

QUICK UPDATE

8 TeV–13 TeV comparisons

G. Aad et. al. [Number 6](#), Number 1

University of Glasgow

2016-09-14



University
of Glasgow | Experimental
Particle Physics

a single, big image



an animated image (compatible with Adobe Reader)

a video (compatible with Okular)



itemized list

- item
- item
 - subitem
 - subitem
 - subitem
- item
- item

enumerate list

- 1 item
- 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

links

- URL: <http://info.cern.ch/hypertext/WWW/TheProject.html>
- hyperlink: TheProject
- hyperlink: ATL-COM-PHYS-2014-1471

mathematics

- $H^+ \rightarrow tb$
- lepton p_T and η

mathematics

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.

emoticons

- smiley: 😊
- frownie: 😞
- neutralie: 😐

centered text

some centered text

some more centered text

blocks

block 1

item
item

block 2

item
item

columns (2)

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multiple columns (2)

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multiple columns (4)

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positioning by textblock

- item 1
- item 2
- item 3

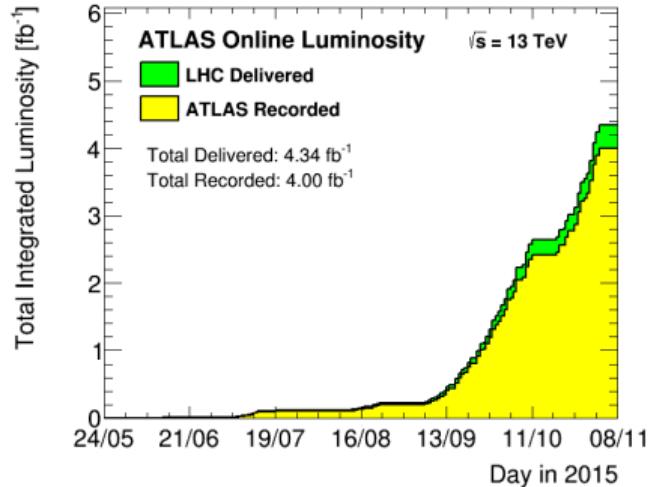
- item 1
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- item 3

- item 1
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- item 3

- item 1
- item 2
- item 3

positioning by textblock

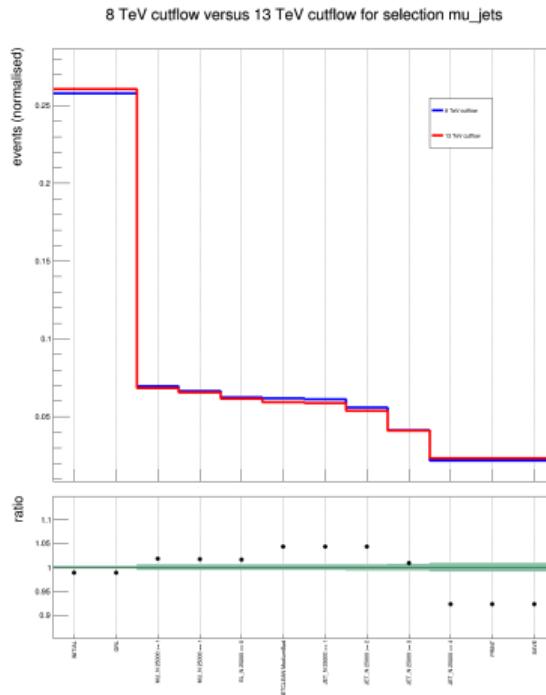
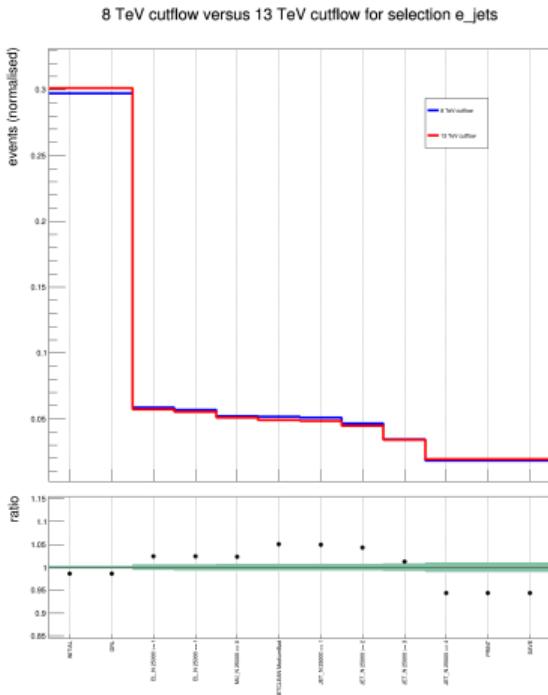
- suppressed with respect to other Higgs modes
- $H \rightarrow b\bar{b}$ has the largest branching ratio (0.577 for m_H 125 GeV)
- irreducible background from $t\bar{t}b\bar{b}$
- other backgrounds: $t\bar{t}$ production in association with light quarks (u, d, s) or gluon jets (called $t\bar{t} + \text{light}$),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



