



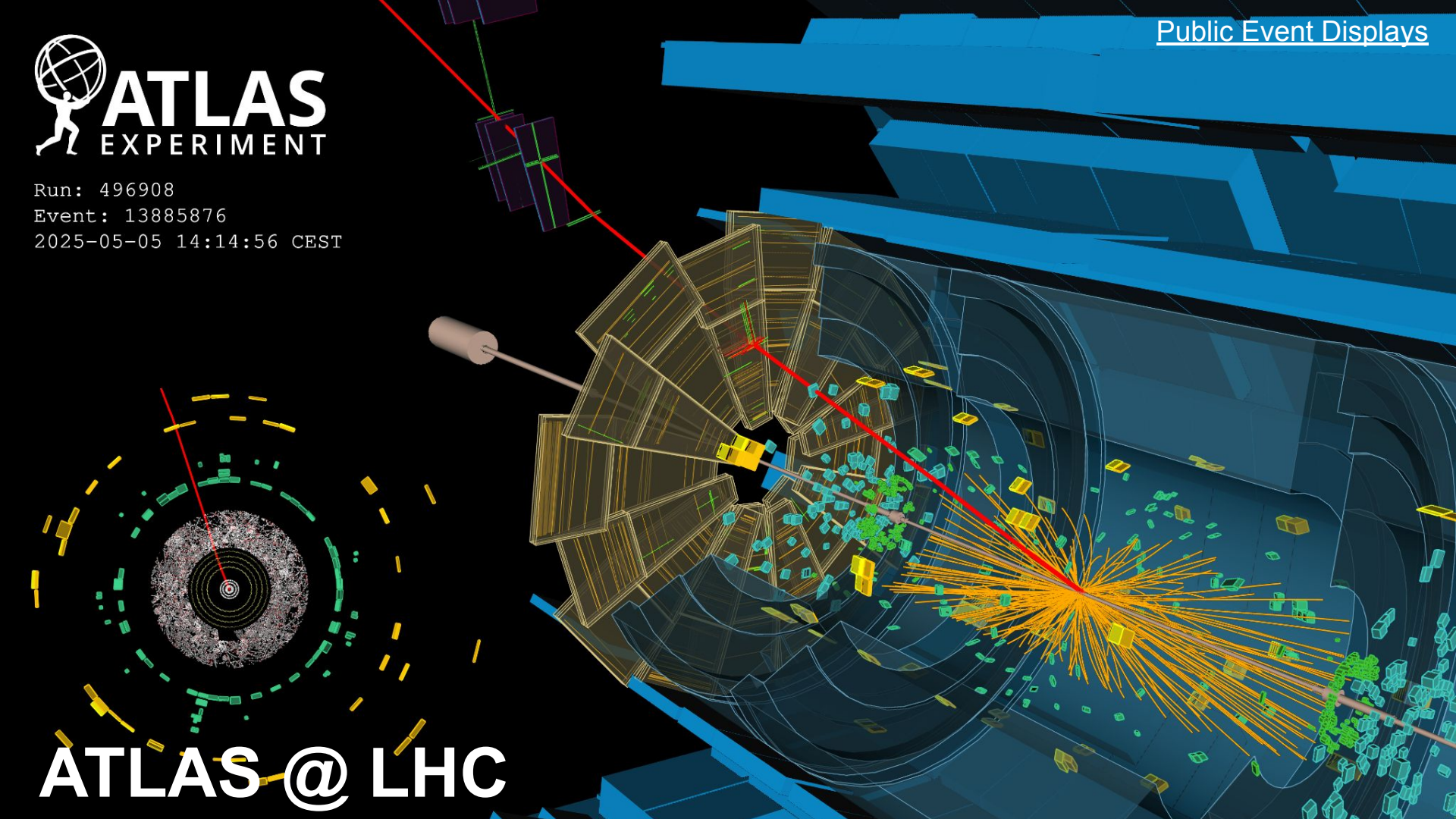
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ATLAS @ LHC

Heather Russell, on behalf of ATLAS Canada
IPP AGM
13 June 2025



**University
of Victoria**





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Canadian ATLAS group



Founded in 1992: Michel Lefebvre, Victoria
Spokesperson (94-07): Bob Orr, Toronto
Spokesperson (15-23): Peter Krieger, Toronto

Institutes

Alberta
Carleton
McGill
Montréal
SFU
Toronto
TRIUMF
UBC
Victoria
York

Current ATLAS-Canada Management

Spokesperson, PI (07-15, 23--): Rob McPherson, Victoria/IPP
Deputy spokesperson: Alain Bellerive, Carleton
Physics coordinator: Max Swiatlowski, TRIUMF
Computing coordinator: Isabel Trigger, TRIUMF
EDI coordinator: Heather Russell, Victoria

39 Universities/Labs with 39 (33 FTE) faculty*
38 postdocs, 72 graduate students, ~ 25 undergrads/year
additionally engineers and technicians
*Includes 5 IPP Research Scientists, 6 CRC (4 former, 2 new)

Leading physics program, strong educational & training role

Many leadership roles in ATLAS: Deputy Spokesperson, Management committee chairs, Physics Coordinator – detailed in grant request

ATLAS-Canada Faculty Group



39 faculty represent
33 FTE

Anticipate some
retirements by
2030

→ set hours to 0

.. but expect to
have new hires too
(not in table)

Member	Institute	FTE now (h/month)	expected FTE 2030 (h/month)	total research (h/month)
Justin Albert	Victoria	50% (60)	50% (60)	120
Jean-François Arguin	Montréal	100% (120)	100% (120)	120
Alain Bellerive	Carleton	100% (120)	100% (120)	120
François Corriveau	McGill/IPP	80% (128)	0% (0)	160
Matthias Danninger	SFU	50% (80)	50% (80)	160
Colin Gay	UBC	100% (120)	100% (120)	120
Dag Gillberg	Carleton	100% (120)	100% (120)	120
Douglas Gingrich	Alberta/TRIUMF	100% (160)	100% (160)	160
Kevin Graham	Carleton	80% (120)	70% (105)	150
Jesse Heilman	Carleton	90% (152)	90% (152)	169
Nigel Hessey	TRIUMF	90% (118)	0% (0)	131
Nikolina Ilic	IPP/Toronto	70% (112)	70% (112)	160
Richard Keeler	Victoria	100% (100)	100% (100)	100
Thomas Koffas	Carleton	95% (110)	95% (110)	116
Peter Krieger	Toronto	100% (120)	100% (120)	120
Leonid Kurchaninov	Victoria/TRIUMF	100% (160)	100% (160)	160
Michel Lefebvre	Victoria	100% (120)	100% (120)	120
Alison Lister	UBC	100% (120)	100% (120)	120
Robert McPherson	Victoria/IPP	100% (200)	100% (200)	200
Dugan O'Neil	SFU	0% (0)	50% (15)	15
Robert Orr	Toronto	100% (120)	100% (120)	120
Katherine Pachal	TRIUMF	50% (75)	50% (75)	150
James Pinfold	Alberta	55% (80)	55% (80)	145
Luise Poley	SFU/TRIUMF	95% (152)	95% (152)	160
Heather Russell	Victoria/CRC	70% (100)	50% (70)	140
Pierre Savard	Toronto/TRIUMF/CRC	100% (120)	100% (120)	120
Randall Sobie	Victoria/IPP	70% (140)	70% (140)	200
Bernd Stelzer	SFU	95% (152)	95% (152)	160
Oliver Stelzer-Chilton	TRIUMF	95% (150)	95% (150)	158
Max Swiatlowski	TRIUMF	95% (152)	95% (152)	160
Reda Tafirout	TRIUMF	50% (79)	20% (32)	158
Wendy Taylor	York	100% (100)	100% (100)	100
Richard Teuscher	Toronto/IPP	100% (160)	100% (160)	160
Isabel Trigger	TRIUMF	100% (160)	100% (160)	160
Dominique Trischuk	Victoria/CRC	100% (100)	100% (130)	130
William Trischuk	Toronto	100% (160)	100% (160)	160
Brigitte Vachon	McGill	95% (152)	95% (152)	160
Manuella Vincter	Carleton	100% (120)	100% (120)	120
Andreas Warburton	McGill	60% (72)	60% (72)	120
Total		33.35(4684)	31.55 (4391)	5150

