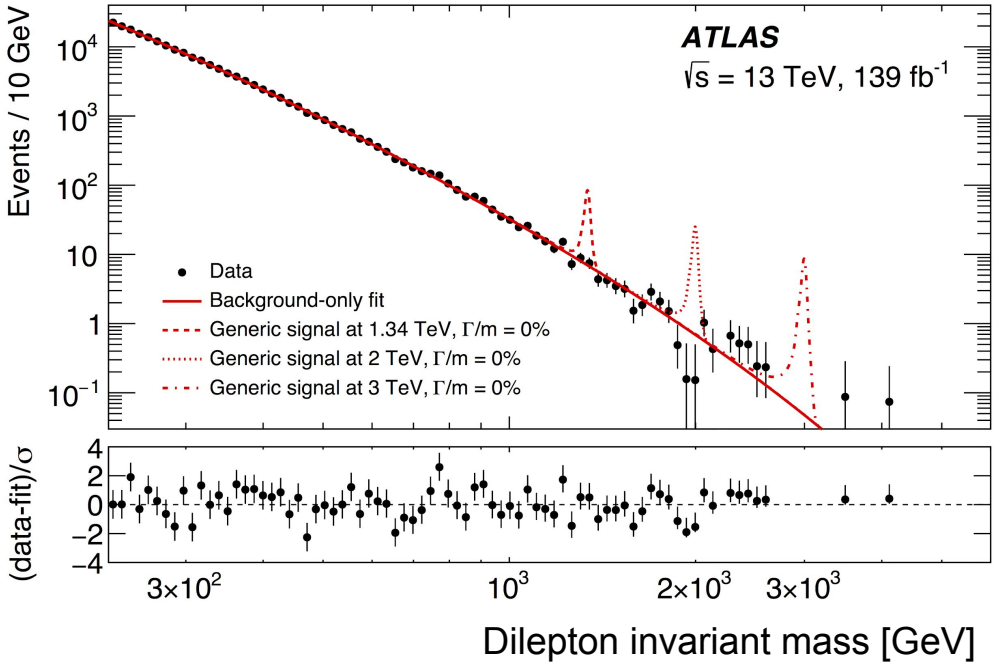
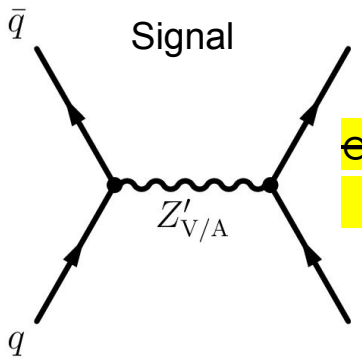
DM@LHC 2019

Poster Pitch Talks
Aug 13

Dark matter mediators in the dilepton final state at ATLAS

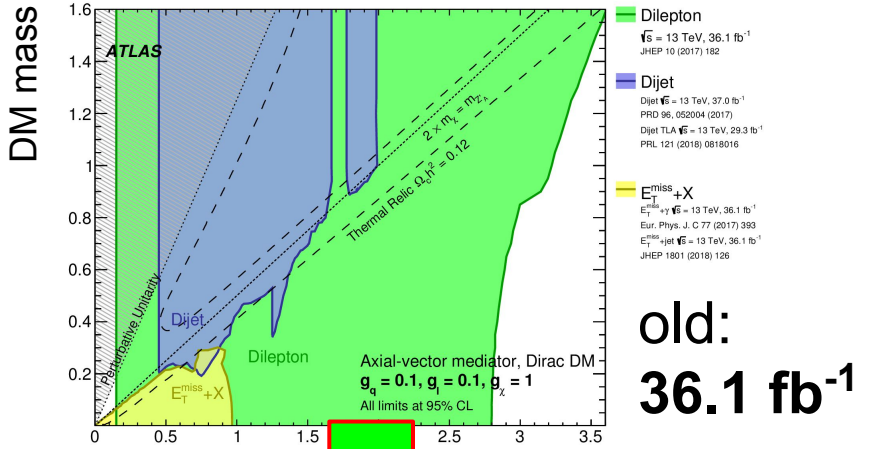
Etienne Dreyer
PhD graduate
Simon Fraser University





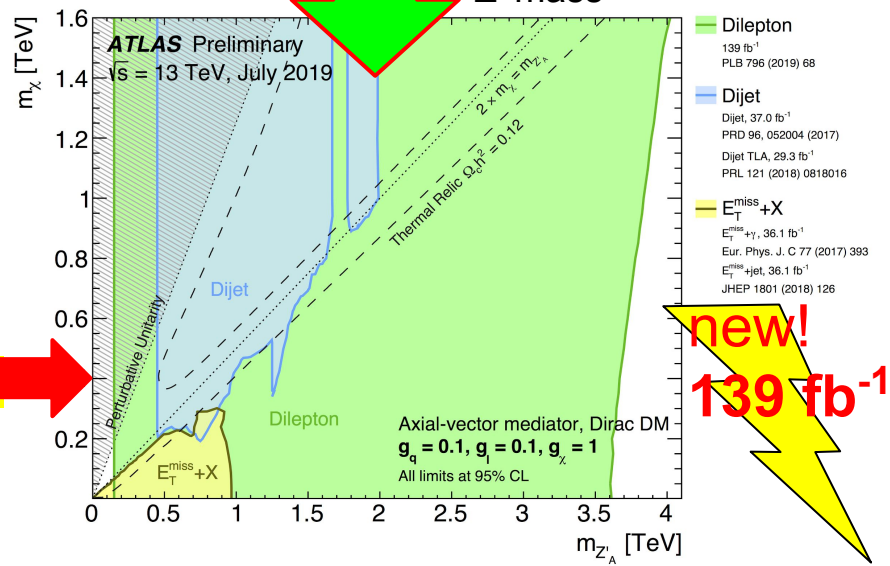
~~excess in dilepton spectrum~~

⇒ limits on dark mediators



old:
36.1 fb^{-1}

Z' mass

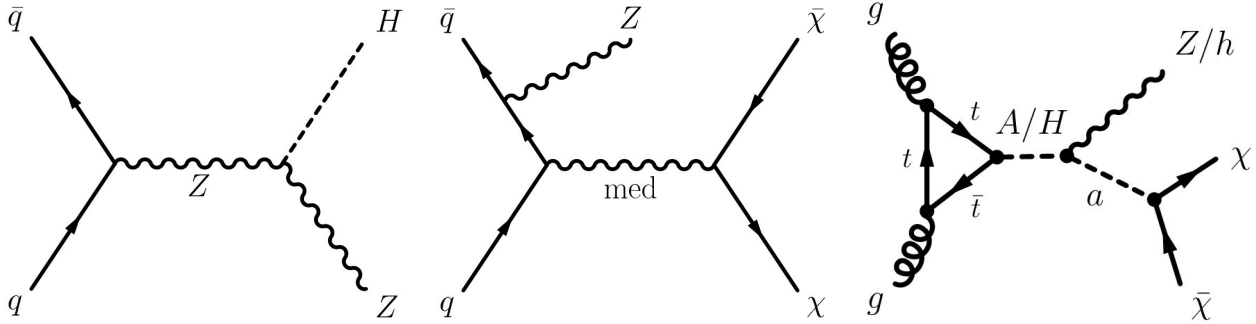


new!
139 fb^{-1}

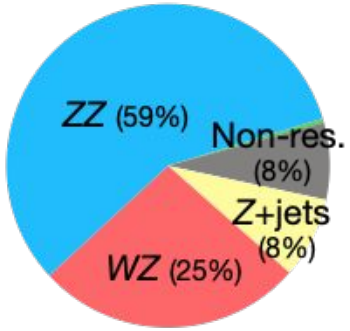
Search for dark matter in events with missing transverse momentum and a Z boson produced in 13 TeV proton-proton collisions with the ATLAS detector at the LHC

