Demonstration of Lattestex

In the 13 TeV era

Number 6, Number 1

Universidade de São Paulo

14 January 2026

ATLAS EXPERIMENT FAPESP HEPIC IFUSP IFUSP Instituto de Física da USP USP

A single, large image

Some centred text

Some more centred text

Centred text (horizontal and vertical)

Some centred text

2026-01-14
14 January 2026
January 2026

Itemised list

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  - Subitem
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Itemised list with overlay

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Enumerate list

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2. Item
    1. Subitem
    2. Subitem
        1. Subitem
3. Item
4. Item

Description list

A Item

B Item

- A Subitem
- B Subitem
  - A Subitem

C Item

D Item

Description list with checkmarks

- ✓ Item
- ✓ Item
  - ✓ Subitem
  - Subitem
    - Subitem
- ✓ Item
- ✗ Item

An attached ROOT data file:

↓ data.root

- URL: `http://info.cern.ch/hypertext/WWW/TheProject.html`
- Hyperlink: TheProject
- Hyperlink: ATL-COM-PHYS-2014-1471

- $H^+ \to tb$
- Lepton p_T and η

Jet pull is a variable that can be constructed from particles within a jet cone. The procedure is as follows:

- Select a pair of jets in an event.
- Build a vector sum of calorimeter cells within each jet.

$$\vec{p} = \sum_i \frac{E_T^i |r_i|}{E_T^{\text{jet}}} \vec{r}_i$$

- $\vec{r_i}$: position of jet cell i relative to jet centre
- E_T^i: transverse energy of cell i
- E_T^{jet}: transverse energy of jet

Each cell is assigned to the closer jet in (η, ϕ) space.

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Code: Python (syntax highlighting by listings)

Python code inline is like this: `print["hello"]`

Python as a code block is like this:

```
import multiprocessing

def function[x]:
    return x * x

if __name__ == '__main__':
    pool = multiprocessing.Pool[processes=4]
    result = pool.apply_async[function, [10]]
    print[result.get[timeout=1]]
    print[pool.map[function, range[10]]]
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    print[pool.map[function, range[10]]]
```

