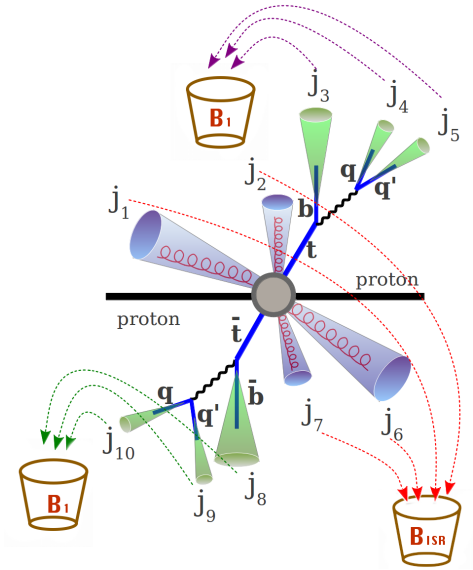
Buckets of tops algorithm: C++ version update



source: https://tinyurl.com/y7uvbjre

Sourav Sen
Duke

BSM 4-tops discussion
September 10, 2018

Buckets of tops Algorithm[1] [code repo]

step 1 Complete top quark ('tw') bucket search

- distribute jets into two buckets, such that each has 1 b-jet and minimum $\Delta^2 = 100 * \Delta^2_{B1} + \Delta^2_{B2}$, $\Delta_{B1(2)} = |m_{B1(2)} - m_{top}|$
- if bucket mass not within (155 GeV, 200 GeV) then 't0'
- if $|\frac{m_{any\ \ jet\ \ pair}}{m_{B_i}} - \frac{m_W}{m_{top}}| < 0.15$ then 'tw' else proto-'t-'

step 2 Incomplete top quark ('t-') bucket search

- exclude all jets in 'tw' buckets
- if event has one proto-'t-' bucket, find the b-jet quark-jet pair with minimum Δ^{bj}_B, where:

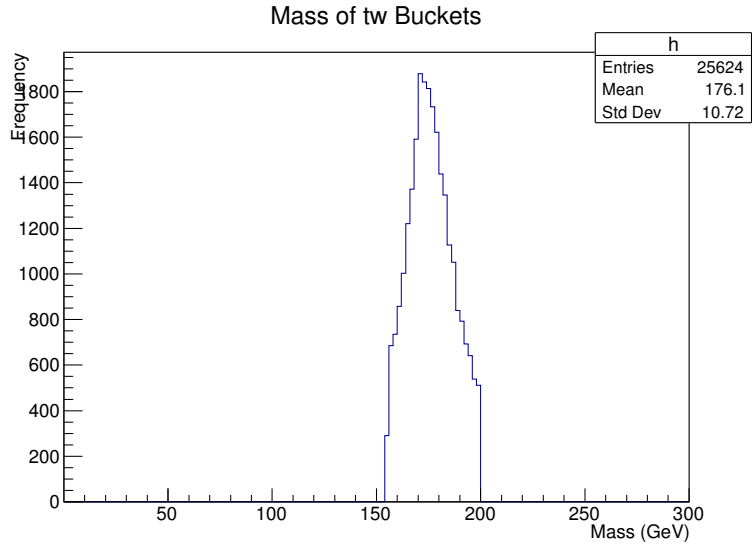
$$\Delta^{bj}_B = \begin{cases} |m_B - 145| & \text{if } m_B < 155 \text{ GeV} \\ 0 & \text{else} \end{cases}$$

- if event has two proto-'t-' buckets, find two b-jet quark-jet pairs with minimum $\Delta^{bj}_{B1} + \Delta^{bj}_{B2}$
- if bucket mass within (75 GeV, 155 GeV) then 't-' else 't0'
- any leftover jet is put in extra bucket 'tX'

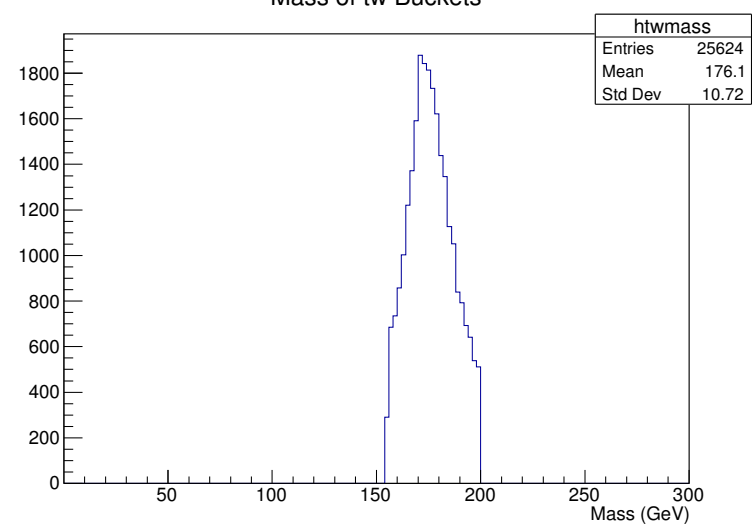
[1] ATL-COM-PHYS-2016-1496

bbjjj comparison

version	tw	t-	t0	tX
python	25624	7132	124459	92077
C++	25624	7132	124459	92077



Chongbin(python)



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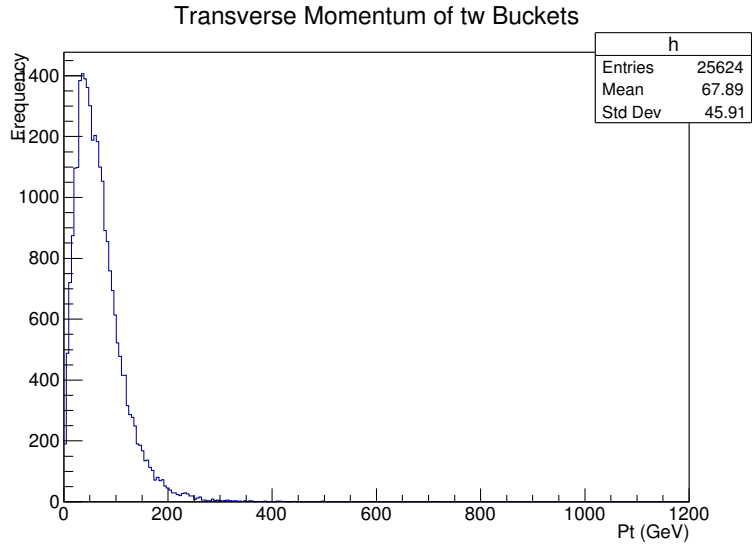

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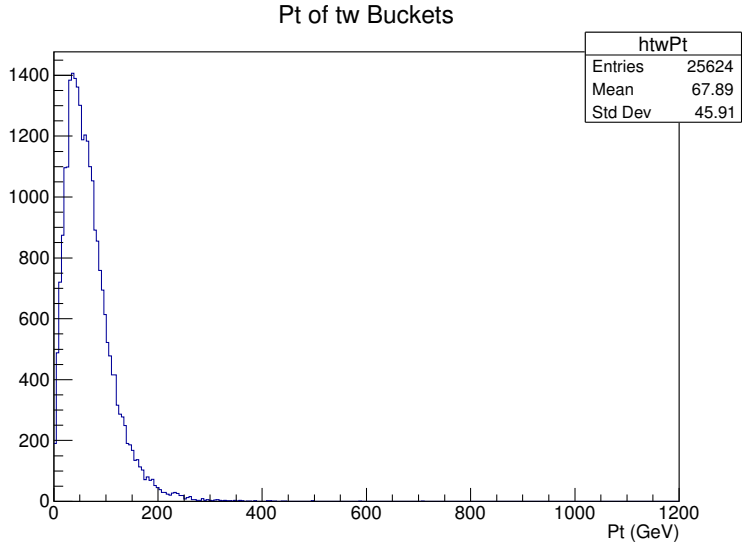

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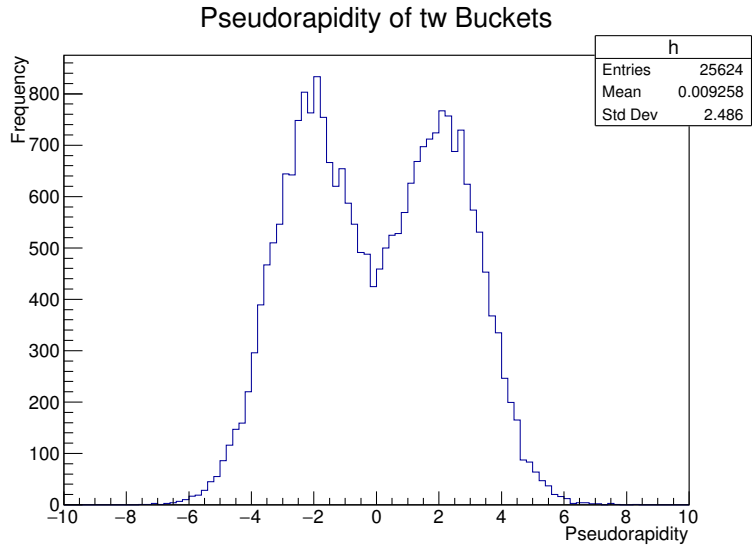

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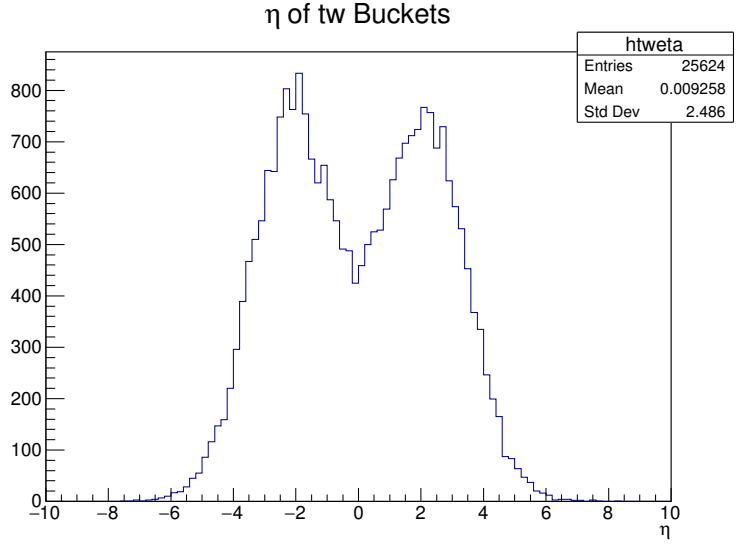

