

# CLIC

## Perspectives and implications for DESY

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DESY FLC Strategy Retreat

Albersdorf, Dec 4, 2017



# Content

**Reminder**

**CLIC plans**

**Opportunities for DESY**



# Summary of the KET e+e- workshop

Munich, May 2016

## My Pros and Cons Matrix

### CLIC Physics Case

- Energy reach for possible new states
- High energy - high Higgs production cross section
  - > 1 million Higgs at 1.4 and 3 TeV
- Top physics
- **Second most favoured option after ILC and before circular machines**

Topic	CEPC	FCC-ee	ILC	CLIC
Higgs Mass, couplings	+	+	+	+
Higgs self-coupling	-	+-	+	+
Top physics	-	+	+	+
ew- precision parameters	+	+	+-?	?
BSM	-	+-	+-	+
Flexibility to new high mass signal	-	-	+-	+
Maturity of project (not age!)	-	-	+	-
Detectors	-	-	+	+
Start 2035	-	-	+	-

# Summary of the KET e+e- workshop

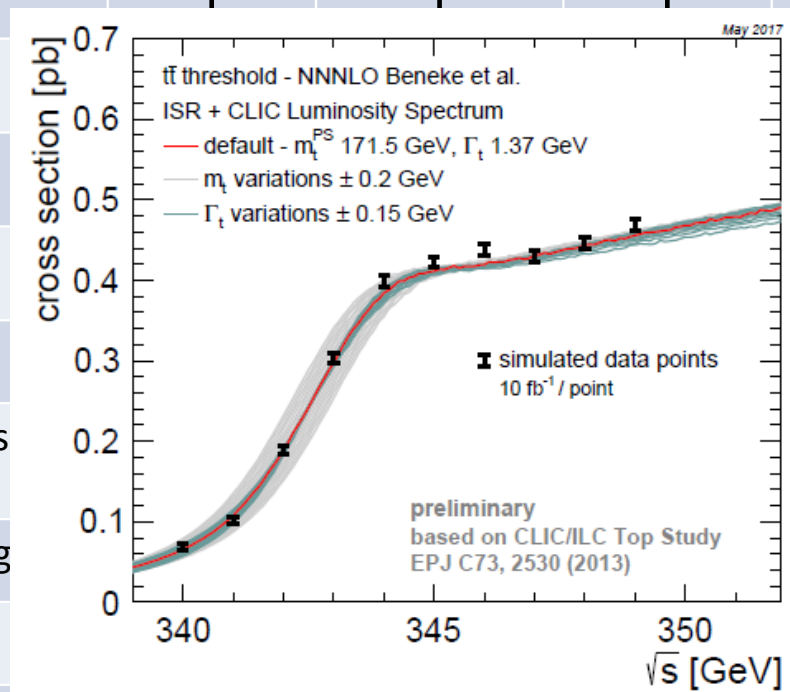
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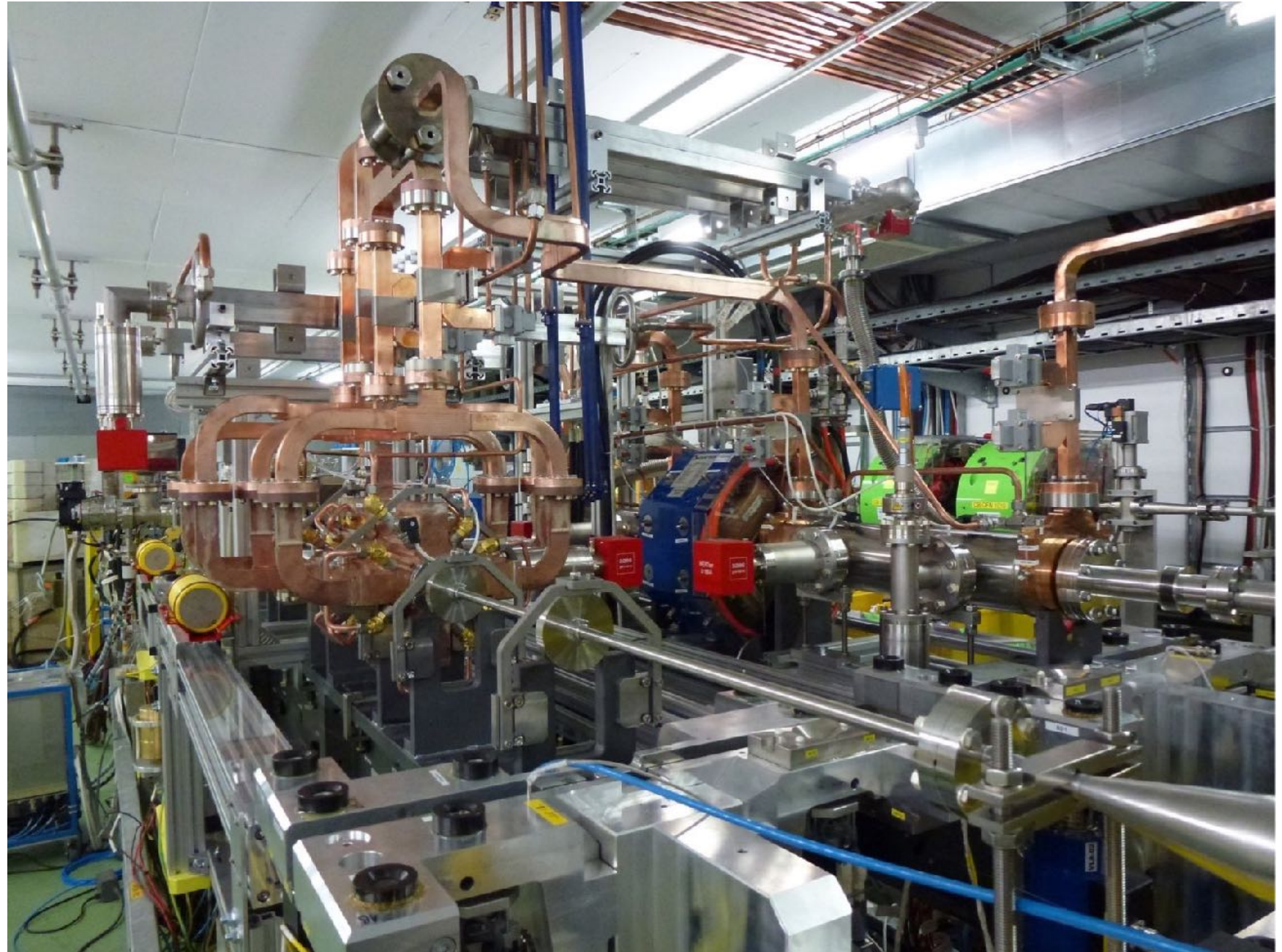




