

Snowmass 2021
Update and plans
for Instrumentation Frontier/Calorimetry

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CALICE Collaboration Meeting, March 26, 2021

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Update and plans for Instrumentation Frontier/Calorimetry

- Instrumentation Frontier/Calorimetry specific items

Organization, topics, experiments, facilities

LOIs received – breakdown, categorization

White papers

- Overall Snowmass schedule – delayed
- Instrumentation plans short/medium term

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for Instrumentation Frontier/Calorimetry

INSTRUMENTATION FRONTIER

Topical groups

- IF1: Quantum Sensors
- IF2: Photon Detectors
- IF3: Solid State Detectors and Tracking
- IF4: Trigger and DAQ
- IF5: Micro Pattern Gas Detectors (MPGDs)
- **IF6: Calorimetry**
- IF7: Electronics/ASICs
- IF8: Noble Elements
- IF9: Cross Cutting and Systems Integration
- IF10: Radio Detection

Conveners

Name	Institution	email
Phil Barbeau	Duke University	psbarbeau[at]phy.duke.edu
Petra Merkel	Fermi National Accelerator Laboratory	petra[at]fnal.gov
Jinlong Zhang	Argonne National Laboratory	zhangjl[at]anl.gov

Liaisons

Other Frontier	Liaisons
Energy Frontier	Maksym Titov (CEA SACLAY), Caterina Vernieri (SLAC)
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)

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Instrumentation Frontier
IF06 - Calorimetry - Conveners

Andy White (UTA), Minfang Yeh (BNL), Rachel Yohay (Florida State)

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Instrumentation Frontier - Calorimetry

- ☛ Calorimetry Requirements from Physics
- ☛ Experiments/Facilities using Calorimetry
- ☛ Technology Tools and Calorimetry Development Areas
- ☛ Performance studies
- ☛ Calorimeter R&D

Experiments/Facilities using Calorimetry

Colliders

- LHC (ATLAS, CMS, ALICE, LHCb)/HL-LHC, FCChh,...
- Lepton Colliders – ILC (SiD, ILD), CLIC, CEPC, FCCee, ...
- CALICE
- EIC

