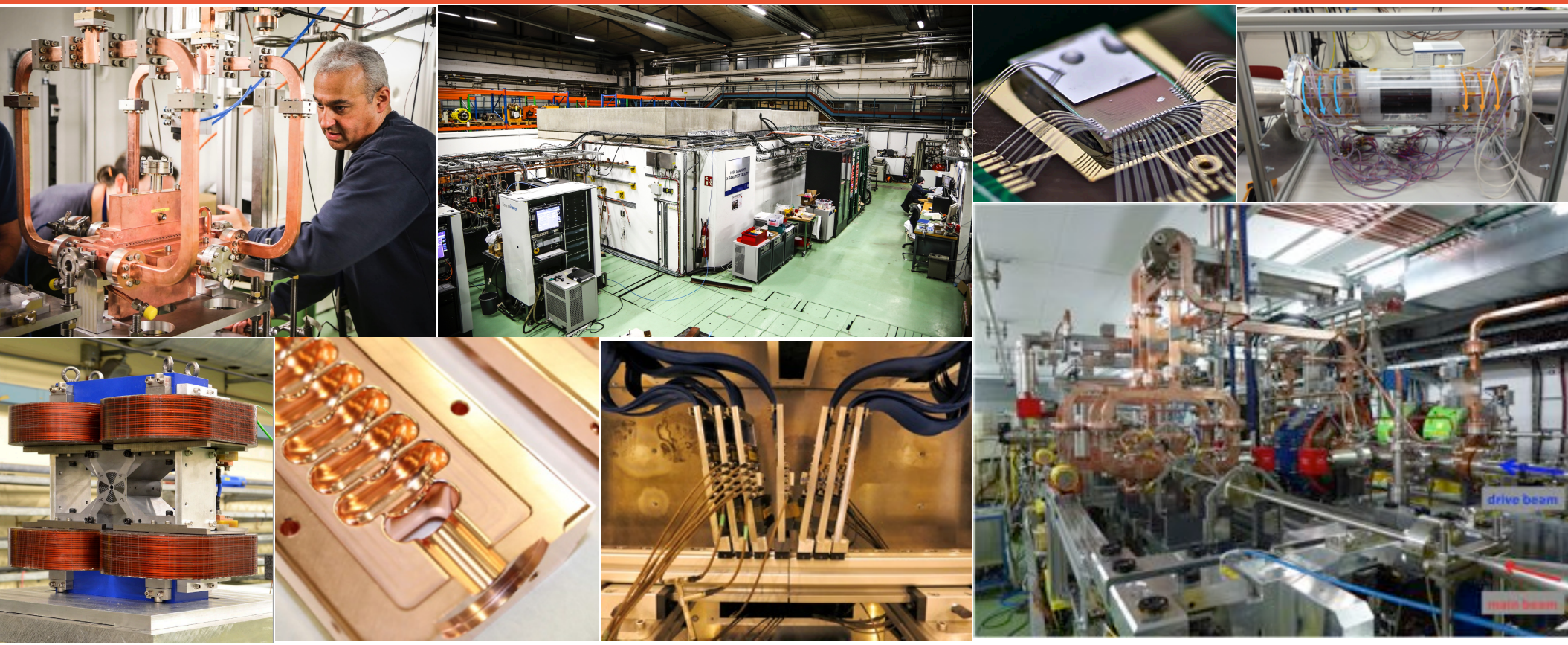
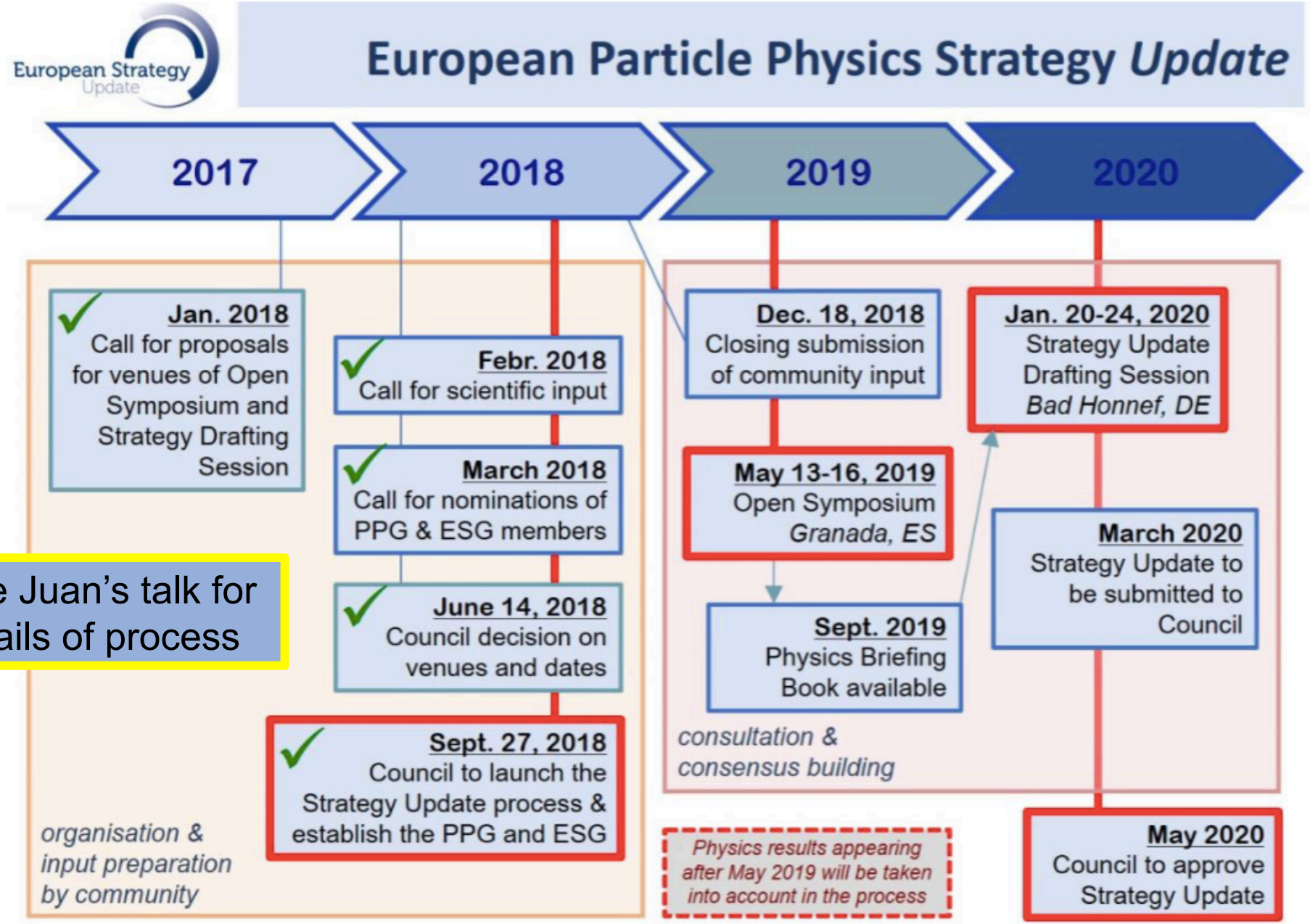
European Strategy Update for CLIC



