Auxiliary information for paper SUSY-2018-13 by the ATLAS Collaboration:

Search for long-lived, massive particles in events with displaced vertices and multiple jets in pp collisions at $\sqrt{s} = 13$ TeV with the ATLAS detector

HepData material

The material in this document allows those who are not members of the ATLAS Collaboration to reinterpret the results of the search in many models predicting displaced vertices in multi-jet events. Parameterized efficiencies are provided to allow the calculation of expected signal event yields in the signal region (SR). The efficiencies should be applied to vertices and events which pass certain acceptance requirements at particle-level in Monte Carlo simulations.

The parameterized efficiencies allow calculating a weight for every given event passing the acceptance requirements, representing the contribution to the SR yield, given symbolically by

$$P = \mathcal{A}_{\text{event}}\varepsilon_{\text{event}} \times \left(1 - \prod_{\text{vertices}} (1 - \mathcal{A}_{\text{vertex}}\varepsilon_{\text{vertex}})\right) . \tag{1}$$

$\mathcal{A}_{\text{event}}$ and $\mathcal{A}_{\text{vertex}}$ are the fractions of events passing the event-level and vertex-level acceptance requirements. The $\varepsilon_{\text{event}}$ and $\varepsilon_{\text{vertex}}$ factors are the parameterized efficiencies for passing the event-level and vertex-level selections provided the acceptance is fulfilled.

Definition of acceptances

Parameterized efficiencies are provided for events passing certain event-level acceptances, separately for the High-p_{T} jet SR and the Trackless jet SR. The event-level requirements include the presence of several truth jets. Truth jets are reconstructed using an anti-k_t algorithm of radius $R = 0.4$ from all stable particles, excluding neutrinos and muons. Note that this definition includes particles from the long-lived particle (LLP) decay. We additionally define displaced truth jets as jets mached with the decay position of LLPs, with the same parameters and selections above and the additional requirement that particles have $|\eta| < 2.5$. The truth jet is determined to originate from the LLP decay that produced the closest decay product with $\Delta R_{\text{jet, decay product}} < 0.3$ by calculating ΔR between truth jets and the decay products of each LLP. All displaced truth jets that originate from LLPs decaying outside the calorimeter ($R > 3870$ mm) are discarded and not used for the selections. Table 1 summarizes the selections on truth jets for the event-level acceptance calculation.

Table 1: Summary of the truth jet selections. The x in the $n^{x}_{\text{jet/displaced jet}}$ notation refers to the jet p_{T} threshold in GeV.

Signal Region	High-p_{T} jet SR	Trackless jet SR
Truth jet selection	$n^{250}_{\text{jet}} \geq 4$ or $n^{195}_{\text{jet}} \geq 5$ or $n^{116}_{\text{jet}} \geq 6$ or $n^{90}_{\text{jet}} \geq 7$	$n^{137}_{\text{jet}} \geq 4$ or $n^{101}_{\text{jet}} \geq 5$ or $n^{83}_{\text{jet}} \geq 6$ or $n^{55}_{\text{jet}} \geq 7$, $n^{70}_{\text{displaced jet}} \geq 1$ or $n^{50}_{\text{displaced jet}} \geq 2$

The vertex-level acceptance requires a displaced heavy particle decay to have the following properties:

- The decay position must lie within the fiducial volume of $R_{xy} < 300$ mm and $|z| < 300$ mm.
- The transverse distance between the interaction point and the decay position must be greater than 4 mm.
- At least 1 charged particle in the truth vertex decay must have an approximate transverse impact parameter $|d_0| \equiv R_{\text{decay}} \times \sin\Delta\phi > 2$ mm, where R_{decay} is the transverse distance between the interaction point and the massive particle decay, and $\Delta\phi$ is the azimuthal angle between the particle momentum at its creation and the vector from the interaction point to the position of the displaced decay.

