A first dive into CLIC

OCT. 20 2018 ROBERTO FRANCESCHINI & MICHAEL SPANNOWSKY (CLIC PHYSICS POTENTIAL WG)

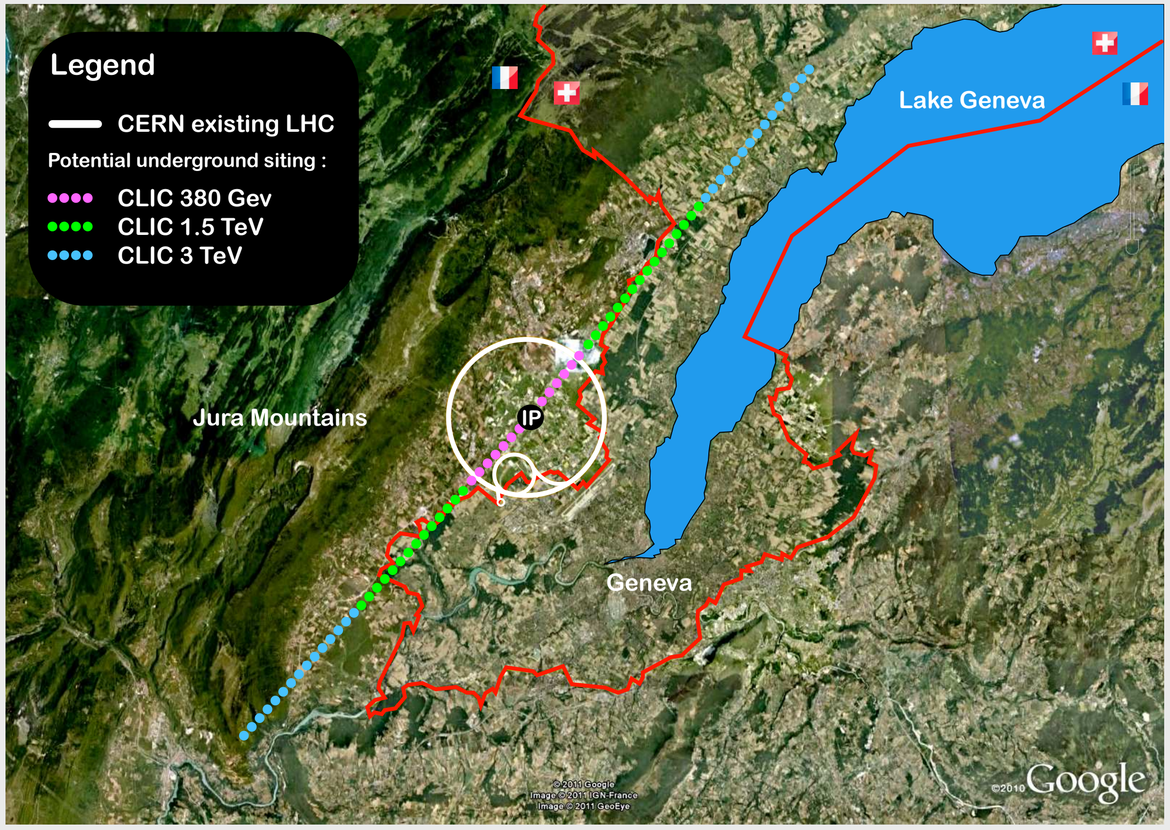
Searches for long-lived particles at the LHC: Second workshop of the LHC LLP Community, Oct 17-20, 2017, ICTP, Trieste, Italy

Outline

- General info on CLIC and detectors
- What could be interesting for LLP and other exotica

A novel accelerator concept

- Accelerator concept fully proven at Clic Test Facility 3
- Unprecedented acceleration gradient around 100 MeV/m
- Staged construction: 380 GeV, 1.5 TeV, 3.0 TeV



Post-LHC operation (data in 2035)

2013 - 2019 Development Phase

Development of a Project Plan for a staged CLIC implementation in line with LHC results; technical developments with industry, performance studies for accelerator parts and systems, detector technology demonstrators

2020 - 2025 Preparation Phase

Finalisation of implementation parameters, preparation for industrial procurement, Drive Beam Facility and other system verifications, Technical Proposal of the experiment, site authorisation

2026 - 2034 Construction Phase

Construction of the first CLIC accelerator stage compatible with implementation of further stages; construction of the experiment; hardware commissioning

