

Instrumentation Frontier: White Paper Status

All Conveners Meeting, March 18th 2022

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IF01

Quantum Sensors

- Snowmass 2021: Quantum Sensors for HEP Science - Interferometers, Mechanics, Traps, and Clocks:
<https://arxiv.org/abs/2203.07250>
- Quantum Sensors for high precision measurements of spin-dependent interactions: submission today

IF02

Photon Detectors

- Photon counting from the vacuum ultraviolet to the short wavelength infrared using semiconductor and superconducting technologies: last touches
- (Reading list for Photon Detector Developments in Snowmass white papers): document that will point to the submitted WPs with sections relevant to photon detectors, so that we have a full reading list to prepare our report

IF03

Silicon Tracking & Vertexing

- Simulations of Silicon Radiation Detectors for High Energy Physics Experiments:
<https://arxiv.org/abs/2203.06216>
- Novel Sensors for Particle Tracking: a Contribution to the Snowmass Community Planning Exercise of 2021:
<https://arxiv.org/abs/2202.11828>
- 4-Dimensional Trackers: Draft complete, being reviewed by authors now
- Integration and Packaging:
<https://arxiv.org/abs/2203.06093>
- Mechanics, lightweight materials, cooling: authors expect to submit by today
- Monolithic Active Pixel Sensors on CMOS technologies:
<https://arxiv.org/abs/2203.07626>

IF04

TDAQ

- Innovations in trigger and data acquisition systems for next-generation physics facilities: draft submitted, pending
- Readout Technologies for Future Detectors: being finalized very soon.
- Applications and Techniques for Fast Machine Learning in Science:
<https://arxiv.org/abs/2110.13041>

IF05

MPGD

- MPGDs: Recent advances and current R&D:
<https://arxiv.org/abs/2203.06562>
- Micro Pattern Gaseous Detectors for Nuclear Physics: <https://arxiv.org/abs/2203.06309>
- Recoil imaging for dark matter, neutrinos, and physics beyond the Standard Model:
<https://arxiv.org/abs/2203.05914>
- MPGDs for TPCs at future lepton colliders:
<https://arxiv.org/abs/2203.06267>
- MPGDs for tracking and Muon detection at future high energy physics colliders:
<https://arxiv.org/abs/2203.06525>

IF06

Calorimetry

- Precision timing for collider-experiment-based calorimetry:
<https://arxiv.org/abs/2203.07286>
- Materials for Future Calorimeters:
<https://arxiv.org/abs/2203.07154>
- Particle Flow Calorimetry for Future Colliders: will submit on 3/25
- Dual Readout Calorimetry for Future Colliders: <https://arxiv.org/abs/2203.04312>
- New Calorimeter Techniques and Materials for Dark Matter Detection: submitted; waiting for arXiv link

IF07

Electronics & ASICs

- Enabling Capabilities for Infrastructure and Workforce in Electronics and ASICs: expect submission before 3/31
- Readout for Calorimetry: expect submission before 3/31
- Silicon and Photodectors: Awaiting input
- Electronics for Fast Timing: expect submission before 3/31
- Fast (optical) Links: expect submission before 3/31
- Smart sensors using artificial intelligence for on-detector electronics and ASICs: expect submission before 3/31
- Cryogenics Readout: expect submission before 3/31
- RF Electronics: expect submission before 3/31

IF08

Noble Element Detectors

IF08 organized Executive Summary pages instead of white papers. They will be located at: https://snowmass21.org/instrumentation/noble_elements

- Pixel readout for noble element time projection chambers
- Charge gain for noble element time projection chambers
- Light Collection for noble element time projection chambers
- Low-threshold TPCs
- Enabling directionality and micron precision in noble element time projection chambers
- Metastable Fluids detectors
- Enhancing physics reach at existing noble element infrastructure
- Barium Tagging in Xenon TPCs
- Scaling challenges for noble element detectors
- Noble element detector characterization and calibration

IF09

Cross Cutting and Systems Integration

- Cryogenic User Facilities for R&D on Noble Liquid Detectors and Low Temperature Devices: <https://arxiv.org/abs/2203.06146>
- A Facility for Low-Radioactivity Underground Argon: not yet
- Test Beam and Irradiation Facilities: submitted on 3/15; moved from hep-ex to accelerator physics

IF10

Radio Detection

- Instrumentation Development for Radio Detection of High-Energy Neutrinos: not yet
- Large-Format, Transmission-Line-Coupled Kinetic Inductance Detector Arrays for HEP at Millimeter Wavelengths: not yet

Discussions Across Frontier Boundaries

- Several IF Topical Groups need to coordinate sections in their summary reports with other Frontiers and Topical Groups in other Frontiers
- Plan to organize either TG-level working meetings or IF-wide workshop with other Frontiers' TGs between now and Seattle