Neutrino experiments

- DUNE
- neutrinoless double-beta decay (CUORE, nEXO)
- MINOS, SuperNEMO, NovA

Low Energy Experiments

- Mu2e, EDM, rare decays

Dark Matter Search Experiments

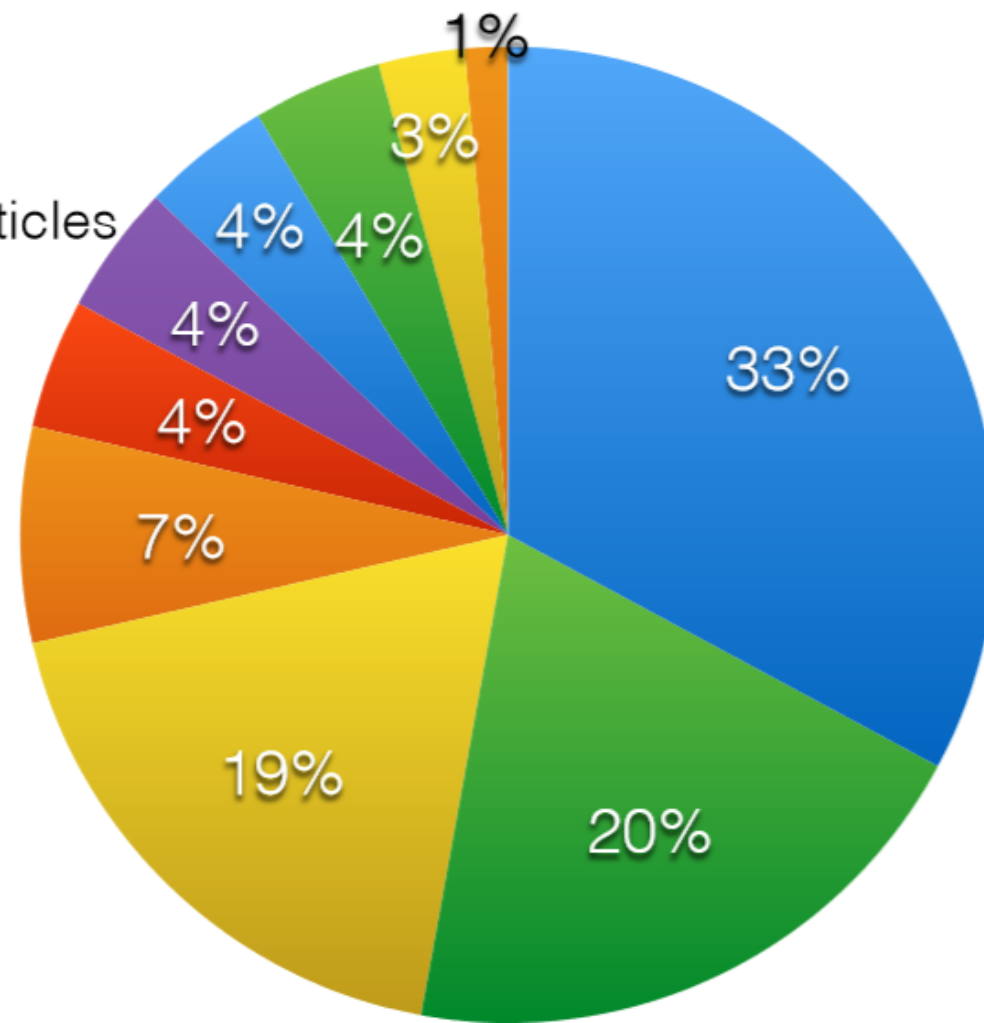
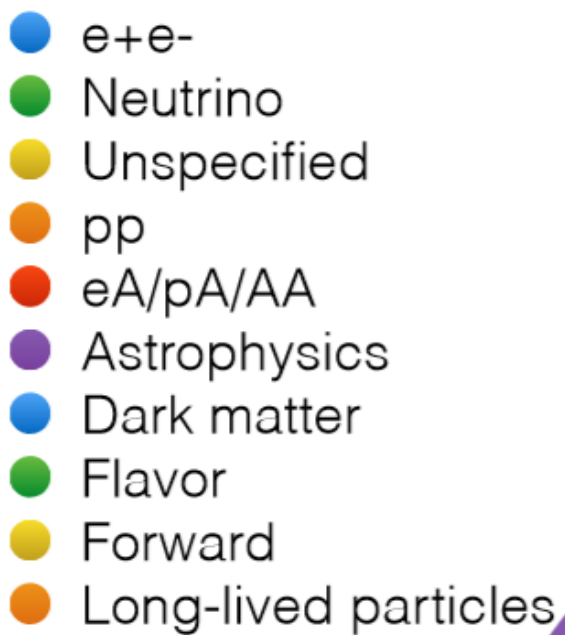
- veto (e.g. LZ)
- future G3 concept