Code: Python with smaller font (syntax highlighting by minted)


```
import sys
import time

def is_prime(n):
    return zip([True, False], decompose(n))[-1][0]

class IsPrimeCached(dict):
    def __missing__(self, n):
        r = is_prime(n)
        self[n] = r
        return r

is_prime_cached = IsPrimeCached()

def primes():
    yield 2
    n = 3
    while n < sys.maxint - 2:
        yield n
        n += 2
        while n < sys.maxint - 2 and not is_prime_cached[n]:
            n += 2

def decompose(n):
    for p in primes():
        if p*p > n: break
        while n % p == 0:
            yield p
            n /=p
    if n > 1:
        yield n
```

```
#include <iostream>
#include <thread>

void say_hello();

int main(int argc, char** argv){

    std::thread my_first_thread(say_hello);
    my_first_thread.join();

    return 0;
}

void say_hello(){
    std::cout << "hello from a thread" << std::endl;
}
```

```cpp
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#include <thread>

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```
\documentclass{article}
\title{Processes involving charged mesons}
\author{C. ~M. ~G. ~Lattes, H. ~Muirhead, G. ~P. ~S. ~Occhialini, C. ~F. ~Powell}
\begin{document}
\maketitle
In recent investigations with the photographic method, it has been shown
    that slow charged particles of small mass, present as a component of
    the cosmic radiation at high altitudes, can enter nuclei and produce
    disintegrations with the emission of heavy particles. It is convenient
     to apply the term `meson` to any particle with a mass intermediate
    between that of a proton and an electron.
\end{document}
```

```latex
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```

Block 1

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Block 2

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Multiple columns (4)

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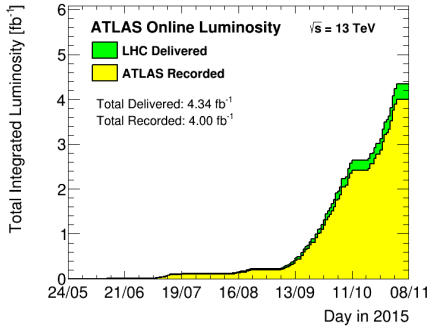
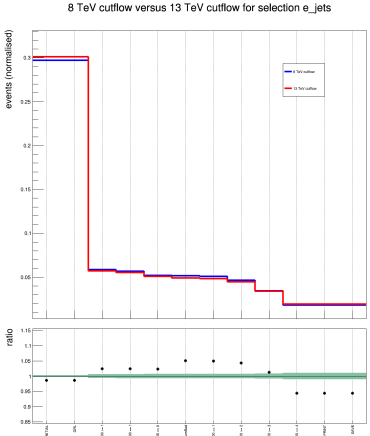
- Suppressed with respect to other Higgs modes
- $H \to b\bar{b}$ has the largest branching ratio (0.577 for m_H 125 GeV)
- Irreducible background from $t\bar{t}b\bar{b}$
- Other backgrounds: $t\bar{t}$ production in association with light quarks (u, d, s) or gluon jets (called $t\bar{t}$ + light), and $t\bar{t} + c\bar{c}$

