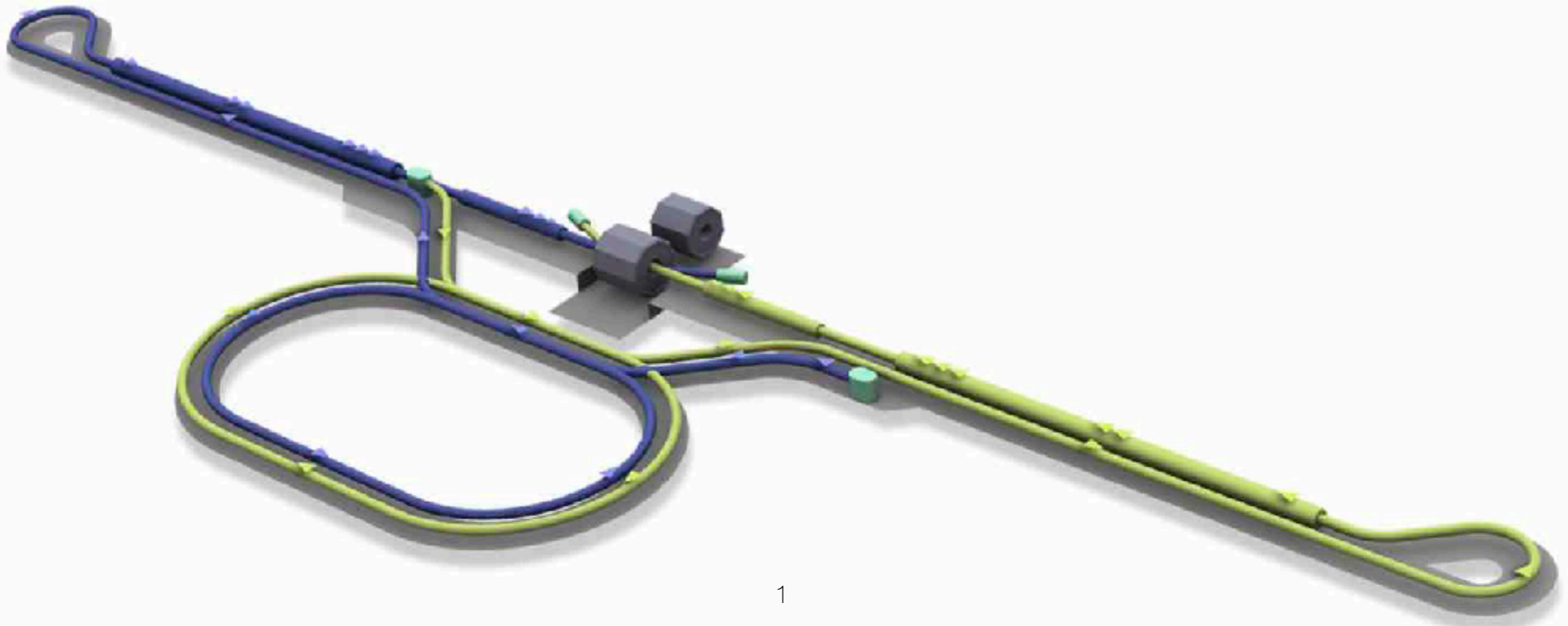


Introduction to the ILC and the IDT

Hitoshi Murayama (Berkeley/Kavli IPMU)
IDT-WG3-Phys Kickoff Meeting, May 27, 2021





