

# IF5: Micro-Pattern Gaseous Detectors (MPGDs)

Conveners: Bernd Surrow, Maxim Titov, Sven Vahsen

# The Snowmass Process

- LOI submission complete
- 24 unique LOIs received – thank you!
- Next step: writing of Contributed Papers a.k.a. White Papers
  - Anyone can write a white paper. It is not required to have written a LOI.
  - **Official Deadline: July 31**
- However
  - **we would like to see a reduction in #contributions, ideally 1 White Paper per 10 LOIs (!)**
  - **we need your preliminary material much earlier for you to end to end up in the final Snowmass report – which is the key product of Snowmass!**
  - **→ need draft executive summaries of white papers before March 18, see last page**
- **Today, want to start discussion: how to go from 24 LOIs to a few white papers**

# Submitted LOIs: 24 (links below are clickable)

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

1	<a href="#">CF/SNOWMASS21-CF1_CF0-NF10_NF4-IF5_IF4_Vahsen-189.pdf</a>	31/08/2020
2	<a href="#">EF/SNOWMASS21-EF3_EF4-IF3_IF5-031.pdf</a>	06/08/2020
3	<a href="#">EF/SNOWMASS21-EF4_EF0-AF3_AF0-IF3_IF5_GrahamWilson-119.pdf</a>	30/08/2020
4	<a href="#">IF/SNOWMASS21-IF2_IF7_IF3_IF4_IF5_IF6-056.pdf</a>	29/08/2020
5	<a href="#">IF/SNOWMASS21-IF3_IF5-EF1_EF4-183.pdf</a>	01/09/2020
6	<a href="#">IF/SNOWMASS21-IF3_IF5_Simone_Mazza-175.pdf</a>	31/08/2020
7	<a href="#">IF/SNOWMASS21-IF5-005.pdf</a>	27/07/2020
8	<a href="#">IF/SNOWMASS21-IF5-EF4-007.pdf</a>	07/08/2020
9	<a href="#">IF/SNOWMASS21-IF5_CF2_AF5_Ferrer-Ribas-020.pdf</a>	27/08/2020
10	<a href="#">IF/SNOWMASS21-IF5_IF0-057.pdf</a>	30/08/2020
11	<a href="#">IF/SNOWMASS21-IF5_IF0-184.pdf</a>	01/09/2020
12	<a href="#">IF/SNOWMASS21-IF5_IF0-193.pdf</a>	08/09/2020 late
13	<a href="#">IF/SNOWMASS21-IF5_IF0_Brunbauer-096.pdf</a>	31/08/2020
14	<a href="#">IF/SNOWMASS21-IF5_IF0_C.Lampoudis-098.pdf</a>	31/08/2020
15	<a href="#">IF/SNOWMASS21-IF5_IF0_Gnanvo_Hohlmann_Posik_Surrow-044.pdf</a>	28/08/2020
16	<a href="#">IF/SNOWMASS21-IF5_IF0_Kondo_Gnanvo-159.pdf</a>	31/08/2020
17	<a href="#">IF/SNOWMASS21-IF5_IF0_M_Hohlmann-040.pdf</a>	28/08/2020
18	<a href="#">IF/SNOWMASS21-IF5_IF0_Marco_Cortesi-103.pdf</a>	31/08/2020
19	<a href="#">IF/SNOWMASS21-IF5_IF3-015.pdf</a>	24/08/2020
20	<a href="#">IF/SNOWMASS21-IF5_IF6-EF4_EF0_COLALEO-068.pdf</a>	30/08/2020
21	<a href="#">IF/SNOWMASS21-IF5_IF9-EF0_EF0-168.pdf</a>	31/08/2020
22	<a href="#">IF/SNOWMASS21-IF6_IF5_Laktineh-Calice-050.pdf</a>	29/08/2020
23	<a href="#">IF/SNOWMASS21-IF7_IF5_H.MULLER-101.pdf</a>	31/08/2020
24	<a href="#">IF/SNOWMASS21-IF8_IF5-NF10_NF0_Ben_Jones-070.pdf</a>	30/08/2020

# Possible ways to categorize

Technology driven

- By MPGD technology
- By performance (segmentation, max rate, radiopurity)

Physics Needs driven

- By Snowmass Frontier
- By Experiment (/Type)
- By MPGD role



Done via LOI naming process



Preliminary categorization



We track IF5-related LOIs at the above link. We will keep updating there.