Equity, Diversity and Inclusion

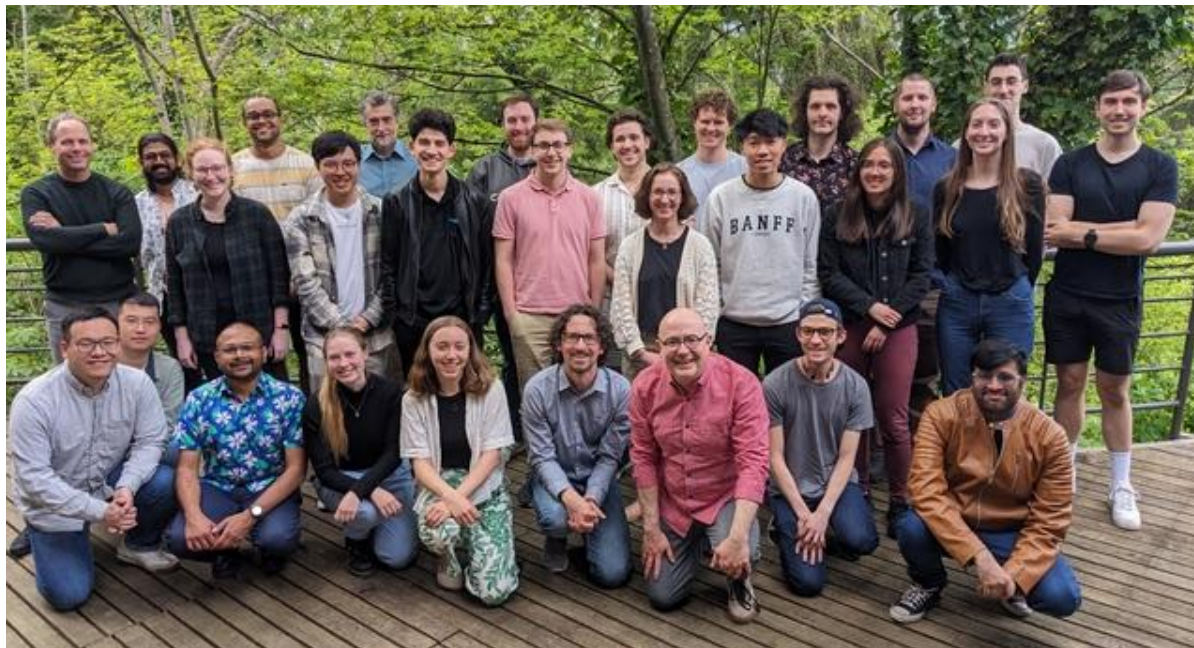


Formed an EDI Committee and led by an EDI Coordinator (2023)

- Meet monthly to discuss EDI and HQP training issues
- Foster an inclusive environment and improve support for all HQP
- Will form a connection with new ATLAS EDI Office
- Encourage folks to access the CERN Ombuds office and similar offices at universities
- Prepared a “Diversity in Hiring” recommendations document
- Run an ATLAS Canada annual demographics survey
 - recurring strong message that our HQP struggle financially
- Working on improving sense of community in ATLAS Canada
 - Annual workshop with career panel
 - Mattermost chat channel
 - Kudos newsletter celebrating awards and graduations



- ATLAS provides excellent training activities:
 - Induction day, analysis software tutorials, advanced software tutorials, weekly lecture series, oral/written skills practice
- Rely on postdocs to help train and support students, especially for students based at CERN
- HQP need access to more professional development opportunities, particularly to prepare for non-academic careers



- Annual workshop in Canada with a strong HQP focus
- Opportunity for presentations
- Networking & community-building
- Panel discussions

Left: ATLAS Canada Workshop, SFU, May 2025

Strong record of completed HQP (last decade)



Name	Role/Degree	Completion	Current or Next position (if known)
Hubert Trepantier	MSc Montreal	2016	Development Expert at Photon Etc.
Jerome Claude	MSc Montreal	2017	PhD Carleton
James Beare	MSc SFU	2017	PDF, Oak Ridge, US
Mack van Rossum	MSc UBC	2017	-
Ricardo Chavez-Gonzalez	MSc UBC	2017	-
Justin Chiu	MSc Victoria	2017	PhD Victoria
Wei Wu	MSc McGill	2017	-
Felix Cormier	MSc UBC	2017	PhD UBC
Rod Parsa	MSc Toronto	2017	-
Shreya Saha	MSc McGill	2017	PhD McGill
Levin Popin	MSc McGill	2017	Communication Industry
Felix Leger	MSc McGill	2017	Startup Company
Ana Maria Rodriguez Vera	MSc York	2017	PhD York
Joel Foo	MSc Toronto	2017	PhD Toronto
Sana Ketabchi	MSc Toronto	2017	PhD Toronto
Robert Hunter	MSc Carleton	2017	PhD Carleton
Andre Hupe	MSc Carleton	2017	-
Graeme Niedermeyer	MSc Victoria	2018	-
Steven Lee	MSc Carleton	2018	PhD Zurich
Alessandro Ambler	MSc McGill	2018	PhD McGill
Bianca Cuingu	MSc Toronto	2018	PhD Toronto
Kays Hadad	MSc McGill	2018	PhD McGill
Shahd Salomon	MSc McGill	2018	PhD McGill
Wen-Yi Song	MSc York	2018	PhD York
Tae Hyun Park	MSc Carleton	2018	PhD Toronto
Adam Azoulay	MSc York	2018	-
Andre Hupe	MSc Carleton	2018	Postdoc
Steven J. Lee	MSc Carleton	2018	Postdoc
John Flores	MSc McGill	2021	-
Lia Formenti	MSc McGill	2021	-
Bohan Chen	MSc McGill	2019	PhD Victoria
Evan Carlson	MSc Victoria	2019	PhD TRIUMF/Victoria
Zhelun Li	MSc Victoria	2019	PhD McGill
Alex Bachiu	MSc Carleton	2019	PhD Carleton
Dylan Pizzi	MSc Carleton	2019	PhD Carleton
Pourya Vakilipourtakalou	MSc Alberta	2019	Private business Toronto
Sina Safarabadi	MSc Alberta	2019	PhD Alberta
Gabriel Demontigny	MSc Montreal	2019	PhD Ecole Polytechnique
Brandon Death	MSc Carleton	2020	Software Developer at Dragonfly Systems
Cameron Clarry	MSc Toronto	2020	-
Chloé Lefebvre	MSc Montreal	2020	PhD Queen's
Sahibjeet Singh	MSc Toronto	2020	PhD Toronto
Sundeep Singh	MSc SFU	2020	Senior Research Engineer, CA
Malayer Shirat	MSc Victoria	2020	PhD Victoria
Ezekiel Staats	MSc Carleton	2021	PhD Carleton
Luis Pinto	MSc McGill	2020	Scientist Air Liquide
Luke Polson	MSc Victoria	2021	PhD UBC
Parker Reid	MSc SFU	2020	Associate Technical Artist, Electronic Arts, CA
Samantha Taylor	MSc Victoria	2021	PhD Victoria
Haoji Ni	MSc Alberta	2021	HSBC Guangzhou
Ruth Fairhurst Lyons	MSc Alberta	2021	PhD Freiburg
Ana Maria Rodriguez Vera	MSc York	2017	Postdoc Northern Illinois
Wen-Yi Song	MSc York	2018	Financial Risk Modeller at Deloitte
Adam Azoulay	MSc York	2018	Media Analytics Manager II at Instacart
Leesa Brown	MSc Victoria	2022	PhD Victoria
Ethan Brooks	MSc York	2023	PhD York
BMahdi Boussa	MSc Montreal	2023	PhD Montreal
Fannie Bilodeau	MSc Montreal	2024	Cogep teacher College Brebeuf
Alex Bunka	MSc SFU	2024	PhD, UBC
Paras Pokharel	MSc SFU	2024	-
Stefan Marinov	MSc Carleton	2024	Software Tester at FNZ
Benjamin Wright	MSc Victoria	2021	Parks Canada
Michael Jarrett	MSc Victoria	2011	Population BC
Colin Sam	MSc UBC 7 2023	2023	ML engineer at FourSails Partnership