Linear Collider Workshop, 26 October 2018

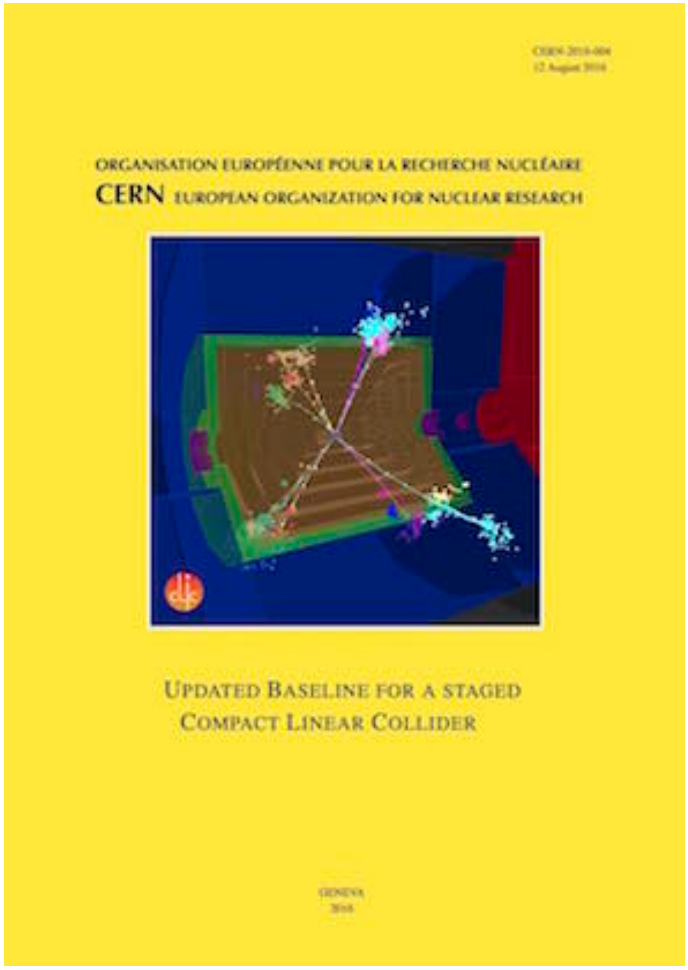
Aidan Robson, University of Glasgow & CERN
on behalf of the CLIC and CLICdp Collaborations

