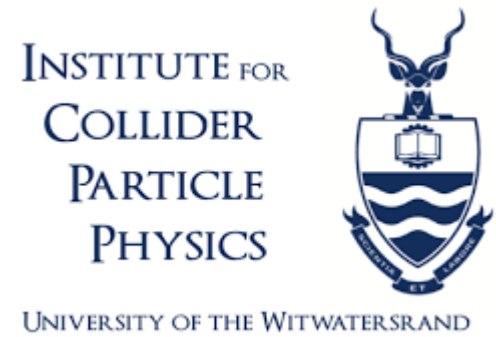


A Search for a Scalar Resonance using Di-Photons in Association with a lepton and a b-jet with the ATLAS Detector



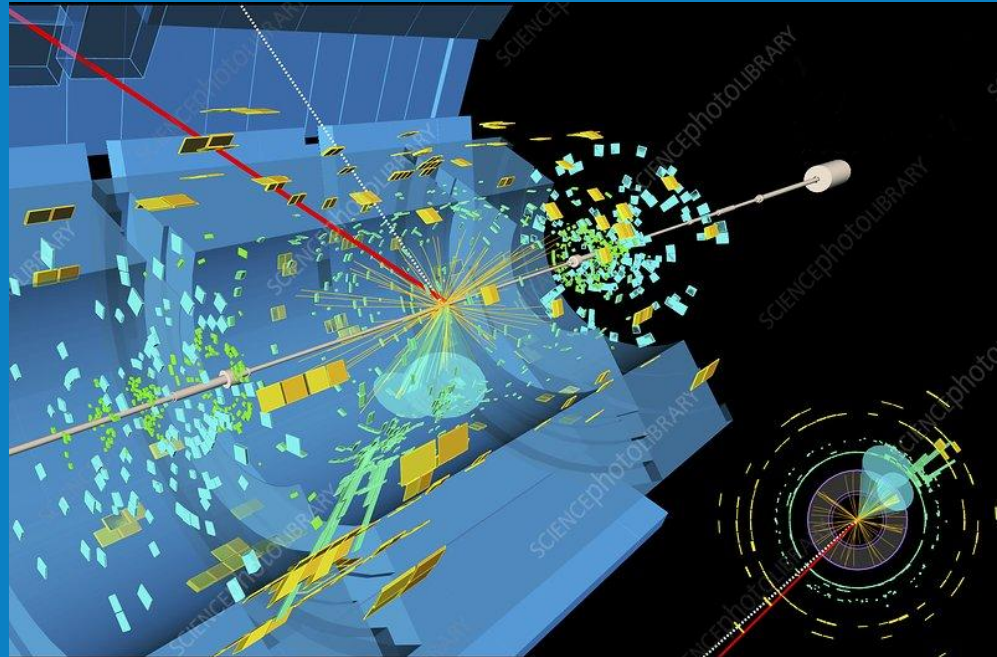
Presented by: Baballo-Victor Ndhlovu
In collaboration with Bruce Mellado, Mukesh Kumar, Vuyolwethu Kakancu, Kutlwano Makgetha, Njokweni Mbuyiswa, Kgothatso Ntumbe



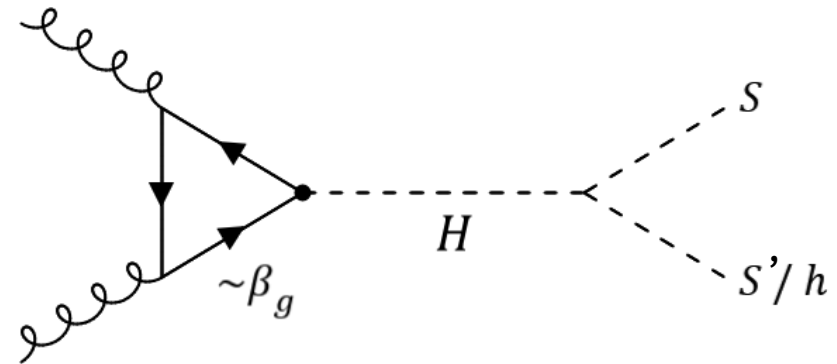
Overview



- Signal Process
- Background Process
- Object Definitions
- Event Selections
- Kinematic
Distributions
- Conclusions



- We are interested in the final states:
 - $\gamma\gamma + 0l + 1\tau$
 - $\gamma\gamma + 0l + 2\tau$
 - $\gamma\gamma + 1l + 1\tau$
 - $\gamma\gamma + 2l + 0\tau$
 - $\gamma\gamma + 1l + 0\tau$
 - $\gamma\gamma + 1l + 1b$
- We are analysing the final state with 1 lepton (electron or muon) and 1 b-jet ($\gamma\gamma + 1l + 1b$)



$$gg \rightarrow H \rightarrow (S \rightarrow \gamma\gamma)(S'/h \rightarrow b\bar{b}/\tau^+\tau^-)$$

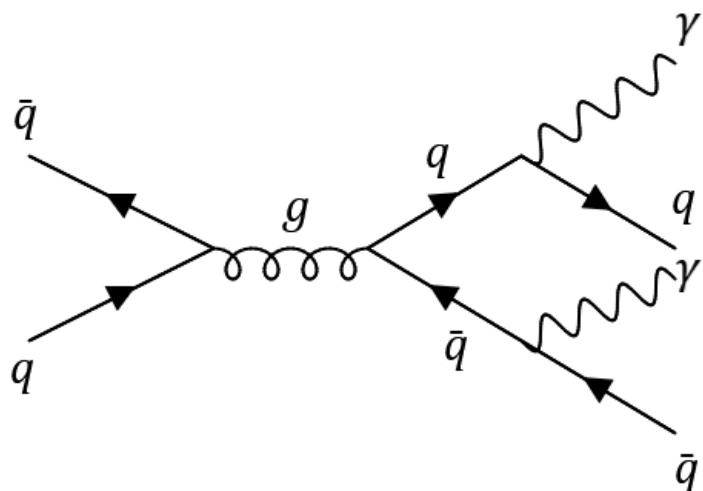
Mass Scans:

$$H[250 - 400] \text{ GeV},$$

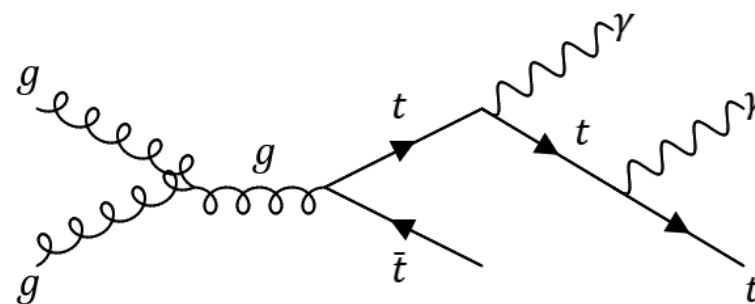
$$S[150 - 275] \text{ GeV},$$

$$S'[95 - 125] \text{ GeV}$$

Dominant Background Processes



$$pp \rightarrow \gamma\gamma jj$$



$$pp \rightarrow \gamma\gamma t\bar{t}$$

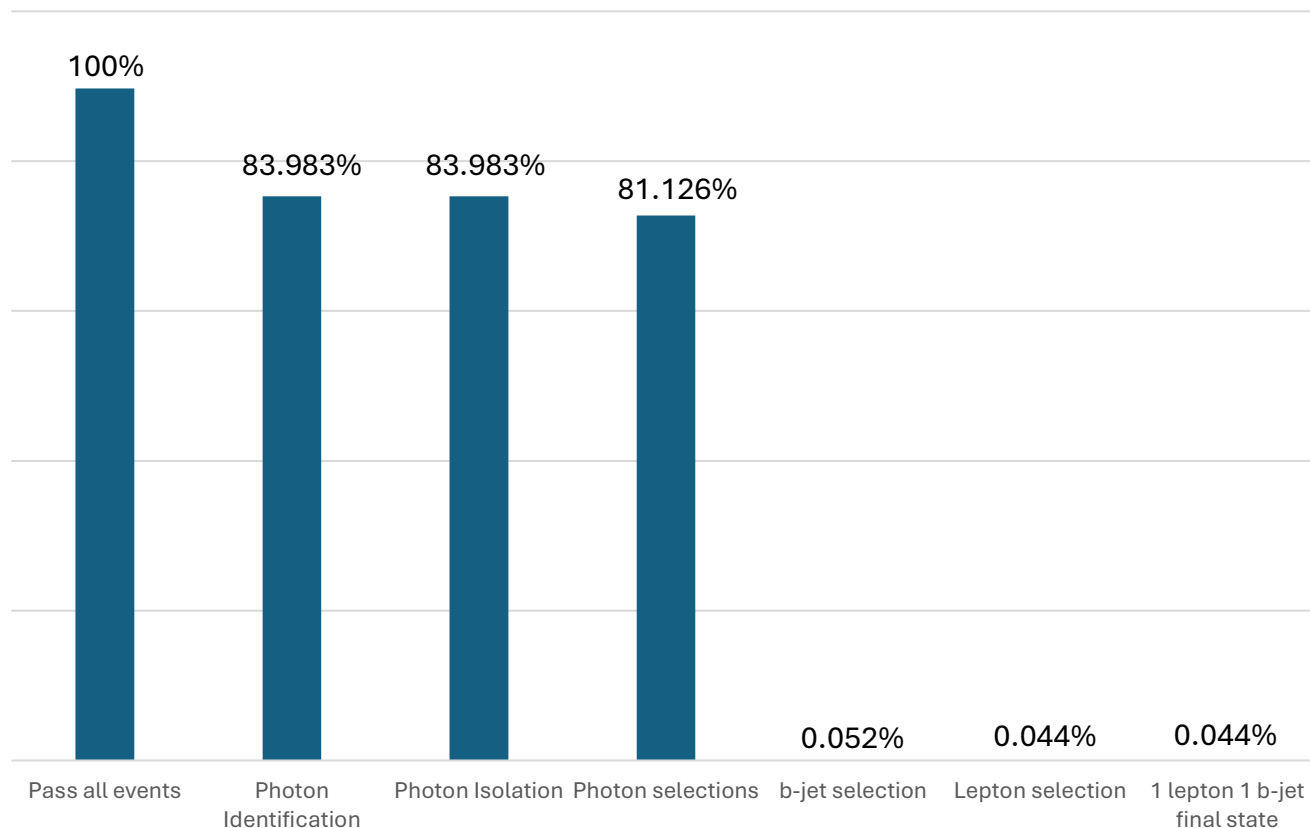
We are working with the di-photon
top quark pair production mode

These are the requirements for the candidates of selected events

Object	Transverse Momentum (p_T)	Pseudorapidity ($ \eta $)	Identification	Isolation	ΔR
b-jet	$> 25 \text{ GeV}$	< 2.5	DL1r tagger (deep learning)	-	0.4
Photons	lead (sub) ≥ 35 (25) GeV	< 2.37	Loose	Non isolated	-
Electrons	$> 10 \text{ GeV}$	< 2.47	Loose	Non isolated	-
Muons	$> 10 \text{ GeV}$	< 2.5	Medium	Loose	-

Cutflow Chart ($\gamma\gamma + l + b$)

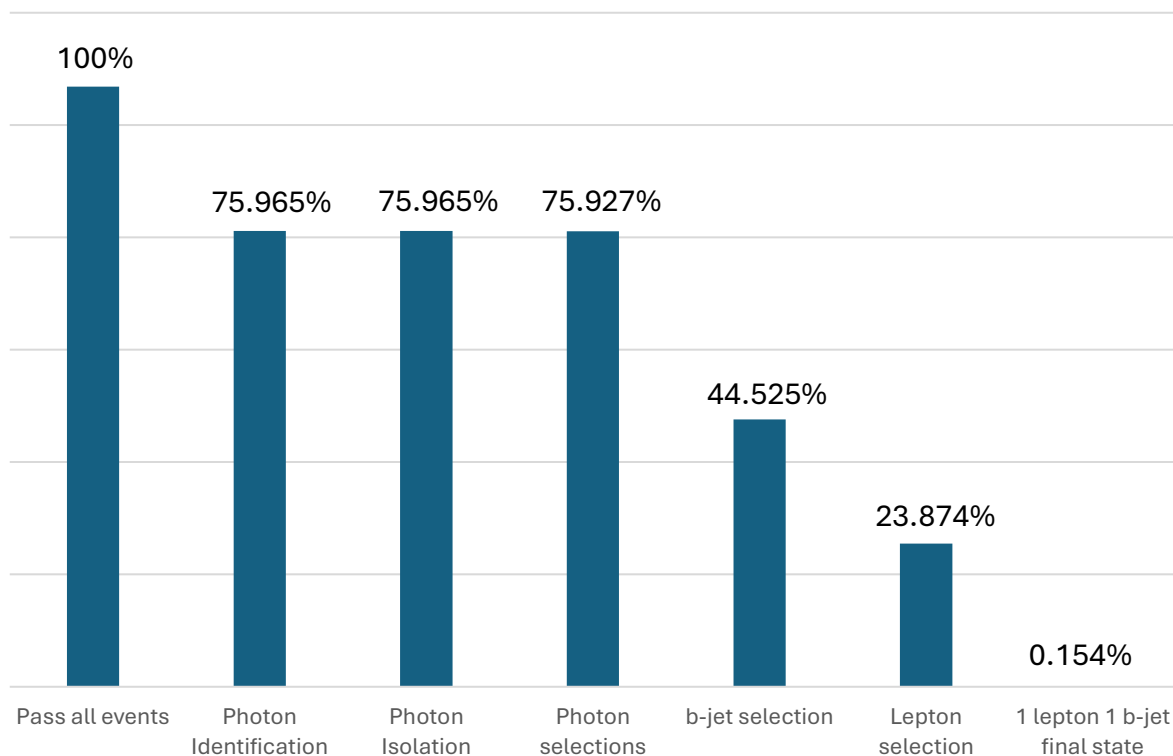
The efficiency after applying the object selections and selecting the final state of interest in the $pp \rightarrow \gamma\gamma jj$ background



This gives an efficiency of 0.044% after choosing events that satisfy the final state

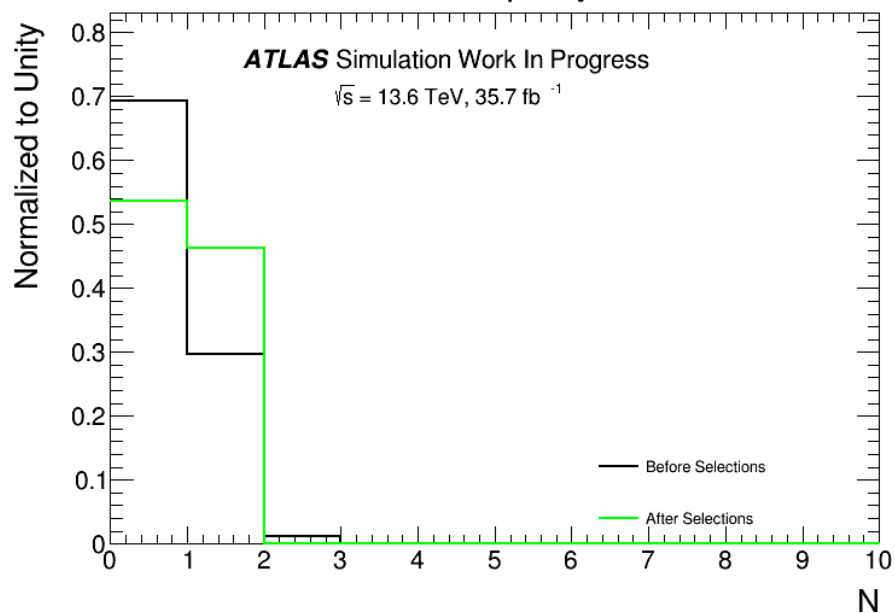
Cutflow Chart ($\gamma\gamma + l + b$)