MSc Students

Name	Role/Degree	Completion	Current position (if known)
Vincent Pascuzzi	PhD Toronto	2020	IBM Quantum Computing division
Tuan Nguyen	PhD	2020	SW Developer Vanilla Forums
Haider Abidi	PhD Toronto	2020	Postdoc BNL
Laurelle Veloce	PhD Toronto	2020	Postdoc Toronto
Albert Casha	PhD Toronto	2020	analytics engineer - Wealthsimple
Louis-Guillaume Gagnon	PhD Montreal	2020	Postdoc BNL
Stephen Weber	PhD Carleton	2021	Defence Research and Development Canada
Kayla McLean	PhD Victoria	2021	Data Scientist BC Ministry of Health
Justin Chiu	PhD Victoria	2021	Software Engineer in Research, DeepMind, London
Elham Khoda	PhD UBC	2021	-
Martina Ojeda	PhD Toronto	2021	CERN Senior Research Fellow
Vincent Wong	PhD UBC	2021	Postdoc UBC
Etienne Dreyer	PhD SFU	2021	Postdoc, Weizmann Institute of Science, IL
Albert Casha	PhD Toronto	2021	-
Danika MacDonnell	PhD Victoria	2022	MIT Climate and Sustainability Fellow
Konstantin Lehmann	PhD SFU	2022	Quantum Engineer, Orange Quantum Systems, NL
Benjamin Jaeger	PhD SFU	2022	Deep Learning Researcher, Picovox, CA
Lukas Adamek	PhD Toronto	2022	-
Matt Basso	PhD Toronto	2022	Postdoc TRIUMF/SFU
Joe Carter	PhD Toronto	2022	IT specialist, Canada
Bianca Cingu	PhD Toronto	2022	-
Yifei Han	PhD Toronto	2022	-
Sana Kotabachi	PhD Toronto	2022	Minerva AI
Alexandre Laurier	PhD Carleton	2022	Lead Data Scientist Competition Bureau of Canada
Wen-Yi Song	PhD York	2023	Financial Risk Modeller at Deloitte
Ana Maria Rodriguez Vera	PhD York	2023	Postdoc Northern Illinois
Dylan Kishluk	PhD Toronto	2023	cryptanalyst position with the Communications Security Establishment
Zhelun Li	PhD McGill	2023	Postdoc University of Tokyo
Alessandro Ambler	PhD McGill	2024	-
Aurianne Ganesse	PhD McGill	2021	CERN Senior Research Fellow
John McGowan	PhD McGill	2023	Postdoc Victoria
Laura Miller	PhD Carleton	2023	Postdoc TRIUMF
Constantine Papadatos	PhD Montreal	2022	Cogep Teacher Vanier College
Bruna Pascual Dias	PhD Montreal	2024	Postdoc Clermont-Ferrand
Hobin Hayes	PhD UBC/TRIUMF	2022	Postdoc NIKHEF
Chris Gubbels	PhD UBC/TRIUMF	2022	Freelance Software Development
Benjamin Davis-Purcell	PhD Carleton	2022	Postdoc TRIUMF
Meisam Ghasebi-Bostanabad	PhD Carleton	2021	PhD Carleton
Waleed Ahmed	PhD McGill	2024	-
Alessandro Ambler	PhD McGill	2024	Postdoc UBC
Evan Carlson	PhD Victoria	2024	Process Engineer, nLIGHT, Vancouver WA
Charlie Chen	PhD Victoria	2024	Seismic Analyst, Viridien, Calgary
Sahibjeet Singh	PhD Toronto	2024	Postdoc BNL
Ovidiu Miu	PhD Toronto	2024	-
Tae Youn Park	PhD Carleton	2024	Postdoc Max-Planck Institute, Munich
Joel Foo	PhD Toronto	2025	-
Alexandre Bachiu	PhD Carleton	2025	-

PhD Students

Name	Role/Degree	Completion	Current position (if known)
Robert Keyes	PhD McGill	2017	Postdoc Toronto
Koos van Nieuwkoop	PhD SFU	2017	Scientist Shopify
Jamie Horton	PhD SFU	2017	Senior Physicist, Ideon Technologies, CA
Robert Keyes	PhD McGill	2017	Software Engineer, DarkVision Technologies, CA
Graham Cree	PhD Carleton	2017	Analytics Engineer, Shopify
David Di Valentino	PhD Carleton	2018	Senior Data Analyst Government of Canada
Annabel Chuihard	PhD McGill	2018	Data Scientist at Privacy Analytics
Benoit Lefebvre	PhD McGill	2018	Data Scientist with Keela
Steffen Henkelmann	PhD UBC	2018	Radiation Physicist ELI Beamlines Prague
Sebastian Prince	PhD McGill	2018	Senior Data Scientist with Credit Suisse
David DiValentino	PhD Carleton	2018	Project Manager, Octasic
Annabelle Chuihard	PhD McGill	2018	CIT Data Scientist Privacy Analytics Ottawa
Aaron Liblong	PhD Toronto	2019	Data Scientist, Keela
David DeMarco	PhD Toronto	2019	Senior Data Scientist with Loblaw Digital
Nooshin Delghanian	PhD Alberta	2019	Special Projects Officer, Trinity College
Alexander Held	PhD UBC/TRIUMF	2019	Data scientist at RWI Synthetics
Sebastian Rettie	PhD UBC/TRIUMF	2019	Research Scientist U Wisconsin-Madison
Benjamin Freund	PhD Montreal	2019	Faculty NIKHEF
Vincent Pascuzzi	PhD Toronto	2019	Data Scientist Shopify
Thomas Billoud	PhD Montreal	2019	Computational Science Division BNL
Kyle Cormier	PhD Toronto	2019	Postdoc Freiburg
Sina Bahrasemani	PhD SFU	2019	Postdoc University of Zurich
Robert Les	PhD Toronto	2019	Senior Data Scientist, Jungle Scout, CA
Haider Abidi	PhD Toronto	2019	Postdoc Michigan
Aaron Liblong	PhD Toronto	2019	BNL staff scientist
			Aaron Liblong

Strong record of completed HQP (last decade)