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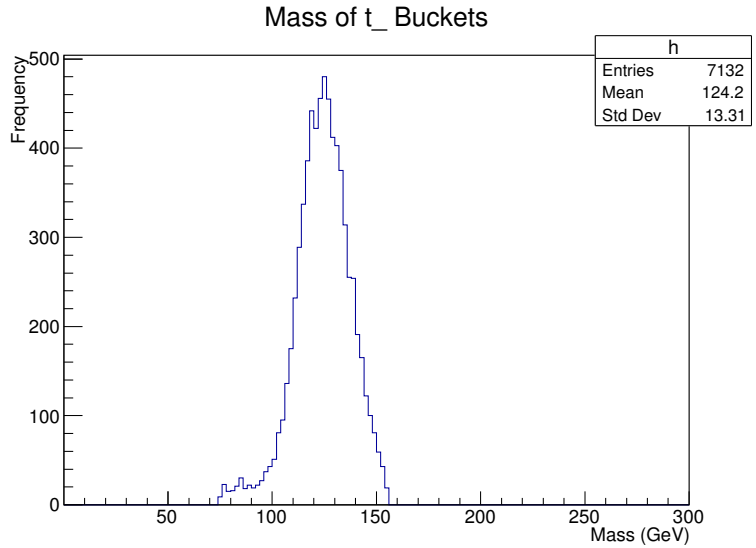

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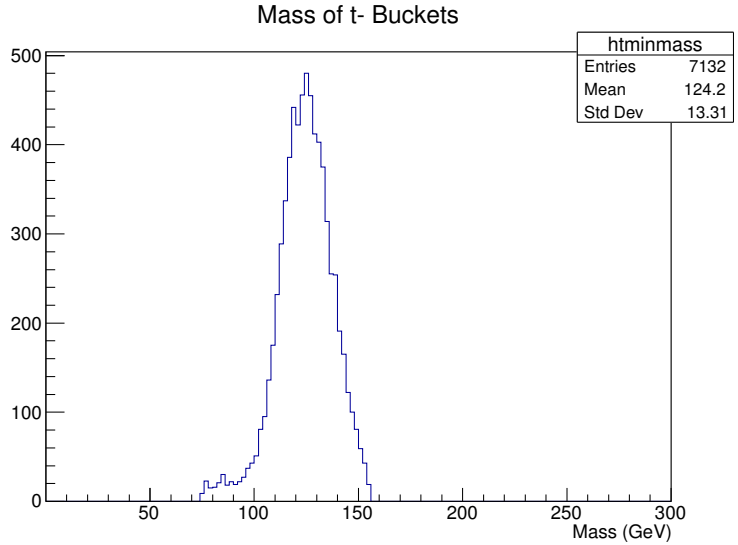

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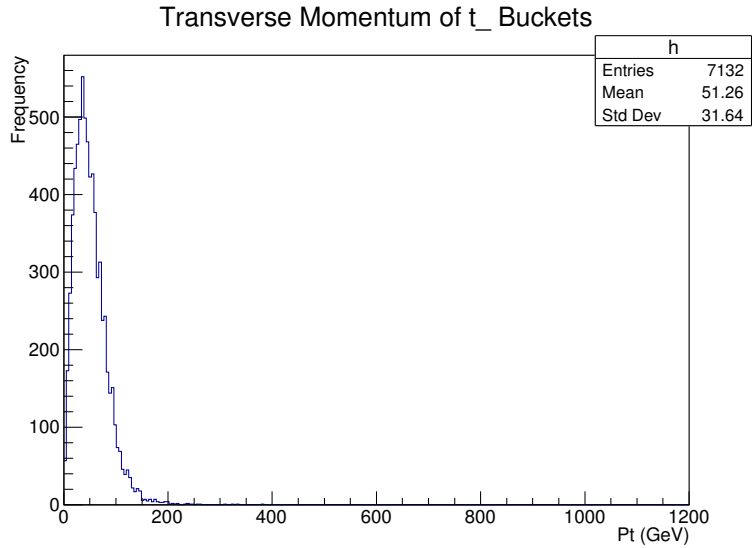

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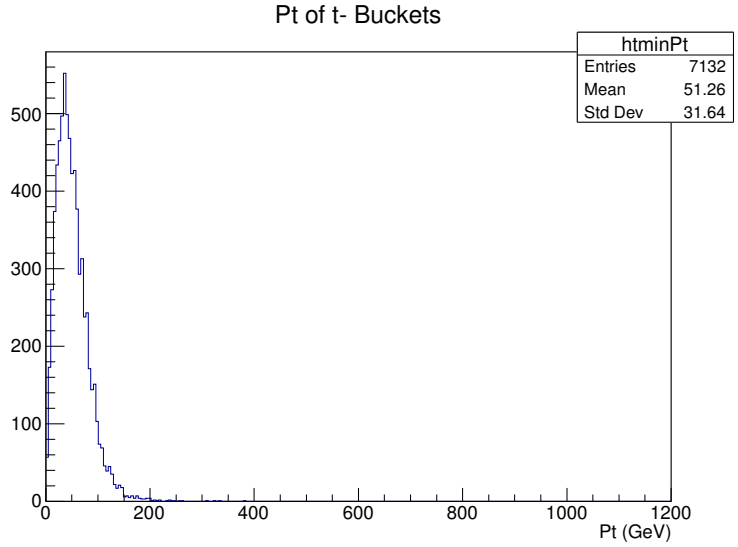

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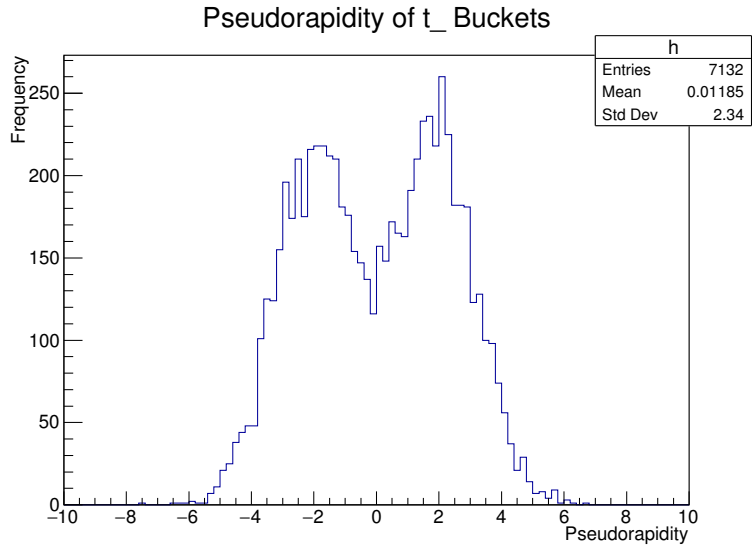

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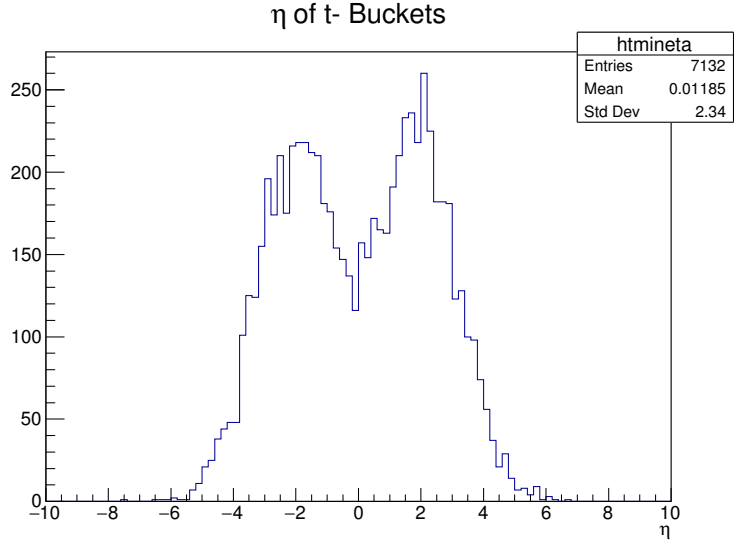

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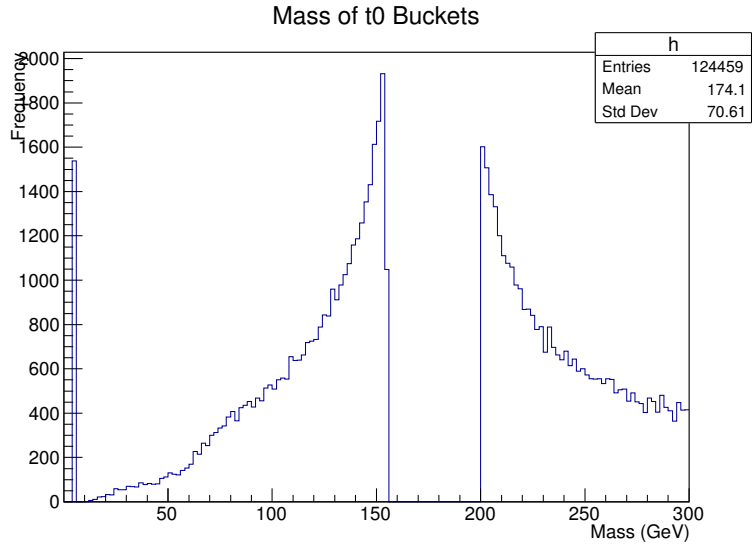

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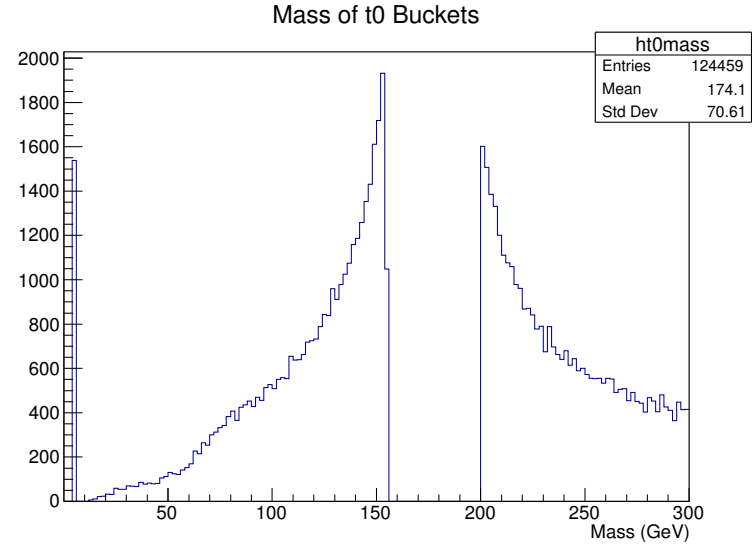

