IF03: Solid State Detectors and Tracking

Status and Plans

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December 16, 2021
Where are we?

• The current stage of the Snowmass Process is the generation of White (Contributed) Papers.
  – Topical Group Summaries, Instrumentation Summaries to follow

• Today’s meeting will focus on White Paper progress and planning
  – Provide outline with responsible persons per section

• Next meeting Thursday at 1 pm Central on Jan 20th
  – Expect to have the first draft white paper

• Instrumentation Frontier White Paper Wrap-up
  – February 14-17 @ Stoneybrook University: in-person is default plan
  – 2 days parallel sessions (IF TGs): sit down and start finishing white papers (1 month before deadline)
White Paper Timelines

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Snowmass Timelines

- **Fall 2021**: White paper submission
- **01/22**: WP submission
- **02/22**: Preliminary TG reports
- **03/22**: Preliminary Frontier reports
- **04/22**: Frontier Executive summaries
- **05/22**: Final TG/Frontier reports
- **06/22**: Snowmass Book (SG) & on-line arXiv docs
- **07/22**: CSS
- **08/22**: July 17-27, 2022 Community Summer Study UW - Seattle
- **09/22**: Snowmass Book & arXiv
- **10/22**: White paper submission

*First drafts*
Snowmass Important Dates

• 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 online 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.
White Paper Content, Templates, Topic Summaries

• White papers should address
  – Challenges that are being tackled
  – Briefly summarize the physics motivation,
  – Recent results and a roadmap for near- to middle-term R&D.

• Suggested length of 10-15 pages
  – One page executive summary
  – Executive summaries will be used to build up Topical Group Summary

• Topical Group Summary should give a general overview of the area of silicon trackers, in addition to specific summaries of each WP
  – Suggested length of 5-10 pages, with 1-2 page executive summary

• LaTex template at https://snowmass21.org/submissions/start
White papers in IF03

- 4D trackers and precision timing: R. Heller, A. Schwartzman
- Integration and Packaging: S. Mazza
- Novel Sensors for Particle Tracking: S. Seidel
- Mechanics, lightweight materials, cooling: A. Jung
- Simulation tools: B. Nachman
- Monolithic integrated silicon detectors, CMOS (MAPs): C. Vernieri
- Non-silicon trackers:
1. Physics motivations for requirements of tracking detectors (Requirements)

- IF9_EF9_EF0-AF4_AF1-143: **Muon collider tracker requirements**: contact S. Jindariani (FNAL)
- EF1_EF2-EF3_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 Bs-->PhiNuNu and other b-->sNuNu 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)
- RF-EF-OF-CompF-011: **Letter of interest from the US LHCb Group**: contact M. Artuso (Syracuse)
- **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)
- Designed to give requirements/motivation for the rest of the White Papers
White papers (2)

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_Metcalfe-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 papers (3)

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 No longer involved. IS THERE ANYONE THAT COULD PROVIDE INPUTS HERE?

6. Novel Sensors for Particle Trackers (Novel)
   - IF3_IF0_N._Fourches-107: Beyond CMOS sensors, submicron pixels for the vertex detector : contact: N.T. Fourches (CEA-Saclay)
   - IF3_IF9_Jessica_Metcalfe-161: Thin Film Detectors: contact Jessica Metcalfe (ANL)
   - IF3_IF0_H_Kagan-130: 3D Diamond Detectors: contact: H. Kagan (OSU)
   - Silicon Sensors in 3D Technology: contract S. Seidel (New Mexico)

7. Non-silicon trackers: (Non-silicon)
   - 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 (Minnesota)
   - IF0_IF0-043: Identification of TeV hadrons: Transition Radiation Detectors: contact M. Albrow (FNAL)
   - IF3_IF0_Pavel_Murat_129: Exploration of charge particle tracking using InAs quantum dots in GaAs semiconductor matrix. Contact M. Hedges (Purdue)

8. Simulation Tools for Silicon Detector Developments (Simulation)
   - Simulation tools and radiation damage - Ben Nachman (LBNL)-IF 03 presentation
   - Simulation tools and radiation damage - Timo Peltola (Texas Tech)- IF03 presentation
Completeness and contacts

- Is the White Paper list capturing the community completely?
  - Is your LoI incorporated in one of the papers?
- Is there any optimization to be done with the groupings?
  - Should we split any?
- For each White Paper, we would like a contact person to simplify communication
  - Can each White Paper please volunteer 1-2 persons?