Table 2: The steps of truth-level acceptance selections for the Strong RPV model with the several masses of the $\tilde{g}$ and $\tilde{\chi}_1^0$ and $\tilde{\chi}_1^0$ lifetimes in the High-p_{T} jet SR. The acceptance value is defined as the ratio of surviving events to the all generated events.

Selection	Acceptance [%] $m(\tilde{g}) = 2000$ GeV, $m(\tilde{\chi}_1^0) = 850$ GeV, $\tau(\tilde{\chi}_1^0) = 0.01$ ns	$m(\tilde{g}) = 2000$ GeV, $m(\tilde{\chi}_1^0) = 50$ GeV, $\tau(\tilde{\chi}_1^0) = 0.1$ ns	$m(\tilde{g}) = 2400$ GeV, $m(\tilde{\chi}_1^0) = 200$ GeV, $\tau(\tilde{\chi}_1^0) = 1$ ns	$m(\tilde{g}) = 2000$ GeV, $m(\tilde{\chi}_1^0) = 1250$ GeV, $\tau(\tilde{\chi}_1^0) = 10$ ns
Jet selection	99.9	96.6	97.2	96.1
Event has ≥ 1 DV passing:				
$R_{xy} < 300$ mm and $\lvert z \rvert < 300$ mm	99.9	78.7	44.7	31.7
Transverse distance from the primary vertex > 4 mm	29.6	77.0	43.8	30.9
Have at least 1 charged particle with $\lvert d_0 \rvert > 2$ mm	29.6	75.6	43.7	30.9
$n_{selected\ decay\ products} \geq 5$	29.6	75.5	43.7	30.9
Invariant mass > 10 GeV	29.6	74.7	43.7	30.9

Table 3: The steps of truth-level acceptance selections for the EWK RPV model with the several masses and lifetimes of the $\tilde{\chi}_1^0$ in the Trackless jet SR. The acceptance value is defined as the ratio of surviving events to the all generated events.

Selection	Acceptance [%] $m(\tilde{\chi}_1^0) = 500$ GeV, $\tau(\tilde{\chi}_1^0) = 0.1$ ns	$m(\tilde{\chi}_1^0) = 500$ GeV, $\tau(\tilde{\chi}_1^0) = 1$ ns	$m(\tilde{\chi}_1^0) = 1300$ GeV, $\tau(\tilde{\chi}_1^0) = 0.1$ ns	$m(\tilde{\chi}_1^0) = 1300$ GeV, $\tau(\tilde{\chi}_1^0) = 1$ ns
Jet selection	49.5	50.1	96.8	98.5
Event has ≥ 1 DV passing:				
$R_{xy} < 300$ mm and $\lvert z \rvert < 300$ mm	49.5	41.0	96.8	92.1
Transverse distance from the primary vertex > 4 mm	46.5	39.8	85.9	89.9
Have at least 1 charged particle with $\lvert d_0 \rvert > 2$ mm	46.5	39.8	85.9	89.9
$n_{selected\ decay\ products} \geq 5$	46.5	39.8	85.9	89.9
Invariant mass > 10 GeV	46.5	39.8	85.9	89.9

- The number of *selected decay products* (described below) must be at least 5.
- The invariant mass of the truth vertex must be larger than 10 GeV. The truth vertex is constructed using the momenta of the *selected decay products* but assuming a charged-pion mass (consistent with the assumptions in the displaced vertex (DV) reconstruction used in the analysis).

