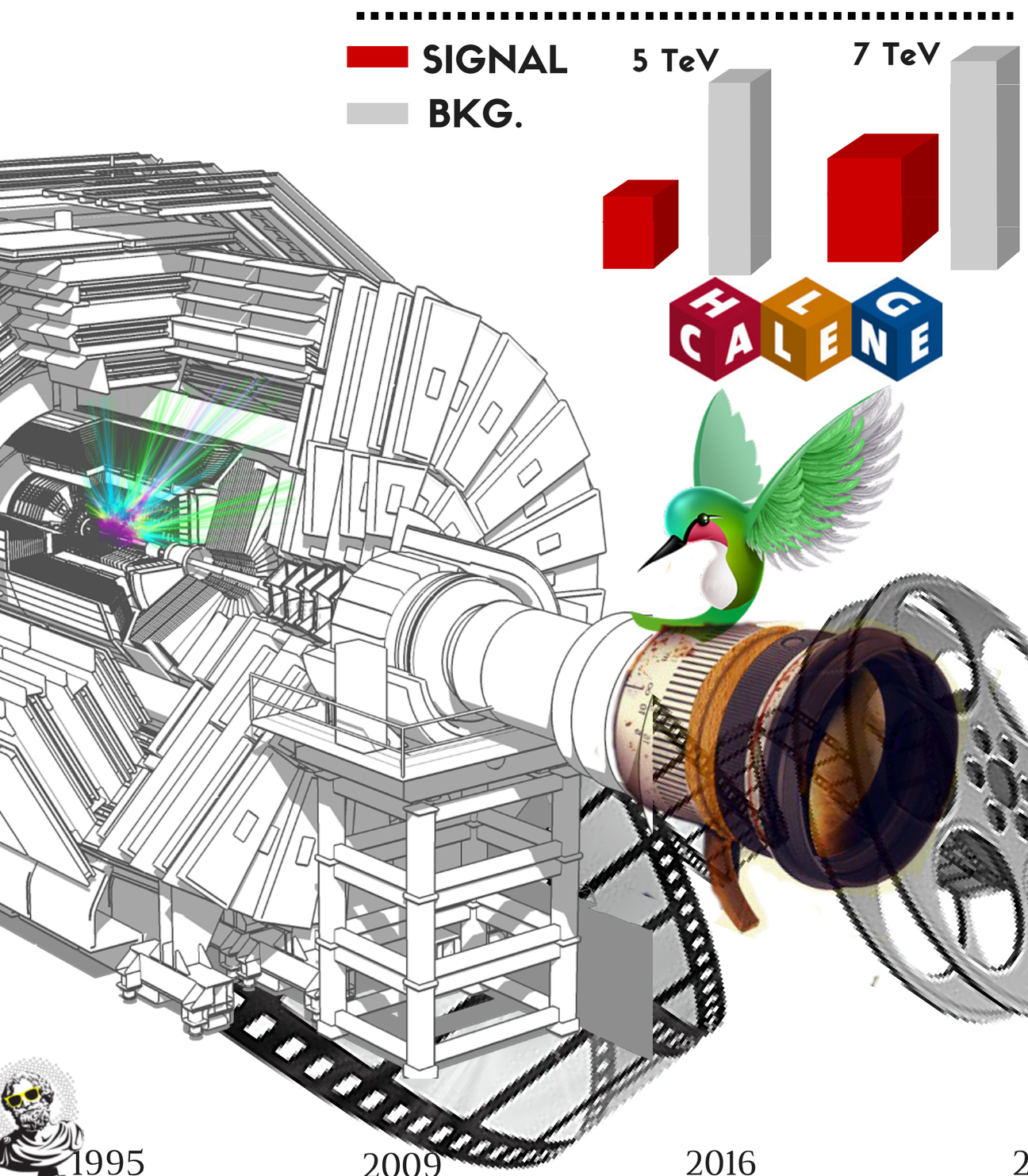
TOP QUARK

"WHEN IT COMES TO *TOP*, NO PAIRING IS BEYOND BELIEF"

LHC UCL CMS



1995 *Top at Tevatron*

2009 *Top at LHC (7 TeV)*

2016 *Top at LHC (5 TeV)*

2016 *Top in hot QCD (Expected)*

5 TeV ? Not a typo ?

In November 2015, the LHC delivered proton-proton (pp) collisions at √s = **5.02 TeV**. This is a unique opportunity to verify the **evolution** of the top pair-production (tt) cross section **as a function of √s**, while the latter can be used to constrain the **large-*x* gluon distribution function**. A measurement of tt cross section in pp collisions in these unprecedented conditions serves as an reference for **measuring top quark in nuclear collisions** (such as pPb and PbPb) at the same nucleon-nucleon √s energy.