Experiments in Space

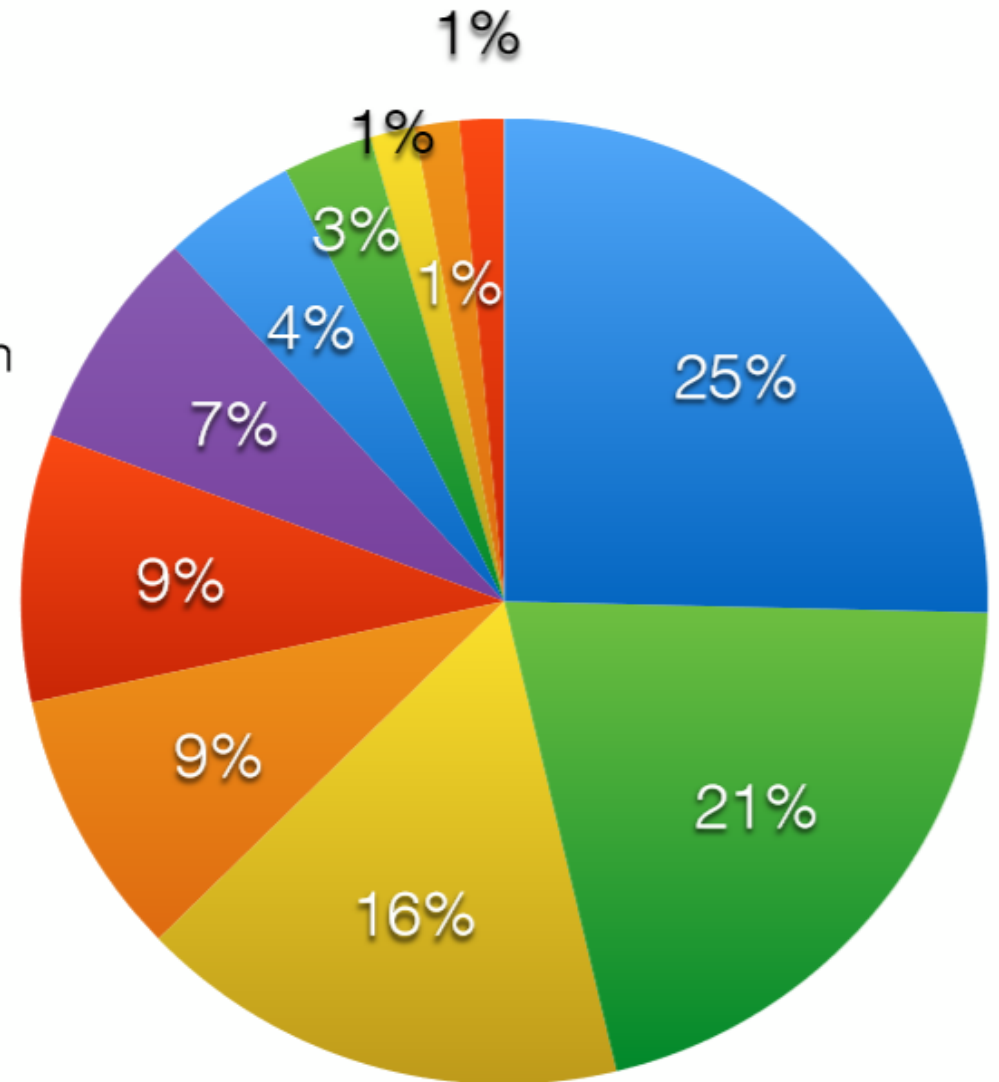
- AMS

65 LOIs Submitted

- e^+e^- , generalized R&D, and neutrino applications dominate



- Particle flow / high granularity
- Dual readout
- Unspecified/Multiple
- Timing
- Nuclear recoil
- Photodetection
- Very low noise
- Sampling
- Readout
- Total absorption
- Secondary emission



- Particle flow, dual readout, generalized R&D, timing, and nuclear recoil applications dominate

