



Status of DEAP

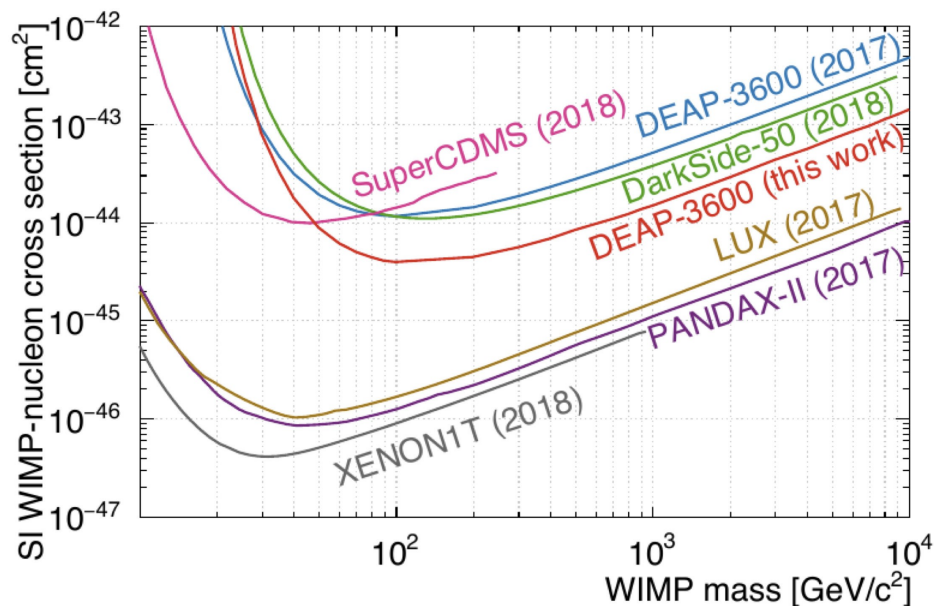
Simon Viel
Carleton University

IPP AGM
June 7th, 2019

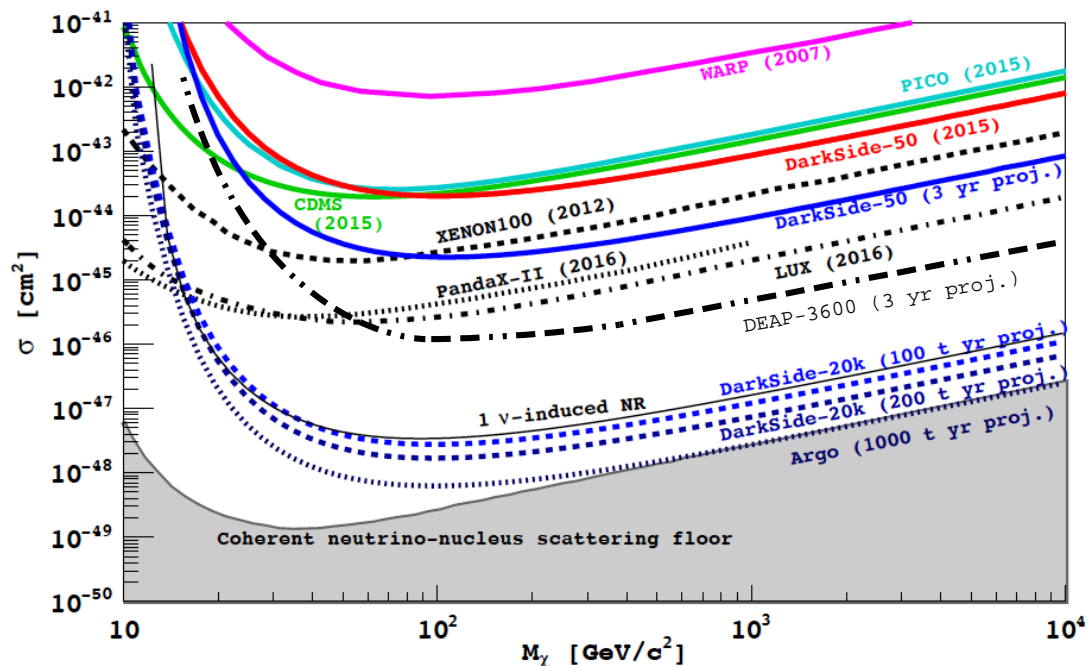
Dark Matter Searches with Liquid Argon

DEAP-3600 is the most recent step in an ambitious, international research program

