

# Top quark: a probe for new physics

Loïc Valéry

DESY Fellow meeting — February 1st 2019



# About (the young version of) me

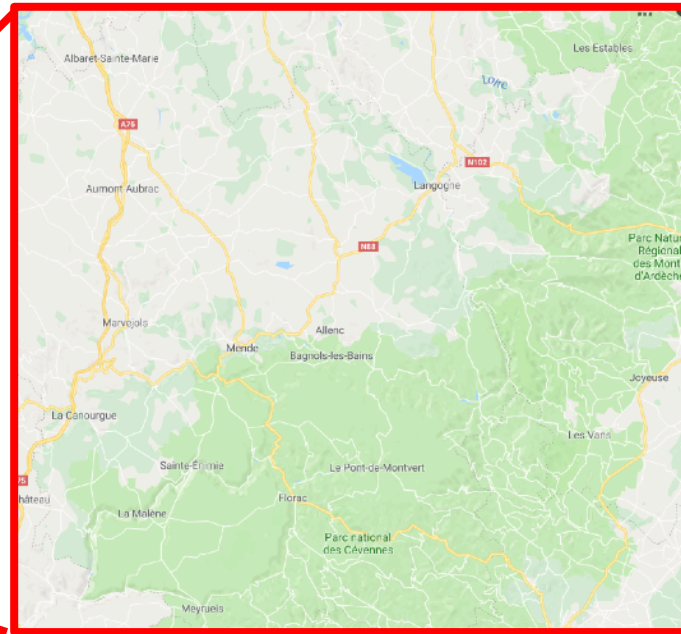
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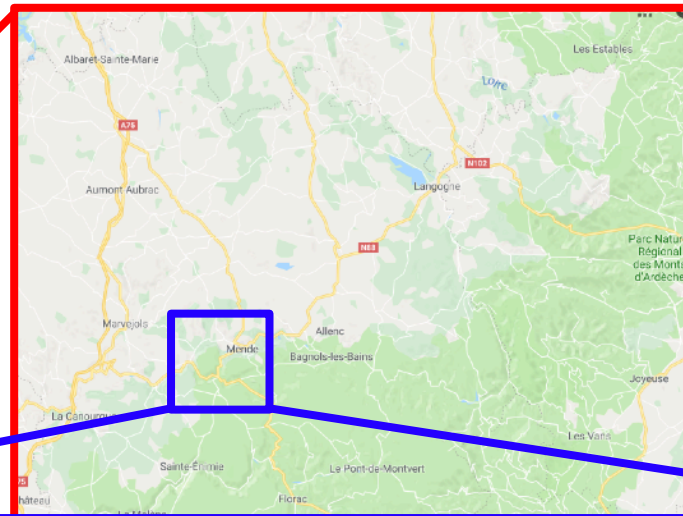
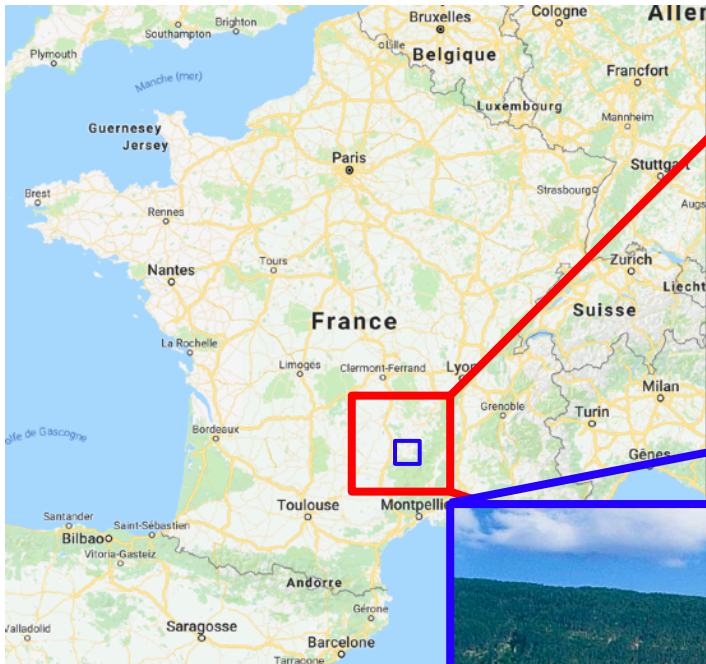
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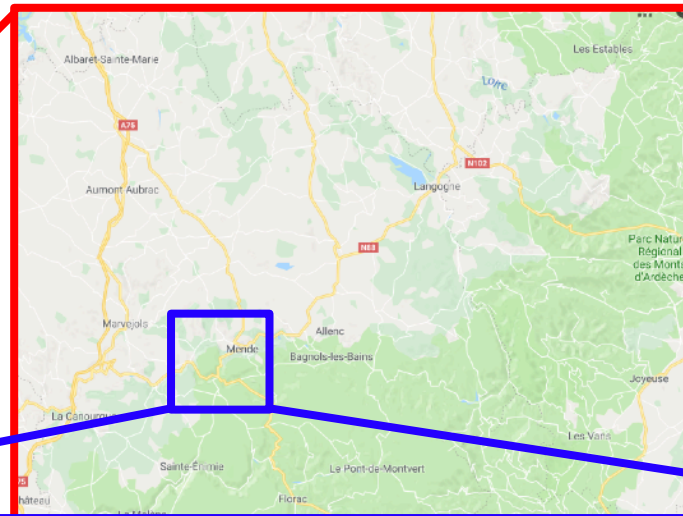
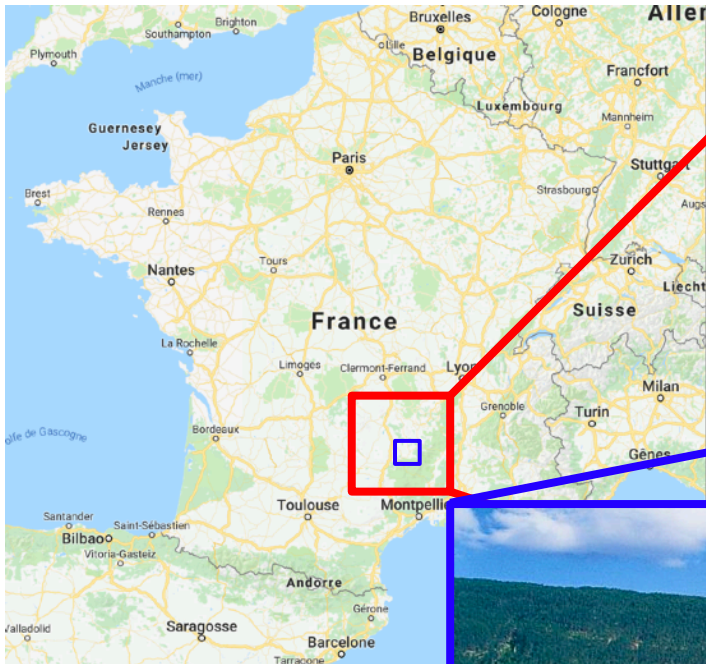
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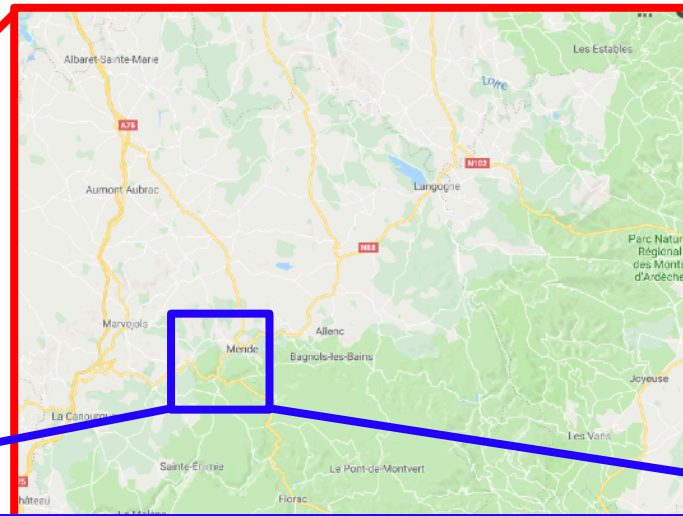
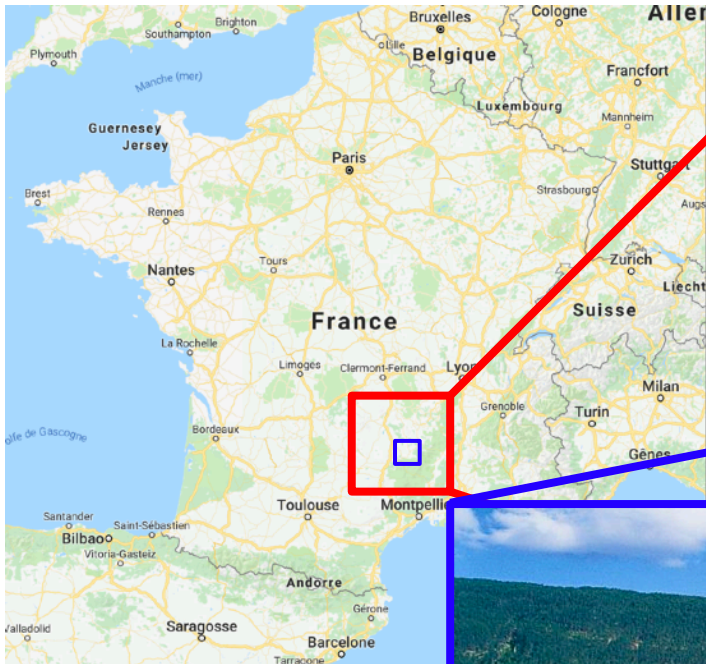
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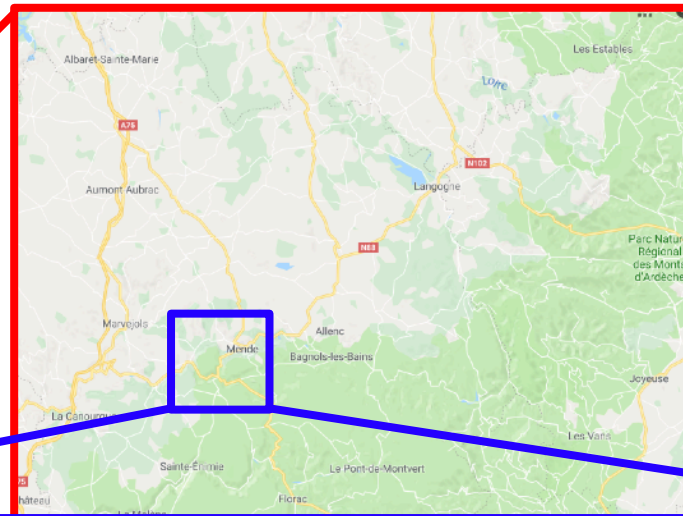
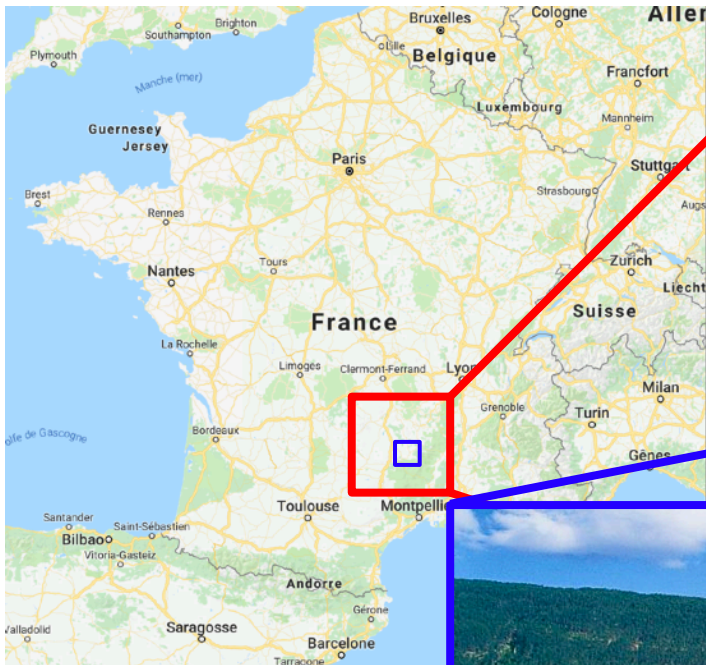