Note: We have marked LOIs assigned to IF5, which we think another topical should handle, black.

<https://docs.google.com/spreadsheets/d/1EBj27pUGWTrfY6X87RXxPp-BnZzl1SAKtdyFlydumLE/edit?usp=sharing>

id#	File (color: primary white paper topic)	Title	contact	Talk given in IF meeting?
56	<a href="#">IF2_IF7_IF3_IF4_IF5_IF6-056.pdf</a>	Belle II detector upgrades	sevahsen@hawaii.edu, for	N
175	<a href="#">IF3_IF5_Simone_Mazza-175.pdf</a>	High density 3D integration of LGAD sensors through wafer to wafer bonding	simazza@ucsc.edu	n/a
183	<a href="#">IF3_IF5-EF1_EF4-183.pdf</a>	Time projection chamber R&D	qih@ihep.ac.cn	N
20	<a href="#">IF5_CF2_AF5_Ferrer-Ribas-020.pdf</a>	The International Axion Observatory (IAXO): MPGD development	E. Ferrer Ribas (Irfu, CEA)	Y
96	<a href="#">IF5_IF0_Brunbauer-096.pdf</a>	Optical readout of MicroPattern Gaseous Detectors: developments and perspectives	florian.brunbauer@cern.ch	N
98	<a href="#">IF5_IF0_C.Lampoudis-098.pdf</a>	High precision timing with the PICOSEC micromegas detector	Christos.Lampoudis@cern.ch	Y
44	<a href="#">IF5_IF0_Gnanvo_Hohlmann_Posik_Surrow-044.pdf</a>	Advanced Micro-Pattern Gas Detectors for Tracking at the Electron Ion Collider	hohlmann@fit.edu	Y
159	<a href="#">IF5_IF0_Kondo_Gnanvo-159.pdf</a>	Development of large micro pattern gaseous detectors for high rate tracking at Jefferson Lab	kgnanvo@virginia.edu	Y
40	<a href="#">IF5_IF0_M.Hohlmann-040.pdf</a>	MPGDs for tracking and muon detection: progress review and updated R&D roadmap	hohlmann@fit.edu	Y
103	<a href="#">IF5_IF0_Marco_Cortesi-103.pdf</a>	LOI from NSCL	cortesi@nscl.msu.edu	Y
57	<a href="#">IF5_IF0-057.pdf</a>	Pixelated resistive MicroMegas for high-rates environment	massimo.della.pietra@cern.ch	Y
184	<a href="#">IF5_IF0-184.pdf</a>	A high-gain, low ion-backflow double micro-mesh gaseous structure	zhzhy@ustc.edu.cn	N
15	<a href="#">IF5_IF3-015.pdf</a>	A time projection chamber using advanced technology for the International Large Detector at the International Linear Collider	A. Bellerive (Carleton)	N
68	<a href="#">IF5_IF6-EF4_EF0_COLALEO-068.pdf</a>	Advanced GEM detectors for future collider experiments	A.Colaleo (Bari)	N
168	<a href="#">IF5_IF9-EF0_EF0-168.pdf</a>	Development of the Micro-Pattern gaseous detector technologies: an overview of the CERN-RD51 collaboration	Silvia.DallaTorre@ts.infn.it	N
5	<a href="#">IF5-005.pdf</a>	The role of MPGD-based photon detectors in RICH technologies	S. Dalla Torre (Trieste)	N
7	<a href="#">IF5-EF4-007.pdf</a>	micro-RWELL detector	Giovanni.Bencivenni@Inf.infn.it	N
50	<a href="#">IF6_IF5_Laktineh-Calice-050.pdf</a>	Timing semi-digital hadronic calorimeter (T-SDHCAL)	laktineh@in2p3.fr	N (n/a)
101	<a href="#">IF7_IF5_H.MULLER-101.pdf</a>	Trigger extensions for the scalable readout system SRS	Hans.Muller@cern.ch	N
70	<a href="#">IF8_IF5-NF10_NF0_Ben_Jones-070.pdf</a>	Scintillating and quenched gas mixtures for HPGTPCs	ben.jones@uta.edu	N
189	<a href="#">CF1_CF0-NF10_NF4-IF5_IF4_Vahsen-189.pdf</a>	CYGNUS: a nuclear recoil observatory with directional sensitivity to dark matter and neutrinos	sevahsen@hawaii.edu	Y
31	<a href="#">EF3_EF4-IF3_IF5-031.pdf</a>	The IDEA drift chamber for a Lepton Collider	franco.grancagnolo@le.infn.it	n/a
119	<a href="#">EF4_EF0-AF3_AF0-IF3_IF5_GrahamWilson-119.pdf</a>	Exploring precision electroweak physics measurement potential of e+e- colliders	gwwilson@ku.edu	n/a
193	<a href="#">SNOWMASS21-IF5_IF0-193.pdf</a>	Snowmass 2021 Expression of Interest: MPGD-based Transition Radiation Detector	yulia@jlab.org	