DEAP-3600 231-day search results



Global Argon Dark Matter Collaboration

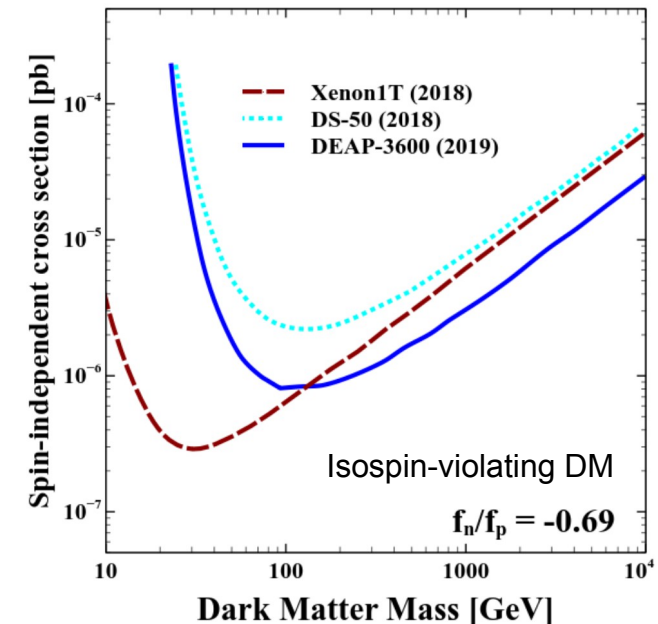


- Results presented at symposium Tuesday
- Stable operations Nov 2016 – present
 - 80% blind since Jan 2018
- Analysis improvements will improve sensitivity
- Many publications in preparation

- DarkSide-20k soon to start construction
- ARGO: Multi-hundred tonnes LAr detector
 - Building case for SNOLAB location
 - Goal: start ARGO data-taking by 2030

Impact of DEAP-3600 (publications since 2017)

- Search for dark matter with a 231-day exposure of liquid argon using DEAP-3600 at SNOLAB, arXiv:1902.04048
- Electromagnetic backgrounds and potassium-42 activity in the DEAP-3600 dark matter detector, arXiv:1905.05811
- First results from the DEAP-3600 dark matter search with argon at SNOLAB, Phys. Rev. Lett. 121, 071801 (2018)
- Design and construction of the DEAP-3600 dark matter detector, Astropart. Phys. 108 (2019) 1-23
- Photoluminescence response of acrylic (PMMA) and polytetrafluoroethylene (PTFE) to ultraviolet light, arXiv:1905.03044
- Database support of detector operation and data analysis in the DEAP-3600 dark matter experiment, arXiv:1905.02964
- Estimating the efficiency turn-on curve for a constant-threshold trigger without a calibration dataset, EPJ C 79 (2019) 322
- In-situ characterization of the Hamamatsu R5912-HQE photomultiplier tubes used in the DEAP-3600 experiment, NIM A 922 (2019) 373-384
- A new tool for (α, n) yield calculations and its implications for DEAP-3600, AIP Conf. Proc. 1921 (2018) 060002
- On the DEAP-3600 resurfacing, AIP Conf. Proc. 1921 (2018) 070005
- Application of the TPB wavelength shifter to the DEAP-3600 spherical acrylic vessel inner surface, JINST 12 (2017) P04017
- A method for characterizing after-pulsing and dark noise of PMTs and SiPMs, NIM A 875 (2017) 87-91