# Challenges

## Machine

- Drive beam concept
- Interaction region
- Power budget

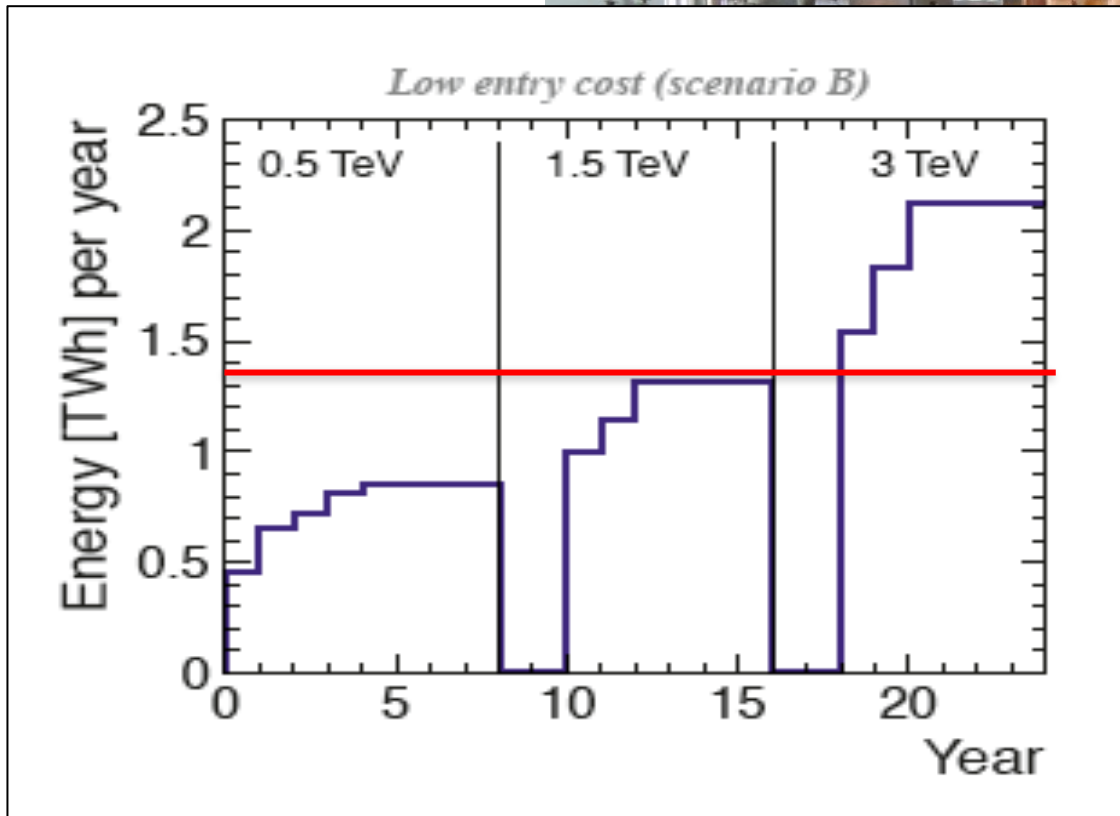
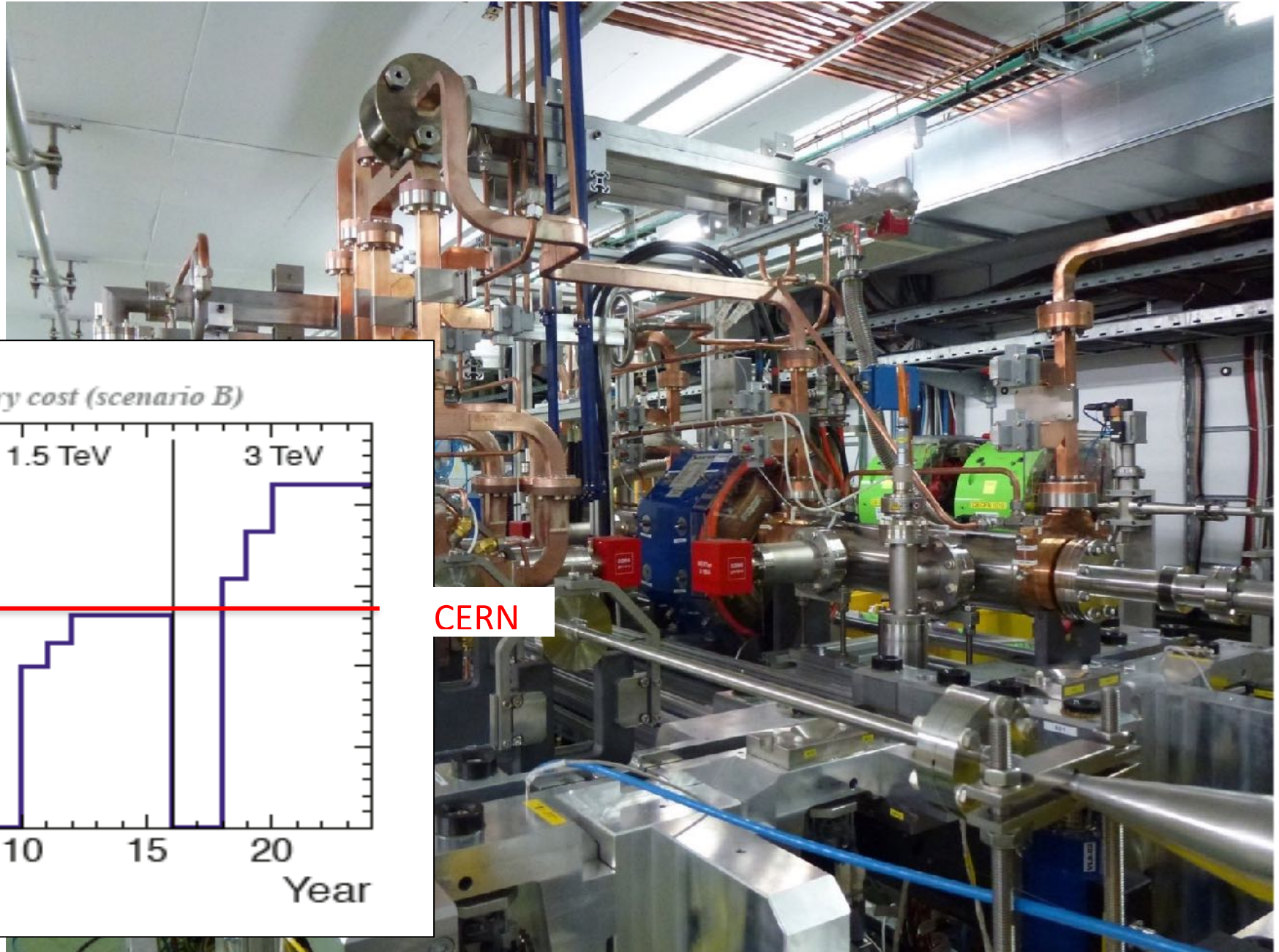




