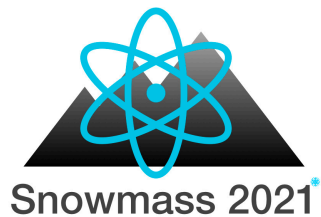


Instrumentation Frontier Workplan



July 17, 2022

Phil Barbeau (Duke), Petra Merkel (FNAL), Jinlong Zhang (ANL)

Instrumentation Frontier

Wiki: <https://snowmass21.org/instrumentation/start>

Descriptions, Mailing lists, slack channels, etc

The Instrumentation Frontier is geared to discuss **detector technologies and R&D needs for future experiments in collider physics, neutrino physics, intensity physics and at the cosmic frontier**. It is divided into diagonal topical groups with some overlap among a few of them. Synergies between the different topical groups, as well as with other Frontier groups and research areas outside of HEP will be paid close attention to.

“New directions in science are launched by new tools much more often than by new concepts.

The effect of a concept-driven revolution is to explain old things in new ways. The effect of a tool-driven revolution is to discover new things that have to be explained”

Freeman Dyson

Instrumentation Frontier – Topical Groups

Topical Group	Co-Conveners			
Quantum Sensors (IF01)	Thomas Cecil (ANL)	Kent Irwin (SLAC)	Reina Maruyama (Yale)	Matt Pyle (Berkeley)
Photon Detectors (IF02)	Carlos Escobar (FNAL)	Juan Estrada (FNAL)	Chris Rogan (KU)	
Solid State Detectors and Tracking (IF03)	Tony Affolder (UCSC)	Artur Apresyan (FNAL)	Steve Worm (DESY)	
Trigger and DAQ (IF04)	Darin Acosta (Florida)	Allison Deiana (SMU)	Wes Ketchum (FNAL)	
Micro Pattern Gas Detectors (IF05)	Bernd Surrow (Temple)	Maxim Titov (SACLAY)	Sven Vahsen (Hawaii)	
Calorimetry (IF06)	Andy White (UTA)	Minfang Yeh (BNL)	Rachel Yohay (FSU)	
Electronics/ASICS (IF07)	Gabriella Carini (BNL)	Mitch Newcomer (Penn)	John Parsons (Columbia)	
Noble Elements (IF08)	Eric Dahl (Northwestern)	Roxanne Guenette (Harvard)	Jen Raaf (FNAL)	
Cross Cutting and System Integration (IF09)	Jim Fast (JLab)	Maurice Garcia-Sciveres (LBL)	Ian Shipsey (Oxford)	
Radio Detection (IF10)	Amy Connolly (OSU)		Albrecht Karle (Wisconsin)	

Ex co-conveners: IF02: Maly Sanchez (ISU); IF03: Lucie Linssen (CERN); IF04: Stephanie Majewski (Oregon); IF10: Jim Beatty (OSU), Abigail Vieregg (Chicago).

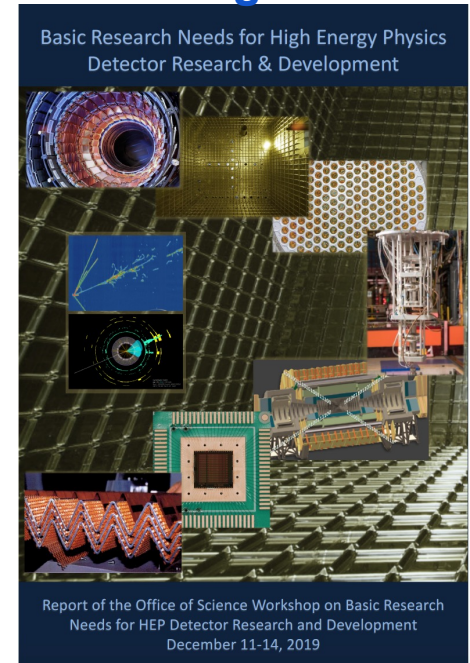
Liaisons

- **High-level and bi-directional communication between Frontiers**
- **Expertise and experience in both communities**
- **IF liaisons**
 - Energy Frontier: Caterina Vernieri (SLAC), Maksym Titov (CEA Saclay)
 - Neutrino Physics Frontier: Mayly Sanchez (ISU), NF10
 - Rare Processes and Precision: Marina Artuso (Syracuse)
 - Cosmic Frontier: Kent Irwin (SLAC), Hugh Lippincott (UCSB)
 - Accelerator Frontier: Andy White (UTA)
 - Computational Frontier: Darin Acosta (Florida)
 - Underground Facilities: Eric Dahl (Northwestern), Maurice Garcia-Sciveres (LBNL)
 - Community Engagement: Farah Fahim (FNAL)
 - Early Career representatives: S. Butalla (FIT), K. Dunne (Stockholm), J. Zettlemoyer (FNAL)

DOE Detector R&D BRN Report

- Great input for Snowmass IF studies. IF has been building on the research plans presented in the BRN study for the relevant topical areas, by developing and refining them further and introducing and developing new instrumentation ideas

- *“Transformative discovery in science is driven by innovation in technology. Our boldest undertakings in particle physics have at their foundation precision instrumentation. To reveal the profound connections underlying everything we see from the smallest scales to the largest distances in the Universe, to understand its fundamental constituents, and to reveal what is still unknown, we must invent, develop, and deploy advanced instrumentation”.*