Kayla McLean
PhD graduate
University of Victoria

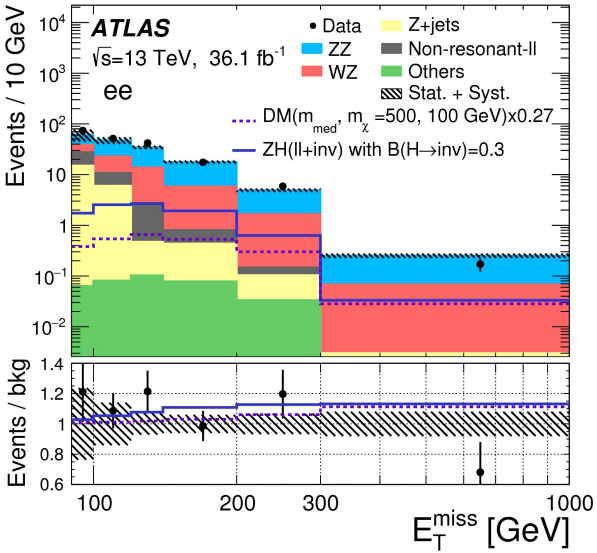
“Mono-$Z(\ell\ell)$” signatures:



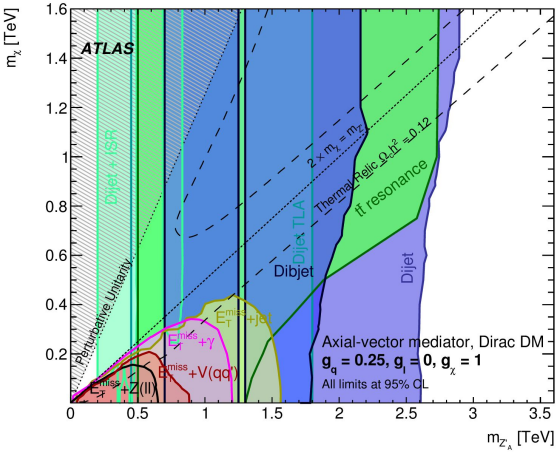
Backgrounds:

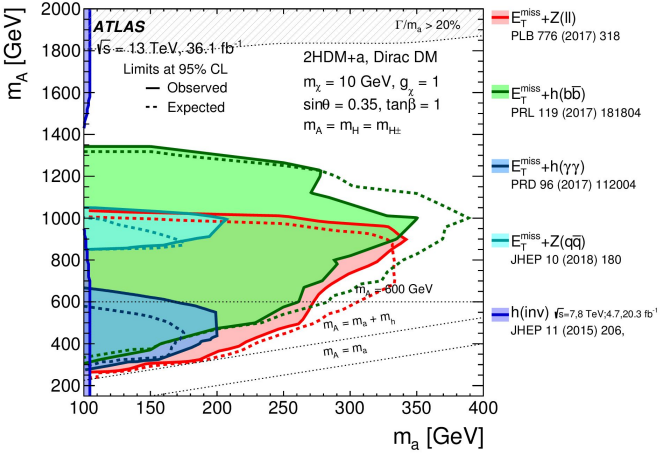


E_T^{miss} spectrum:



Interpretations:

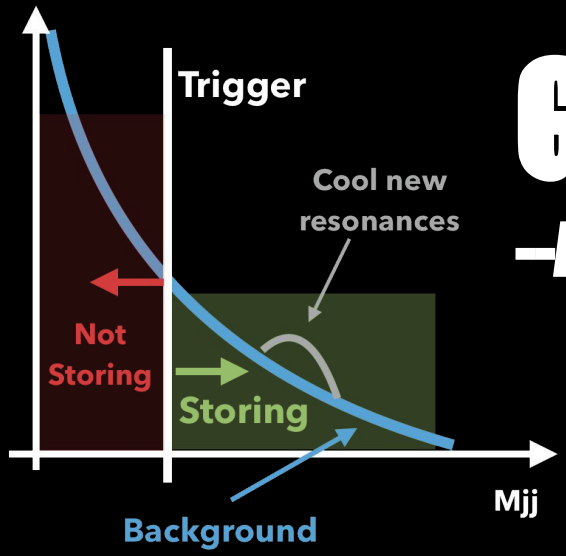




… and more!

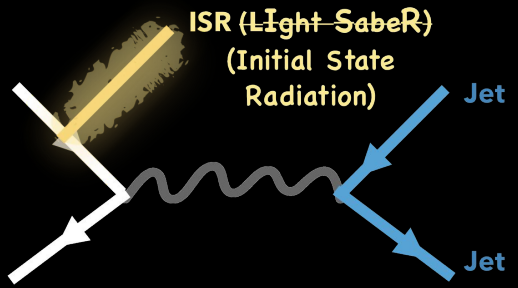
Low mass dijet resonances search using ISR with ~80fb-1 √s=13TeV ATLAS Data

Yvonne Ng
PhD Candidate
University of California Irvine



Going Lower Than Low:

–ATLAS Run II Dijet ISR Results



Mass

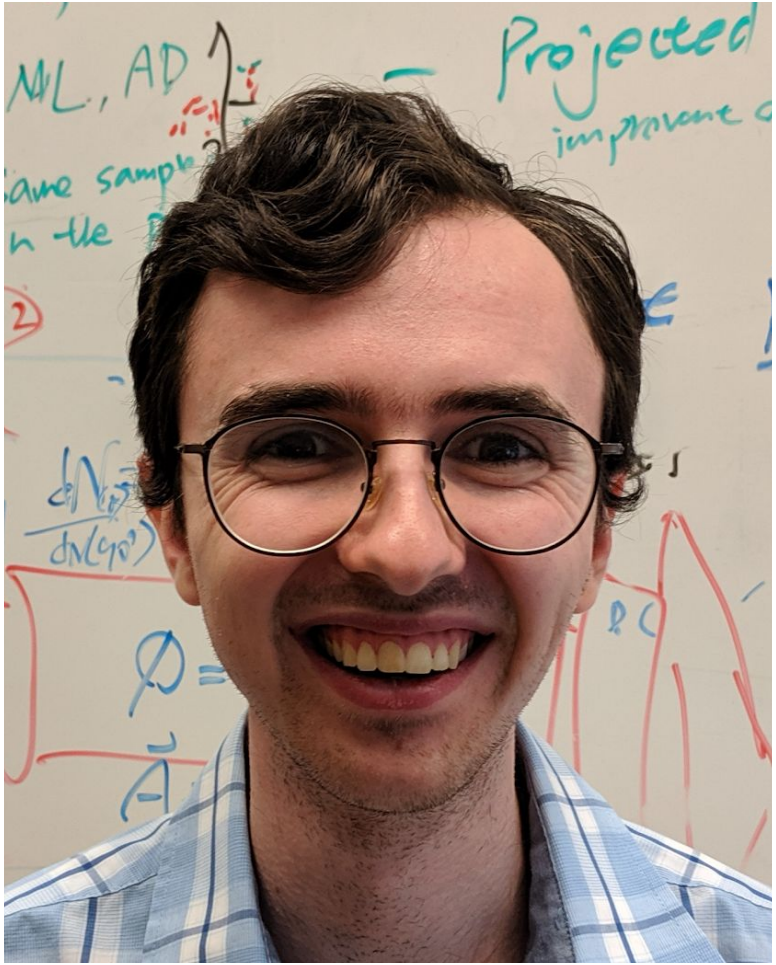
Lowest mass dijet limits of ATLAS!

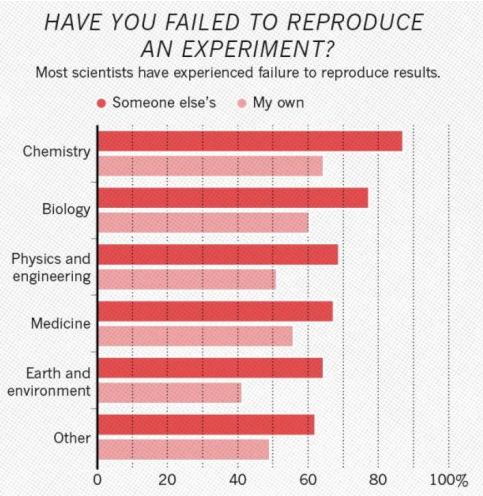
Featuring:

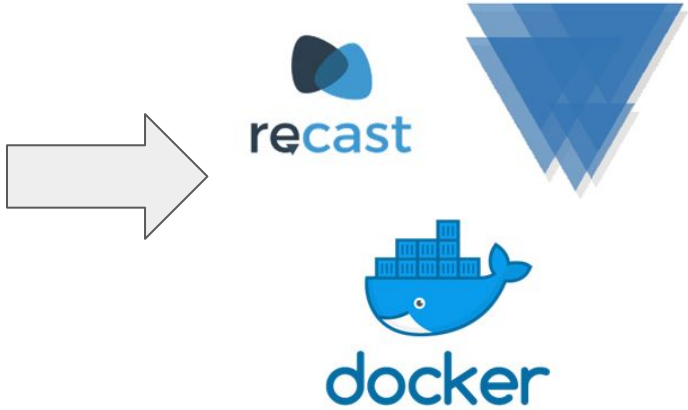
- First b-tagged results
- 2 channels
- Bonus: Higgs at 5.8 sigma through gluon fusion!

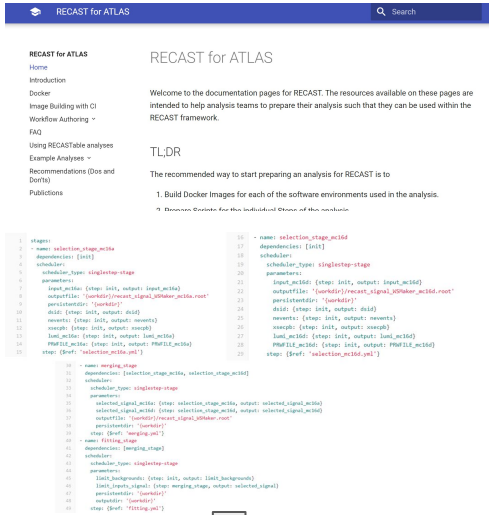
RECAST for Mono-S(bb) with ATLAS

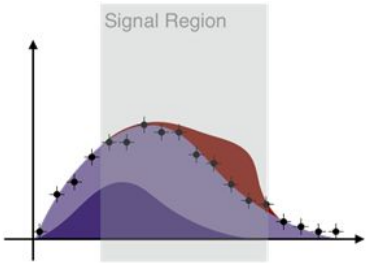
Alex Schuy
PhD graduate
University of Washington Seattle





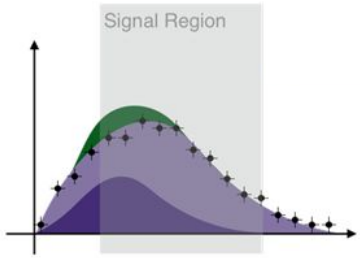




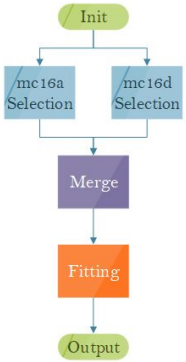


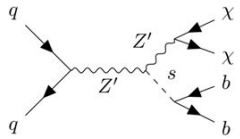
original analysis (w.r.t **model A**)

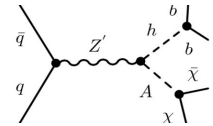
RECAST

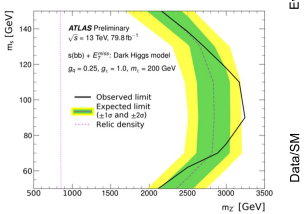


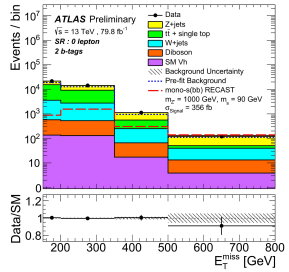
original analysis (recast to **model B**)





