

IFAE pizza seminar

March 12th

Searches for non-SM
quarks with ATLAS

fresh DR. Antonella Succurro

Electrons, Protons, Neutrons and ...

1936



by 1963
a "Particle
Zoo"



emerged



quark

model

u, d, s



NEW QUARKS

predicted

discovered

c 1970 (GIM)

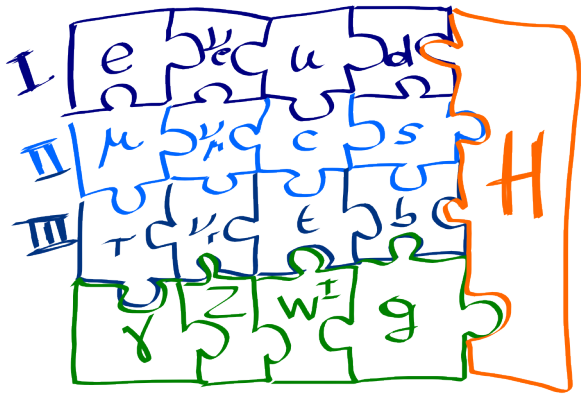
1974

b 1973 (CKM)

1977

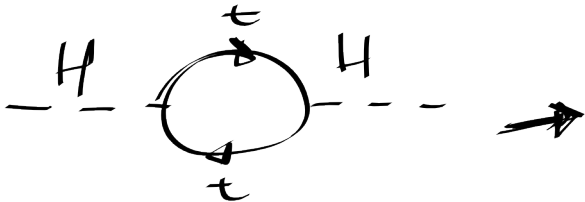
t 1995

$m_t \sim 175 \text{ GeV} \gg m_{\text{others}}$



A complete
theory
since
2012!

BUT...



MANY (MANY!) PROPOSALS
FOR BEYOND SM PHYSICS

SUSY!

COMPOSITE HIGGS!

SM4!

EXTRA-DIMENSIONS!

but what experimentalists
actually want are...

NEW PARTICLES!

e.g.

vector-like T

SM top

$$\begin{pmatrix} t \\ b \end{pmatrix}_L \quad t_{R, b_R}$$

$$t \rightarrow Wb$$

new heavy top

$$\begin{matrix} T_{L,R} \\ \underbrace{\hspace{1cm}} \\ \begin{pmatrix} T \\ B \end{pmatrix}_{L,R} \quad \begin{pmatrix} T \\ X \end{pmatrix}_{L,R} \end{matrix}$$

$$T \rightarrow Wb$$

$$T \rightarrow Zt$$

$$T \rightarrow Ht$$

$$\underbrace{\hspace{10cm}}$$

$$T \rightarrow Zt$$

$$T \rightarrow Ht$$

CHIRALITY

$SU(2) \times U(1)$

Symmetry

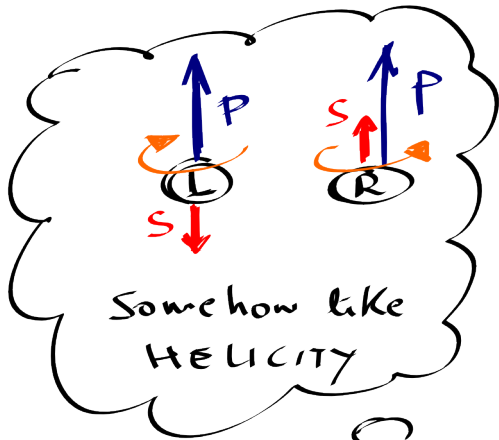
[ELECTROWEAK
INTERACTION]

