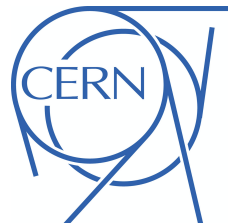


# IF03: Solid State Detectors and Tracking

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*Bi-weekly IF03 Solid State Detectors and Tracking*



UC SANTA CRUZ

# IF03: Solid State Detectors and Tracking

- IF03 tracking: <https://snowmass21.org/instrumentation/tracking>
- This topical group aims to study detectors and technologies needed for charged particle tracking:
  - Technologies for colliders, fixed target, or precision measurement experiments
  - Ranging from silicon to diamond and other alternative materials.
  - Also non-solid-state trackers, e.g. for high-intensity experiments.
  - 3D integration, ultra-lightweight materials for mechanical support & cooling.
- Trackers should be discussed in the context of future experimental challenges
  - Identify technological challenges and technology opportunities with different future accelerators
  - Moreover “blue sky” R&D is important => opportunities for future transformative breakthroughs’

# Snowmass process, Instrumentation Frontier

- Community-driven effort on long-term planning for particle physics
- **Bottom-up process => your input is needed !!**
  - That's the most important aspect at this phase of the process
  - The idea is to get the community at large involved
- **Milestones along the way:**
  - Letters of Interest due 31 Aug 2020: **DONE**
  - (Virtual) Community Planning Meeting: October 5-8 **DONE**
  - Definition of the list of White Papers: pre-Christmas 2020
    - We would like to have all the contributing groups/authors defined by then
    - We will hold another meeting before Christmas to discuss the WPs
  - Summer Study meeting meeting: 11-20 July 2021
  - Contributed Papers due July 31 2021

# Letters of interest received by IF03

- We received about 60 LOIs
  - Two main groupings: Experiments that include trackers, or generic tracker Technology LOIs
  - In several cases the LOIs submitted to IF03 fit into many categories (e.g. calorimeters, quantum, etc),
- LOIs focusing on an experiment (rather than specific detector technology) were directed to the IF conveners to coordinate across the groups
- If an LOI was listed in several IF groups, we coordinated with other IF groups to identify the **lead** group where the contribution will be taken
  - Please let us know if you don't find your contribution listed in IF03 and you believe it should be
  - We are trying to find a home for several LOIs that are solid-state based detectors but are not trackers
- All the IF03 that we believe should be in this group were organized around White Paper ideas, and are shown in the next slides

# White paper candidates

## 1. Studies focusing on physics motivations for tracking detectors (Requirements)

- IF9\_IF3-EF9\_EF0-AF4\_AF1-143: **Muon collider tracker requirements**: contact S. Jindariani (FNAL)
  - EF1\_EF2-IF3\_IF0\_Valentina\_Maria\_Martina\_Cairo-047: **Strange Quark as a probe for new physics in the Higgs Sector**: contact V.M.M. Cairo (SLAC)
  - EF3\_EF0-RF1\_RF0-IF3\_IF6-077: **Searching for  $B_s \rightarrow \Phi \nu \nu$  and other  $b \rightarrow s \nu \nu$  processes at CEPC**: contact M. Ruan (IHEP China)
  - EF4\_EF0-AF3\_AF0-IF3\_IF5\_GrahamWilson-119: **Exploring precision electroweak physics measurement potential of  $e^+e^-$  colliders**: contact G. Wilson (KU)
  - EF5\_EF7-TF7\_TF0-IF6\_IF3-CompF3\_CompF0\_Ben\_Nachman\_(bpnachman@lbl.gov)-035: **Jets and jet substructure at future colliders**: contact B. Nachman (LBNL)
  - **Solid State & Tracking in BRN**- Marina Artuso (Syracuse)-IF03 Presentation
  - **Silicon detectors R&D and physics drivers for future machines**- Caterina Vernieri- IF03 Presentation
  - **Parameters for future trackers**- Simone Griso (LBNL)-IF03 Presentation
  - **EF perspective (Maxim Titov) and RF perspective (Mariana Artuso (Syracuse))**-CPM 130
- Will be organized by EF and RF liaisons to IF (Maxim, Caterina, Marina)

