Open Session C Summary

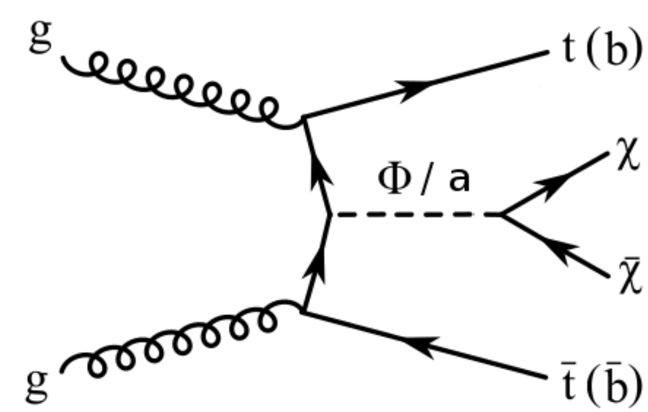
Speakers (part 1):

Brandon Allen
Eric Madge
Stanislava Sevova
Yoav Afik
Bingxuan Liu
Adrian Carmona
Marco Rimoldi
Juan Garcia Ferrero

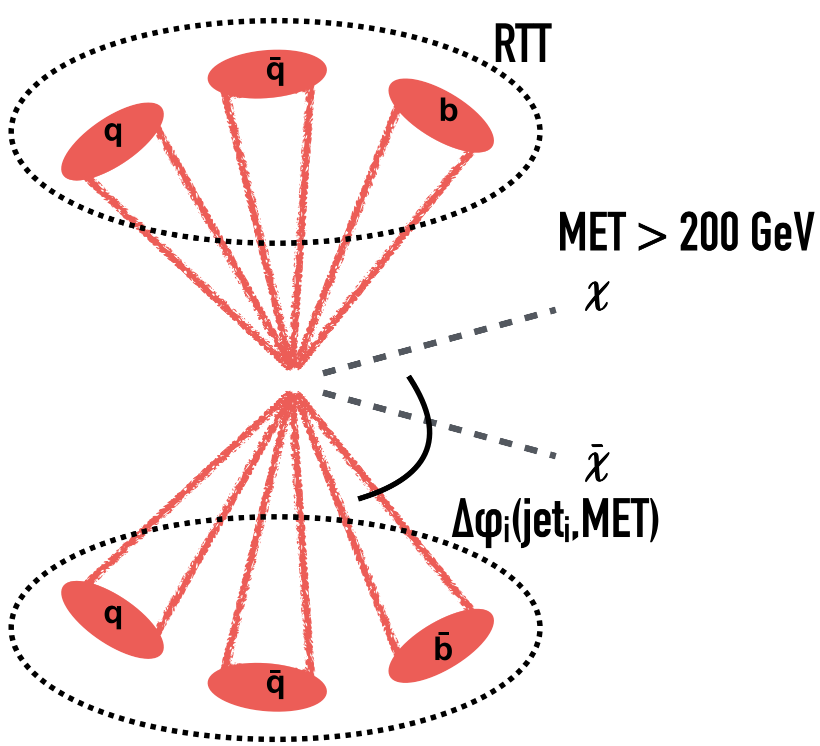
Heavy Flavour I

CMS combined $t\bar{t}$+DM search with 2016 data

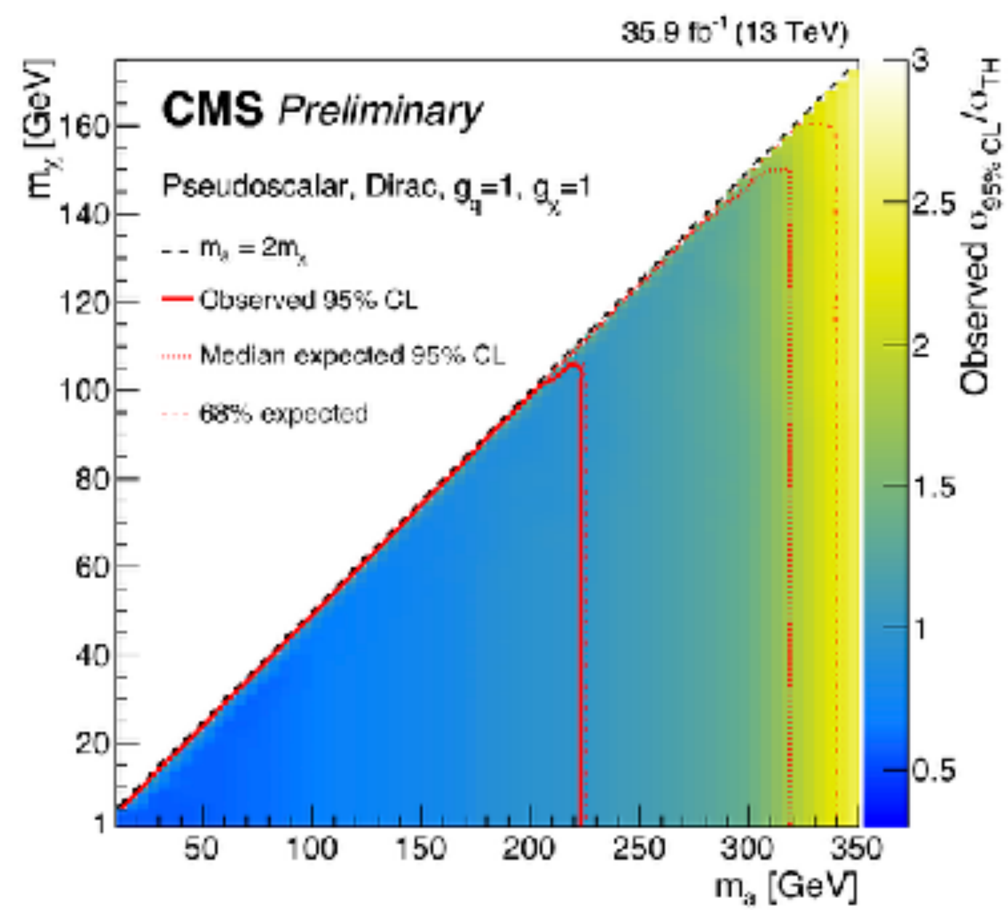
Stanislava Sevova, Northwestern University



Resolved Top Tagger



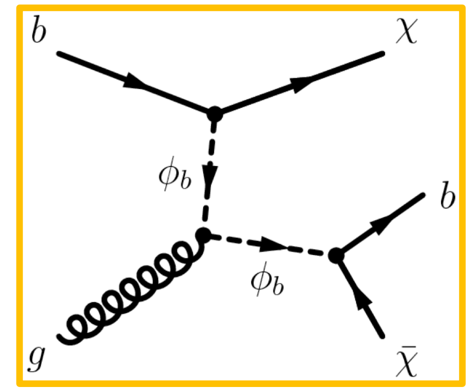
16 Signal Regions, including leptonic channels



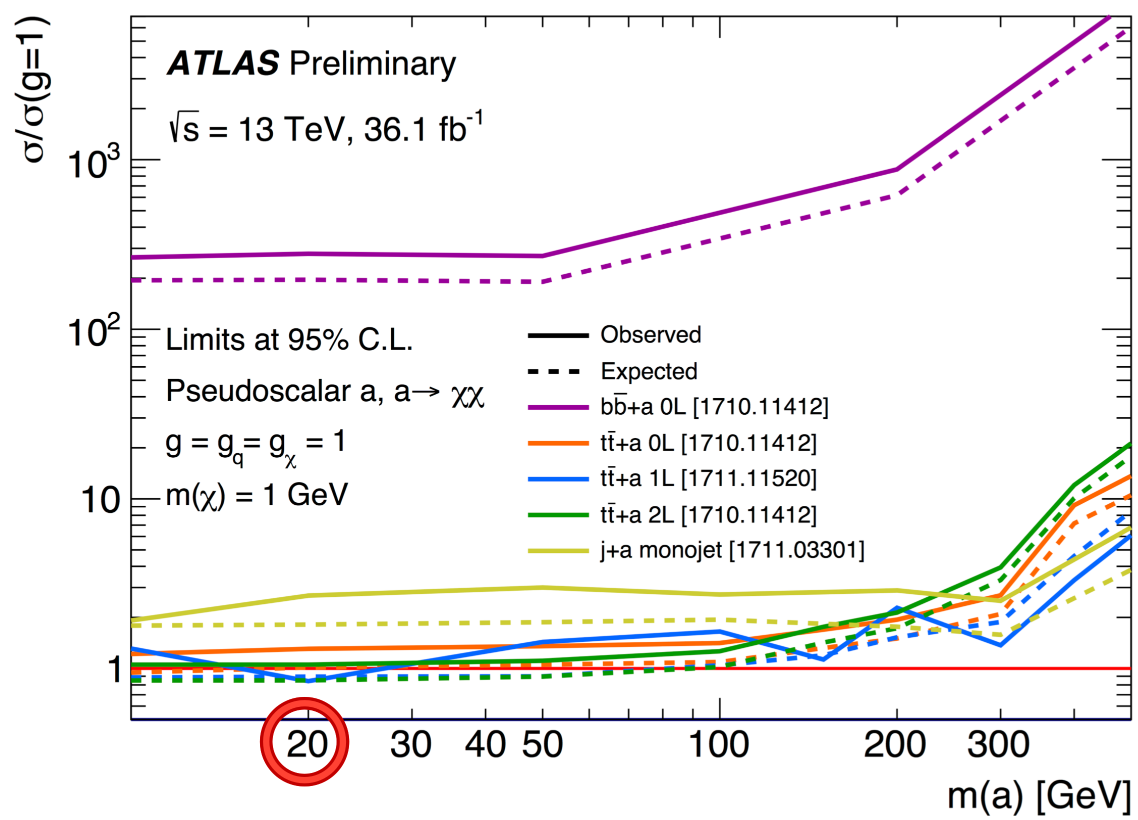
Heavy Flavor II

SEARCH FOR DARK MATTER PRODUCED
IN ASSOCIATION WITH BOTTOM OR TOP QUARKS
IN $\sqrt{S}$=13 TEV PP COLLISIONS WITH THE ATLAS DETECTOR