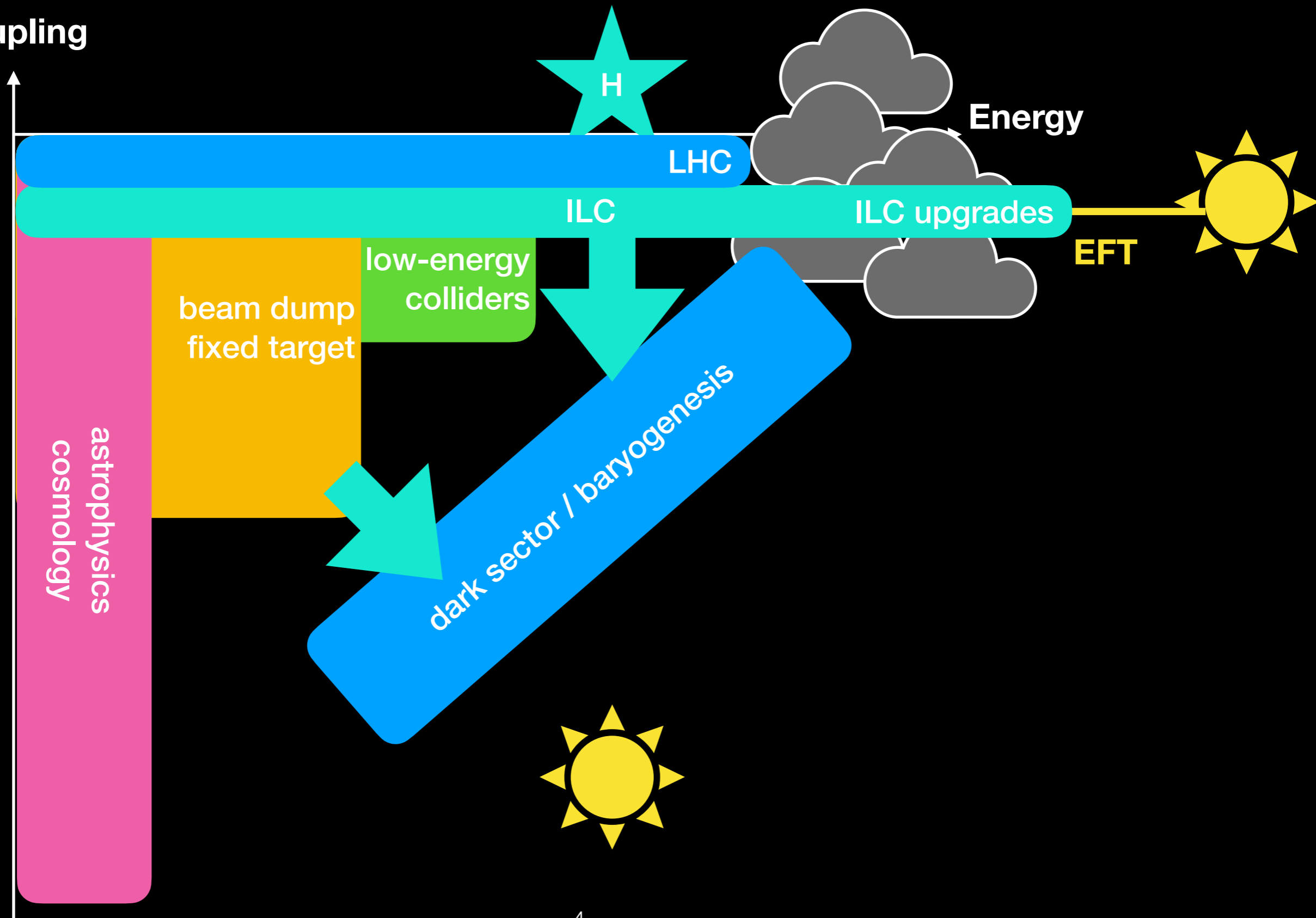
Beyond the Standard Model

- data say there are **at least five missing pieces in the SM**
 - **dark matter (2003)**
 - **neutrino mass (1998)**
 - **dark energy (1998)**
 - **inflation (2003)**
 - **matter anti-matter asymmetry (2003)**

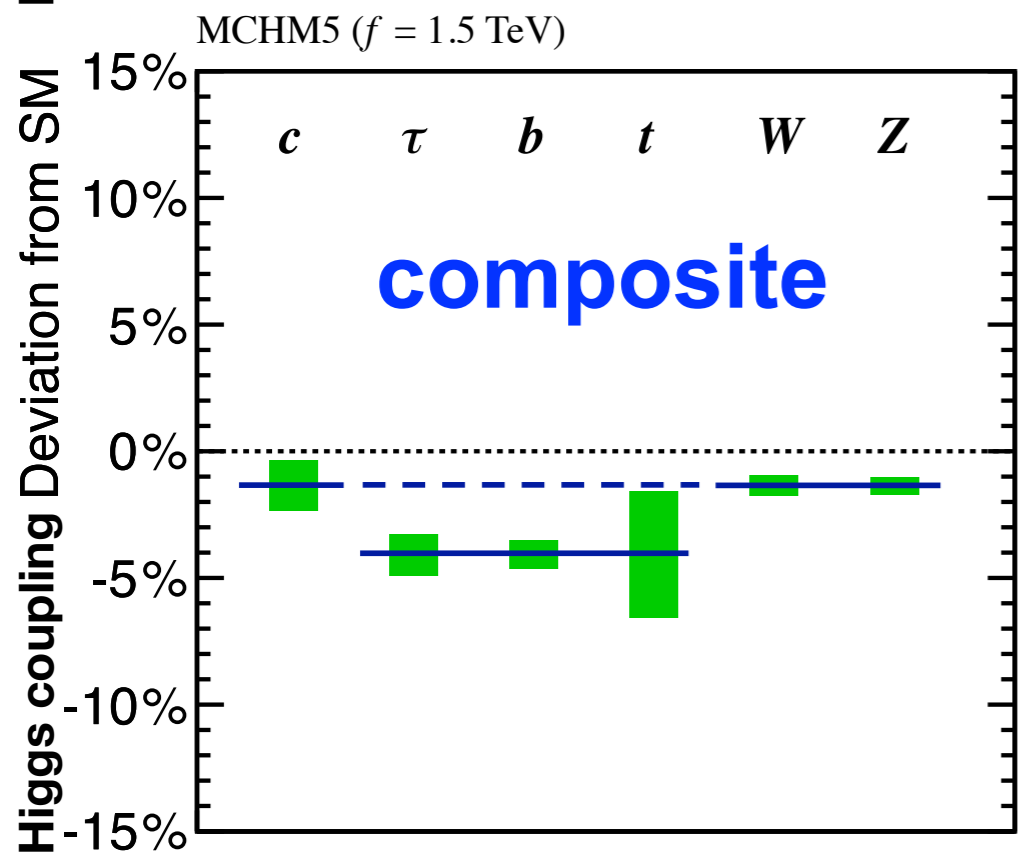
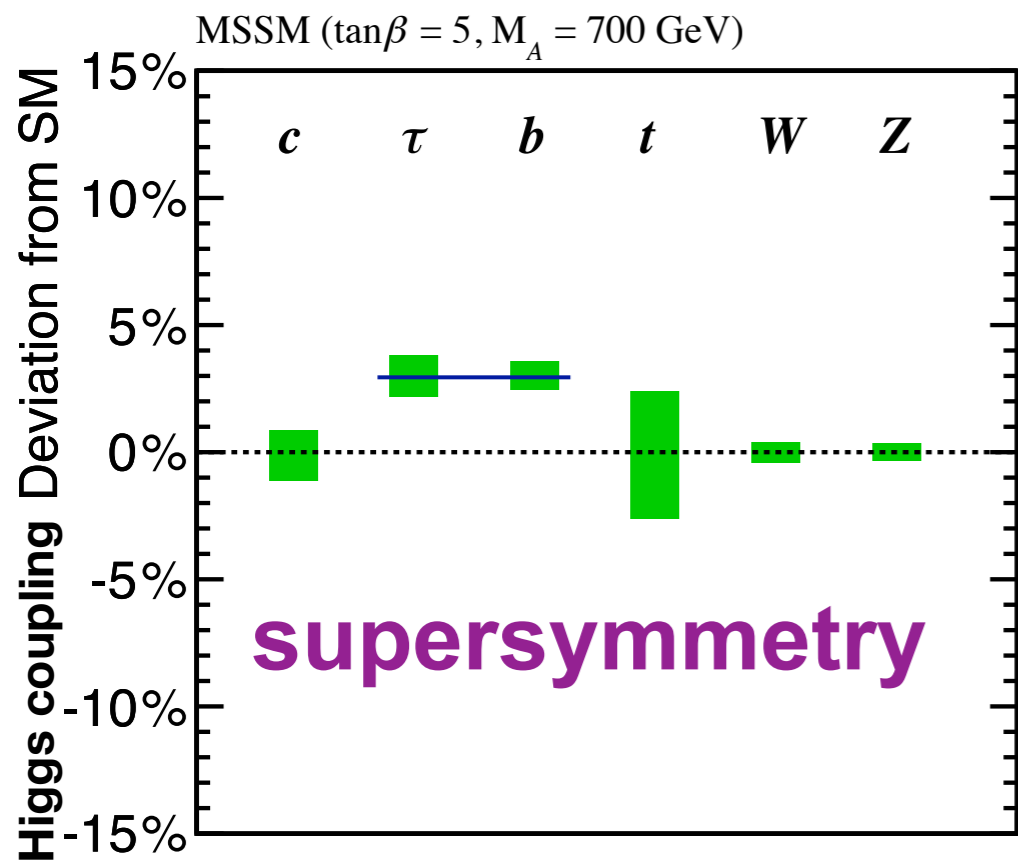
What is the next energy scale?