2019 - 2020 Decisions

Update of the European Strategy for Particle Physics; decision towards a next CERN project at the energy frontier (e.g. CLIC, FCC)

2025 Construction Start

Ready for construction; start of excavations

2035 First Beams

Getting ready for data taking by the time the LHC programme reaches completion

Detector concept(s)

CLICdp-Note-2017-001
01 March 2017

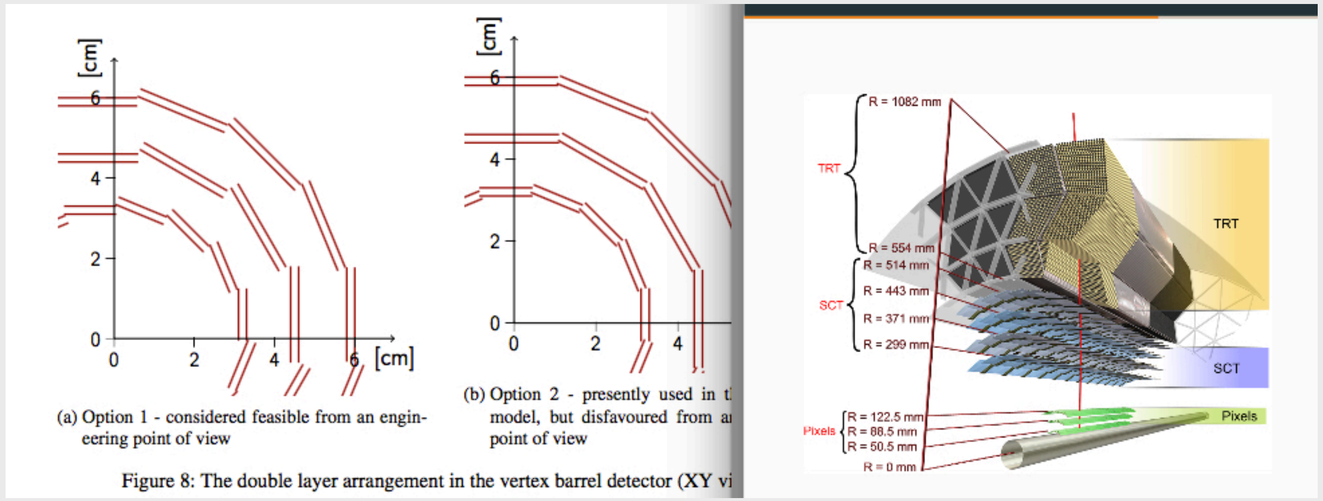
CLICdet: The post-CDR CLIC detector model

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. Nürnberg*, 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*, R. Ström*, M.A. Weber*

Tracker

CLICdp-Note-2017-001

CLOSER TO THE BEAM



Track-reco algorithms might work within the first few centimeters

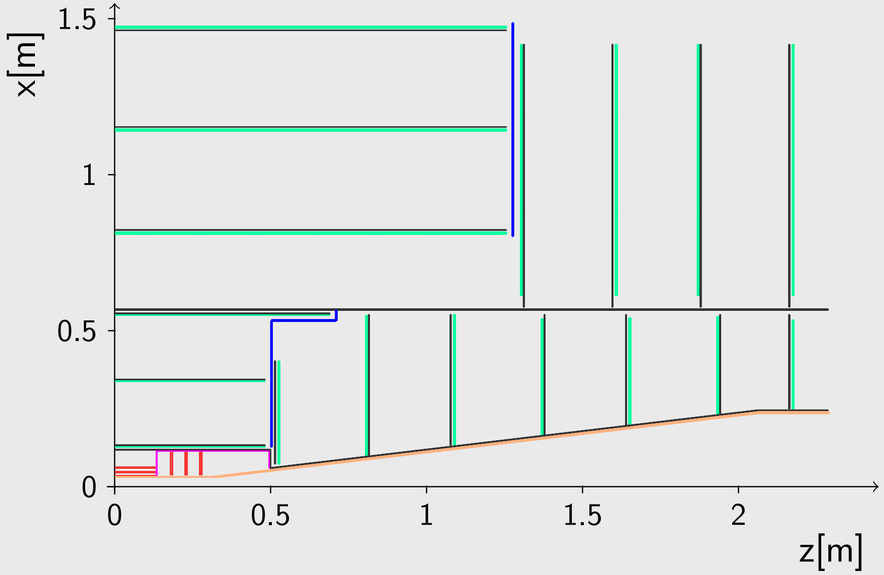
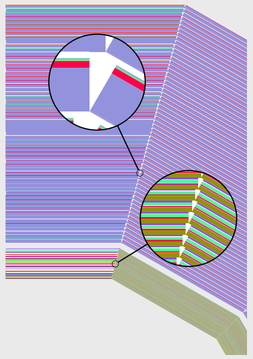


