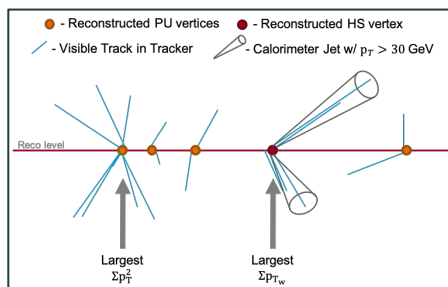


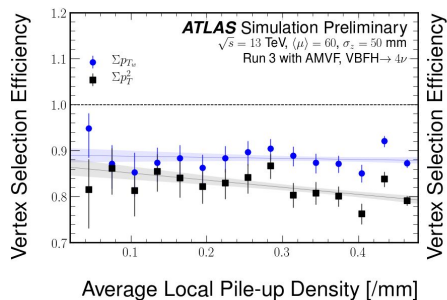
Rescuing $VBF H \rightarrow Invisible$ Events with Novel Vertex Selection

Murtaza Safdari for the ATLAS Experiment



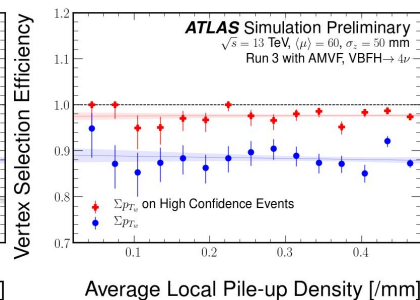
$$\text{Maximize } \Sigma p_T^2 \quad \text{Maximize } \sum p_{T_w} = \sum_{\text{tracks}} p_{T(\text{track})}^2 \frac{p_{T(\text{closest jet})}^2}{\Delta R^1} \mathbb{1}(\Delta R < 0.4) \mathbb{1}(p_{T(\text{jet})} > 30 \text{ GeV})$$

A novel vertex selection method Σp_{T_w} is introduced that exploits the correlation between HS tracks and jets to boost the visible p_T of the $VBF H \rightarrow Invisible$ vertex and remove the impact of uncorrelated PU interactions. A new event categorization (High Confidence Events [HCE]) is defined to identify the conditions under which the vertex selection algorithm is reliable, rescuing VBF invisible events that could be otherwise rejected due to a wrongly selected vertex.



Current Geometry (Run 3)

- Vertex Selection Efficiency improved from 80% to **88%**
- Impact of Pileup Merging rectified
- Restricting to HCE yields higher VSE at **98%**
- Other events usable but contain uncertain vertex



HL-LHC (Run 4)

- Vertex Selection Efficiency improved from 88% to **97%**
- Increased track acceptance & improved track resolution gives boost in performance of both methods