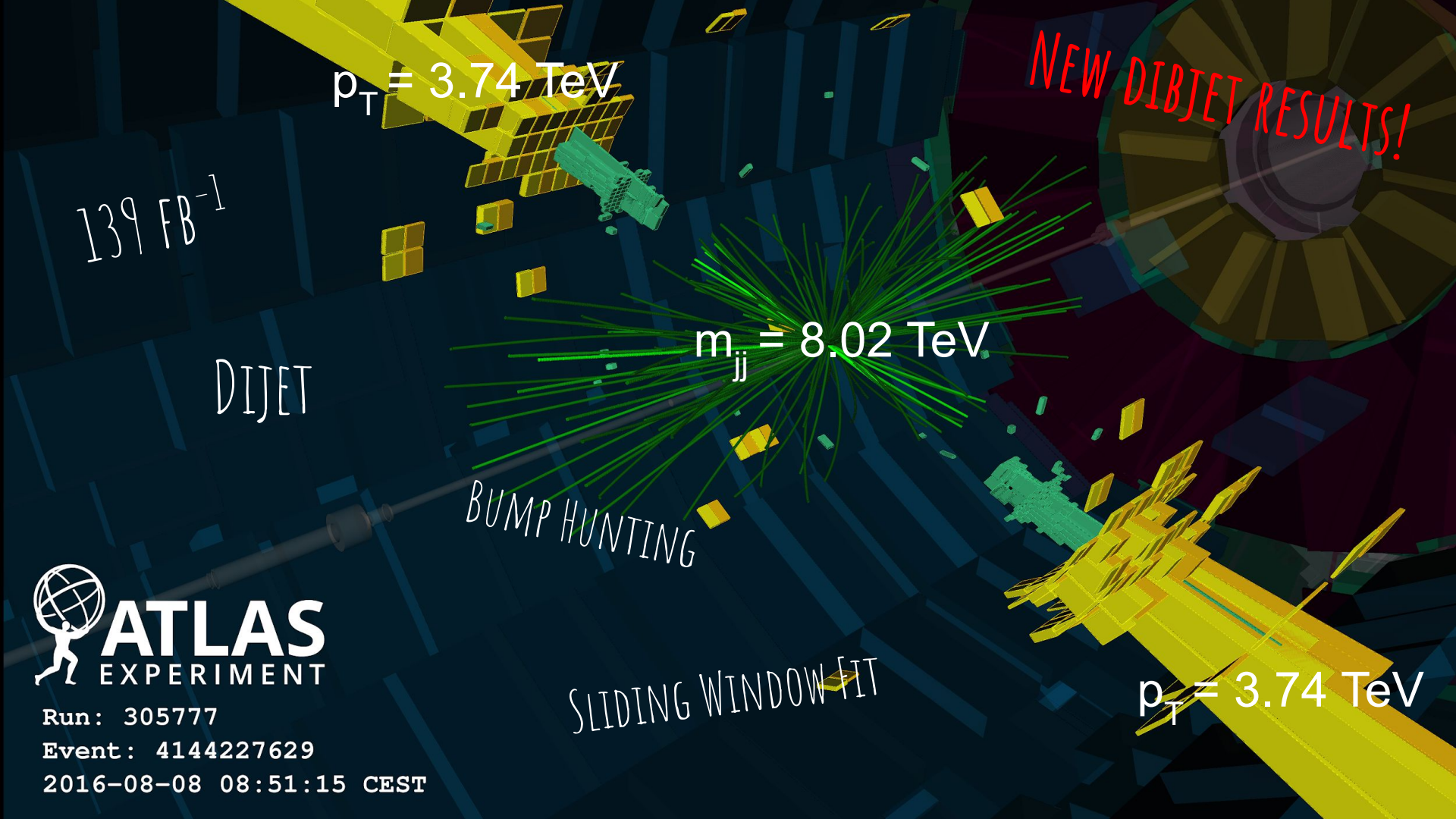






Search for New Phenomena in Dijet Events using 139 fb^{-1} of p p collisions at $\sqrt{s}$ = 13 TeV collected with the ATLAS Detector

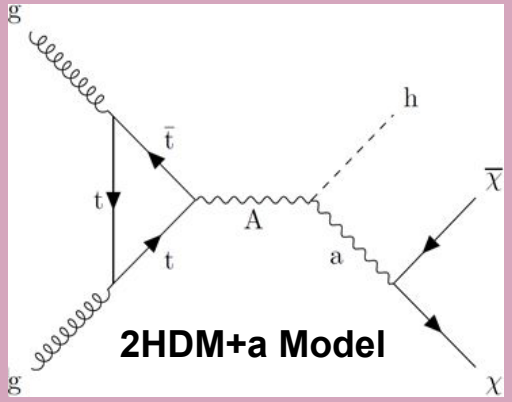
Trine Poulsen
PhD graduate
Lund University


p_T = 3.74 TeV
NEW DIBJET RESULTS!
139 FB^{-1}
DIJET
m_{jj} = 8.02 TeV
BUMP HUNTING
ATLAS
EXPERIMENT
Run: 305777
Event: 4144227629
2016-08-08 08:51:15 CEST
SLIDING WINDOW FIT
p_T = 3.74 TeV

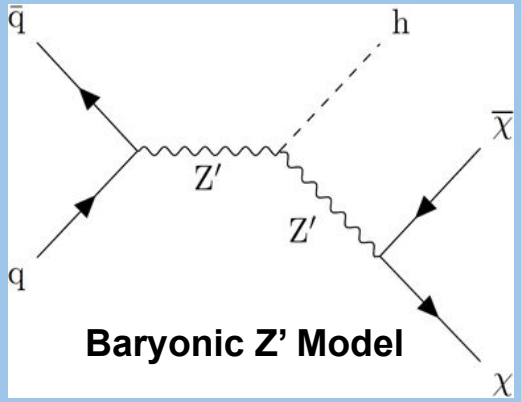
Search for dark matter produced in association with a Higgs boson decaying to a pair of bottom quarks in proton-proton collisions at sqrt(s) = 13 TeV with the CMS detector

Shu-Xiao Liu
Master student
National Central University

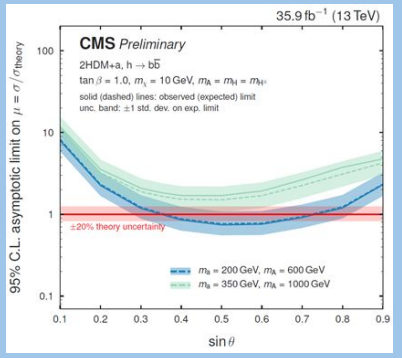
Mono-Higgs Channel, h→bb
Background: W+jet, Z+jet, tt