Figure 13: XZ-view of the tracker as implemented in the simulation model. The black lines indicate the tracker support structures including cooling and cables, the green lines represent the tracker sensor layers. The blue lines show the main support tube and the interlink structures. The orange line indicates the vacuum tube. The vertex detector is shown in the centre (in red). Cables going outwards from the vertex detector are represented in magenta.

Calorimeter

CLICdp-Note-2017-001

FINELY SEGMENTED



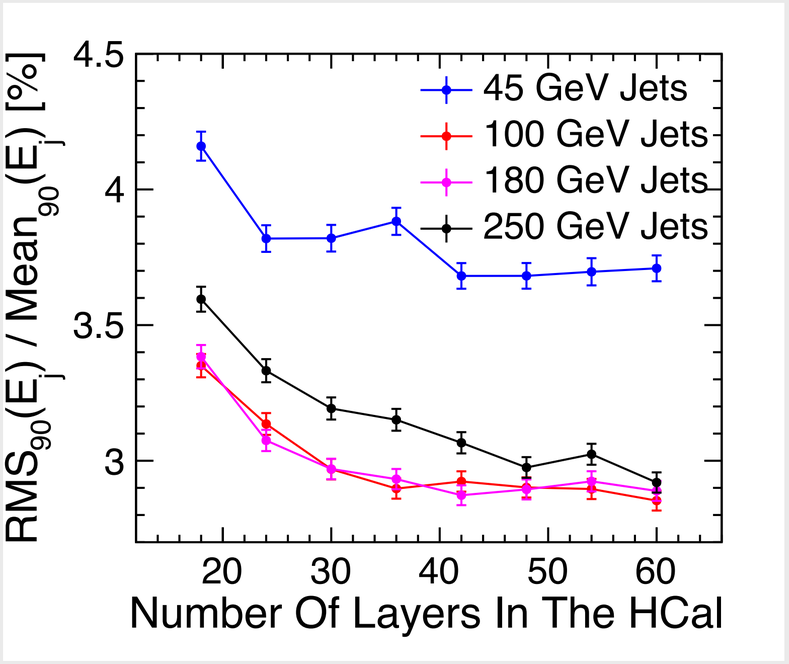
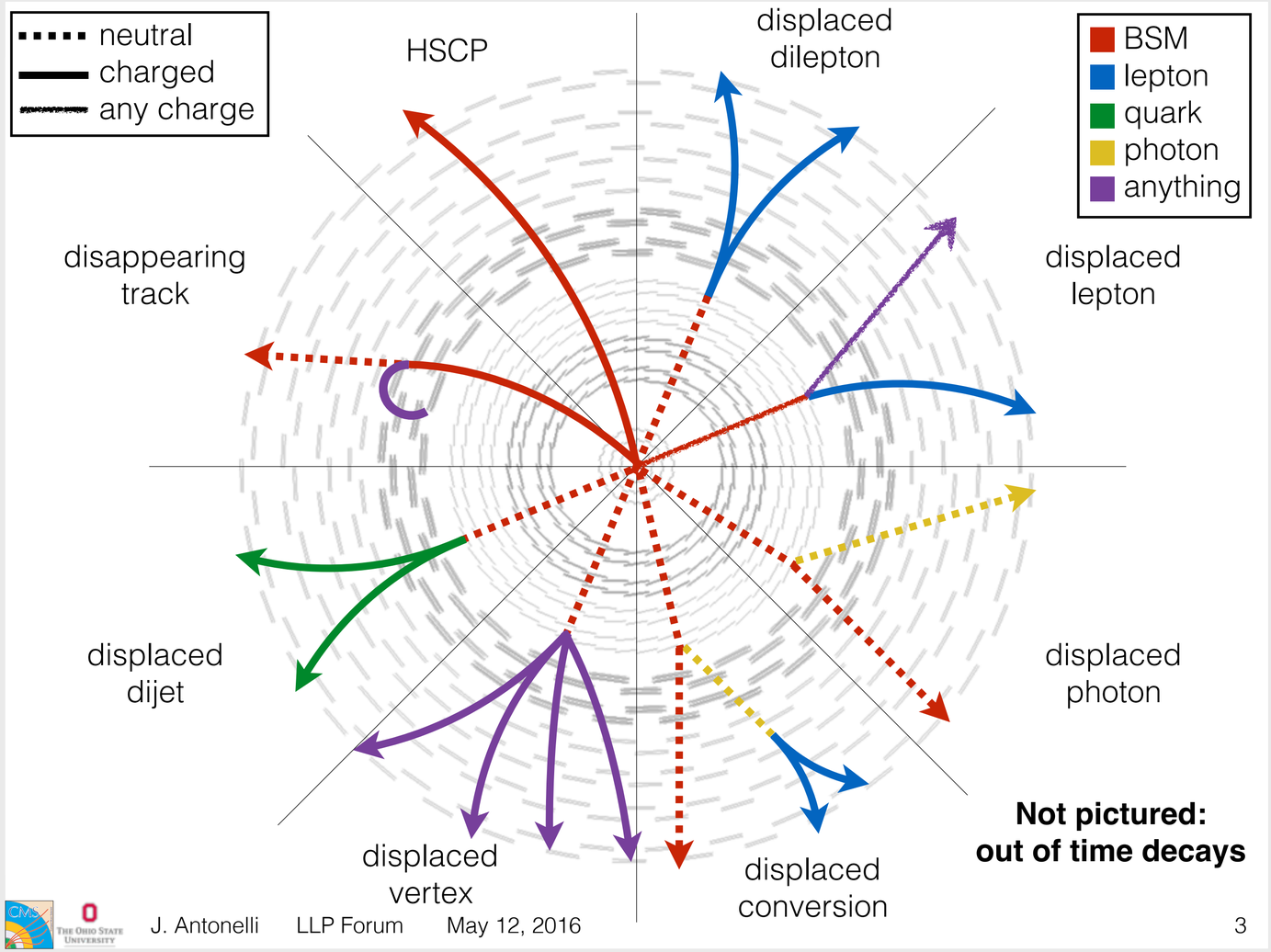