# Challenges

## Machine

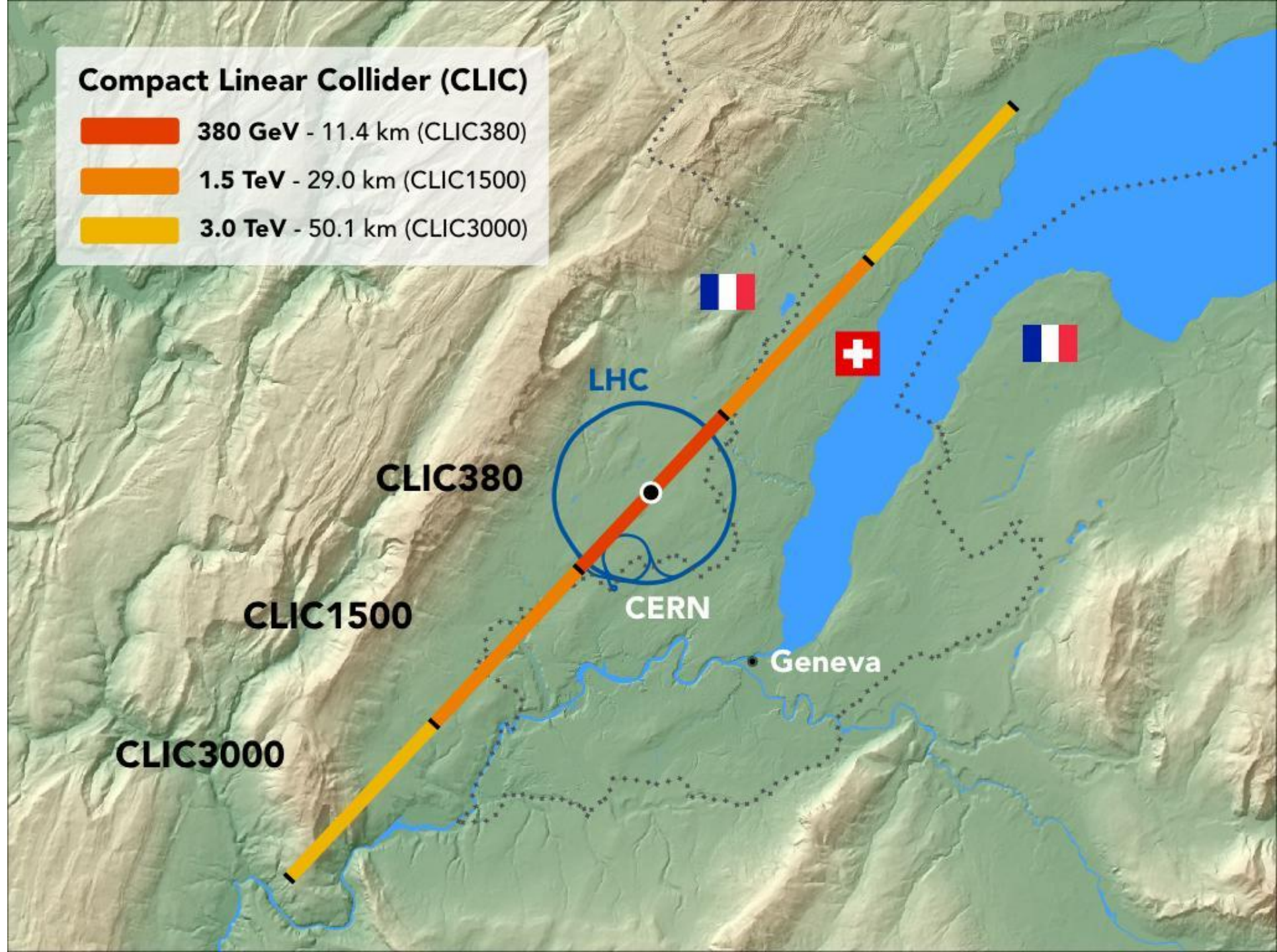
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- Power budget