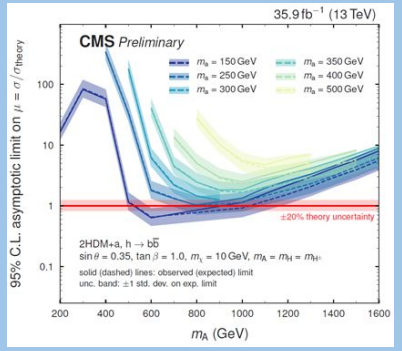


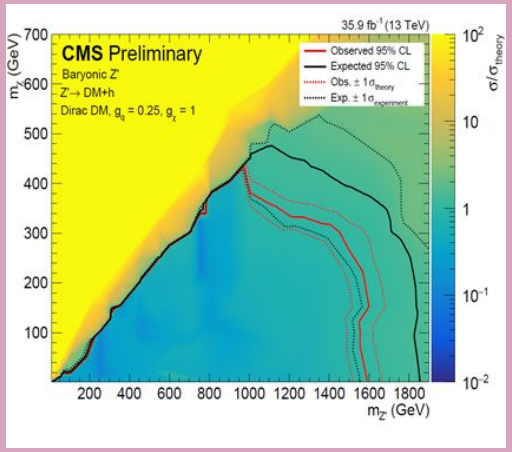
2HDM+a Model

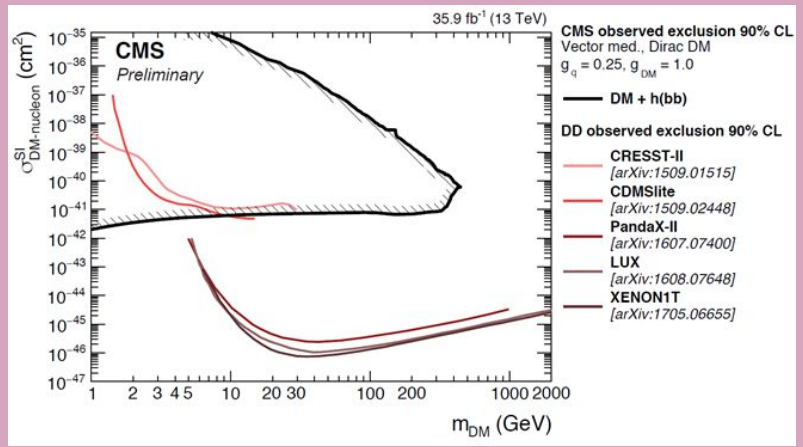


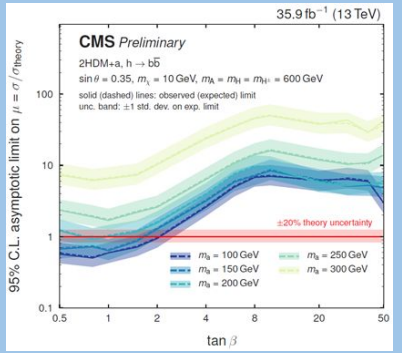
Baryonic Z' Model











New long-lived particle searches at the LHC with FASER: the ForwArd Search ExpeRiment

Aaron Soffa
Research Assistant
University of California Irvine

LHC searches for new physics

Heavy, strongly interacting regime

Light, weakly interacting regime

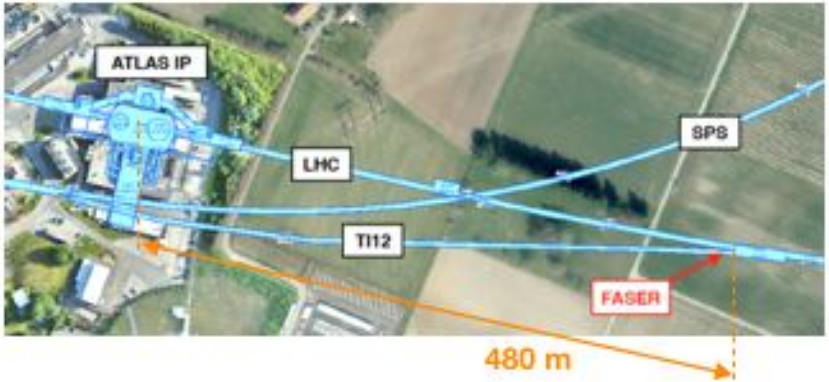
Focus of current LHC experiments
- Look near & ~transverse to beam line
- Production ~isotropic

New opportunity?
- Look at π, K, D, B decays
- Production highly collimated

$\Delta\theta \sim \frac{A_{QCD}}{TeV} \sim$ mrad

to FASER

Look along the beam line!
(~10% of pions produced within 2 mrad of beam line)



On beam collision axis line-of-sight inside LHC tunnel TI12

480 m downstream from the ATLAS interaction point IP1

FASER Physics

Dark Sector Searches

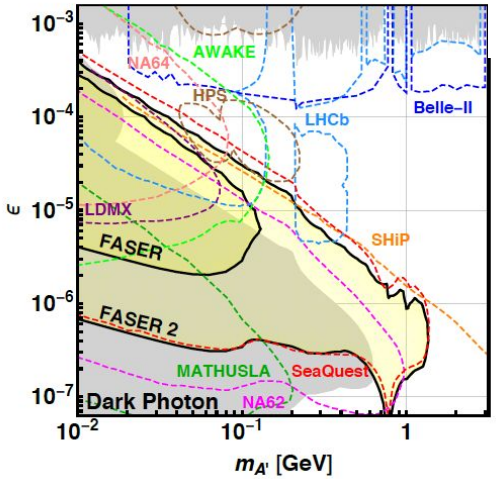
Discovery potential for:
- Dark vectors
- Dark scalars & pseudoscalars
- Heavy neutral leptons (HNLs)
- Axion-like particles (ALPs)

(proposed) Neutrino Measurements

Potential for:
- First collider detection
- New forward production constraints
- TeV-scale cross sections
- BSM neutrino physics

Projected exclusion reach in dark photon scenario

$$\mathcal{L} \supset -\epsilon e \sum_f q_f \bar{f} \not{A}' f$$



Funding obtained — December 2018

FASER approved by CERN — March 2019

2019-2020: Detector construction, installation, & integration during LS2

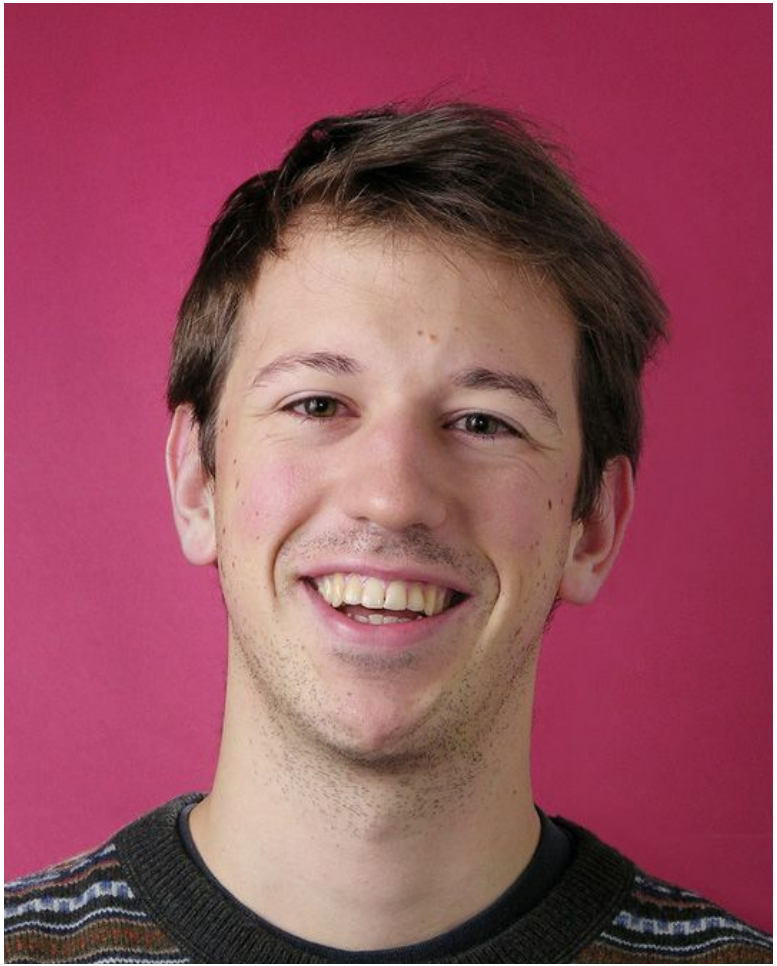
2021-2023: Data collection during LHC Run 3