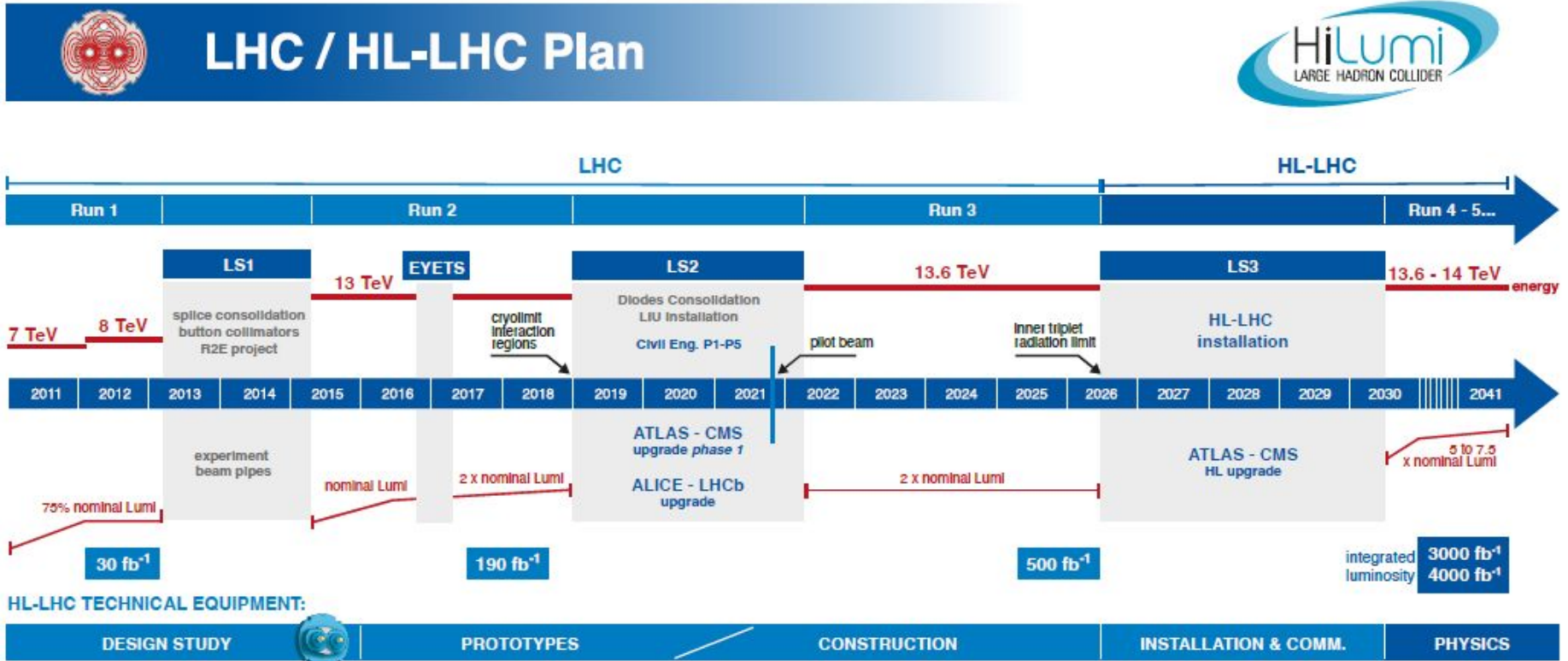
Name	Role/Degree	Completion	Current position (if known)		
Richard Polifka	Toronto	2011-2016	CEO AI Consulting, Geneva		
Mark Stockill	McGill	2011-2016	Data Analytics at Transport London		
Nicola Venturi	Toronto	2011-2016	Scientific Project Leader Armasuisse		
Patrick Czodrowski	Alberta	2013-2016	CERN Fellow		
William Leight	Carleton	2013-2016	software research associate UMASS Amherst		
Joany Manjarres	York	2013-2016	Faculty, Université Toulouse III – Paul Sabatier		
Jamie Dassoulas	Alberta	2013-2016	Private Sector (software)		
Houry Keoshkerian	Toronto	2016	Started Business		
Herberth Torres	SFU	2013-2017	Researcher, Laboratoire des 2 infinis Toulouse		
Andree Robichaud-Veronneau	McGill	2014-2017	Data Scientist, Ciena		
Manuela Venturi	Victoria	2014-2017	Director of Data Analytics at team.blue		
Quentin Buat	SFU	2013-2017	Faculty, University of Washington		
Rashid Mehdiyev	McGill	2017-2018	Senior Data Scientist UL LLC	7-2021	Government of Canada (Data Science)
Ioannis Nomidis	Carleton	2014-2017	Postdoc LPNHE	9-2020	Senior Data Scientist Accenture Zurich
Arantxa Ruiz Martinez	Carleton	2016-2018	Faculty Valencia, Spain	9-2020	Instituto de Fisica Corpuscular (IFIC),
Monica Trovatielli	Victoria	2015-2018	Research Scientist at Microsoft, Vienna	7-2020	Principal Scientist, Snorkel AI, US
Emma Kuwertz	Victoria	2015-2018	Software Engineer, European Center For Medium Range Weather Forecasts	7-2020	Victoria Faculty, CRC-2
Tamara Vazquez Schroeder	McGill	2015-2018	Faculty, IFAE Barcelona	8-2021	Radiation Physicist ELI Beamlines Prague
Jesse Heilman	Carleton	2016-2018	Carleton Faculty	8-2021	Data Scientist HP
Noam Tal Hod	TRIUMF	2016-2018	Senior Scientist Weizmann	6-2022	Faculty LAPP
Kate Pachal	SFU	2015-2018	Research Scientist, TRIUMF	0-2021	Senior firmware engineer, Camlin Group
Wojtek Fedorko	UBC	2013-2018	Data Scientist, IBM	8-2021	Data Scientist, HP
Chris Anelli	Victoria	2016-2019	Weapon System Analyst, Johns Hopkins	9-2022	Senior Technology Manager, LDS, CA
Francesco Guescini	TRIUMF	2016-2019	Senior Data Analyst MSC Mediterranean Shipping Company	7-2022	CERN Staff
Xiaohu Sun	Alberta	2016-2019	Faculty Peking University	8-2022	Senior FPGA Designer, MDA
Hulin Wang	Alberta	2016-2019	Faculty Central China Normal University Wuhan China	7-2023	Senior Data Advisor at Technical Standards and Safety Authority
Riccardo Di Sipio	Toronto	2014-2019	-	1-2023	Design Specialist, Teledyne DALSA
Matthias Danninger	UBC	2012-2019	SFU Faculty	8-2023	Modeling Specialist at TRANSMUTEX, Genev
Frank Berghaus	Victoria	2017-2019	Max Planck Computing and Data Facility, Munich	9-2023	Canadian Nuclear Lab
Otilia Ducu	Montreal	2015-2019	Permanent Research Scientist at IFIN-HH	9-2024	CERN Staff Scientist
				0-2024	CERN Senior Research Fellow
				2022-2024	Postdoc Stockholm
Ellis Kay	Victoria	2018-2022			CERN Senior Research Fellow
Rimsky Rojas	Victoria	2021-2022			CERN Quest Fellow
Hanna Borecka-Bielska	Montreal	2019-2022			Postdoc, Edinburgh
Gerardo Vasquez	Victoria	2018-2023			Postdoc, U of Zürich
Bingxuan Liu	SFU	2020-2023			Faculty, Sun Yat-sen University, CN
Tiago Vale	SFU/TRIUMF	2021-2023			Data Science Researcher, Digital Transformation CoLAB
Xavi Fernandez Fdez	SFU	2020-2024			Researcher, CNM Barcelona
Ali El Moussaouy	Montreal	2022-2024			Assistant Professor at Hassan II University
Romain Bouquet	Victoria	2023			Postdoc Genova
Shreya Saha	Victoria	2023			Postdoc Adelaide
Tony Kwan	McGill	2018-2023			Research Scientist, Wyatt AI Inc
Vahktang Tsiskaridze	Toronto	2022-2025			-
Steffen Staerz	McGill	2018-2023			Product Manager, OCSIN, Geneva
- Sandeep Kaur	Carleton	2020-2025			Canadian Nuclear Lab

Postdocs



LHC Schedule

- The LHC and HL-LHC: Run to 2041
 - Long Shutdowns (LS) for installation of detector upgrades
 - Physics analysis will continue for many years to come
 - Students will be writing theses with ATLAS analysis even when working on hardware for post HL-LHC projects





Canadian **Tier-1 centre** stores and reprocesses 10% of ATLAS data

- run by TRIUMF at SFU, 24/7 availability, dedicated facility
- funded primarily by CFI IF competitions

Two Tier-2 federations in Canada, running on DRAC resources
run by Alliance personnel, mostly with HEP backgrounds

- **CA-East-T2:** Waterloo (Graham → Nibi)
- **CA-West-T2:** SFU (Cedar → Fir), Victoria (Arbutus cloud)
- RRP resource request every 3 years to subatomic/space resource allocation committee
- We depend on Alliance resources being upgraded regularly (not all at same time!)



