set itself the objective of creating the knowledge society by developing the know-how and strengthening the scientific and technological bases of the Community industry, including service industries, with a view to assuring a high level of competitiveness. To this end, the Community recognises the responsibility and independence of scientists in the definition of the broad lines of research at the frontiers of knowledge and it shall promote all the research activities deemed necessary, in particular by encouraging undertakings, including small and medium sized enterprises ("SMEs"), research centres and universities in their research and technological development activities, giving priority to those areas and projects where European funding and cooperation is of particular importance and gives an added value. **Through its support for research at the frontiers of knowledge, applied research and innovation, the Community seeks to promote synergies in European research** and thus provide a more stable foundation for the European Research Area. This will make a positive contribution to the social and economic progress of all Member States.
- (2) The central role of research was recognised by the European Council of Lisbon which highlighted knowledge and innovation as the key, setting itself a new strategic goal for the next decade: **to become the most competitive and dynamic knowledge-based economy in the world**, capable of sustainable economic development and aiming at full employment with more and better jobs and greater social cohesion.

Introducing ESGARD

- European Steering Group for **Accelerator R&D**
- Established Sept. 2002 by ECFA and the directors of the following labs:
- CEA/Saclay (Roy ALEKSAN, chair), INFN/LNF (Susanna GUIDUCCI), CERN (Gilbert GUIGNARD), CCLRC (now STFC, Rob EDGECOCK), IN2P3/LAL (François RICHARD), DESY (Dieter PROCH), PSI (Leonid RIVKIN)
- ESGARD has coordinated EU funded Accelerator R&D since 2003.

CLIC

- A technology to go beyond 1 TeV.
- Recognized by the Council Strategy Group:

The European strategy for particle physics

- In the strategy document it says, right after the LHC upgrade:
- ... a coordinated programme should be intensified, to develop the *CLIC technology* and *high performance magnets* for future accelerators, and to play a significant role in the study and development of a *high-intensity neutrino facility*.
- CLIC study has a well defined programme until 2010, centred around CTF3.

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THE PRESENT

Present:



- Inside the *Integrated Infrastructure Initiative* **CARE** (55 M€ total / 15.2 M€ from EU):
 - European Linear Accelerator Network **ELAN**
 - Photo-Injector JRA **PHIN**
- Design Study **EUROTeV** (27.6 M€ / 9 M€)
 - started Jan. 2005
 - duration 3 years
 - Goals:
 - provide missing design spec. of ILC components
 - advance accelerator expertise in Europe
 - investigate future LC design options

ELAN



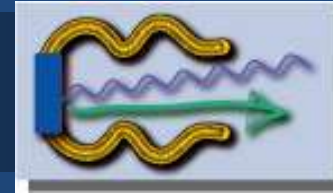
- **Objectives:**

- Coordinate R&D on electron accelerators
- Evaluate technologies for improving present facilities; set priorities; define roadmap
- Enhance synergy – avoid duplication of work

- **Recent events:**

- CTF3 Collaboration meeting, Jan. 2007
- ECL2 Workshop, March 2007 (jointly with HHH and EUROTeV)
- POSIPOL Workshop, May 2007
- CLIC X-band accelerating structure design and testing-program workshop, June 2007
- This workshop!

