IF03: Solid State Detectors and Tracking

Artur Apresyan, Lucie Linssen, Tony Affolder

August 27, 2020

Bi-weekly IF03 Solid State Detectors and Tracking

Fermilab

CERN

UC SANTA CRUZ

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
  - See text "how to Snowmass" by Chris Quigg
  - 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
    - Summer Study meeting meeting: 11-20 July 2021
    - Contributed Papers due July 31 2021
- Instrumentation Frontier focuses on detector technologies and R&D needs for future experiments across the physics frontiers
- See IF kickoff workshop: https://indico.fnal.gov/event/43730/

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’

Letters of interest received by IF03

- We received 62 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), and their final assignment is in progress

- Some common themes that emerge in these LOIs:
  - Studies focusing on physics motivations for a particular technology
  - 4D trackers, precision time + position measurements
  - Monolithic integrated silicon detectors, CMOS, 3D integration
  - High rad tolerant sensors, radiation hardness
  - Mechanics and hybridization, integration aspects, light weight materials
  - Gaseous trackers, scintillating fibers, some detectors fit more into MPGD
  - Several CEPC oriented proposals

IF03: Solid State Detectors and Tracking

	Experiments	Title	contact
3	IF0_IF0-RF0_RF0_Daniel_Ambrose-094.pdf	Mu2e-II Tracker	ambr0028@umn.edu
4	IF10_IF3_David_R_Winn-093.pdf	Forward 3<eta<6 lepton-photon-jet system	winn@fairfield.edu
5	IF2_IF7_IF3_IF4_IF5_IF6-056.pdf	Belle II detector upgrades	sevahsen@hawaii.edu
6	IF3_IF0_Oskar_Hartbrich-192.pdf	STOPGAP - a Time-of-Flight extension. for the TOF	ohartbri@hawaii.edu
7	IF3_IF0_Zhijun_Liang-169.pdf	Silicon vertex detector for CEPC	zhijun.liang@cern.ch
8	IF3_IF6_Mathieu_Benoit-188.pdf	Detector optimisation and detector technology R&D	mbenoit@bnl.gov
9	IF3_IF6-112.pdf	Detector optimisation and detector technology R&D	mbenoit@bnl.gov
10	IF3_IF6-EF1_EF4_Andy_White,_Marcel_Stanitzki-027.pdf	SiD	A.White
11	IF3_IF7_CEPC-190.pdf	Time of Flight detector for CEPC	zhijun.liang@cern.ch
12	IF3_IF8-NF2_NF9_Jing_Liu-095.pdf	COHERENT: Instrumentation development	jing.liu@usd.edu
13	IF5_IF3-015.pdf	A time projection chamber using advanced technol	A. Bellerive (Carleton)
14	IF	Dual-readout calorimeter for future Electron-Ion Co	hdyoo@yonsei.ac.kr
15	CI	Potential future uses of the Rubin Observatory facil	skahn@slac.stanford.edu
16	IF	Muon collider experiment: requirements for new de	D.Lucchhesi (Padova)
17	EF1_EF2-IF3_IF0_Valentina_Maria_Martina_Cairo-047.pdf	Strange quark as a probe for new physics in the Hi	V.M.M. Cairo (SLAC)
18	EF1_EF4-IF3_IF6-096.pdf	IDEA detector	F.Bedeschi
19	EF3_EF0-RF1_RF0-IF3_IF6-077.pdf	Searching for Bs-->PhiNuNu and other b-->sNuNu	manqi.ruan@ihep.ac.cn
20	EF3_EF4-IF3_IF5-031.pdf	The IDEA drift chamber for a Lepton Collider	franco.grancagnolo@le.infn.it
21	EF4_EF0-AF3_AF0-IF3_IF5_GrahamWilson-119.pdf	Exploring precision electroweak physics measurem	gwwilson@ku.edu
22	EF5_EF7-TF7_TF0-IF6_IF3-CompF3_CompF0_Ben_Nachi	Jets and jet substructure at future colliders	bpnachman@lbl.gov
23	EF9_EF10-NF3_NF0-RF6_RF0-AF5_AF0-IF3_IF7_MATHU	Recent progress and next steps for the MATHUSLA	dcurtin@physics.utoronto.ca
24	NF2_NF0-IF3_IF0_Susanne_Mertens-197.pdf	Prospects for keV sterile neutrino searches with KA	mertens@mpp.mpg.de
25	RF2_RF6-IF6_IF3_REDTOP_Collaboration_-_new-083.pdf	The REDTOP experiment: an eta/eta' factory	gatto@na.infn.it
26	RF2_RF6-IF6_IF3_REDTOP_Collaboration-035.pdf	The REDTOP experiment: an eta/eta' factory	gatto@na.infn.it
27			