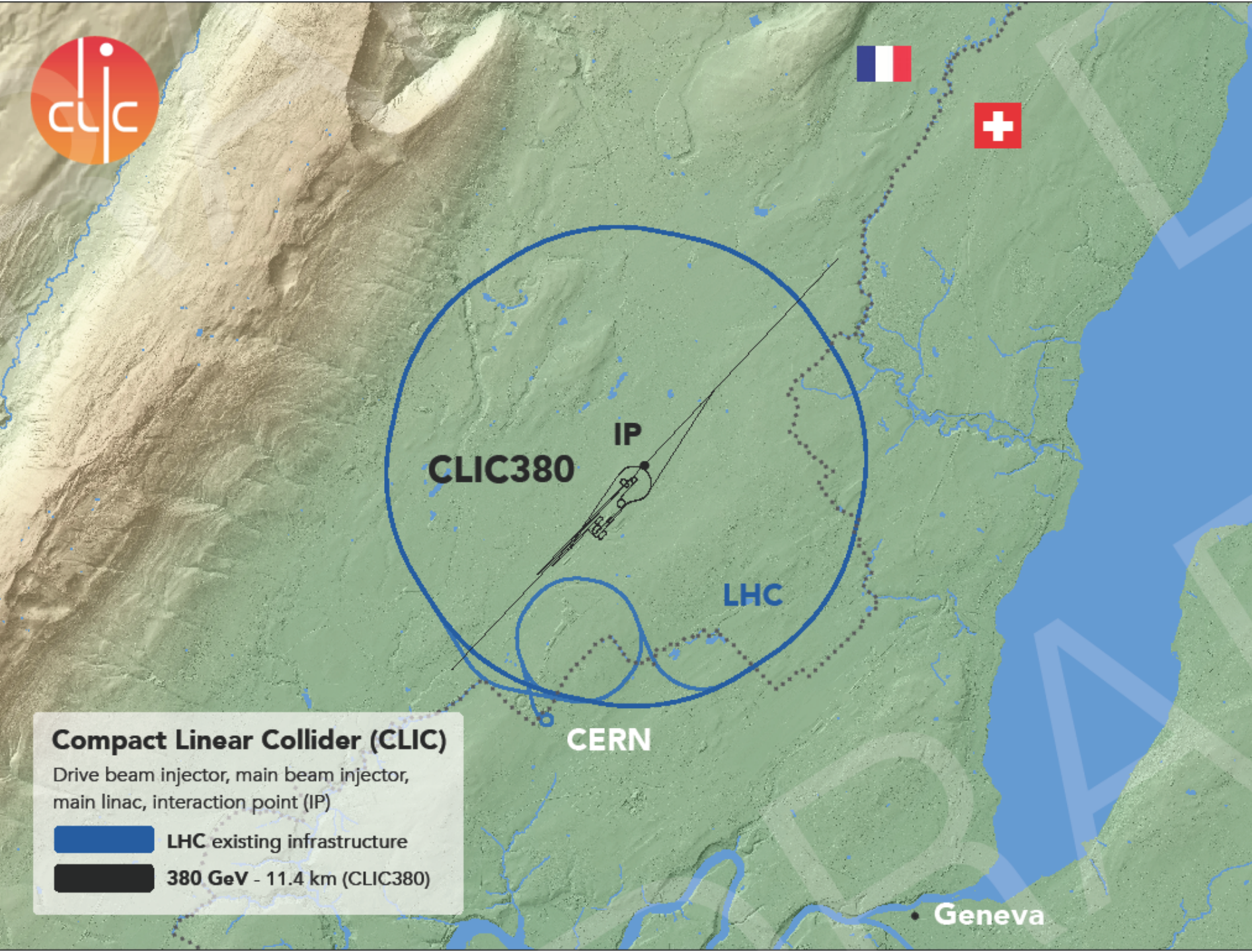


## Compact Linear Collider (CLIC)

- 380 GeV - 11.4 km (CLIC380)
- 1.5 TeV - 29.0 km (CLIC1500)
- 3.0 TeV - 50.1 km (CLIC3000)