2024-2026: Upgrade to FASER 2 during LS3

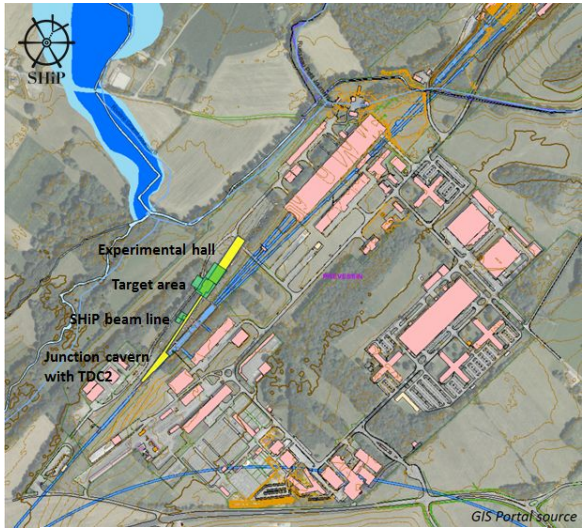
HL-LHC operation

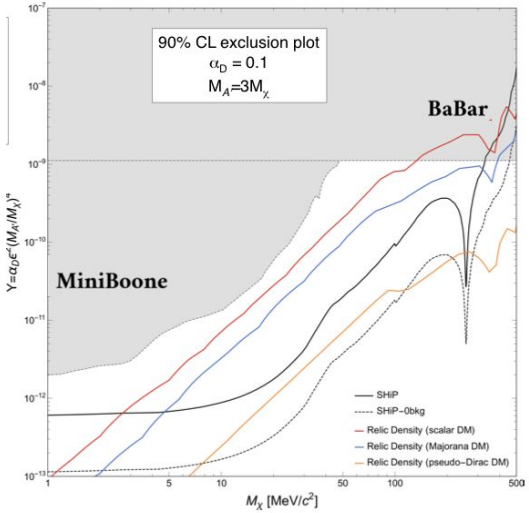
Dark Matter and Dark Sector with the SHiP experiment at CERN

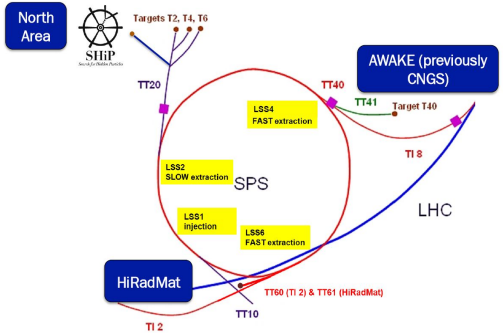
Federico Leo Redi
Postdoc
Ecole Polytechnique Federale Lausanne

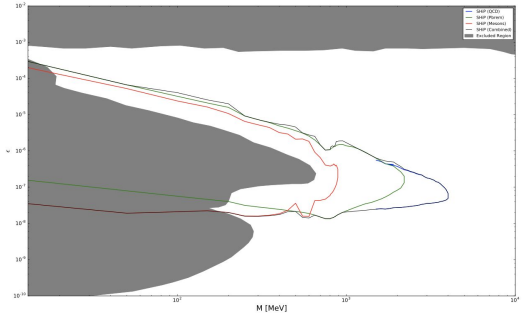


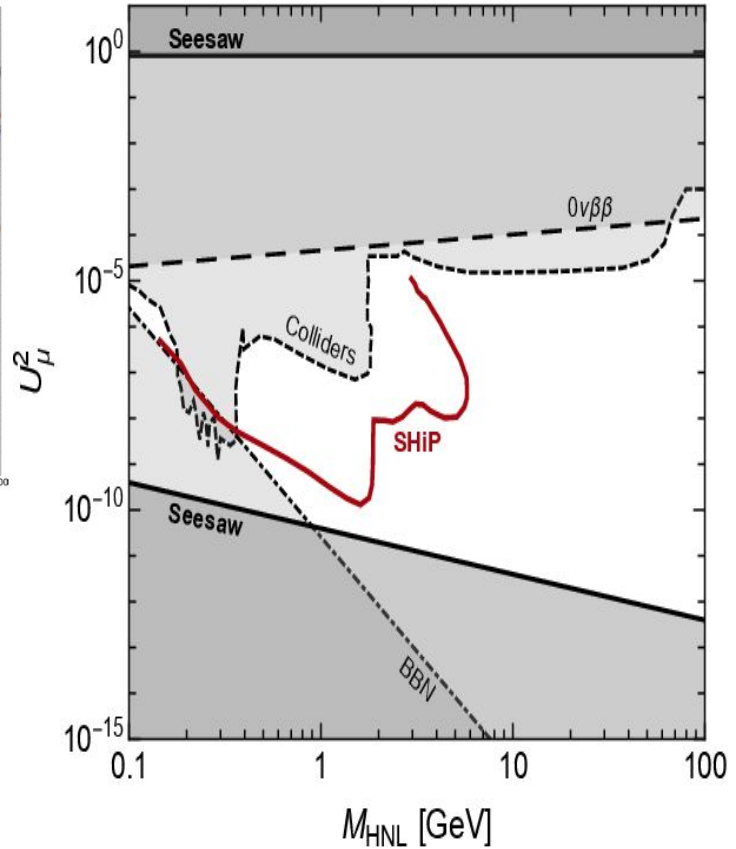
The SHiP detector







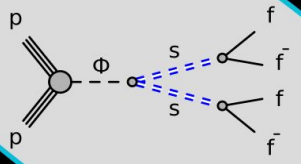




Search for long-lived particles decaying into displaced hadronic jets in the ATLAS Calorimeter