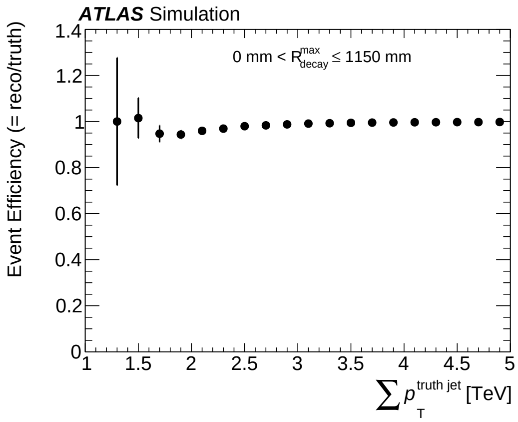
The selected decay products used in the above truth vertex construction are those decay products of a given massive particle decay that satisfy the following conditions:

- The particle is charged and stable for timescales required to traverse the tracking volume (≈ 52 cm in the radial direction).
- The particle has transverse momentum p_{T} and electric charge q such that $p_{\mathrm{T}}/|q| > 1$ GeV.

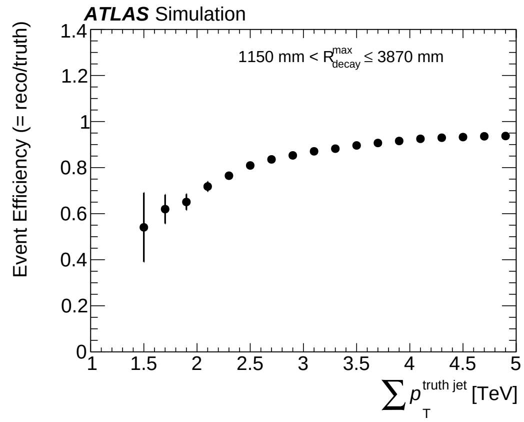
A cutflow of the truth-level acceptance is shown in Table 2 (Table 3) for several Strong (EWK) RPV samples.

Parameterized efficiencies

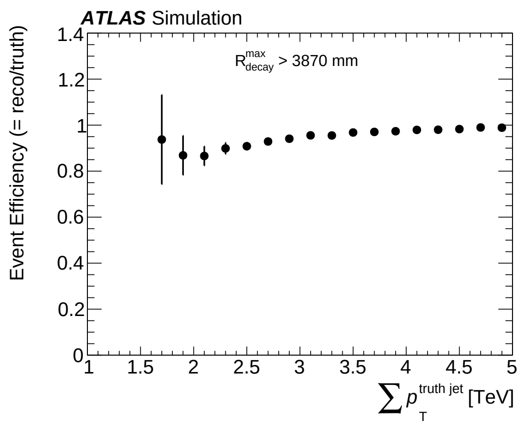
Parameterized efficiencies are provided at the event-level and vertex-level, respectively. Because of the inability for the ATLAS detector to fully measure the energy of jets that are produced within or beyond the calorimeter, the event-level efficiency $\varepsilon_{\mathrm{event}}$ is provided as a function of the sum of truth jets p_{T} and the transverse distance of the furthest LLP decay. No requirements on p_{T} or η are adopted for the truth jet when calculating the sum of truth jet p_{T}. The event-level efficiencies for the High-p_{T} jet SR are defined as the number of reconstructed events that pass the multi-jet trigger, high-p_{T} jet filter, and the high-p_{T} jet selection defined in Section 5, divided by the number of events which satisfy the acceptance requirements. Similarly, the efficiencies for the Trackless jet SR are defined as the number of reconstructed events that pass the multi-jet trigger, the trackless jet filter, and the trackless jet selection, divided by the number of events which satisfy the acceptance requirements. These efficiencies can be found in Figures 1 and 2. In Figure 2, the efficiency requirements include the requirement that the events *fail the high-p_T jet selection*, but it is not included in the acceptance requirements, resulting in lower efficiencies in regions where the sum of truth jets p_{T} is large.



(a) All truth decay vertices occurring before the start of the calorimeter.



(b) The farthest truth decay occurring inside the calorimeter.



(c) The farthest truth decay occurring after the end of the calorimeter.