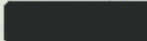




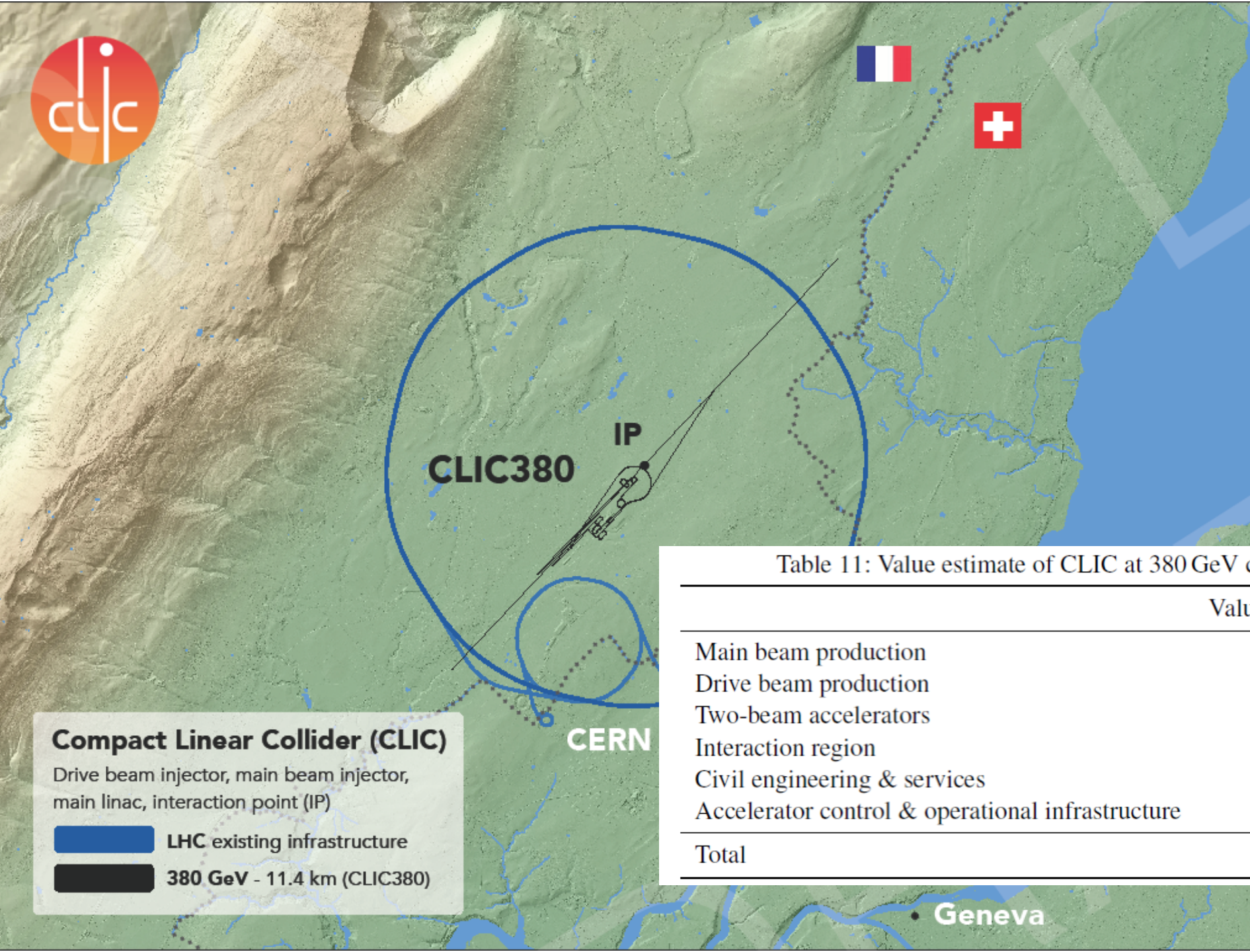


### Compact Linear Collider (CLIC)

Drive beam injector, main beam injector,  
main linac, interaction point (IP)