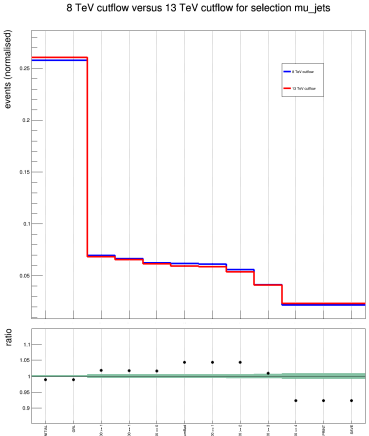


$\sqrt{s}$ (TeV)	7	8	13	14
$t\bar{t}H$ ($m_H = 125$ GeV) (pb)	0.086	0.130	0.5085	0.611
$t\bar{t}$ (pb)	177	253	832	950
$S/\sqrt{B}$	0.00646	0.0082	0.0176	0.0198

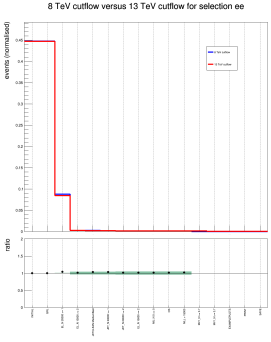
7 TeV $\to$ 13/14 TeV: $S/\sqrt{B}$ changes by factor of $\simeq$3

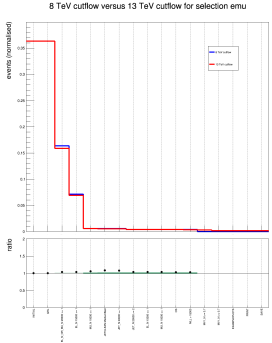
Images (2)

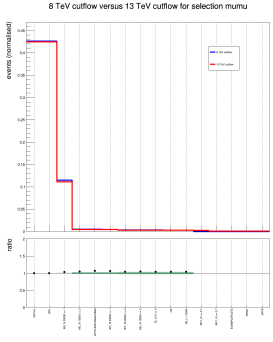

8 TeV cutflow versus 13 TeV cutflow for selection e_jets
events (normalised)
8 TeV cutflow
13 TeV cutflow
ratio


8 TeV cutflow versus 13 TeV cutflow for selection mu_jets
events (normalised)
8 TeV cutflow
13 TeV cutflow
ratio

Images (3)

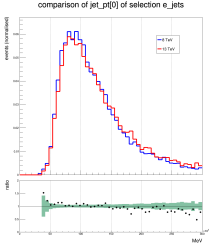


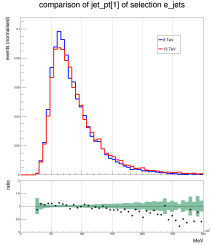


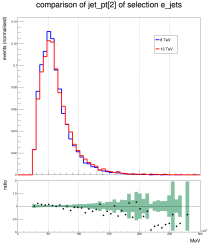


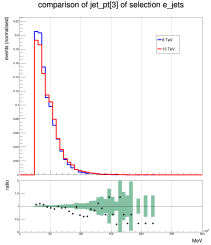
I3PD+SV1: https://indico.cern.ch/event/387410/contribution/9/material/slides/0.pdf

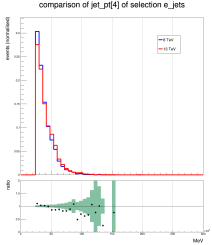
Images (6)

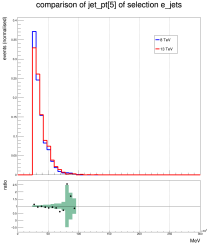

comparison of jet_pt[0] of selection e_jets
8 TeV
13 TeV
events (normalized)
ratio
MeV


comparison of jet_pt[1] of selection e_jets
8 TeV
13 TeV
events (normalized)
ratio
MeV


comparison of jet_pt[2] of selection e_jets
8 TeV
13 TeV
events (normalized)
ratio
MeV

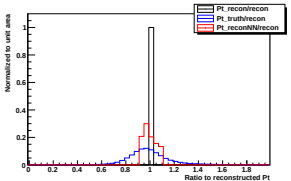

comparison of jet_pt[3] of selection e_jets
8 TeV
13 TeV
events (normalized)
ratio
MeV


comparison of jet_pt[4] of selection e_jets
8 TeV
13 TeV
events (normalized)
ratio
MeV

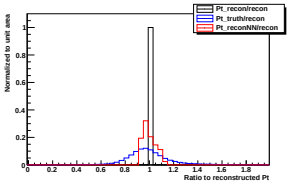

comparison of jet_pt[5] of selection e_jets
8 TeV
13 TeV
events (normalized)
ratio
MeV

Images (4) with titles

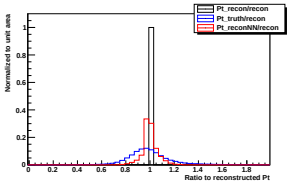
40 epochs:



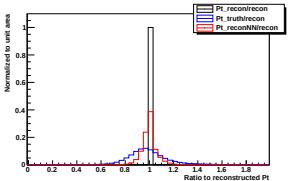
100 epochs:



145 epochs:



300 epochs:



$M_{b\bar{b}}$ resolutions for $VH_{b\bar{b}}$ for progressively decreasing MET energy cut requirements for various neural networks, shown to 3 significant figures:

Selection	Events	NN0	NN1	NN2	NN3
$VH_{b\bar{b}}$	23686	0.133	0.129	0.131	0.131
$VH_{b\bar{b}} + \text{MET} < 100$ GeV	22654	0.132	0.130	0.129	0.131
$VH_{b\bar{b}} + \text{MET} < 70$ GeV	21094	0.131	0.128	0.129	0.129
$VH_{b\bar{b}} + \text{MET} < 40$ GeV	15050	0.128	0.126	0.126	0.126
$VH_{b\bar{b}} + \text{MET} < 20$ GeV	6174	0.130	0.127	0.126	0.127

