



General news, and report on the CLICdp Advisory Board

CLICdp general meeting, 14 May 2018



Aidan Robson, University of Glasgow & CERN



News since the CLIC Workshop, 22–26 January 2018

- CERN Academic Training Lectures
- CLIC Communications Initiative articles
- CERN Testbeam

European Strategy progress

- Detector Performance note
- Top-quark physics paper
- R&D and BSM reports
- National meetings

Report on CLICdp Advisory Board review

Announcements / reminders

- Wolfgang Kilian at CERN
- CLICdp job opening at Warsaw
- CLICdp August workshop
- Provisional CLICdp Physics Week in January



CERN Academic Training Lectures



- 5 lectures, 5–9 March 2018
- Excellent lectures; reasonable attendance
- From CLICdp:
 - Physics potential of a high-energy e^+e^- collider – Philipp Roloff
 - Detector technology R&D for CLIC – Eva Sicking
- Recordings and slides available, linked from <http://clic.cern>
-> very useful resource

A screenshot of a web browser displaying the CLIC website. The browser's address bar shows 'clic.cern'. The main heading on the page is 'CERN Academic Training lectures on CLIC'. Below this heading is a list of five lecture topics, each preceded by a blue bullet point.

clic.cern

CERN Academic Training lectures on CLIC

- **Physics potential of a high-energy electron-positron collider**
- **Detector technology R&D for CLIC**
- **The CLIC accelerator design and performance**
- **Key technology developments for the CLIC accelerator**
- **Overview of applications using high-gradient acceleration, from photon sources to medical physics**



CLIC Communication Initiative



- Recent articles:

CLIC overview in Europhysics News (Feb 2018)

Towards TeV-scale electron-positron collisions: the Compact Linear Collider

Eva Sicking & Steffen Doebert

X-band article in CERN Courier (April 2018)

High-gradient X-band technology: from TeV colliders to light sources and more

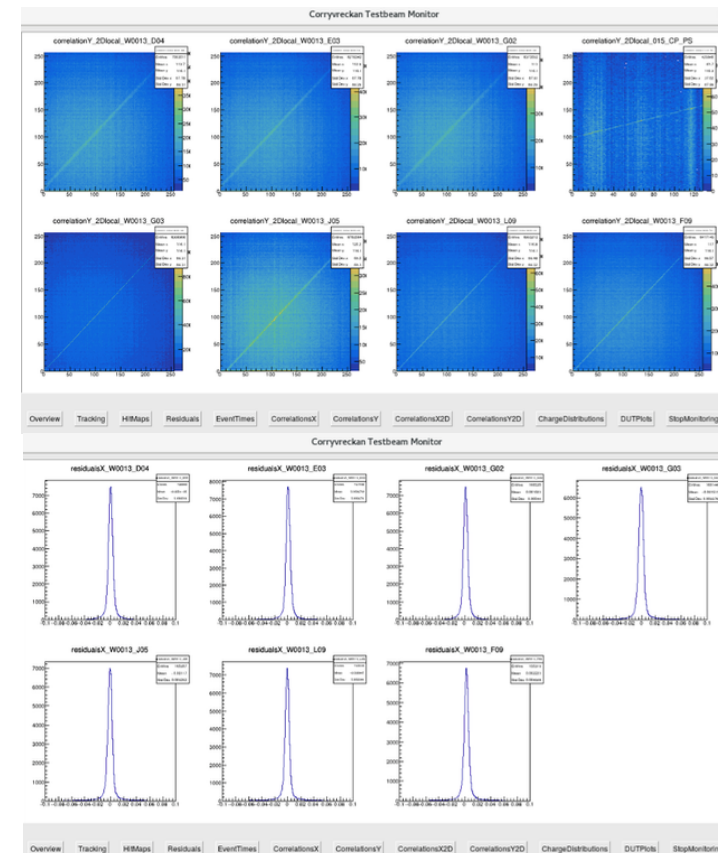
Walter Wuensch

→ both linked from <http://clic.cern>

– as well as reports of CLIC Workshop in CERN Courier and EP newsletter

- CLIC 'statements' in powerpoint form → attached to meeting agenda
Key messages; useful basis for presentations etc. Will be made public.
Please look and send comments **by Wednesday lunchtime**