The efficiency after applying the object selections and selecting the final state of interest $pp \rightarrow \gamma\gamma t\bar{t}$ background

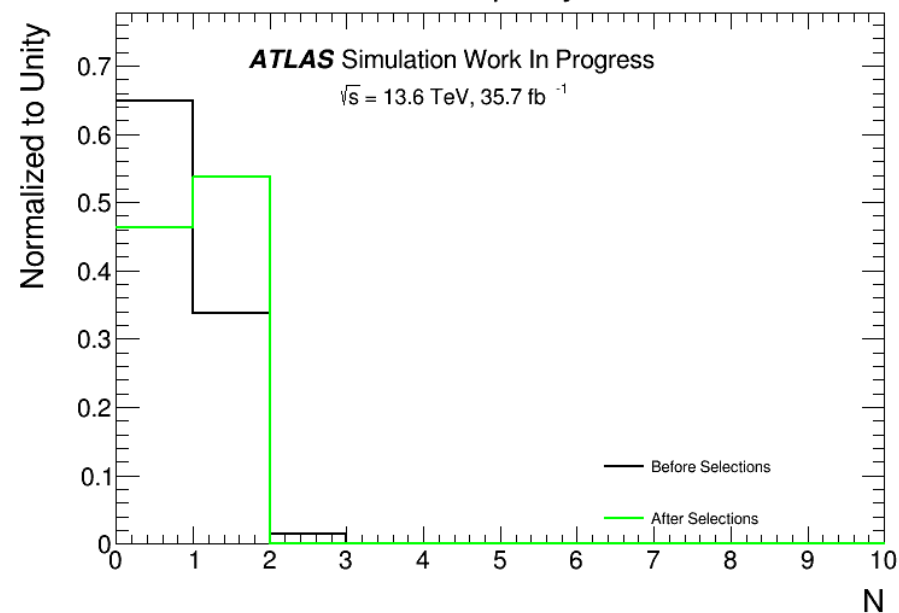


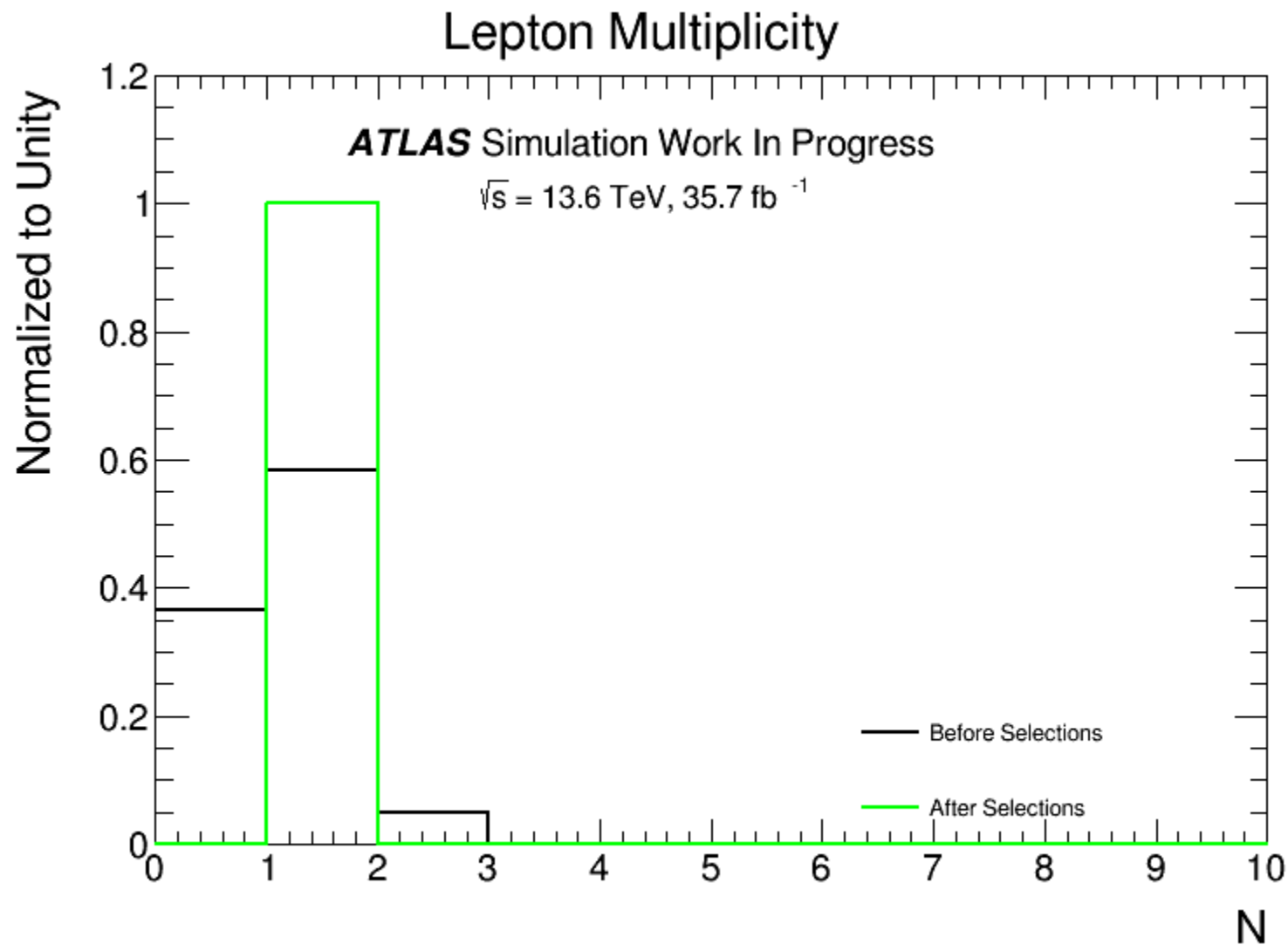
This gives an efficiency of 0.154% after choosing events that satisfy the final state