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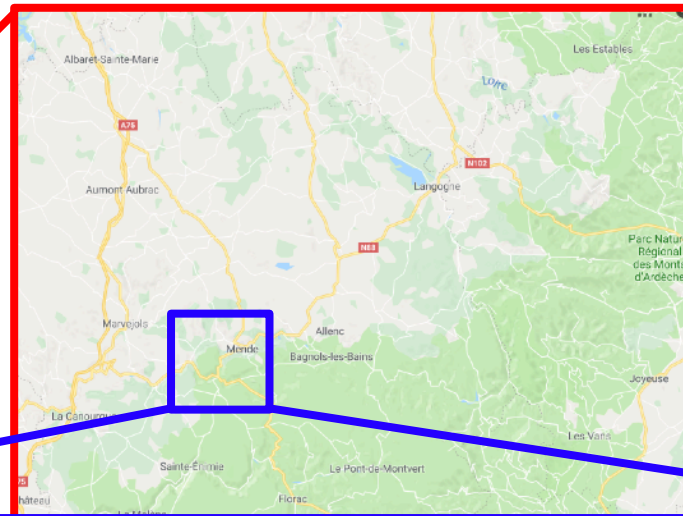
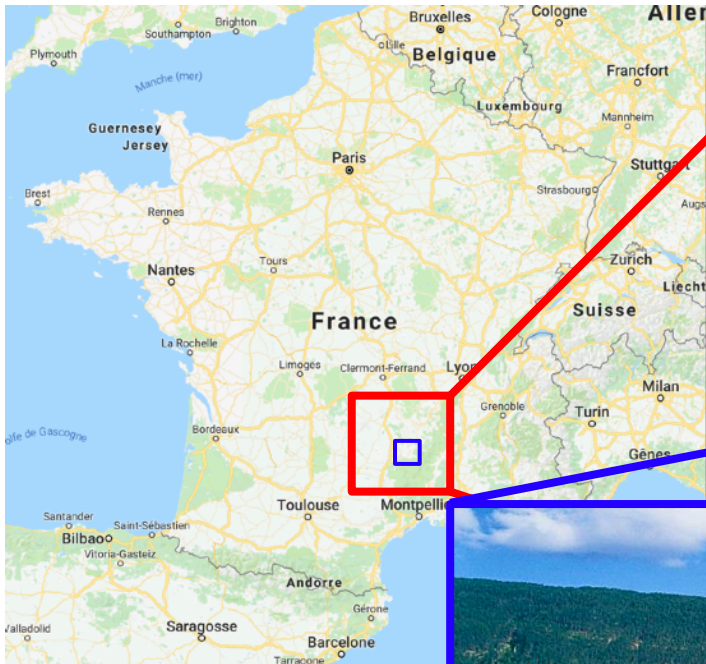




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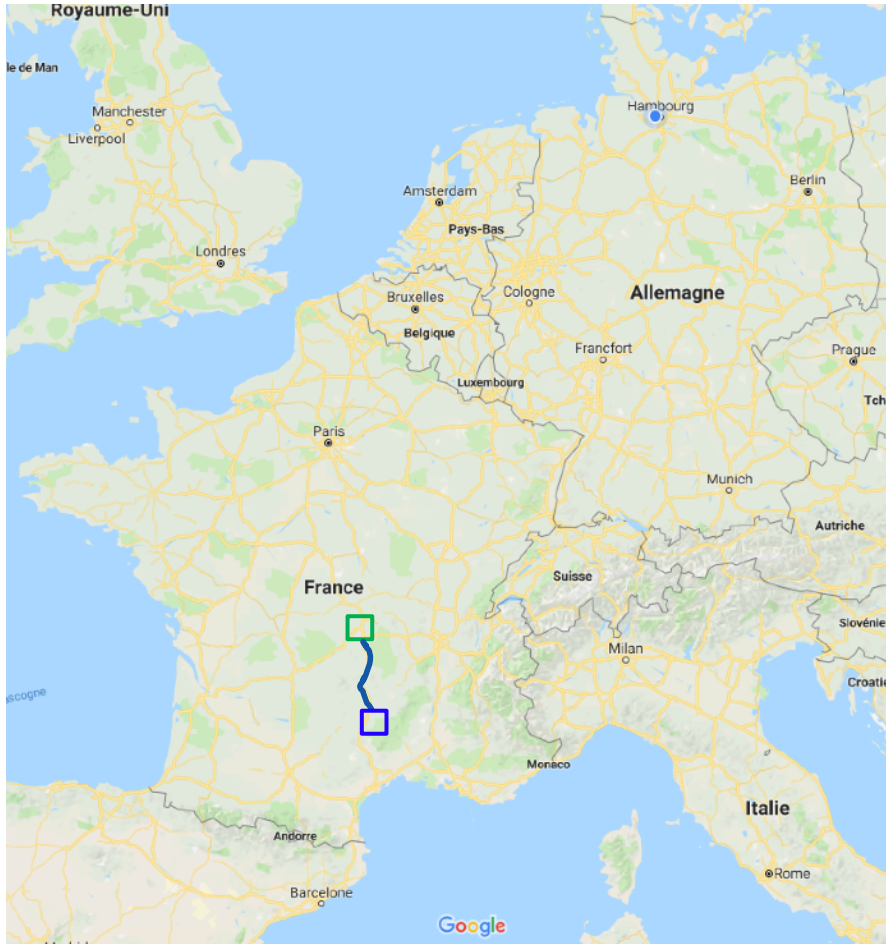
# About (the young version of) me



# About (a slightly older version of) me

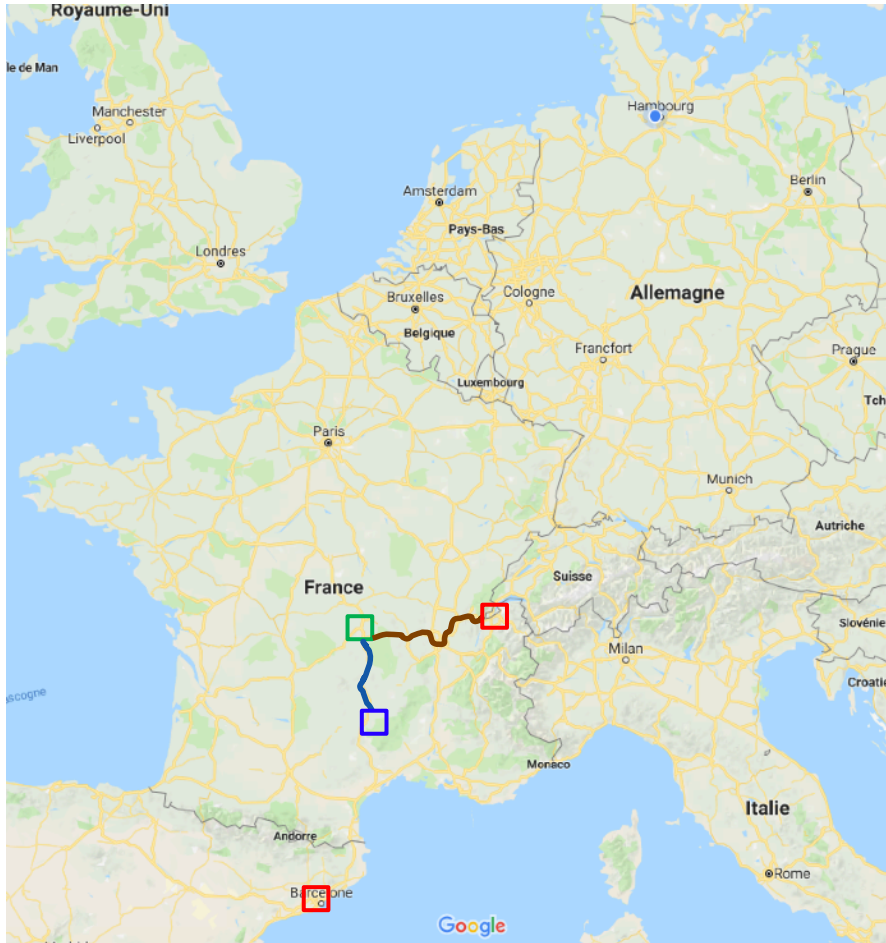


# About (a slightly older version of) me



**Clermont-Ferrand (2006-2014)**

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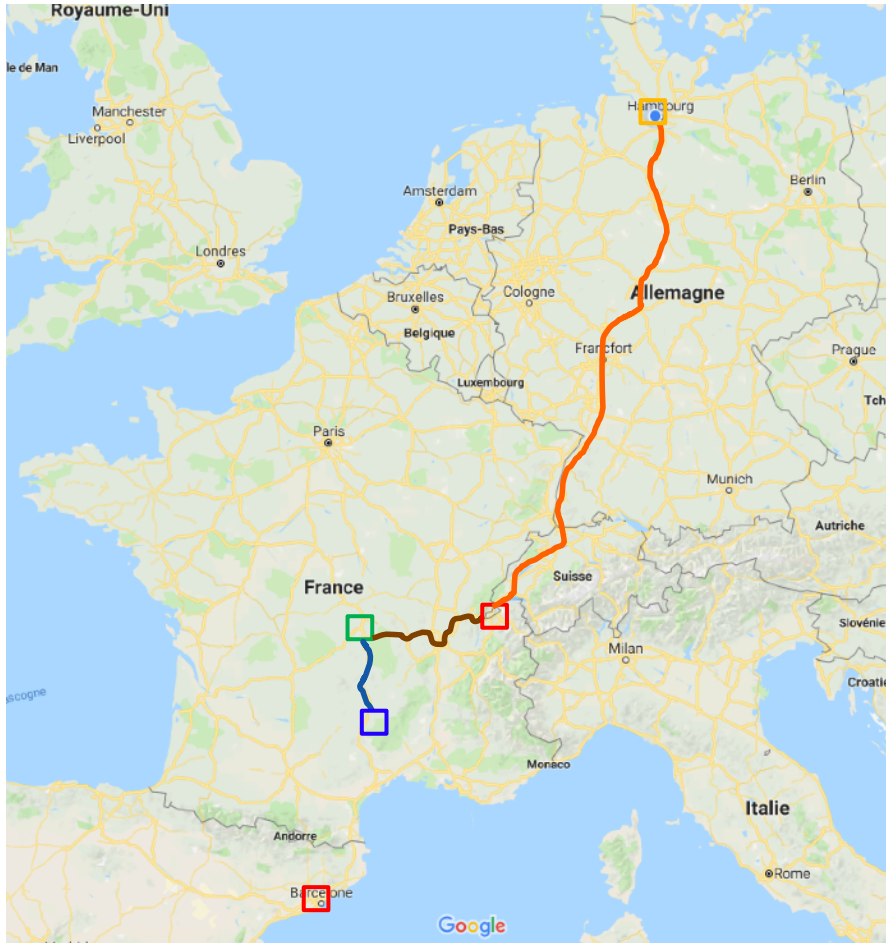