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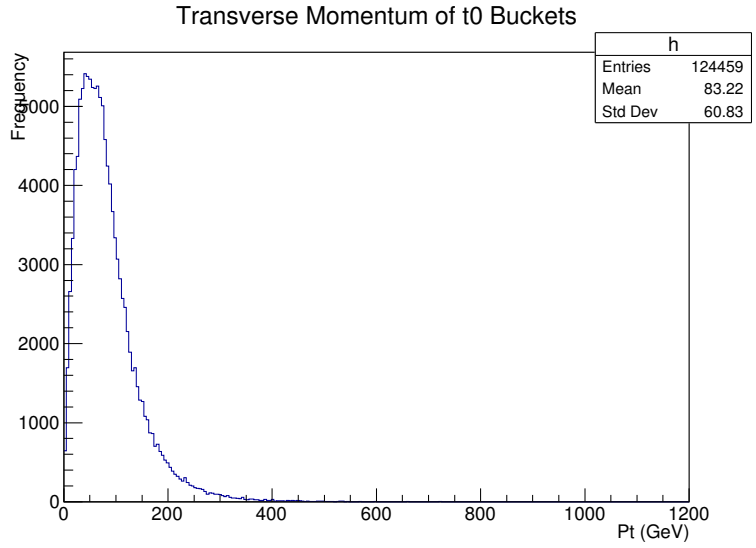

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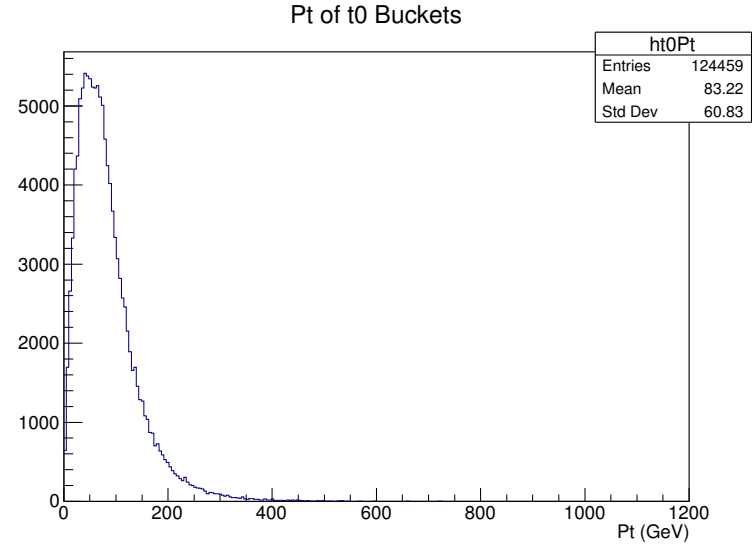

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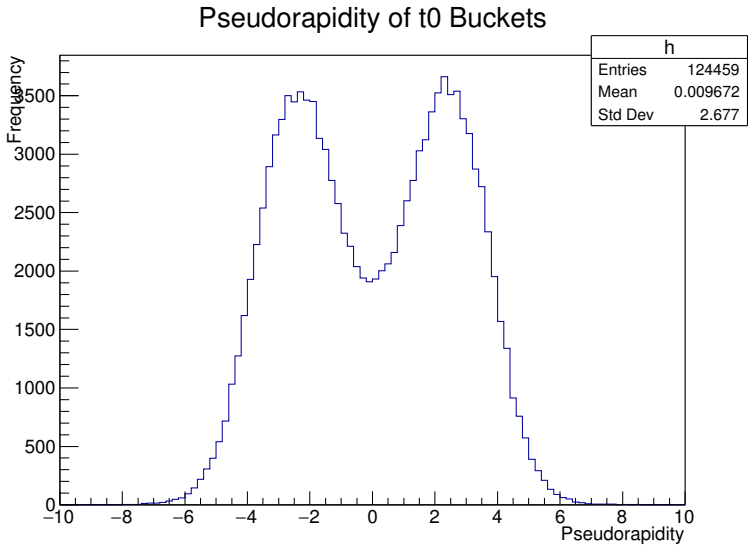

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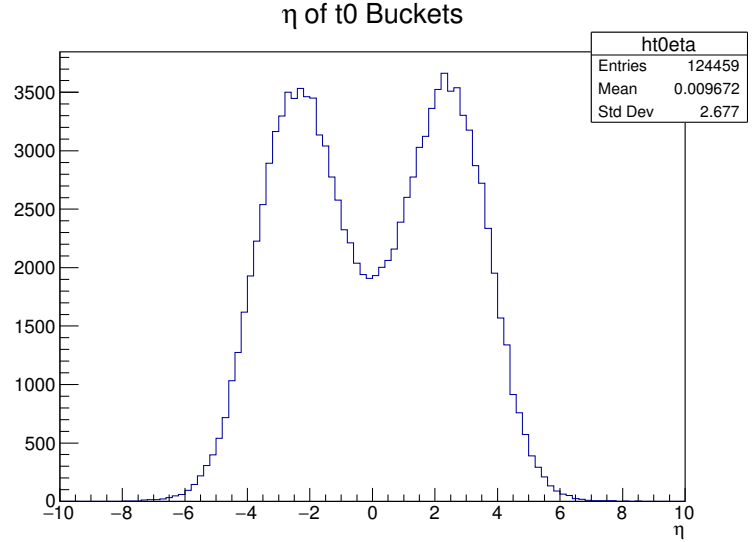

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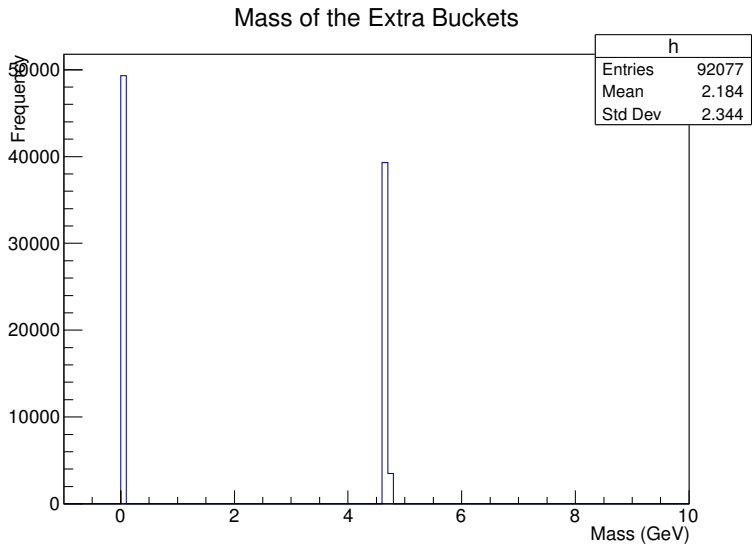

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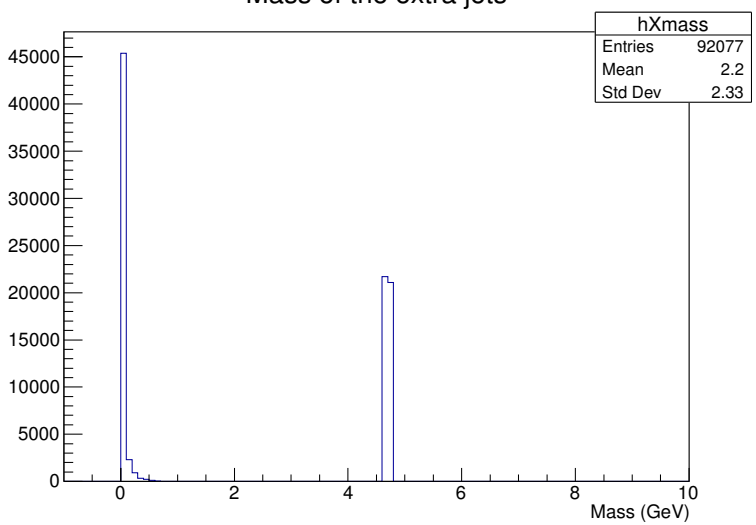

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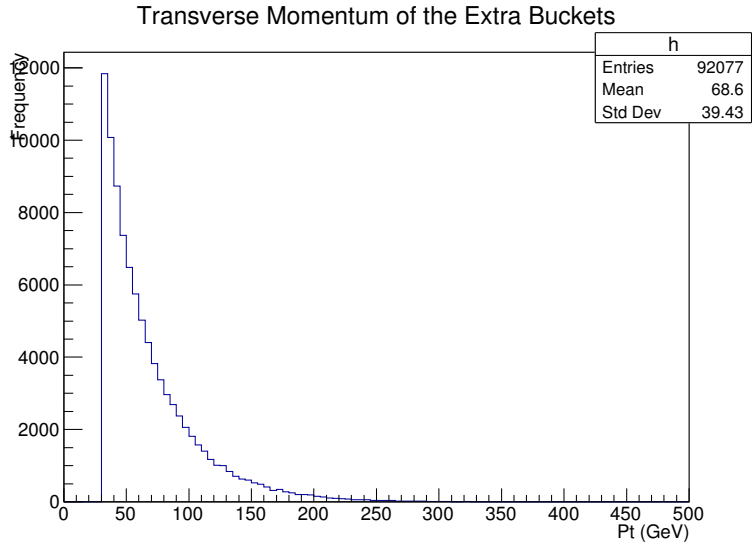

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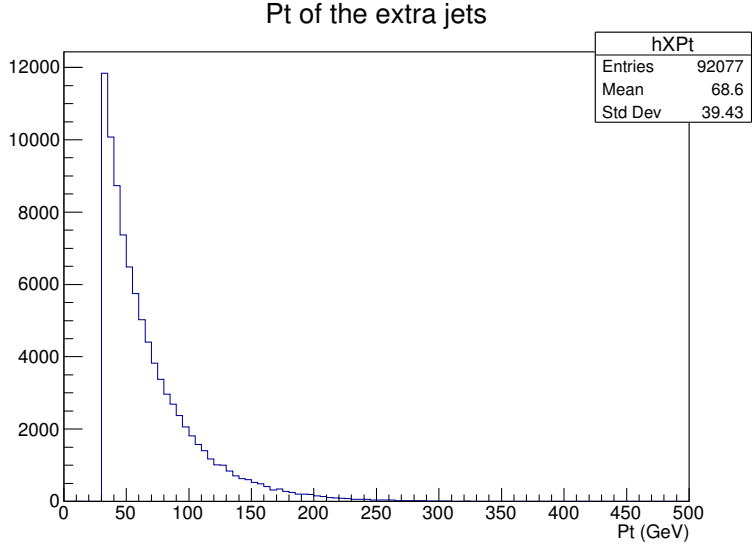