ESU timeline



See Juan's talk for details of process

CLIC Updated Baseline



The Compact Linear Collider (CLIC) is a multi-TeV high-luminosity linear e^+e^- collider under development. For an optimal exploitation of its physics potential, CLIC is foreseen to be built and operated in a staged approach with three centre-of-mass energy stages ranging from a few hundred GeV up to 3 TeV. The first stage will focus on precision Standard Model physics, in particular Higgs and top-quark measurements. Subsequent stages will focus on measurements of rare Higgs processes, as well as searches for new physics processes and precision measurements of new states, e.g. states previously discovered at LHC or at CLIC itself. In the 2012 CLIC Conceptual Design Report, a fully optimised 3 TeV collider was presented, while the proposed lower energy stages were not studied to the same level of detail. This report presents an updated baseline staging scenario for CLIC. The scenario is the result of a comprehensive study addressing the performance, cost and power of the CLIC accelerator complex as a function of centre-of-mass energy and it targets optimal physics output based on the current physics landscape. The optimised staging scenario foresees three main centre-of-mass energy stages at 380 GeV, 1.5 TeV and 3 TeV for a full CLIC programme spanning 22 years. For the first stage, an alternative to the CLIC drive beam scheme is presented in which the main linac power is produced using X-band klystrons.

CERN-2016-004

arXiv:1608.07537

Reference plots for physics, luminosity, power, costs...

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CERN Yellow Report in preparation

- Accelerator parameters
- Cost
- Power
- Site
- Staging
- Construction schedule
- Summary of main technical issues
- Preparation phase summary

Supported by technical documentation in EDMS

Higgs and Top physics

Eur. Phys. J. C (2017) 77:475
DOI 10.1140/epjc/s10052-017-4968-5

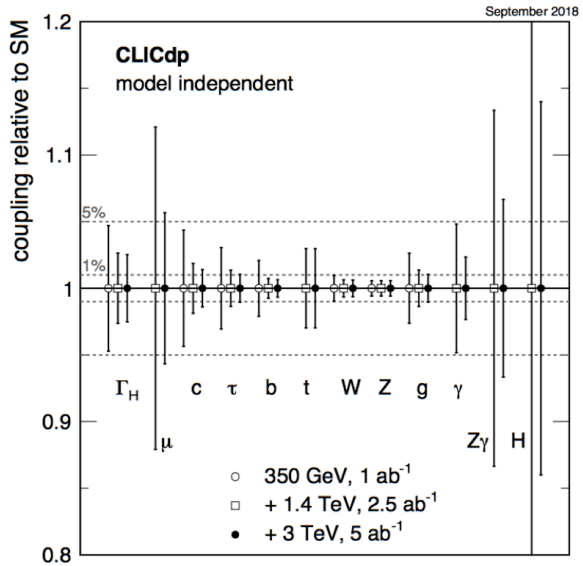
THE EUROPEAN PHYSICAL JOURNAL C

Regular Article - Experimental Physics

Higgs physics at the CLIC electron–positron linear collider

H. Abramowicz[1], A. Abusleme[2], K. Afanaciev[3], N. Alipour Tehrani[4], C. Balázs[5], Y. Benhammou[1], M. Benoit[6], B. Bilki[7], J.-J. Blaising[8], M. J. Boland[9], M. Boronat[10], O. Borysov[1], I. Božović-Jelisavčić[11], M. Buckland[12], S. Bugiel[13], P. N. Burrows[14], T. K. Charles[5], W. Daniluk[15], D. Dannheim[4], R. Dasgupta[13], M. Demarteau[7],

arXiv: 1608.07538,
Eur. Phys. J. C77 (2017) 475



Comprehensive full-simulation Higgs studies; model-independent and model-dependent fits to couplings. Sensitivities with new luminosity scenario are in this year's documents (g_{HZZ} 0.6%, Higgs self coupling 10%)