Figure 23: Jet energy resolution in the ILD detector for jets of different energies, as a function of the number of HCAL layers, keeping the number of λ_I constant.

Table 14: Parameters for the HCAL segmentation as implemented in the simulation model, with a total of 60 Fe-Scintillator layers.

Function	Material	Layer thickness [mm]
Absorber	steel	19
Space	air	2.7
Cassette	Steel	0.5
PCB	mixed	0.7
Conductor	Cu	0.1
Scintillator	Polystyrene	3
Cassette	Steel	0.5
Total between steel plates		7.5
Total Fe-scint. layer		26.5

LLP & Exotica @ e^+e^-



Clean Experimental Environment

NO TRIGGER

NO QCD BACKGROUND

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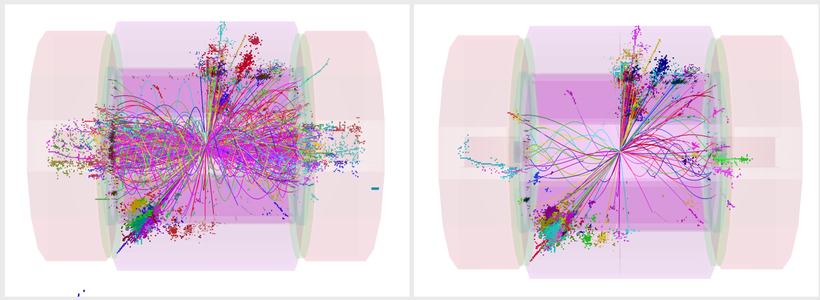


Fig. 2.12: (left) Reconstructed particles in a simulated $e^+e^- \to H^+H^- \to t\bar{b}b\bar{t}$ event at 3 TeV in the CLIC_ILD detector concept with background from $\gamma\gamma \to$ hadrons overlaid. (right) the effect of applying tight timing cuts on the reconstructed cluster times.