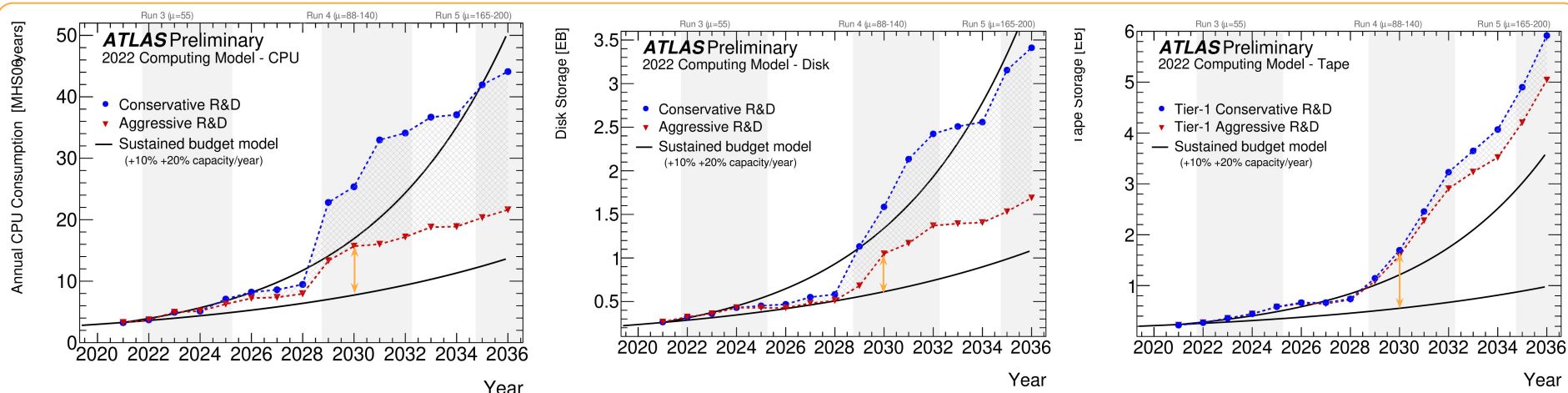
Recent Tier-2 status:

- **2020-2023:** Canada delivered the pledged T2 disk (5% of ATLAS T2 total) and delivered almost twice the pledged T2 CPU (through fairshare, when available)
- **2024:** delivered ~160% of CPU pledge even with Waterloo down, but were **only able to pledge 8.4 PB of our 10 PB disk share**
 - **For the last few, months, we have not been able to deliver even that:** Waterloo (and occasionally SFU) storage was offline.
 - T1+T2 CPU remains ~pledged level.
- **2025 allocation should allow us to recover**, but...
 - Due to hardware replacements, the 2025 allocation is projected to start in July (though it's not clear all the hardware will be available before **September**)
 - currently, we can provide only 7.9 PB of 11.5 PB pledged T2 disk, although our **2025 allocation (starting in July) is 13.8 PB** and our 2024 allocation was 8.4 PB



Computing for ATLAS - III

Requirements go up with the data-taking rate and size of dataset:

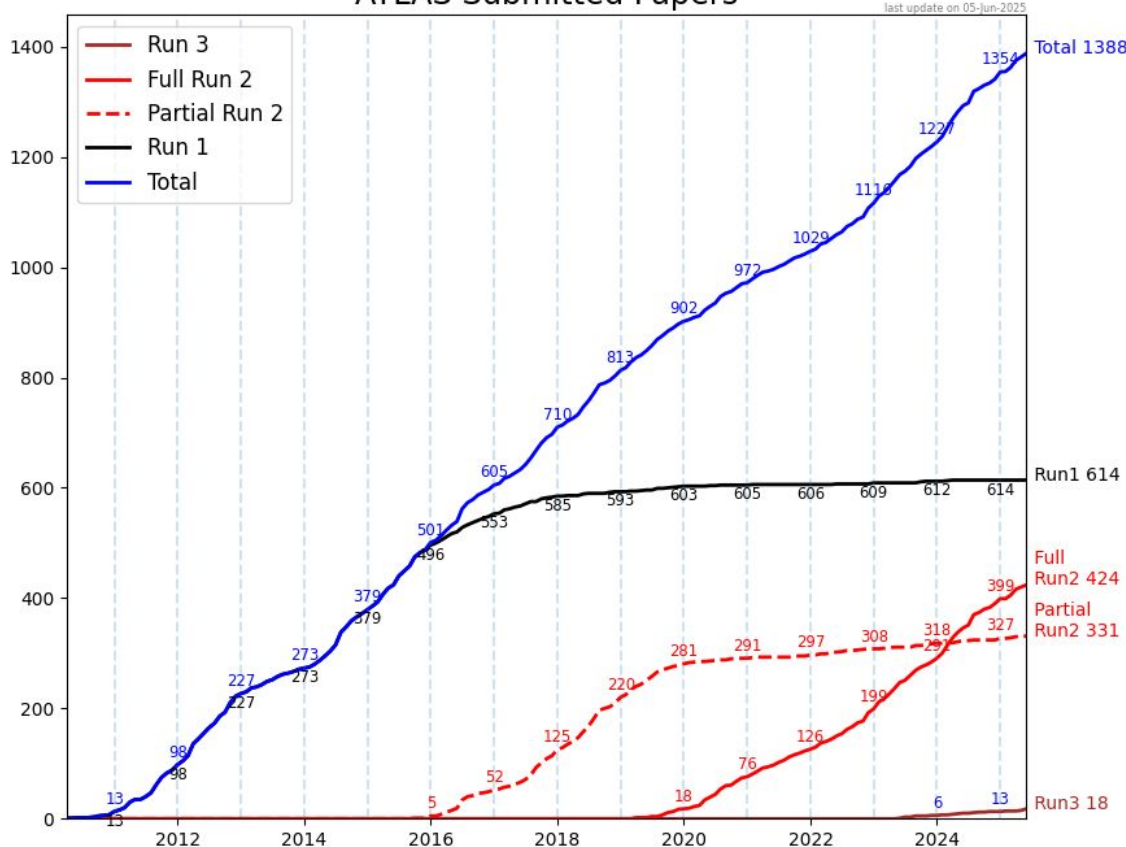


Requirements for ATLAS (not just Canada!) computing from [LHCC-G-182](#).
Run 4 now starts in 2030, so short reprieve!

- Given the increased [requirements of HL-LHC](#), we need to prepare requests now with >2030 in mind to make sure the hardware and networking exist
- Require more dCache(-like) disk for ATLAS than Alliance currently has for everyone, so this isn't just a question of filling out a form: requires that they buy suitable storage systems and we must build the storage we need!