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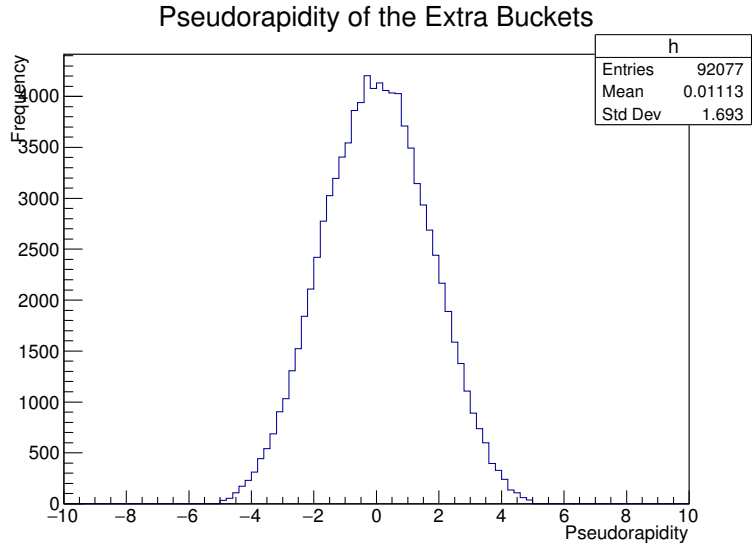

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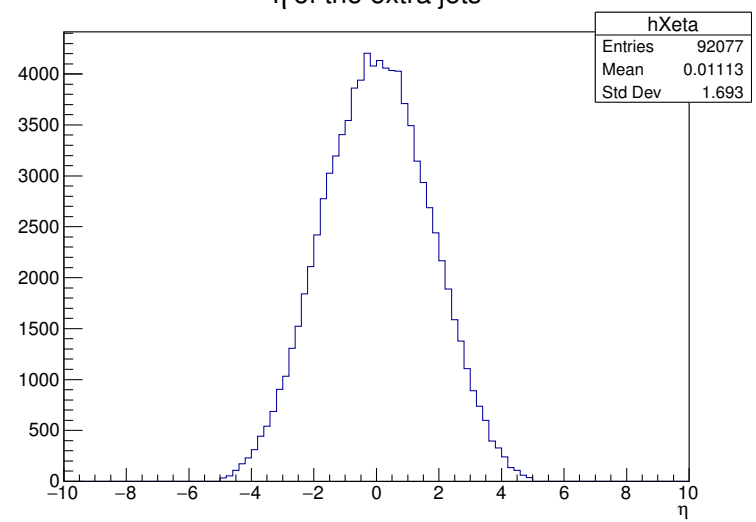

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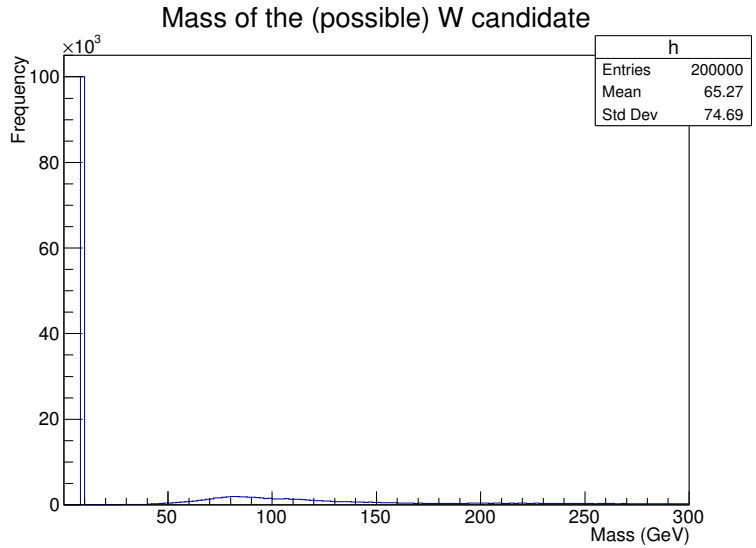

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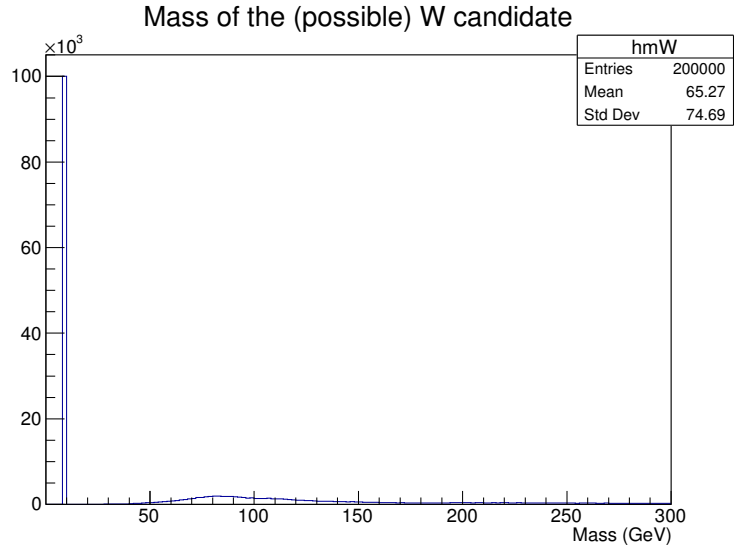

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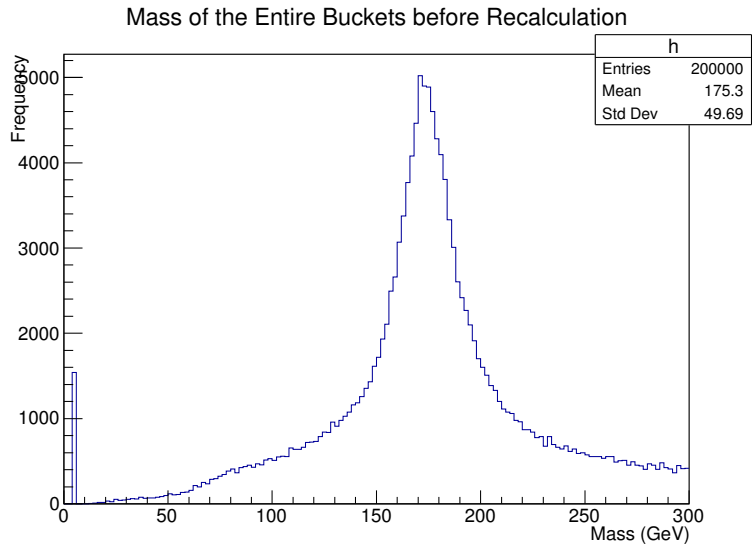

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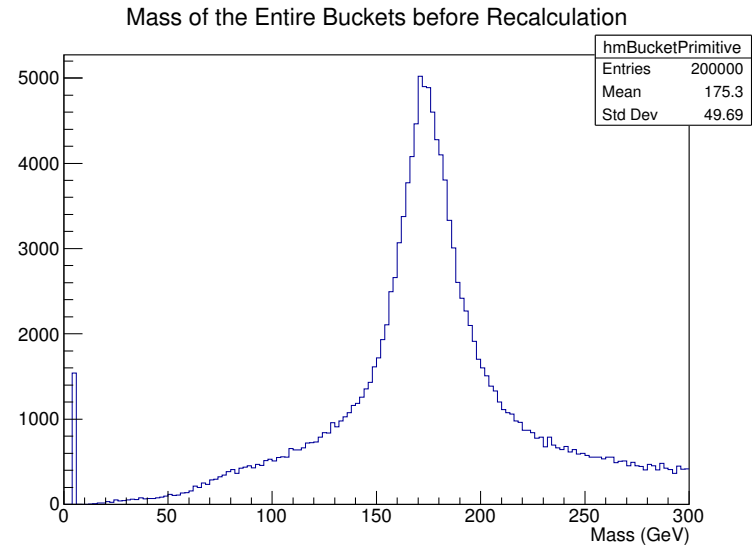

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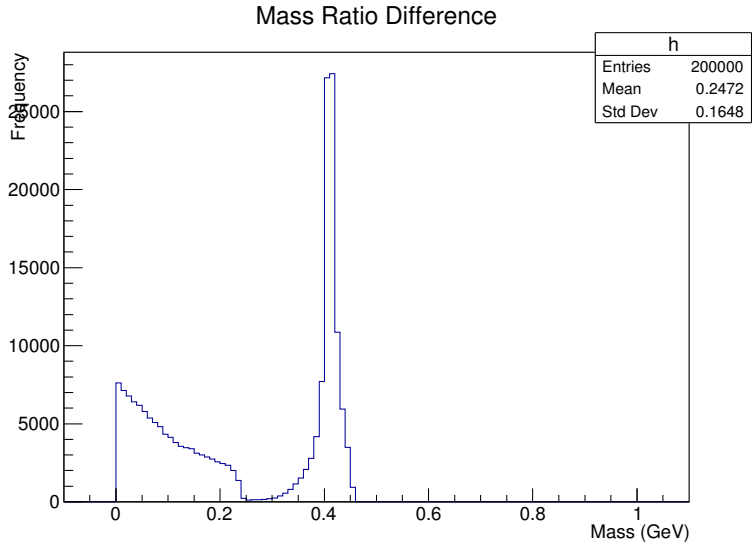