Organize LOIs into groups for White Paper planning

Collider related						
Particle Flow						
Title	Contact	File	e	Experiment	Material	Physics
e+e-						
Belle II detector upgrades	sevahsen@hawaii.edu	IF2_IF7_IF3_IF4_IF5_IF6-056.pdf	Multiple	Belle II	Plastic scintillator	e, gamma ID
Detector optimisation and detector technology R&D for the CLIC detector and for the CLD detector of FCC-ee	mbenoit@bnl.gov	IF3_IF6_Mathieu_Benoit-188.pdf	PF	CLIC, CLD	Si, scintillator	e+e-
SID	A.White	IF3_IF6-EF1_EF4_Andy_White_Marcel_Stanitzki-027.pdf	PF	SID/ILC	Si, scintillator	e+e-, e+e-, mu+mu-, hh
Advanced GEM detectors for future collider experiments	A.Colaleo (Bari)	IF5_IF6-EF4_EF0_COLALEO-068.pdf	Sampling	FCC, muon collider	GEM	
Development of highly granular scintillator strip electromagnetic calorimeter	wataru@icepp.s.u-tokyo.ac.jp	IF6_IF0_CALICE-058.pdf	PF	CALICE	Scintillator	e+e-
CALICE R&D for a highly granular silicon tungsten electromagnetic calorimeter, SiW-ECAL	Vincent.Boudry@llr.in2p3.fr	IF6_IF0_CALICE-077.pdf	PF	CALICE	Si	e+e-
CALICE R&D for compact readout systems for highly granular calorimeters	katja.krueger@desy.de	IF6_IF0_CALICE-082.pdf	PF	CALICE	Asic	e+e-
Digital hadron calorimetry	yasar-oneel@uiowa.edu	IF6_IF0_Yasar_Oneel-048.pdf	PF	ILC/CLIC/FCC	RPC	e+e-
High-granularity crystal calorimetry	S.Eno	IF6_IF0_Yong_Liu-064.pdf	PF	ILC/CLIC/FCC	Crystals	e+e-
CALICE R&D for compact readout systems for highly granular calorimeters	katja.krueger@desy.de	IF6_IF0-026.pdf	Readout			e+e-
Particle flow calorimeters for the CEPC	liujianb@ustc.ac.cn	IF6_IF0-176.pdf	PF	CEPC	Si, scintillator	e+e-
Fast optical photon transport at GEANT4 with dual-readout calorimeter at future e+e- colliders	hdyoo@yonsei.ac.kr	IF6_IF0-CompF2_CompF0_Hwidong_Yoo-060.pdf	DRO	CEPC, FCCee	Optical fibers	e+e-
Tau reconstruction and identification using machine learning technique with dual-readout calorimeter at future e+e- colliders	hdyoo@yonsei.ac.kr	IF6_IF0-EF1_EF0_Hwidong_Yoo-063.pdf	GEANT, DRO	CEPC, FCCee	Optical fibers	e+e-
pp						
The High Granularity Calorimeter upgrade to the Compact Muon Solenoid detector	ryohay@fsu.edu	IF6_IF0-165.pdf	PF	CMS	Si, scintillator	pp
Advanced optical instrumentation for ultra-compact, radiation hard EM calorimetry applications	rruchti@nd.edu	IF6_IF4-EF1_EF4-102.pdf	Sampling, photodetection	FCChh	Scintillator	pp
Forward region of future colliders, high intensity and low earth orbit cosmic frontiers	irfield.edu	IF6_IF9_David_R_Winn-036.pdf	Photodetection	any	PMT, dynodes	

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Instrumentation Frontier – Calorimetry

Draft White Papers

1) Collider

- Particle Flow Calorimetry for Future Colliders
- Dual Readout Calorimetry for Future Colliders
- Precision Timing for Collider Experiment based Calorimetry

2) Neutrino

- Calorimeter Techniques and Materials for Neutrino Experiments

3) Dark Matter

- New Calorimeter Techniques and Materials for Dark Matter Detection

4) Astro/Cosmic

5) Materials

- Materials for Future Calorimeters

Next steps

- Finalize White Papers
- appoint lead authors for White Papers

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Instrumentation Frontier – Calorimetry

New schedule

- White Paper submission to arXiv: no later than March 15, 2022. Late submissions and updates are likely not to be incorporated in the working group reports, but will be included in the Snowmass on-line archive documents.
- Preliminary reports by the Topical Groups due: no later than May 31, 2022.
- Preliminary reports by the Frontiers due: no later than June 30, 2022.
- Snowmass Community Summer Study (CSS): July, 2022 at UW-Seattle.
- All final reports by TGs and Frontiers due: no later than September 30, 2022.
- Snowmass Book and the on-line archive documents due: October 31, 2022.

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for Instrumentation Frontier/Calorimetry

Next steps for Instrumentation Frontier

- Pause in general activities until August
- Let LOI writers know in which White Paper their inputs will be processed
- IF6 Conveners – Calorimetry – meet each month
- Consider convergence of IF6 issues with DoE/BRN
- Study input from e.g. LCWS2021, CPAD, TIPP,...