**Clermont-Ferrand** (2006-2014)



**Barcelona** (2014-2017)

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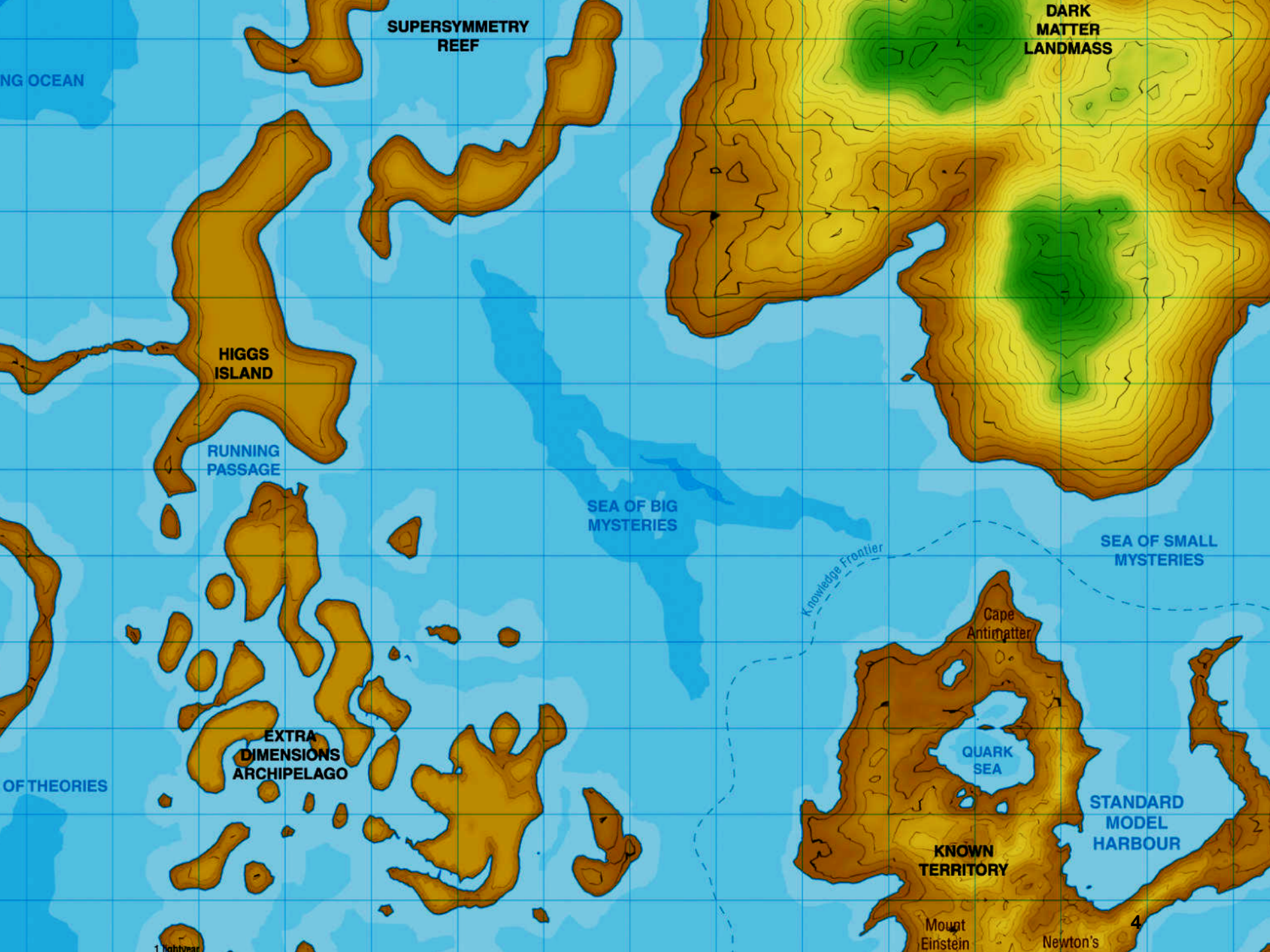


**Barcelona (2014-2017)**



**Hamburg**

# My work ?



**SUPERSYMMETRY REEF**

**DARK MATTER LANDMASS**

**HIGGS ISLAND**

**RUNNING PASSAGE**

**SEA OF BIG MYSTERIES**

**SEA OF SMALL MYSTERIES**

*Knowledge Frontier*

**EXTRA DIMENSIONS ARCHIPELAGO**

**Cape Antimatter**

**QUARK SEA**

**STANDARD MODEL HARBOUR**

**KNOWN TERRITORY**

**Moujt Einstein**

**Newton's**

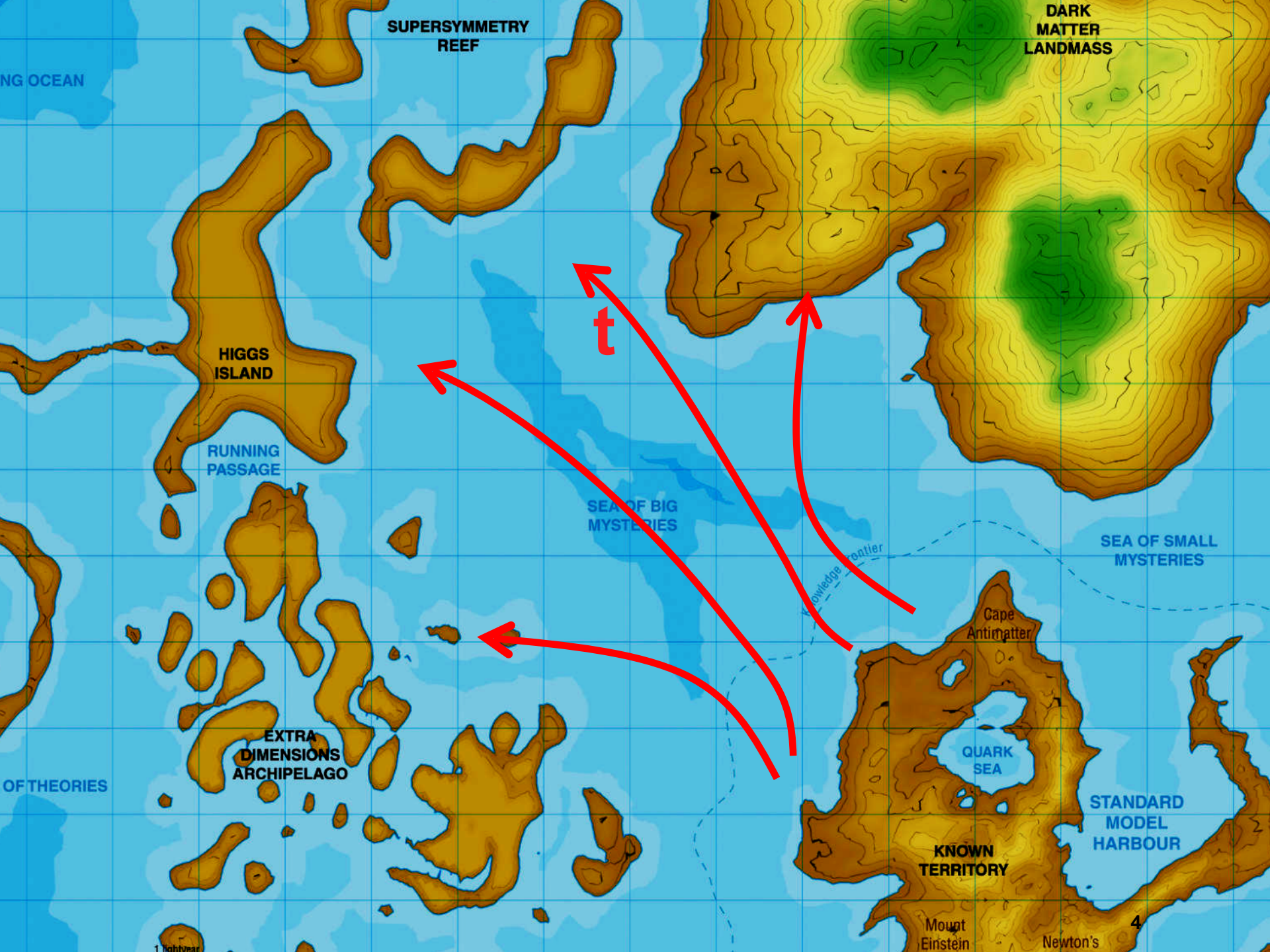
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**NG OCEAN**

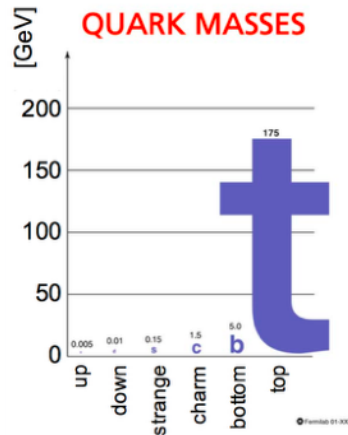
**OF THEORIES**

**1 light year**

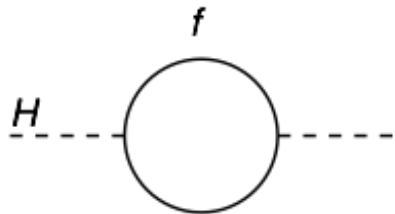




# Top quark: probe for New Physics?

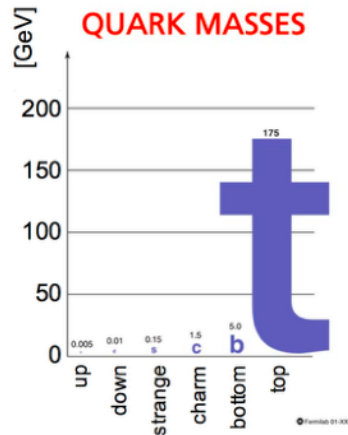


Distinctive **properties**  
(mass,  $y_t$ , ...)

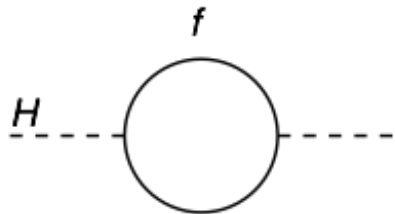


**Leading** radiative corrections  
to Higgs mass

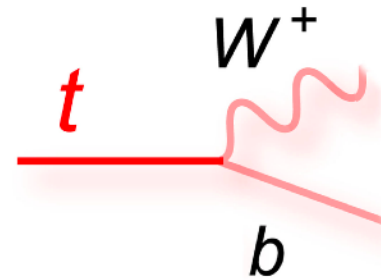
# Top quark: probe for New Physics?



