

ILD strategy

ILD group meeting

7.9.2022



Agenda Today

- ILD events
- ILD strategy



ILD meeting ahead of ECFA WS



- Date October 4, 2022
- Where: DESY Hamburg and Zoom
- Indico: <https://agenda.linearcollider.org/event/9725/>
 - Please register at least if you will be here in person

Agenda ILD meeting



09:00	→ 09:10	Opening and welcome Speaker: Ties Behnke	🕒 10m	✎
09:10	→ 11:00	ILD general plenary meeting	🕒 1h 50m	✎
11:00	→ 11:20	Coffee break	🕒 20m	
11:20	→ 13:00	ILD parallel sessions	🕒 1h 40m	✎
13:00	→ 13:59	Lunch	🕒 59m	
14:00	→ 15:00	ILD parallel sessions	🕒 1h	✎
15:00	→ 15:30	ILD general plenary meeting	🕒 30m	✎
15:30	→ 16:00	Coffee	🕒 30m	

ILD strategy: The process



- Series of meetings (ILD group meetings) to discuss the state of ILD and to identify critical areas and topics, where ILD would need to change if ILD would be applied to other collider concepts
- Formation of an ILD strategy group (ET members, conveners, experts) who discussed regularly the outcome of the meeting and have developed an strategy
- Draft of a strategy document which has been approved by the strategy group and ET, and has now been submitted for discussion to ILD

The ILD strategy document



The ILD strategy 2022

ILD: Proposal for an ILD strategy 2022

Version 3 4.9.2022

1. Introduction

The ILD experiment has been conceived as an experiment at the proposed ILC. The detector concept has been developed for a science program which spans collision energies from 90 GeV to approximately 1 TeV [\[1\]](#).

ILD as a concept has been developed with a strong focus on particle flow as the central guiding paradigm for event reconstruction. With the strong requirement particle flow puts on the reconstruction of individual particles, the detector has been optimized in this direction. This implies an overall excellent granularity of the detector systems, and it implies a system optimized to extract as much information as possible on individual particles. A special feature of ILD is the use of a large volume time projection chamber as a key component of the inner tracker, which allows not only an excellent reconstruction of tracks, but also contributes to a good particle identification by providing dE/dx information.

What is ILD



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Start point of the discussion



Considering this situation, the ILD group has initiated a broad discussion process to determine how ILD as a detector concept group should position itself, which options it should support, and how it might interact with more than one collider proposal [\[7\]](#).

What is our mission?



The ILD group sees as its mission the definition and development of a detector concept for high energy electron positron collisions with particle-flow capabilities with optimal particle identification. This mission is not tied to a specific collider proposal. We are interested in a detector which can deliver the science, independent of where this experiment could take place. The ILD group continues to put a large value on energy extensibility, which would allow the execution of a complete program including Z, Higgs and top physics, and maximize the reach of the search for BSM physics. The state of the ILD proposal and a summary of the most recent studies on ILD performance are available in the ILD interim design report, IDR [\[1\]](#).

The origin of ILD is clearly with the ILC concept, and the sets of parameters which have been defined for ILC and for ILD@ILC remain the baseline option for ILD [\[1\]](#). They form a very well understood set of benchmarks both in detector performance and in science performance. The performance of ILD at other collider options should always be defined relative to this benchmark performance. Nevertheless we remain convinced that the ILC collider option is the most mature proposal, and would offer the fastest possibility to realize a Higgs factory.

The ILD Roadmap



ILD has been developed for the ILC, and has been tuned to the particular beam conditions at the ILC. FCC-ee has very different beam parameters, which will impact the way the experiment is operated. ILD is ready to engage with these studies, and to make the case for an ILD-like detector at FCC-ee in particular. Whether or not this will eventually lead to a proposal to FCC-ee for a concrete detector concept should be decided after a period of study and based on the findings of the study, similar to the way ILD has cooperated with CLIC and CEPC in the past.

The same could apply to other concepts like C^3 .

Whenever possible ILD will look for and try to utilize cooperation with other groups at the other proposed Higgs factories. Whether or not ILD should also formally join forces with any of the discussed concepts should be decided at a later time, based on the results of the study focused on the development of the ILD concept as laid out in the appendix to this document.

How do we contribute



The ILD group has traditionally contributed strongly to the development of common software tools, and shared reconstruction packages with non-ILD groups. ILD remains fully committed to an open approach towards software systems, and participates in the development of a common, broadly usable software framework to be used by different future collider projects.

As part of the studies directed towards understanding ILD performance at other collider concepts than ILC, ILD will attempt to develop an integrated detector model for ILD which can be used for studies at this collider. For the FCC collider concept, this work may happen in close cooperation with other detector concepts, in particular with the CLD concept.

An ILD work program



1. The forward tracking region of ILD has a number of shortcomings. A dedicated optimization for this region, in particular of the acceptance of the vertex detector, should be done. This region will also be heavily affected by different environmental conditions at different collider projects, and might need dedicated solutions for each proposal.
2. Circular colliders will have a smaller inter-bunch timing difference than ILC, and also do not deliver bunch-trains, but rather continuous beams. This significantly changes the possibility to do power-pulsing for the front-end electronics of the ILD sub-detectors. The current design of the ILD sub-detectors depends crucially on their capability to manage the thermal load through power pulsing. Using the ILD sub-detectors at FCC will require a very detailed study of how the systems can perform without power pulsing, and the development of a concept of how the thermal management can work in this new situation, while minimising additional dead material in the system.
3. The close inter-bunch spacing and lack of inter-bunch train quiet periods puts additional challenges on the operation of a TPC in this environment. ILD should explore how an ILD-like TPC would perform in these different conditions, and where the limits are for the TPC. Since the TPC adds significant particle identification power in particular at lower center-of-mass energies, this study should focus on the lower range of energies at a Higgs/ EW/Top factory.
4. A focus of experimentation at circular colliders is a high-luminosity Z program. ILD should investigate how well the detector performs under these conditions, and identify components which might need replacement or modification.
5. Circular colliders will have a very different forward region, in order to control the machine backgrounds, and in order to provide the beam focusing. ILD should develop a concept for a forward region compatible with FCC-ee and study the impact this changed region will have on the detector performance.
6. A central challenge for a detector like ILD, optimized for precision physics, is the delivery of an excellent and stable calibration and alignment environment. These considerations need to be included from early on in the design. The different running conditions and beam conditions might impact the way the detector is to be calibrated and aligned, and need to be studied.

Next steps



- Today: discussion of the document, collect input from a broad ILD community
- The document will remain open for comments until September 15, 9am Paris time
- The document including the comments received (except for minor wording) will be presented to the ILD IA on September 16, for final approval
- The strategy will be presented to the ECFA Higgs/ Top/ EW meeting in October 2022 (@ DESY)