Physics Potential WG

CLIC-HERE HTTP://CLICDP.WEB.CERN.CH/CONTENT/WG-PHYSICS-POTENTIAL

CLICdp

CLIC detector and physics study

HOME | COLLABORATION | ORGANISATION | DOCUMENTS & PUBLICATIONS | OUTREACH | USEFUL LINKS | GALLERIES

ORGANISATION

- Institute Board
- Executive Team
- Working groups
  - WG Physics Analysis
  - WG Physics Potential
  - WG Vertex and Tracking Detector Technology
  - WG Detector Optimisation and Validation

WG Physics Potential

Conveners: *Jorge de Blas*, *James Wells*, *Andrea Wulzer*

This working group coordinates the theory community effort to assess the CLIC potential to discover cracks in the Standard Model. The physics picture that is emerging from the LHC results and the recent completion of the CLIC feasibility study and detector design, make this assessment particularly timely, in preparation of the forthcoming update of the European Strategy.

New physics might be discovered at CLIC either indirectly, through precise measurements showing departures from the Standard Model predictions, or via the direct observation of new particles. Both aspects will be investigated under several beyond-the-Standard Model perspectives. A summary of ongoing activities and the corresponding contact persons is reported below.

Kick-off Meeting

CLIC-HERE HTTPS://INDICO.CERN.CH/EVENT/632228/

Physics at CLIC

17-18 July 2017
CERN
Europe/Zurich timezone

Search...

- Overview
- Timetable
- Contribution List
- Registration
- List of Participants
- Computer Access
- Health insurance, VISA
- Accommodation

The physics picture that is emerging from the LHC results and the recent completion of the CLIC feasibility study and detector design, make an assessment of the CLIC physics potential particularly timely, in preparation of the forthcoming update of the European Strategy. A dedicated working group was recently set up at CERN, with the purpose of collecting and coordinating the theory community effort in this direction. This workshop is the kickoff meeting of this initiative. Topics include direct or indirect searches for new physics, from any beyond-the-SM perspective, that are relevant for the CLIC experimental program.

Starts 17 Jul 2017, 07:25
Ends 18 Jul 2017, 19:30
Europe/Zurich

CERN
503-1-001 - Council Chamber

So far…

- mostly standard signatures analyses (MSSM, Z' …) but in progress studies on compressed spectra (e.g. Higgsino)

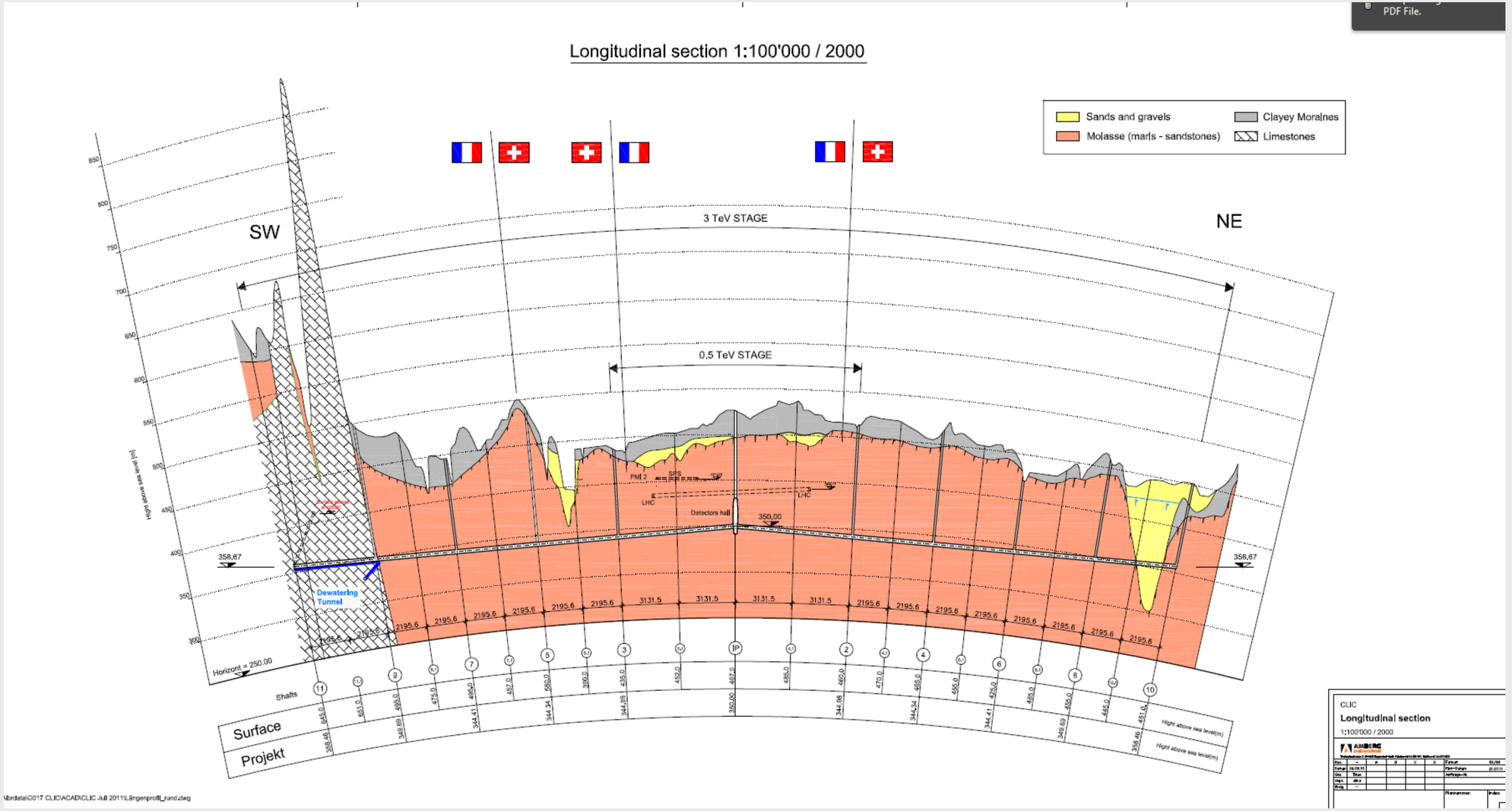
- Interest for all signals involving soft mono-photon, stub-tracks, appearing and disappearing tracks, milli-charged …