ILC++

Coupling

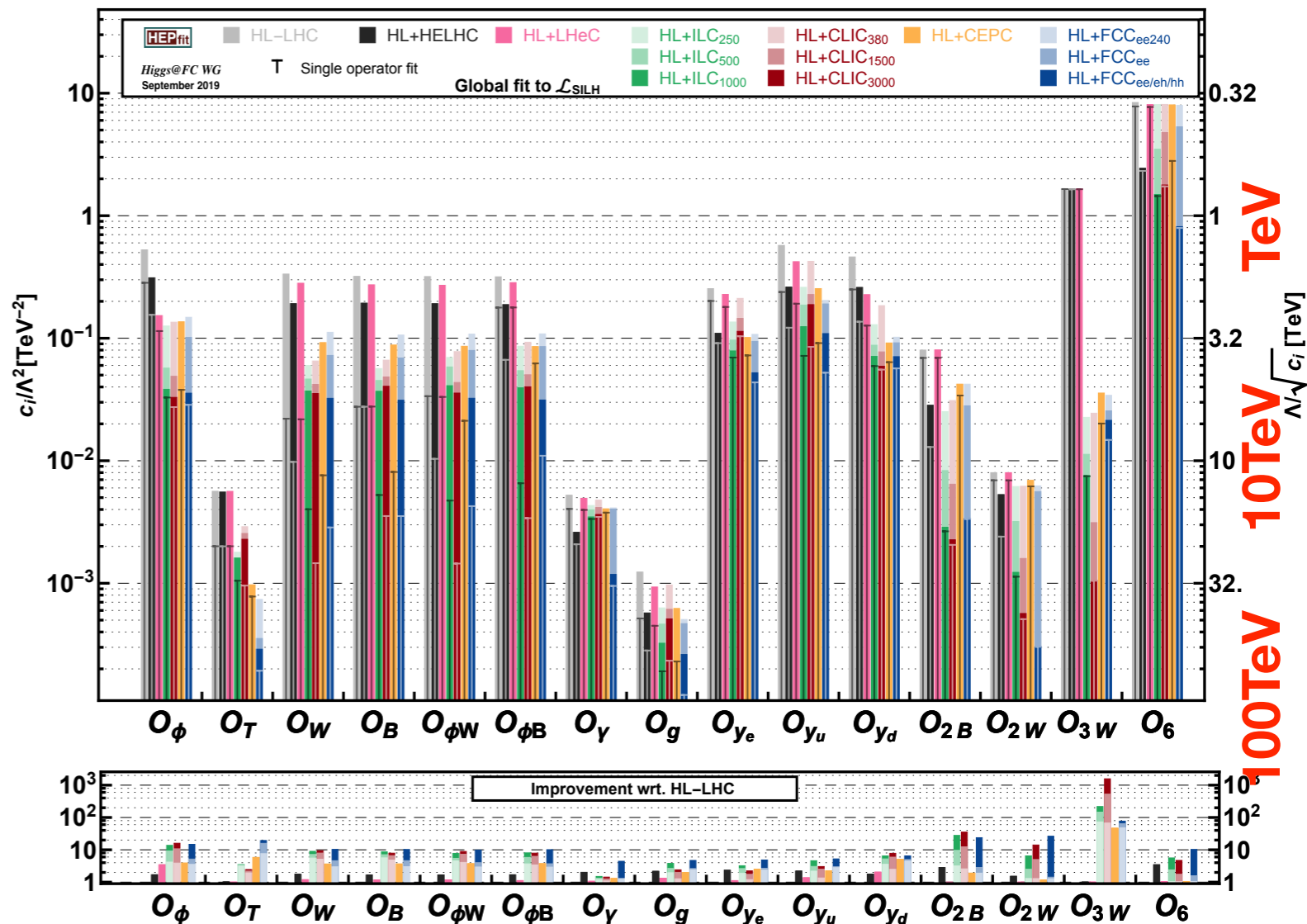


What is Higgs boson really?



What is the next energy scale?

