

# Snowmass 2021

## Instrumentation Frontier

### Calorimetry

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

# Snowmass 2021

## Instrumentation Frontier Calorimetry

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

# Contacting Collaborations

Dear Colleagues,

We are writing to you as the conveners of the Calorimetry group of the Instrumentation Frontier for Snowmass 2021. The mission of our Snowmass 2021 process is for all of us to review the current status of calorimetry, put forward new ideas, and define the next 5-10 years in terms of improved experiments.

We look forward to hearing about and discussing your work on calorimetry, lessons learned, ongoing and projected R&D, ideas for new techniques and suggestions for improving existing techniques, and any views or concerns about the state of our research area.

We are presently organizing our activities into several major areas:

- Calorimetry requirements from physics
- Experiments/Facilities using Calorimetry
- Technology Tools and Calorimeter Development Areas
- Performance Studies

We have a few different communication channels that we hope you will participate in.

Webpage for community meeting announcements and minutes:

<https://snowmass21.org/instrumentation/calorimetry>

E-mail list, primarily for announcements: SNOWMASS-IF-06-CALORIMETRY@fnal.gov (to subscribe, send an e-mail to [listserv@fnal.gov](mailto:listserv@fnal.gov) with the subject line blank and the words SUBSCRIBE SNOWMASS-IF-06-CALORIMETRY FIRSTNAME LASTNAME in the body of the message)

Slack, for real-time discussion: team snowmass2021, channel #if06-calorimetry (using a CERN or Fermilab e-mail address to join the team should work—if not, please e-mail [rhbob@fnal.gov](mailto:rhbob@fnal.gov) with the subject line “snowmass slack” for help)

We look forward to hearing from you, either directly via email, or through the submission of Letters of Interest (<https://snowmass21.org/loi>) and through contributed papers (<https://snowmass21.org/submissions/start>). Letters of interest are being solicited now through August 31, 2020.

With best regards,

Andy White, University of Texas at Arlington ([awhite@uta.edu](mailto:awhite@uta.edu))

Minfang Yeh, Brookhaven National Laboratory ([yeh@bnl.gov](mailto:yeh@bnl.gov))

Rachel Yohay, Florida State University ([ryohay@fsu.edu](mailto:ryohay@fsu.edu))

Snowmass 2021, Instrumentation Frontier – Calorimetry conveners.

# 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

- 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

# Snowmass 2021

## Instrumentation Frontier Calorimetry

- > Continue/complete contacting collaborations
- > Encourage/monitor LOIs
- > Mailing list growing (25+)
- > Discussing plans for a general Instrumentation/Calorimetry meeting
- > Conveners meeting bi-weekly

Backup

# Calorimetry Requirements from Physics

Energy resolution

Energy containment

Single particles

Showers

Charged and neutral particles

Linearity

Compensation

Pileup rejection

# Technology Tools and Calorimetry Development Areas

Sampling, homogeneous calorimeters

Materials for Calorimetry (high-Z, high-concentration, metal-doped liquid scintillator, water-based liquid scintillator, and plastics scintillator, hybrid liquid/crystal/plastics/glass, high-purity metal, etc.)

Energy detection mechanisms (Scintillation, Ionization, Cryogenic,...)

Radiation Hardness

Fast Timing

Readout systems/transducers/noise

Calibration/monitoring

Triggers/DAQ

Reconstruction algorithms

Particle Flow, Dual readout

Calorimeter Simulations



# Performance studies

Electromagnetic showers

Hadron showers

Single particles

Particle ID in calorimeters (background rejection?)

Timing studies

Simulations vs calorimeter data

Hadronic and electromagnetic energy resolution

Pileup rejection