PHIN



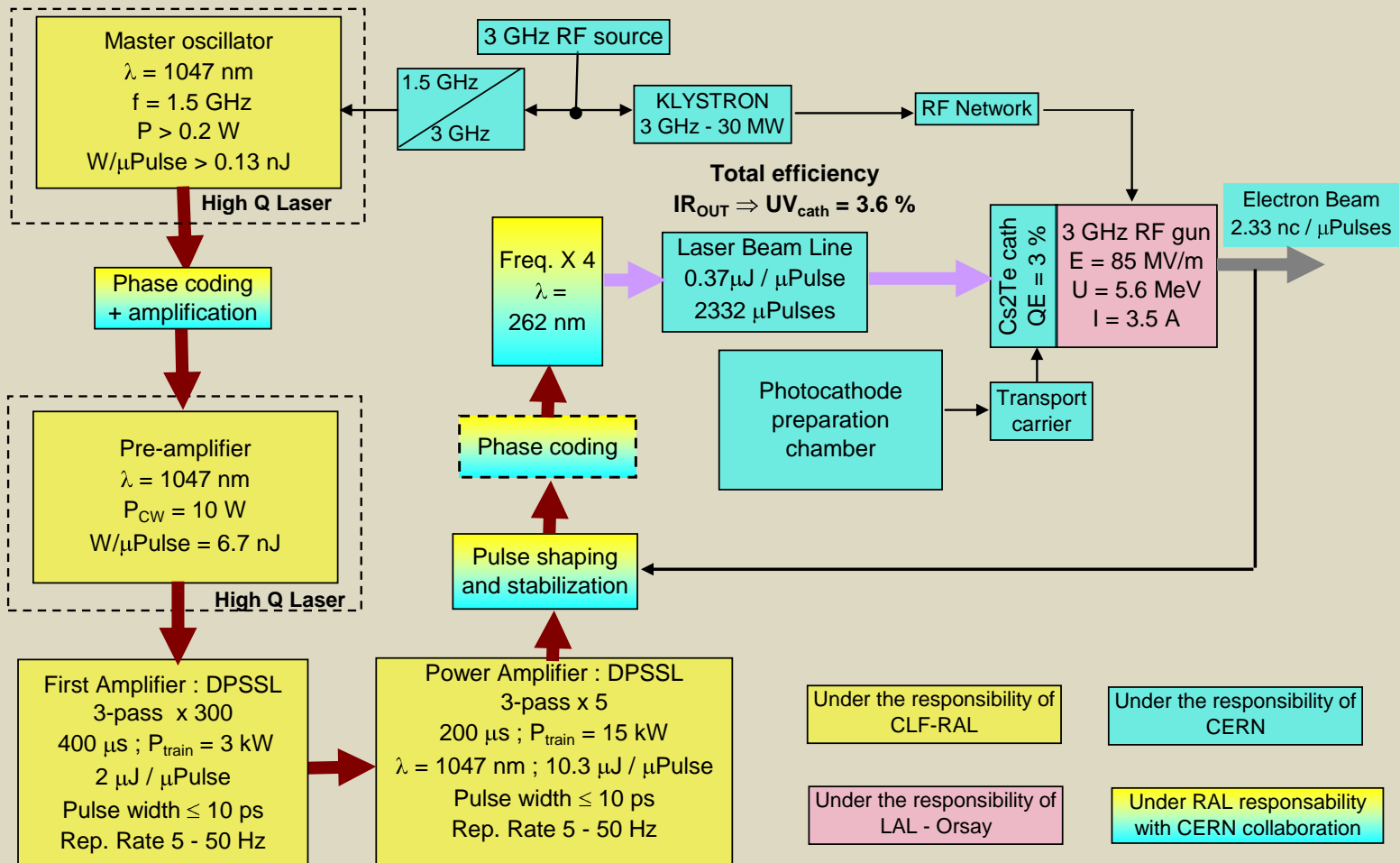
- **Objectives**

- Create synergy for various photoinjector applications
- Identify and deal with common problems
- Perform R&D on electron production

- **Deliverables**

- Reports ...
- Laser system for CTF3 and pulse shaper
- Prototype SC gun
- RF gun for CTF3 and NEPAL
- Prototype RF gun for CLIC

PHIN Overview: CTF3 system



PHIN recent progress

- **After many years, first re-production of Cs_2Te photocathodes at CERN, QE 6.2 % measured (2006)**
- **FZ Rossendorf: 1.3 GHz SC RF gun built to be installed at ELBE (2007)**

EUROTeV

- ILC & CLIC
- 2005 – 2007
- Work packages:



EUROTeV – recent events:

- **CLIC and ILC LET meetings (Feb. 2006)**
- **EUROTeV Workshop, Paris, June 2006**
- **Several CLIC and ILC beam physics coordination**
 - **2006, Meetings in Bangalore, Vancouver, Valencia and at CERN.**
- **Impressive number of reports:**
28 in 2005, 106 in 2006, 63 in 2007 (so far).

EUROTeV – recent progress (1):

- **BDS: 40% luminosity increase by multi-D optimization with smaller beam size.**
- **DR: e-cloud build-up simulated and X-checked against DAΦNE data. Clearing electrodes and grooves introduced.**
- **Diagnostics:**
 - **Precision phase meas. system designed.**
 - **Wide-band WCM: Analyzed, new structures proposed, prototypes being designed.**
 - **100 nm BPM: Prototype being tested.**

EUROTeV – recent progress (2):

- **ILPS (Integrated Luminosity Performance Sim.):**
 - Systematic collimator simulations performed.
 - ILC Failure modes simulated and compared to DESY data.
 - Luminosity & Alignment: PLACET improved (6-D tracking; Octave interface; MICADO type feedback for full correction; benchmarked against other simulations; study of tunnel curvature for ILC and CLIC
 - Halo & Tail generation processes studied
 - Beam-beam simulations: Guinea-pig benchmarked
 - Post-collision line designed
 - Main beam bunch compressors and drive beam tuning chicane designed
- **... (*list not exhaustive*)**