- First SPS testbeam of the year, 9–16 April
 nice beam
 smooth telescope recommissioning
 first use of new 'Corryvreckan' reconstruction framework at beam
 → provides online DQM with full reconstruction monitoring
 with tracks: correlations, residuals, hitmaps...
- Three bump-bonded (IZM) planar sensor assemblies and one capacitively-coupled HVCMOS assembly with CLICpix2 tested
- Preliminary look: connected parts of sensors working well;
 some issues with uniformity of interconnections
 → further tests ongoing





Detector Performance/Validation Note



- Complete version of the CLICdet detector performance & validation note was available for the Advisory Board review
- -> huge effort in freezing new reconstruction by Emilia, Matthias, Andre and all
- Efforts continue on several improvements e.g. flavour tagging, forward tracking, and forward calorimetry reconstruction
- Note will be updated and released in due course

Editorial Team:

Andre Sailer (CERN) [lead]
 Emilia Leogrande (CERN)
 Matthias Weber (CERN)
 with support from
 Konrad Elsener (CERN)



Prepared for the CLIC Detector & Physics Advisory Board Review
 April 17-18, 2018

A detector for CLIC: main parameters and performance

D. Arominski^{*‡}, Author list is under construction[§],
 E. Leogrande^{1)*}, A. Sailer^{1)*}, M.A. Weber^{1)*}

On behalf of the CLICdp Collaboration

^{*} CERN, Switzerland, [‡] Warsaw University of Technology, Poland, [§] Other University, Country

Abstract

Together with the recent CLIC detector model CLICdet a new software suite was introduced for the simulation and reconstruction of events in this detector. This note gives a brief introduction to CLICdet and describes the CLIC experimental conditions at 380 GeV and 3 TeV, including beam-induced backgrounds. The simulation and reconstruction tools are introduced, and the physics performance obtained is described in terms of single particles, particles in jets, jet energy resolution and flavour tagging. The performance of the very forward electromagnetic calorimeters is also discussed.



CLIC Top Physics paper



- Top physics paper is one of the three major physics sensitivity documents in preparation for European Strategy Update (along with comprehensive Higgs paper and BSM report)
- Aiming for JHEP
- Paper draft was circulated for light review before Advisory Board meeting
- Now approaching completion
 - some final results will be presented in the Physics Analysis working group next Thursday
 - aiming for collaboration circulation next Friday

Editorial Team:

Aidan Robson (University of Glasgow)
 Philipp Roloff (CERN)
 Frank Simon (MPI Munich)
 Rickard Ström (CERN)
 Andrea Wulzer (CERN)
 Filip Źarnecki (University of Warsaw)

Contributor/reviewer:

Marcel Vos (Valencia)

PubComm Lead:

Nigel Watson (University of Birmingham)

Official Readers:

Igor Boyko (JINR)
 Wolfgang Kilian (University of Siegen)



Prepared for the CLIC Detector & Physics Advisory Board review
 April 17-18, 2018

1
2
3
4
5
6
7
8
9
10
11
12
13

Top-Quark Physics at the CLIC Electron-Positron Linear Collider

Author list is being prepared^{*1)}

* [author list is being prepared]

Abstract

The Compact Linear Collider (CLIC) is a proposed future high-luminosity linear electron-positron collider operating at three energy stages, with nominal centre-of-mass energies $\sqrt{s} = 380\text{GeV}$, 1.5TeV , and 3TeV . Its aim is to explore the energy frontier, providing sensitivity to physics beyond the Standard Model (BSM) and precision measurements of Standard Model processes with an emphasis on Higgs boson and top-quark physics. The opportunities for top-quark physics at CLIC are discussed in this paper. The initial stage of operation focuses on top-quark production measurements, as well as the search for rare



R&D and BSM Reports



- R&D and BSM reports intended as CERN Yellow Reports; both to be in good shape by the summer
- R&D: covering vertex and tracker R&D, summaries of CALICE and FCAL work, and DAQ. Structure in place, work started
- BSM: Combination of theory contributions arising from Physics Potential WG, and full simulation studies (including summary of earlier studies to be comprehensive). Regular editorial meetings.