-  LHC existing infrastructure
-  380 GeV - 11.4 km (CLIC380)





Klystron version  
5% cheaper

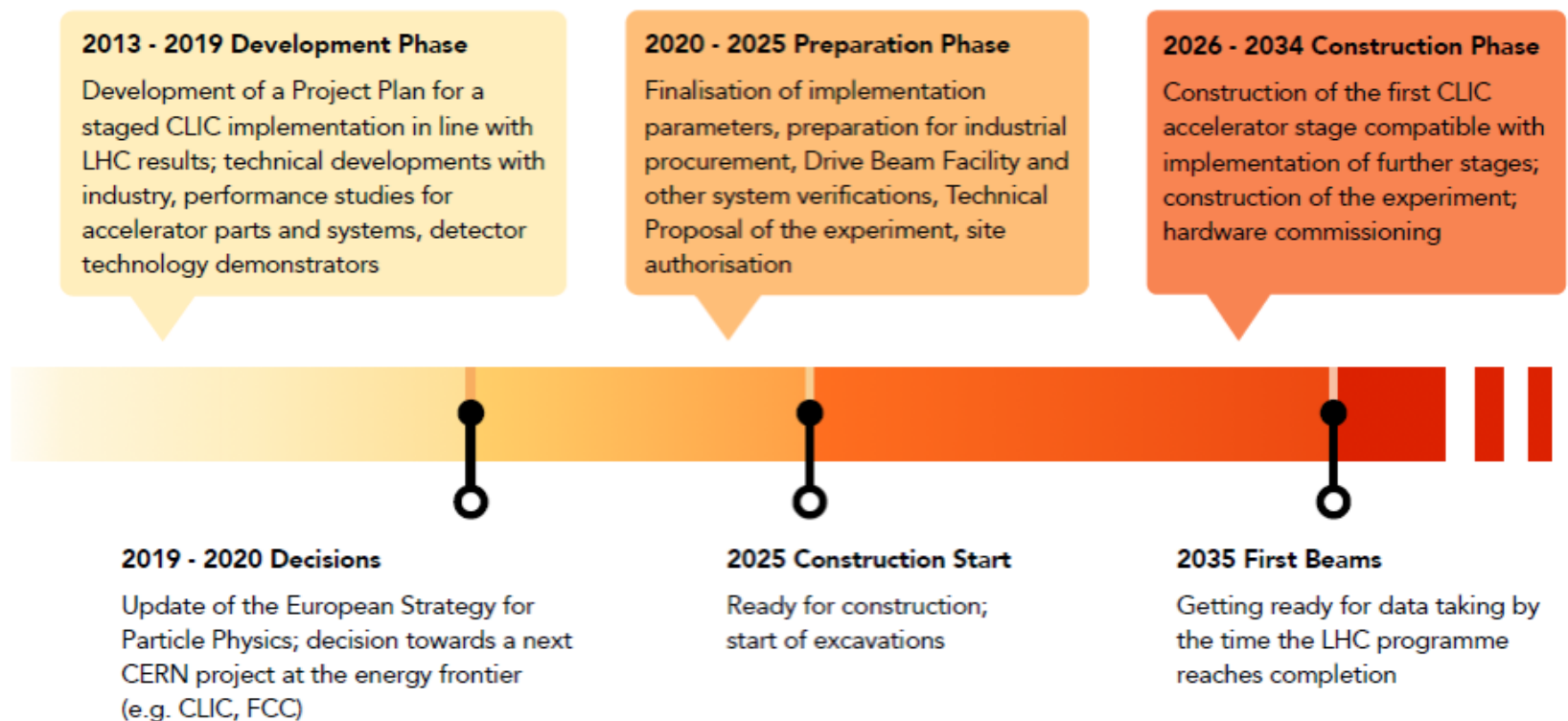
Table 11: Value estimate of CLIC at 380 GeV centre-of-mass energy.