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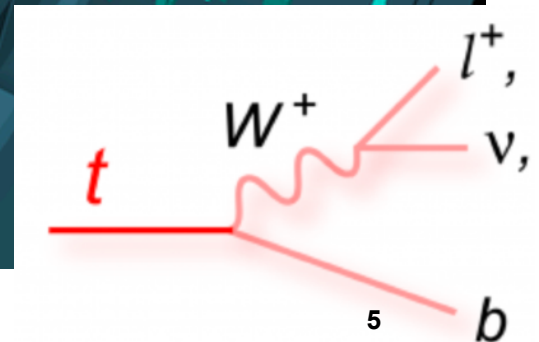
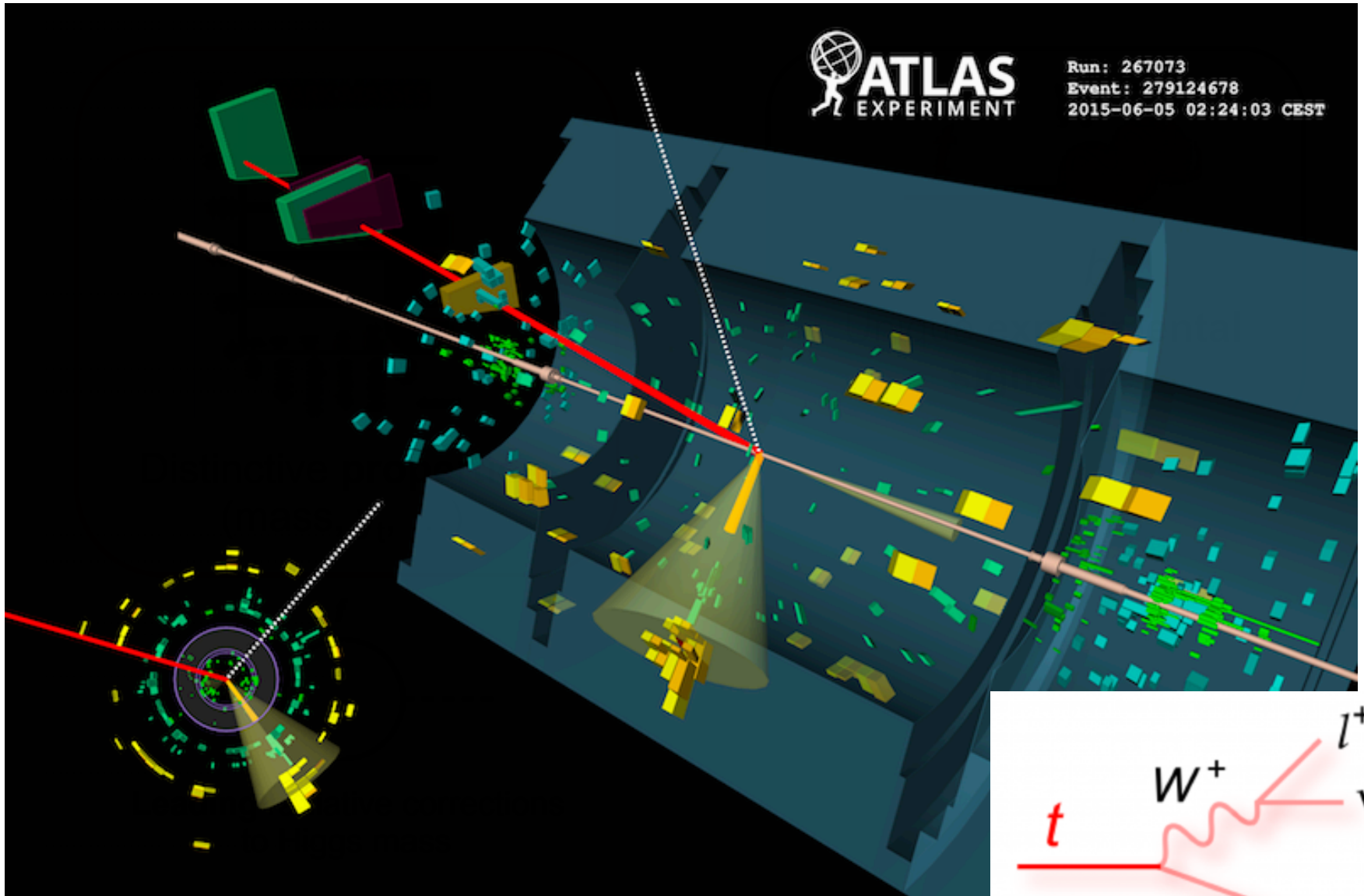


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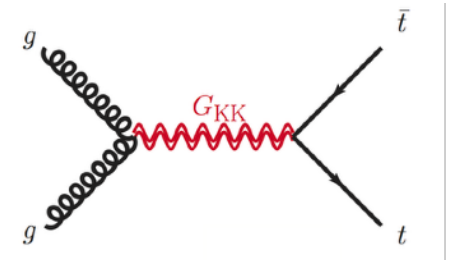
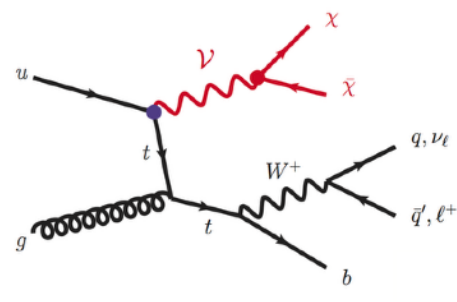
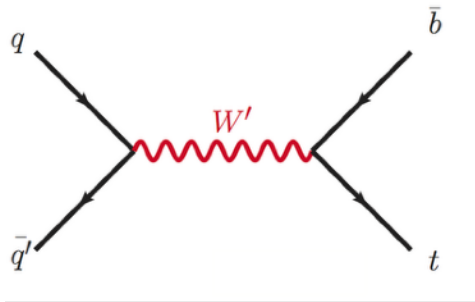
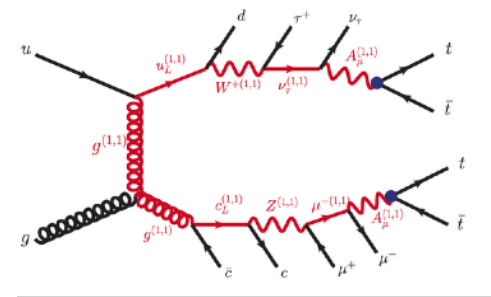
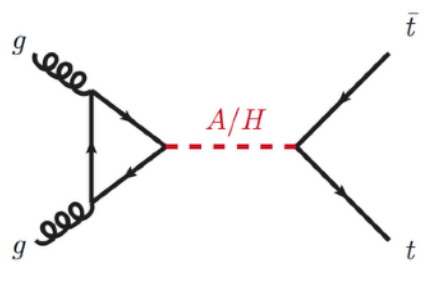
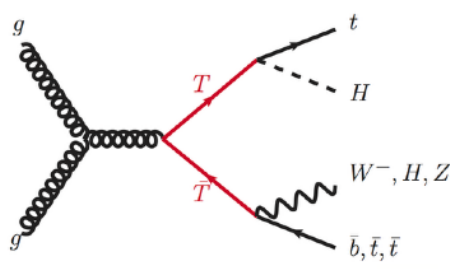
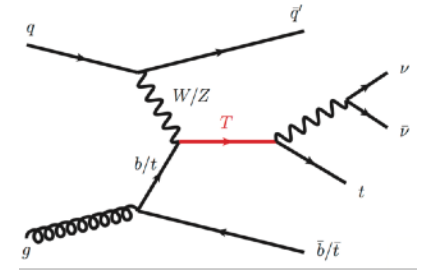
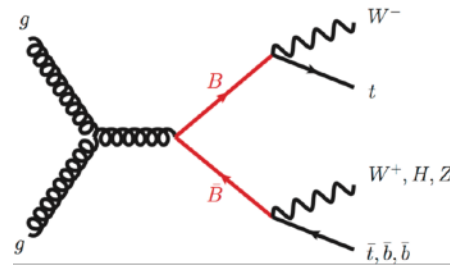
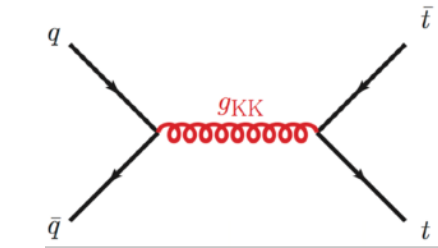


Unique **experimental**  
**signature**

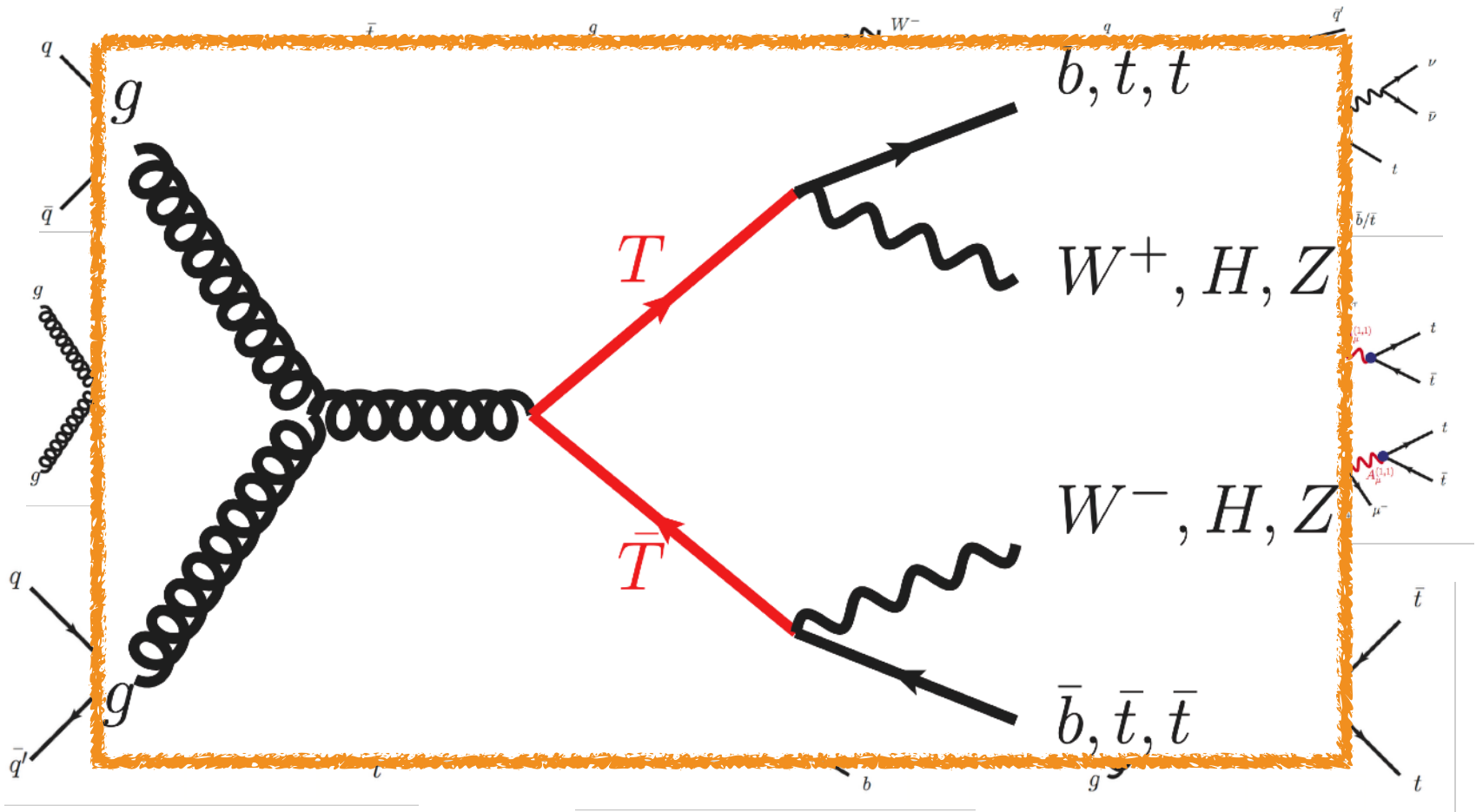
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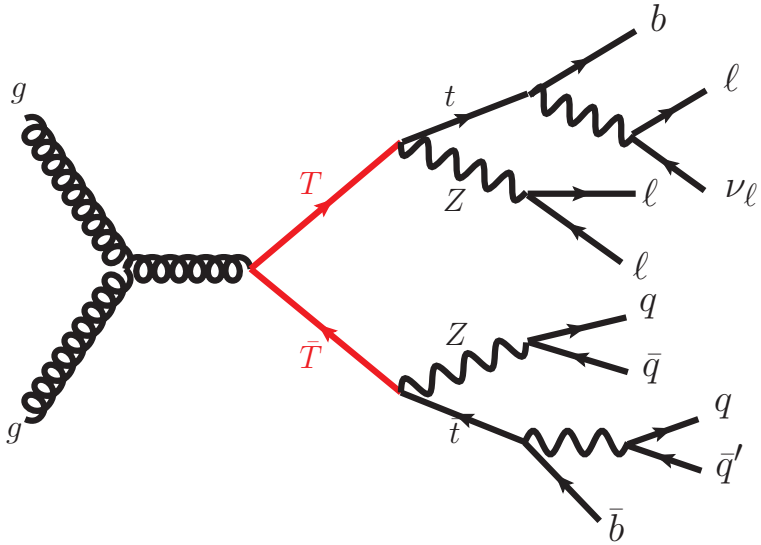