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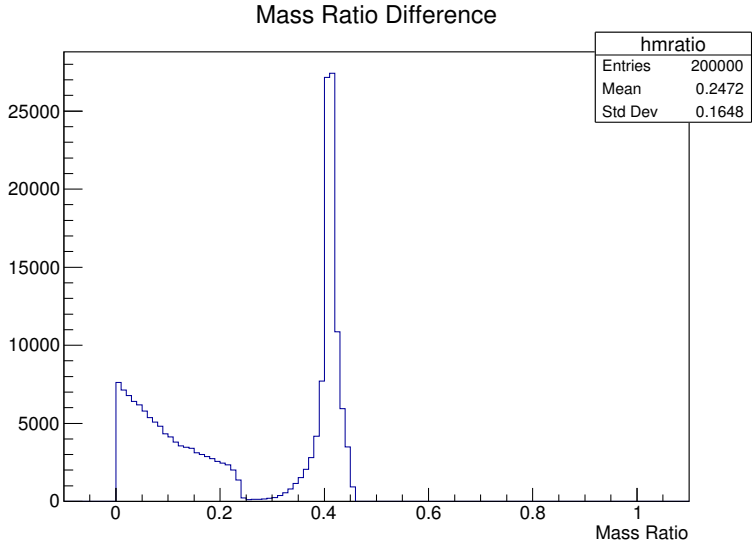
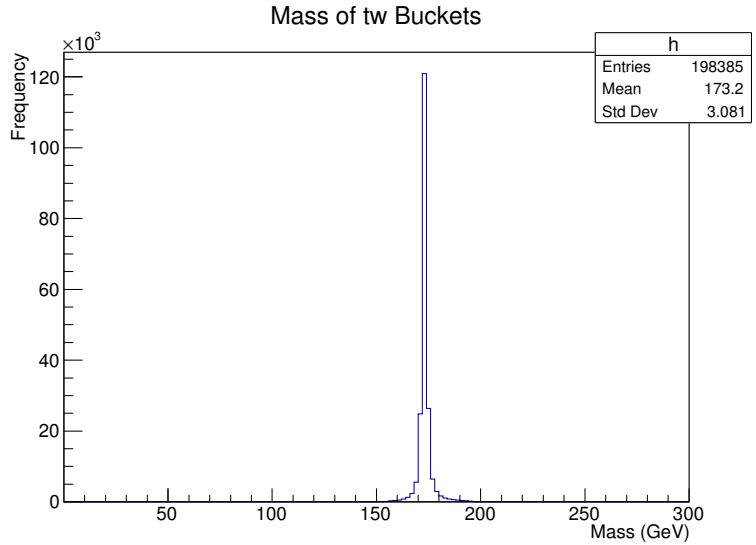


C++

ttbar comparison

version	tw	t-	t0	tX
python	198385	1040	467	1262
C++	198385	1040	467	1262



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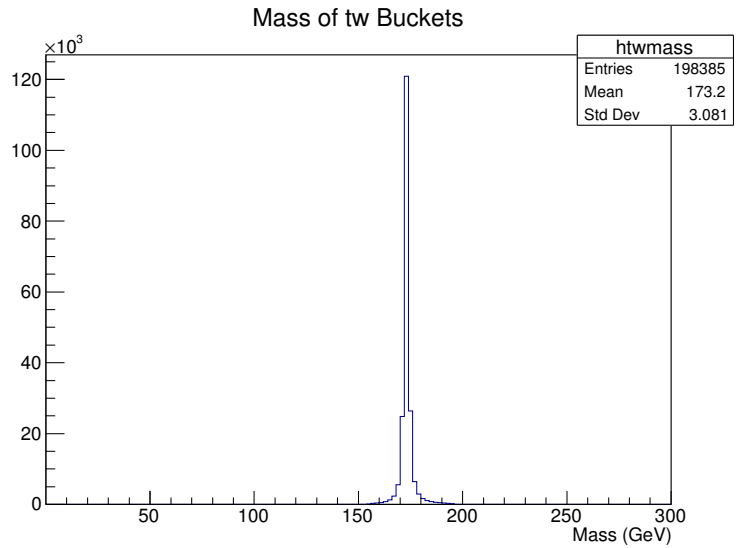

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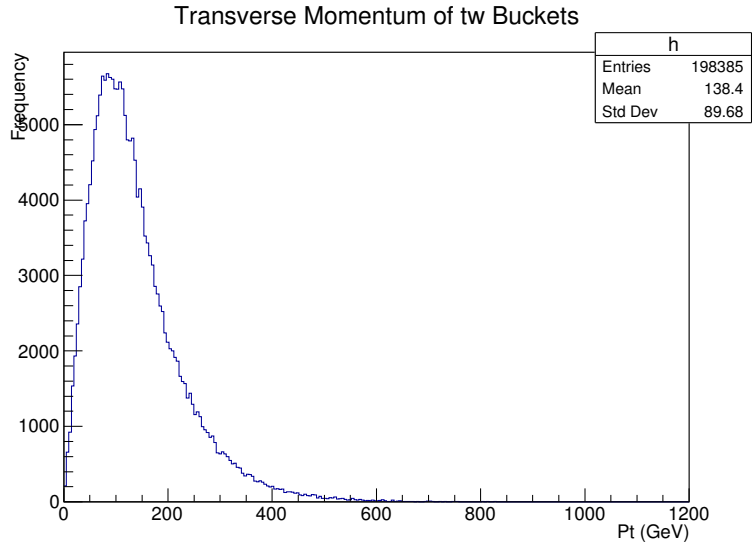

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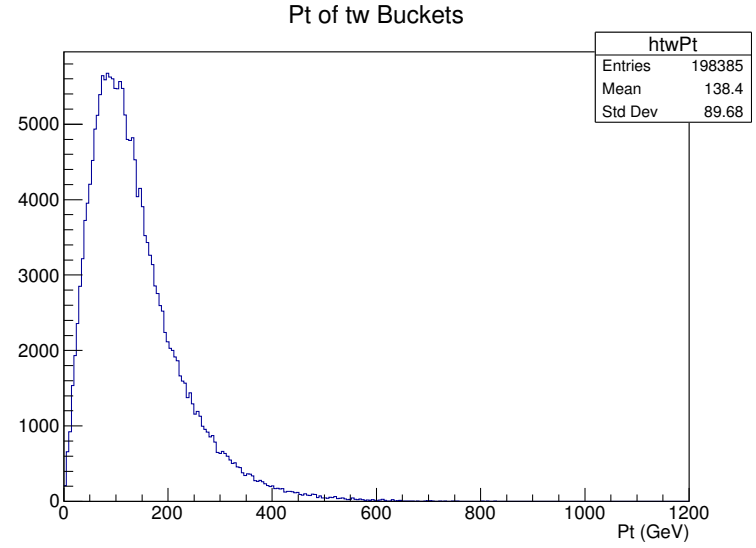

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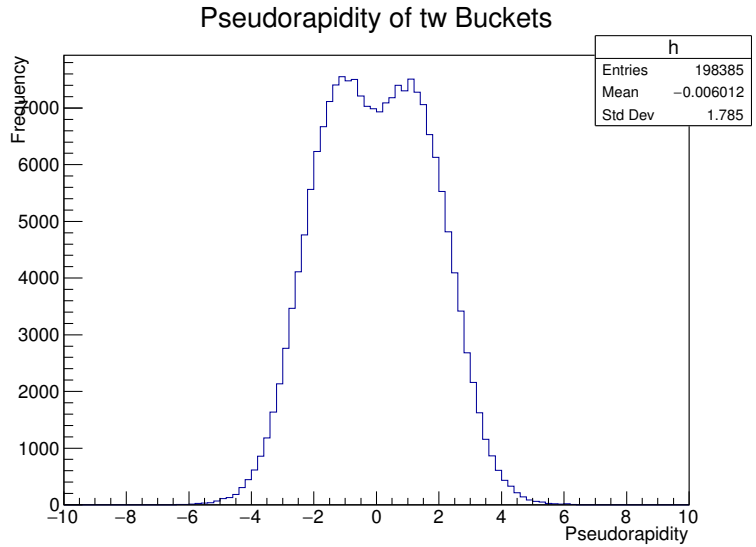

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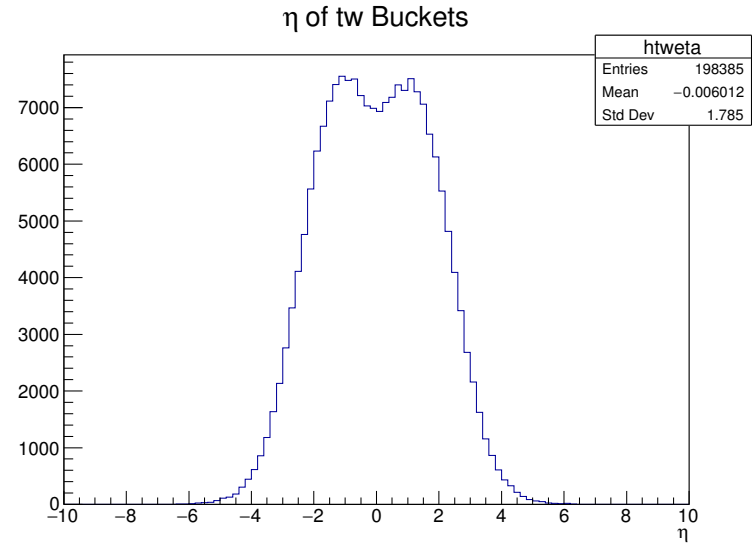

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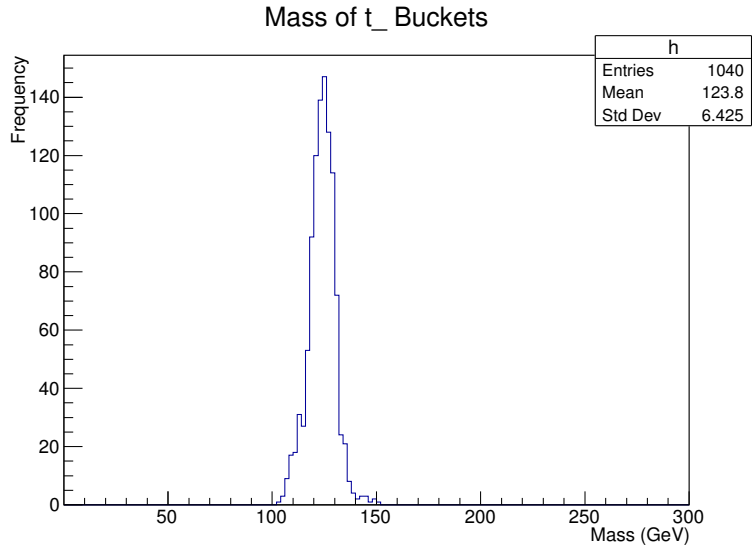