	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





# CLIC roadmap



# Outlook → European Strategy

## Key deliverables:

**Project plan:** physics, machine parameters, cost, power, site, staging, construction schedule, summary of main tech. issues, preparation phase (2020-2025) summary, detector studies

**Preparation-phase plan:** critical parameters, status and next steps - what is needed before project construction, strategy, risks and how to address them

# CLICdp documents in preparation for next European Strategy

## CLICdp reports serving as ingredients for a **CLIC summary report**:

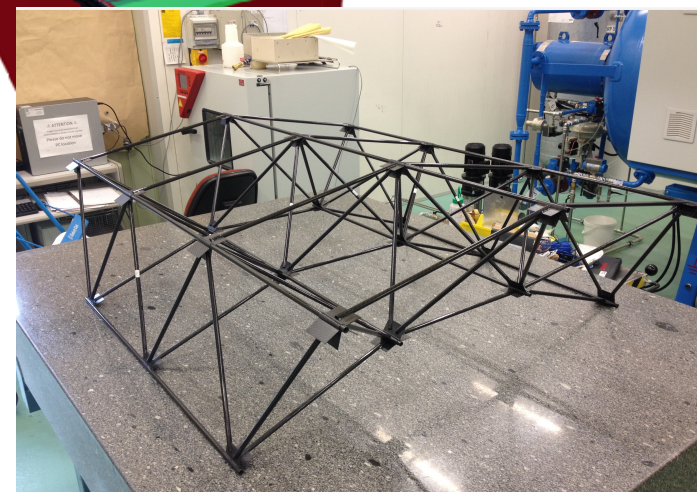
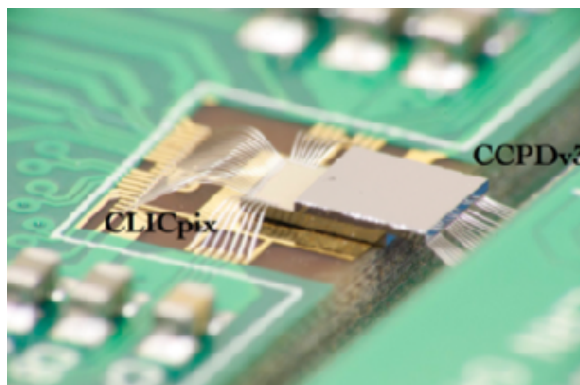
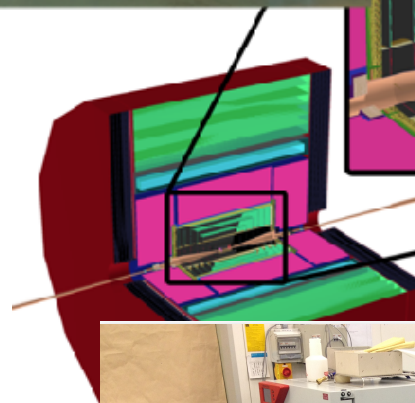
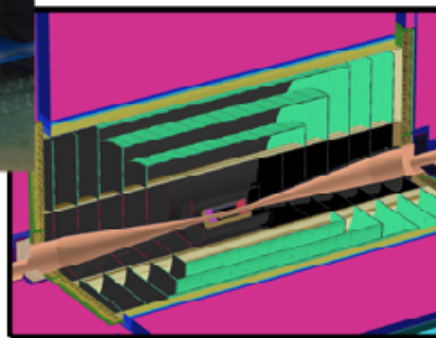
- Updated Baseline for a Staged Compact Linear Collider (380 GeV, 1.5 TeV, 3 TeV) ✓
  - [arXiv:1608.07537](#), [CERN-2016-004](#)
- Higgs Physics at the CLIC Electron-Positron Linear Collider ✓
  - [arXiv:1608.07538](#), [Eur. Phys. J. C77 \(2017\) no.7, 475](#)
- The new optimised CLIC detector model CLICdet ✓✓
  - CLICdp note [CLICdp-Note-2017-001](#) (detector/SW validation in progress)
- An overview of CLIC top physics
  - CLIC top physics publication => complete draft before the end of 2017
- Extended BSM studies (hopefully also motivated by LHC discoveries)
  - CLIC BSM overview publication in 2018
- CLIC R&D report => with main CLIC technology demonstrators
  - Summary publication(s) in 2018
- Plan for the period ~2019-2025 in case CLIC would be supported by next strategy



# Possible involvement

DESY

- Many common activities already in LCC framework
  - Scintillator HCAL
  - Detector optimisation
  - Software
  - Physics
- Further possibilities for DESY
  - CLICpix
  - light-weight tracker mechanics
  - FCAL, Yoke: most likely CERN