Colors denote tentative white paper assignment. Some LOIs fit into multiple white papers – more details at link below.

<https://docs.google.com/spreadsheets/d/1EBj27pUGWTrfY6X87RXxPp-BnZzl1SAKtdyFlydumLE/edit?usp=sharing>

# Proposed list of IF5 Contributed/ White Papers

- *very preliminary – needs more discussion*

	<b>White Paper Topic</b>	<b>Executive Summary Length</b>
1	MPGDs: Recent advances and current R&D	3
2	MPGDs for nuclear physics experiments	1.5
3	MPGDs for future low background experiments	1.5
4	MPGDs for TPCs at future lepton colliders	1.5
5	MPGD for muon detection at future colliders	1.5
	Grand summary table + text	1

Papers can be any length

Total of summaries should be  $\leq 10$  pages

# 6 LOIs: co-assigned to IF5, but another TG should take the lead

<a href="#">IF3 IF5 Simone Mazza-175.pdf</a>	High density 3D integration of LGAD sensors through wafer to wafer bonding	simazza@ucsc.edu	<b>Suggest IF3</b>
<a href="#">IF6 IF5 Laktineh-Calice-050.pdf</a>	Timing semi-digital hadronic calorimeter (T-SDHCAL)	laktineh@in2p3.fr	<b>Suggest IF6 (?)</b>
<a href="#">IF8 IF5-NF10 NF0 Ben Jones-070.pdf</a>	Scintillating and quenched gas mixtures for HPGTPCs	ben.jones@uta.edu	Focused on scintillation and gas physics. <b>Let other TG take lead?</b>
<a href="#">EF3 EF4-IF3 IF5-031.pdf</a>	The IDEA drift chamber for a Lepton Collider	franco.grancagnolo@le.infn.it	<b>IDEA drift chamber. Tracking. Suggest IF3.</b>
<a href="#">EF4 EF0-AF3 AF0-IF3 IF5 GrahamWilson-119.pdf</a>	Exploring precision electroweak physics measurement potential of e+e- colliders	gwwilson@ku.edu	<b>Focused on physics, not MPGDs. Needs another TG.</b>
<a href="#">IF7 IF5 H.MULLER-101.pdf</a>	Trigger extensions for the scalable readout system SRS	Hans.Muller@cern.ch	Important for IF5, let IF7 take lead, <b>but should also be discussed in IF5 whitepaper</b>

# LOIs that did not indicate IF5, but which may be relevant

<a href="#">IF8 IF0-NF10 NF6 Jacob Zetlemoyer-150.pdf</a>	Towards directional nuclear recoil detectors: tracking of nuclear recoils in gas Argon TPCs	David Caratelli (davidc@fnal.gov)
<a href="#">IF/SNOWMASS21-IF9 IF8-NF3 NF10-CF1 CF0-145.pdf</a>	Dual-Readout Time Projection Chamber: exploring sub-millimeter pitch for directional dark matter and tau identification in $\nu\tau C C$ interactions.	Elena Gramellini, (Fermi National Accelerator Laboratory), elenag@fnal.gov

Please let us know if you are aware of additional LOIs we should be tracking!