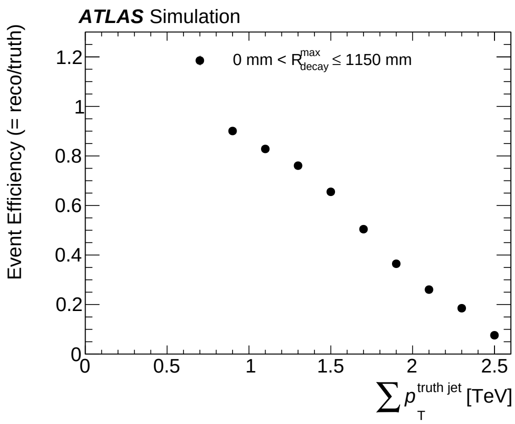
Figure 1: Parameterized event-level efficiencies for the High-p_{T} jet SR are shown as a function of the sum of truth jets p_{T}. The event-level efficiencies are evaluated separately for events which have all truth decay vertices occurring before the start of the ATLAS calorimeter, the farthest truth decay occurring inside the calorimeter, and the farthest truth decay occurring after the end of the calorimeter.

In addition to this event-level efficiency, events entering the SR are required to have at least one selected DV. For each heavy particle decay, an efficiency for reconstructing a displaced vertex $\varepsilon_{\mathrm{vertex}}$ is provided as a function of truth decay vertex mass and particle multiplicity using events which pass the event-level acceptance requirements. Considering the effects of the material and disabled pixel module vetos, the efficiencies are binned by the the transverse distance of the LLP decay. The per-vertex efficiency is defined as the number of truth vertices that can be matched to a reconstructed DV which passes the full selection as defined in Section 5, divided by the number of truth vertices which satisfy the vertex-level acceptance requirements. These efficiencies can be found in Figures 3 and 4.

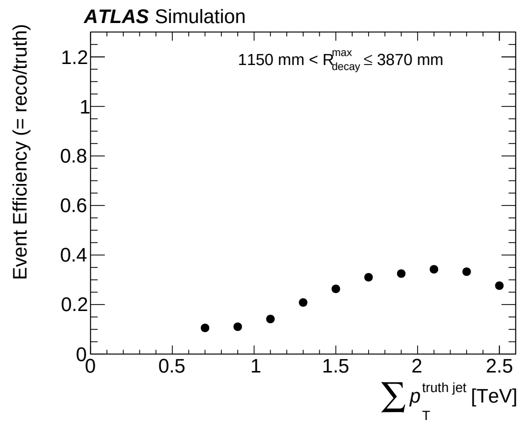
Scope of efficiencies

The parameterized efficiencies and the method for applying them are designed to be as model-independent as possible. However, these efficiencies are calculated and validated only with the samples described in Section 3, and thus there are a few limitations to their broader applicability. The following considerations indicate requirements for models that the efficiencies can safely be applied to:

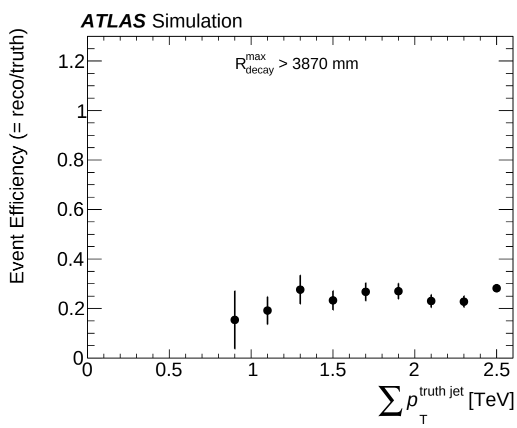
1. Parameterized efficiencies are calculated for sensitive regions in this analysis, so they may not adapt well to regions with low sensitivity. Therefore, the parameterized efficiencies are recommended to be applied



(a) All truth decay vertices occurring before the start of the calorimeter.

