

# IDT-WG2 report

*Shin MICHIZONO (KEK/IDT-WG2)*

*(June 28, 2022)*

-Snowmass accelerator

Conference information:

July 6-13: ICHEP 2022 (Bologna, Italy)

<https://agenda.infn.it/event/28874/program>

July 17-26: Snowmass Community Summer Study Workshop

<http://seattlesnowmass2021.net/>



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Organization

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Snowmass Frontiers

- Energy Frontier
- Neutrino Physics Frontier
- Rare Processes and Precision
- Cosmic Frontier
- Theory Frontier
- Accelerator Frontier
- Instrumentation Frontier
- Computational Frontier
- Underground Facilities
- Community Engagement
- Snowmass Liaisons

Community Contributions

- Letters of Interest
- Contributed (White)

Trace: • [accelerator](#)

<https://snowmass21.org/accelerator/start>

## ACCELERATOR FRONTIER

\* **Snowmass 21/22 Community Summer Study (Seattle, July 17-26) - please, REGISTER ASAP**

<http://seattlesnowmass2021.net/>

### AF Reports (Drafts)

Here is the list of the preliminary drafts of reports in the Accelerator Frontier and their associated documents to collect feedback by the community before the reports are finalized. **LINKS ARE TO BE**

#### ADDED

1. [AF1: Beam Physics, Education and Outreach](#)
  - Please enter your comments and feedback on the report draft in this [shared document](#)
2. [AF2: Accelerators for Neutrinos](#)
  - Please enter your comments and feedback on the report draft in this [shared document](#)
3. [AF3: Higgs/Electroweak Factories](#)
  - Please enter your comments and feedback on the report draft in this [shared document](#)
4. [AF4: Energy Frontier Colliders](#)
  - Please enter your comments and feedback on the report draft in this [shared document](#)
5. [AF5: Beams for BSM Physics](#)
  - Please enter your comments and feedback on the report draft in this [shared document](#)
6. [AF6: Advanced Colliders](#)
  - Please enter your comments and feedback on the report draft in this [shared document](#)
7. [AF7-T: Accelerator Technologies - Targets and Sources](#)
  - Please enter your comments and feedback on the report draft in this [shared document](#)
8. [AF7-M: Accelerator Technologies - Magnets](#)
  - Please enter your comments and feedback on the report draft in this [shared document](#)
9. [AF7-R: Accelerator Technologies - RF](#)
  - Please enter your comments and feedback on the report draft in this [shared document](#)
10. [Implementation Task Force Report](#)
  - Please enter your comments and feedback on the report draft in this [shared document](#)
11. [Muon Colliders Forum Report \(available\)](#)
  - Please enter your comments and feedback on the report draft in this [shared document](#)
12. [e+e- Colliders Forum Report](#)
  - Please enter your comments and feedback on the report draft in this [shared document](#)
13. [Accelerator Fronties Summary Report](#)
  - Please enter your comments and feedback on the report draft in this [shared document](#)

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To join the Snowmass mailing list, follow the instructions at the bottom of the Welcome page.

Frontier Conveners

# Implementation Task Force report

Draft was released last week and I circulated it to the IDT-WG2 steering members .

<https://indico.fnal.gov/event/54953/sessions/20614/attachments/156153/203696/ITFreportDRAFT.pdf>

## Report of the Snowmass'21 Collider Implementation Task Force

Thomas Roser (chair)<sup>1</sup>, Reinhard Brinkmann<sup>2</sup>, Sarah Cousineau<sup>3</sup>, Dmitri Denisov<sup>1</sup>, Spencer Gessner<sup>4</sup>, Steve Gourlay<sup>5</sup>, Philippe Lebrun<sup>6</sup>, Meenakshi Narain<sup>10</sup>, Katsunobu Oide<sup>7</sup>, Tor Raubenheimer<sup>4</sup>, John Seeman<sup>4</sup>, Vladimir Shiltsev<sup>8</sup>, Jim Strait<sup>8</sup>, Marlene Turner<sup>5</sup>, and Lian-Tao Wang<sup>9</sup>

<sup>1</sup>Brookhaven National Laboratory, Upton, NY 11973, USA

<sup>2</sup>DESY, 22607 Hamburg, Germany

<sup>3</sup>Oak Ridge National Laboratory, Oak Ridge, TN 37830, USA

<sup>4</sup>SLAC National Laboratory, Menlo Park, CA 94025, USA

<sup>5</sup>Lawrence Berkeley National Laboratory, Berkeley, CA 94720, USA

<sup>6</sup>ESI Archamps, 74160 Archamps, France

<sup>7</sup>KEK, Tsukuba, Ibaraki 305-0801, Japan

<sup>8</sup>Fermi National Accelerator Laboratory, Batavia, IL 60510, USA

<sup>9</sup>University of Chicago, Chicago, IL 60637, USA

<sup>10</sup>Brown University, Providence, RI, 02912, USA

June 15, 2022

### Abstract

The Snowmass'21 Implementation Task Force has been established to evaluate the proposed future accelerator projects for performance, technology readiness, schedule, cost, and environmental impact. Corresponding metrics has been developed for uniform comparison of the proposals ranging from Higgs/EW factories to multi-TeV lepton, hadron and ep collider facilities, based on traditional and advanced acceleration technologies. This report documents the metrics and processes, and presents evaluations of future colliders performed by Implementation Task Force.