A Time Projection Chamb...
snowmass21.org

IF03: Solid State Detectors and Tracking

30	Technology	Title	contact
31	IF3_IF0_N._Fourches-107.pdf	Beyond CMOS sensors, submicron pixels for the ve	N.T.Fourches (Saclay)
32	IF3_IF9_David_R_Winn-032.pdf	High precision timing and high rate detectors	winn@fairfield.edu
33	IF3_IF9_Jessica_Metcalfe-161.pdf	Thin film detectors	jmetcalfe@anl.gov
34	IF3_IF0_H_Kagan-130.pdf	3D diamond detectors	kagan.1@osu.edu
35	IF3_IF0_Jung-118.pdf	Light-weight and highly thermally conductive suppo	anjung@purdue.edu
36	IF1_IF2-CF1_CF0-147.pdf	Superconducting nanowire single-photon detectors	berggren@mit.edu
37	IF2_IF3_Jean-Francois_Pratte-114.pdf	The particle/photon to digital converters	J.F.Pratte (Sherbrooke)
38	IF2_IF3_Laktineh-PICMIC-066.pdf	PICosecond-sub-MICron (PICMIC) concept for 4D	laktineh@in2p3.fr
39	IF2_IF3_Perez-120.pdf	Large-area, low-cost Si(Li) detectors for cosmic par	kmperez@mit.edu
40	IF2_IF4_Charles_C._Young-115.pdf	Front-end electronics and DAQ for large scintillator	young@slac.stanford.edu
41	IF3_IF0_Pavel_Murat-129.pdf	Exploration of charged particle tracking using InAs	murat@fnal.gov
42	IF3_IF0_Ronald_Lipton-080.pdf	3D integration of sensors and electronics	lipton@fnal.gov
43	IF3_IF0_University_of_California_Santa_Cruz-018.pdf	Use of extremely thin 'LGAD' ultra-fast silicon detec	H. Sadrozinski
44	IF3_IF2_Jessica_Metcalfe-154.pdf	Silicon pixel detectors in space	jmetcalfe@anl.gov
45	IF3_IF2_Mazziotta-100.pdf	Gamma-ray scintillator fiber tracker	mazziotta@ba.infn.it
46	IF3_IF4_Garcia-Sciveres-019.pdf	Wavelength division multiplexed high speed optical	mgs@lbl.gov
47	IF3_IF4-189.pdf	Muon scintillator R&D	xiaolong@fudan.edu.cn
48	IF3_IF5_Simone_Mazza-175.pdf	High density 3D integration of LGAD sensors throu	simazza@ucsc.edu
49	IF3_IF5-EF1_EF4-183.pdf	Time projection chamber R&D	qihr@ihep.ac.cn
50	IF3_IF6_David_R_Winn-033.pdf	Novel low workfunction semiconductors for dark ma	winn@fairfield.edu
51	IF3_IF6_David_R_Winn-034.pdf	Novel low workfunction semiconductors for dark ma	winn@fairfield.edu
52	IF3_IF7_Karri_DiPetrillo-142.pdf	Precision timing detectors for future colliders	kdipetri@fnal.gov
53	IF3_IF7_Martin_Breidenbach-113.pdf	Large area CMOS monolithic active pixel sensors f	M.Breitenbach (SLAC)
54	IF3_IF7_Timon_Heim-104.pdf	28nm CMOS for 4D tracker readout chips	theim@lbl.gov
55	IF3_IF7-131.pdf	4-dimensional trackers	sch@slac.stanford.edu
56	IF6_IF3_Hwidong_Yoo-059.pdf	Feasibility study of combining a MIP timing detecto	hdyoo@yonsei.ac.kr
57	IF6_IF3_Hwidong_Yoo-061.pdf	Heavy flavour tagging using machine learning techi	hdyoo@yonsei.ac.kr
58	IF6_IF3-078.pdf	Novel silicon sensors for high-precision 5D calorim	suehara@phys.kyushu-u.ac.jp
59	IF7_IF3_Leo_Greiner-160.pdf	Monolithic active pixel sensors for high performanc	L.Greiner (LBNL)
60	CF1_CF0-NF10_NF4-IF3_IF0_Ethan_Brown-034.pdf	Paleo detectors	browne7@rpi.edu
61	CF1_CF2-NF10_NF0-IF2_IF3_Kurinsky-101.pdf	Cryogenic carbon detectors for dark matter searche	kurinsky@fnal.gov
62	CF2-IF2-002.pdf	Tunable plasma holoscope	katherine.dunne@fysik.su.se
63	CF3_CF4-IF2_IF7_Tyson-050.pdf	Low earth orbit satellites and the DOE HEP prograr	tyson@physics.ucdavis.edu
64	CF4_CF3-IF2_IF0_David_Erskine-009.pdf	Cosmology and dark matter at a cm/s	erskine1@llnl.gov
65	CF4_CF6-IF2_IF0_Juan_Estrada-081.pdf	Development of R&D platform for astronomical inst	estrada@fnal.gov
66	CompF3_CompF2-NF1_NF5-CF1_CF2-IF8_IF3_Monzani-(	The future of machine learning in rare event search	monzani@stanford.edu
67	UF4_UF3-NF5_NF6-CF1_CF0-IF3_IF0-CommF3_CommF5	Advanced Germanium detectors and technologies	Dongming.Mei@usd.edu
68	UF4_UF3-NF5_NF6-CF1_CF0-IF3_IF0-CompF2_CompF3-	Advanced Germanium detectors and technologies	Dongming.Mei@usd.edu

Community Planning Meeting

- October 5-8, virtual
- (replaces the community meeting initially planned at Fermilab in November)

- Register and follow the agenda here:
- https://indico.fnal.gov/event/44870/

- Agenda is being currently developed
  - There will be many parallel sessions with lots of discussions

Conclusion

- Many ideas and directions to explore and study
  - We need you input and participation in shaping the process,
  - working together towards conclusions on directions and needs for the future,
  - to be summarized in the final report

- Many LOIs received: thank you everyone for engaging and sending great proposals!

- Community planning meeting to organize the work going forward
  - Organized around the submitted LOIs and community's interest