ATLAS Submitted Papers



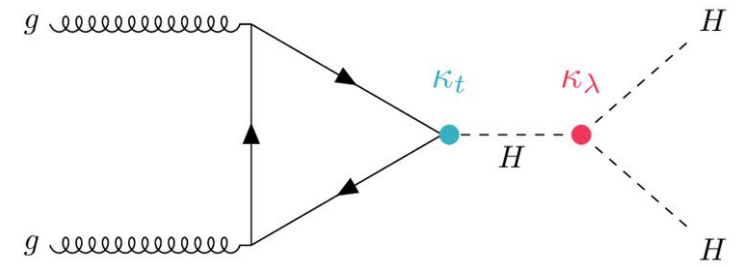
- 1388 total papers submitted
 - 28% have strong Canadian involvement
- New: 18 papers with Run3 data!
- Publications are enabled by efficient operations, reconstruction, and performance
 - Important Canadian contributions to all

Physics Highlights: $HH \rightarrow \gamma\gamma b\bar{b}$

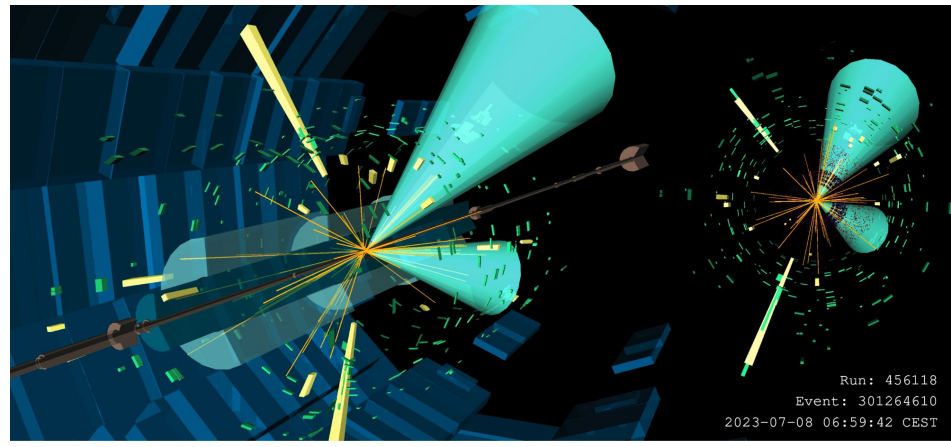
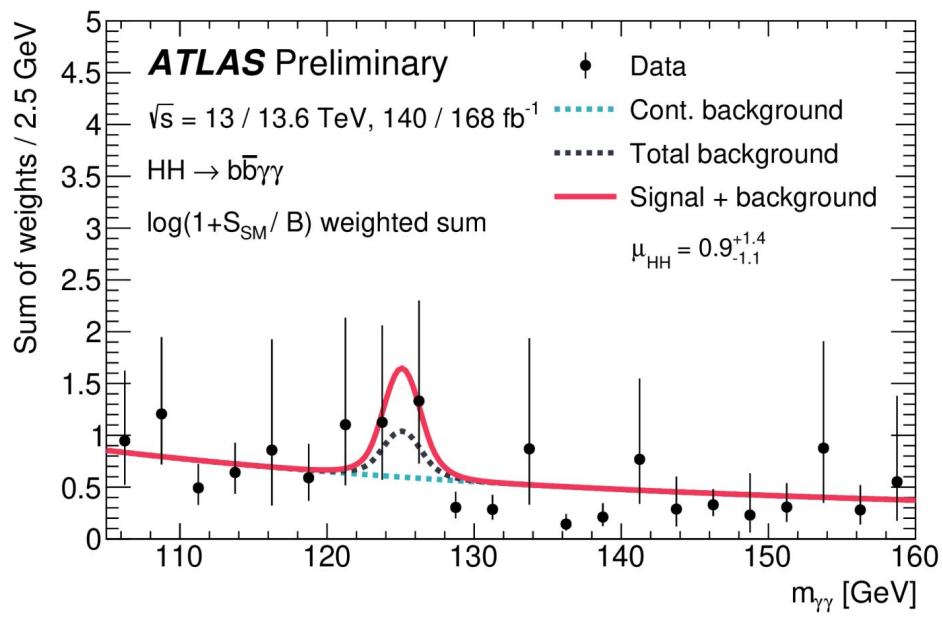


Spectacularly rare process: 500x less common than single Higgs production

- Key for measuring κ_λ , the Higgs boson self-interaction
- 1σ observed sensitivity: progress towards discovery at HL-LHC!



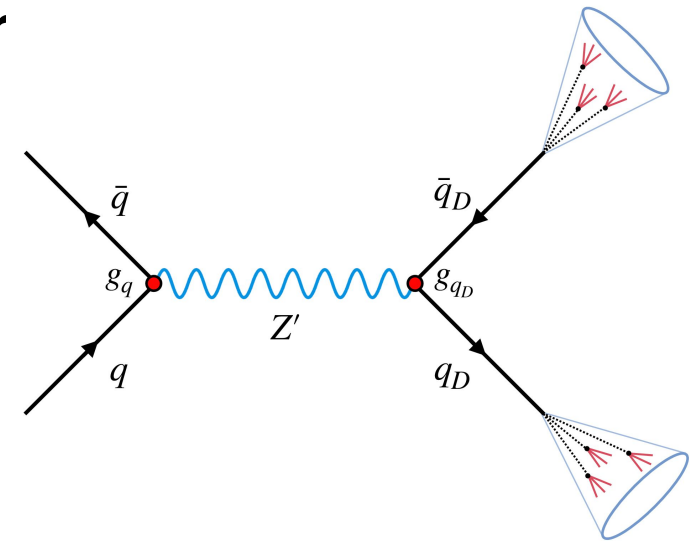
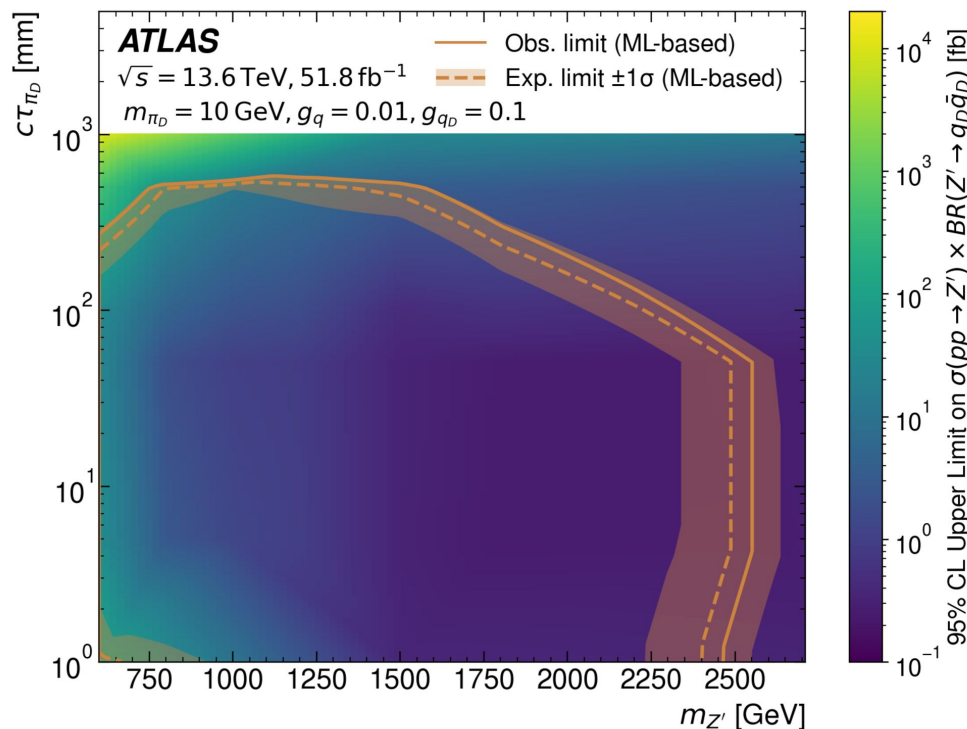
First LHC search to use 300/fb of data!