# Whitepaper 1: MPGDs: Recent advances and current R&D

LOI title	Contact
Development of the Micro-Pattern gaseous detector technologies: an overview of the CERN-RD51 collaboration	Silvia.DallaTorre@ts.infn.it
High precision timing with the PICOSEC micromegas detector	Christos.Lampoudis@cern.ch
Optical readout of MicroPattern Gaseous Detectors: developments and perspectives	florian.brunbauer@cern.ch
Pixelated resistive MicroMegas for high-rates environment	massimo.della.pietra@cern.ch
Trigger extensions for the scalable readout system SRS	Hans.Muller@cern.ch
A high-gain, low ion-backflow double micro-mesh gaseous structure	zhzhy@ustc.edu.cn
LOI from NSCL	cortesi@nscl.msu.edu

# Whitepaper 2: MPGDs for nuclear physics experiments

LOI title	Contact
Advanced Micro-Pattern Gas Detectors for Tracking at the Electron Ion Collider	hohlmann@fit.edu
Development of large micro pattern gaseous detectors for high rate tracking at Jefferson Lab	kgnanvo@virginia.edu
LOI from NSCL	cortesi@nscl.msu.edu
The role of MPGD-based photon detectors in RICH technologies	S. Dalla Torre (Trieste)
Snowmass 2021 Expression of Interest: MPGD-based Transition Radiation Detector	yulia@jlab.org

# Whitepaper 3: MPGDs for future low background experiments

LOI title	Contact
The International Axion Observatory (IAXO): MPGD development	E. Ferrer Ribas (Irfu, CEA)
CYGNUS: a nuclear recoil observatory with directional sensitivity to dark matter and neutrinos	sevahsen@hawaii.edu
Optical readout of MicroPattern Gaseous Detectors: developments and perspectives	florian.brunbauer@cern.ch
Towards directional nuclear recoil detectors: tracking of nuclear recoils in gas Argon TPCs	David Caratelli (davidc@fnal.gov)
Dual-Readout Time Projection Chamber: exploring sub-millimeter pitch for directional dark matter and tau identification in $\nu\tau C C$ interactions.	Elena Gramellini, elenag@fnal.gov
To-do: Contact TRES-DM, potentially dual-phase TPCs, other relevant experiments	

Considering alternative approach: Inter-frontier (Neutrino, Dark Matter, Instrumentation) White Paper on directional nuclear recoil detection w/ dedicated executive summaries on for each snowmass topical group (including MPGD requirements for IF5)

# Whitepaper 4: MPGDs for TPCs at future lepton colliders

LOI title	Contact
Belle II detector upgrades	for TPC: Peter Lewis; lewis@physik.uni-bonn.de
Time projection chamber R&D	qihr@ihep.ac.cn
A time projection chamber using advanced technology for the International Large Detector at the International Linear Collider	A. Bellerive (Carleton)
A high-gain, low ion-backflow double micro-mesh gaseous structure	zhzhy@ustc.edu.cn

# Whitepaper 5: MPGD for muon detection at future colliders

LOI title	Contact
MPGDs for tracking and muon detection: progress review and updated R&D roadmap	hohlmann@fit.edu
Pixelated resistive MicroMegs for high-rates environment	massimo.della.pietra@cern.ch
Advanced GEM detectors for future collider experiments	A.Colaleo (Bari)
micro-RWELL detector	Giovanni.Bencivenni@Inf.infn.it

# IF5 Plans

- December 2020, Jan 2021:
  - We are soliciting LOI authors who have not yet presented, to give ~20 minute talks at one of our Friday meetings: <https://indico.fnal.gov/category/1185/>
  - Next meeting: Dec 18
- January-February 2021:
  - Converge on ~5 White Papers - ideally each with a US-based lead person
  - Keep going w/ bi-weekly IF5 meetings, but ask White Paper leads to present
    - scope / outline of their papers (Jan, Feb)
- Goals vs time:
  - Draft executive summaries for CPAD workshop, March 18, 19, 22, 2021
    - Needed for topical group reports that will form final Snowmass report
  - Draft White Papers for Snowmass Summer Study: July 11 - 20, 2021 at UW Seattle
  - White papers completed before July 31<sup>st</sup>, 2021