x10 HL-LHC

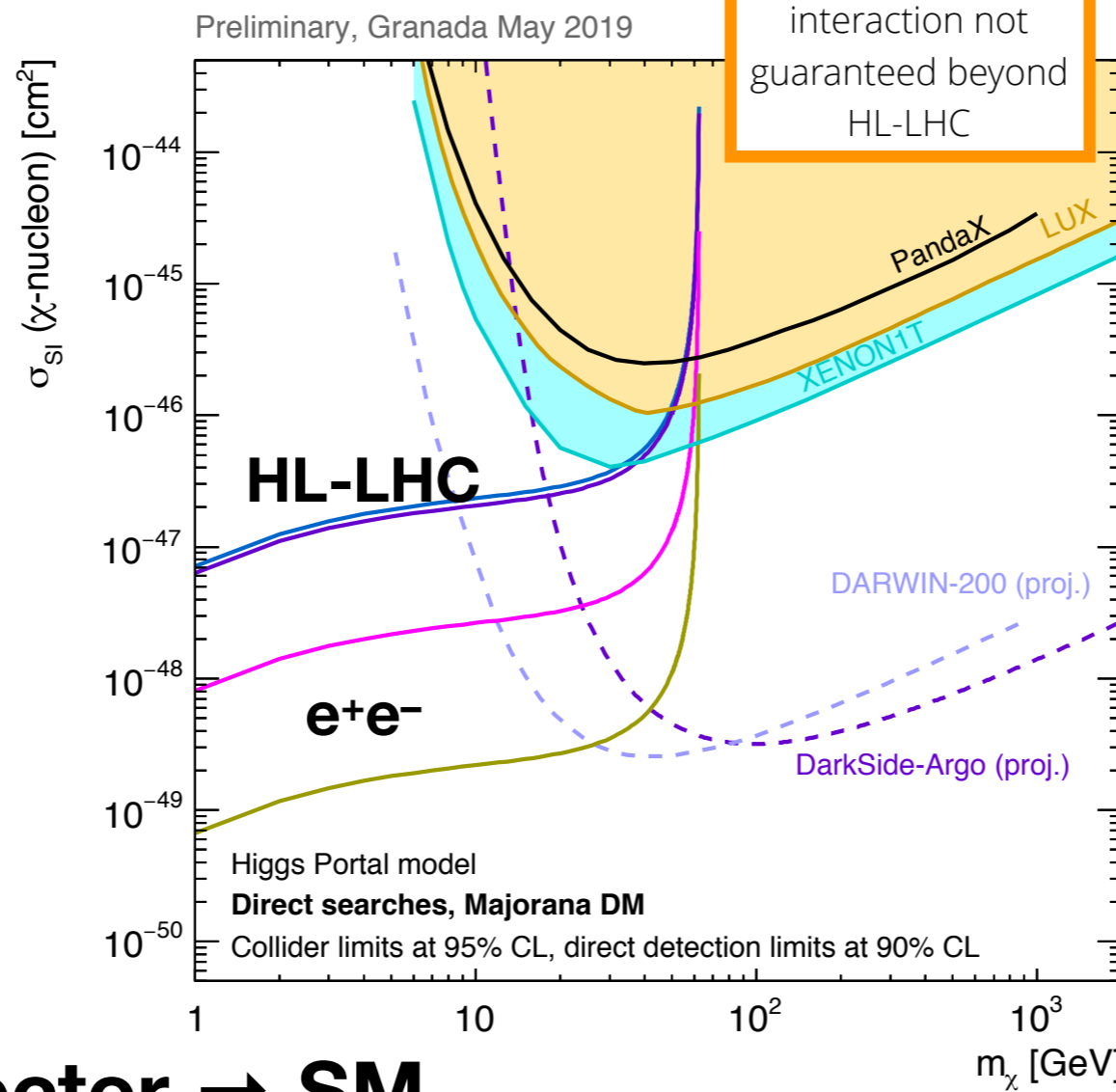


2000fb⁻¹@250GeV
200fb⁻¹@350GeV
4000fb⁻¹@500GeV

direct detection limits

Higgs decay to dark matter

x10 HL-LHC

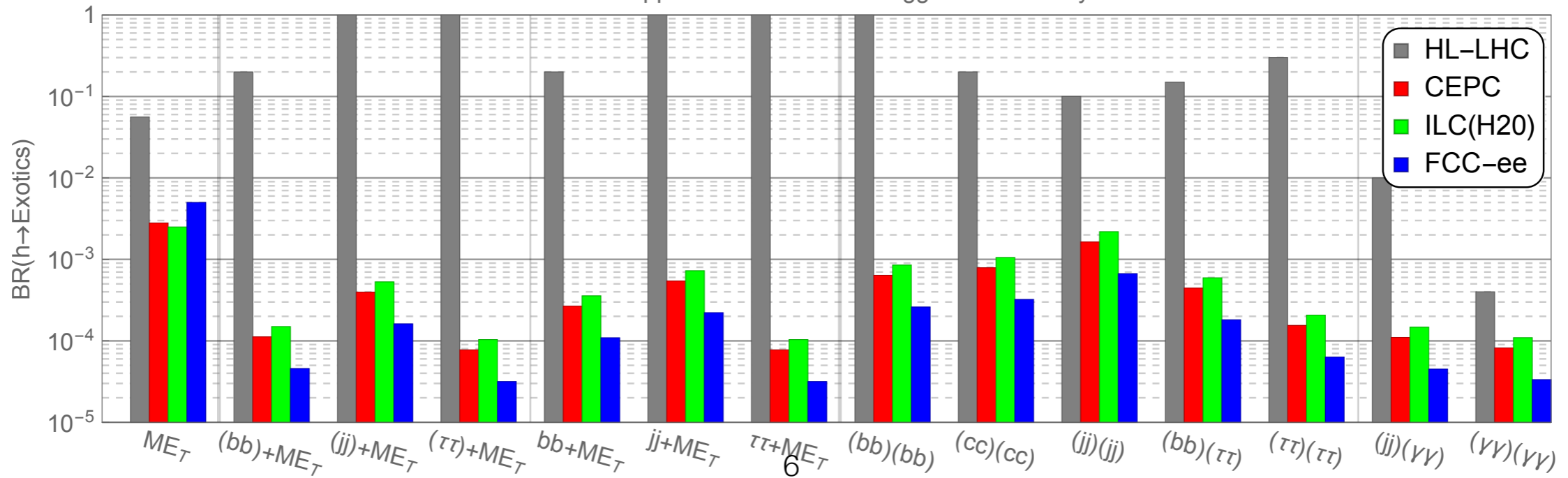


x1000-10000 HL-LHC

exotic Higgs decays

Higgs → dark sector → SM