# Scenarios

after European Strategy update



- A: Green light ILC:
  - win collaborators at CERN
  - CERN and DESY jointly structure and support European effort
- B: ILC starves
  - B1: CLIC discontinued, too - forget linear.
  - B2: CLIC supported by European Strategy
    - very likely strong German contribution
    - strong demand for DESY's expertise and capabilities
    - make sure this remains an option for DESY, too (not granted)
  - B3: CERN undecided
    - CLIC and FCC detector efforts joined together, common R&D
    - DESY involvement in context of a more generic activity towards future collider projects

# Back-up

# CompactLight EU proposal accepted

Research infrastructures call  
Infradev-10, **Design study**

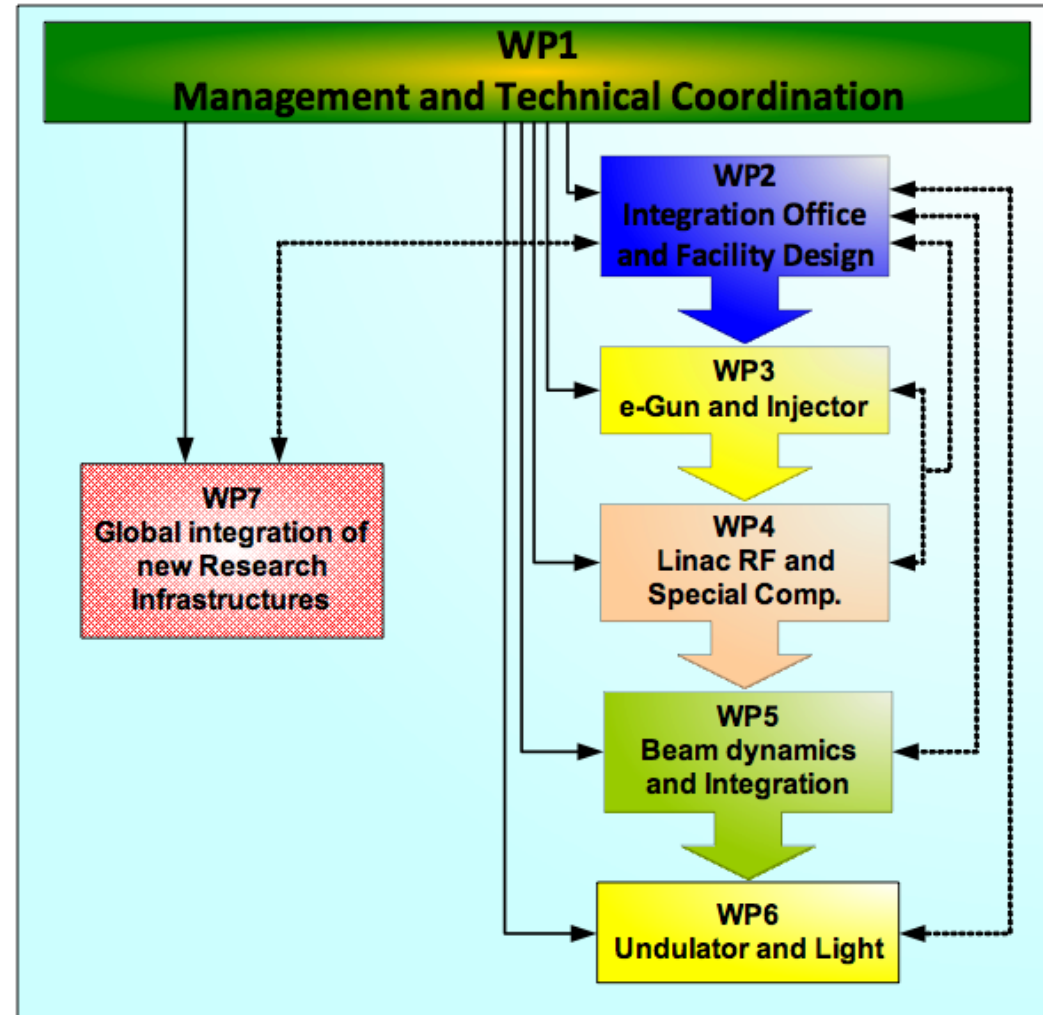
- 24 participating labs/firms
- Coordinator: Elettra Trieste
- 3 M€ EU funds requested

**Accelerator design of hard X-ray FEL:**

- **12 GHz X-band**  $\leq$  *CLIC technology*
- Compact short-period undulators
- Hard X-rays (down to 0.1 nm)

Compared to conventional FELs:

- Lower energy ( $\sim 4.6$  GeV)
- More compact
- Less power demand
- Cheaper to construct and operate



*Statement: “ The design of such an X-ray FEL requires collective expertise of many institutes. However, the construction will be possible/affordable for a single University. ”*

# CLIC-like detector for FCC-ee

Recent progress in defining a CLIC-like detector, taking FCC-ee conditions into account.

Initial sub-detector layouts defined.

Optimisation/validation studies ongoing, using DD4hep-based Linear Collider software tools.