C. E. Yaguna, Journal of Cosmology and Applied Physics 04 (2019) 041

Membership of DEAP-3600

- **International collaboration** with researchers from 16+ institutes in Canada, Germany, Italy, Mexico, Russia, Spain, UK, USA

Current membership (April 2019):

	Canada	Total
Graduate students	11	21
Postdocs	10	18
Faculty members	8	20
Research scientists	12	26



Canadian Nuclear
Laboratories
Laboratoires Nucléaires
Canadiens



Carleton
UNIVERSITY



Laurentian University
Université Laurentienne



Istituto Nazionale
di Fisica Nucleare



NATIONAL
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INSTITUTE"



PRINCETON
UNIVERSITY



Queen's
UNIVERSITY



Particle Physics
Rutherford Appleton Laboratory



US
University of Sussex

Technical
University
of Munich



Challenges and Solutions

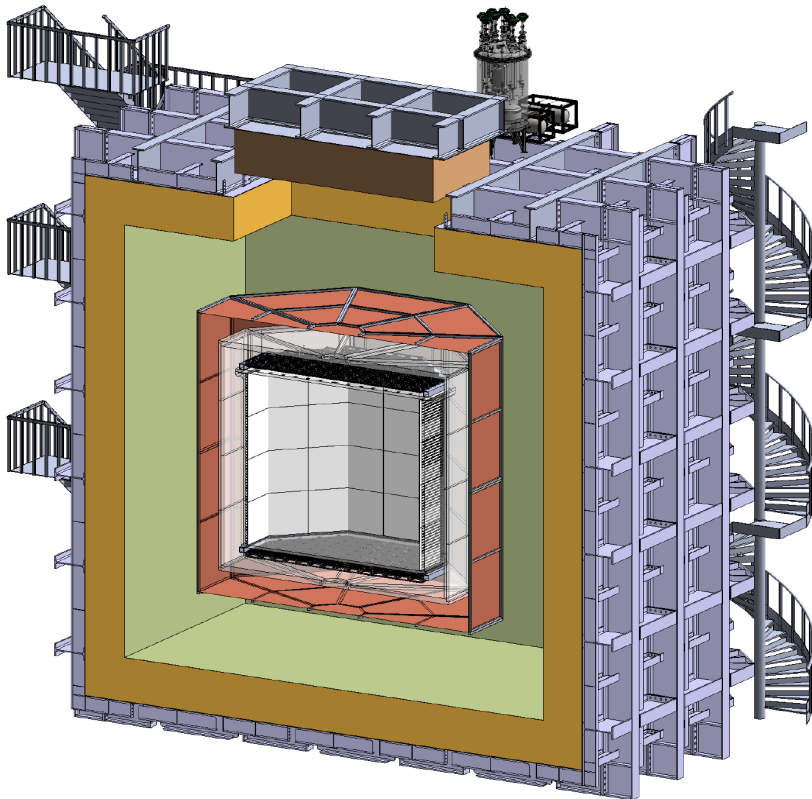
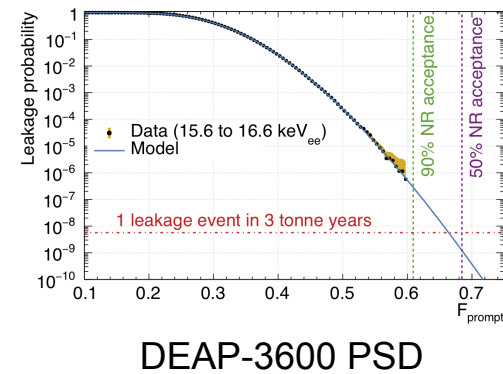
- IPP question: “Major concerns the project has been having and how they are being addressed?”