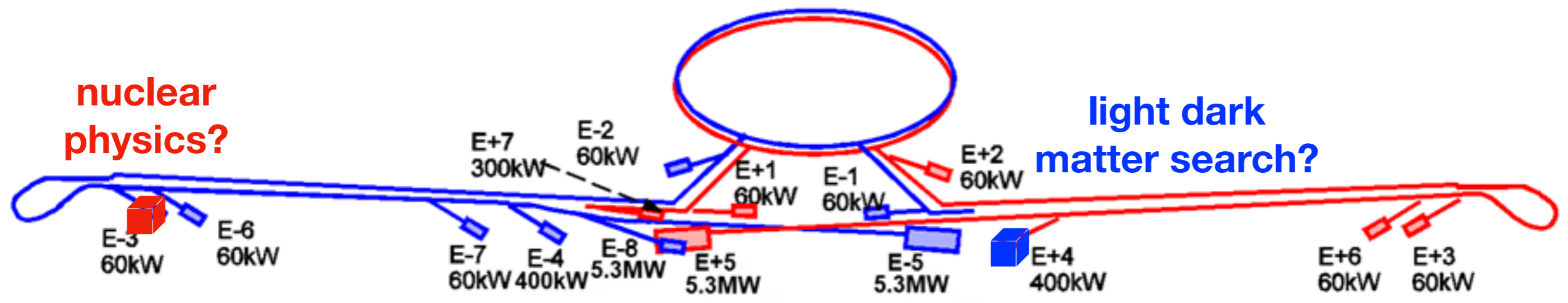
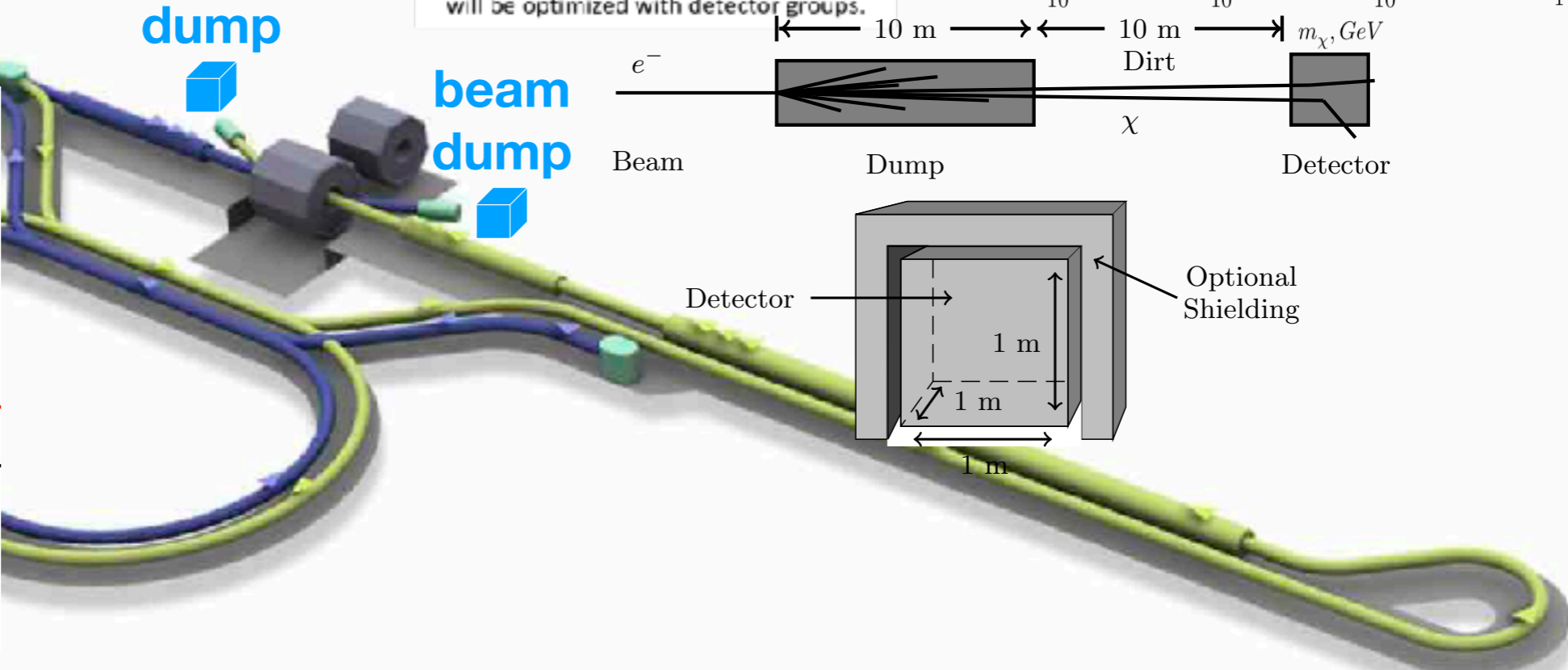
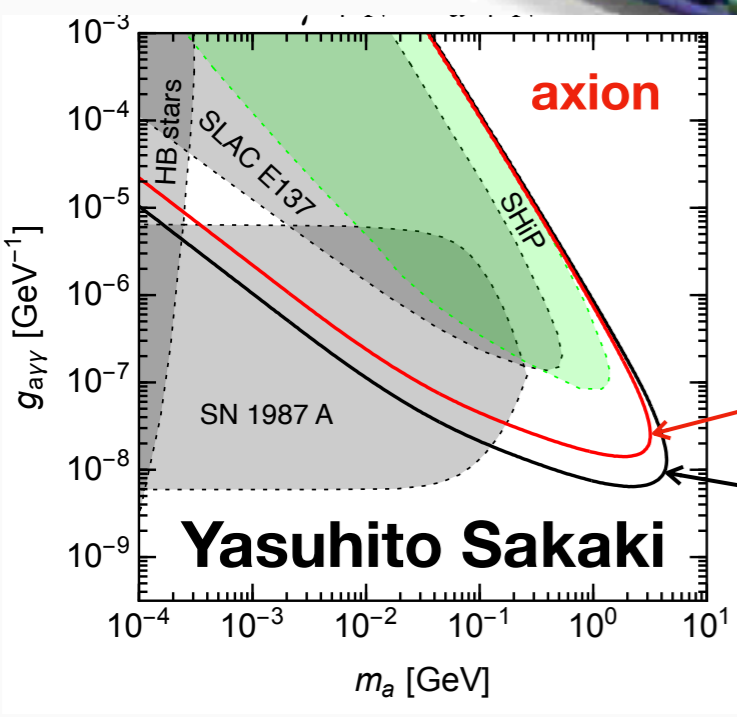
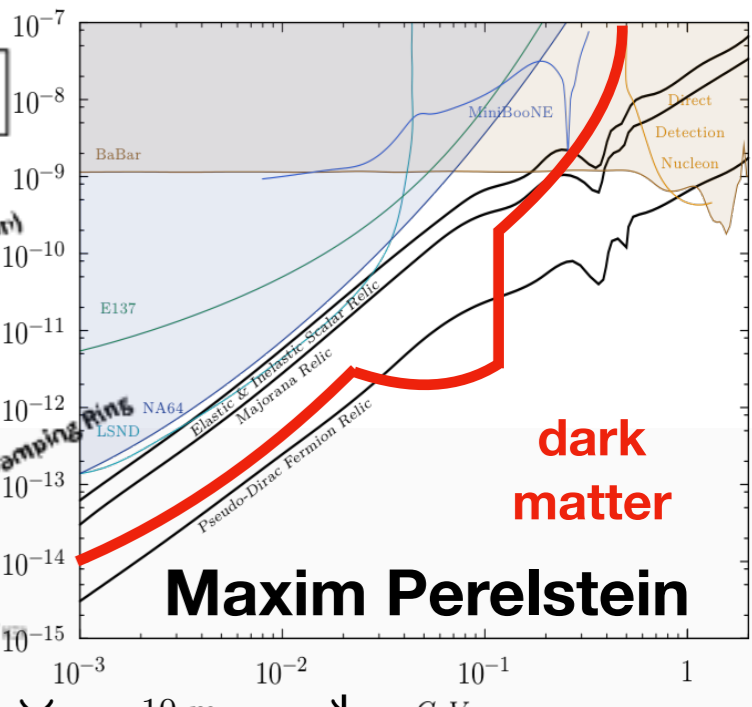
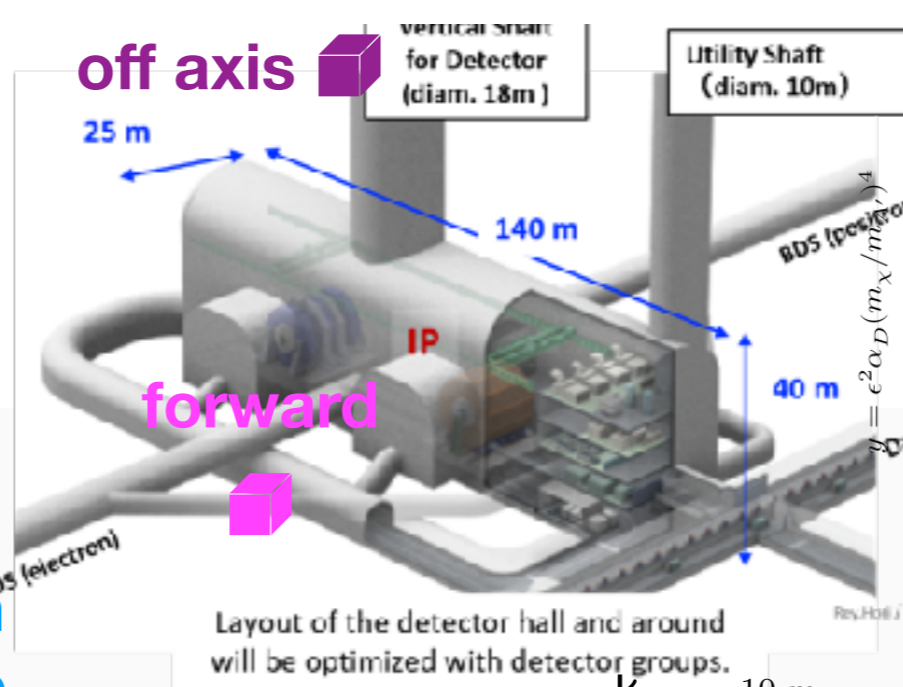
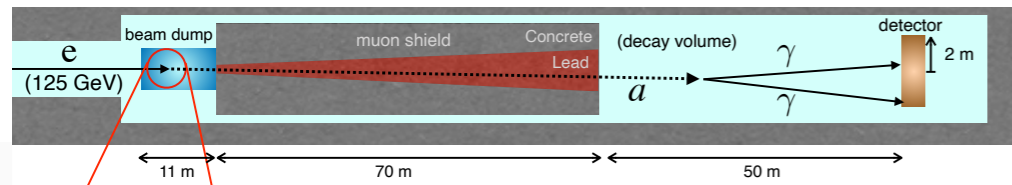
95% C.L. upper limit on selected Higgs Exotic Decay BR