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Event: 301264610
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- Challenging topologies are an increasingly important search area
- “Emerging jets” occur when **dark sector quarks** shower and hadronize into metastable dark mesons
- motivated by DM models



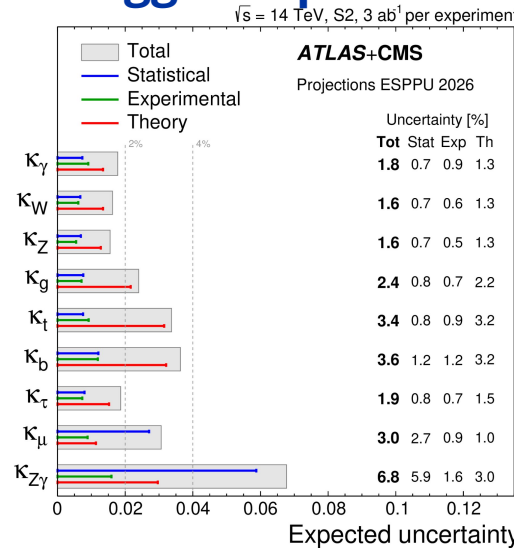
- Uses a dedicated trigger developed for Run 3 and advanced ML-tagging
- Significant Canadian contributions



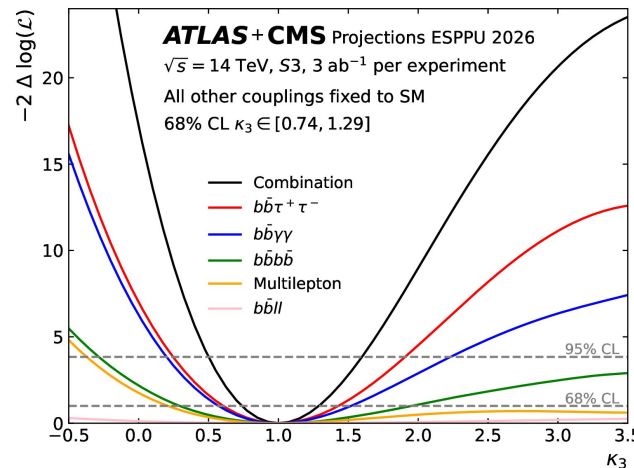
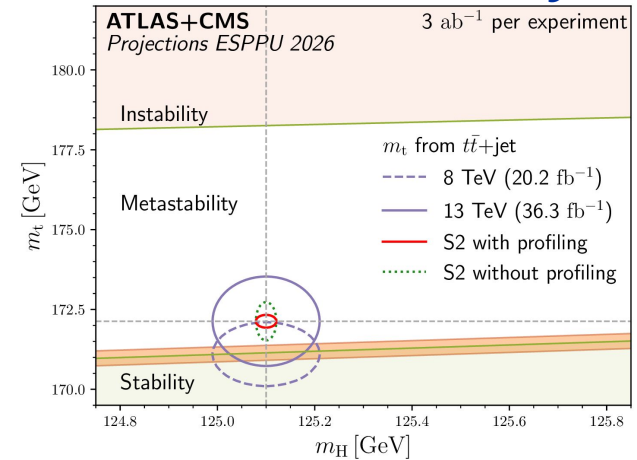
HL-LHC physics projections updated for input to European Strategy Update

- Significant gains over last round of projections in many cases
- Higgs self-coupling to 28% accuracy!

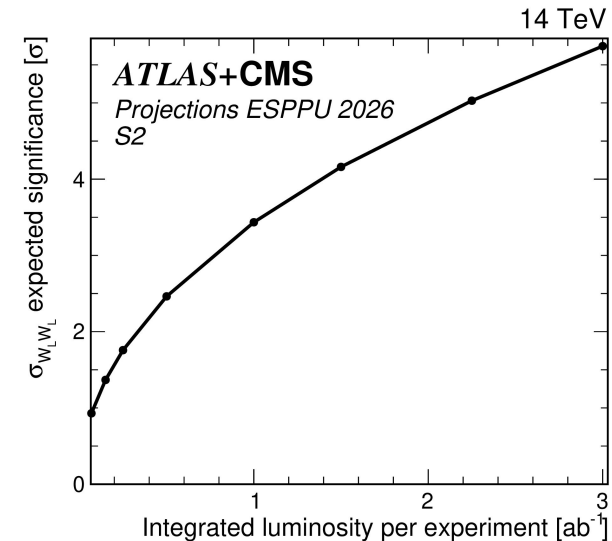
Higgs Properties



Vacuum Stability





Higgs Self-coupling



$V_L V_L$ Scattering

ATLAS Upgrades for HL-LHC



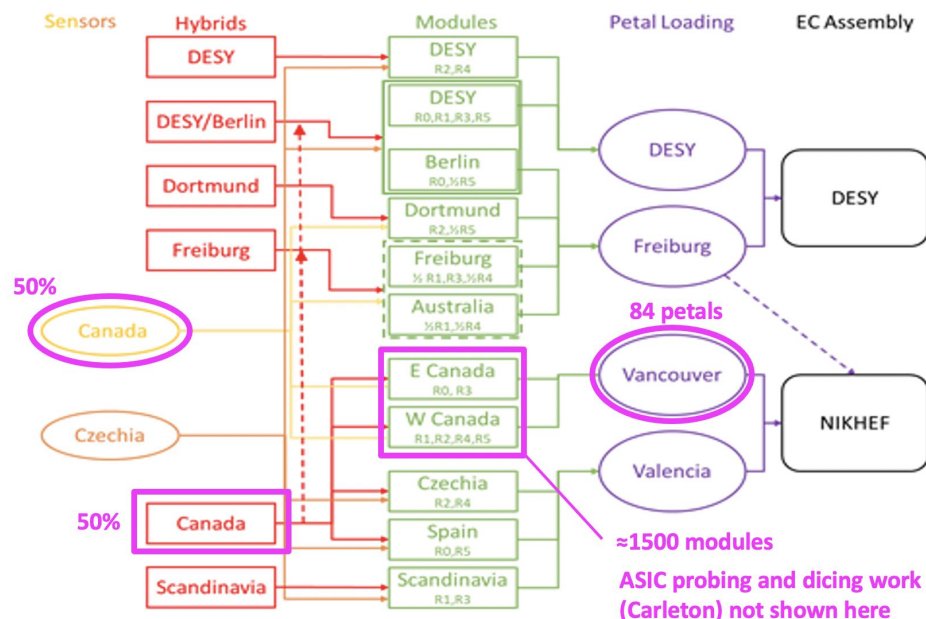
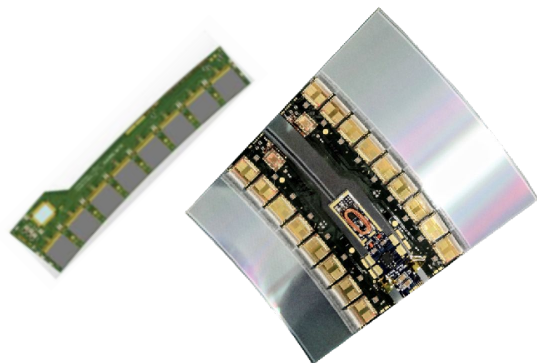
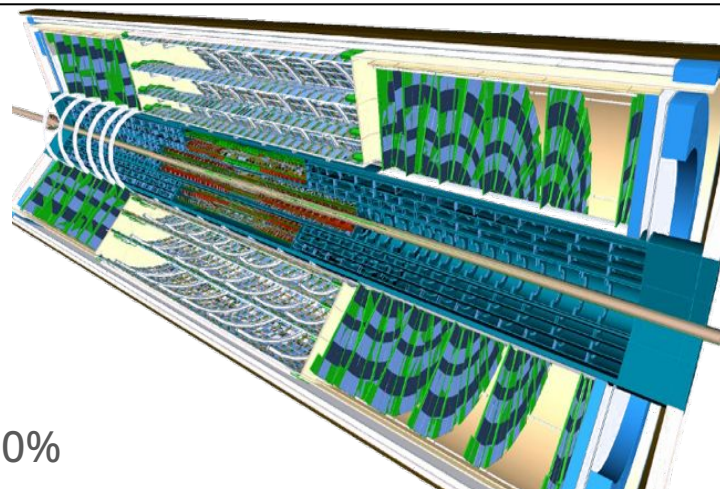
- Proposed instantaneous luminosity of $7.5 \times 10^{34} \text{ cm}^{-2}\text{s}^{-1}$ ($\mu \approx 200$)
 - Necessary for the desired 10x increase in integrated luminosity
 - Rate and accumulated dose causes problems for some detector subsystems
 - Need for pileup suppression becomes crucial issue for detector upgrades
- Planned L0 trigger scheme with rate of 1 MHz is incompatible with existing tracker and calorimeter readout electronics
 1. Tracker will be entirely replaced by a new, all-silicon tracker (ITk) 
 - Pixels at low radius, strips at higher radius, coverage to $|\eta| = 4.0$ (from 2.5)
 - 160 m² of silicon, almost half the cost / effort of the Phase-2 upgrades
 2. Calorimeter on- and off-detector electronics will be entirely replaced 
 - Multiple technical leadership & management roles in both projects
 - Funding from CFI (IF 2017)
 - Involvement of industry in some tasks
 - Local infrastructure at production sites in place
 - Both projects are in the production phase
- Also other upgrades - Canada is involved only in the ones listed above