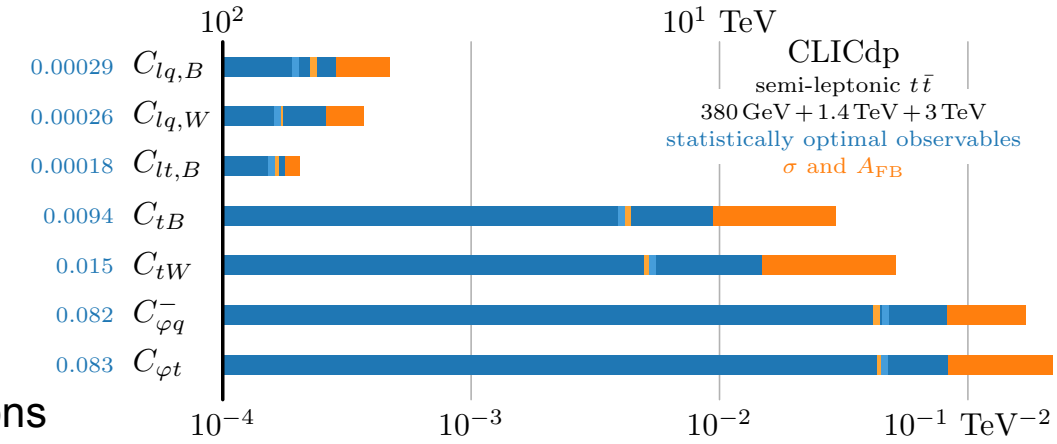
PREPARED FOR SUBMISSION TO JHEP

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

CLICdp collaboration

H. Abramowicz,[1] N. Alipour Tehrani,[2] D. Arominski,[2,a] Y. Benhammou,[1] M. Benoit,[3]

arXiv: 1807.02441, in journal review



Top mass, cross-section, asymmetry, boosted reconstruction, EFT fits and model-based interpretations

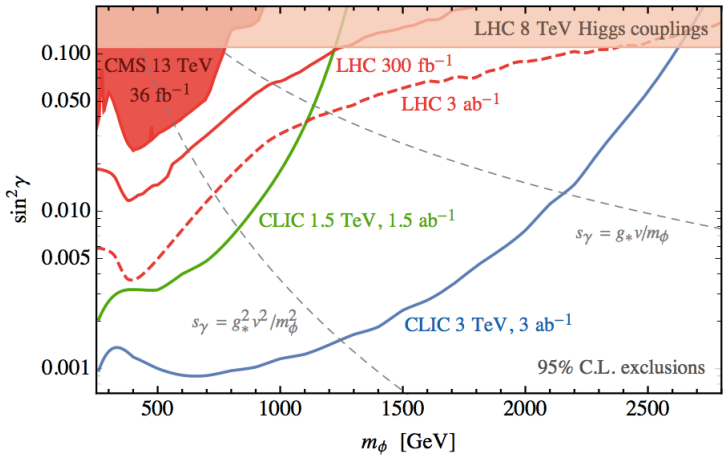
Beyond-Standard Model physics

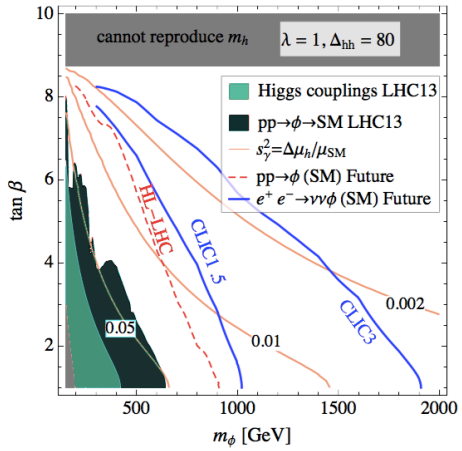
Collaboration with theorists through the CLIC Physics potential working group:

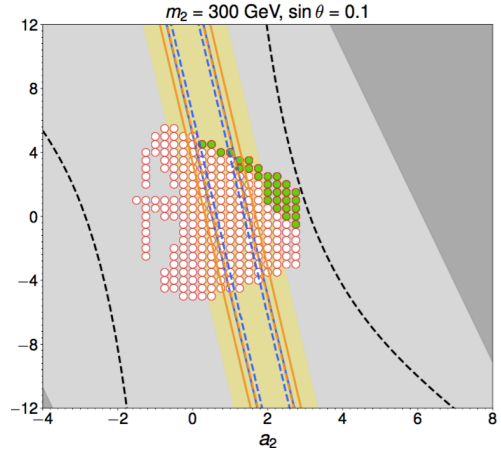
The CLIC Potential for New Physics

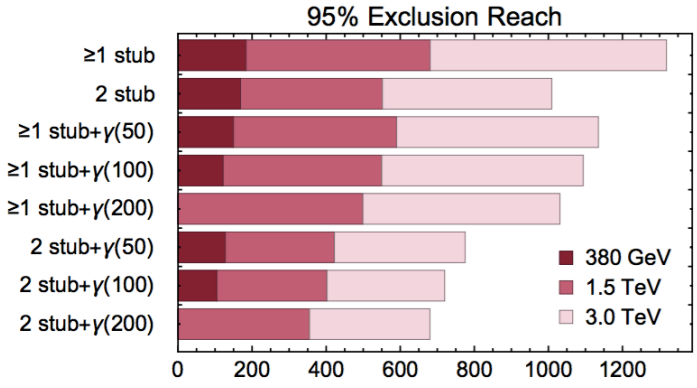
- Standard Model Effective Field Theory
- Direct Searches
  - Electroweak symmetry breaking
  - Dark matter
  - Baryogenesis
  - New neutrinos
  - Simplified models
- Flavour physics

CERN Yellow Report in preparation









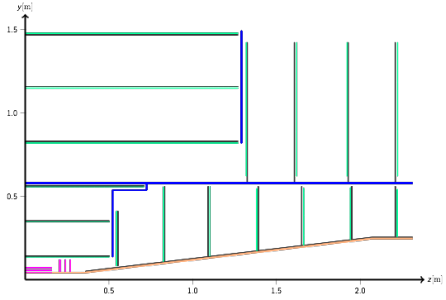
CLIC Detector Model

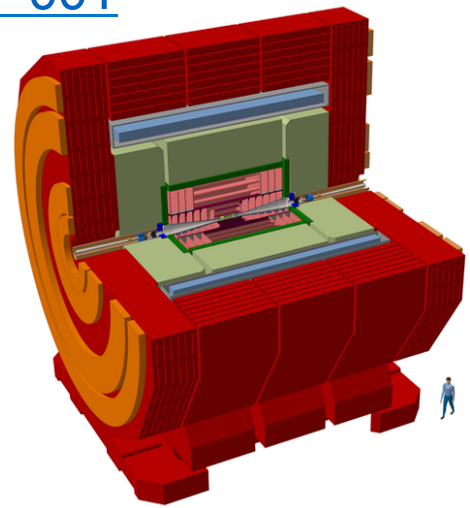
CLICdp-Note-2017-001
23 February 2018

CLICdet: The post-CDR CLIC detector model

N. Alipour Tehrani*, J.-J. Blaising†, B. Cure*, D. Dannheim*, F. Duarte Ramos*, K. Elsener*, A. Gaddi*, H. Gerwig*, S. Green‡, C. Grefe§, D. Hynds*, W. Klempt*, L. Linssen*, N. Nikiforou*, A. Nurnberg*, J.S. Marshall‡, M. Petric*, S. Redford*, P. Roloff*, A. Sailer*, F. Sefkow¶, E. Sicking*, N. Siegrist*, F. Simon‖, R. Simoniello*, S. Spannagel*, S. Sroka*, L.R. Strom*, M.A. Weber*

[CLICdp-Note-2017-001]





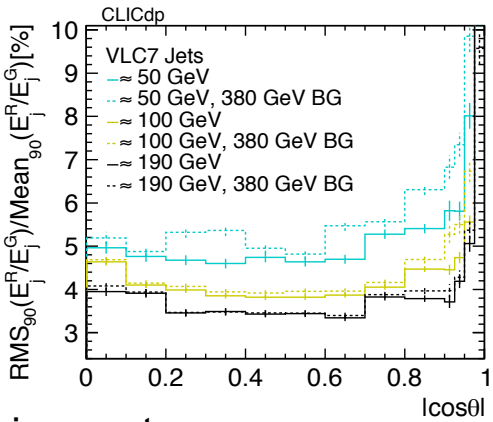
Design choices, detector parameters and optimisation