Electron Multiplicity

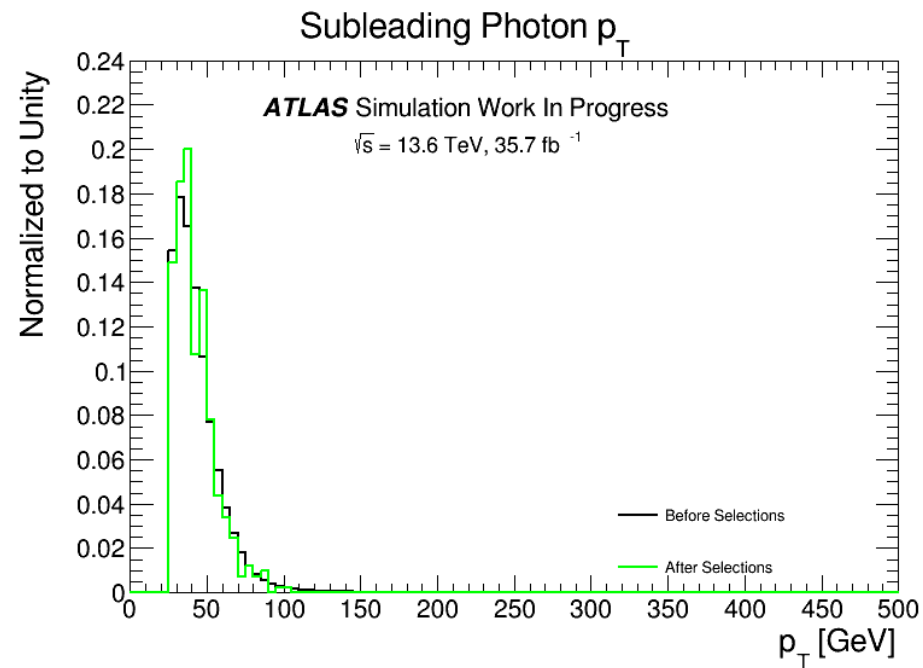
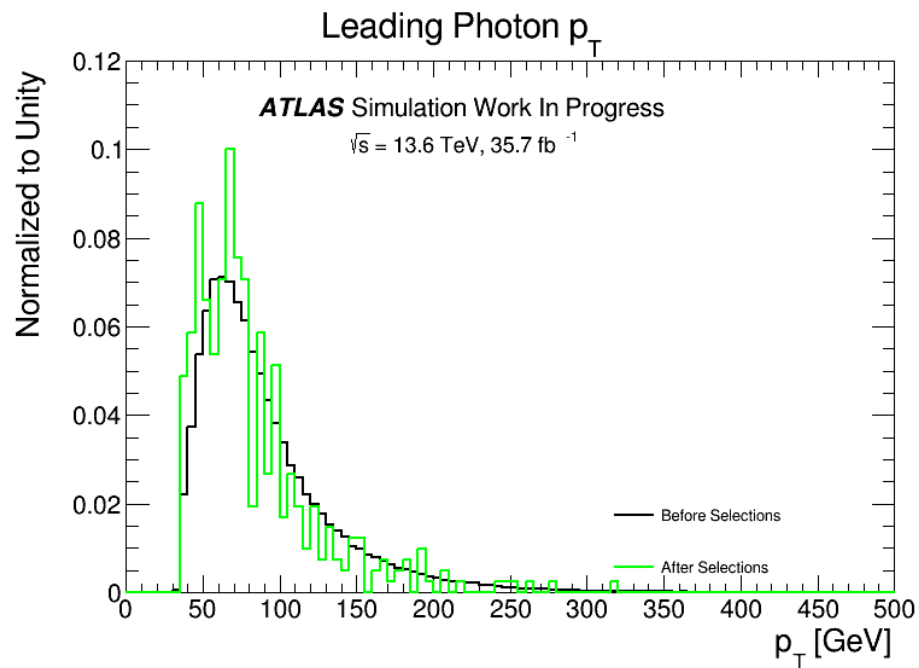


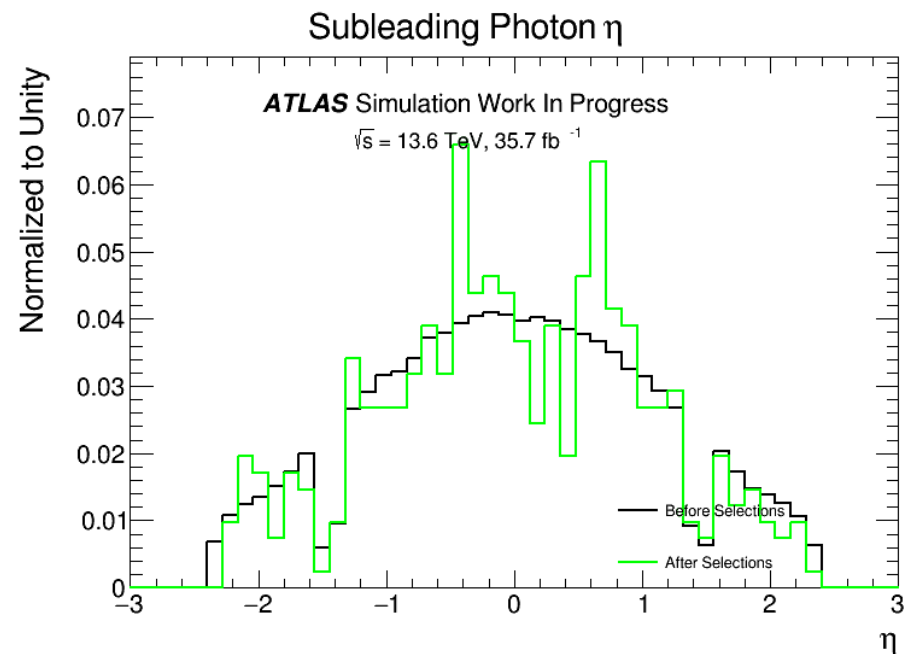
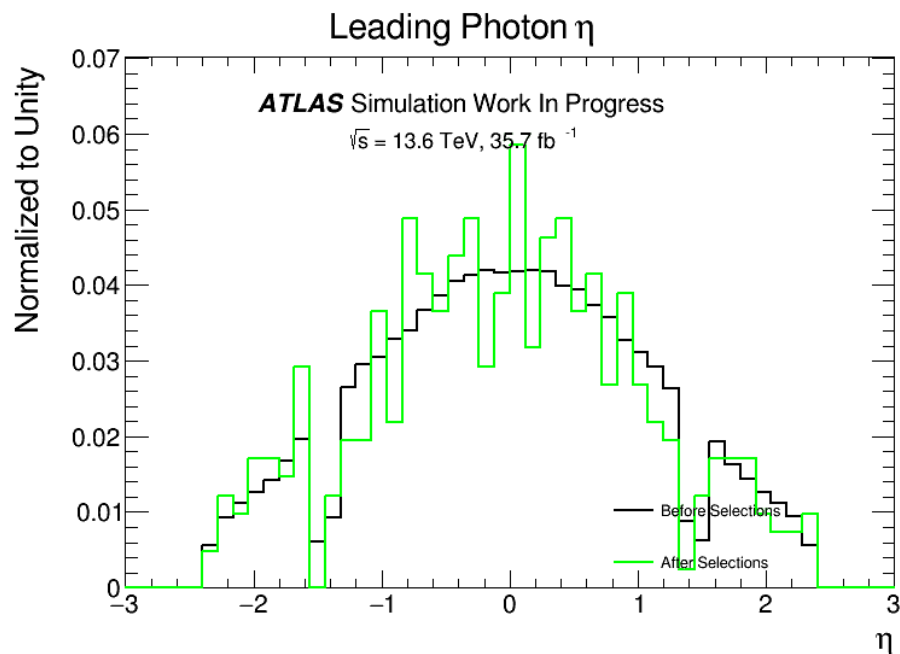
Muon Multiplicity



