# CLIC detector & physics study

## “news from the ET ”

Lucie Linssen

# LC workshops and meetings

**FCAL meeting**, Cracow, April 29 – May 1
http://indico.cern.ch/conferenceDisplay.py?confId=225688

**Italian R&D meeting**, lepton collider, Como, May 16+17
https://agenda.infn.it/conferenceDisplay.py?ovw=True&confId=6182
*Invitation for a CLIC talk*

**ECFA** Linear Collider workshop, DESY, May 27-31 2013
http://lc2013.desy.de
*CLIC-related abstract submissions (~18) are listed here:*
*https://twiki.cern.ch/twiki/bin/view/CLIC/LC2013*

**EPS HEP, Stockholm, July 18-24**
http://eps-hep2013.eu/
*3 CLIC-related abstracts (Higgs, BSM, detector) + 1 common ILC/CLIC abstract (top) were submitted. No suggestion/decision on speakers.*

# CLIC and USA Snowmass process

**BNL (Snowmass) Energy Frontier meeting**, at BNL, April 3-6
http://www.bnl.gov/snowmass2103
*CLIC was represented by Frank Simon and Lucie Linssen*
*4 talks were given (Higgs, top, BSM, precision electroweak)*

**Seattle (Snowmass) Energy Frontier meeting**, June 30 – July 3
https://sharepoint.washington.edu/phys/research/snowmass2013/Pages/default.aspx
Philipp Roloff *will attend, we need at least 1 additional person*

**Minneapolis (main community meeting)**, July 29 – August 6
http://www.hep.umn.edu/css2013/
*Mark Thomson will attend, we need at least 1 additional person*

**CLIC input paper to Snowmass**, *in preparation*
Editors: T. Lastovicka, L. Linssen, P. Roloff, A. Sailer, F. Simon, M. Thomson, J. Wells
See: http://indico.cern.ch/categoryDisplay.py?categId=4679

# CLIC Whitepaper

## Proposed whitepaper

- ★ Short (~20-25 page) summary of CLIC results
  - Brief introduction to CLIC
  - Physics sensitivity for staged machine
  - Physics sections follow Snowmass EF topics:
    - Higgs physics
    - Top physics
    - Electroweak/precision physics
    - BSM physics
  - Summary of existing results + theory motivated estimates
  - Emphasis on tabulating results rather than detailed descriptions

http://indico.cern.ch/categoryDisplay.py?categId=4679

## Longer Term – an opportunity

- ★ Turn the whitepaper into a synoptic publication (PRD?)
  - Focus on physics reach – not detailed descriptions of analysis

**Following discussion at last IB meeting => "author list" rather than "signatory list"**

# Progress with the Higgs studies

**Comprehensive set of Higgs studies at CLIC at 350 GeV, 1.4 TeV and 3 TeV.**

1.) Simultaneous extraction of H -> bb, H -> cc and H -> gg at 350 GeV (Jan Strube, Victoria Martin, Jonatan Rosen) and 1.4 TeV (Tomas Lastovicka)

2.) Measurement of H -> WW* at 350 GeV and 1.4 TeV (and 3 TeV?)
(John Marshall: fully hadronic final state, Nigel Watson: qqlv final state, lvlv not covered yet):

3.) ZZ fusion at 1.4 TeV (and 3 TeV?) (Aidan Robson, Dan Protopopescu, Tom Doherty):

4.) Higgs to gamma+gamma (Christian Grefe) and Z+gamma (Eva Sicking) at 1.4 TeV

5.) Measurement of H -> tautau at 350 GeV and 1.4 TeV (Astrid Münnich)

6.) Measurement of H->mumu at 1.4 TeV (Ivanka Bozovic-Jelisavcic, Gordana Milutinovic-Dumbelovic, Strahinja Lukic, Mila Pandurovic)

7.) Measurement of the top Yukawa coupling at 1.4 TeV (Sophie Redford, Marcelo Vogel, Philipp Roloff)

8.) Measurement of the Higgs self-coupling at 1.4 and 3 TeV (Tomas Lastovicka, Jan Strube (CLIC_SiD & CLIC_ILD) + MPI Munich (investigating potential of different analysis techniques in CLIC_ILD))

# European strategy, latest news

**The European strategy statements:**

- A draft was made public at the end of January
- There were some minor wording changes in March (nothing important for LC)
- Will be approved in a special ministerial session May 29/30

**Deliberation document:**

Drafted by the European Strategy Group serving to provide:

- Rationale behind the scientific issues
- Recommendations of the ESG Working Groups on the non-scientific issues => council may consider taking them up for future considerations

***The deliberation document is still in DRAFT form***

Below, an extract, just three slides out of 15 pages….