Marco Rimoldi

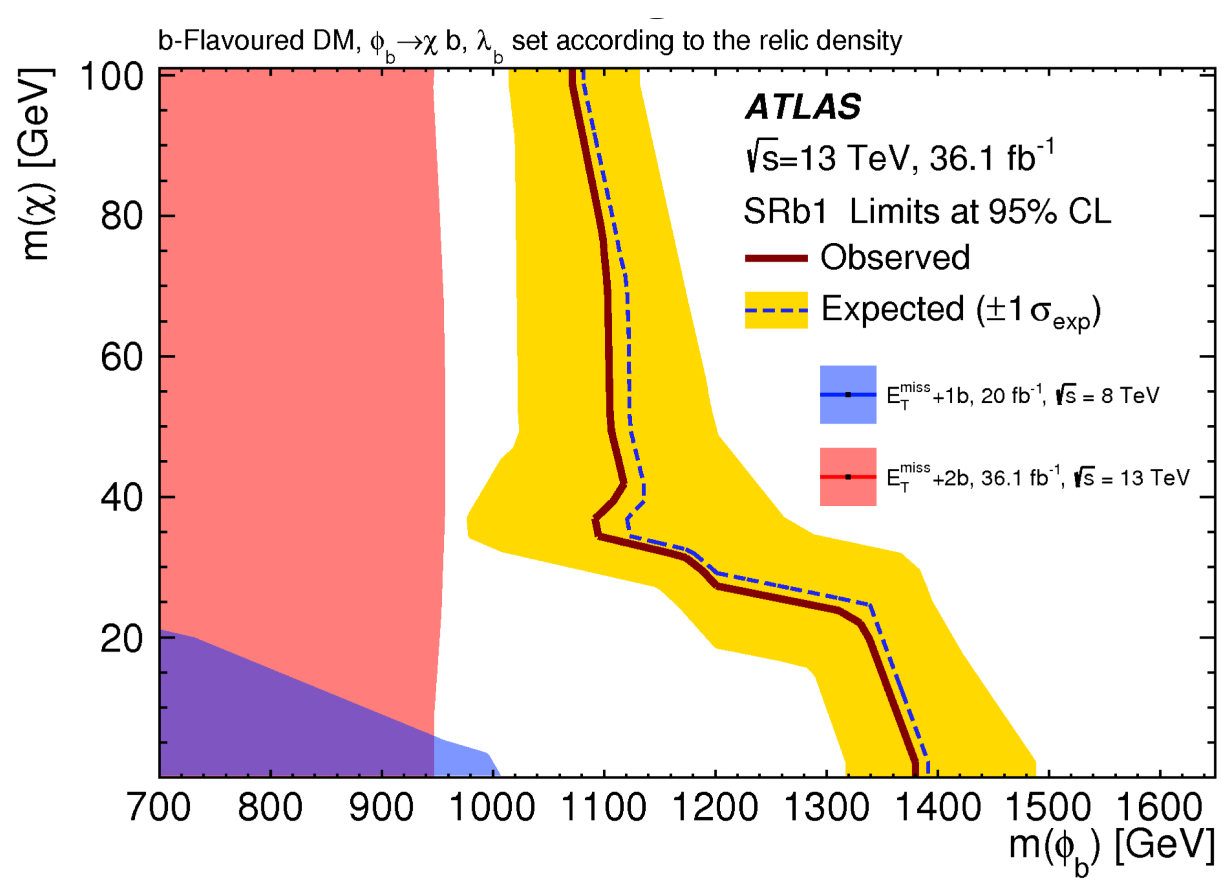


Colour-charged scalar mediator



Very close to exclude up to 100 GeV

Collider probe of models for galactic center excess!



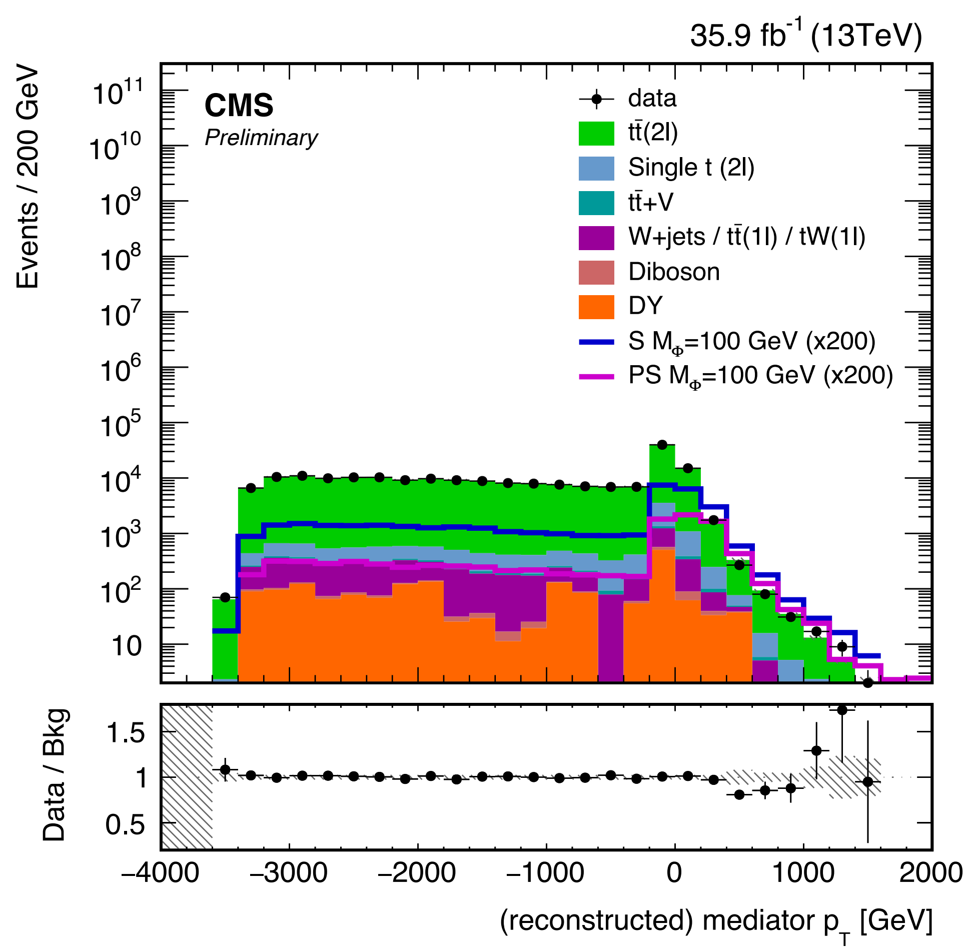
Combination of channels?

Heavy Flavor III

Search of DM in association with $t\bar{t} \to 2\ell$ at $\sqrt{s} = 13$ TeV with the CMS experiment

Juan Ferrero

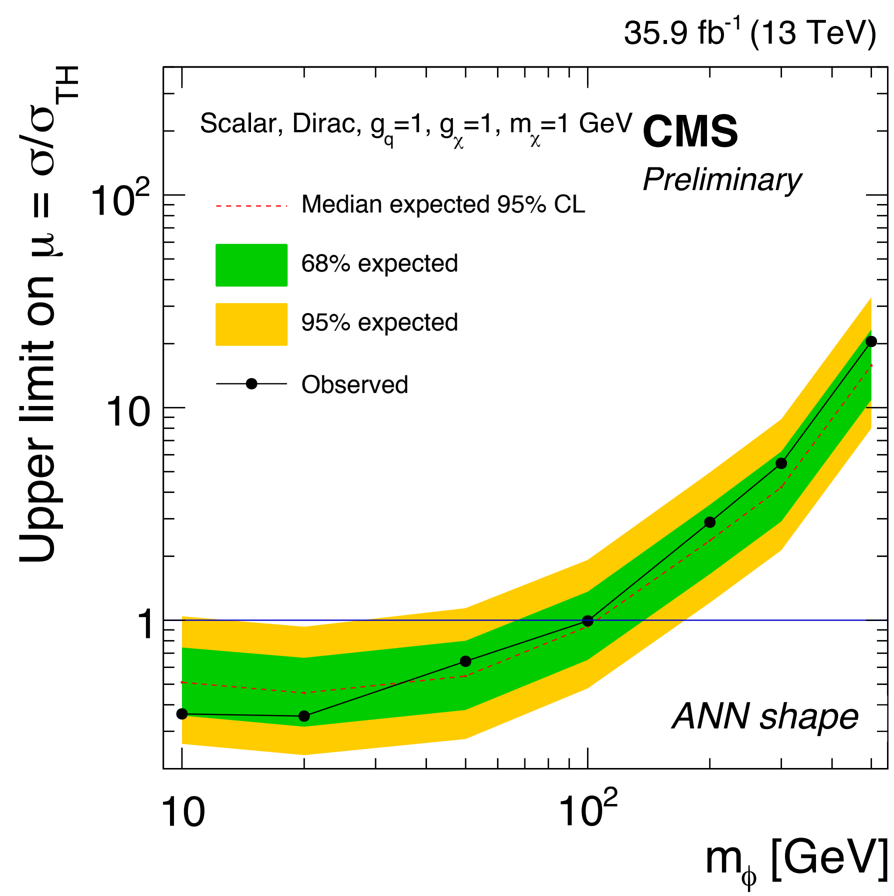
The reconstructed p_T of the DM mediator (2)



→

Can we distinguish the dark matter - MET from the neutrino MET?

- A well-established result: the $t\bar{t} \to 2\ell$ is **kinematically reconstructible**.
- To do that, one needs to find out the root(s) of a **quartic equation**, whose coefficients depend on $\{\vec{p}_l, \vec{p}_{\bar{l}}, \vec{p}_b, \vec{p}_{\bar{b}}, \text{MET}_x, \text{MET}_y\}$.