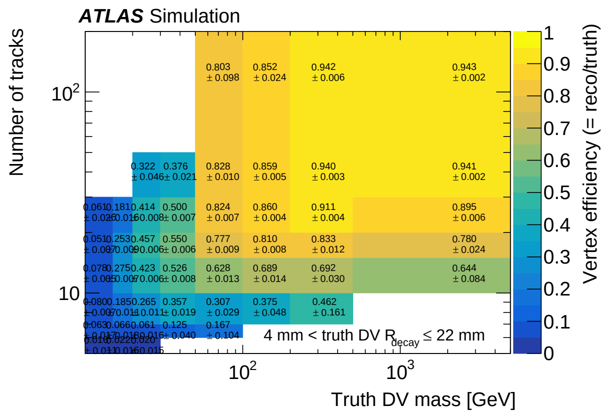


(b) The farthest truth decay occurring inside the calorimeter.

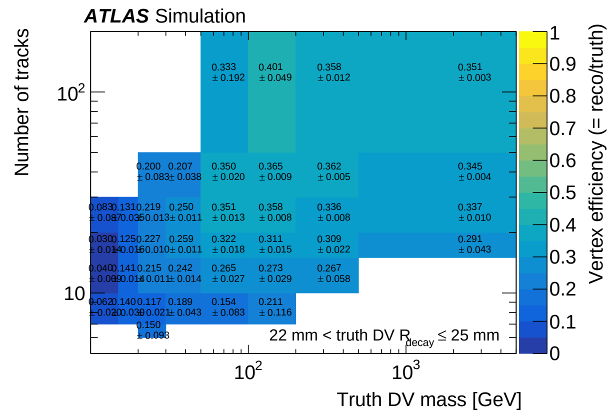


(c) The farthest truth decay occurring after the end of the calorimeter.

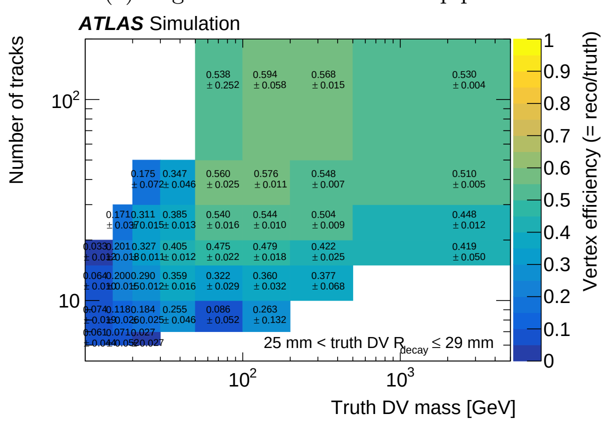
Figure 2: Parameterized event-level efficiencies for the Trackless jet SR are shown as a function of the sum of truth jets p_{T}. The event-level efficiencies are evaluated separately for events which have all truth decay vertices occurring before the start of the ATLAS calorimeter, the farthest truth decay occurring inside the calorimeter, and the farthest truth decay occurring after the end of the calorimeter.