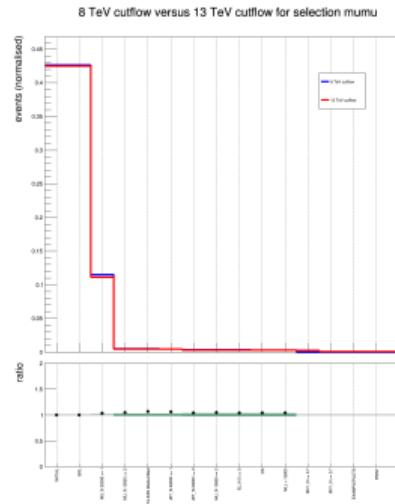
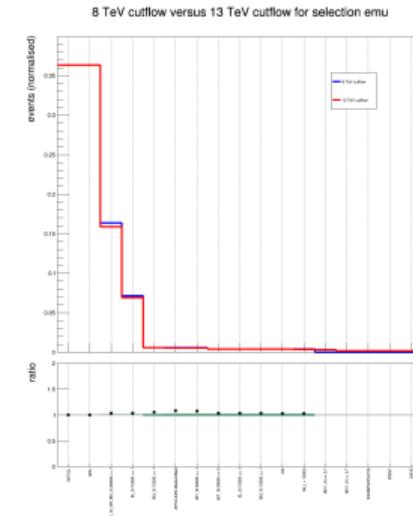
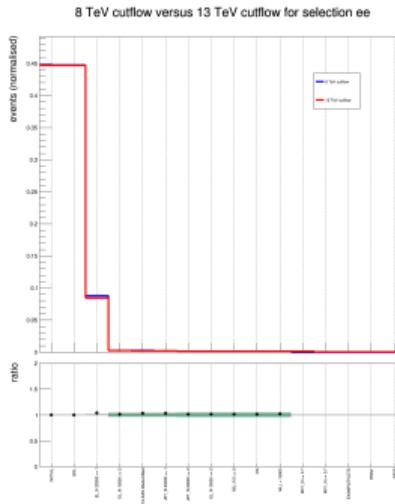
\sqrt{s} (TeV)	7	8	13	14
$t\bar{t}H$ ($m_H = 125$ GeV) (pb)	0.086	0.130	0.5085	0.611
$t\bar{t}$ (pb)	177	253	832	950
S/\sqrt{B}	0.00646	0.0082	0.0176	0.0198