SiD

ILD

optimizations?
new technologies?
new concepts?



higher energies

- main reason to go linear: extendable!

- 350GeV: $t\bar{t}$ threshold

- 400GeV: open top

- 550GeV: $t\bar{t}H$

- 1TeV: Higgs self coupling, vector boson scattering

- multi TeV: SUSY, extra dim, Z' ,

ILC Nb	35-50MV/m	0.5–1.5TeV
ILC Nb ₃ Sn	120MV/m	4TeV
CLIC	100MV/m	3TeV
PWFA DLA	1GV/m	30TeV

IDT organisation

ICFA

ILC-IDT

Executive Board

Andrew Lankford (UC Irvine): Americas Liaison

Shinichiro Michizono (KEK): Working group 2 Chair

Hitoshi Murayama (UC Berkeley/U. Tokyo): Working group 3 Chair

Tatsuya Nakada (EPFL): Executive Board Chair and Working group 1 Chair

Yasuhiro Okada (KEK): KEK Liaison

Steinar Stapnes (CERN): Europe Liaison

Geoffrey Taylor (U. Melbourne): Asia-Pacific Liaison

Working group 1
Pre-lab set-up

Working group 2
Accelerator

Working group 3
Physics & Detectors

Scientific secretary: Tomohiko Tanabe (KEK)

Communication team led by Rika Takahashi (KEK)

Unlike LCB/LCC, **ILC-IDT is focused on the ILC.**

KEK provides administrative, logistic and some financial support.

T. Nakada, 4

ICFA: International Committee for Future Accelerators

LCB: Linear Collider Board

LCC: Linear Collider Collaboration

IDT: International Development Team

Expected Timeline

triggered by sign for substantial funding for pre-lab in Japan

Timeline for the ILC experiments

- 2021 IDT calls for Eol
Necessary R&D for Eol
- 2022 ----- Assumed start of Pre-lab -----
- 2022 Eol presentation
Necessary R&D for Lol
- 2023 **Lol submission and presentation**
Continuation of R&D
Selection process by the ILCC
- 2024 **ILCC recommendation on the first set of the projects to proceed toward TP**
Necessary R&D for TP
- 2025 TP submission and presentation of the first set of experiments
Continuation of R&D
Selection process by the ILCC
- 2026 ----- Assumed start of ILC-lab -----
- 2026-27 ILCC recommendation for the first set of experiments to proceed toward TDRs
- 2027 **ILC-lab approval of the first set of experiments and request to proceed toward TDRs**

- Funding agencies will not provide dedicated ILC detector R&D funds before the Pre-lab being established.
- For some Eols, R&D would be needed to make Lols.
→ driving the timing for the Lol submission
- Selection process starts with the Lols.
→ driving the timing for the Lol decision
- Experiments are formally approved based on TPs.
- The ILC-lab is needed for approvals.
- Availability of resources is part of the approval criteria.
→ driving the timing for the TP decision
- These considerations are for the initial set of experiments. There could be more experiments proposed at later time.