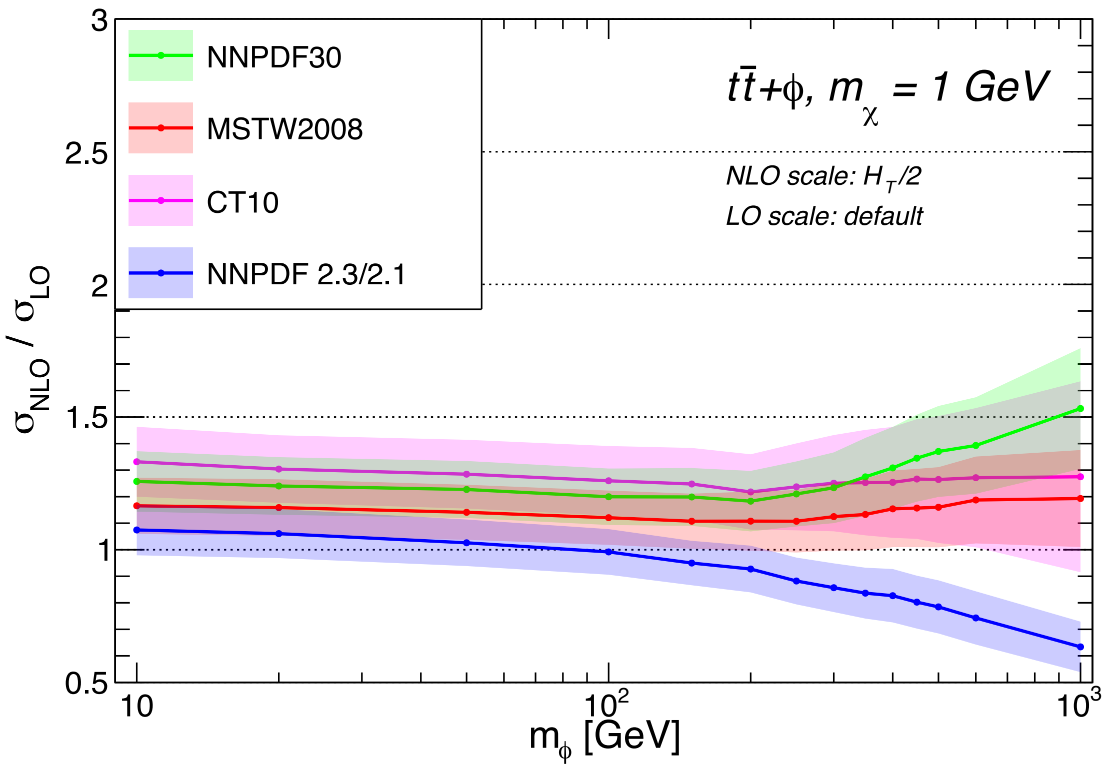


Heavy Flavor IV

Characterisation of the NLO cross sections for the associated production of dark matter with heavy quarks
DM@LHC 2018

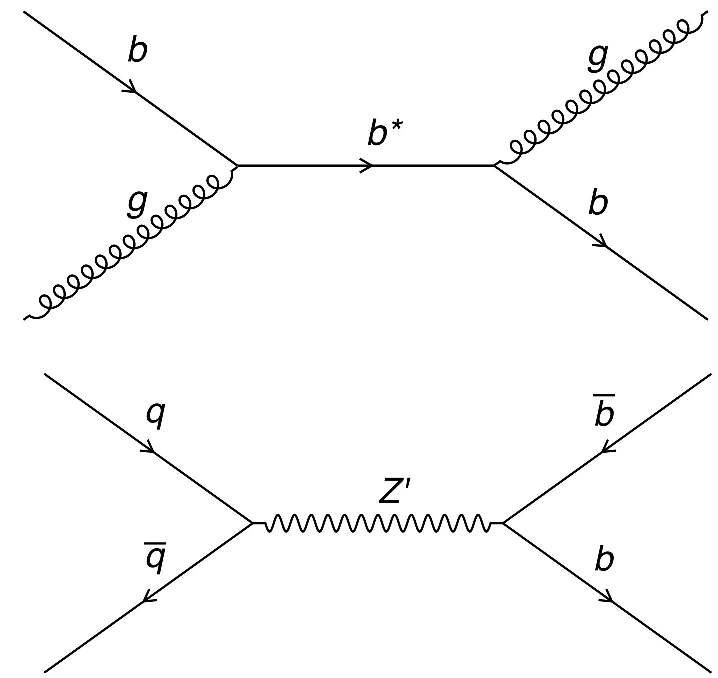
Y. Afik[1]

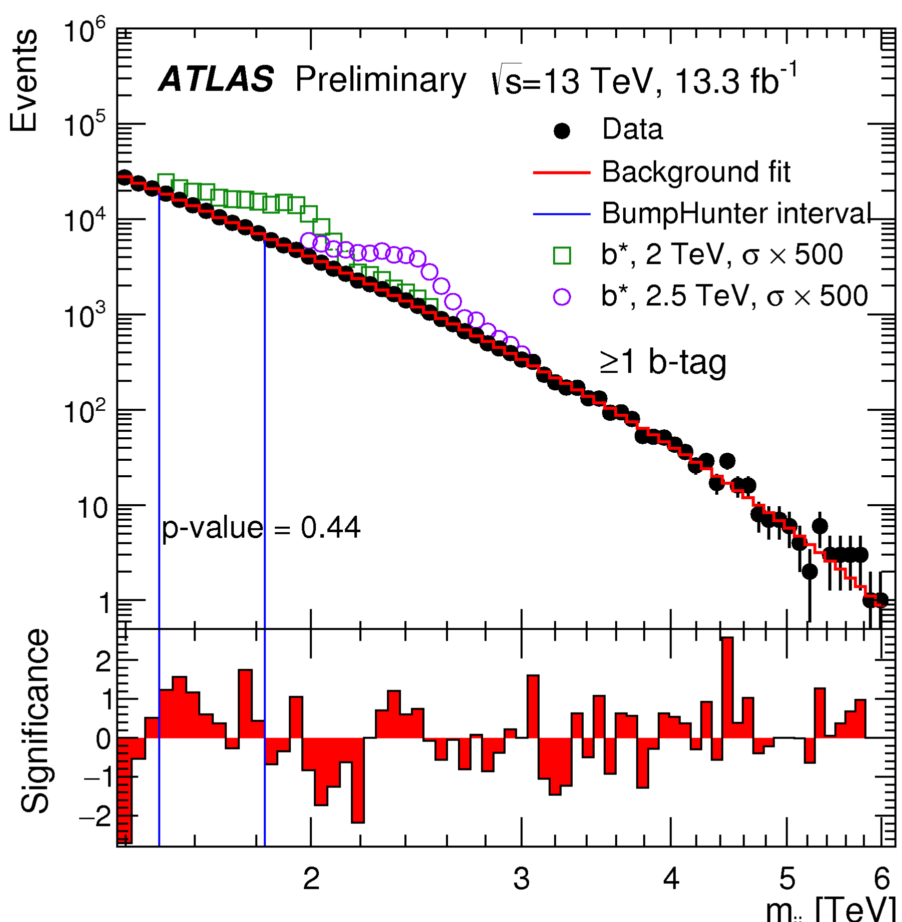
Impact of PDFs, scale choice, flavor scheme, etc on K-factors

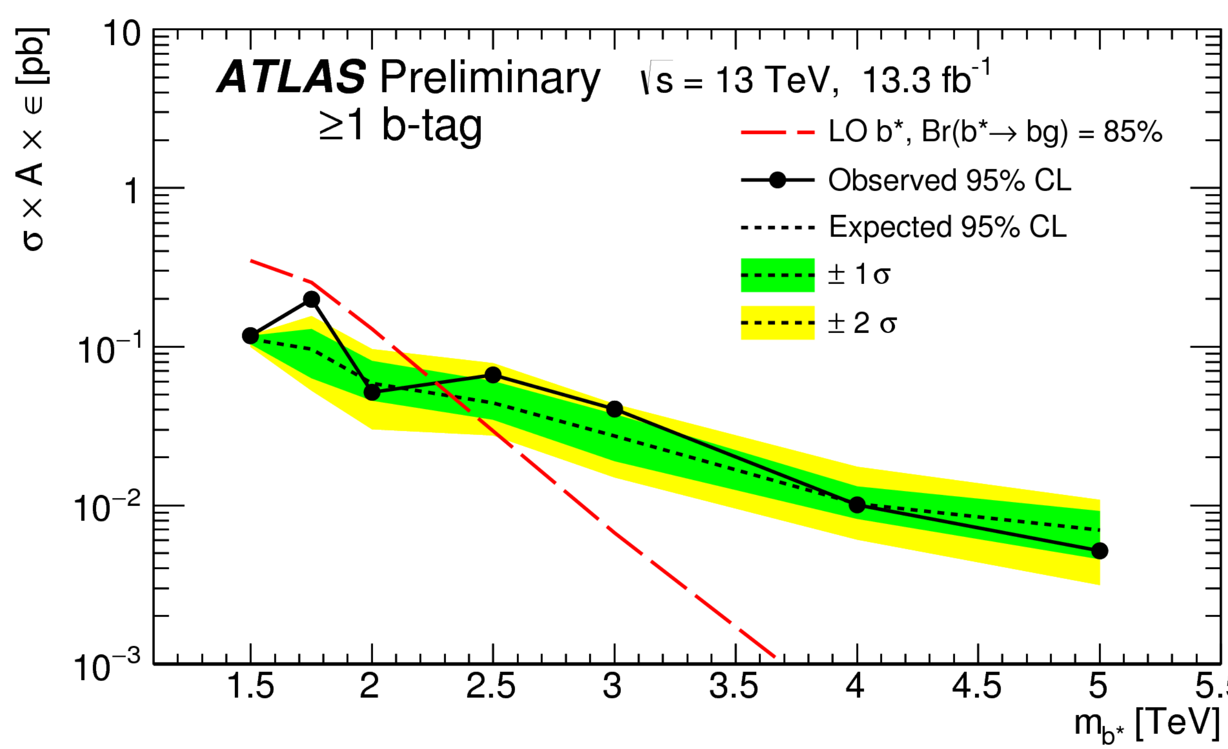


- Our recommandations:
  - DM+$t\bar{t}$: apply NLO calculations using DMSimp, using NNPDF30 (already used by ATLAS).
  - DM+$b\bar{b}$: apply NLO calculations using 5FS, dropping 'xptb' requirement.