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

8 TeV vs. 13 TeV: cutflow for $l + \text{jets}$

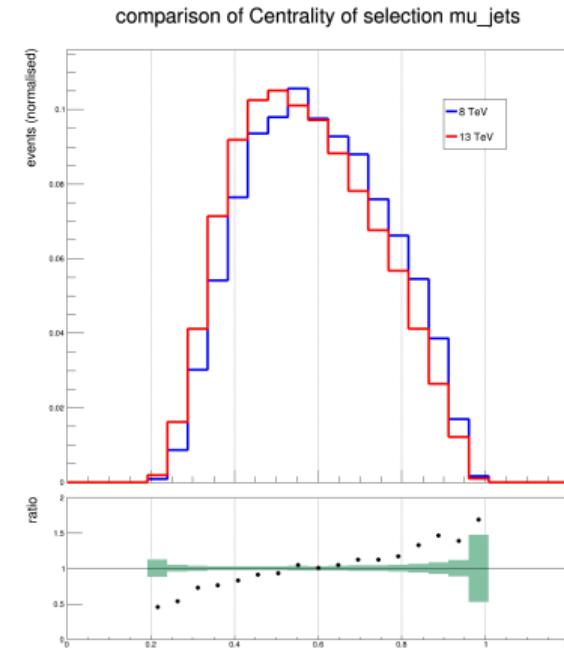
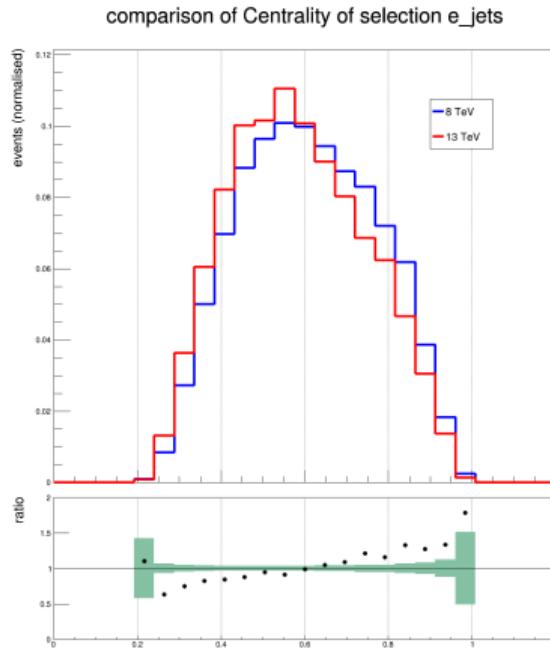


8 TeV vs. 13 TeV: cutflow for dilepton

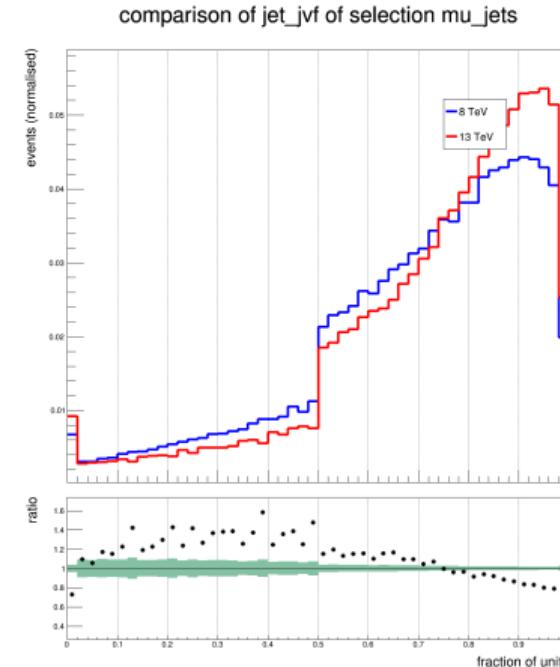
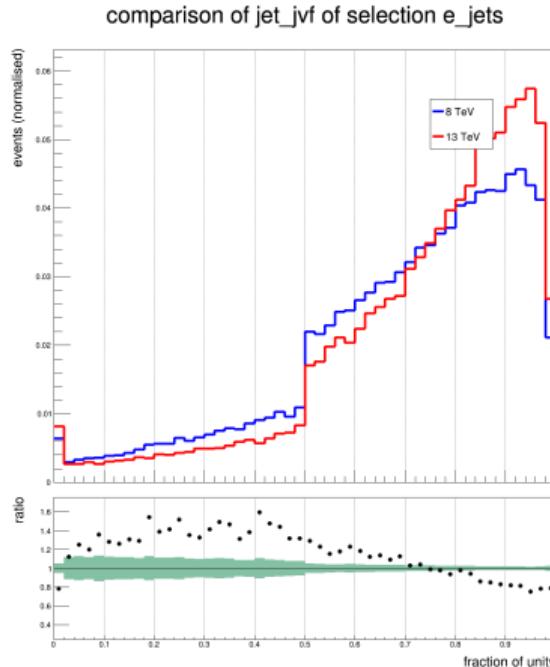


I3PD+SV1: <https://indico.cern.ch/event/387410/contribution/9/material/slides/0.pdf>