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THE FUTURE

Future: The Context of FP7

- “Seventh Framework Programme”
- Duration 2007 – 2013
- Overall budget 50 G€
- “Capacities”: 4.1 G€
- “Infrastructures”: 1.7 G€
- Instruments:
 - Design Studies (FP6: EUROT_eV, EUROFEL, EURISOL; FP7: EURO_v)
 - Construction of New Infrastructures (FP7: SLHC-pp, ILC HiGrade)
 - Integrating Activities (FP6: CARE, EUDET, Laserlab-Europe, IA-SFS; FP7: “CARE-like” IA, in preparation)





Future: IA “CARE II”

- **Aiming at Call**
 - “INFRA-2008-1.1.1”, Closure 29th Feb 2008:
Integrating Activities in all S&T fields (bottom-up): 160 M€, 2009-2012
- **The accelerator community may reasonably hope for 15 M€.**
- **CARE-like Integrating Activity (total \approx 45 M€)**
 - Planned JRA: “Normal Conducting Technology for Future Linear Colliders (1 of 4)”
 - JRA builds on strong synergy between ILC & CLIC.
 - Other JRA’s: LHC upgrade, SC RF, and “other”.

STOP PRESS:

- **ESGARD met yesterday (15th Oct.) with the directors of its founding labs.**
- **In order to comply with announced new budgetary restrictions, the request will contain only highest priority – this defines the size of the planned IA (45 M€)**
- **I will present in the following only those requests that made it through (may be slightly adjusted):**

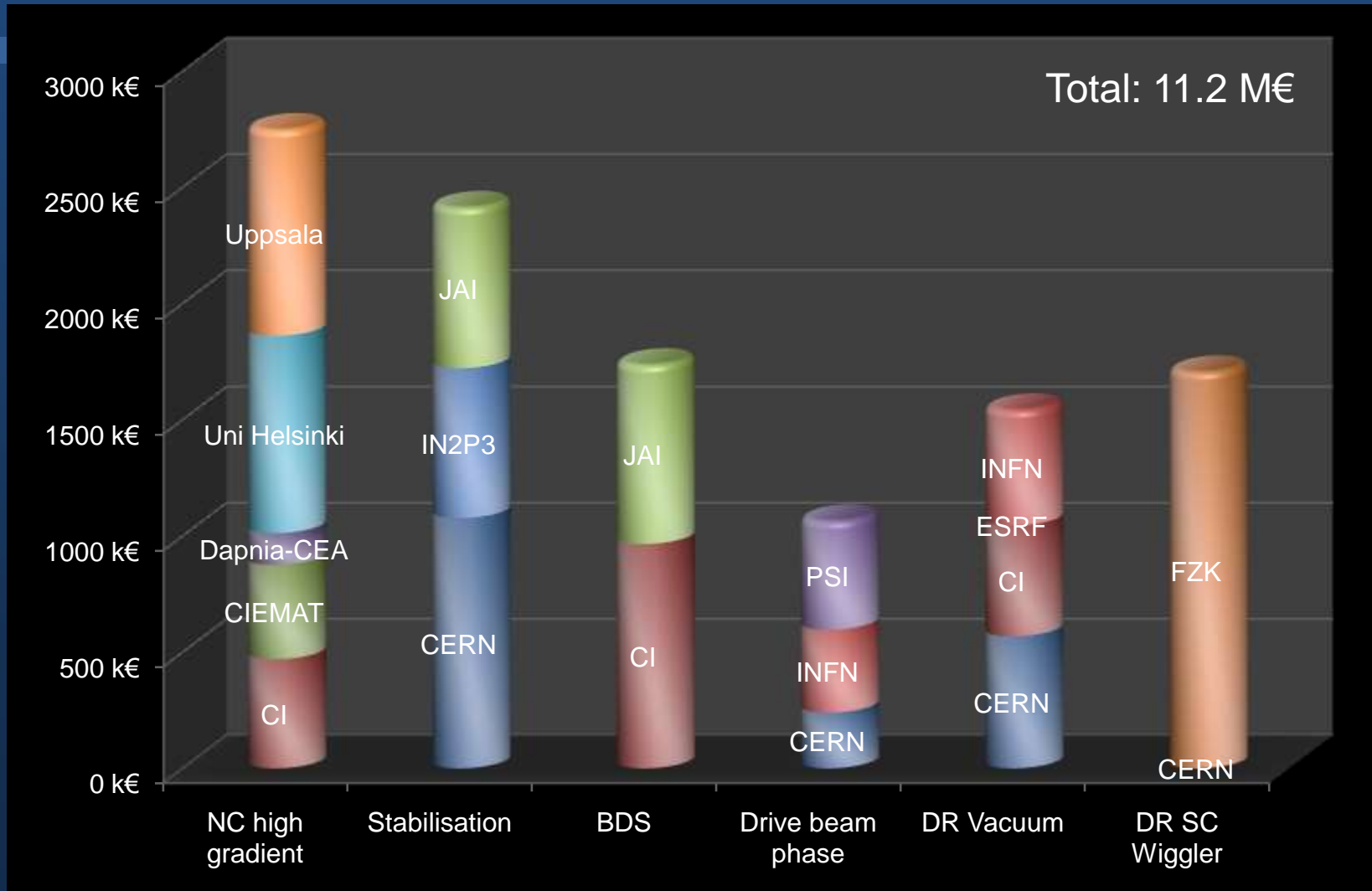
Highest priority CLIC related work packages (1)