# Vector-like quarks

## Signatures

# Vector-like quarks

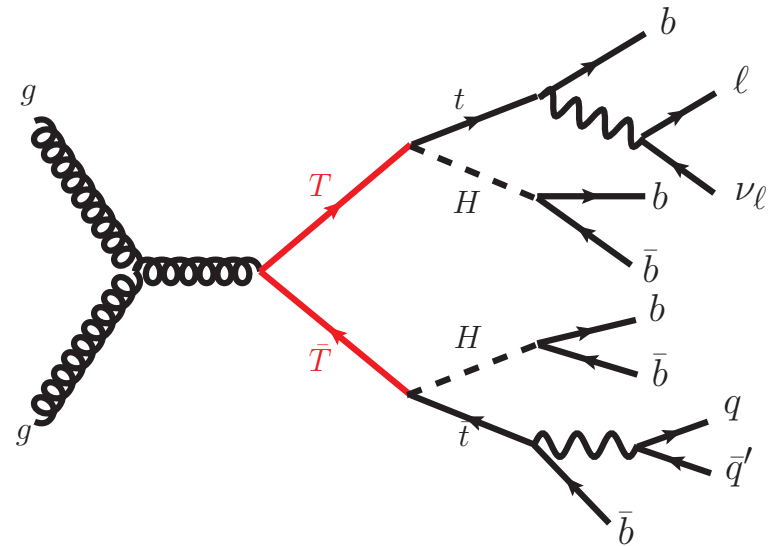
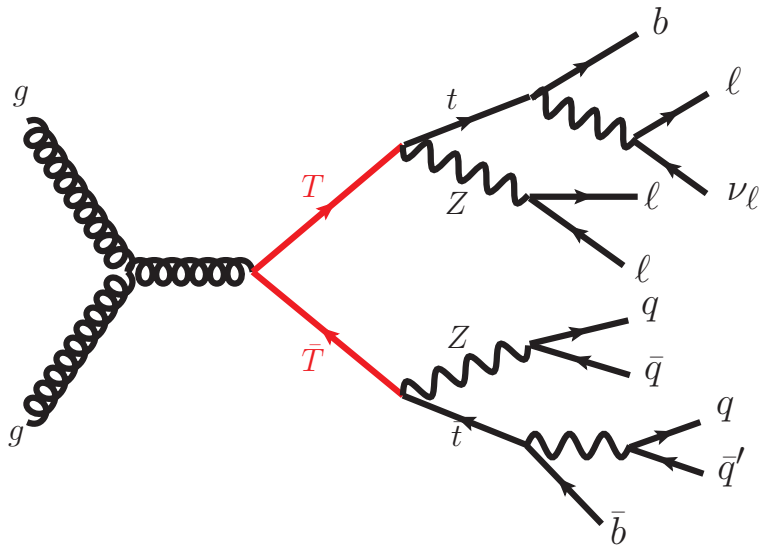
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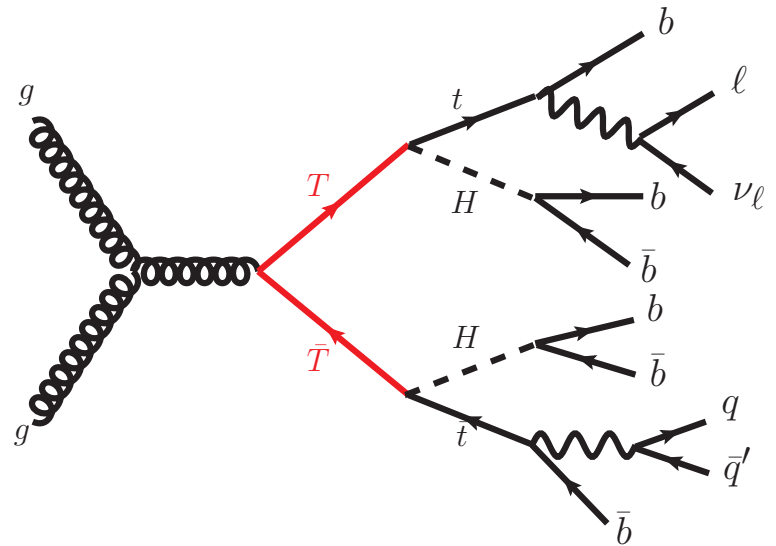
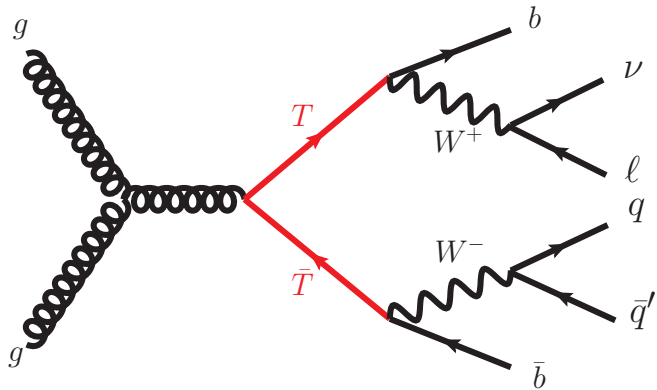
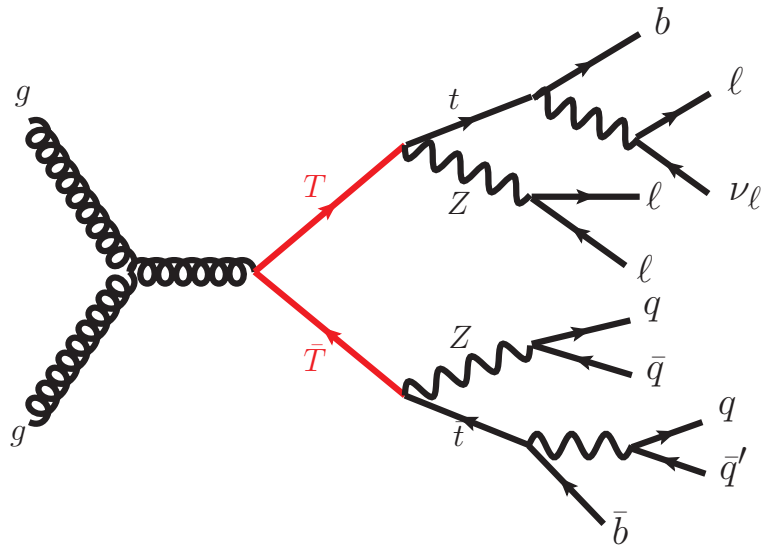
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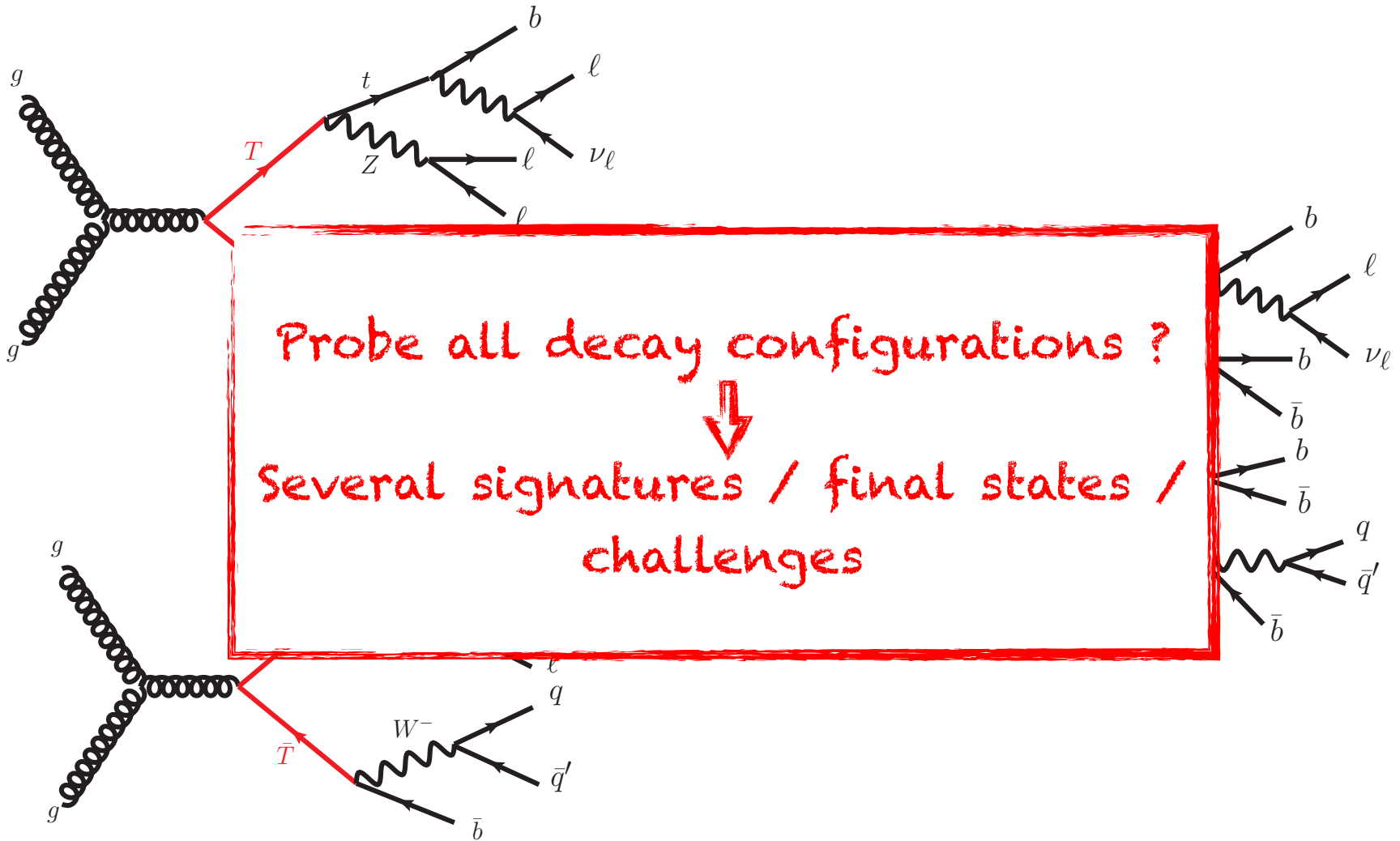
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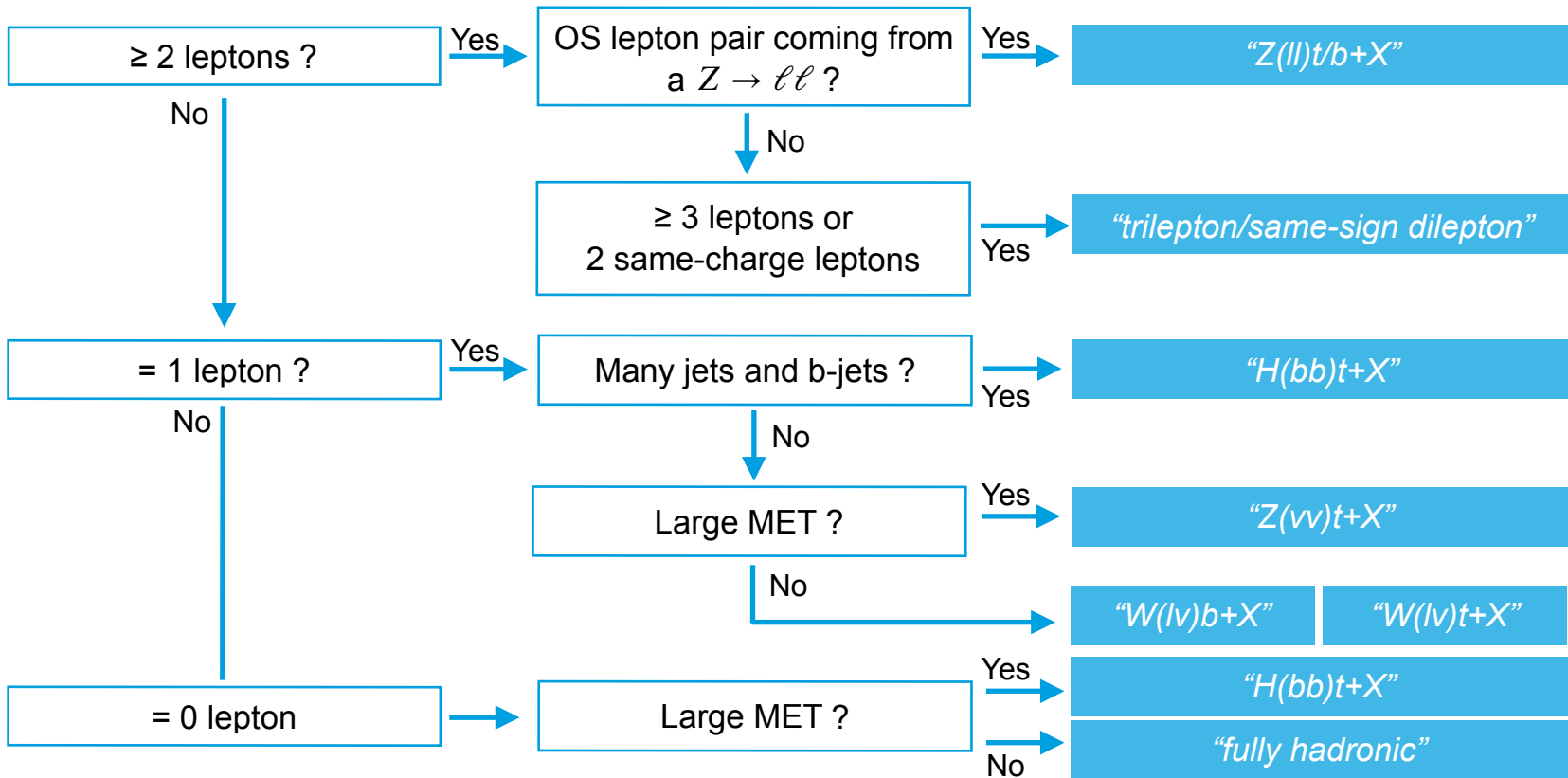
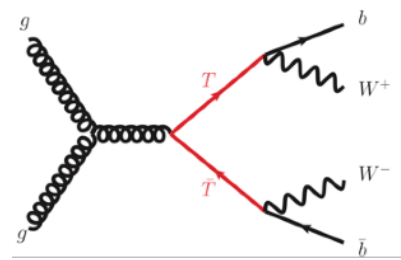
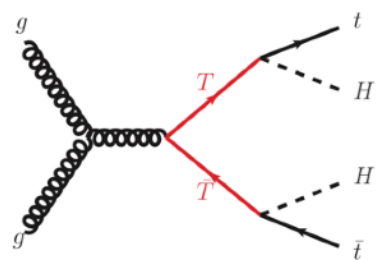
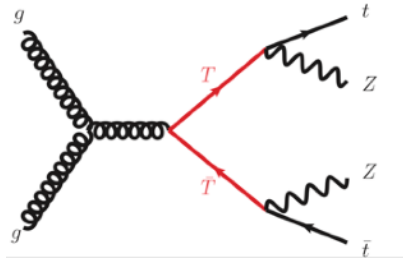