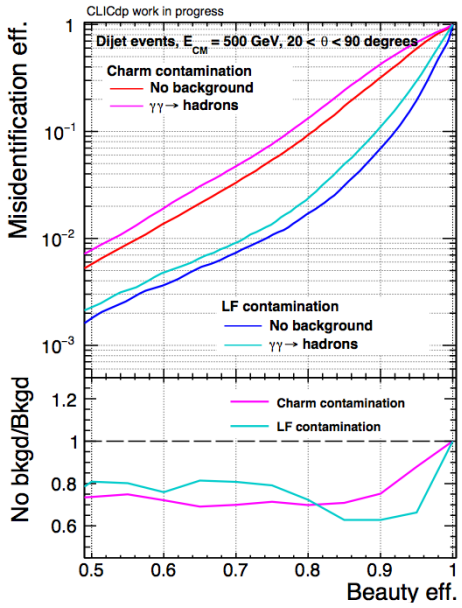
In collaboration review

CLICdp-Draft-2018-004
21 October 2018

1

2 **A detector for CLIC: main parameters and performance**





Experimental conditions, beam backgrounds, detector requirements
Tracking, jet energy resolution, flavour tagging performance

Detector R&D

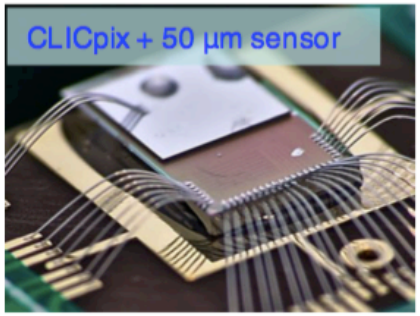
DETECTOR TECHNOLOGIES FOR CLIC

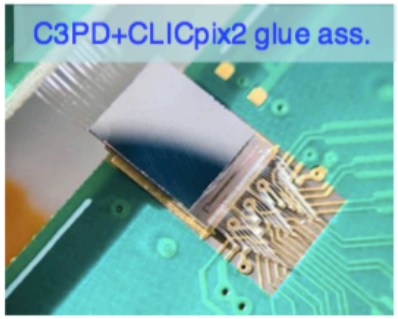
GENEVA
2018

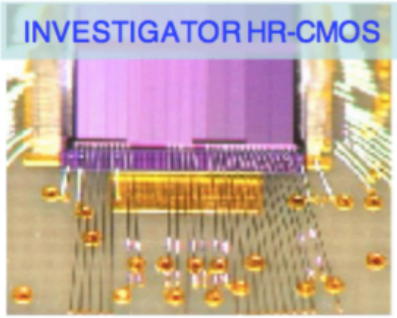
CERN Yellow Report in preparation

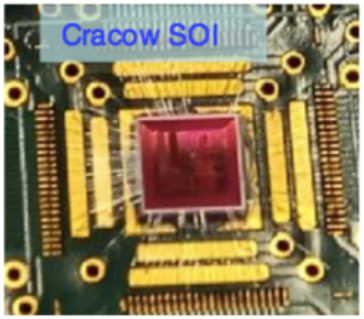
Main detector technology demonstrators:

- Vertex and tracking detectors
- Calorimetry
- Very forward calorimetry
- Readout electronics and data acquisition system