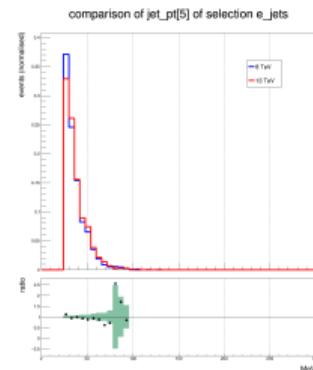
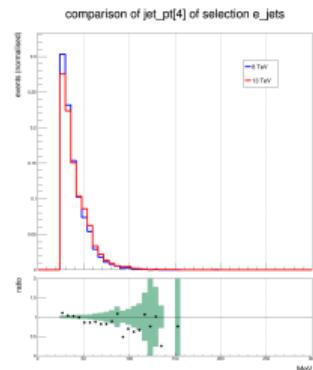
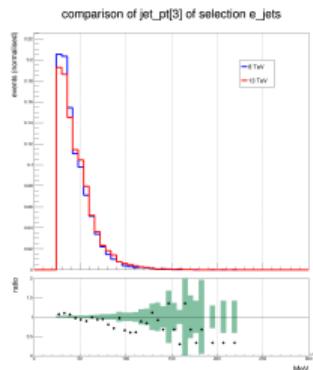
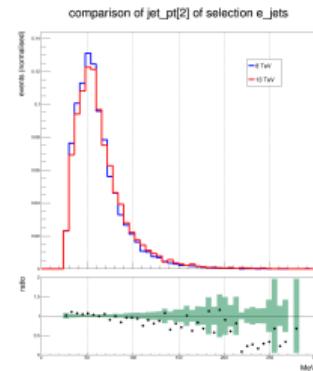
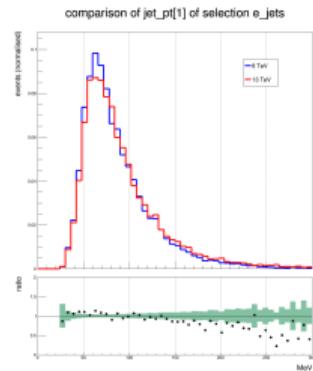
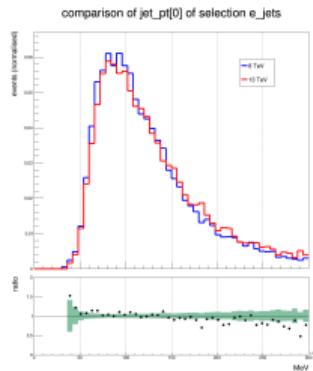
8 TeV vs. 13 TeV: centrality



8 TeV vs. 13 TeV: JVF

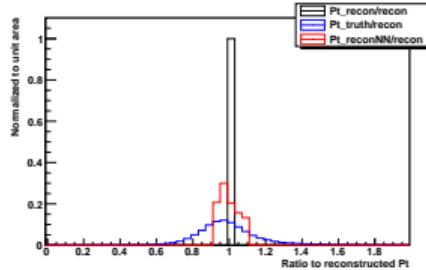


8 TeV vs. 13 TeV: subleading jets p_T of e selection

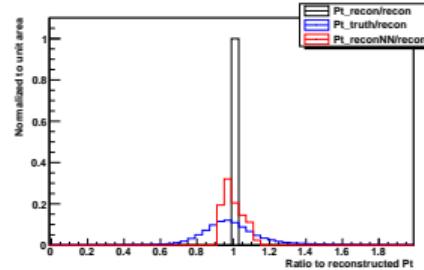


p_T ratio results for training with epochs of interest

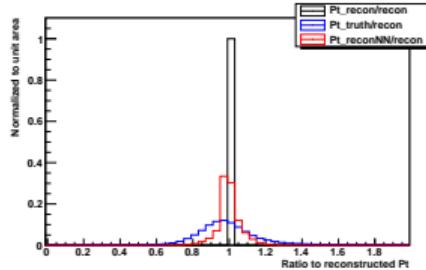
40 epochs:



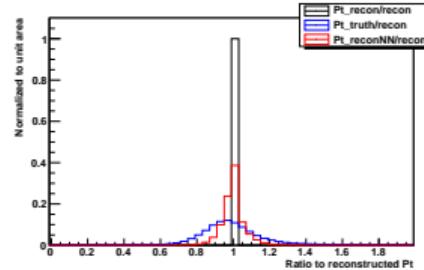
100 epochs:



145 epochs:



300 epochs:



neural networks and input variables

Four neural networks with progressively increasing input information were defined, all trained through 250 epochs (training cycles). NN0 comprises only the μ -in-jet and p_T -only NN corrections, as opposed to further NN corrections.