Heavy Flavor V







Gravitational Waves from Dark Matter

Leptophilic Dark Matter from Gauged Lepton Number

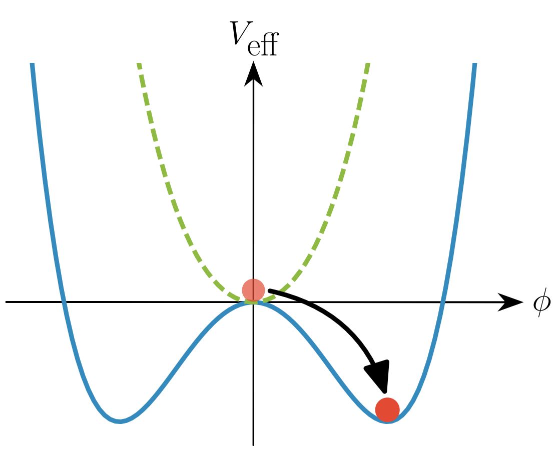
Phenomenology and Gravitational Wave Signatures

Eric Madge

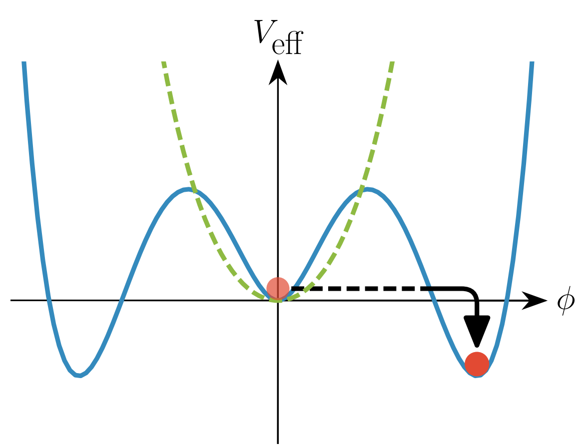
SM + RH ν + $U(1)_\ell$ gauge group

spontaneously broken by scalar ϕ

cross-over:

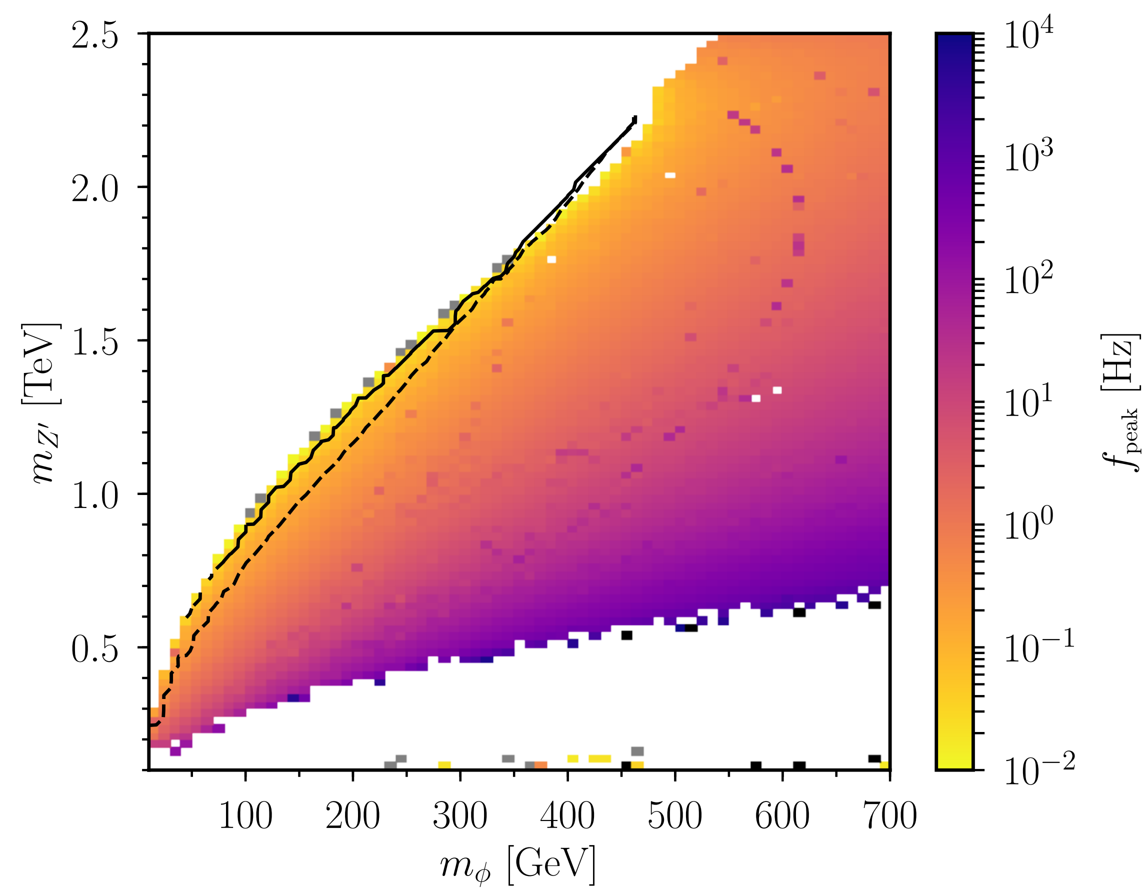


1st-order:



1st order PT produces gravitational waves in the early universe

Detectable by future LISA experiment



Exceptional Dark Matter

AN EXCEPTIONAL COMPOSITE DARK MATTER CANDIDATE

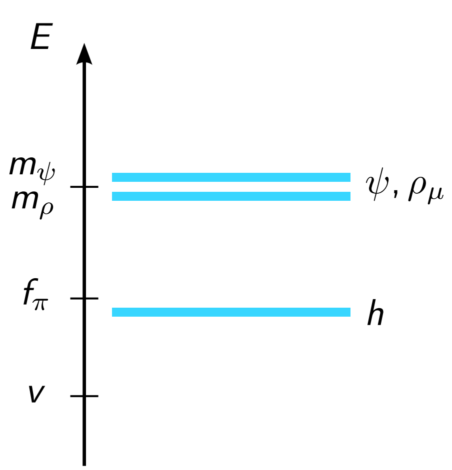
ADRIAN CARMONA BERMUDEZ

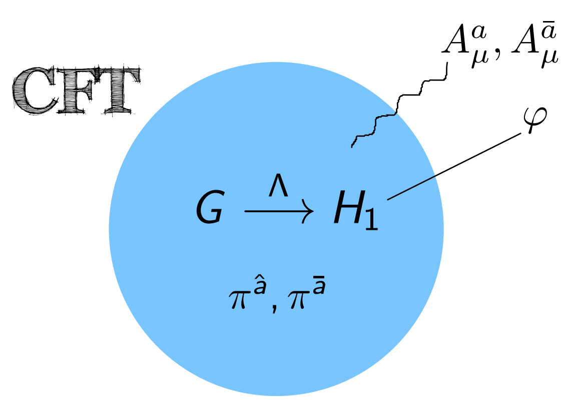
Composite Higgs, solves hierarchy problem

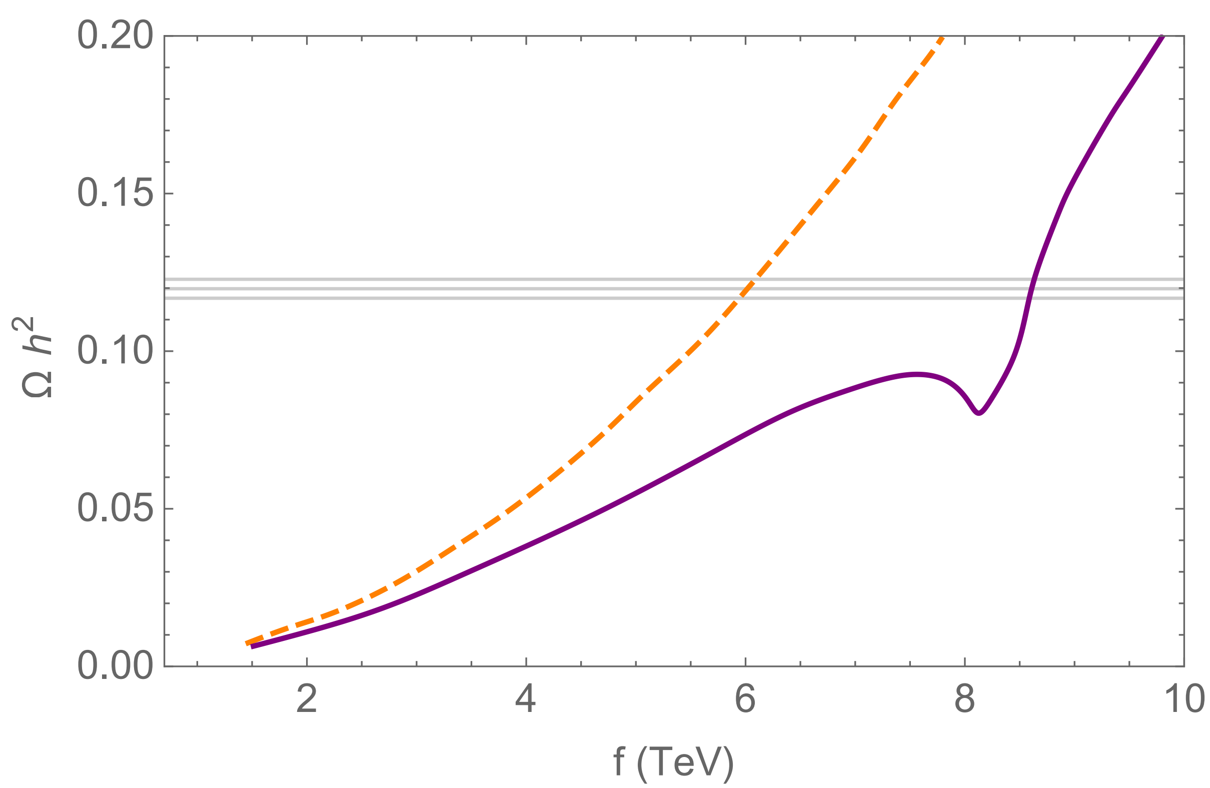
Stable composite DM candidate, if G/H is non-anomalous

$$SO(7)/G_2$$

✓ Extremely predictive, only one free parameter f !