# Large-scale scientific activities, d

Currently the world's leading laboratory at the high-energy frontier, CERN is Europe's greatest asset in particle physics. Pushing further the high-energy frontier has been essential to tackling many of the most exciting questions in particle physics, and it is likely to remain so in the future. To stay at the forefront of particle physics, **Europe needs to be in a position to propose an ambitious post-LHC accelerator project at CERN by the time of the next Strategy update**. The process of preparing for future decisions on the next large project at CERN must be started now, even though **the physics output of the 2015-2017 full-energy run of the LHC will be essential to such decisions**. **The two most promising lines of development towards the new high energy frontier after the LHC are proton-proton and electron-positron colliders**. Focussed design studies are required in both fields, together with vigorous accelerator R&D supported by adequate resources and driven by collaborations involving CERN and national institutes, universities and laboratories worldwide. The Compact Linear Collider (**CLIC**) is an electron positron machine based on a novel two-beam acceleration technique, which could, in stages, reach a centre-of-mass energy up to 3 TeV. A Conceptual Design Report for CLIC has already been prepared. **Possible proton-proton machines of higher energy than the LHC** include **HE-LHC**, roughly doubling the centre-of-mass energy in the present tunnel, and **V-LHC**, aimed at reaching up to 100 TeV in a new circular 80km tunnel. A large tunnel such as this could also host a circular electron-positron machine (**TLEP**) reaching energies up to 350 GeV with high luminosity**. In parallel with the technical design studies, the crucial R&D activities for assessing their feasibility include high-gradient accelerating structures in the case of CLIC and high-field magnets in the case of HE-LHC and V-LHC**. In parallel with this focussed R&D, Europe should also pursue accelerator R&D programmes aimed at a broader scientific community. In this regard, the TIARA project, which aims at developing a distributed Test Infrastructure and Accelerator Research Area in Europe, could play an important role.

# Large-scale scientific activities, e

There is also a strong scientific case for an electron-positron collider that could initially study the Higgs properties with high precision, in a way complementary to the LHC, and later be upgraded to higher energy. Already at energies around 250 GeV, such a machine could perform precise and model-independent measurements of the Higgs branching ratios, with sensitivity to most decay modes at the percent level. At energies around 350 GeV, such a machine could perform precision tests of the top quark properties. At energies of 500 GeV and higher, such a machine could explore further Higgs properties, for example the coupling to the top quark, the self-coupling and the total width. It could also search for colour-neutral new particles, for example some dark matter candidates that may have escaped detection at the LHC. **The Japanese initiative to offer to host the ILC opens a new window of opportunity in particle physics.** European groups have already made several crucial contributions to the recently Completed Technical Design Report and are very interested in participating in the ILC project. Until now, it is the Japanese high-energy physics community that has expressed unanimous support for hosting the ILC in Japan. Nonetheless, much progress on the political side has been reported to the ESG meetings and **Europe thus need to be prepared in the event that the Japanese government comes forward with a clear plan for hosting the ILC in Japan and invites Europe to participate.**

# Organisational issues, I

**It is a well-established practice in particle physics that experiments are conducted by a collaboration of institutes from all over the world and the cost of detector construction and operation is shared by all participants.** Accelerators, on the other hand, used to be built and operated by a single national laboratory or by CERN. With the increasing cost of energy frontier machines, it has become more and more difficult for a single country or for CERN on by itself to build such machines with their own resources alone. HERA and LHC are recent examples where external partners contributed to the construction of accelerators by providing parts, expertise, and manpower. This model will become even more common in future energy frontier machines, where the cost and effort for construction and - possibly - operation, will require collaboration on a global scale. After adopting the first Strategy in 2006, in March 2010, the CERN Council approved a set of statements as a framework for Europe's possible future participation in accelerator projects to be constructed globally…… continues over 1 more page, including various ideas (not just one) about organisation of Europe and CERN with respect to an ILC in Japan.

# Web pages: CLIC detector & physics

Until now web-posting for the CLIC detector and physics study has been part of the web page for the CERN LCD project

http://lcd.web.cern.ch/lcd/Welcome.html

**The CLIC detector and physics study needs its own web pages**

We are looking for a volunteer !

This task can easily be done from a remote location