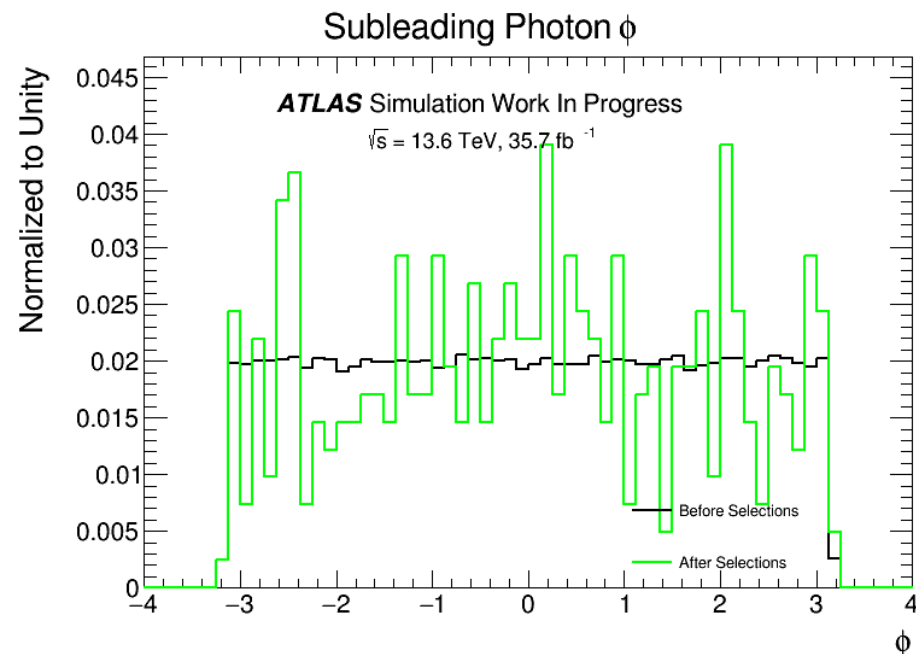
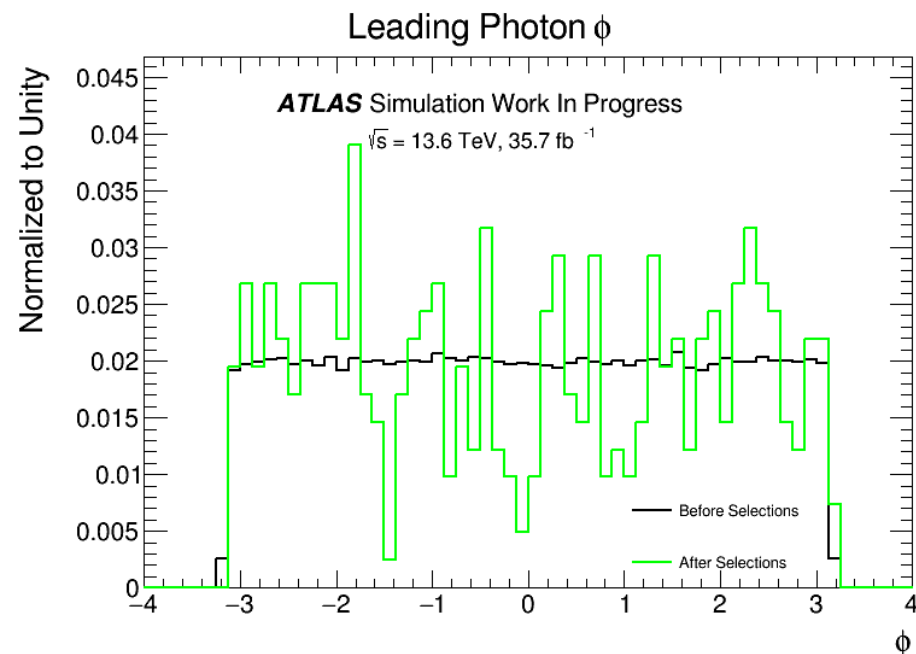


Kinematic Distributions

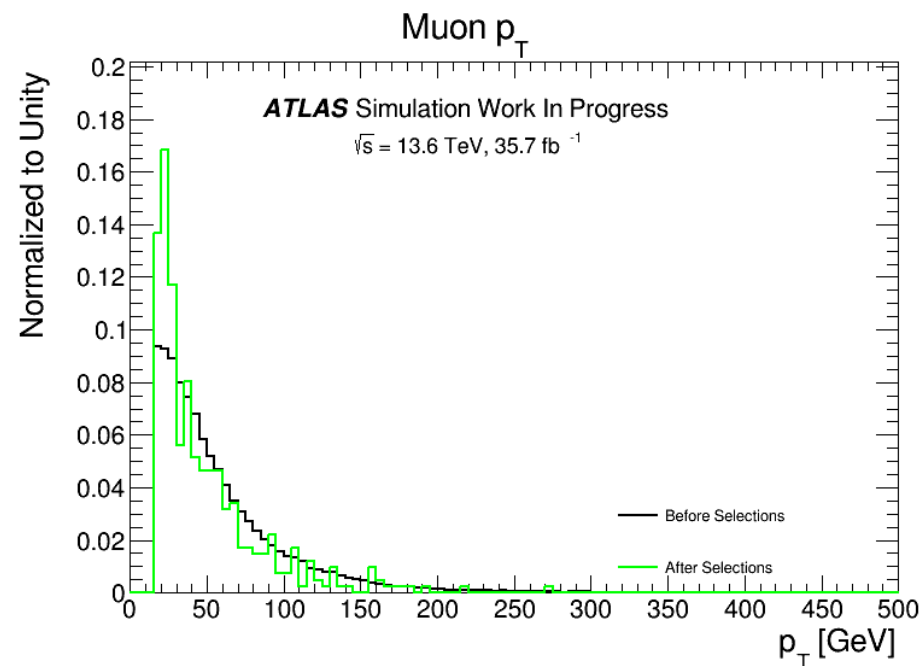
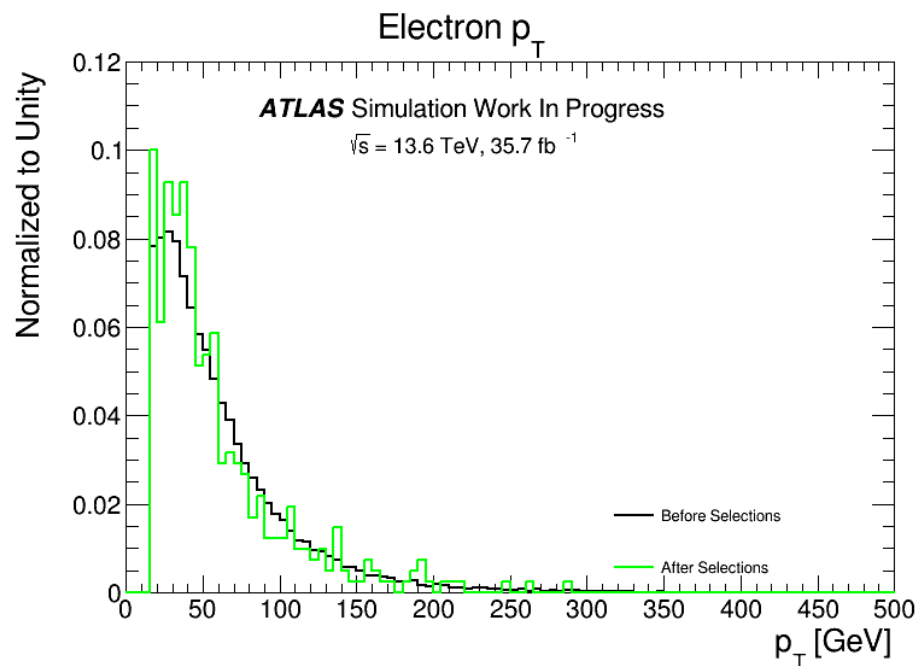