2021 ECFA Detector R&D Roadmap

- Another great input for Snowmass IF studies.
- *“The centrality of experimentation to the scientific method which has led to the discoveries that underpin our current understanding of the Universe, and the technological wonders which have owed from this understanding, cannot be overstated. To appropriately test our current level of understanding requires very high accuracy instrumentation. The degree of confirmation that can be assigned to any hypothesis is determined both by the agreement between theoretical prediction and measurements and the level of precision achievable in each. Enabling future particle physics experiments to achieve the most accurate measurements possible is the fundamental target of all the proposed detectors outlined in this report.”*



LOI, White Paper & Report

- **LOIs**

- [~340 LOIs related to IF](#)
- [Summarized by topical groups](#)

- **White papers**

- [Few papers per topical group](#)
- Contributed or organized by topical groups

- **IF Report and IF topical group reports**

- Draft available soon on [Snowmass IF webpage](#)
 - Please make comments via the links there
- Major materials to be presented at IF plenary and parallel sessions
- Dedicated IF parallel sessions on Reports with community

Final Reports (Draft)

The IF report and all IF topical group reports will appear soon.

- [IF report](#) and [Community feedback](#)
- [IF01 topical group report](#) and [Community feedback](#)
- [IF02 topical group report](#) and [Community feedback](#)
- [IF03 topical group report](#) and [Community feedback](#)
- [IF04 topical group report](#) and [Community feedback](#)
- [IF05 topical group report](#) and [Community feedback](#)
- [IF06 topical group report](#) and [Community feedback](#)
- [IF07 topical group report](#) and [Community feedback](#)
- [IF08 topical group report](#) and [Community feedback](#)
- [IF09 topical group report](#) and [Community feedback](#)
- [IF10 topical group report](#) and [Community feedback](#)

IF Plenary

Wednesday July 20, 3:30 – 5pm

“Detector Technologies for the Next Decade”

- “Advancing detector instrumentation over the next decades”
- “Detector needs for future collider experiments”
- “Detector needs for future cosmic experiments”
- “Detector needs for future neutrino and intensity experiments”

Sunday July 24, 3:30 – 5pm

“Careers in Detector Instrumentation”

- Minfang Yeh: “Development and production of high-performance water based liquid scintillators for particle physics experiments” (15+5 minutes)
- Kerstin Perez: “Development of novel low-cost, large-area lithium-drifted silicon detectors” (15+5 minutes, virtual)
- Yuzhan Zhao: “Development of Deep Junction Low Gain Avalanche Diodes for high Granularity Timing Detectors” (8+2 minutes)
- Karia Dibert: “MKID Development for Measurement of the Cosmic Microwave Background” (8+2 minutes, virtual)
- Panel on workforce development, collaboration with industry and cross cutting technologies with outside HEP (30 minutes)

Co-organized with CPAD

IF Parallel Sessions

- **Topical group sessions for report discussions and technology highlights**
 - 07/18: IF01, IF02
 - 07/19: IF03, IF04, IF06, IF10
 - 07/20: IF07
 - 07/22: IF05, IF08, IF09
- **IF Report sessions with community**
 - 07/21 08:00-12:00: Instrumentation Frontier (Discussing the Report with the Community)
 - 07/23 10:00-12:00: Instrumentation Frontier (Finalizing the Report with Community Input)
 - 07/24 10:00-12:00: Instrumentation Frontier (Vision for Detector Instrumentation in HEP)

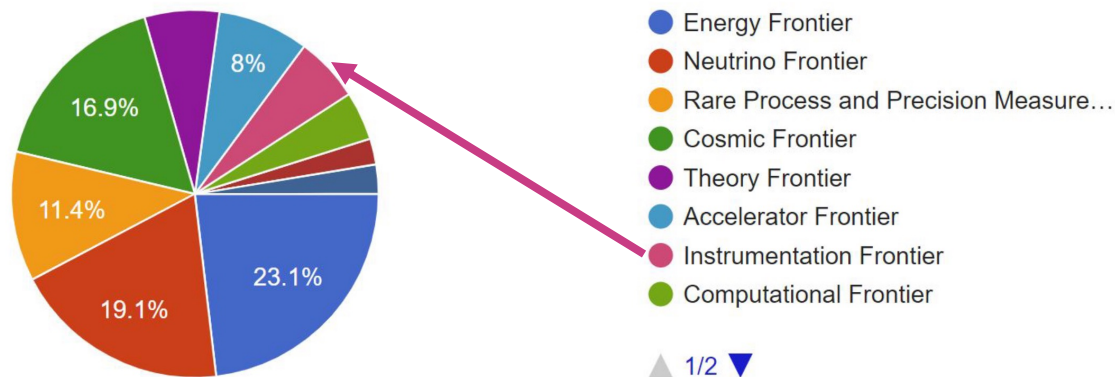
Cross-Frontier IF Sessions

- **IF relevant sessions**

- 18A: 07/18 08:00-12:00 CEF Feedback
- 22F: 07/20 08:00-10:00 IF-UF Quantum Science & Technology (QST)
- 21F: 07/23 08:00-10:00 IF-UF Cross-cutting Facilities
- 21J: 07/21 08:00-10:00 IF-RF-EF Fast timing requirements and technology developments for future experiments
- 21I: 07/21 08:00-12:00 IF-EF-AF Detectors and MDI and Plots
- 21G (+22J): 07/23 08:00-10:00 IF-NF Instrumentation for Neutrino Experiments
(22J): 07/23 10:00-12:00 NF-CF-IF Dark matter detector

Instrumentation Frontier

Primary Frontier



Let's sharpen the message together:

a strong need for much increased technology development, in preparation for the next big step in facilities and experiments while we exploit the ones we are currently developing/building

Please come to IF meetings, comment on IF reports, contact IF conveners and sub conveners