Your Ideas And Inputs Are Very Welcome

- Follow-up meetings & Document in 2018 for the Update of the European Strategy for Particle Physics

Thank you!

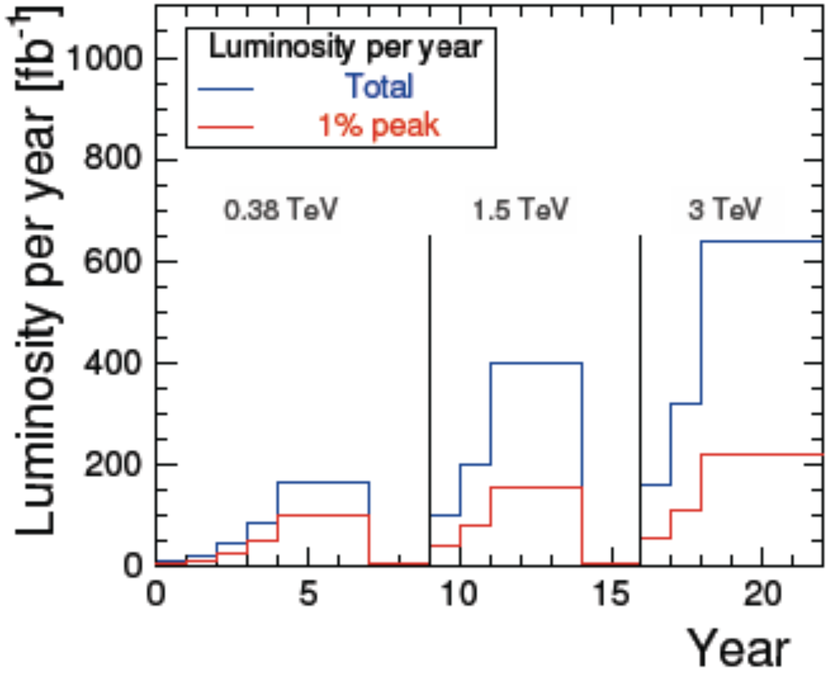
Planned Site



Planned Cost and Running

Table 11: Value estimate of CLIC at 380 GeV centre-of-mass energy.

	Value [MCHF of December 2010]
Main beam production	1245
Drive beam production	974
Two-beam accelerators	2038
Interaction region	132
Civil engineering & services	2112
Accelerator control & operational infrastructure	216
Total	6690



A beam dump at the Linear Collider?