R&D Editorial Team:

Dominik Dannheim (CERN) [lead]
Andreas Nürnberg (Karlsruhe)
Aharon Levy (Tel Aviv)
Katja Krüger (DESY)

BSM Editorial Team:

TH: Jorge De Blas (INFN-Padova)
Roberto Franceschini (Rome)
Francesco Riva (EPFL)
Michael Spannowsky (Durham)
James Wells (Michigan)
Andrea Wulzer (CERN)
Jure Zupan (Cincinnati)

EXP: Philipp Roloff (CERN)
Ulrike Schnoor (CERN)



ESU National Meetings



- At CLIC January workshop I asked to be kept informed of national meetings preparing for ESU, so that we could consider how/when to provide CLIC input.
- So far, aware of three that have taken place:

CH: CHIPP Strategic Workshop, Roadmap Planning, 3–5 April
Daniel Schulte gave a LC summary talk

UK: First strategy discussion meeting, Durham 16–18 April
Aimed for 'mid-career' people
Victoria Martin gave a Higgs Properties talk
CLICdp provided input to several other speakers
→ more formal community-wide meeting 16–17 July

DE: Community strategy workshop on particle physics, Bonn 3–4 May
CLICdp provided input to LC speaker
Philipp Roloff, Ulrike Schnoor & Frank Simon were present
for discussion

→ please continue to let us know about such meetings (in advance!)



CLICdp Advisory Board Meeting

16–17 April 2018

<https://indico.cern.ch/event/707225/>

Aim: to review CLICdp's ongoing activities and preparations for the European Strategy Update with a focus on physics, underpinned by detector/technology development.

Advisory board members

Dave Charlton, Univ. Birmingham (Chair)
Juan Alcaraz Maestre, CIEMAT Madrid
Freya Blekman, Vrije Univ. Brussels
Keisuke Fujii, KEK
Christophe Grojean, DESY
Matthew McCullough, CERN
Sven Menke, MPI Munich
Roger Rusack, Univ. Minnesota
Peter Schleper, Univ. Hamburg
Joao Varela, LIP & Univ. Lisbon
Vincenzo Vagnoni, Bologna Univ. & INFN
Pippa Wells, CERN



Review Material



Material

Principal material for the review:

- The CLIC staging baseline document, CERN-2016-004
- The CLIC Higgs physics paper, Eur. Phys. J. C77 (2017) 475
- The CLIC top physics paper (draft, being prepared for submission to JHEP)
- The detector description:
 - CLICdet: the post-CDR CLIC detector model, CLICdp-Note-2017-001
 - Requirements for the CLIC tracker readout, CLICdp-Note-2017-002
 - A detector for CLIC: parameters and performance (draft note)
- Slides for the talks (available ~1 week before review)

Other useful links:

Recent events:

- CERN Academic Training Lectures on CLIC, 5-9 March 2018
 - In particular:
 - Lecture 1: CLIC: Physics potential of a high-energy e+e- collider
 - Lecture 2: CLIC: Detector technology R&D for CLIC
- CLIC Workshop, 22-26 January 2018
- CLICdp vertex and tracker R&D status and plans summary talk, 20 November 2017
- CLICdp collaboration meeting, August 2017
- Workshop on CLIC physics potential, July 2017
- Workshop on top physics at the linear collider, June 2017
- CERN seminar on CLIC physics (Lucie Linssen), January 2017

Presentations:

- | | |
|--|------------------|
| Context and history of CLICdp | Lucie Linssen |
| Status of the CLIC accelerator | Steinar Stapnes |
| Detector requirements and experimental conditions at CLIC | Andre Sailer |
| Overview of the CLIC detector (incl. reconstruction/performance) | Emilia Leogrande |
| Higgs physics at CLIC | Rosa Simoniello |
| Top-quark physics at CLIC | Marcel Vos |
| Direct & indirect BSM searches at CLIC | Philipp Roloff |
| The CLIC new physics potential | Andrea Wulzer |
| Vertex/tracker technologies | Dominik Dannheim |
| Calorimeter technologies | Frank Simon |
| DAQ/readout considerations | Eva Sicking |
| Outlook on the next 5 years | Aidan Robson |

As much time allocated for discussion as for presentation, plus 3 hours of closed panel time



THANK YOU

to everyone who contributed,
through excellent talks, preparation of
notes and other input, and participation!