Here, the physical processes are ranked according to the effectiveness of the corresponding behaviour they induce in NN3, where a greater effectiveness is taken to mean a smaller resolution value. *Caveat:* Systematic uncertainties are not given their due consideration.

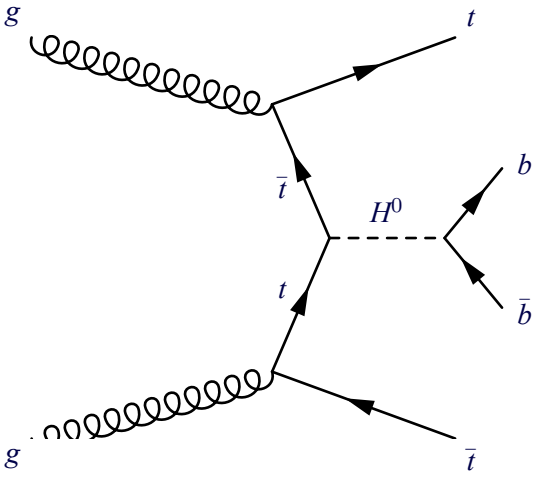
Selection	Events	NN0	NN1	NN2	NN3
$VH_{b\bar{b}} + \text{MET} > 100$ GeV	1032	0.121542	0.129038	0.13072	0.116975
$VH_{b\bar{b}} + \text{MET} < 40$ GeV	15050	0.128387	0.125939	0.125637	0.125963
$VH_{b\bar{b}} + \text{MET} < 20$ GeV	6174	0.129539	0.127454	0.126029	0.127043
$VH_{b\bar{b}} + \text{MET} < 70$ GeV	21094	0.131248	0.128119	0.128908	0.128825
$VH_{b\bar{b}} + \text{MET} < 100$ GeV	22654	0.132004	0.129924	0.129095	0.130467
$VH_{b\bar{b}}$	23686	0.132823	0.129032	0.131202	0.131303
$VH_{b\bar{b}} + \text{MET} > 20$ GeV	17512	0.135974	0.13137	0.13366	0.132341
$VH_{b\bar{b}} + \text{MET} > 40$ GeV	8636	0.140116	0.135415	0.140013	0.140551
$VH_{b\bar{b}} + \text{MET} > 70$ GeV	2592	0.143505	0.15228	0.151469	0.155914

$m_{b\bar{b}}$ resolution results (Gaussian fit) for training with epochs of interest:

		Epochs			
		40	100	145	300
Subset	Training	0.137	0.138	0.138	0.138
	Training test	0.139	0.139	0.139	0.139

Comparison of $m_{b\bar{b}}$ resolutions for various channels both excluding and including the MET variable with various epochs:

Number of epochs		$l\nu bb$	$llbb$	$\nu\nu bb$	all
50	Without MET	0.135159	0.138616	0.135159	0.137488
	With MET	0.130047	0.137266	0.136842	0.138516
	Change	-3.78%	-0.97%	+1.24%	+0.75%
100	Without MET	0.134537	0.138781	0.13656	0.13743
	With MET	0.129719	0.137265	0.136247	0.138948
	Change	-3.58%	-1.09%	-0.22%	+1.1%
150	Without MET	0.13676	0.138464	0.137943	0.13747
	With MET	0.138292	0.137261	0.137344	0.138948
	Change	+1.12%	-0.87%	-0.43%	+1.07%
500	Without MET	0.139041	0.139451	0.13849	0.13827
	With MET	0.139225	0.137261	0.136398	0.138948
	Change	+0.13%	+1.6%	-1.51%	-0.48%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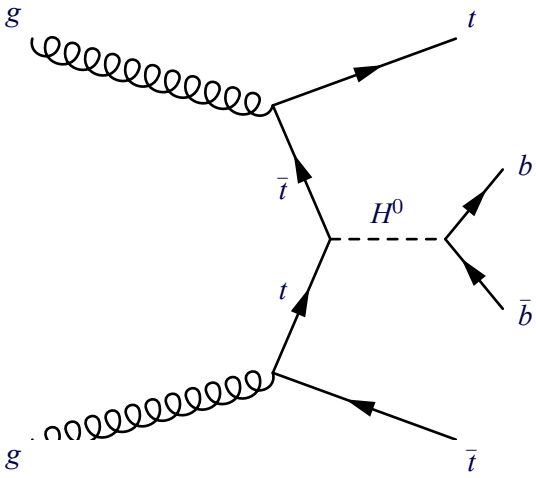

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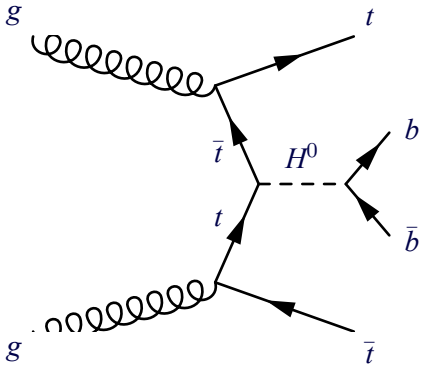
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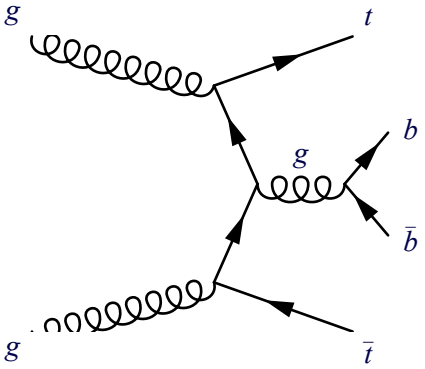
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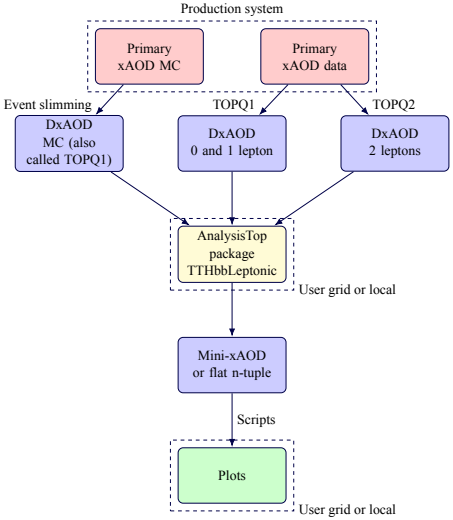
TikZ picture



Fim