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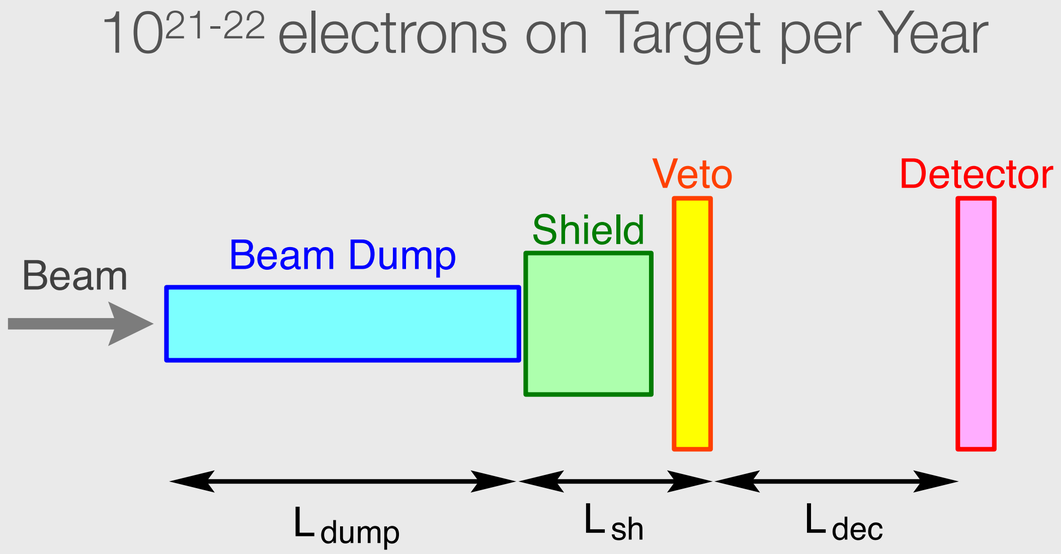

FIG. 1: Schematic view of BD*ee*. The electron (or positron) beam is injected into the beam dump from the left.

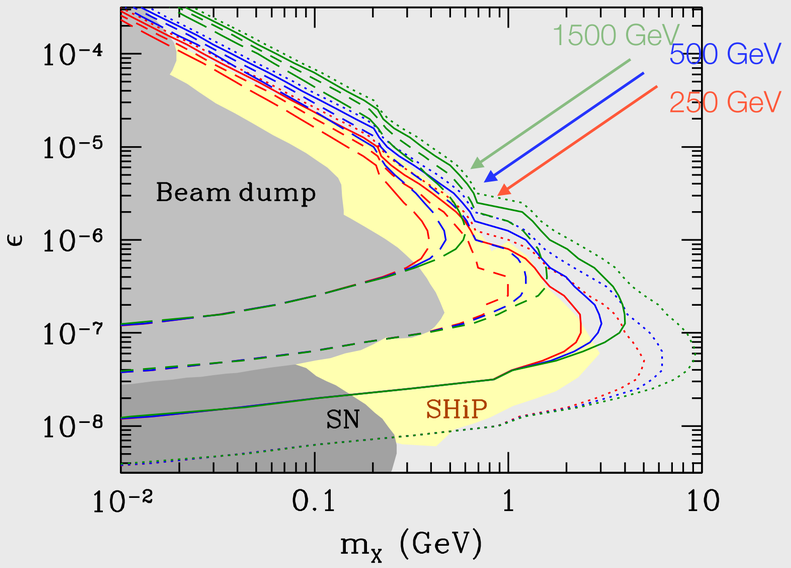

FIG. 2: Contours of constant $N_{\rm sig}$ on the m_X vs. ϵ plane for $E_{\rm beam} = 250$ (red), 500 (blue), and 1500 GeV (green), taking $N_e = 4 \times 10^{21}$, $L_{\rm dump} = 11$ m, $L_{\rm sh} = 50$ m, and $L_{\rm dec} = 50$ m. The dotted, solid, short-dashed, and long-dashed lines correspond to $N_{\rm sig} = 10^{-2}$, 1, 10^2, and 10^4, respectively. The gray-shaded regions are already excluded by past beam dump experiments [10] (light-gray) or supernova bounds [14] (dark-gray), while SHiP experiment, if approved, will cover the yellow-shaded one [15].