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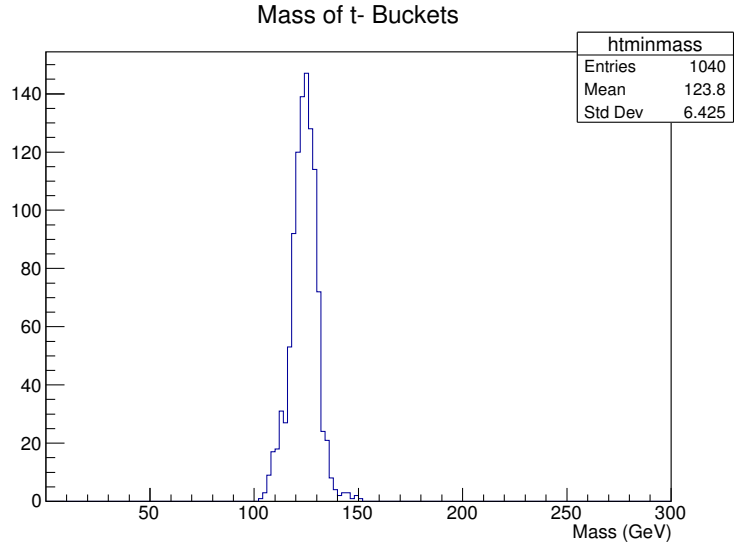

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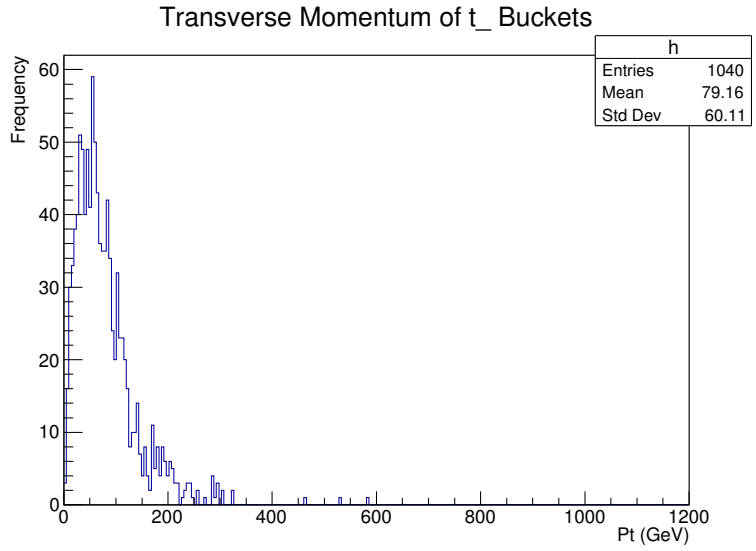

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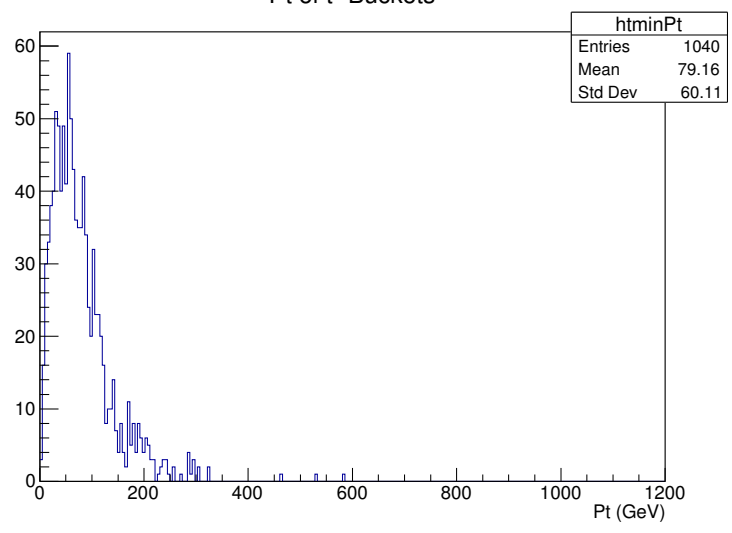

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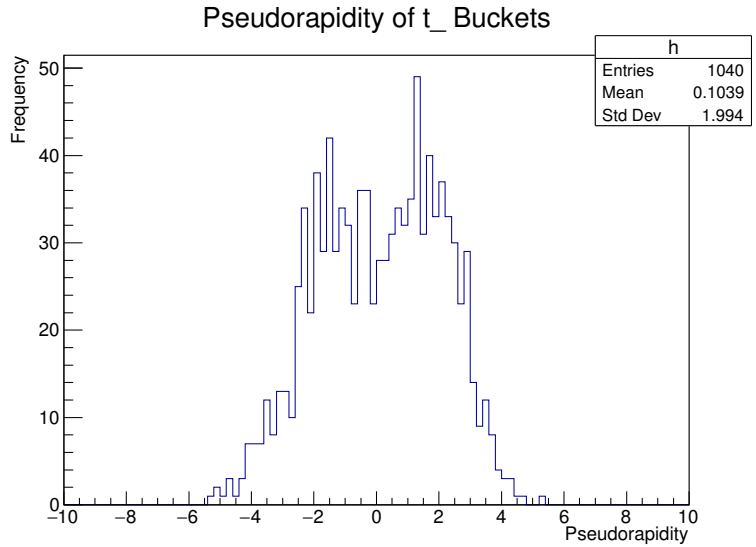
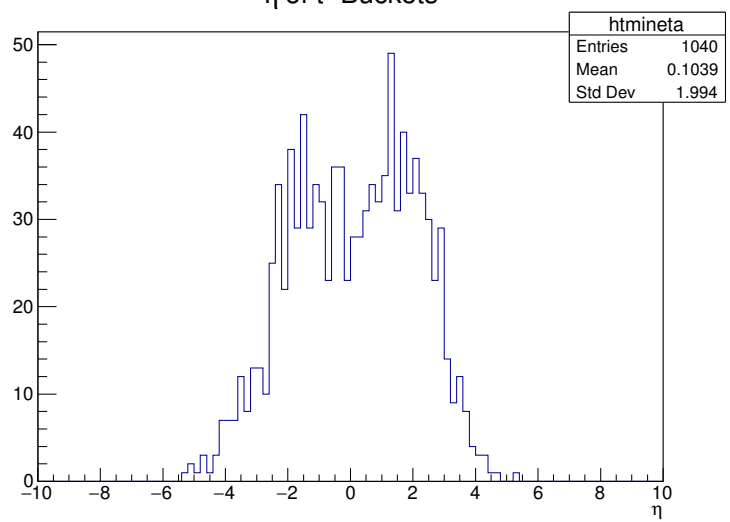


Chongbin(python)



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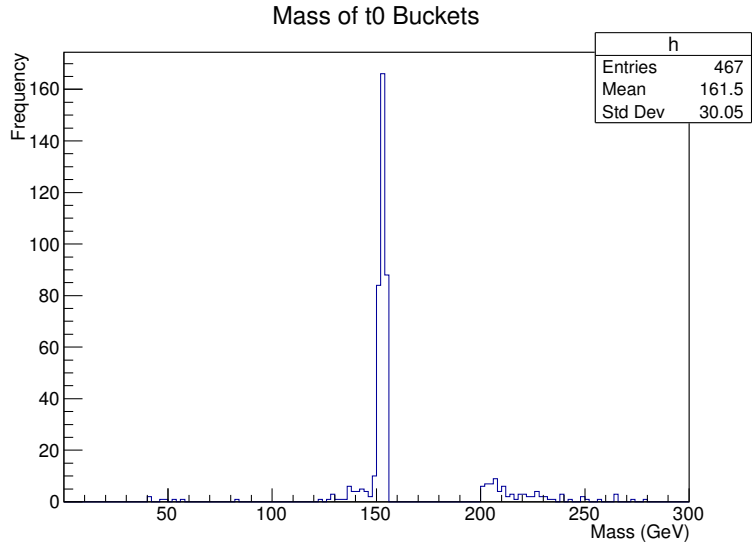

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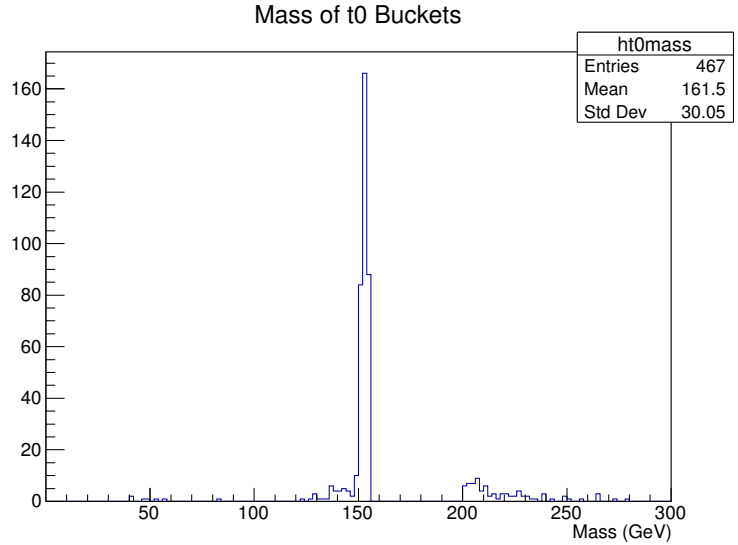

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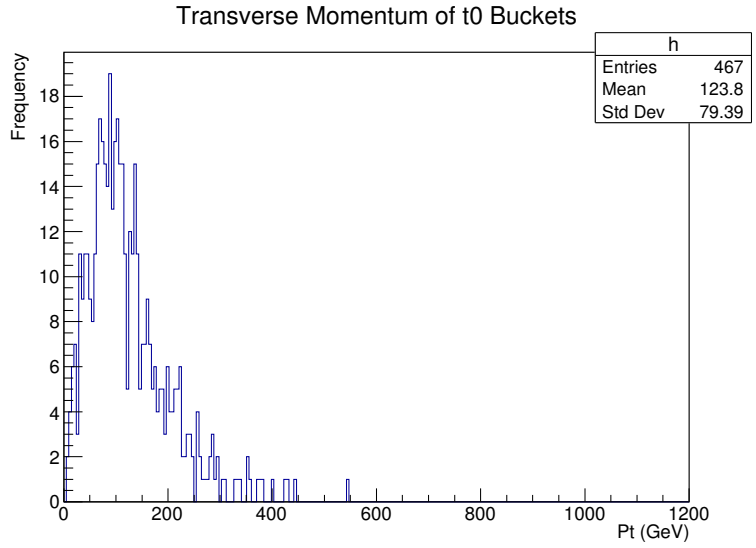

