

RF6: Dark Sector Physics at High-Intensity Experiments

Report Discussion

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<https://www.overleaf.com/read/ggdtjhvnmgjs>

RF6, Dark Sectors at High Intensity

Conveners: Stefania Gori (sgori@ucsc.edu), Mike Williams (mwill@mit.edu)

Organization around science goals/questions.

Consolidation of what we have learned since 2013

We defined 3 big ideas each with associated ambitious—but achievable—goals for the next decade

1. Dark matter production at intensity-frontier experiments

(focus on exploring sensitivity to thermal DM interaction strengths).

Editors: G. Krnjaic, N. Toro (<https://arxiv.org/abs/2207.00597>)

2. Exploring dark sector portals with intensity-frontier experiments

(focus on minimal portal interactions).

Editors: B. Batell, C. Hearty (<https://arxiv.org/abs/2207.06905>)

3. New flavors and rich structures of the dark sector at intensity-frontier experiments

(focus on beyond minimal models)

Editors: P. Harris, P. Schuster, J. Zupan (<https://arxiv.org/abs/2207.08990>)

4. Experiments / facilities.

Editors: P. Ilten, N. Tran (<https://arxiv.org/abs/2206.04220>)

The draft of the report: <https://www.overleaf.com/read/ggdtjhvnmgjs>

RF6 Report Structure

The RF6 report is built on the excellent work done by the “solicited” white paper (WP) editors. Given that we just discussed each of these in detail, these slides largely omit the details of what those cover.

RF6 Report

Big Idea 1 WP

Big Idea 2 WP

Big Idea 3 WP

Experiments
& Facilities WP

The numbered sections in the RF6 report — which make up roughly half of the text — are very lighted edited versions of the Executive Summaries of the 4 solicited WPs.

We do not plan to discuss these further here (since they were just discussed), but will propagate any updates made to the WPs based on discussion today (and consider additional updates based on the discussion if needed).