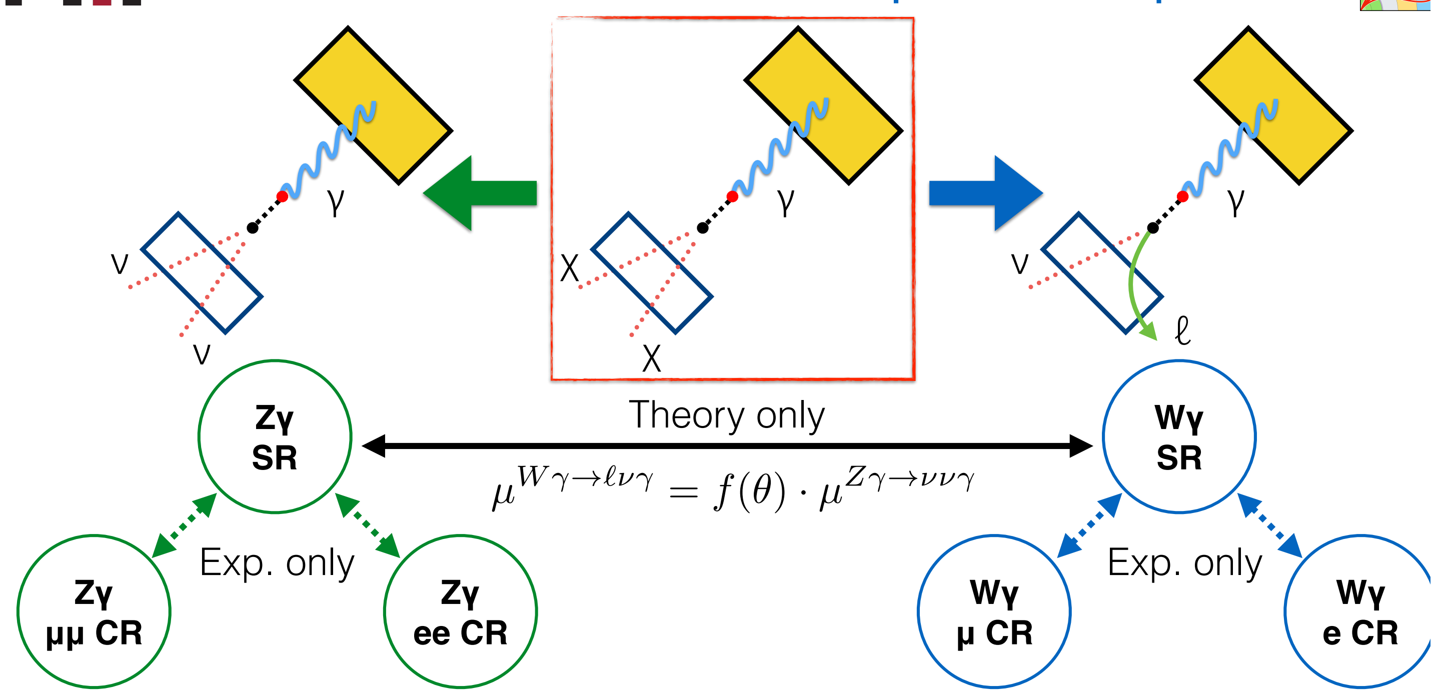
Mono-photon

γ+E_T^{miss} Searches
New Experimental Techniques

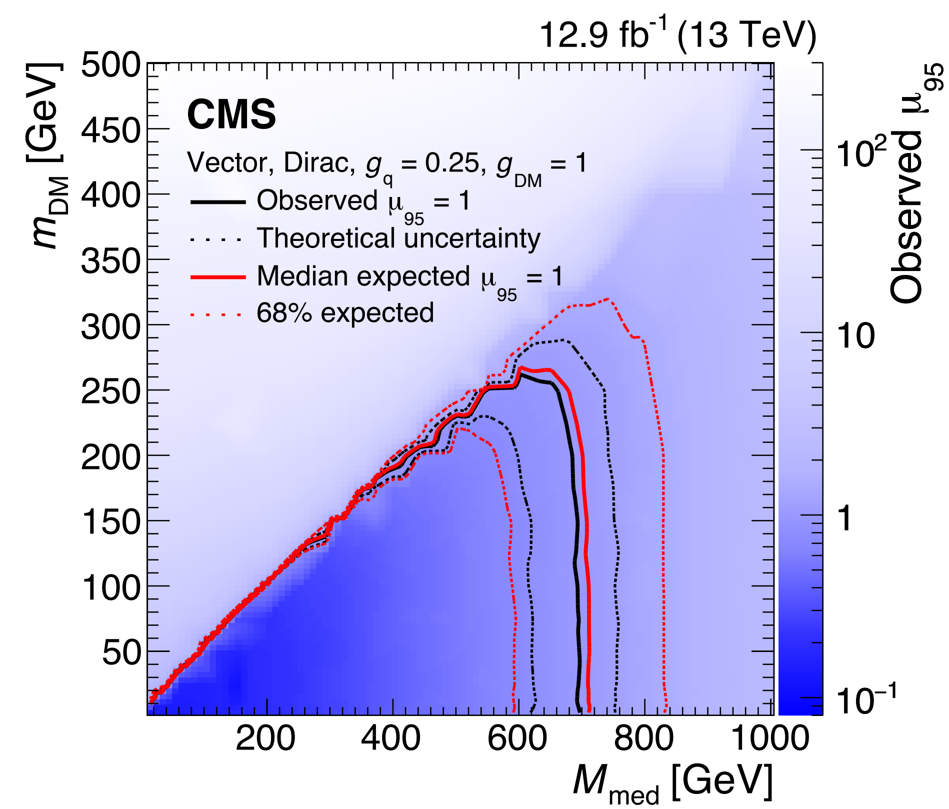
Brandon Allen

From single-bin, cut and count, to data driven shape analysis

Combined Fit for Zγ and Wγ



Expect 70% improvement on old result:



Open Session C Summary

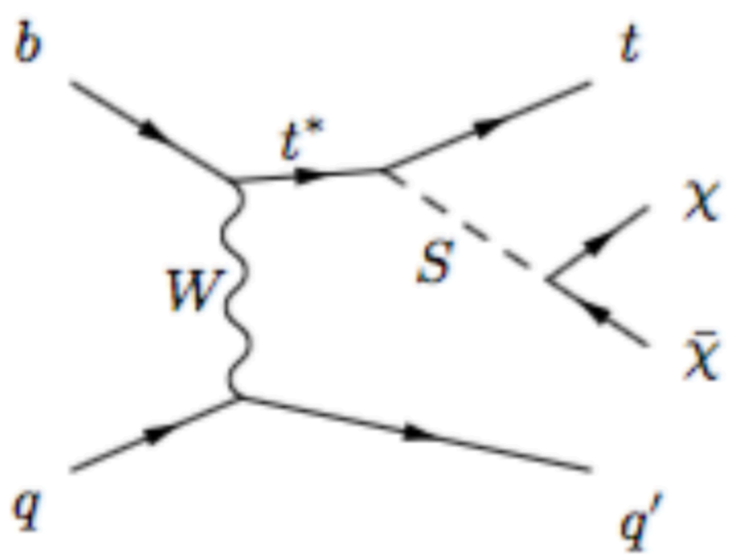
Speakers (part 2):

Jennifer Thompson
Priscilla Pani
Jesse Liu
Conny Beskidt
Giuliano Gustavino
Conny Beskidt (as Wim de Boer)
Rebecca Pickles

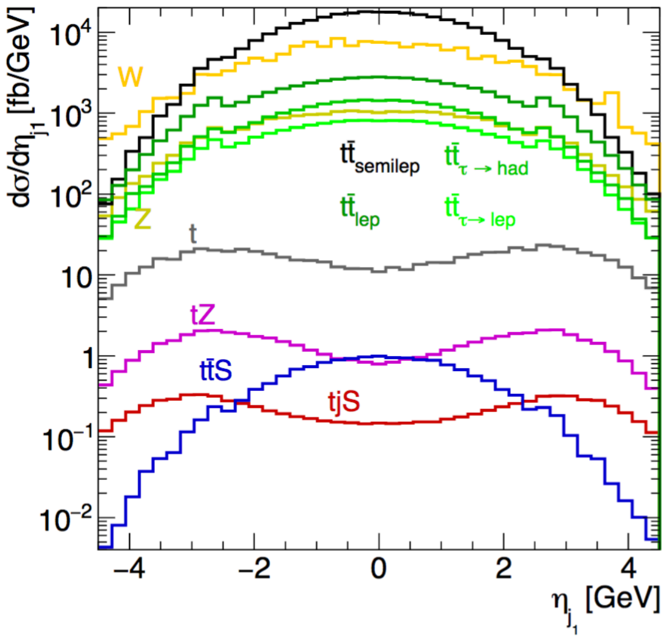
J. Thompson (U. Heidelberg)

Can we use single top as the signal?

$\longrightarrow$ focus on leading t-channel



- Expect lower cross section than $t\bar{t}E_T^{\text{met}}$



J. Thompson
(U. Heidelberg)

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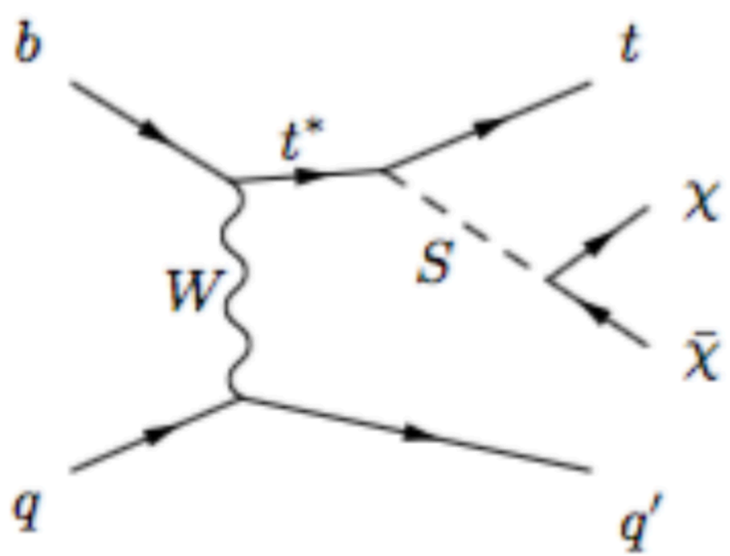

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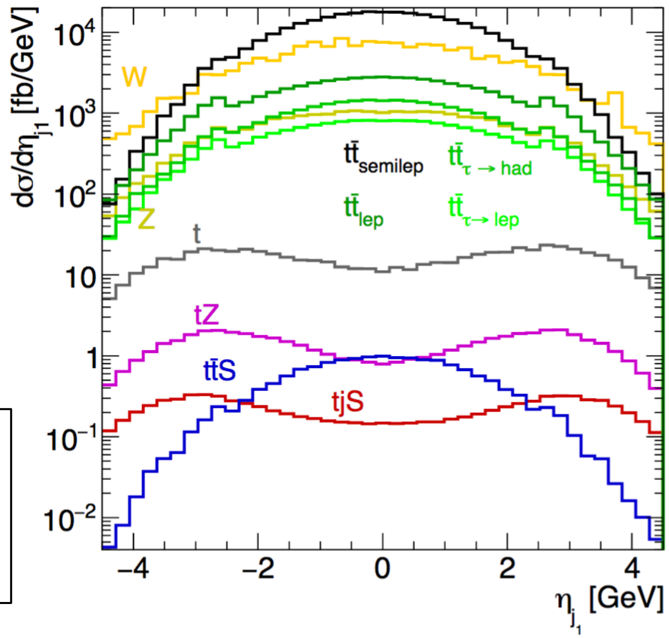
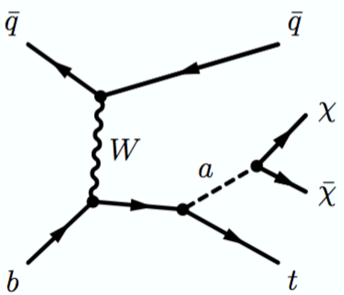
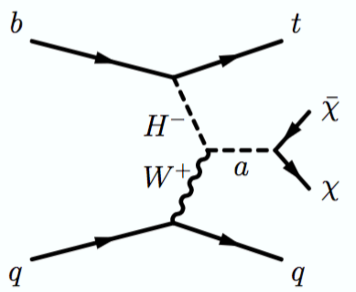


