

# AREA 51 REPORT

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# REQUIREMENTS FOR UNDERGROUND AND LOW BACKGROUND DETECTORS

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- This session was joint between CF01: Dark Matter - Particle Like; RF04: Baryon and Lepton Number Violation (where neutrinoless double beta decay experiments live) and NF05: Neutrino Properties (where also  $n0dbd$  lives but also represented other underground neutrino detectors). The group had also liaisons from the relevant frontiers including IF.
- As in other areas, the BRN has done a significant amount of the groundwork on instrumentation. See next slide.
- There were discussions about the advantages of a single purpose detectors for each effort versus multi-purpose detectors.
  - Is a single purpose detector always better than multi-purpose.
  - Synergies need to be found to go beyond ton-scale detectors for the different areas.
  - Synergies in instrumentation is a way to move forward.

# SUMMARY OF THE BRN REPORT ON LOW BACKGROUND AND UNDERGROUND DETECTORS

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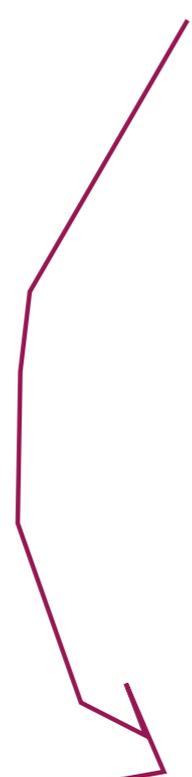
## Relation to Low backgrounds and Underground Detectors

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- **Technology:** Noble Elements, Photodetectors

Priority Research Direction (PRD)
PRD 4: Enhance and combine existing modalities to increase signal-to-noise and reconstruction fidelity
PRD 5: Develop new modalities for signal detection
PRD 6: Improve the understanding of detector microphysics and characterization to increase signal-to-noise and reconstruction fidelity
PRD 25: Advance material purification and assay methods to increase sensitivity
PRD 26: Addressing challenges in scaling technologies

- Thrust 1: Improve and enhance light collection
- Thrust 2: Improve and enhance charge collection
- Thrust 3: Improve and enhance integration of charge and light collection
- Thrust 4: Improve and enhance heat collection
- Thrust 5: Enhance and develop doping and ion collection



# SUMMARY OF THE BRN REPORT ON LOW BACKGROUND AND UNDERGROUND DETECTORS

## Relation to Low backgrounds and Underground Detectors

- **Technology:** Noble Elements, Photodetectors

Priority (PRD)	Research Direction
PRD 7: Extend wavelength range and develop new single-photon counters to enhance photodetector sensitivity	<b>Thrust 1: Increased IR sensitivity</b> <b>Thrust 2: UV and VUV scintillation and Cherenkov photon detection</b> <b>Thrust 3: Single photon detection</b> <b>Thrust 4: Advanced materials for photodetectors</b>
PRD 9: Adapt photodetectors for extreme environments	<b>Thrust 1: Cryogenic operation at noble liquid temperatures</b> <b>Thrust 2: Low-radiological-background sensors and detector packages</b>
PRD 11: Develop new optical coupling paradigms for enhanced or dynamic light collection	<b>Thrust 1: Novel light propagation and collection systems</b>

# SUMMARY OF THE BRN REPORT ON LOW BACKGROUND AND UNDERGROUND DETECTORS

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## Relation to Low backgrounds and Underground Detectors

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- **Technology:** Cross cutting

**PRD 24:** Manipulate detector media to enhance physics reach

Thrust 1: Doping or enrichment to enhance interaction rate

Thrust 3: Doping for enhanced light or charge collection

Thrust 4: Doping to improve event localization

Thrust 5: Metastable systems

**PRD 25:** Advance material purification and assay methods to increase sensitivity

Thrust 1: Radiologically pure materials

Thrust 2: Enhanced capability for measurement and control of surface backgrounds

Thrust 3: Purification and storage of noble liquids

Thrust 4: Isotopic enrichment or rejection

➤ There was no time to discuss what areas to prioritize beyond BRN as that is such a recent report. Still trying to understand if anything might be missing.