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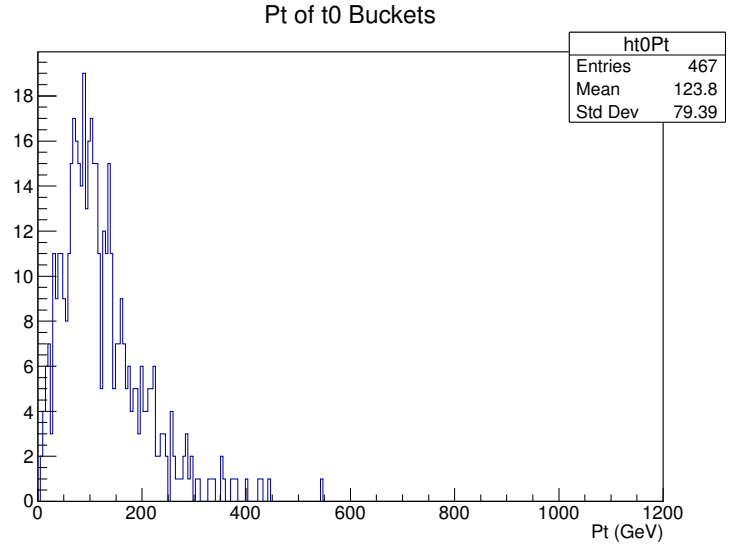
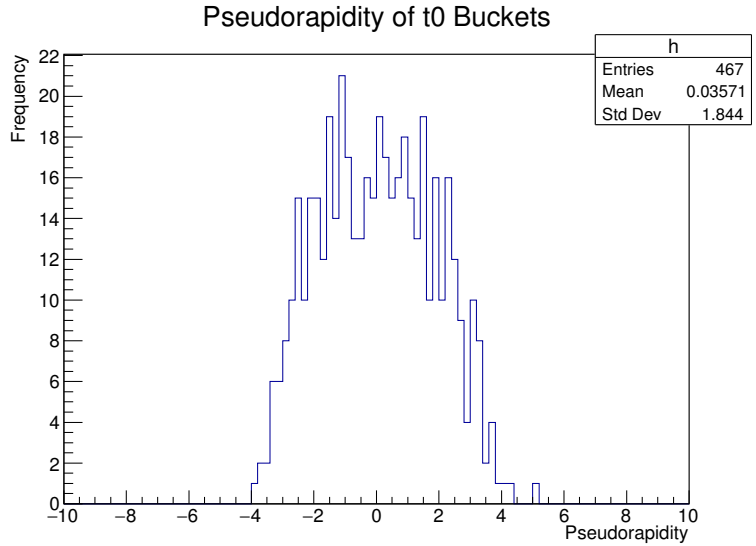
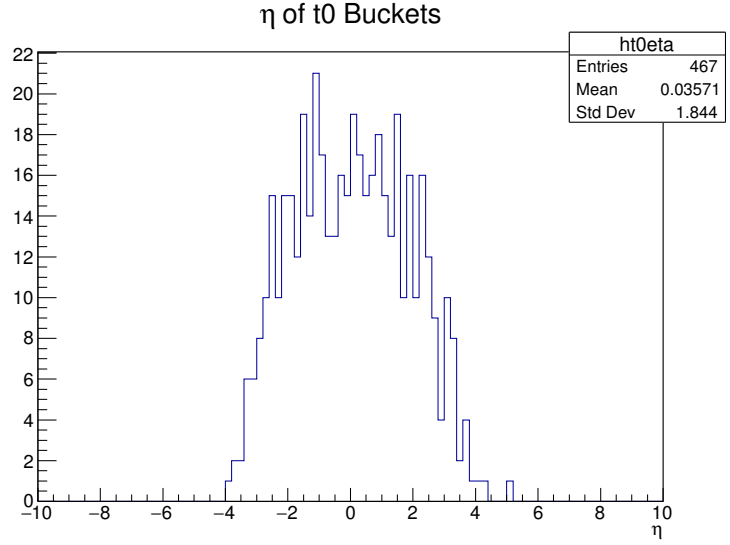


C++



Chongbin(python)



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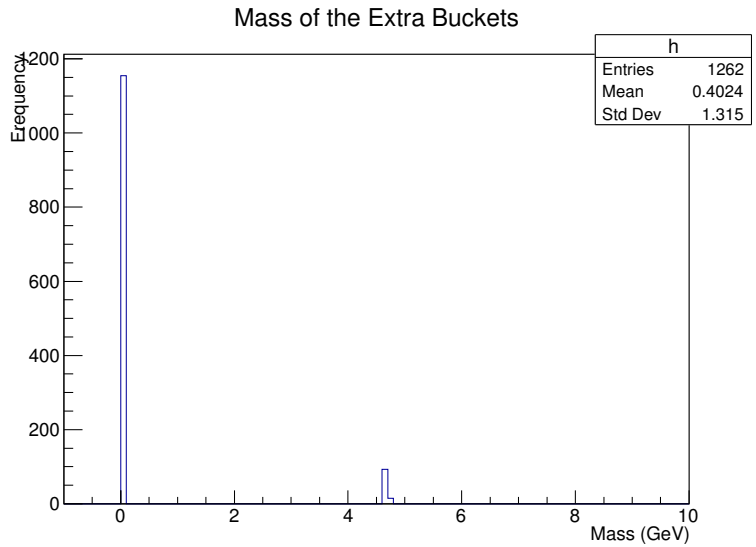
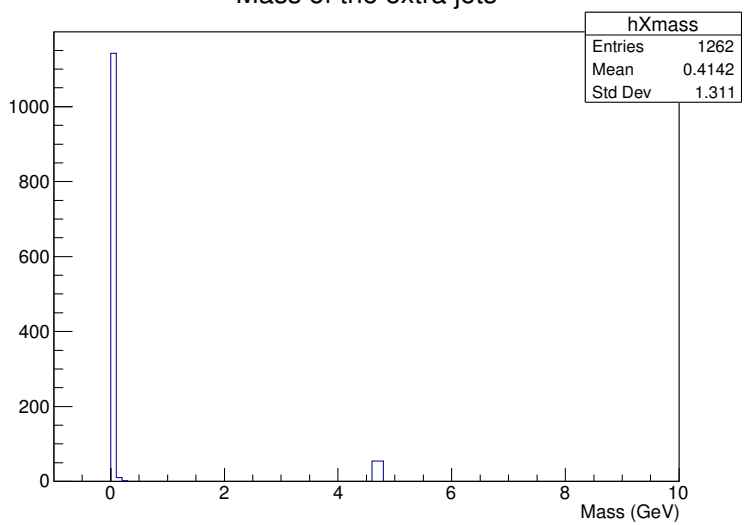


Chongbin(python)



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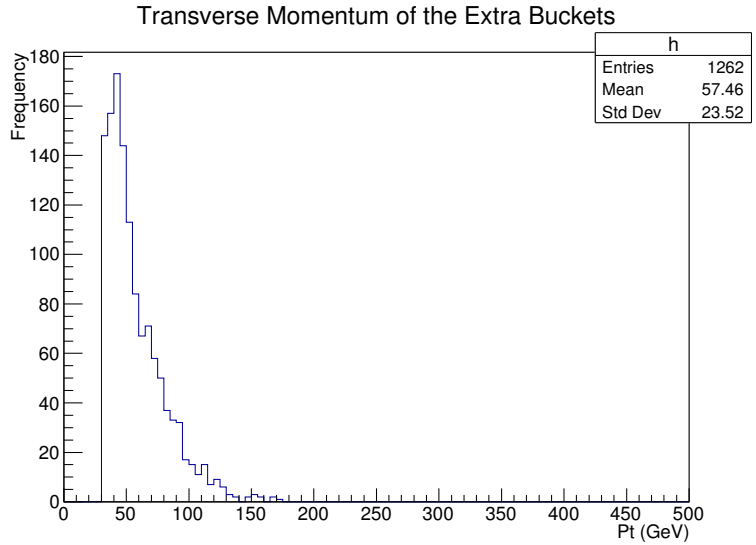
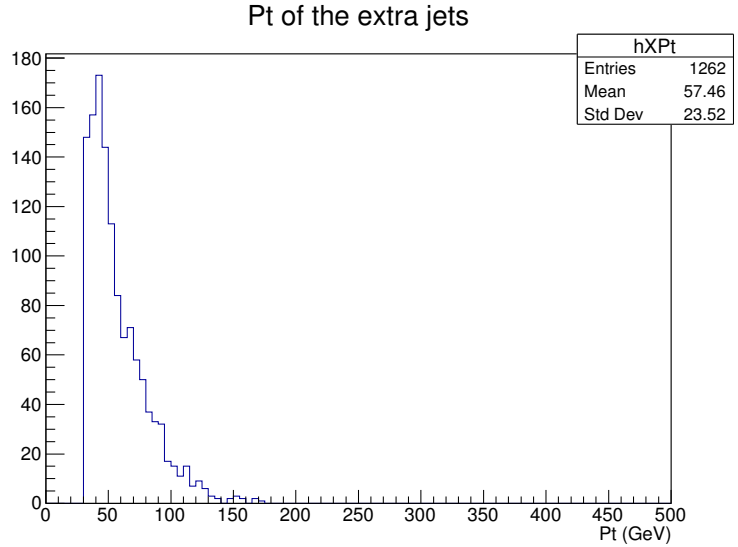


Chongbin(python)