RF6 Report Structure

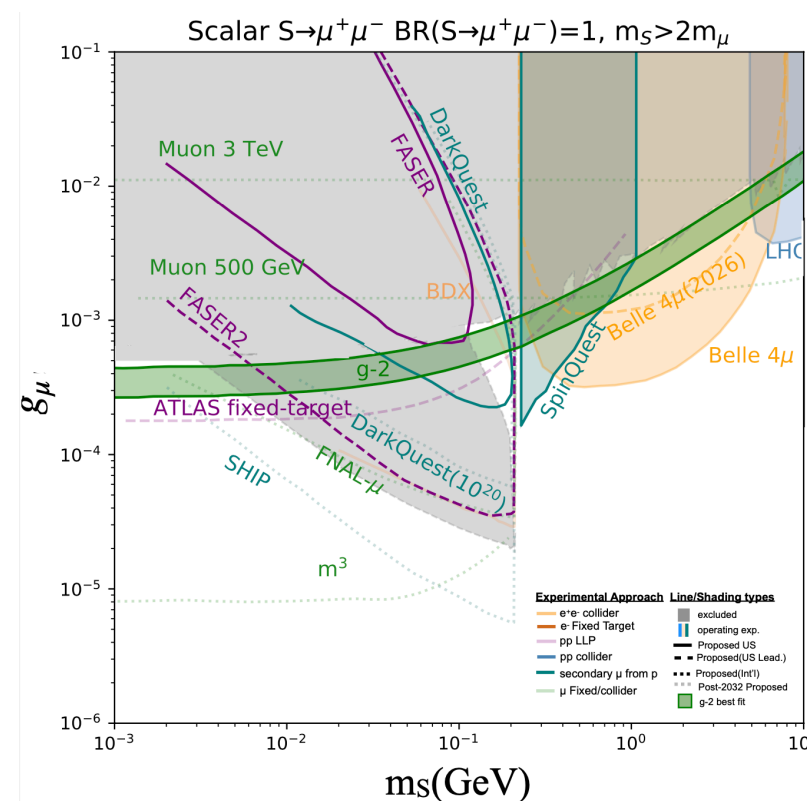
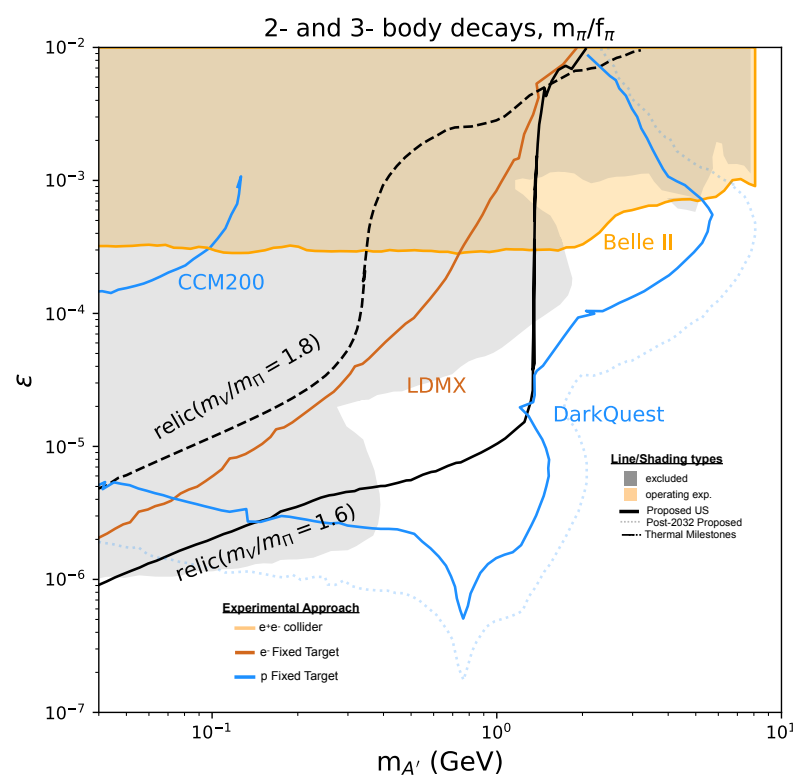
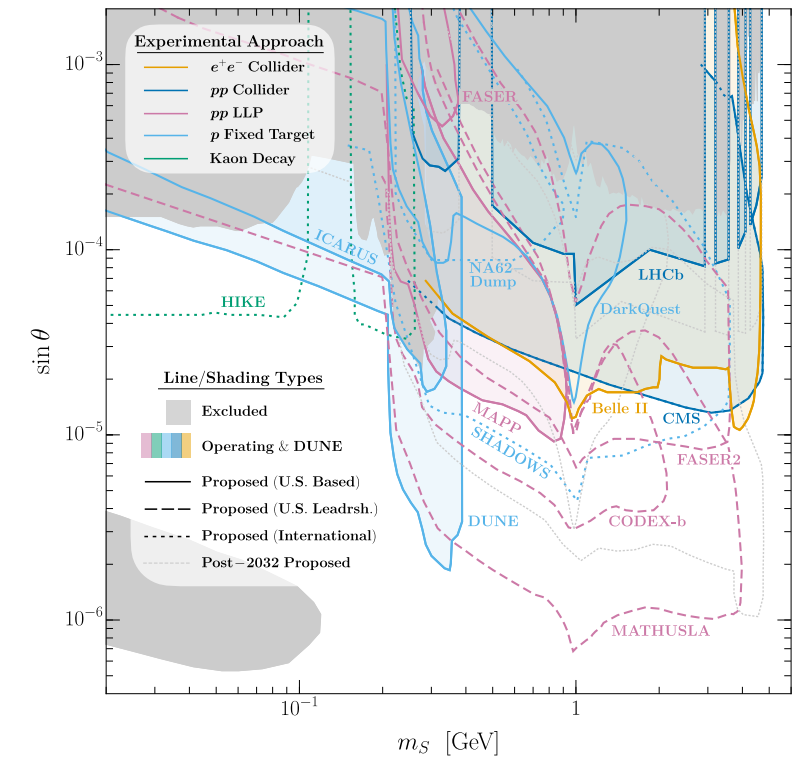