What about backgrounds ?

Final states with **two *prompt* leptons** (DY, single top, dibosons) or **one lepton and jets** can **contaminate** the signal sample. The yields from single-top and diboson events are estimated **from simulation**, while DY and non-*prompt* leptons are **constrained by data** with a 30% and 50% uncertainty, respectively.

What is left ?

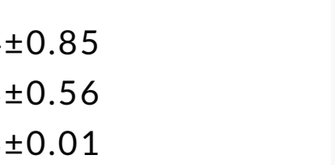
The total **number of events** observed in data, together with the total number of background events expected from simulation or estimated from data, after the **full set of selection criteria** are:

Drell-Yan (DY)	2.84±0.85
Non-prompt leptons	1.13±0.56
Single top	0.93±0.01
Dibosons (WW/WZ)	0.66±0.01
Total background	5.55±1.05
Signal (tt dileptonic)	18.00±0.25
Data	25

And, with what precision ?

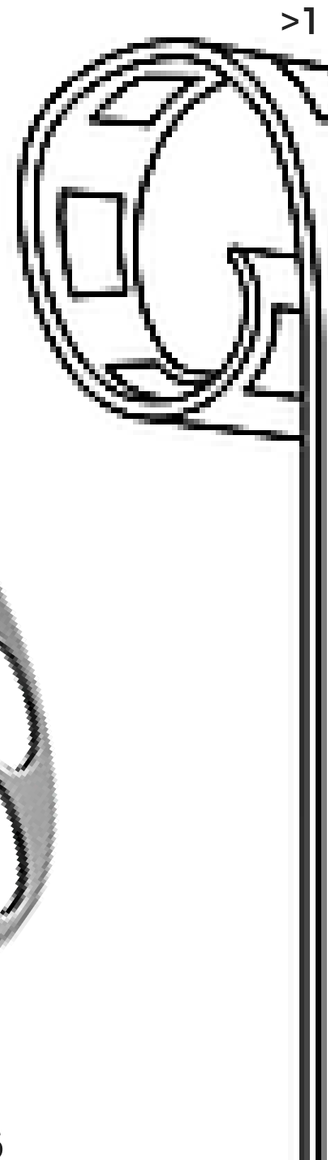
Experimental uncertainties (*pb*) include **trigger** and **lepton** efficiencies, plus **jet energy scale** and **resolution**. Theoretical ones involve **QCD scales**, **hadronization** modeling and **PDF**s.

Experimental	3.0 %
Theoretical	4.1 %
#Background	1.9 %
Luminosity	12.0%
Total systematic	13.0%
Statistical Precision	25%
Total	28%