Panel feedback



- The panel gave initial oral feedback – slides are available on the indico site
- After discussion, the panel's feedback is restricted only to the collaboration – thought it could be more useful to us this way
- We sent some further information in response to the initial oral feedback, in the cases where points they had raised were already documented (available on indico)
- A short written report with recommendations is in progress
- Summary:

The Advisory Board was highly impressed by the series of very high-quality presentations, complemented by impressive documents demonstrating:

- A wide range of work into understanding better the physics case for CLIC
- Interesting examples of sensitivities worked through in detail, with some intelligent selection of topics
- “In some depth” presentations and discussions of the status, overall detector design and optimisation
- Review talks of the recent R&D progress in CLICdp and CALICE, and how this is shared with other experiments

Thanks to all speakers, and the audience, for the high degree of interactivity and discussion in response to the AB's questions



• In what follows I pick out (and paraphrase!) some points raised, concentrating on those that are shorter-term:

• Physics case:

Should we be more explicit about CLIC/HL-LHC interplay/sensitivities? [usually we have deliberately avoided this]

Can we strengthen the Higgs self-coupling case, by including all processes and using a general EFT framework?

Can we highlight scenarios where we have coverage that are particularly difficult at the LHC? (e.g. compressed spectra, high-multiplicity, low-pT)

What are our synergies with the flavour programme?

Have we missed models where CLIC could have unique capabilities? (e.g. Higgsinos, Higgs portal, ALPs, neutrino models)

Are we exploiting capabilities w.r.t. long-lived particles?

Might we try putting our case explicitly in the context of the 'big questions' of particle physics?

In progress, via Physics Analysis and Physics Potential WGs

→ leading to more general questions e.g. how do we most strongly motivate the 2nd CLIC stage? (is higher 380GeV lumi more valuable?)



- Can we develop a more concrete polarisation running scenario, balancing top/BSM needs and Higgs needs?
- Can we further develop an alignment strategy, bearing in mind the unusual heating environment caused by power-pulsing?
- Could we benefit from increased timing resolution? (for one or more tracker layers? in the calorimeter?)
- Some concern over 'ambition' of detector requirements, e.g. SP resolution → understand effect on physics of lower resolution? Dead channels? [\[some already done\]](#)
- Addressing calorimeter optimisation in materials, granularity etc [\[some already done\]](#)

Preparing for the review was already useful

During the review, the engagement of panel and questions they asked, helps to give 'external' perspective on how to present our case → some good shorter-term and some longer-term suggestions; encouraging that many are already in progress.

Will circulate report once it is available.



Announcements / Reminders



Wolfgang Kilian



- Wolfgang is at CERN for 6 months with TP and EP-LCD
 - WELCOME!
- Take advantage of his presence for extra interaction!





CLICdp job opening at Warsaw



- Reminder: University of Warsaw has an open fixed-term (2-year) research Assistant Professor position
- To work on CLICdp, particularly in top/BSM physics analysis
- Open to those whose PhD was awarded in 2011 or later
- Deadline is TOMORROW, 15th May
- → contact Filip Zarnecki urgently if interested



Speakers Committee



- See twiki up-to-date conference/abstract listings:
- <https://twiki.cern.ch/twiki/bin/view/CLIC/UpcomingConferences>



CLICdp August Workshop



- Next collaboration meeting:
2-day workshop, 28–29 August 2018 at CERN
- <https://indico.cern.ch/event/703821/>
- Please register! There is a block booking of 25 hostel rooms
- We will start contacting people soon for session convening etc.

The screenshot shows the top section of an Indico event page. On the left is the CLIC logo. To its right is the event title "CLIC Detector and Physics Collaboration Meeting". Below the title, the dates "28-29 August 2018" and location "CERN" are listed, with "Europe/Zurich timezone" in smaller text. A search bar with a magnifying glass icon is on the right.

Overview
Timetable
Registration
Participant List
Accommodation
Access Cards
How to get to CERN

The 2-day meeting on the CLIC detector and physics study will start on Tuesday 28 August 08:30 and will end on Wednesday 29 August around 17:30. Most of the time will be devoted to topical sessions, providing an overview of ongoing activities and future plans. In order to allow the participants to get a good overview of the work in CLICdp, we try to avoid parallel sessions. The timetable presently proposed is tentative - sessions can be shortened/extended at a later stage, according to the proposed number of talks.

A CLICdp Institute Board meeting is scheduled for Tuesday lunchtime, 28 August.

The workshop dinner is scheduled for Tuesday evening, 28 August - TBC.



Provisional: January 2019 CLIC Physics Week



- In view of the large CLICdp activity this year and the very active Physics Potential WG, we are considering holding the following CLICdp collaboration meeting and physics workshop as a 'CLIC Physics Week' in January, at the 'usual' CLIC Week time
- This is very provisional, and confirmation depends on the date and format of the CLIC Workshop (and regional LC workshop), which is likely to be later
- For now, please note provisional dates: **21–25 January 2019**