# White paper candidates

## 2. 4D trackers, precision time + position; OR precision position + moderately good time (Timing)

- IF3\_IF0\_University\_of\_California\_Santa\_Cruz-018: **Use of extremely thin ‘LGAD’ ultra-fast silicon detectors for fast timing and tracking in high radiation sections at future colliders**: contact: S. Mazza (UCSC)
- IF3\_IF7\_Karri\_DiPetrillo-142: **Precision timing detectors for future colliders**: contact K. DiPetrillo
- IF3\_IF7-131: **4-dimensional trackers**: contact A. Schwartzman (SLAC)

## 3. Monolithic integrated silicon detectors, CMOS (MAPs)

- IF3\_IF2\_Jessica\_Metcalf-154: **Silicon Pixel Detectors in Space**; contact. J. Metcalfe (ANL)
- IF3\_IF7\_Martin\_Breidenbach-113: **Large area CMOS monolithic active pixel sensors for future colliders**: contact M. Breitenbach (SLAC)
- IF7\_IF3\_Leo\_Greiner-160: **Monolithic active pixel sensors for high performance tracking**: contact L. Greiner (LBNL)

## 4. Integration and Packaging (Integration)

- IF3\_IF5\_Simone\_Mazza-175: **High density 3D integration of LGAD sensors through wafer-to-wafer bonding**: contact S. Mazza (UCSC)
- IF3\_IF0\_Ronald\_Lipton-080: **3D Integration of Sensors and Electronics**: contact R. Lipton (FNAL)
- **2.5/3D integration**- Robert Patti (NHanced Semiconductor INC)-IF03 presentation

# White paper candidates

## 5. Mechanics, lightweight materials, cooling (Mechanics)

- IF3\_IF0\_Jung-118: **Light-weight and highly thermally conductive support structures for future tracking detectors**: contact: A. Jung (Purdue)
- **Mechanics supports for future tracking detector**-Eric Anderssen (LBNL)-IF03 presentation
- **Future cooling** - Yadira Padilla- upcoming IF03 meeting

## 6. Exotic Solid-state Materials and Gaseous trackers: (Exotic)

- IF3\_IF0\_N.\_Fourches-107: **Beyond CMOS sensors, submicron pixels for the vertex detector** : contact: N.T. Fourches (CEA-Saclay)
- IF3\_IF9\_Jessica\_Metcalf-161: **Thin Film Detectors**: contact Jessica Metcalfe (ANL)
- IF3\_IF0\_H\_Kagan-130: **3D Diamond Detectors** : contact: H. Kagan (OSU)
- IF3\_IF2\_Mazziotta-100: **Gamma-ray Scintillator Fiber Tracker**: contact M. Nicola Mazziotta (INFN Bari)
- IF0\_IF0-RF0\_RF0\_Daniel\_Ambrose-094: **Mu2e-II Tracker**: contact D. Ambrose University of Minnesota

# White paper candidates

## 7. Simulation Tools (Simulation)

- **Simulation tools and radiation damage** - Ben Nachman (LBNL)-IF 03 presentation
- **Simulation tools and radiation damage** - Timo Peltola (Texas Tech)- IF03 presentation

## 8. System Considerations (Systems)

- If required.
- **Silicon Detectors** - Vitaliy Fadeyev (UCSC)-IF03 presentation

## 9. Future Collaborations and Facilities (Collaborations)

- **European**
- **Asian**
- **Canadian**
- **Organization of US R&D**
- **BRN**
- **Technology Roadmap**



# Summary

- We would now like to start organizing the white paper editing and organization of ideas
  - Need to finalize the list and scope of white papers by Christmas
  - You can still contribute even if you don't have an LoI submitted
  - Interested people please contact us to be editors/leads
  - Need to identify main editors for each white paper
- Please let us know if there are additional White Papers to add