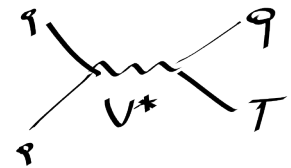
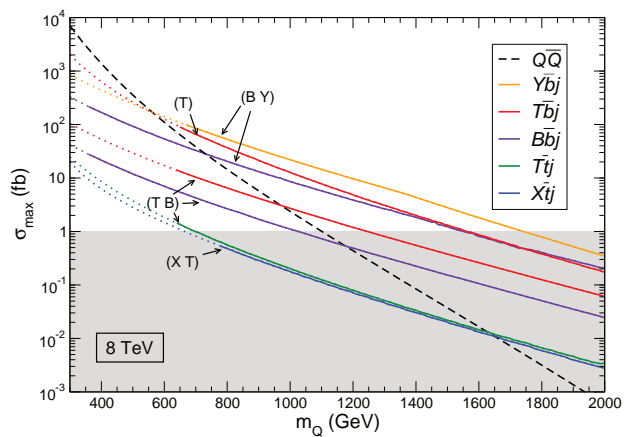
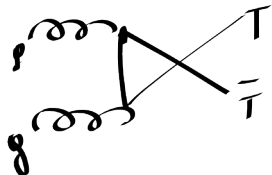
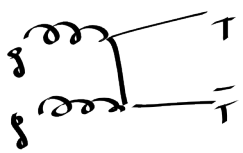
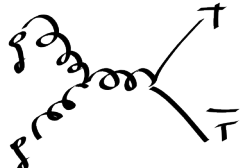
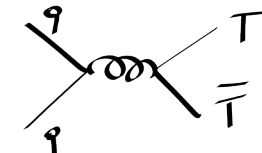
Weak isospin

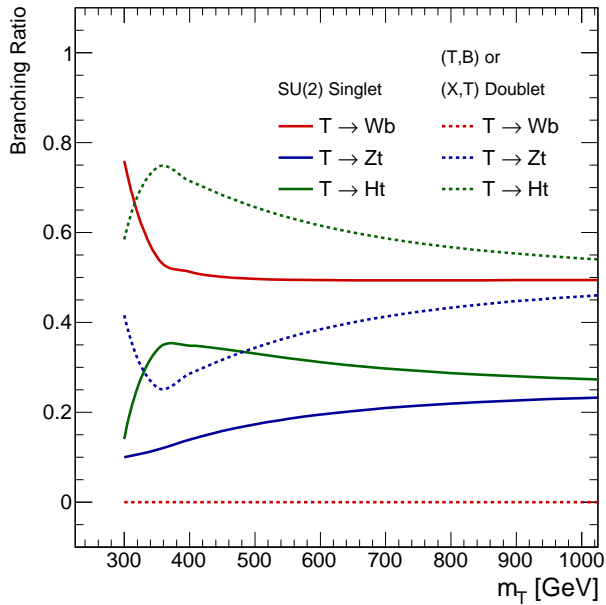
DOUBLET ψ_L

and

SINGLET ψ_R









SIGNATURES

$t \rightarrow Wb$

VS

$T \rightarrow Wb$

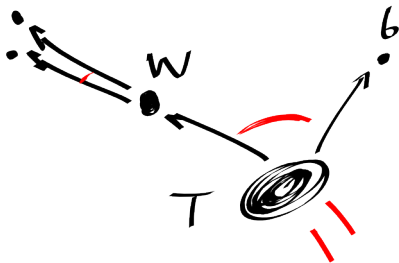
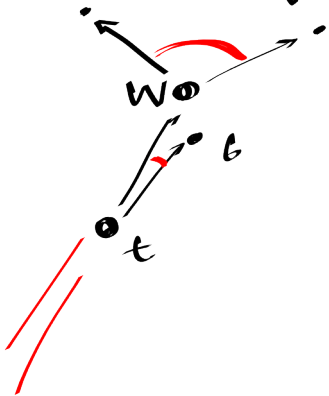
$T \rightarrow Ht$