Phenomenology of DM + single top
→ Forward jets and mT will help
→ Still to see sensitivity after full simulation, pile-up, etc

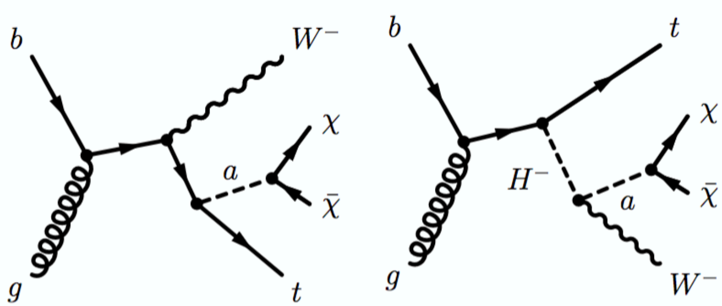
Single top+a production

t-channel

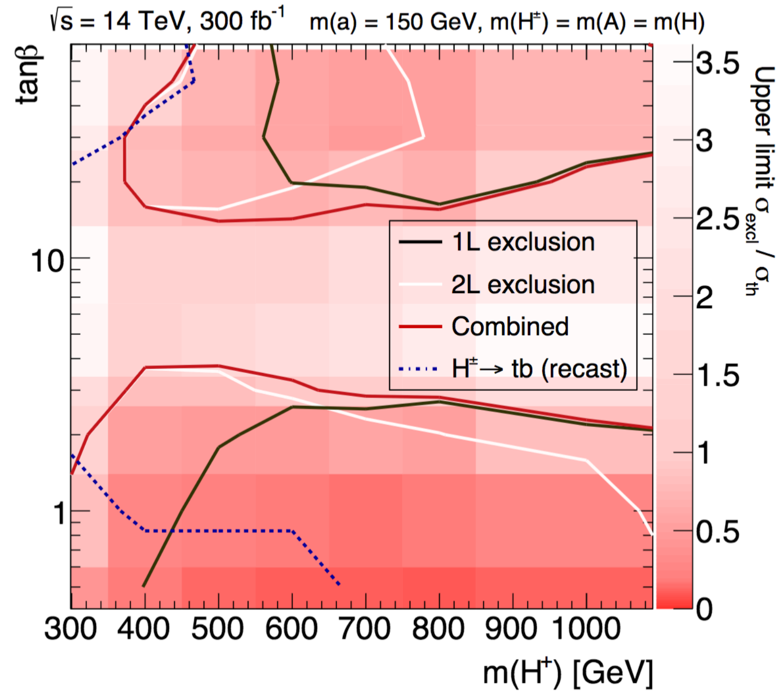




(a) (b)



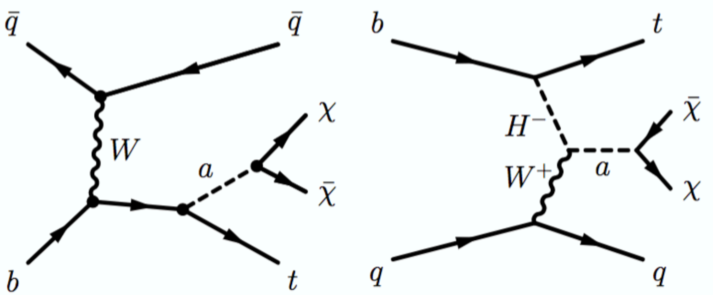
Wt-channel



- ★ (a) diagram divergence is cured by negative interference with (b) diagram

Single top+a production

t-channel



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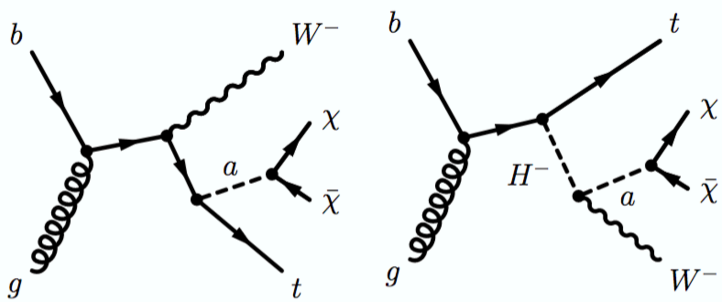
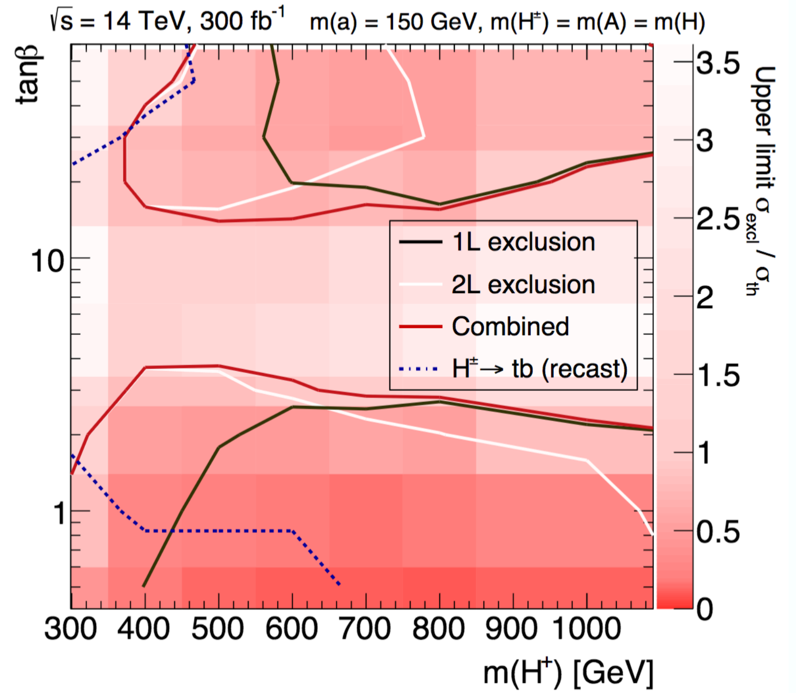