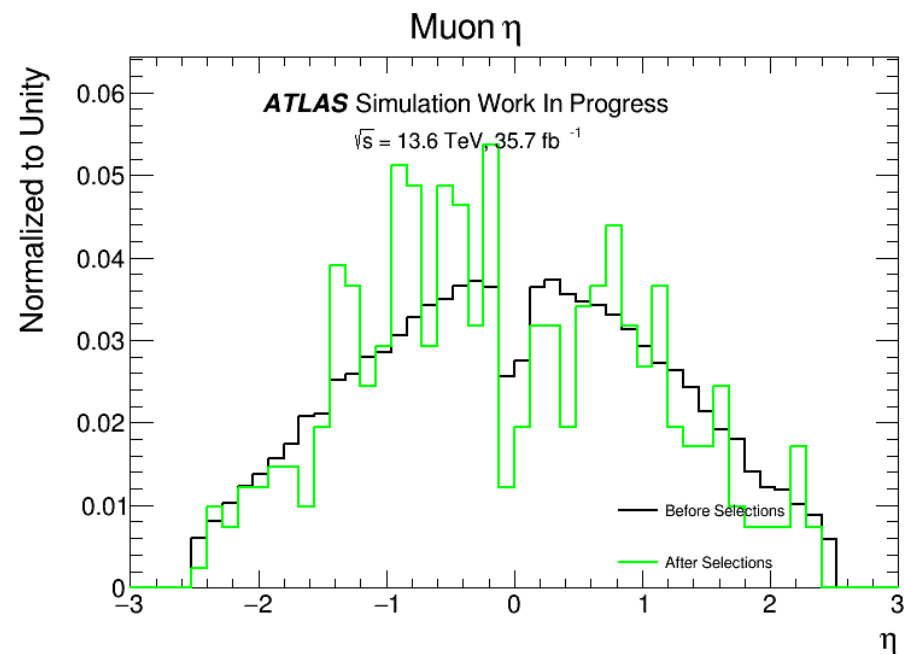
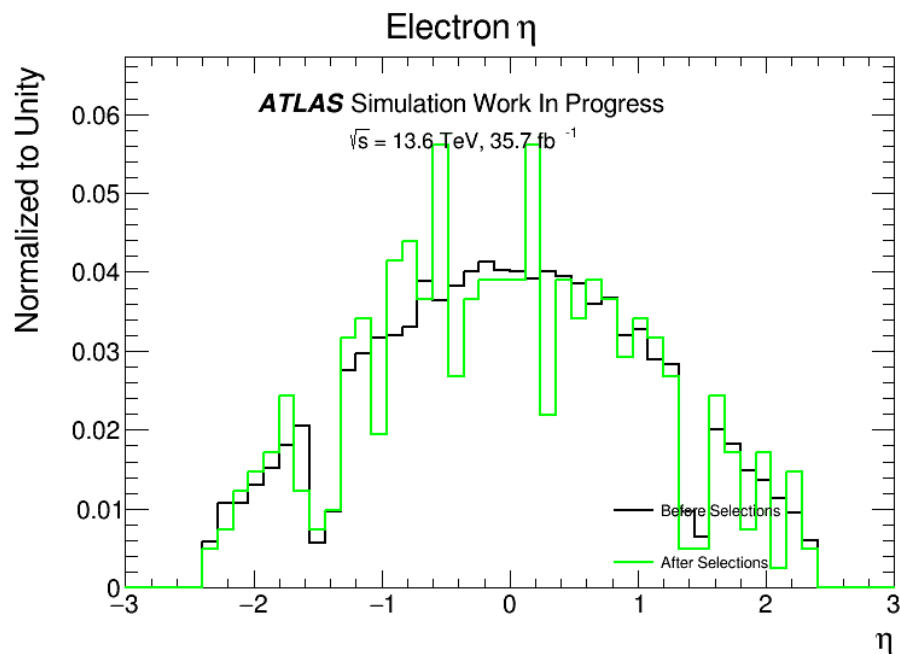


Kinematic Distributions

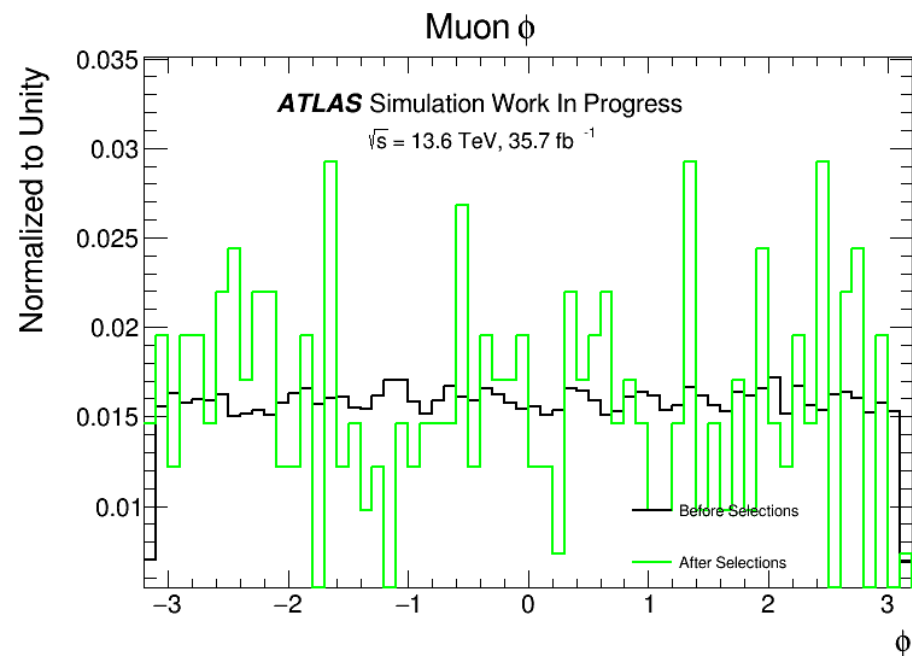
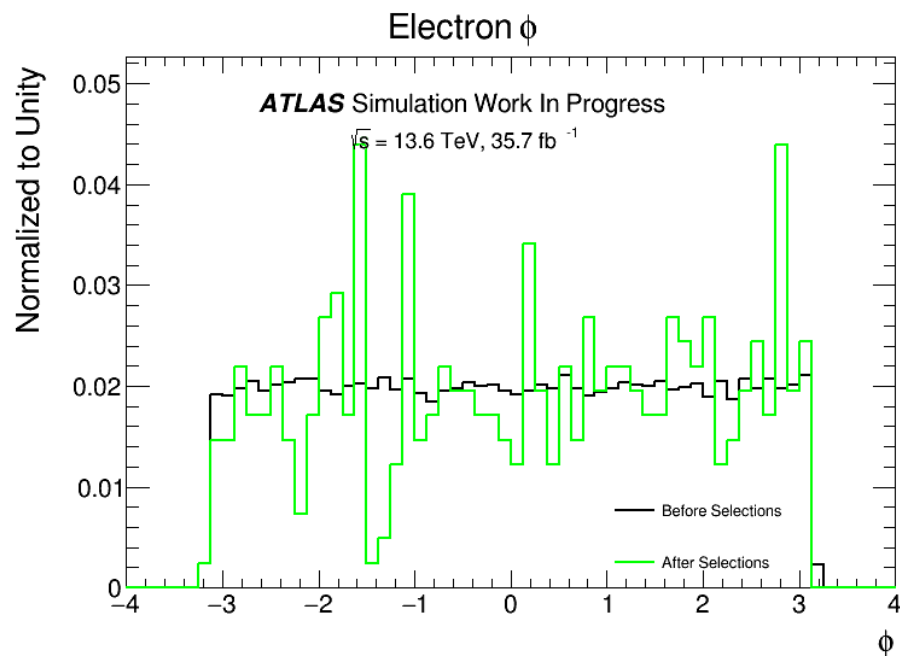