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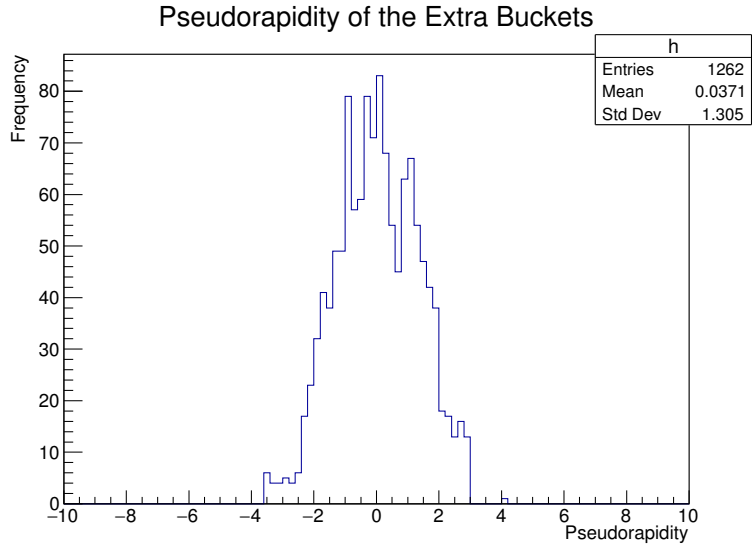
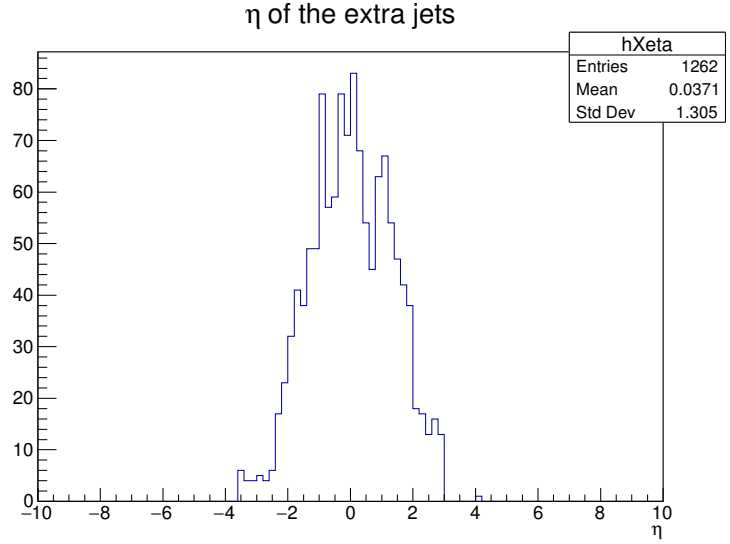


Chongbin(python)



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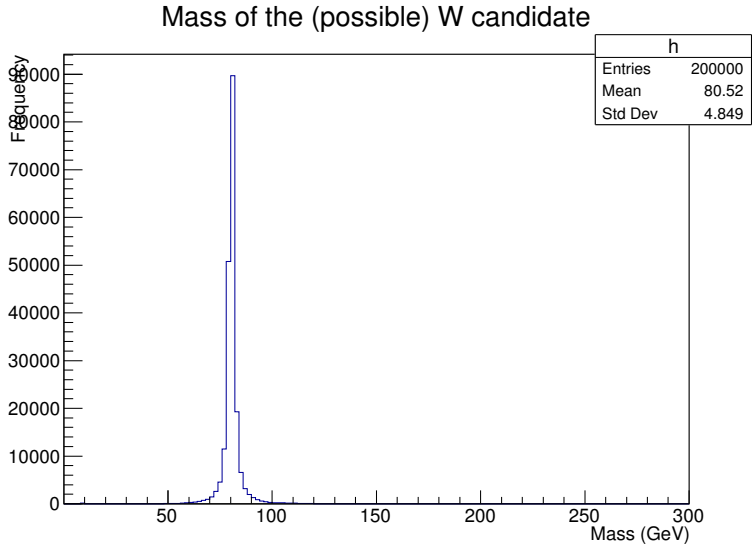
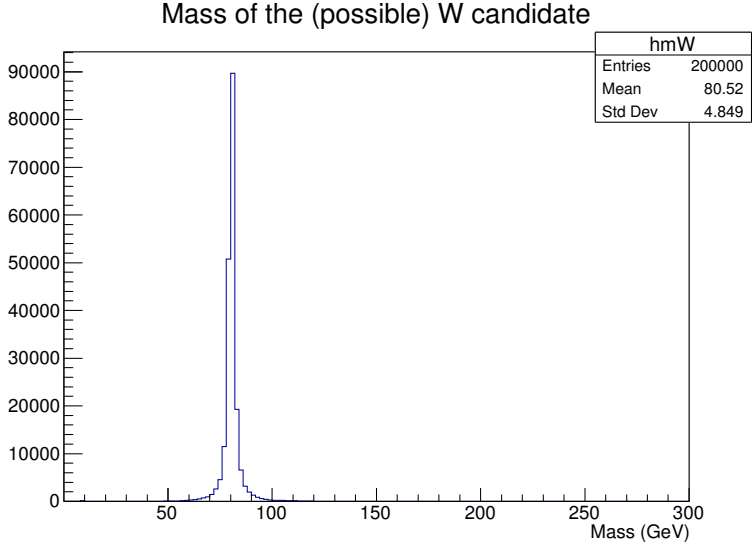


Chongbin(python)



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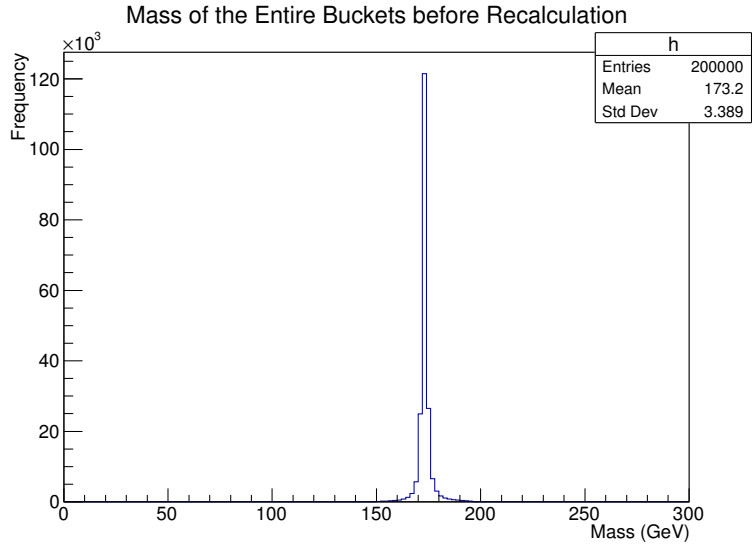
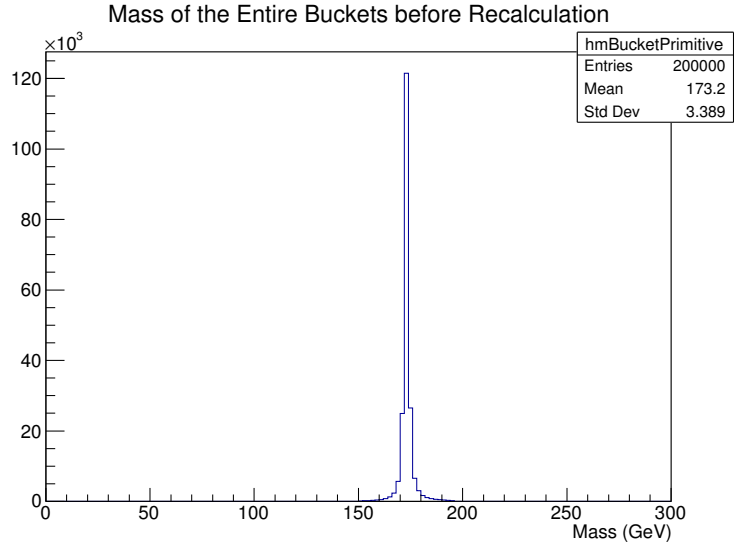


Chongbin(python)



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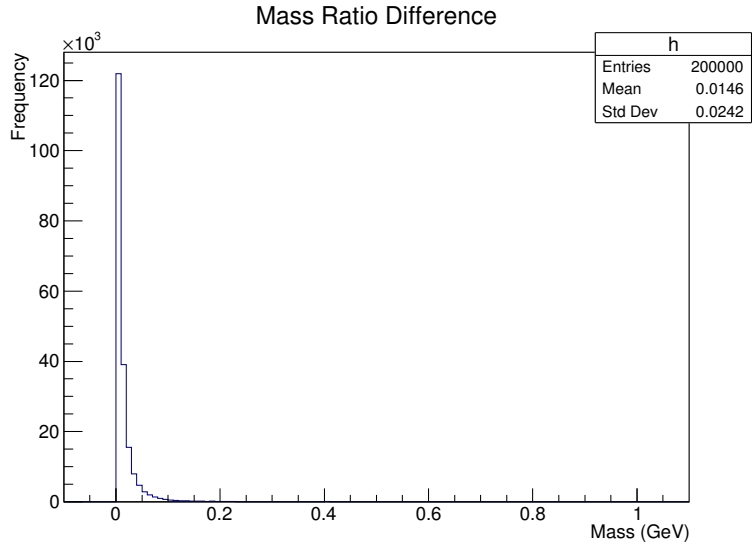
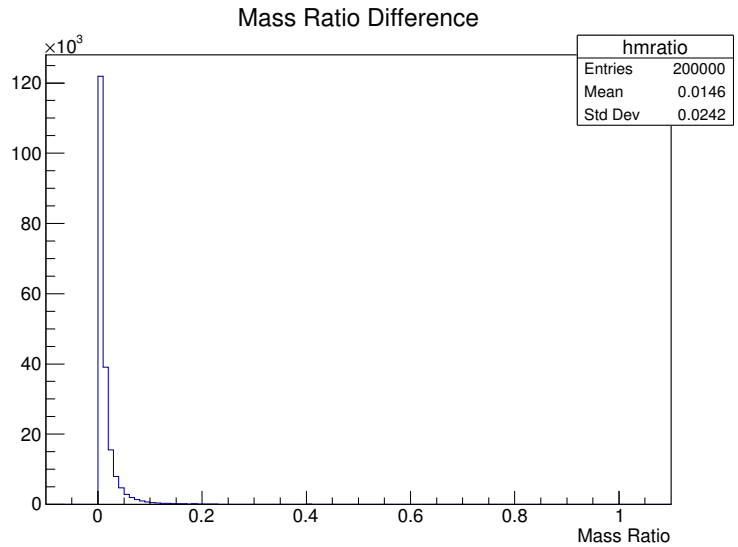


Chongbin(python)



C++

Bug fixes in the python version

- jet pair with minimum mass-ratio is obtained and then checked if less than 0.15 (to assign 'tw' flag)
- nested for loops for b jet - q jet pair in single and double 't-' re-bucketing corrected
- proto-'t-' bucket was not being updated as empty when absent
- condition: if $(|mass^2| < 0.01)$ then $mass = 0$ was changed to: if $(mass^2 < 0)$ then $mass = 0$
- powerset for creating buckets did not include single element sets, i.e. buckets with just a b jet, which is allowed by the algorithm

Summary

- The C++ version matches with the Python version