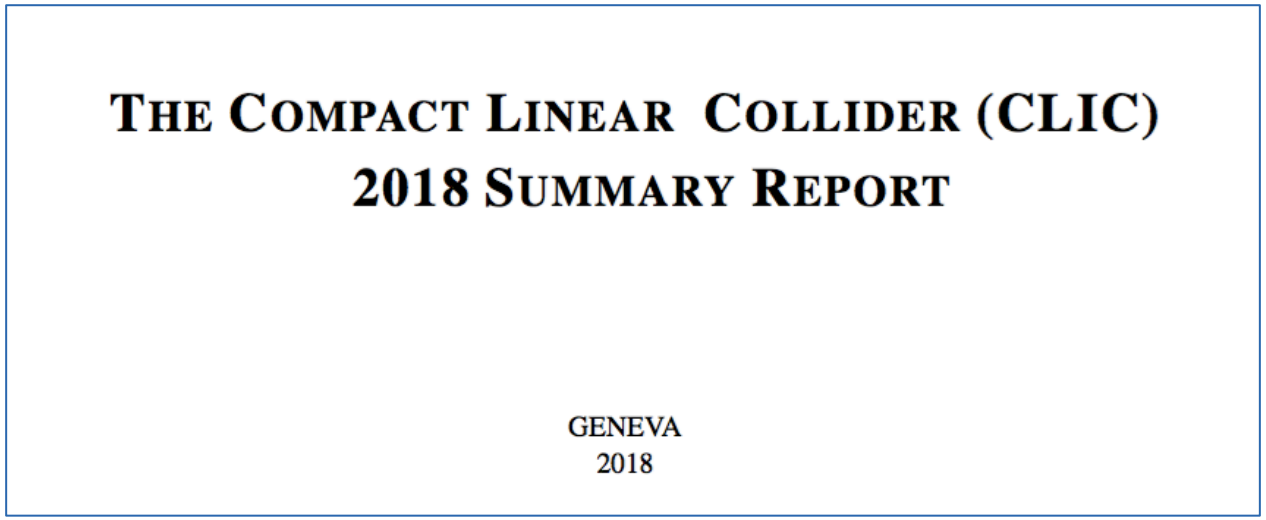








Summary report


THE COMPACT LINEAR COLLIDER (CLIC)
2018 SUMMARY REPORT

GENEVA
2018

CERN Yellow Report in preparation

CLIC physics overview
CLIC accelerator design, technologies and performance
CLIC detector design, technologies and performance
CLIC project implementation
Future opportunities
CLIC objectives for the period 2020-2025

Updated Baseline for a Staged Compact Linear Collider
arXiv: 1608.07537, CERN-2016-004 ✓

Higgs Physics at the CLIC Electron-Positron Linear Collider
arXiv: 1608.07538, Eur. Phys. J. C77 (2017) 475 ✓

The optimised CLIC detector model CLICdet
CLICdp-Note-2017-001 ✓ and CLICdet detector validation note ✓

Top-quark physics at the CLIC electron-positron linear collider
arXiv: 1807.02441, in journal review ✓

The CLIC Potential for New Physics
CERN Yellow Report on extended BSM studies <= to be completed in 2018 ✓

Detector Technologies for CLIC
CERN Yellow Report on detector technology demonstrators <= to be completed in 2018 ✓

The CLIC Project Implementation Plan
CERN Yellow Report on accelerator status <= to be completed in 2018 ✓

The Compact Linear Collider CLIC, 2018 summary report
CERN Yellow Report <= to be completed in 2018 ✓

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The Compact Linear Collider CLIC, 2018 summary report
CERN Yellow Report <= to be completed in 2018 ✓

Official short ESU submissions (~10 pages):
1) CLIC project (accelerator + detector)
2) CLIC physics

CLICWEEK2019

Compact Linear Collider Workshop

January 21 - 25, 2019 @ CERN

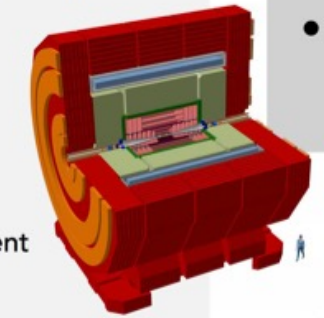
Accelerator technology, high-gradient structures, and low-emittance beams

- Advanced radio frequency technologies: high-efficiency klystrons, pulse compressors, components, and accelerating structures

- Low emittance beams: beam dynamics, damping rings, beam delivery, instrumentation, alignment, stabilization
- Staged approach: from a 380 GeV Higgs/top factory to TeV energies

Detector technology and software

- Detector R&D: new prototype designs, simulation studies, and test-beam results for tracking detectors and calorimeters
- Software for detector geometry, simulation and reconstruction (DD4hep)
- Tracking and particle flow reconstruction
- Distributed data management and computing (iLCDirac)



Precision physics: Higgs, top, and BSM

- CLIC potential for precision measurements of the Higgs boson and top-quark properties, and the flavour sector
- Global interpretation using Standard Model effective field theory
- Signatures for direct discovery at CLIC, complementarity with indirect probes and hadron colliders

e^+e^- collisions at the energy frontier!

Learn more about CLIC here

clicw2019.web.cern.ch