Challenge	Solution adopted	Possible hardware upgrades
Neck failure during first fill (Aug 2016)	Partial re-fill with 3279 kg LAr	Fix, fill completely, recirculate LAr
Neck alpha backgrounds	Reject with clever analysis	Slow wavelength shifter → PSD
Process systems need maintenance	Short-term solutions	Keep running after 2020

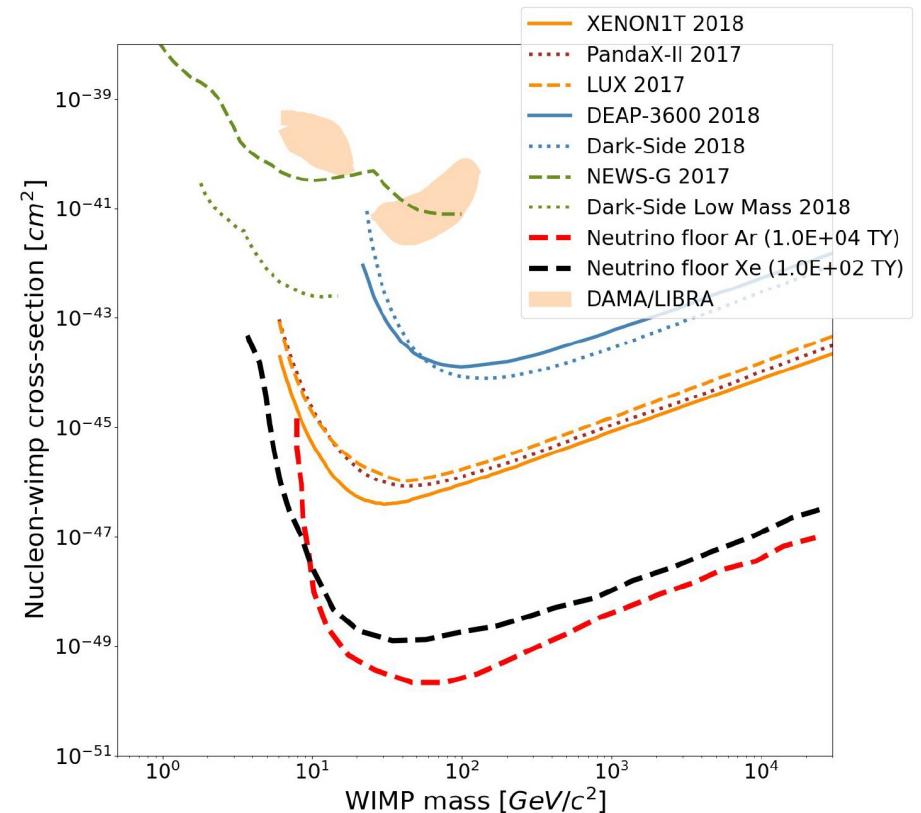
- IPP question: “Computing needs and experiences with Compute Canada resources?”
 - Compute Canada allocation generally covers computing needs; migration a challenge
 - CPU (Graham, Cedar), Disk storage (Graham, Cedar), Nearline storage (Graham, Toronto)
 - Migration from Guillimin, to CAC, to the above has ongoing negative impact on analysis results
 - Unavailability of computing clusters has been a real challenge
 - DEAP Young Members survey January 2019
 - Majority of users negatively affected by downtime and “effective downtime” → Delays analysis!
 - Data corruption incident; Lack of redundancy; Lack of transparency and support
 - IPP/CINP Brief for ISED conveyed issues and recommendations very accurately
 - Mainly we need to reach a *24/7 availability* model for Canadian computing resources

Future Liquid Argon Program

- Exceptional pulse-shape discrimination performance in LAr
 - Neutrino floor in LXe is limited by neutrino-electron interactions
 - Neutrino floor in LAr is significantly lower, thanks to PSD!
 - Underground argon program to reach ultimate sensitivity



DarkSide-20k latest design:
acrylic TPC in ProtoDUNE cryostat



A. Gaspert, P. Giampa, D. Morrissey
CAP Poster 2019