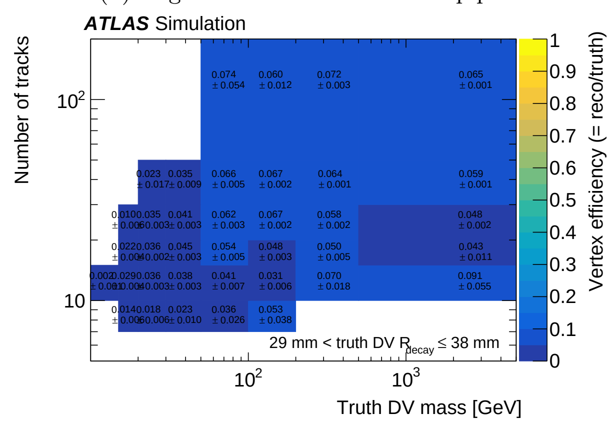
(a) Region 0: Before the beam pipe



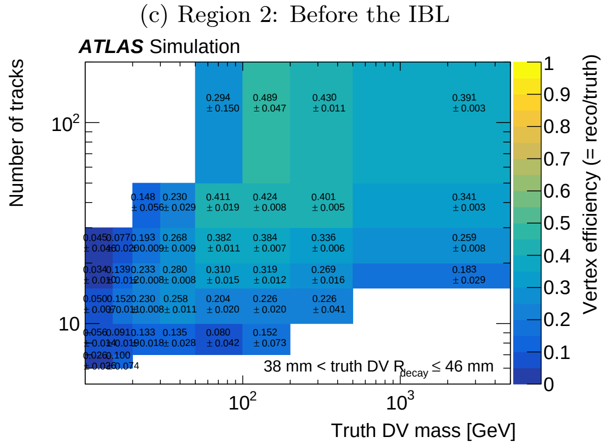
(b) Region 1: Close to the beam pipe



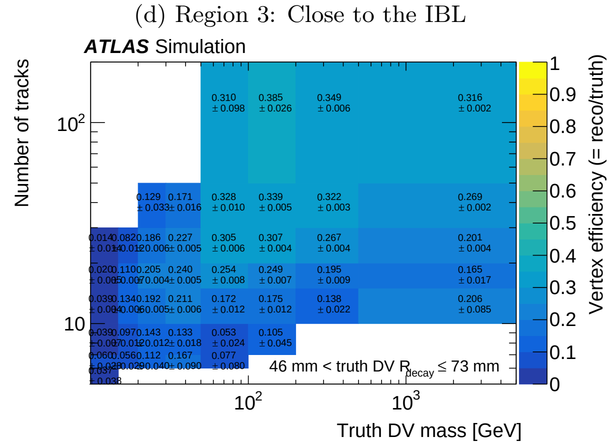
(c) Region 2: Before the IBL



(d) Region 3: Close to the IBL

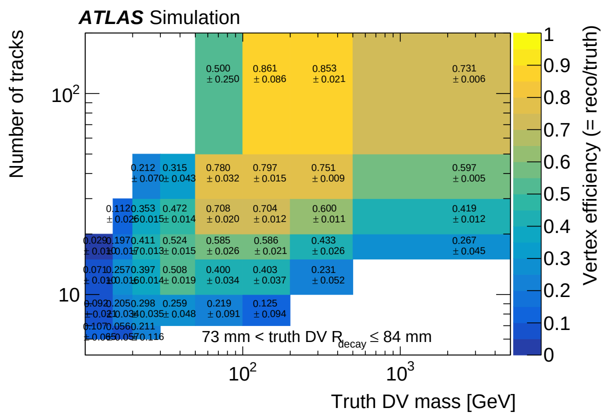


(e) Region 4: Before the B-layer

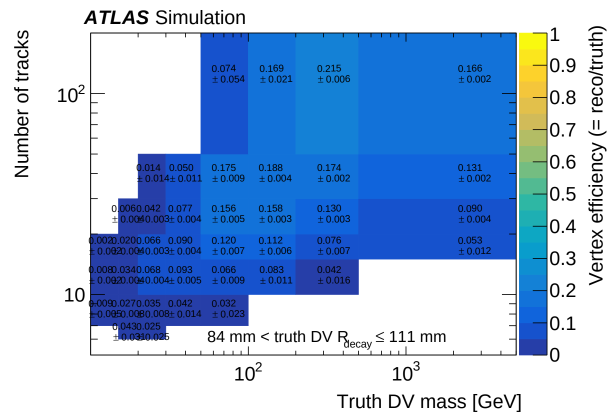


(f) Region 5: Close to the B-layer

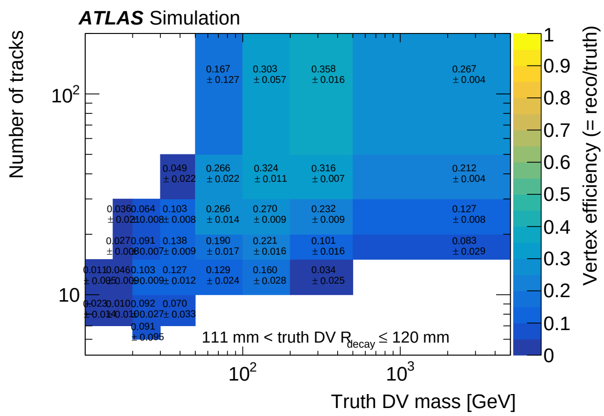
Figure 3: Parameterized vertex-level efficiencies as a function of the number of particles associated to a truth decay vertex, and the vertex invariant mass. Selected particles are required to have nonzero electric charge and $p_{\mathrm{T}} > 1$ GeV as described in the text. Vertex-level efficiencies are given separately for 11 radial regions.