Wt-channel

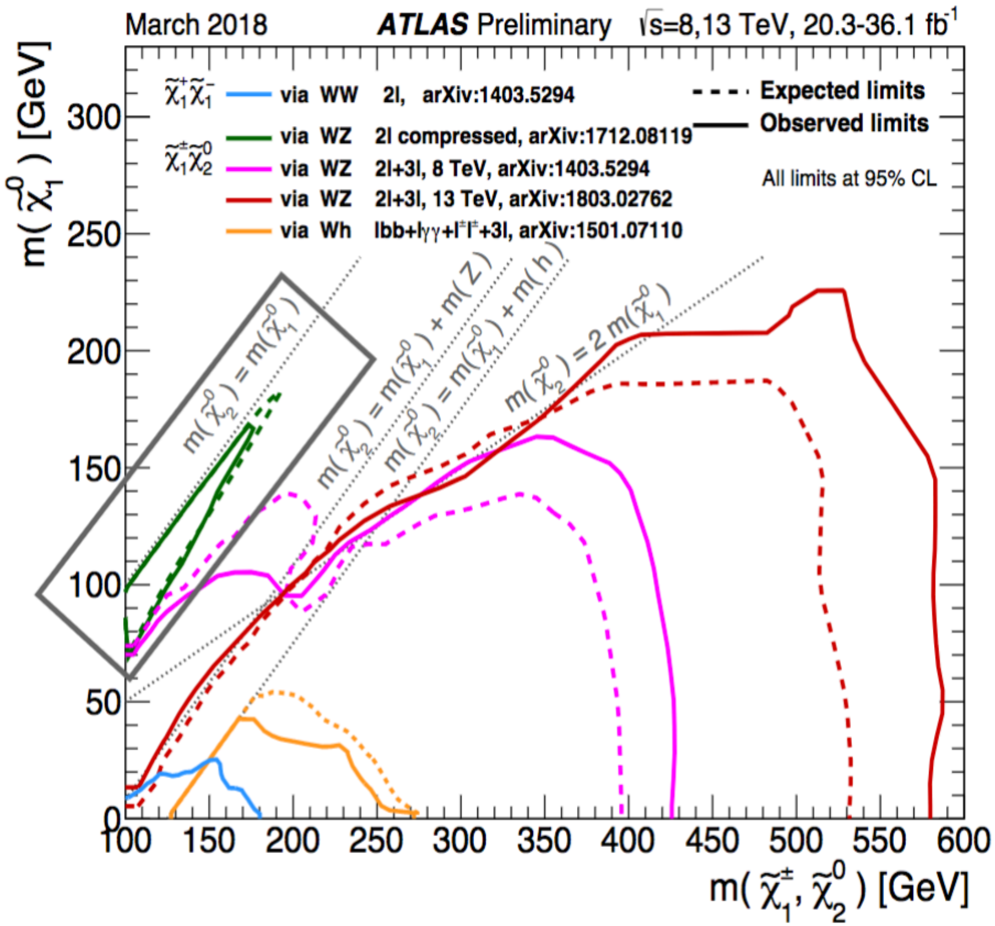


★ (a) diagram divergence is cured by negative interference with (b) diagram

Incorporating 2HDM+a model to DM+single production

→ Sensitivity to the model demonstrated
→ Looking forward for ATLAS/CMS analysis

J. Liu
(U. Oxford)



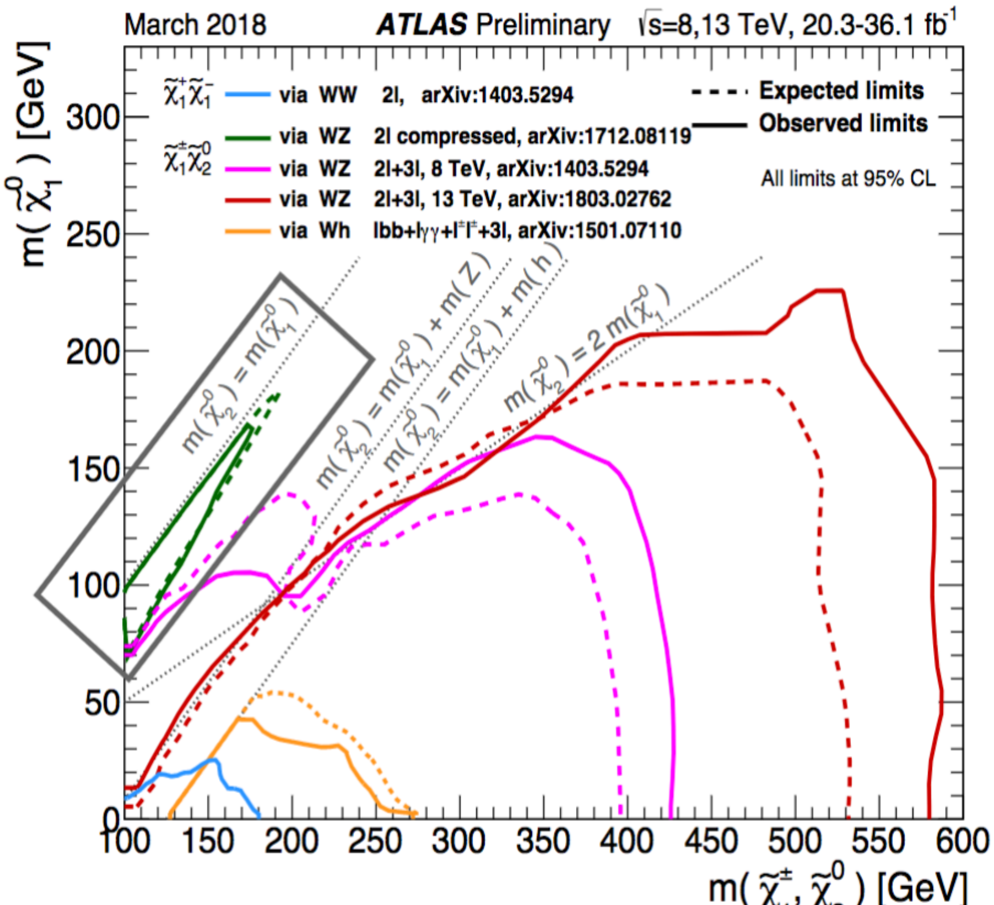
Sensitivity beyond LEP in $\Delta m \lesssim 30$ GeV coannihilation corridor

Compressed frontier: sensitivity down to $\Delta m(\tilde{\chi}_2^0, \tilde{\chi}_1^0) \sim 2.5$ GeV

Mass frontier: up to $m(\tilde{\chi}_2^0) \sim 175$ GeV

Wino–bino: closing the coannihilation corridor

J. Liu
(U. Oxford)



Sensitivity beyond LEP i

Compressed frontier: se

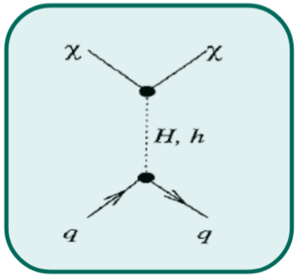
Mass fronti

Higgsinos & sleptons: probing DM coannihilation with sof

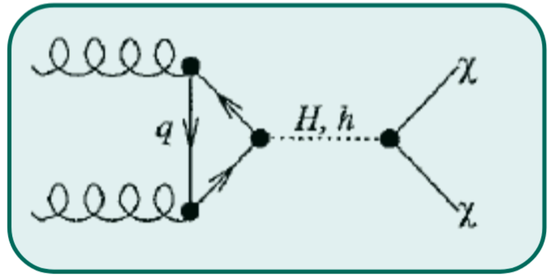
Comprehensive Review of SUSY EWK searches in compressed scenarios

→ Key on soft leptons and disappearing tracks
→ Lets revisit trileptons and mono-jet/gamma sensitivities in the high-lumi regime

Scattering of DM with matter

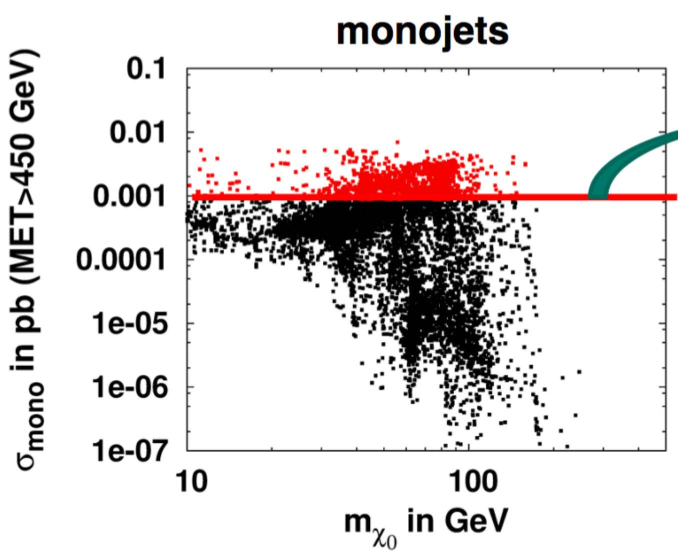


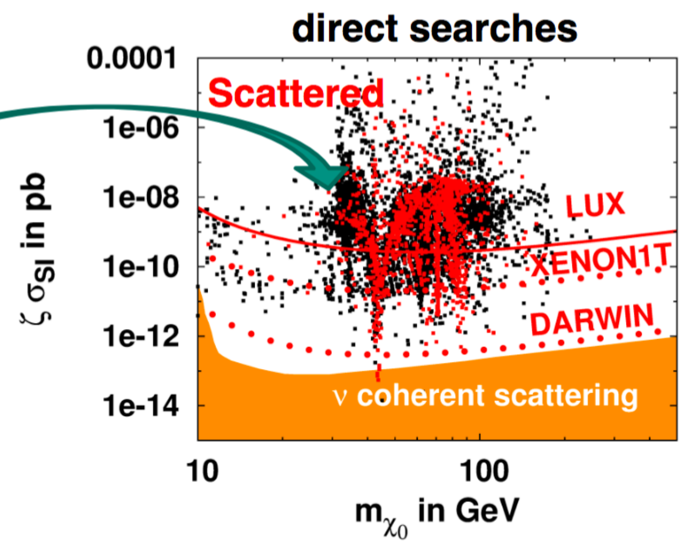
DM production at the LHC



C. Beskidt (KIT)

Monojet vs direct searches

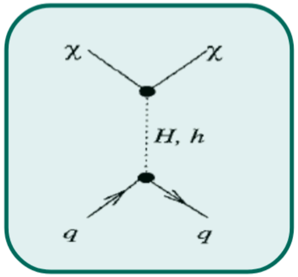




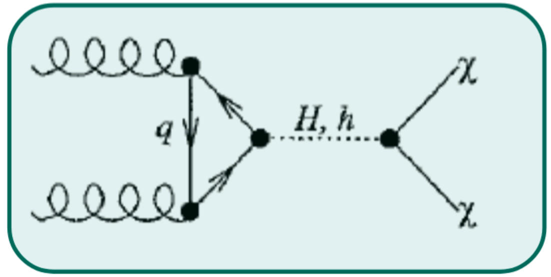
Peaks = resonant DM annihilation

In realistic SUSY models the XS limits from monojets are not a simple line in direct DM XS plane but depend on the DM mass: for some resonances the LHC monojet searches exclude lower XSs compared to the direct DM searches.

Scattering of DM with matter



DM production at the LHC



C. Beskidt (KIT)

Karlsruher Institut für Technologie

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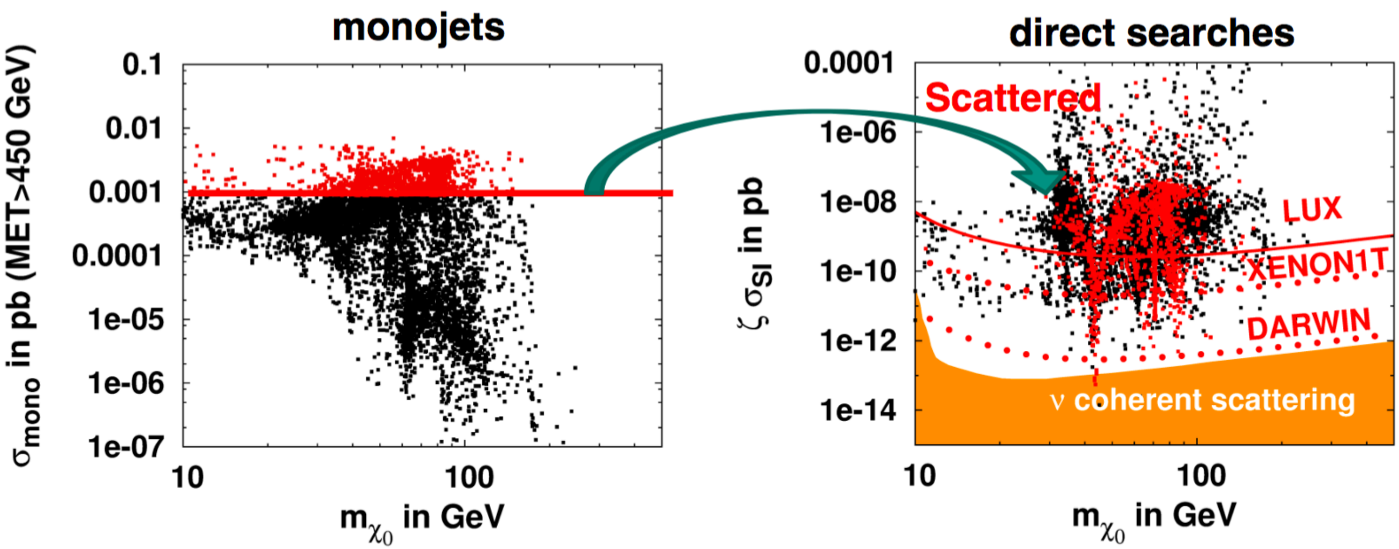


Peaks = resonant DM annihilation

In realistic SUSY model
line in direct DM XS pla
resonances the LHC mo
to the direct DM search

Taking a NMSSM model to translate LHC monojet to DD DM results
→ nicely showes the difficulties in the comparisons
→ It would be interesting to go down in DM mass

G. Gustavino
(U. Oklahoma)

ATLAS monojets

Results

JHEP 1801 (2018) 126

Dominant shape fit uncertainties (total 2-7%):

- muons 2-5%
- electrons 1-3%
- jets/MET 1-6%
- V+jets theoretical 1-7%

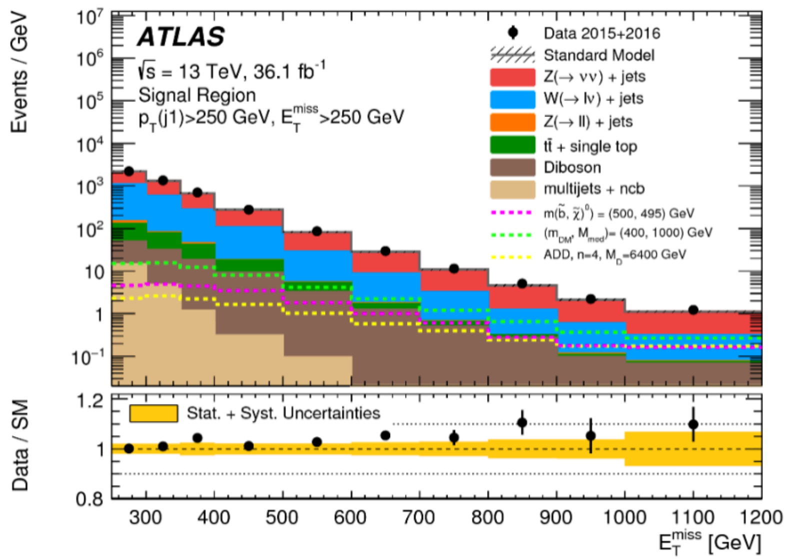
No significance excesses are observed.