# Vector-like quarks

## Signatures



# Vector-like quark searches



# Vector-like quark searches

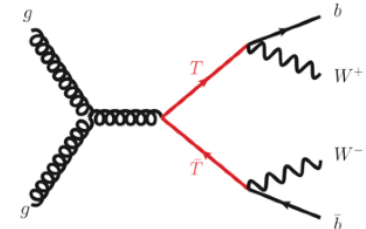
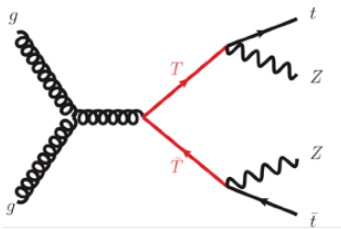
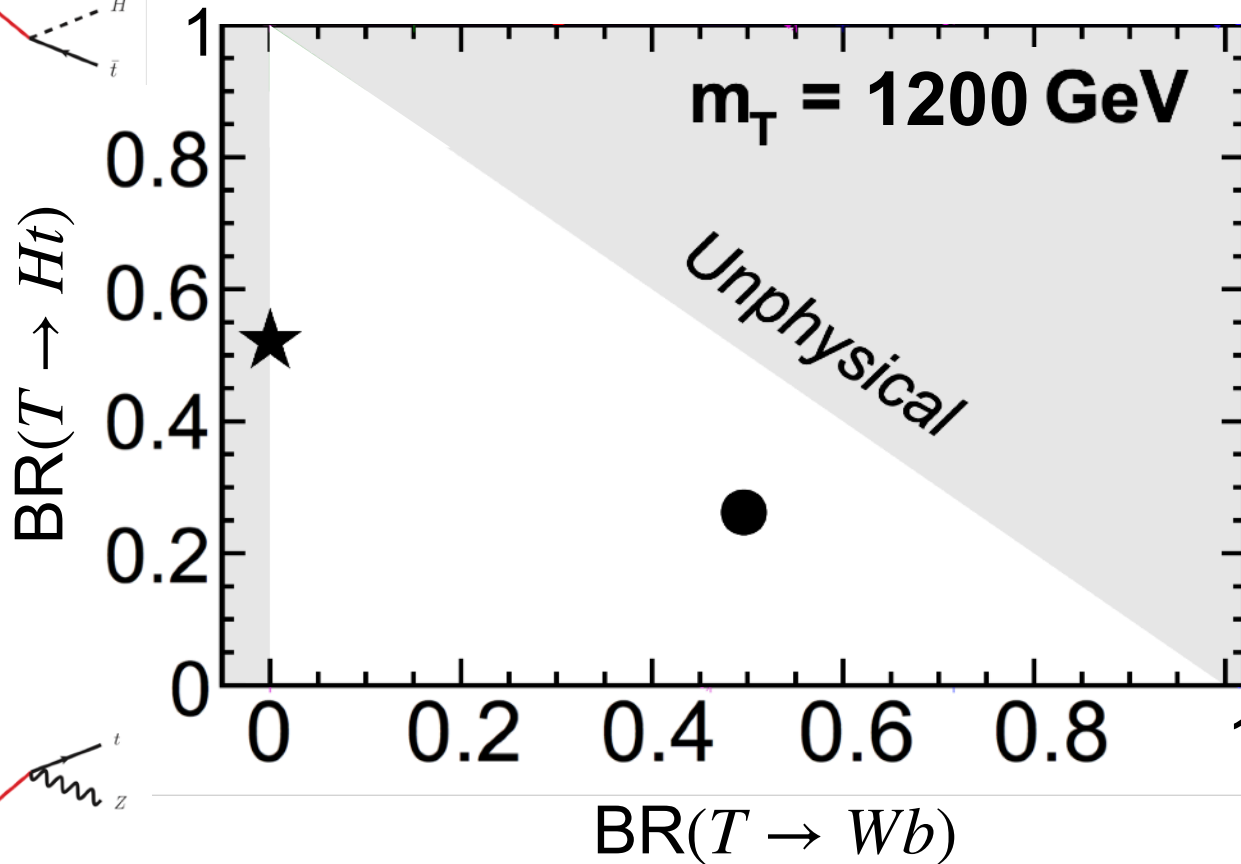
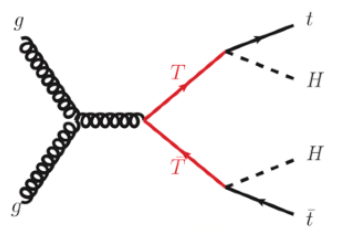
*Phys. Rev. Lett.* 121 (2018) 211801

## Sensitivity

—  $W(l\nu)b+X$  [arXiv:1707.03347]

—  $H(bb)t+X$  [arXiv:1803.09678]

—  $Z(l\bar{l})t/b+X$  [arXiv:1806.10555]