Felix Cormier
PhD student
University of British Columbia

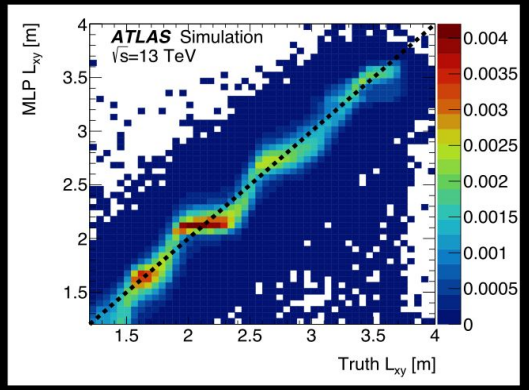
Hidden Sector model

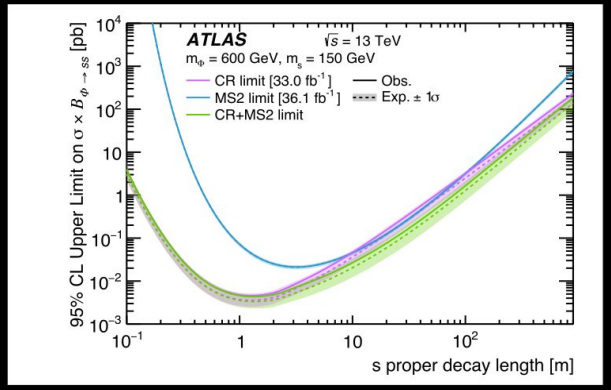


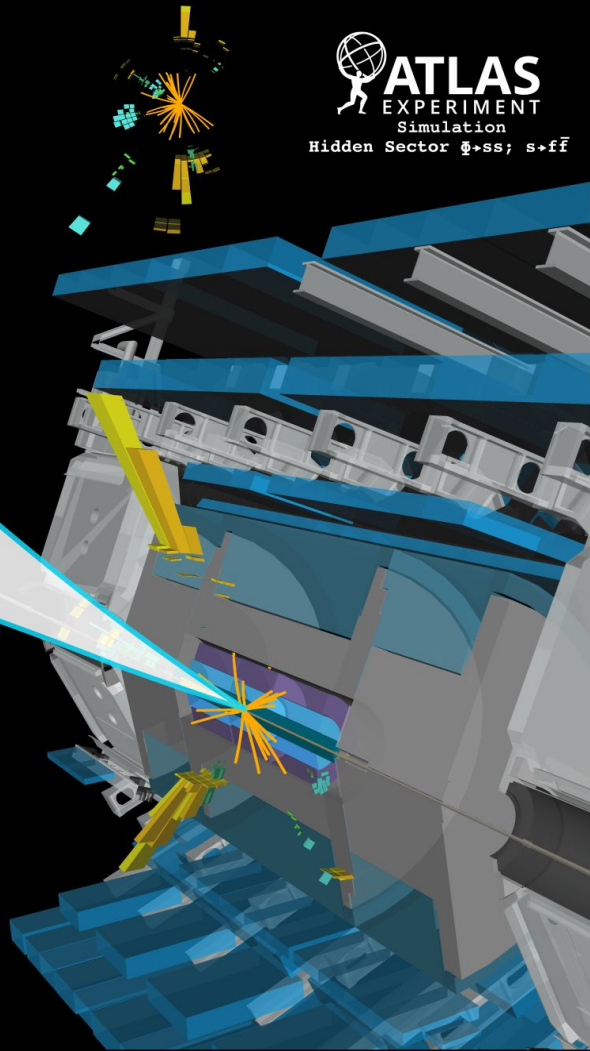
Contains dark matter candidate

Search features:

- Long-lived particles
- Unusual detector signatures
- Non-standard backgrounds
- Need for novel machine learning techniques







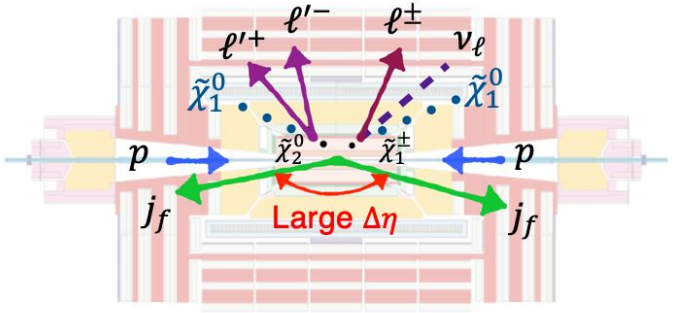
Search for supersymmetry with a compressed mass spectrum in the vector boson fusion topology with 1-lepton and 0-lepton final states

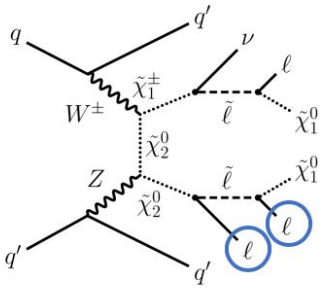
Brenda Fabela Enriquez
PhD student
Vanderbilt University

Search for supersymmetry with a compressed mass spectrum in the vector boson fusion topology with 1-lepton and 0-lepton final states

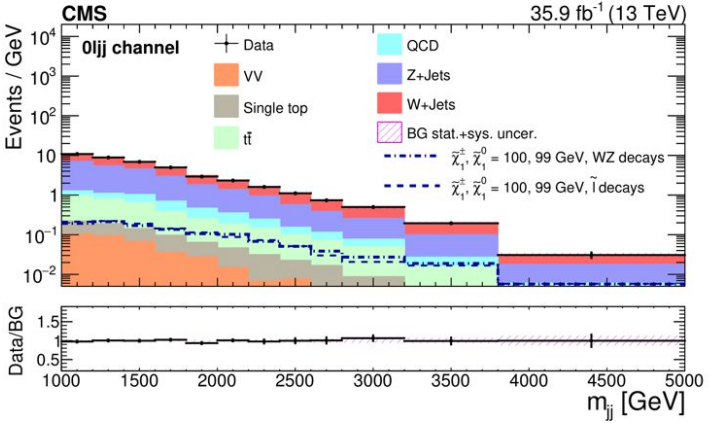
Brenda Fabela Enriquez on behalf of the CMS collaboration
brenda.fabela.enriquez@cern.ch

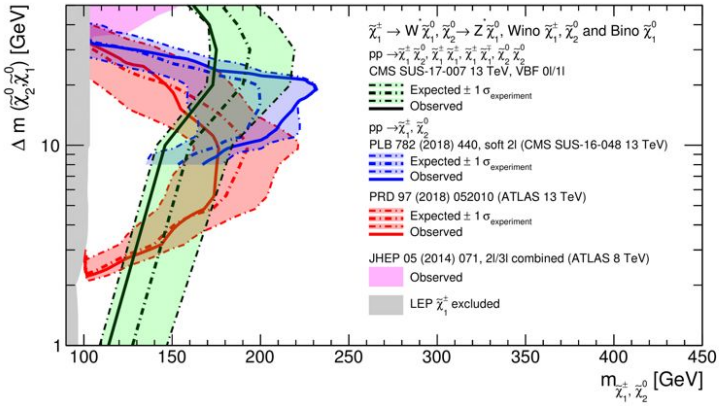
- Lightest neutralino $\tilde{\chi}_1^0$ in R-parity conserving SUSY models: dark matter candidate.
- No evidence of SUSY at LHC yet: low sensitivity to **compressed mass spectra** (small $\Delta m = m(\tilde{\chi}_1^{\pm}) - m(\tilde{\chi}_1^0)$) in traditional searches.
- Increase sensitivity by boosting the system: electroweak vector boson fusion (VBF).