neural network designation	input variables
NN0	no new neural network applied
NN1	E_t , SumPtTrk, Width
NN2	E_t , SumPtTrk, Width, MET
NN3	E_t , SumPtTrk, Width, MET, METPhi, JetPhi

per-event $M_{b\bar{b}}$ resolutions with use of MET direction

$M_{b\bar{b}}$ 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
$VH_{b\bar{b}} + \text{MET} < 100 \text{ GeV}$	22654	0.132	0.130	0.129	0.131
$VH_{b\bar{b}} + \text{MET} < 70 \text{ GeV}$	21094	0.131	0.128	0.129	0.129
$VH_{b\bar{b}} + \text{MET} < 40 \text{ GeV}$	15050	0.128	0.126	0.126	0.126
$VH_{b\bar{b}} + \text{MET} < 20 \text{ GeV}$	6174	0.130	0.127	0.126	0.127

per event $M_{b\bar{b}}$ resolutions with use of MET direction

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

$m_{b\bar{b}}$ value results for training with epochs of interest

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

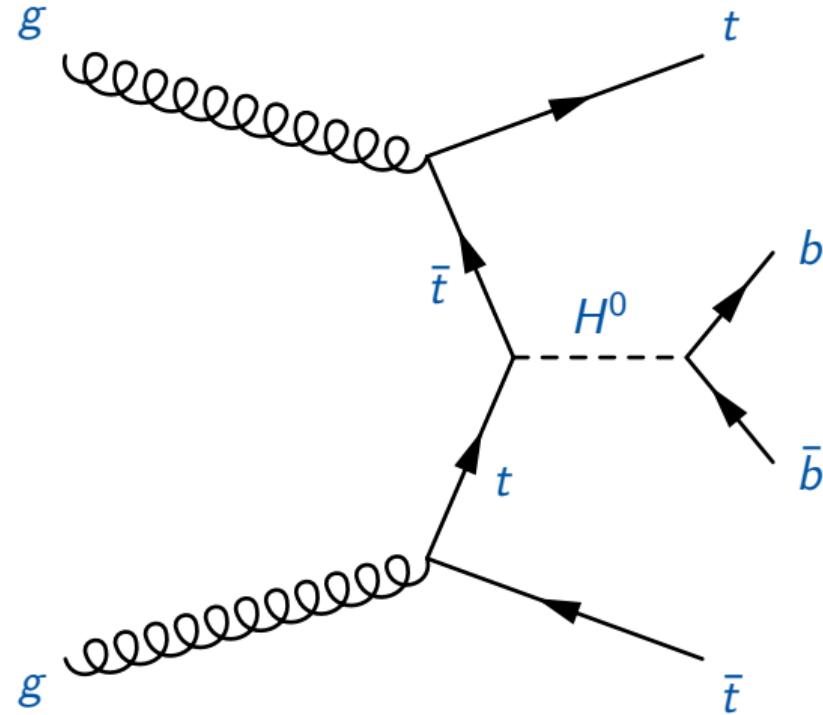
subset		epochs			
		40	100	145	300
	training	0.137	0.138	0.138	0.138
	training test	0.139	0.139	0.139	0.139

$m_{b\bar{b}}$ resolutions with and without MET

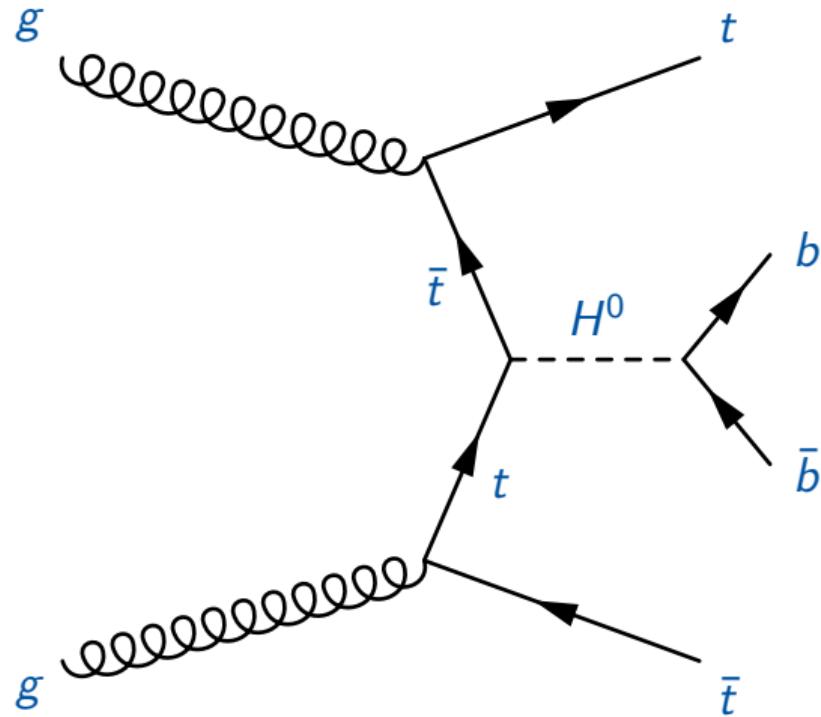
comparison of $m_{b\bar{b}}$ resolutions for various channels both excluding and including the MET variable with various epochs:

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%

Feynman diagram

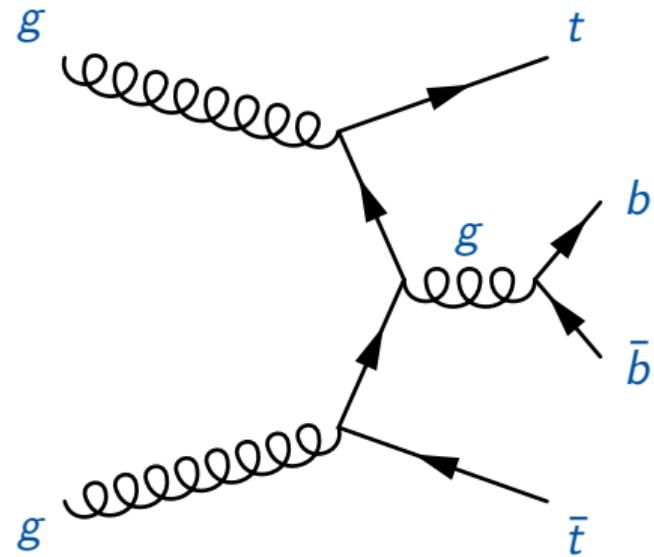
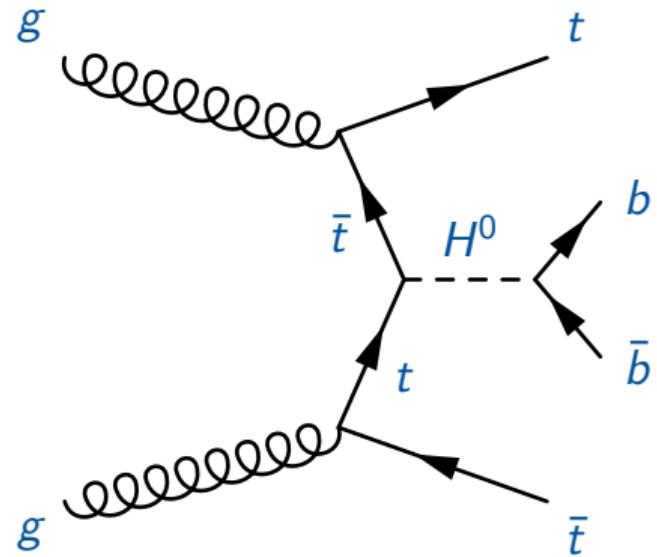


Feynman diagram with text



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lis pretium.

Feynman diagrams



embedded data

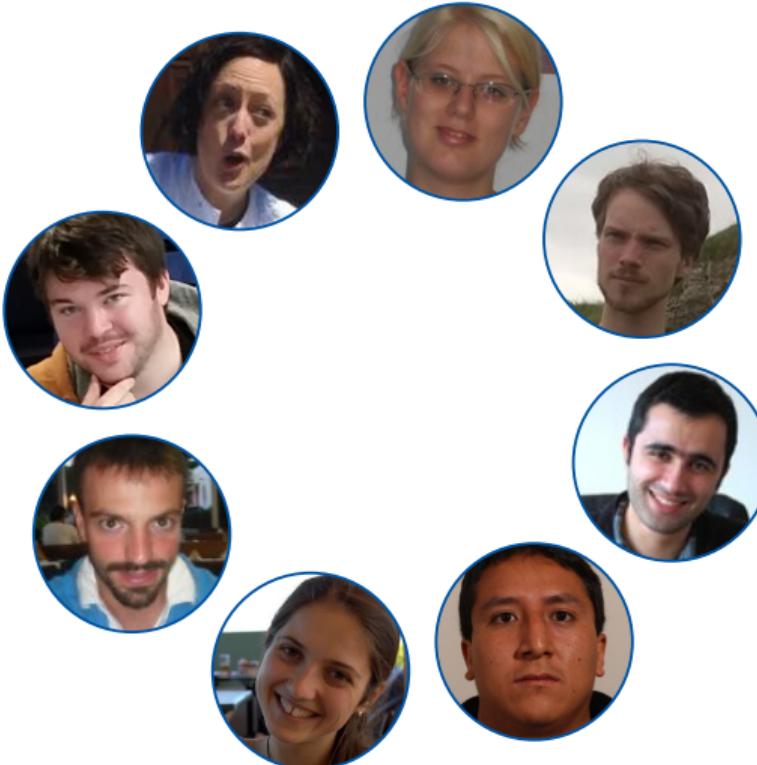
The following is an embedded data file:



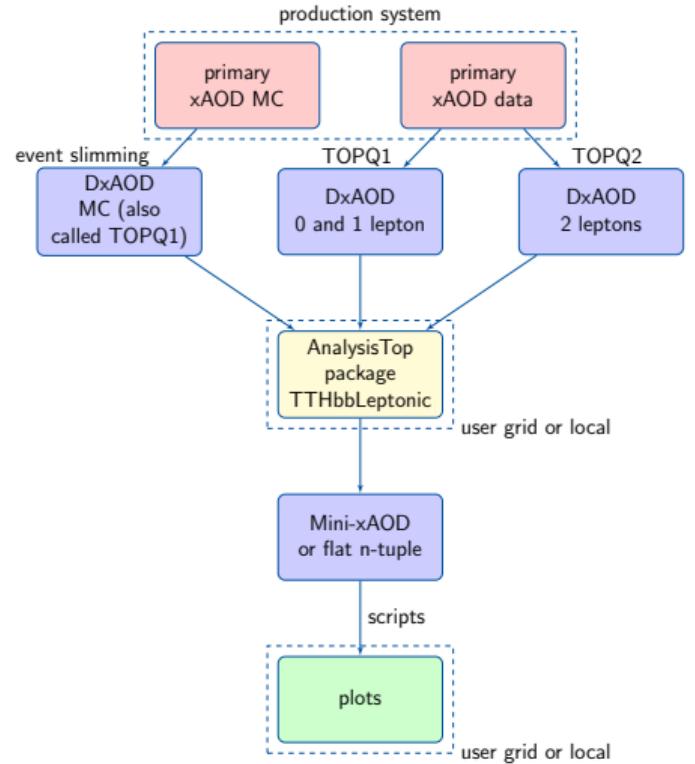
The following is an embedded sound file:



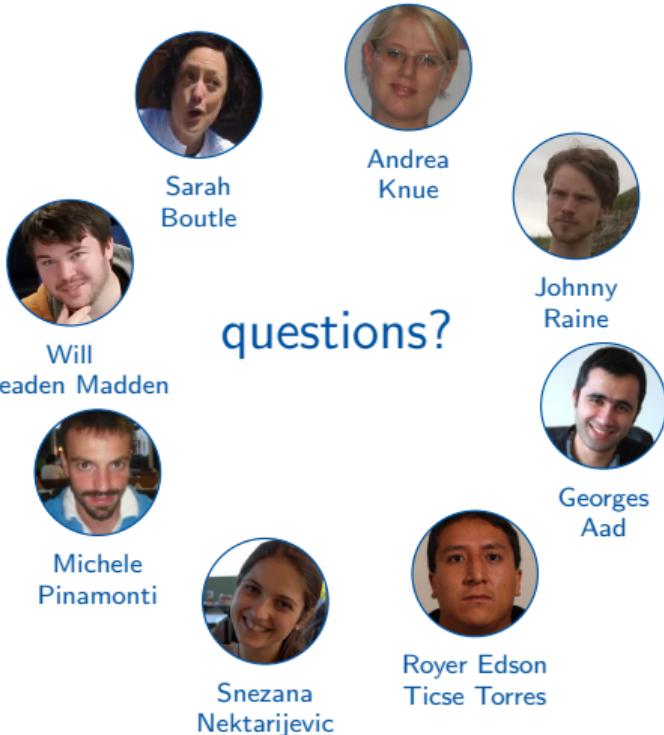
TTHbbLeptonic development team



analysis framework



questions?



END