Inner Tracker Upgrade (ITk)

Canadian contributions include:

- 50% of hybrids (module readout) for the Endcap Strips system
- All silicon-strip modules for “petals”
 - These make up the endcap disks
 - Canada producing 84 of these, or about 20%
- Silicon sensor QA (50%) and QC
- ASIC probing and dicing (50%)
- Interlock crates




Canadian CFI-funded infrastructure. Now beginning module/petal production phase



LAr Calorimeter Upgrades

- Digitize and stream calorimeter data from new on-detector electronics to new off-detector electronics at 40MHz
- As already done for the new Phase-1 digital trigger which will remain in place for the HL-LHC era

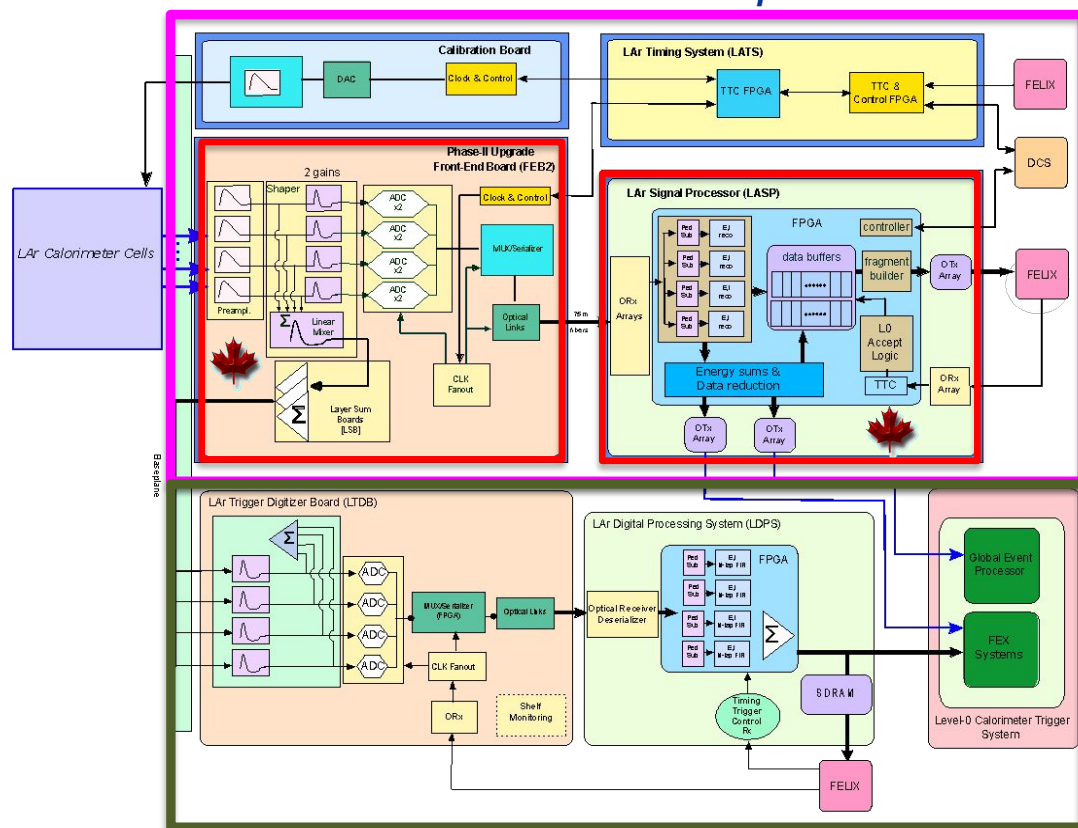
- Strong  contributions to:
 - HEC readout ASIC
 - LASP board design/testing, including algorithms for energy and timing reconstruction
 - LASP firmware

ASIC production complete (including for  HEC ASIC)

Production testing underway

Half-crate test imminent at BNL

Phase-2 readout path



Phase-1 digital trigger (in use for Run-3)



Large number of HQP, and attracting more

- Our financial support doesn't always keep up with the poverty line
- We asked NSERC for enough support to keep our HQP while paying them "just enough"
- **Did not receive enough money. Consequently:**
 - Limiting grad student admissions (losing good applicants)
 - Reducing the number of postdocs
 - Limiting faculty visits to CERN: makes it difficult to operate ATLAS and pass on knowledge
- Together, this **limits our contributions to ATLAS** operations, upgrades, and Canadian physics output
- There are also likely cost overruns from detector upgrades
 - No clear funding mechanism for Canadian share
 - Includes central ATLAS infrastructure needs ("cost to completion")

Summary



- ATLAS at the CERN LHC continues operation, analysis and upgrades
 - Over 1000 papers published to date
 - Direct Canadian contributions in ~ 28%
- Canadian detectors: working well, **but require effort to run**
- Canadian detector upgrades: proceeding, but still a lot to do
 - Integration + commissioning @ CERN requires *people!*
- Pushing precision of Higgs & other precision studies, looking ahead to **Higgs self-coupling measurements at HL-LHC**
- Computing increases needed, but matching purchases to our needs is challenging for Tier-1 and especially in DRAC
- **Attracting more good students than we can properly support,** forcing cuts
 - despite an outstanding review and SAPES scores

We continue to work on extracting benefits from our investments in the LHC



Backup slide: 2025 turn-on

p-p collisions @ $\sqrt{s} = 13.6$ ongoing

- Detector performing well
- working through various issues
 - water leaks
 - gas leaks
 - All addressed
- Continuing data-taking