Proposal Name	CM energy nom. (range) [TeV]	Lum./IP @ nom. CME [ $10^{34} \text{ cm}^{-2} \text{ s}^{-1}$ ]	Years of pre-project R&D	Years to first physics	Construction cost range [2021 B\$]	Est. operating electric power [MW]
FCC-ee <sup>1,2</sup>	0.24 (0.09-0.37)	8.5 (28.9)	0-2	13-18	12-18	280
CEPC <sup>1,2</sup>	0.24 (0.09-0.37)	8.3 (16.6)	0-2	13-18	12-18	340
ILC <sup>3</sup> - Higgs factory	0.25 (0.09-1)	2.7	0-2	<12	7-12	140
CCC <sup>3</sup> (Cool Copper Collider)	0.25 (0.25-1)	1.3	3-5	13-18	7-12	150
CLIC <sup>3</sup> - Higgs factory	0.38 (0.09-1)	1.5	0-2	13-18	7-12	170
CERC <sup>3</sup> (Circular (ERL collider))	0.24 (0.09-0.6)	78	5-10	19-24	18-30	90
ReLiC <sup>1,3</sup> (Linear ERL collider)	0.24 (0.25-1)	165 (330)	5-10	>25	7-12	100
ERLC <sup>3</sup> (ERL linear collider)	0.24 (0.25-0.5)	90	5-10	>25	12-18	250
XCC (FEL-based $\gamma\gamma$ collider)	0.125 (0.125-0.14)	0.1	5-10	19-24	4-7	~90
Muon Collider Higgs Factory <sup>3</sup>	0.13	0.01	>10	19-24	4-7	200

Table 1: Main parameters of the submitted Higgs factory proposals. The superscripts next to the name of the proposal in the first column indicate (1) Facility is optimized for 2 IPs. Total peak luminosity for multiple IPs is given in parenthesis; (2) Energy calibration possible to 100 keV accuracy for  $M_Z$  and 300 keV for  $M_W$ ; (3) Collisions with longitudinally polarized lepton beams have substantially higher effective cross sections for certain processes

# Implementation Task Force report

Table 7: Technical risk registry of accelerator components and systems for future  $e^+e^-$  and  $ep$  colliders: lighter colors indicate progressively higher TRLs (less risk), white is for either not significant or not applicable.

	FCCee/CEPC	ILC	HE ILC	CCC	HE CCC	CLIC	HE CLIC	CERC	ReLiC	HE ReLiC	ERLC	XCC	LHeC/FCCeh
RF cav./power sources													
Cryomodules													
HOM detuning/damp													
High energy ERL													
Positron source													
Arc&booster magnets													
Inj./extr. kickers													
Two-beam acceleration													
Damping rings													
Emitt. preservation													
IP spot size/stability													
High power XFEL													
$e^-$ bunch compression													
High brightness $e^-$ gun													
IR SR and asymm.quads													

Technical Risk Factor	Score	Color Code
TRL = 1,2	4	
TRL = 3,4	3	
TRL = 5,6	2	
TRL = 7,8	1	

Table 6: TRL scoring chart and color codes (used below in the summary Table 14).

ILC Higgs Factory	Risk Factor	Technology Validation	Cost Reduction Impact	Performance Achievability	R&D Timescale	Average of Squares
<b>Critical Enabling Technologies</b>						
SRF Cavities	1	1	1	1	0.5	0.85
Cryomodules/Assembly	1	2	2	1.5	0.5	2.3
Positron Source	2	2	1	3	0.5	3.65
nm Spot Size/Stability at IP	1	2	1	1	0.5	1.45
Damping rings inj and extr	1	1	1	1	0.5	0.85

Table 13: ILC Higgs Factory Scoring Example

Performance Achievability	Score	Color Code
Significant - needs explicit demo of beyond state-of-the-art	3	
Moderate - Feasible to achieve 2 - 3X state-of-the-art	2	
Feasible - at state-of-the-art	1	


Table 11: Technical component and subsystems' performance achievability scoring chart and color codes (used below in the summary Table 14).


Our comments are

1. in Table 7 (Technical Risk) ILC and HEILC, the positron column should be the same gray as CCC, CLIC, etc.
2. change "Performance Achievability" from 3 to 1 for the positron source in Table 13

# meeting with ITF - Snowmass Accelerator Conveners (AF1-AF7, ee/mmFora) Meeting #18

<https://indico.fnal.gov/event/55116/>

 Wednesday 29 Jun 2022, 16:00 → 19:00 Europe/Berlin

 Steve Gourlay (LBNL) , Tor Raubenheimer (SLAC) , Vladimir Shiltsev (FNAL)

**Description** Q&A Meeting with ITF - Snowmass Accelerator Frontier Conveners and Proponents (Meeting #18)  
Time: Wed., June 29, 2022 09:00 AM Central Time (US and Canada)

Agenda:

1. ITF members address submitted questions and comments

2. Discussion

ITF Report:

<https://indico.fnal.gov/event/54953/sessions/20614/attachments/156153/203696/ITFreportDRAFT.pdf>

Submitted Questions/comments: [https://docs.google.com/document/d/1zBnSmDX0iAmnE1\\_X5agaBHjk4Echjk31Qs7ZrGrs4xM/edit](https://docs.google.com/document/d/1zBnSmDX0iAmnE1_X5agaBHjk4Echjk31Qs7ZrGrs4xM/edit)

Zoom Link:

Join Zoom Meeting

<https://fnal.zoom.us/j/98105241806?pwd=RjJ4QlhGcXQ1aE5DV3NVdmZhVG5rZz09>

Meeting ID: 981 0524 1806

Passcode: 527516

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**16:00** → 18:45 **Summaries:: ITF (chair and members) address submitted Qs/comments and critique**

Convener: Vladimir Shiltsev (FNAL)

**18:45** → 19:00 **AOB**

AOB

**Speakers:** Steve Gourlay (LBNL), Tor Raubenheimer (SLAC), Vladimir Shiltsev (FNAL)