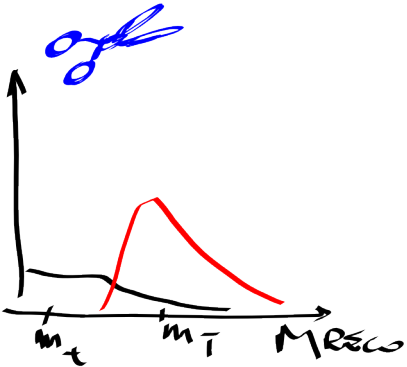
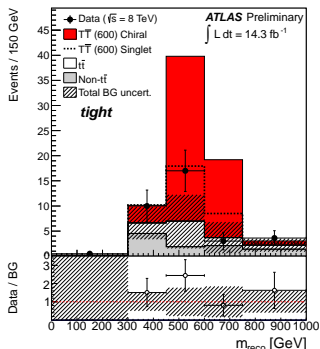
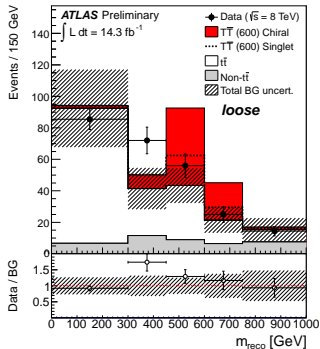
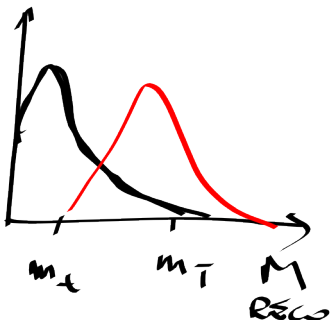
W b

$$m_t \sim 175 \text{ GeV}$$

$$m_T > 350 \text{ GeV}$$

$$\sqrt{s} = 8 \text{ TeV}$$

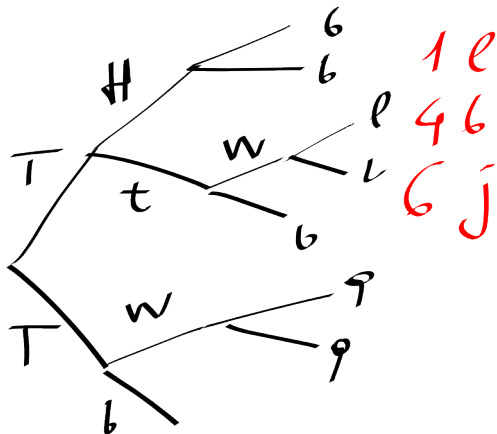
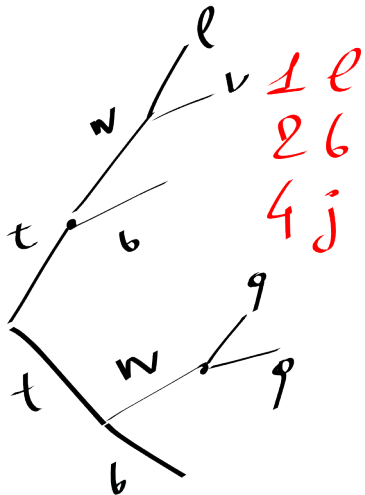