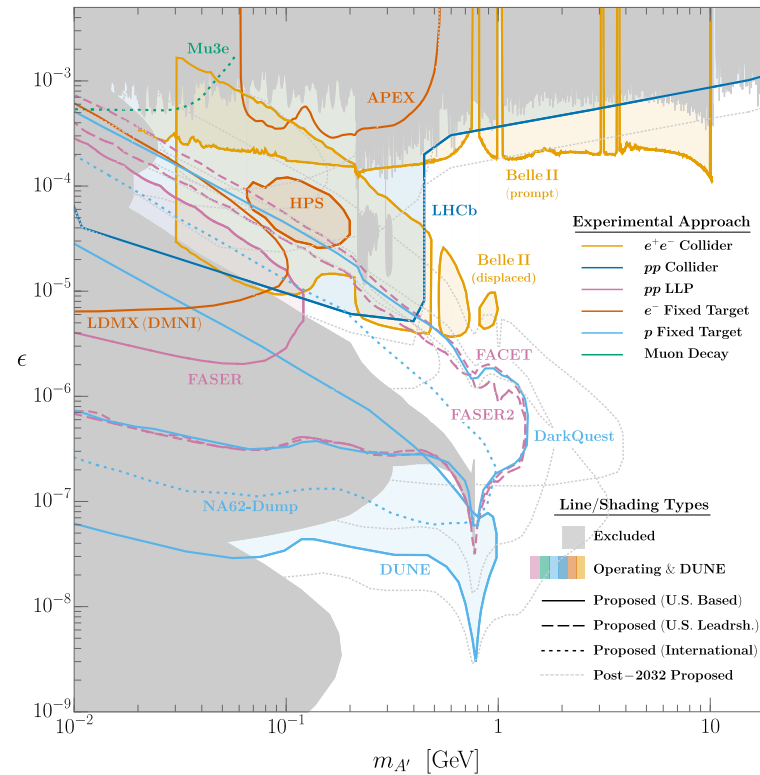
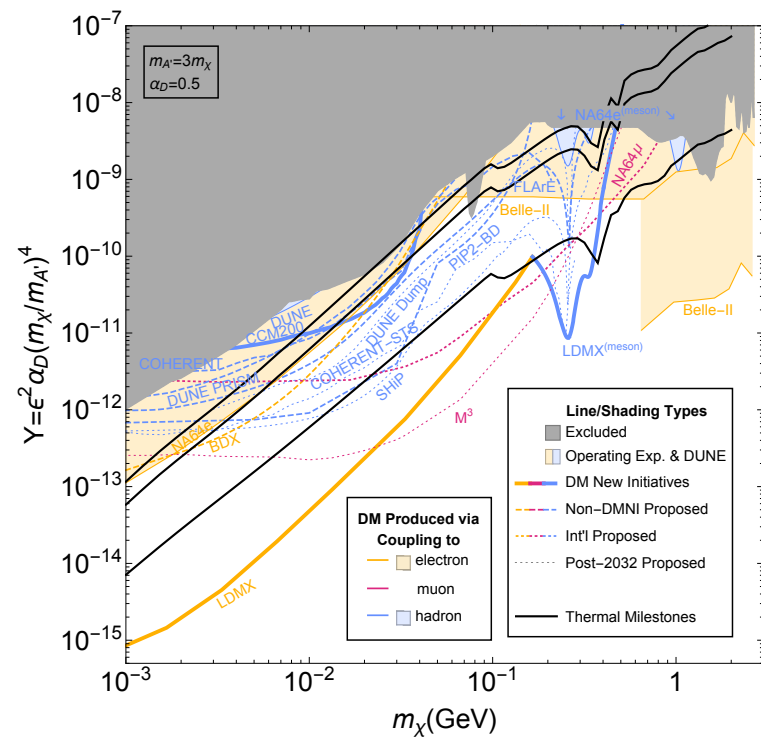
The remainder of the RF6 report is structured as follows:

- Just over 1 page Executive Summary that employs a Russian Doll approach to summarizing dark-sector physics and presenting our main high-level messages, first in one paragraph then with more detail in about a page.
- 1 page “Theoretical Framework” that concisely summarizes the dark-sector paradigm, the minimal portals, etc.
- Roughly 0.5-1 page summaries of the 4 solicited WPs, including some figures.
- 1 page “Scientific Opportunities & Roadmap” which provides more details about the high-level messages we want to send to P5 (and the broader HEP community).

We plan to focus the discussions here on the first and last bullets above (given that the 4 WPs have already been discussed), but if there’s time we can cover other items — and of course we welcome comments / feedback on anything in the report on overleaf or in today’s googledoc [here](#).

RF6 Report Sensitivity Plots

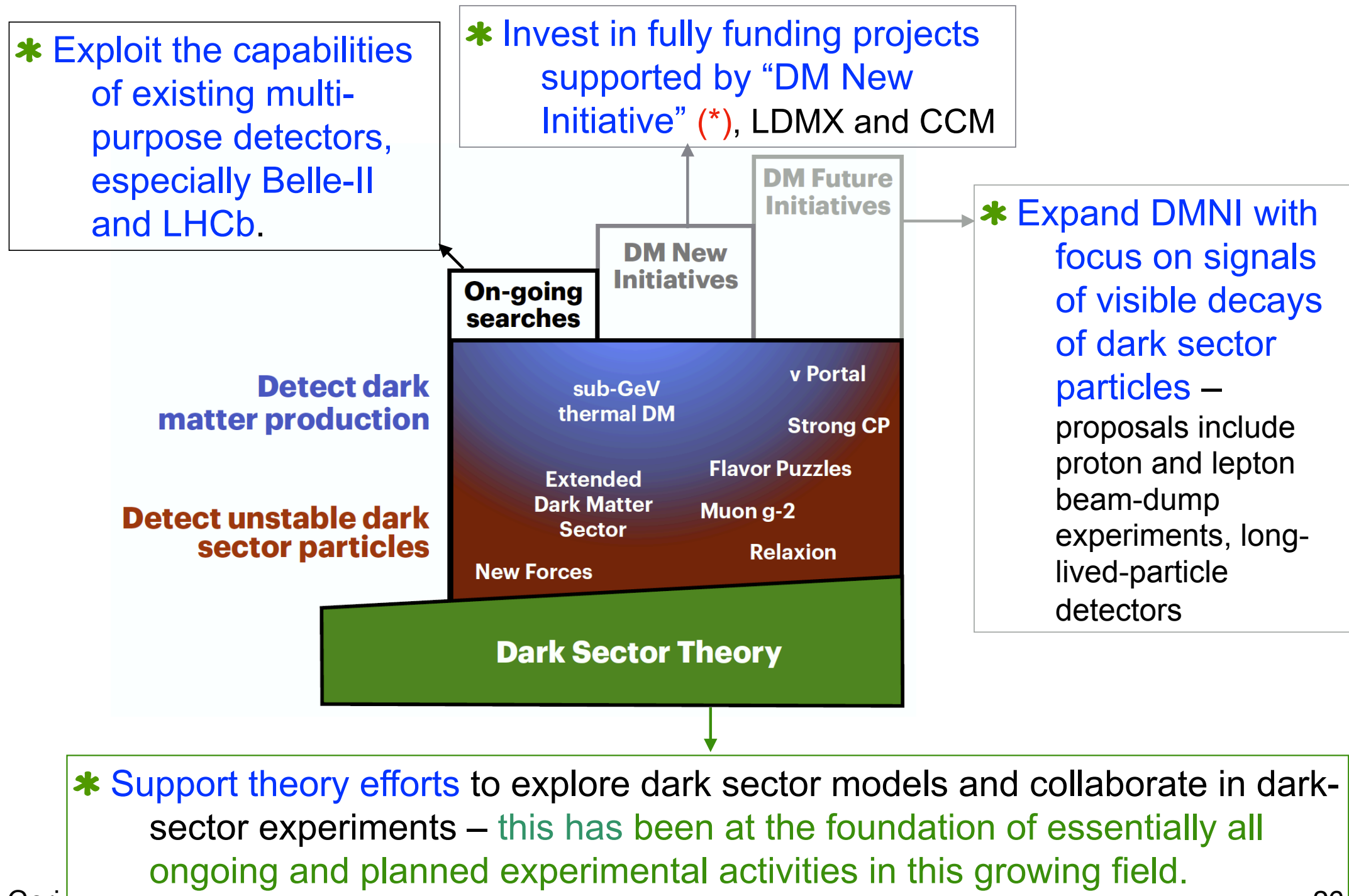
Plots taken from the Big Idea WPs. Choose smallest set that showcases achievable goals (e.g thermal DM), complementarity of approaches, potential of running / fully funded experiments, and where new efforts are needed (and which types are most promising).