IDT: International Development Team
Eol: Expression of Interest
Lol: Letter of Interest
TP: Technical Proposal
TDR: Technical Design Report
ILCC: ILC Committee



WG3 Organisation and mandates

Chair: Hitoshi Murayama (Berkeley/Tokyo)

Deputies: Jenny List (DESY) and Claude Vallée (Marseille)

Coordinator and Deputy coordinator(s)

Kiyotomo Kawagoe (Kyushu), Alain Bellerive (Carleton),
Ivanka Božović Jelisavčić (Belgrade)

Steering Group
Subgroup conveners, Coordinator and Deputy Coordinator(s)

Speaker's bureau

Andy White (UT Arlington), Ties Behnke (DESY), Yuanning Gao (Peking), Frank Simon (MPP), Jim Brau (Oregon), Keisuke Fujii (KEK), Phil Burrows (Oxford), Francesco Forti (INFN),
Filip Zarnecki (Warsaw), Patty McBride (Fermilab), Mihoko Nojiri (KEK), CERN member, Timothy Nelson (SLAC), Kajari Mazumdar (Mumbai), Phillip Urquijo (Melbourne), Dmitri Denisov (Brookhaven)

Interface with machine

Detector and technology R&D

Software and computing

Physics potential and opportunity

Coordinate the interactions between the accelerator and facility infrastructure planning and the needs of the experiments

Provide a forum for discussion and coordination of the detector and technology R&D for the future experimental programme

Promote and provide coordination of the software development and computing planning

Encourage and develop ideas for exploiting the physics potential of the ILC collider and by use of the beams available for more specialised experiments

Karsten Buesser (DESY), Yasuhiro Sugimoto (KEK), Roman Poeschl (Orsay), US

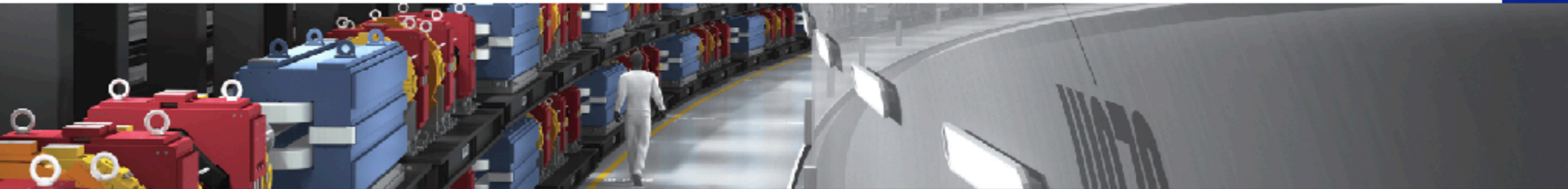
Marcel Vos (Valencia), Katja Krueger (DESY) Petra Merkel (Fermilab), David Miller (Chicago)

Frank Gaede (DESY), Jan Strube (PNNL) Daniel Jeans (KEK)

Michael Peskin (SLAC), Junping Tian (Tokyo) Aidan Robson (Glasgow)

Open to anybody interested!

<https://linearcollider.org/team/wg3>



Physics Potential and Opportunities

[Top](#) » [Team](#) » [WG3](#) » [Physics Potential and Opportunities](#)

Physics Potential and Opportunities Subgroup (WG3)

Mandate

The Physics Potential and Opportunities subgroup fosters studies of the ILC's physics case outside and across the detector concept groups, including beyond-collider possibilities. In particular this group supports individuals and groups to become newly active in ILC physics. The physics group initiates and coordinates (a) a number of topical groups with open participation, giving a forum for collaboration and discussion between theorists and experimentalists, and (b) task forces dedicated to specific questions, preparing the physics input to upcoming decisions on the ILC accelerator design, and on detector technology choices. Task forces will be common efforts with the other subgroups of IDT-WG3 on interface to the accelerator, detector R&D and Software, depending on the topic. The physics group ensures the connection to, and ILC representation in, relevant particle physics community initiatives [ECFA Higgs Factory Study, Snowmass, ...] and documents the ILC physics potential.

Invitation

We invite interested groups and individuals to join our activities. Please subscribe to our email lists via the following Indico site:

<https://agenda.linearcollider.org/event/9154/>

Our meeting agendas can be found here:

<https://agenda.linearcollider.org/category/266/>

Working Group conveners

Michael Peskin (SLAC), Aidan Robson (Glasgow), Junping Tian (Tokyo) [[Send email](#)]

Topical Groups

Higgs properties

Conveners: Shinya Kanamura (Osaka), Patrick Maade (Stony Brook), Chris Potter (Oregon), Georg Waiglein (DESY) [[Send email](#)]

Working Group conveners

Michael Peskin (SLAC), Aidan Robson (Glasgow), Junping Tian (Tokyo) [[Send email](#)]

Topical Groups

Higgs properties

Conveners: Shinya Kanamura (Osaka), Patrick Maade (Stony Brook), Chris Potter (Oregon), Georg Waiglein (DESY) [[Send email](#)]

Top/heavy flavour/QCD

Conveners: Adrian Iriés (Valencia), Alexander Mitov (Cambridge), Hua-Xing Zhu (Zhejiang) [[Send email](#)]

BSM particle production

Conveners: Mikael Berggren (DESY), Shigeki Matsumoto (IPMU), Werner Porod (Wurzburg), Simone Pagan Griso (LBNL) [[Send email](#)]

Electroweak physics

Conveners: Wolfgang Kilian (Siegen), Taikan Suehara (Kyushu), Graham Wilson (Kansas) [[Send email](#)]

Global interpretations

Conveners: Tim Cohen (Oregon), Christophe Grojean (DESY), Sven Heinemeyer (Madrid), Sunghoon Jung (Seoul) [[Send email](#)]

Modelling and precision theory

Conveners: Gudrun Heinrich (KIT), Stefan Hoeche (FNAL), Zhao Li (IHEP), Juergen Reuter (DESY) [[Send email](#)]