■ ■ ■ Exp. exclusion    ■ Obs. exclusion

# Vector-like quark searches

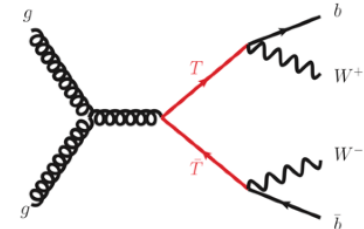
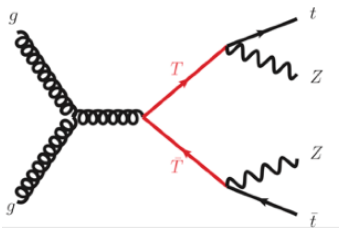
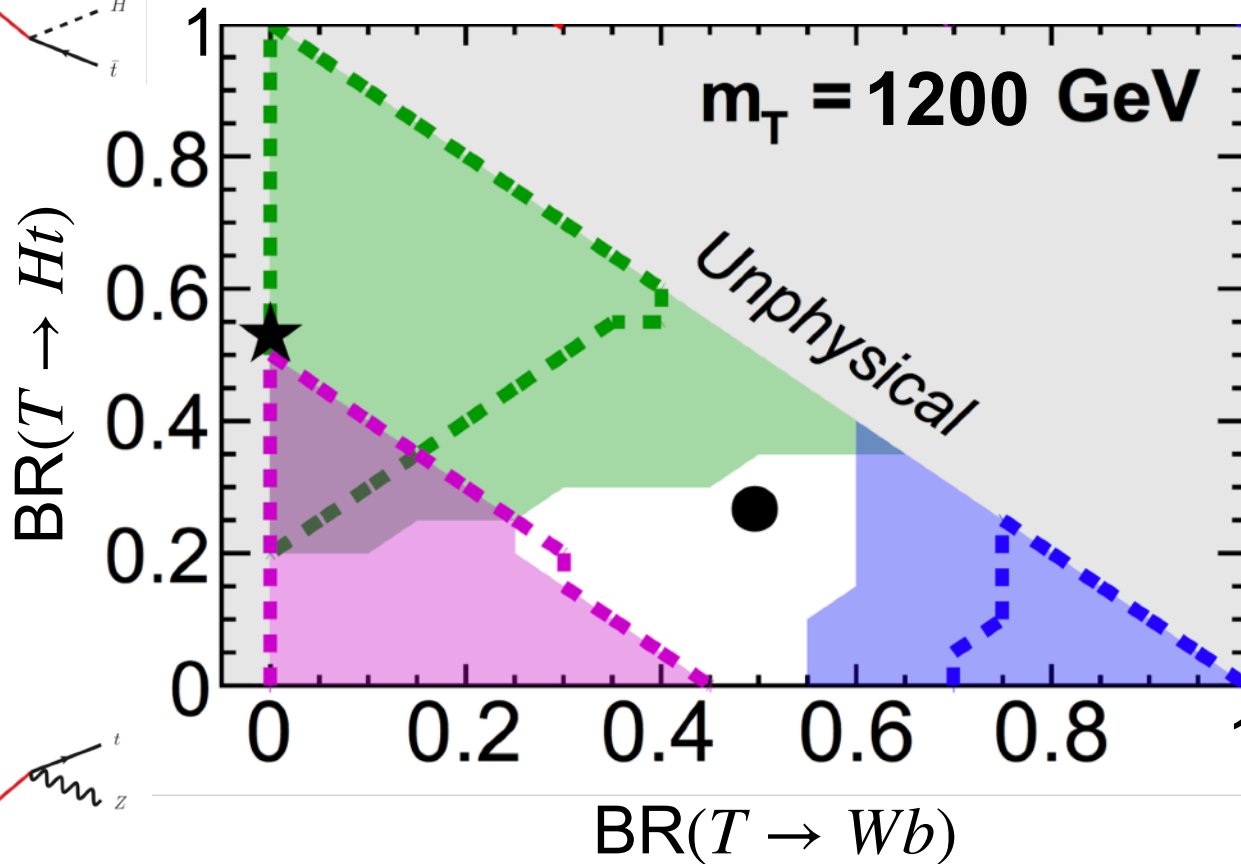
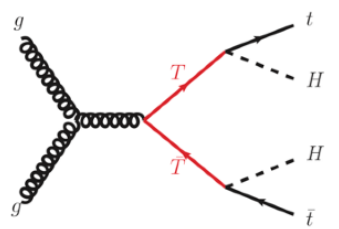
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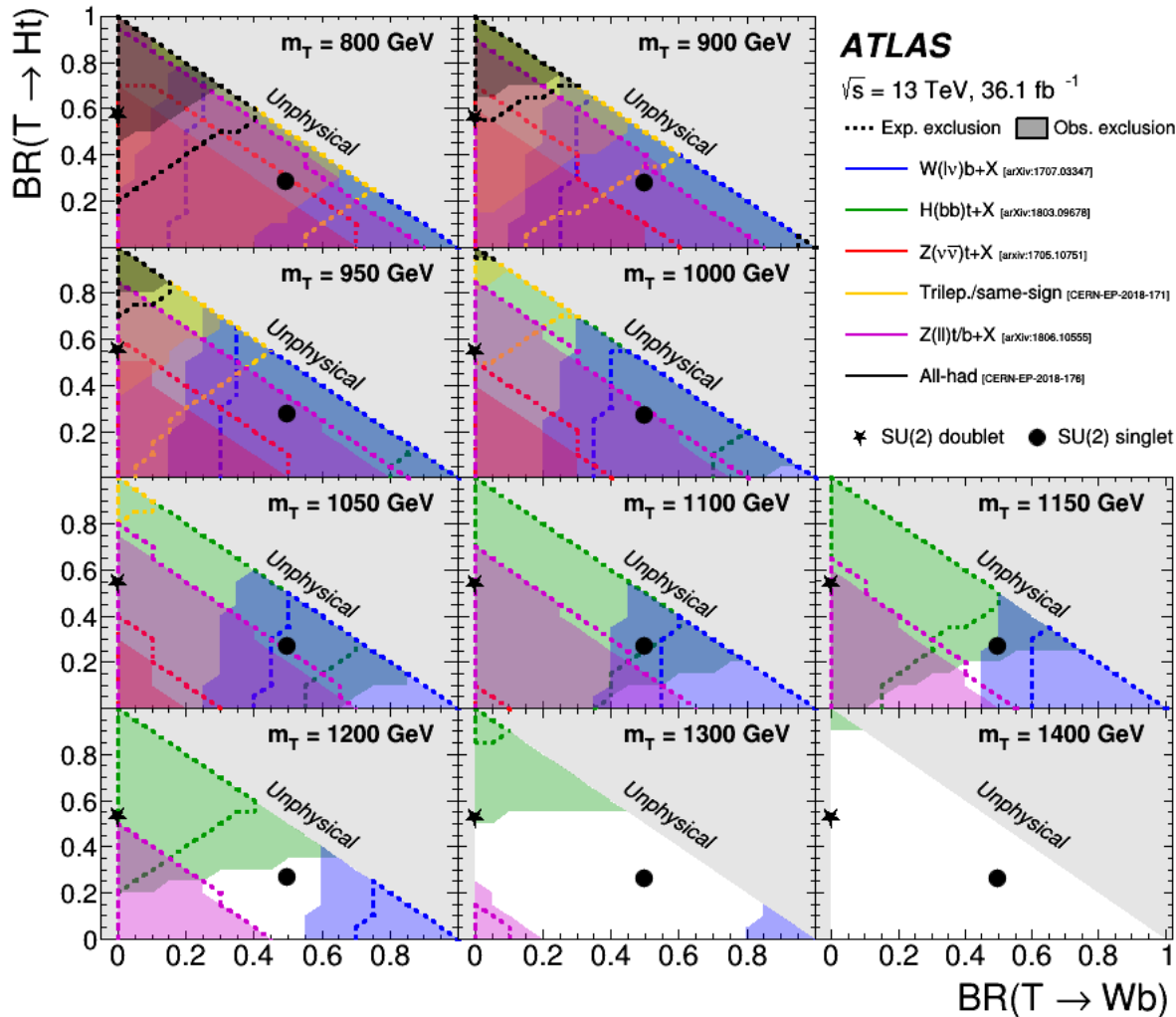


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# Vector-like quark searches

## Summary plots

*Phys. Rev. Lett.* 121 (2018) 211801



- **Excellent complementarity** between analyses: most parameter space “covered”

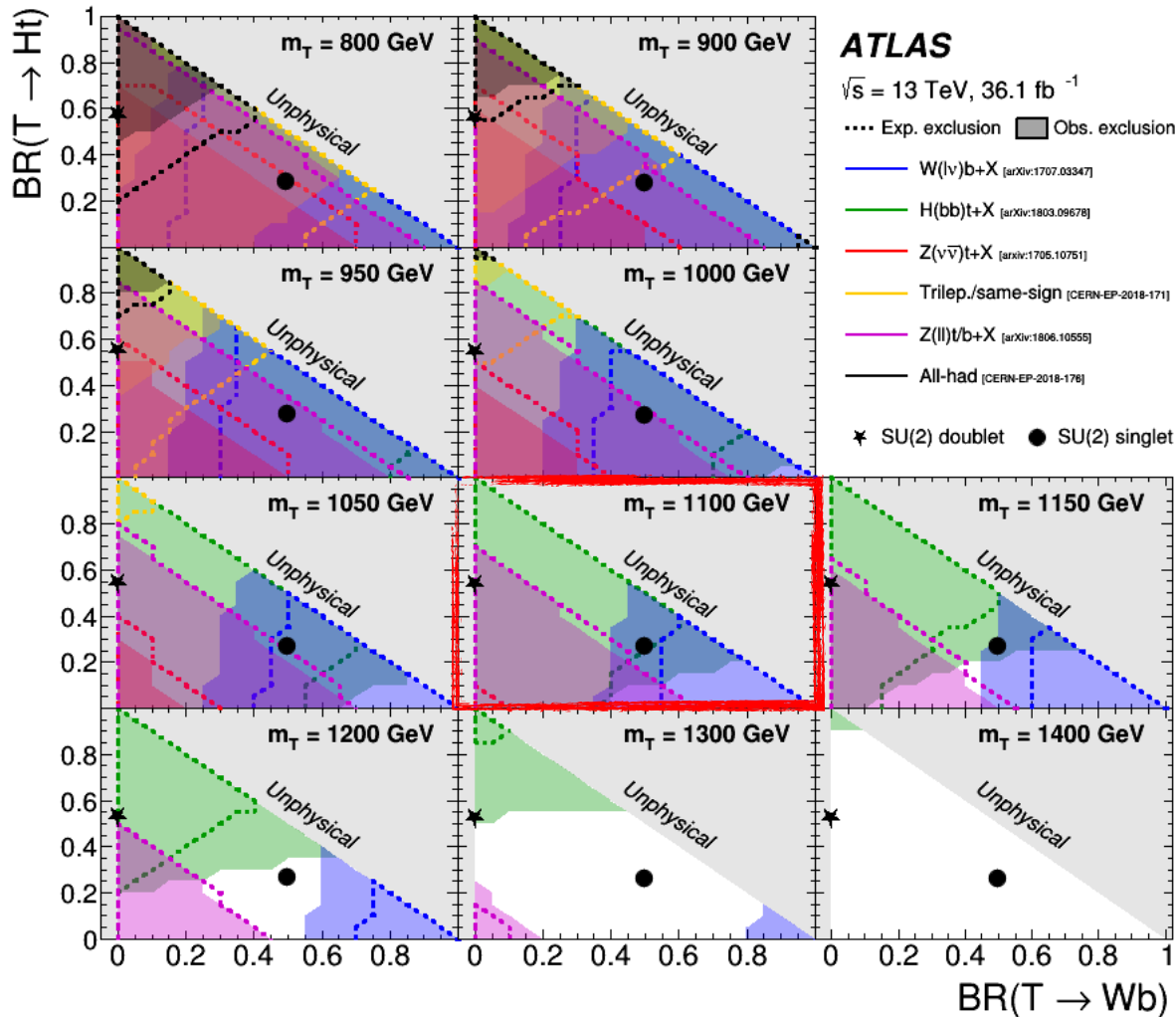
- **Non-overlapping** analyses

→ **combined interpretation !**

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*Phys. Rev. Lett.* 121 (2018) 211801



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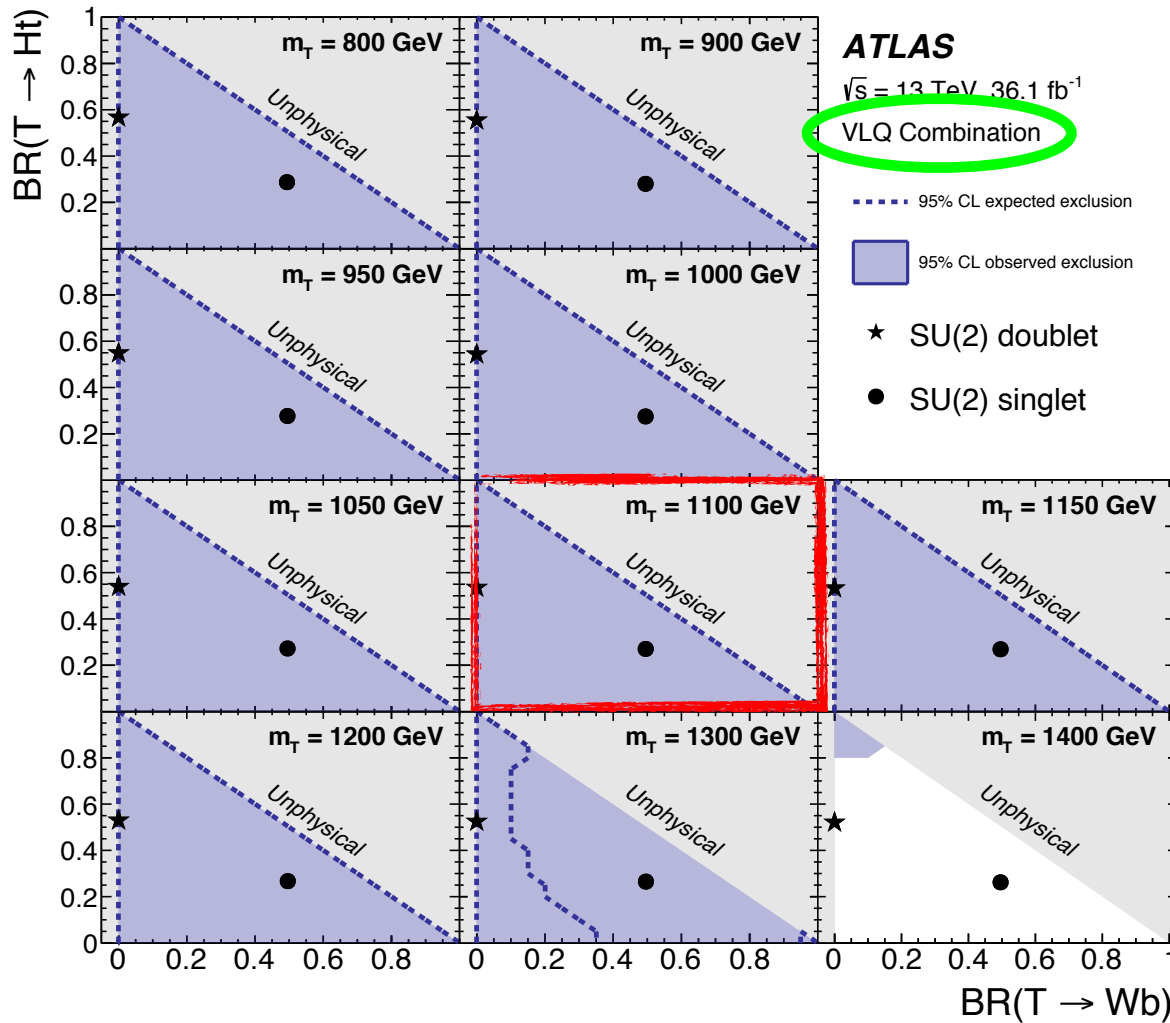
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# Vector-like quark combination