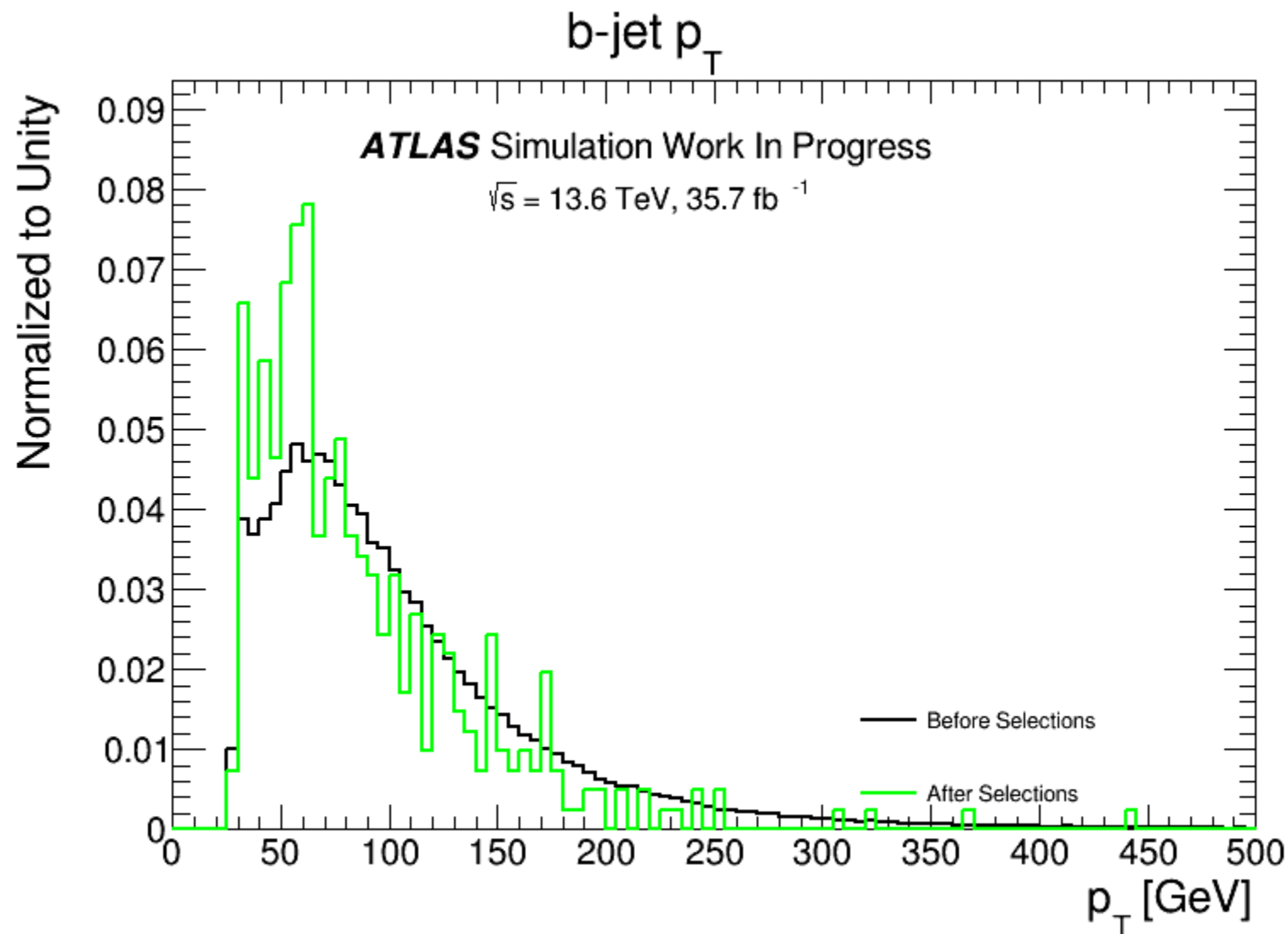
Kinematic Distributions

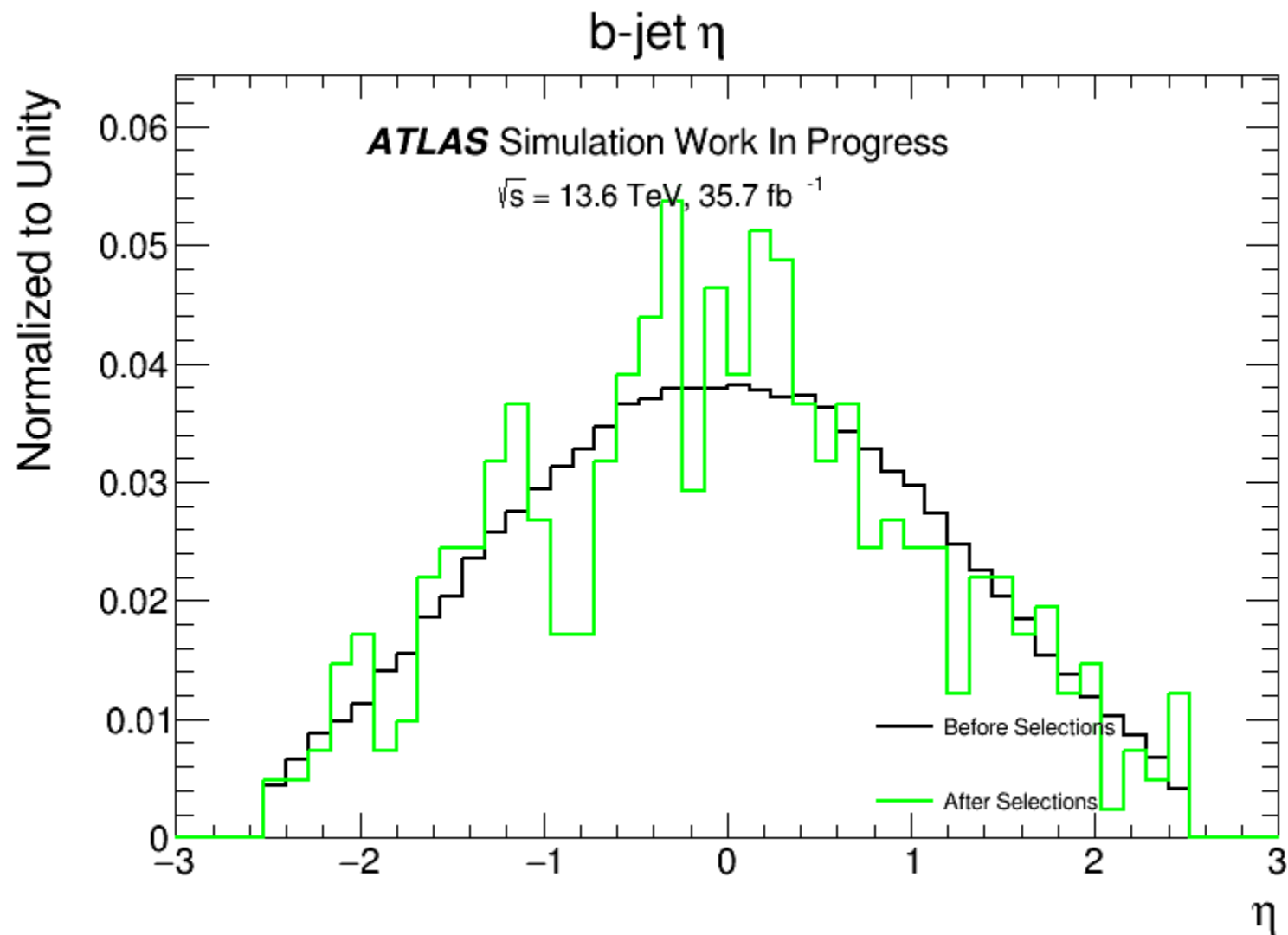


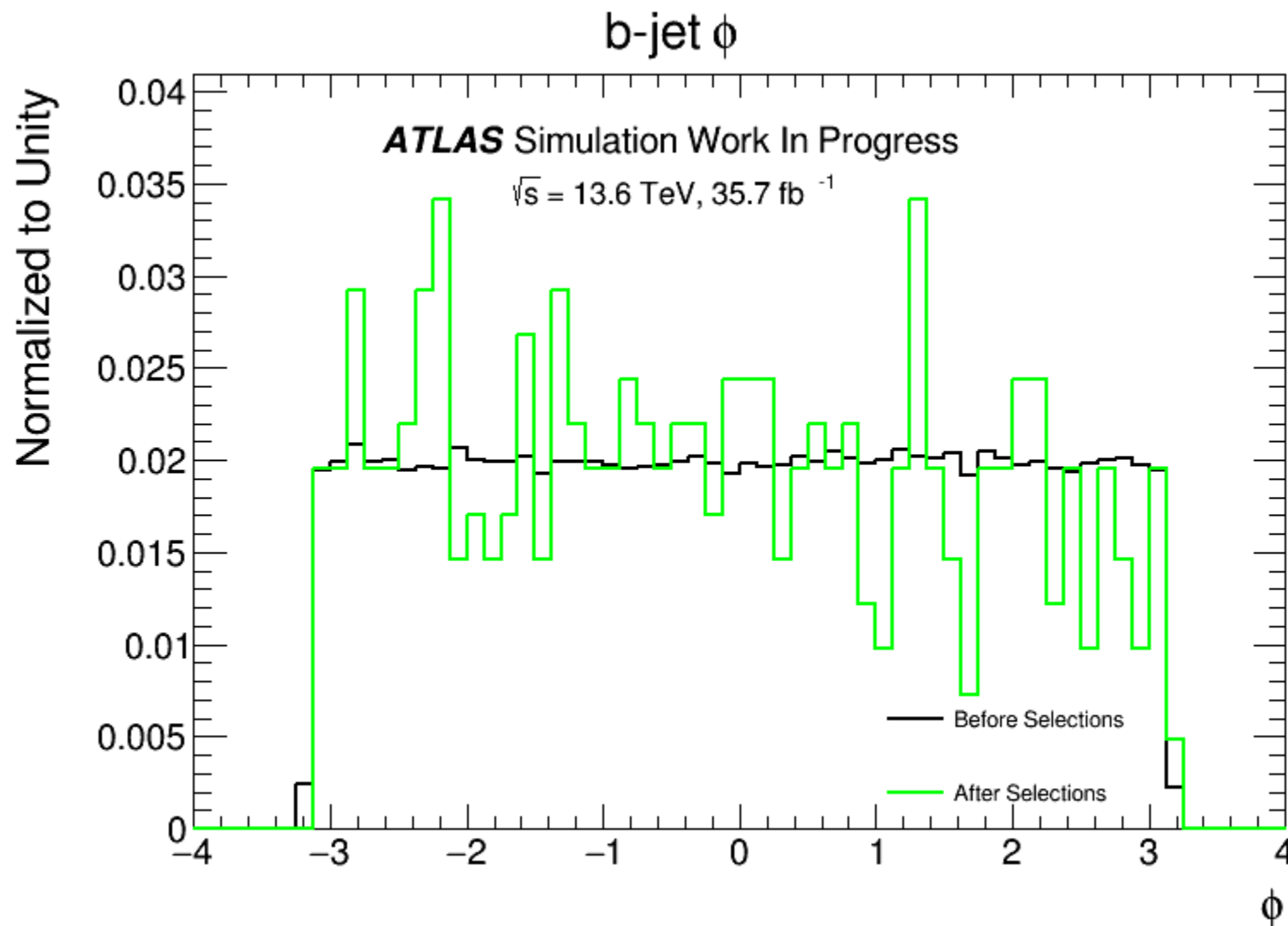


Kinematic Distributions

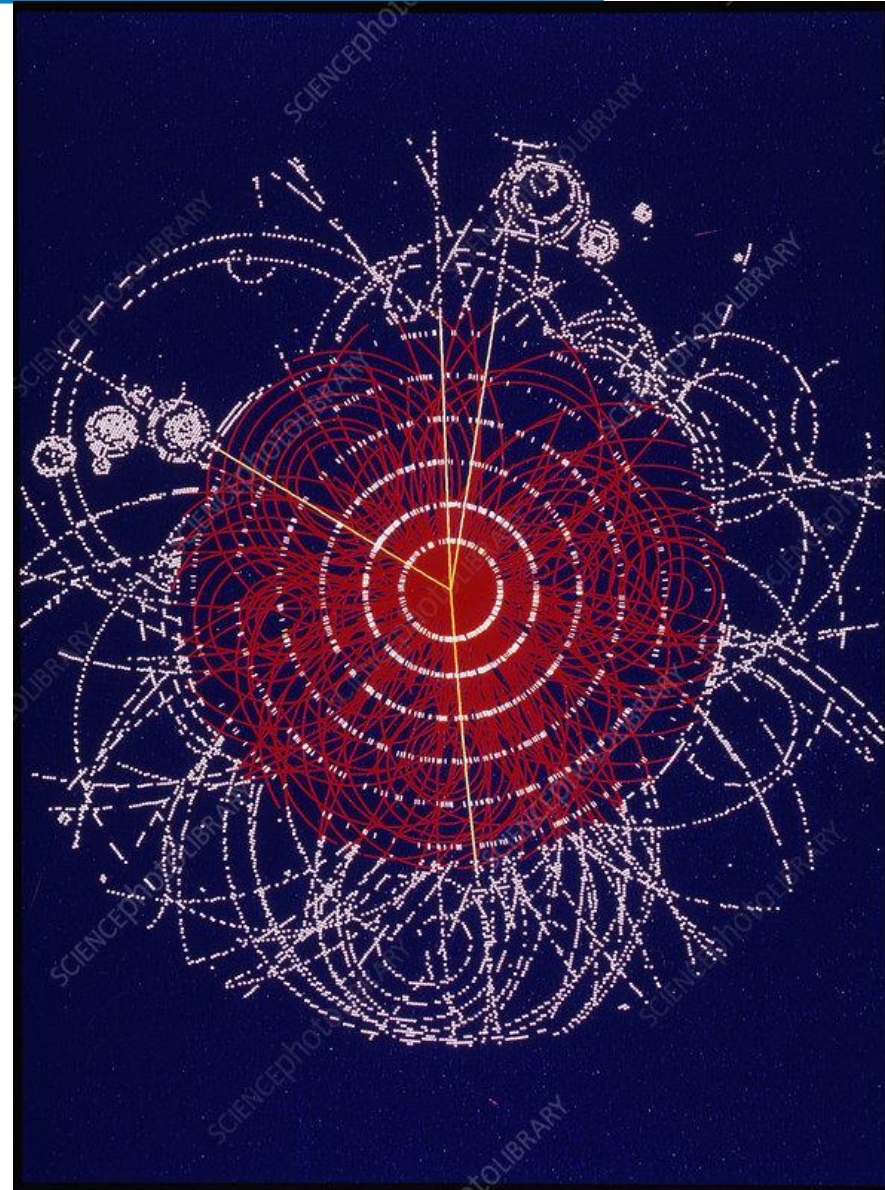








- The 1l1b channel contributes to the broader search for the di-photon resonance
- We have submitted requests for signal Monte Carlo samples
- We have received the $\gamma\gamma + 2\tau/b$ sample already
- We are currently working on the Easyjet Analysis Framework



Thank You!

Email: Baballo-Victor.Ndhlovu@cern.ch

Back Up Slides

The ATLAS Detector