- **Normal Conducting High Gradient Acceleration**
 - PETS prototype
 - HOM damping
 - Breakdown theory
 - Surface treatments
 - 2BTS
 - Assembly issues
- **Linac stabilisation**
 - sub-nm stabilisation of FF
 - quadrupole prototype
 - LET & FB study

Highest priority CLIC related work packages (2)

- **BDS**
 - Crab cavity
 - Final focus and Interaction region optimization
 - Laserwire
 - BPMs
- **Drive beam phase monitor**
- **DR Vacuum**
 - E-cloud, NEG, surface characterization,
- **DR SC Wigglers**
 - 1st prototype

Highest priority CLIC related work packages (3)



Normal Conducting – High Gradient (≈ 2.8 M€)

- **CIEMAT (Spain), PETS prototype:**
Starting from TBL pets, design, build & test CLIC PETS.
- **Cockcroft Institute (UK), HOM-damping:**
Study and test different ways of wake suppression in AS & PETS, including beam dynamics, tolerances.
- **Helsinki IP (FIN), Understanding breakdown:**
Atomic level simulations of breakdown phenomena.
- **CEA/Saclay (F), Surface treatments:**
Surface analysis, preparation & clean room assembly.
- **Uppsala Universitet (S), 2BTS upgrade:**
Instrumentation & diagnostics, DC breakdown analyzer
- **Helsinki IP (FIN), precision assembly:**
How alignment, precision & stability influence breakdowns.

Stabilisation (≈ 2.4 M€)

- **CERN: Magnet prototype:**
Prototype for evaluation of stabilisation methods.
- **LAPP (F): Sub-nm stabilisation:**
Demonstration in detector-like environment.
- **CERN:**
Beam line support inside detector
- **CERN:**
Integration issues: movers + sensors + stabilization system + FF quads + ...
- **JAI/Oxford (UK):**
Alignment monitoring, LET and feedback, ILC & CLIC

Beam Delivery System (for ILC/CLIC, ≈ 1.7 M€)

- **CI (UK), Crab cavity:**
Establish & verify @ CTF3 prototype designs of CLIC crab cavity & its synchronisation.
- **CI, FFS & IR optimisation:**
Test tuning procedures @ ATF2, test FF system with local ξ -correction, study machine induced backgrounds.
- **JAI/RHUL (UK), Laserwire:**
Test laser-scanning system at PETRA3 & ATF2
- **JAI/RHUL (UK), BDS BPM:**
Develop BPM & test @ ATF2

Drive Beam Phase (≈ 1.1 M€)

- **LNF (I): High precision phase monitor:**
Design, build & test low imp. ϕ -monitor
- **CERN: Phase monitor electronics:**
... which allow to test the above.
- **PSI (CH): Longitudinal feedback components:**
... which will complement the above with a laser system, electro-optical detectors, plus tests at SLS

Damping Ring Vacuum (≈ 1.5 M€)

- **INFN/LNF (I), Cockcroft Inst. (UK), ESRF (F) and CERN:**

NEG and other coatings, their preparation and characterisation, e-cloud reduction, e-cloud detection, vacuum system, measurements at DAΦNE, ESRF and CERN/SPS.

Damping Ring SC Wiggler (≈ 1.7 M€)

- **FZK/ANKA (D) and CERN: SC wiggler prototype**
Design, build & test 2-cm-period SC wiggler, beam tests in ANKA

Conclusion

- **EU is funding CLIC related activities:**
 - Presently, in FP6, by means of DS “EUROTeV” and I3 “CARE” with JRA “PHIN” and Network “ELAN”.
 - In the future, in FP7 (and if our application gets accepted), by means of a CARE-like Integrating activity with a JRA concerning “Normal Conducting Technology Development for Linear Colliders”