Lost in the reconstruction due to low p_T





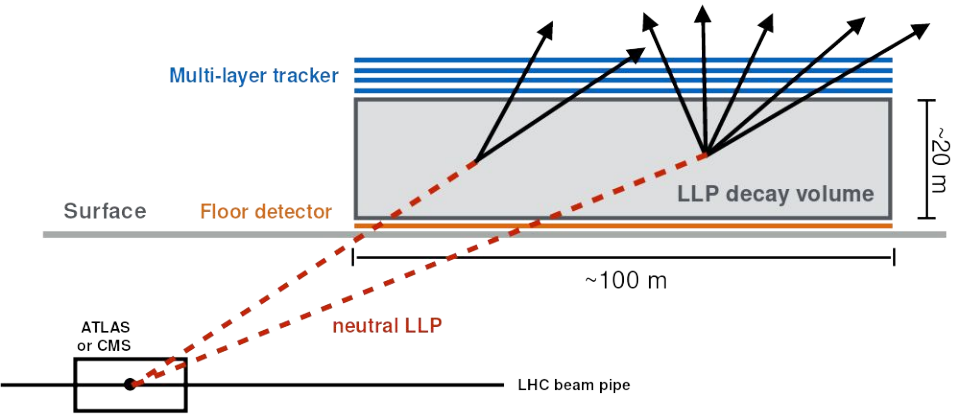
Final states: soft 1- and 0-lepton + p_T^{miss} + VBF jets.

First time a collider search is sensitive to very (very) compressed mass spectrum scenarios.

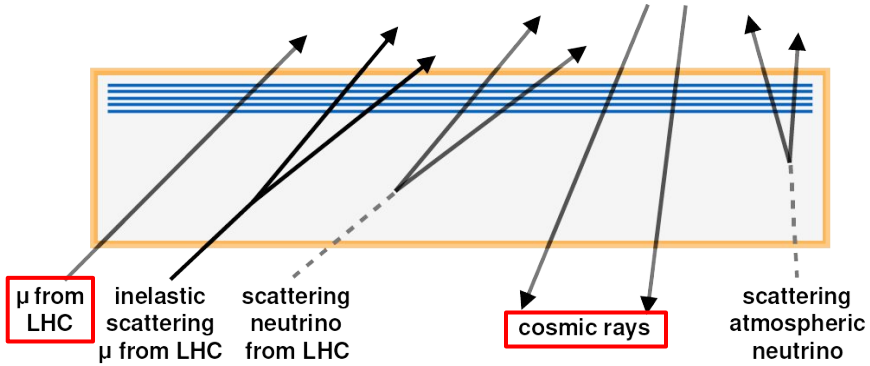
Understanding backgrounds of ultra long-lived particle searches with the MATHUSLA test stand

Mason Proffitt
PhD student
University of Washington

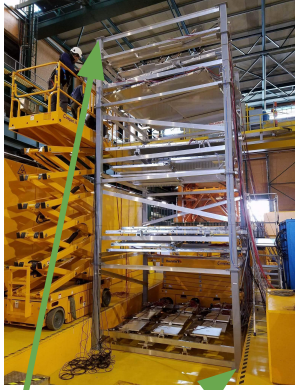
MATHUSLA: an ultra long-lived particle detector at the LHC



Principle backgrounds:

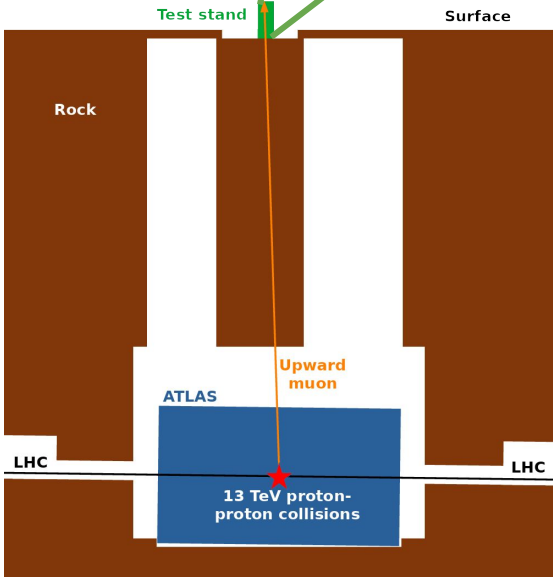


MATHUSLA *test stand*: study background rates and rejection



Collected data in 2017-2018

Ongoing analysis; see poster for preliminary results!

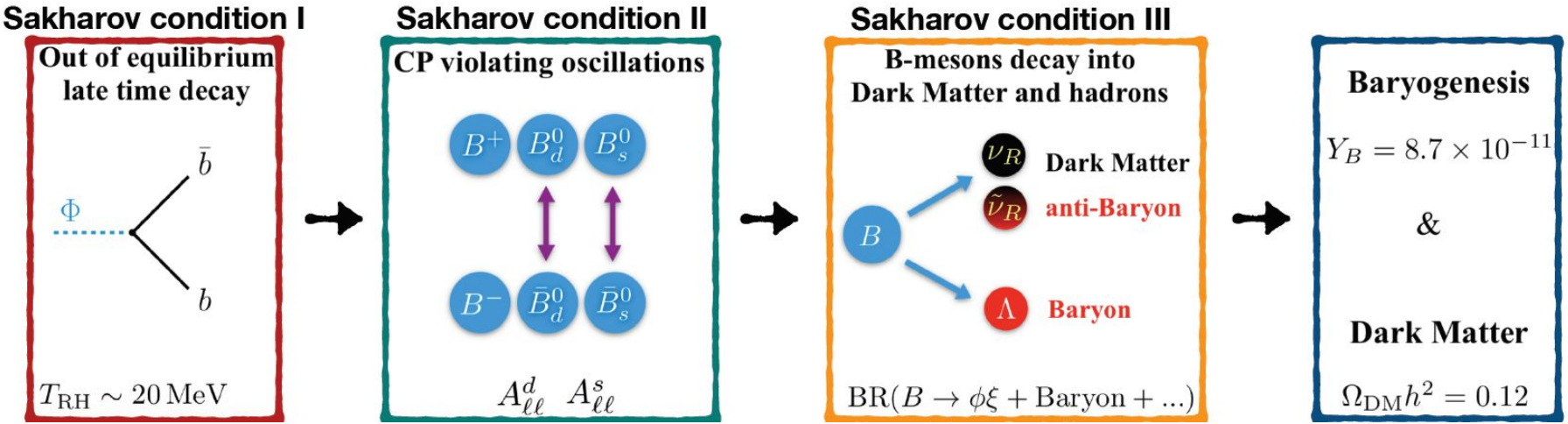


SUSY with a light Dirac bino:
B meson baryogenesis & sneutrino asymmetric DM

Huangyu Xiao
PhD student
University of Washington

Huangyu's 1-slide summary [edit me]

A testable baryogenesis theory at low temperature:



Semileptonic asymmetries of B mesons should be greater than SM values.

Exotic B decays with a branching fraction about 1%.