Resources

- ILC documents submitted to European Strategy Update 2019
 - The International Linear Collider: A Global Project
<https://arxiv.org/abs/1903.01629>
 - Tests of the Standard Model at the International Linear Collider
<https://arxiv.org/abs/1908.11299>
- ILC document submitted to Snowmass 2021
 - ILC Study Questions for Snowmass 2021
<https://arxiv.org/abs/2007.03650>
- ILC Report for Snowmass 2022, ongoing, find more details at:
<https://agenda.linearcollider.org/event/9135/>

IDT-WG3-Phys Kickoff Meeting & Mini-Symposium on Muon g-2

Thursday 27 May 2021, 15:00 → 17:15 Europe/Zurich

Description Topic: IDT-WG3-Phys Kickoff Meeting & Mini-Symposium on Muon g-2
Time: May 27, 2021 03:00 PM Amsterdam, Berlin, Rome, Stockholm, Vienna

Join Zoom Meeting
<https://desy.zoom.us/j/95268555872>

Meeting ID: 952 6855 5872
Passcode: 314159

- | | | | | |
|-------|---------|--|-----|--|
| 15:00 | → 15:15 | Introduction to the ILC and the IDT
Speaker: Hitoshi Murayama (University of California Berkeley (US)) | 15m | |
| 15:15 | → 15:22 | Topical Group plans: Higgs properties
Speaker: Christopher Thomas Potter (University of Oregon (US))
 | 7m | |
| 15:22 | → 15:29 | Topical Group plans: Electroweak physics
Speakers: Graham Wilson, Graham Wilson (The University of Kansas (US)) | 7m | |
| 15:29 | → 15:35 | Topical Group plans: Top / heavy flavour / QCD
Speaker: Adrian Iles (IFIC (CSIC/UVB)) Valencia) | 7m | |
| 15:36 | → 15:43 | Topical Group plans: BSM particle production
Speaker: Shigeki Matsumoto (IPMU, Univ. of Tokyo) | 7m | |
| 15:43 | → 15:50 | Topical Group plans: global interpretations
Speaker: Tim Cohen (University of Oregon) | 7m | |
| 15:50 | → 15:57 | Topical Group plans: Modelling and precision theory
Speaker: Jürgen Reuter (DESY Hamburg, Germany)
 | 7m | |
| 16:00 | → 17:15 | Mini-Symposium: What does the muon g-2 anomaly imply for e+e- colliders? | | |
| | 16:00 | The Tiny (g-2) Muon Wobble from Small-μ Supersymmetry
Speaker: Naushoon Shah (Wageningen) | 15m | |
| | | | | |
| | 16:15 | Muon g-2 in Lepton Portal Dark Matter
Speaker: Yang Bai (Wisconsin) | 15m | |
| | 16:30 | A comprehensive study of vector leptoquark on the B-meson and Muon g-2 anomalies
Speaker: Seong Chan Park (Yonsei)
 | 15m | |
| | 16:45 | The new "MUON G-2" Result and Supersymmetry
Speaker: Sven Heinemeyer
 | 15m | |



ILC Workshop on Potential Experiments (ILCX)

October 26–29, 2021, Tsukuba, Japan

ILC Workshop on Potential Experiments (ILCX2021)

26-29 October 2021

Venue to be decided: Epochal Tsukuba International Congress Center (in-person meeting) or KEK Tsukuba Campus (hybrid meeting)

Asia/Tokyo timezone



The ILCX2021 website has opened. (24 May, 2021)

Overview

ILCX2021 Local
Organizing Committee

✉ ilcx2021@ml.post.kek.jp

The ILC International Development Team (IDT) will hold the ILC Workshop on Potential Experiments (ILCX) from October 26 to 29, 2021.

With the growing anticipation that the preparatory laboratory (Pre-lab) will be launched in the near future, we would like to expand discussions about all the possible experimental opportunities at the ILC laboratory. The workshop will address all the aspects of the collider program at the Interaction Point (IP), including, in addition to the established concepts, ideas for new detector technologies or concepts, detector performance and physics reach, software and computing, and theoretical developments. In addition, we will discuss possible beam dump experiments, forward detectors near the IP, off-axis far detectors, experiments with extracted beams for particle physics and other areas of science, including e.g. nuclear physics, condensed matter physics. Some of these ideas will require additional infrastructure and civil engineering, and therefore need to be incorporated into the ILC site planning during the four years of the Pre-lab.

The workshop organizing committee is the **Executive Board of IDT**, and the program committee is the Steering Group of **Working Group 3 (Physics and Detector)**. Given the uncertainties with the COVID-19 situation, three possible styles are being prepared in parallel: (1) in-person meeting in Tsukuba, Japan, (2) hybrid meeting on the KEK site, and (3) fully online meeting. Decision between (1) vs (2,3) will come by the end of June. In the case of in-person meeting, a visit to ILC-related sites at KEK is being arranged on Oct 25, while an excursion to the candidate ILC site in Tohoku is being planned after the workshop.

ILCX2021 is hosted by IDT, KEK and JAHEP ILC Steering Panel.

<https://agenda.linearcollider.org/event/9211/overview>



Starts 26 Oct 2021, 09:00

Ends 29 Oct 2021, 17:00

Asia/Tokyo



Venue to be decided: Epochal Tsukuba International Congress Center (in-person meeting) or KEK Tsukuba Campus (hybrid meeting)

Style of the workshop

Due to the COVID-19 pandemic situation, 3 different forms should be considered in parallel

- **Plan-A: Hybrid style**
 - Invite IDT members from overseas (20-30 persons?) and host domestic researchers
 - Venue: KEK Tsukuba campus or Epochal Tsukuba International Congress Center (depending on the infection measures and session timetable)
 - Preferable because it will be the first chance to get together at KEK (the IDT host institute) for the IDT members
- **Plan-B: Fully online style**
 - If a case arises where pandemic situations are unavoidable...
- **Plan-C: In-person style**
 - Strongly depends on the vaccination status...
 - Venue: Epochal Tsukuba
 - **Boundary condition:** 10% cancellation fee at Epochal until early July

not in the order of preference!

Timeline & Milestone

Timeline	Milestone
mid-May	Website open
mid-May	1st announcement
early June	Program coordination & session convener nomination
late June	Decision of Plan-A/B or Plan-C
late June	1st circular & registration open
mid-Sep.	Decision of Plan-A or Plan-B
26 October	Day 1 of WS



ILLUSTRATION BY J. M. FLAHERTY

I WANT YOU
FOR IDT W G 3

NEAREST RECRUITING STATION