→ Interpret results as limits

Exclusive Signal Region		
Region	Predicted	Observed
EM1	111100 ± 2300	111203
EM2	67100 ± 1400	67475
EM3	33820 ± 940	35285
EM4	27640 ± 610	27843
EM5	8360 ± 190	8583
EM6	2825 ± 78	2975
EM7	1094 ± 33	1142
EM8	463 ± 19	512
EM9	213 ± 9	223
EM10	226 ± 16	245

2% → 7%

Selection	$\langle\sigma\rangle^{95}_{\rm obs}$ [fb]	$S^{95}_{\rm obs}$	$S^{95}_{\rm exp}$
IM1	531	19135	11700^{+4400}_{-3300}
IM2	330	11903	7000^{+2600}_{-2600}
IM3	188	6771	4000^{+1400}_{-1100}
IM4	93	3344	2100^{+770}_{-590}
IM5	43	1546	770^{+280}_{-220}
IM6	19	696	360^{+130}_{-100}
IM7	7.7	276	204^{+74}_{-57}
IM8	4.9	178	126^{+47}_{-35}
IM9	2.2	79	76^{+29}_{-21}
IM10	1.6	59	56^{+21}_{-16}



ATLAS monojets

G. Gustavino
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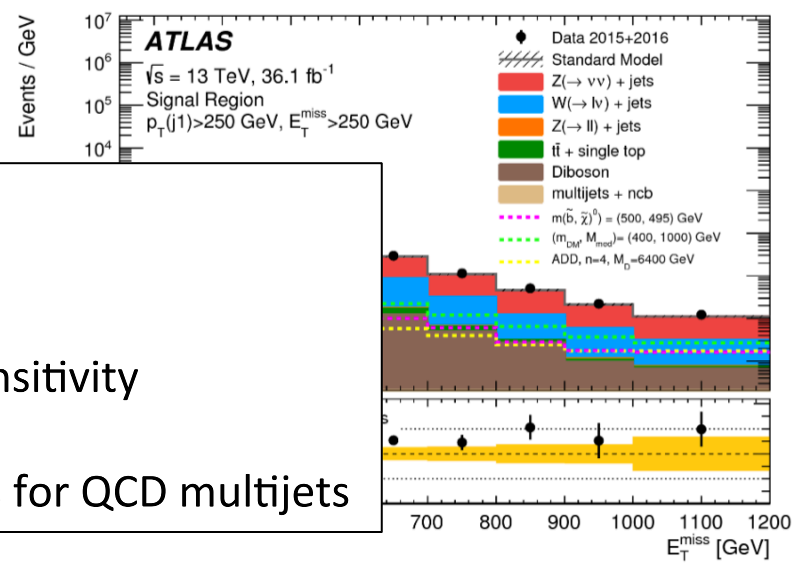


A comprehensive review of ATLAS latest monojet results

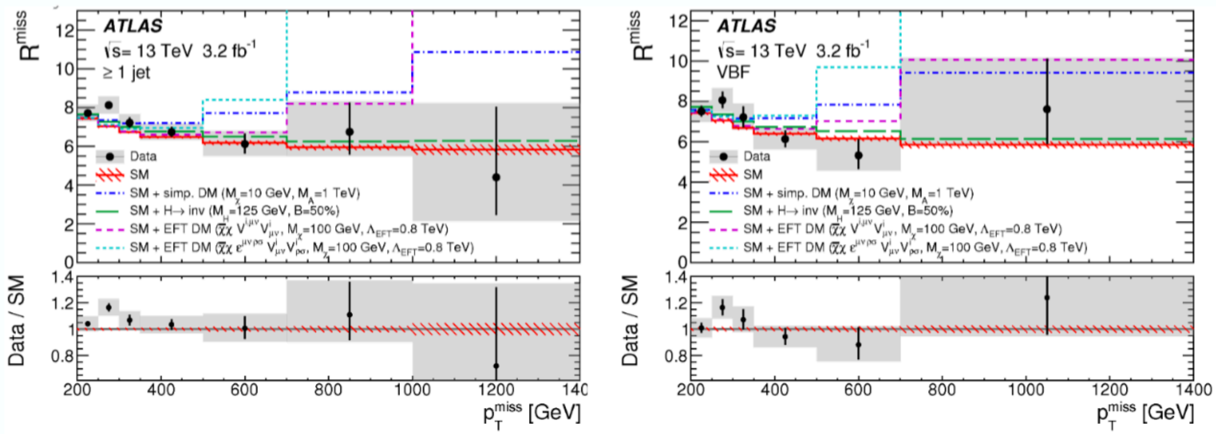
→ Still few ideas to improve further sensitivity
→ Decreasing MET will require
Measuring at trigger turn-on and opens for QCD multijets

$$R_{\text{miss}} = \frac{\sigma(\not{p}_T + \text{jets})}{\sigma(Z(\rightarrow \ell^+\ell^-) + \text{jets})}$$

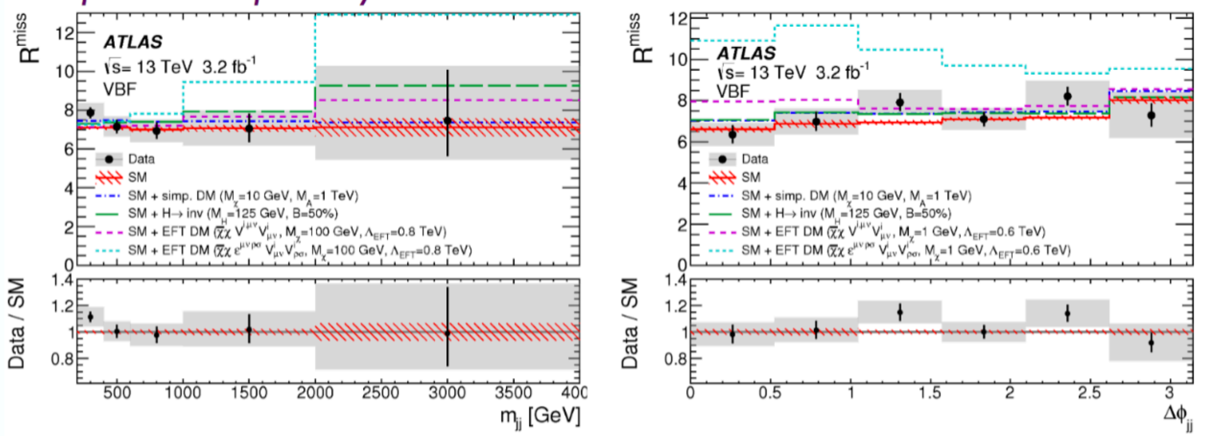
R. Pickless
(U. Manchester)

1824
The University of Manchester

The measurement is consistent with the SM prediction within statistical uncertainties.



p-value compatibility of the data and the SM across all four distributions is 78%



A number of different dark matter models were compared to the Standard Model.

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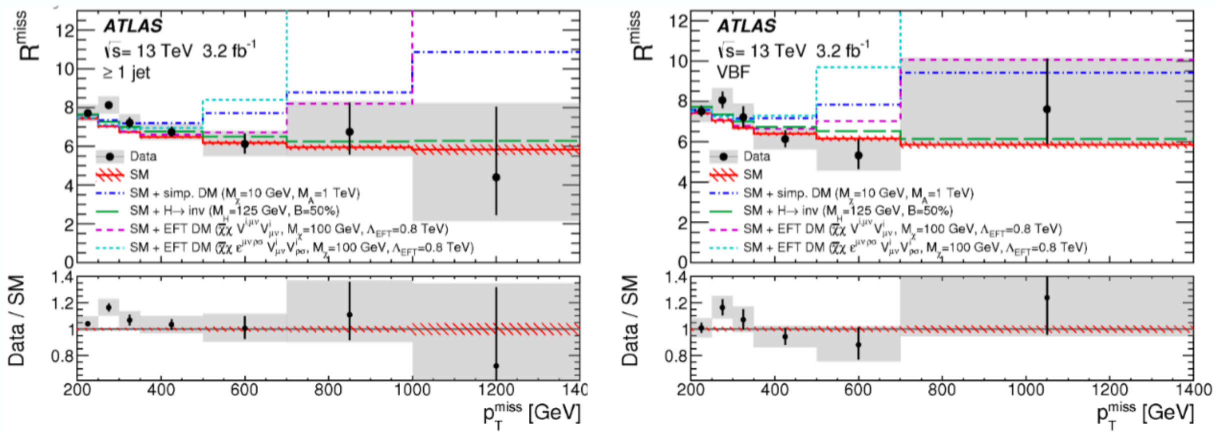

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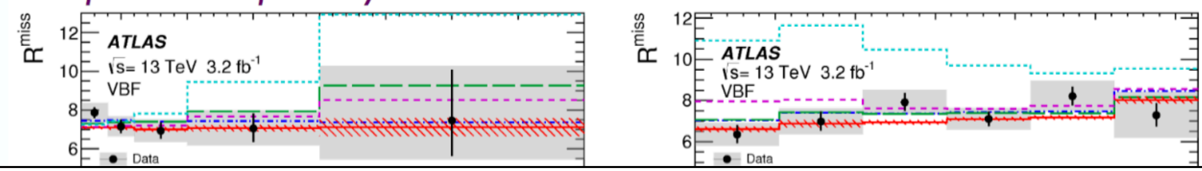

Measurement of fully corrected
cross section ratios as a generic Search

→ Shows potential for competitive results
→ Open question on whether will be able match sensitivity of dedicated analyses

A number of different dark matter models were compared to the Standard Model.