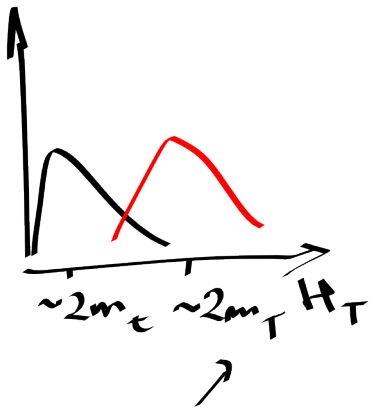


Ht

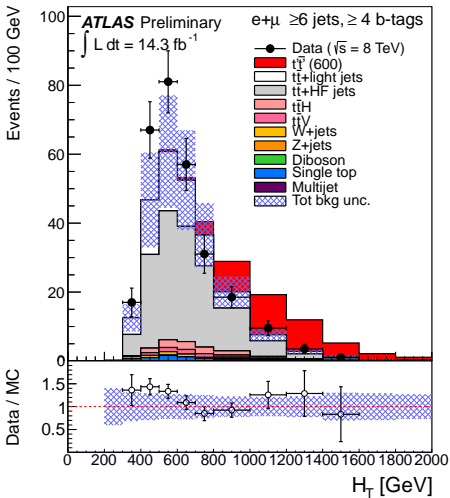
H → bb ~ 60%

H → WW ~ 20%

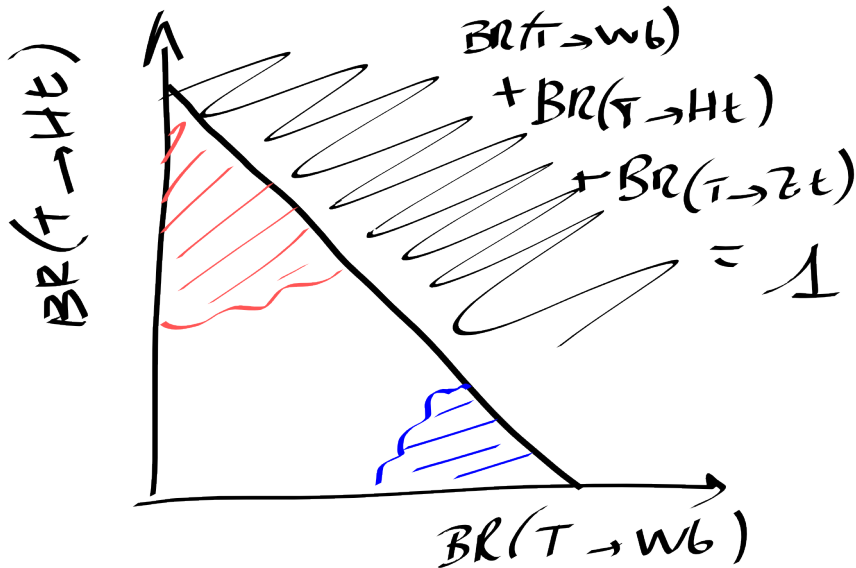


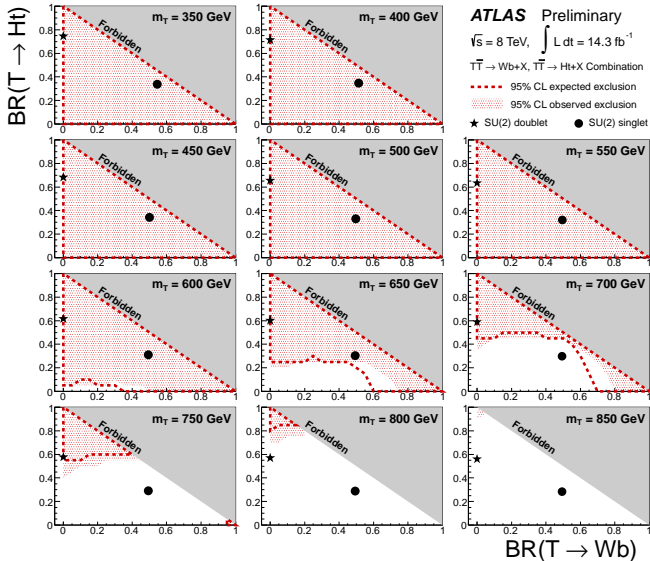


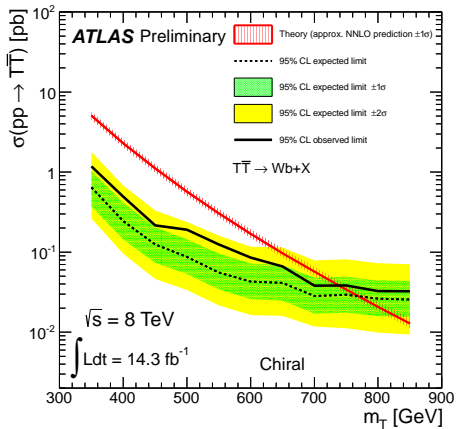
$$P_T(\ell) + \cancel{E}_T + \sum_j P_T(j)$$



COMBINE & SET LIMITS







THANK YOU FOR
YOUR ATTENTION

and

THANKS IFAE
FOR THE
JOURNEY!