Comments on the plots?
Right choices for ones to use?
Formatting?
Etc?

Scientific Opportunities & Roadmap (slide from Stefania's talk)

To promote US leadership in dark sector studies:



S.Gori

Comments on the “RF6 Flag” (plot)? Please read the “Scientific Opportunities & Roadmap” section (roughly lines 230-270) in the RF6 report and send us any comments. Both the content but also wording here is important.

Executive Summary

Comments on the “Russian Doll” approach to the Executive Summary? The first paragraph is below. This will be the most read text in the RF6 report. Please read it carefully and speak up if you have any comments.

Is Dark Matter part of a Dark Sector? The possibility of a dark sector neutral under Standard Model (SM) forces furnishes an attractive explanation for the existence of Dark Matter (DM), and is a compelling new-physics direction to explore in its own right, with potential relevance to fundamental questions as varied as neutrino masses, the hierarchy problem, and the Universe’s matter-antimatter asymmetry. Because dark sectors are generically weakly coupled to ordinary matter, and because they naturally have MeV-to-GeV masses and respect the symmetries of the SM, they are only mildly constrained by high-energy collider data and precision atomic measurements. Yet upcoming and proposed intensity-frontier experiments will offer an unprecedented window into the physics of dark sectors. Support for this program—in the form of dark-sector analyses at multi-purpose experiments, completion of the DM New Initiatives (DMNI) program, a second generation of DMNI with a focus on complementary signals (*e.g.* long-lived particles), and support for a robust dark sector theory effort—will enable comprehensive exploration of low-mass thermal DM milestones, and greatly enhance sensitivity to dark sector particles decaying back to SM particles.

The next page of text fills out the Executive Summary. Please also read this as it’s likely many people will only read this first ~page of text and possibly look at the figures.

Summary

- Thanks to the solicited WP editors — and to everybody who contributed to those WPs — for doing such a great job creating the bulk of the content that is in the RF6 report.
- Thanks to everybody who has commented on those WPs and the RF6 report. Please read the RF6 report carefully — especially the Executive Summary — and post any comments in the googledoc for this session, or in the rf6 slack channel, or if you prefer you can send them directly to us.
- This has been a **LONG** process — but it's almost done! Hopefully the final RF6 report properly conveys the high-level messages our community wants to send out to the broader HEP world (and eventually to P5).
- Let's discover a dark sector in the next decade!

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