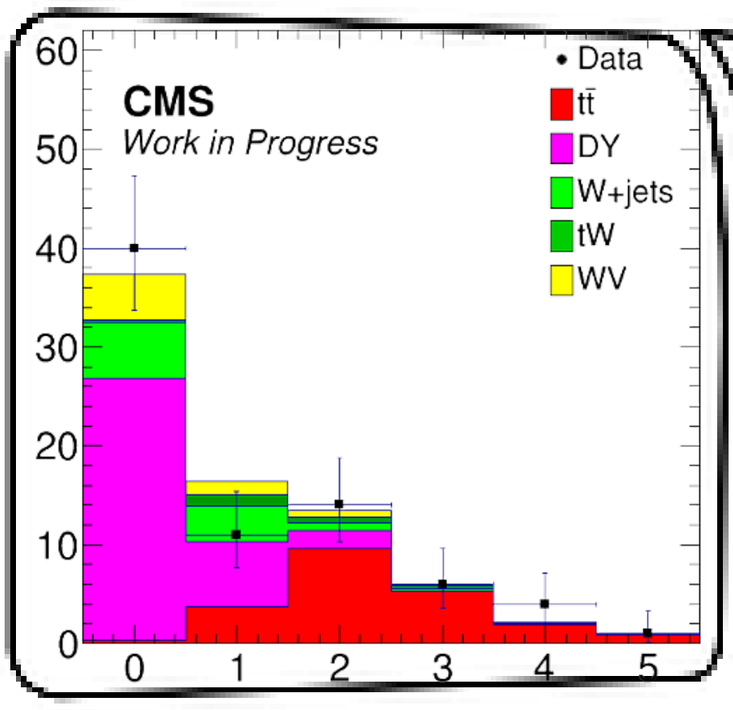


SELECTION — SIGNAL

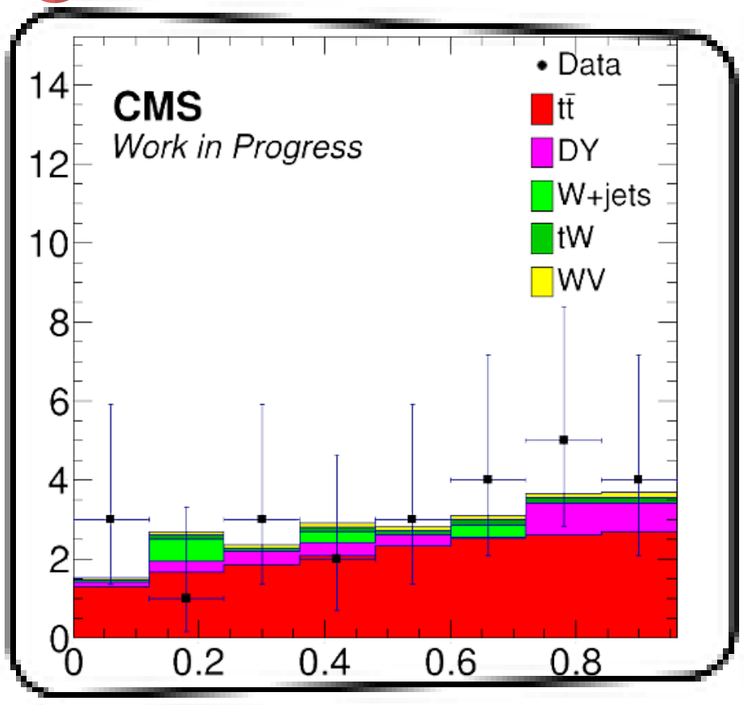
High Level Trigger	● ○ ○ ○ ○
Opposite-sign emu pair	● ● ○ ○ ○
=1 anti-kt clustered jet	● ● ● ○ ○
>1 anti-kt clustered jets	● ● ● ● ○



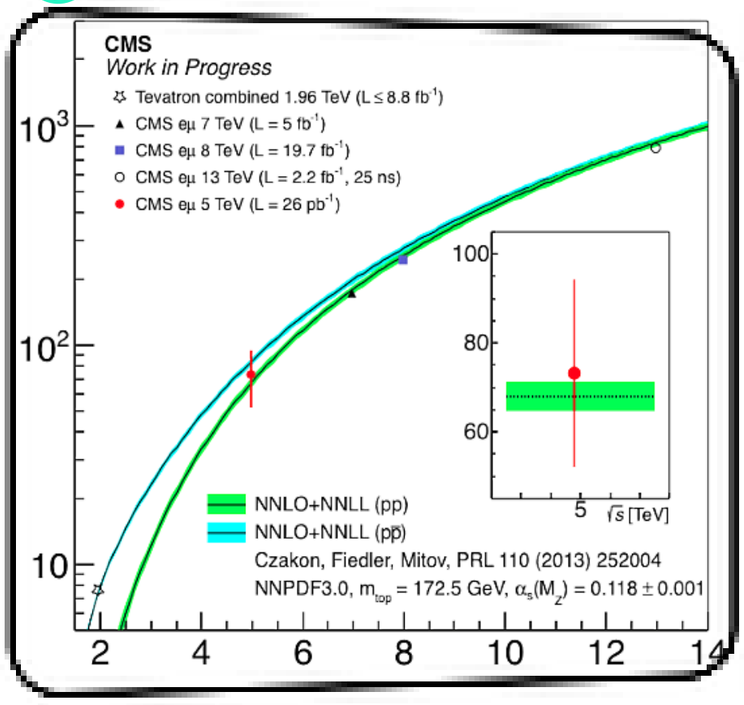
JET MULTIPLICITY



PAIR AZIMUTHAL DIFFERENCE



CROSS SECTION √S DEPENDENCE



Result

$\sigma_{tt} = 73 \pm 21$ pb

in-line with theory

L=25.8PB-1