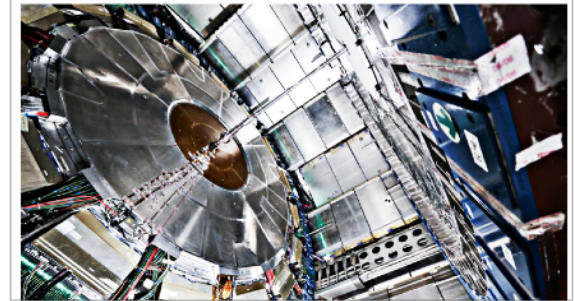
*Phys. Rev. Lett.* 121 (2018) 211801



## The incredible lightness of the Higgs

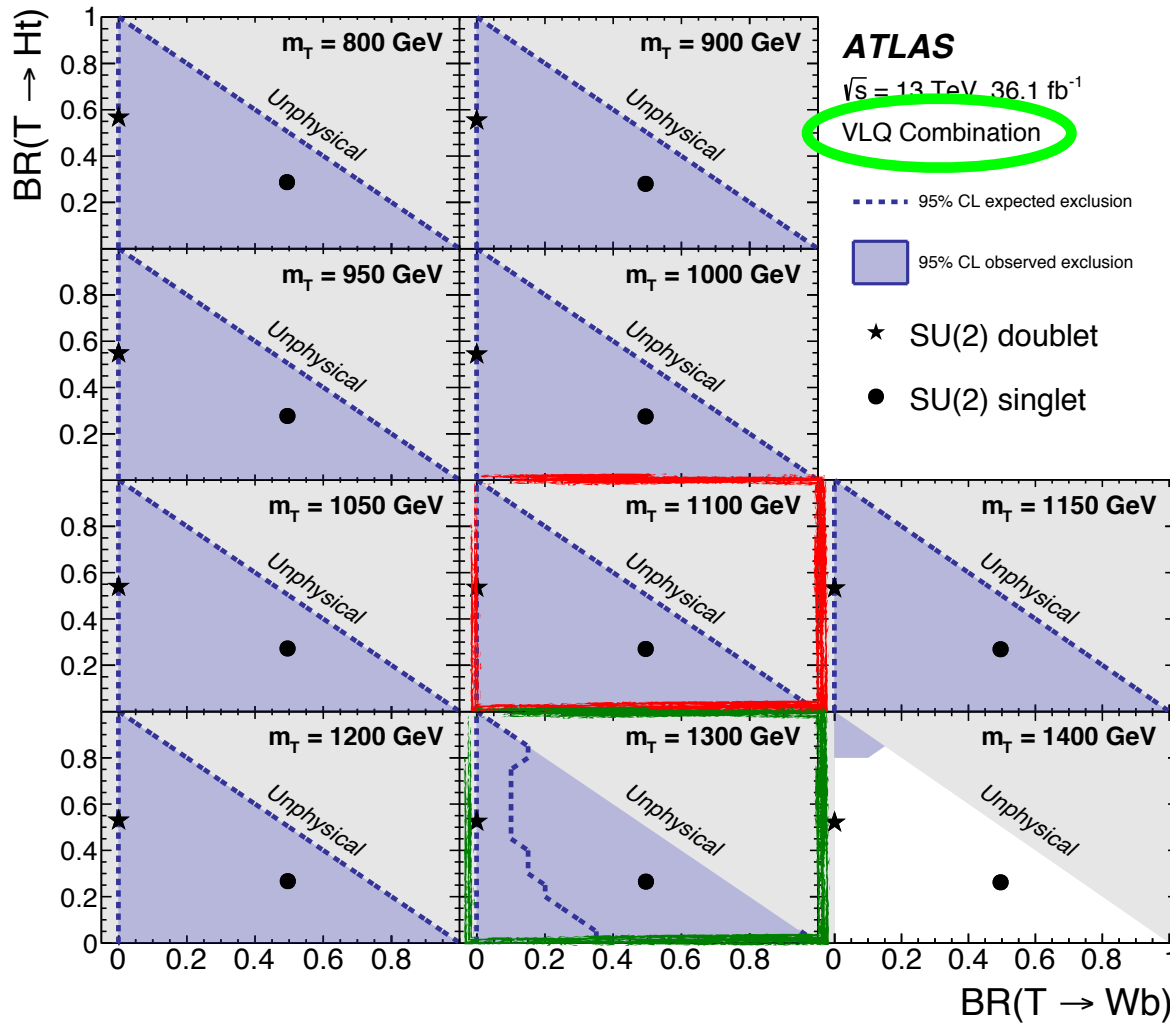
ATLAS searches for vector-like top quarks that could explain the Higgs boson's small mass

11 SEPTEMBER, 2018 | By Ana Lopes



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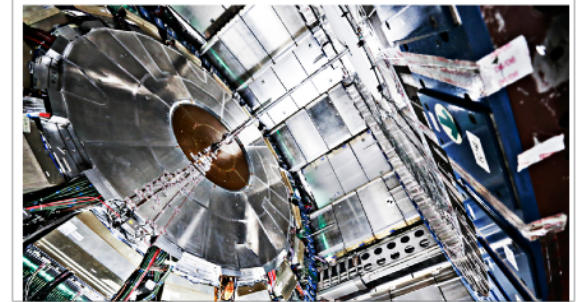
*Phys. Rev. Lett.* 121 (2018) 211801



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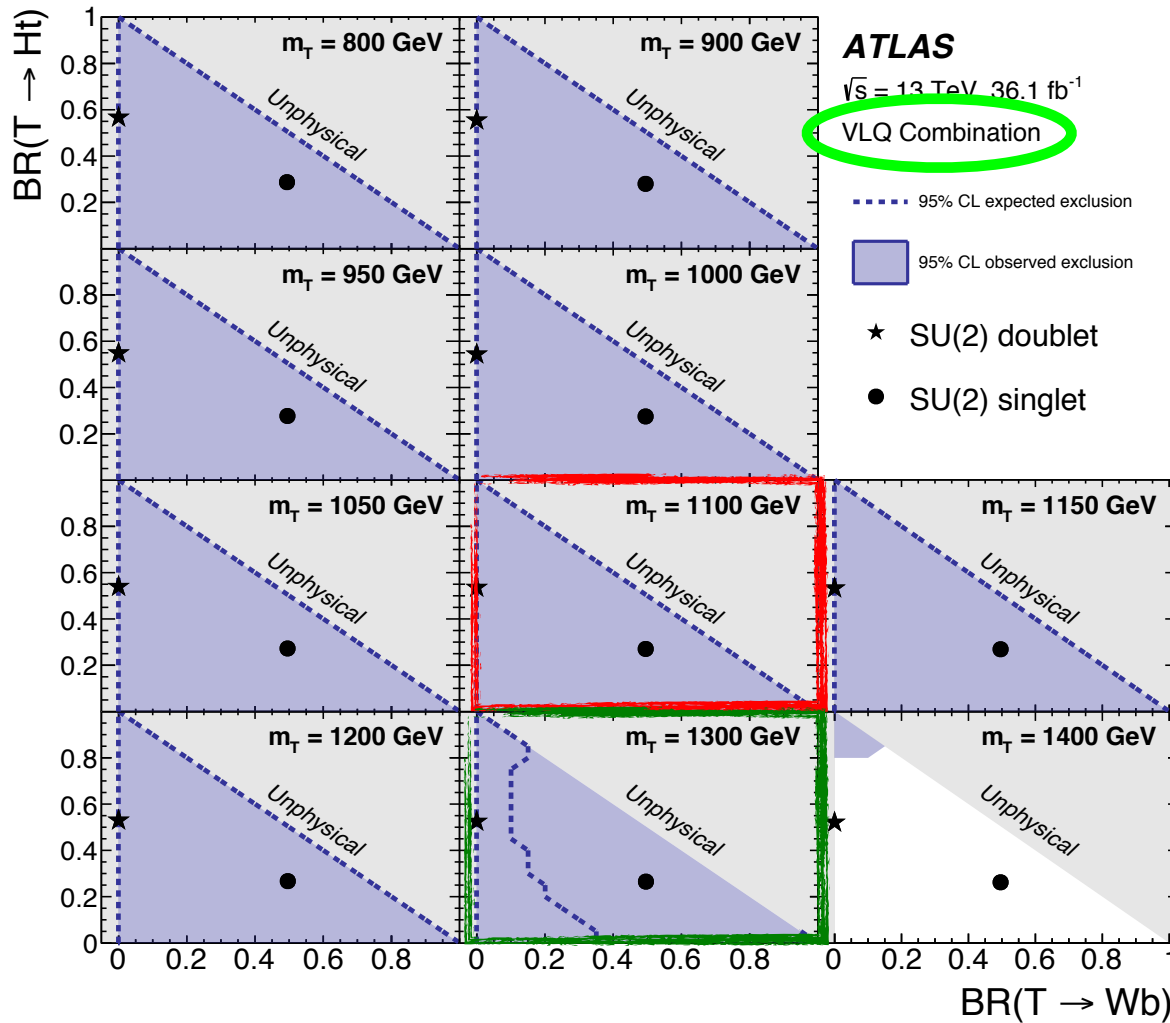
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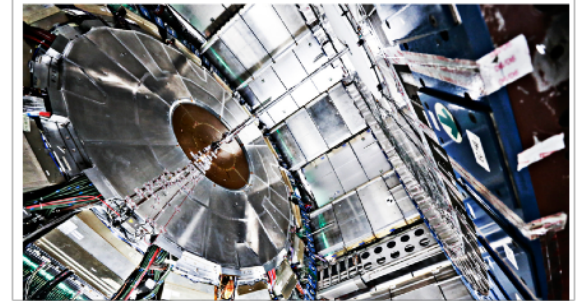
*Phys. Rev. Lett.* 121 (2018) 211801



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**Strong sensitivity gain !**

**⇒ No evidence for low-mass VLQs**

**Thank you**

Contact

**DESY** Deutsches  
Elektronen-Synchrotron

[www.desy.de](http://www.desy.de)

Name Surname

Department

E-mail

Phone