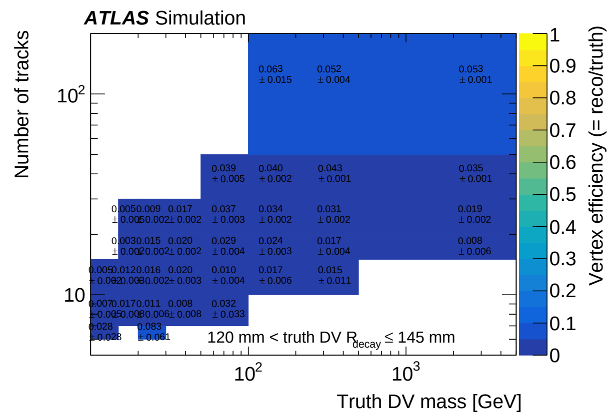
(a) Region 6: Before pixel layer 1



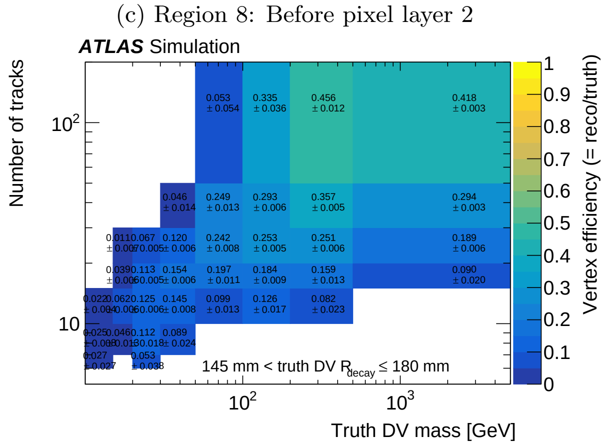
(b) Region 7: Close to pixel layer 1



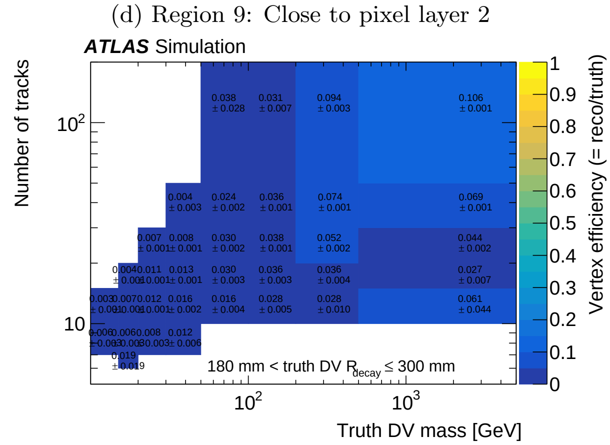
(c) Region 8: Before pixel layer 2



(d) Region 9: Close to pixel layer 2



(e) Region 10: Pixel supports



(f) Region 11: Before SCT

Figure 4: *(Cont'd)* Parameterized vertex-level efficiencies as a function of the number of particles associated to a truth decay vertex, and the vertex invariant mass. Selected particles are required to have nonzero electric charge and $p_{\mathrm{T}} > 1$ GeV as described in the text. Vertex-level efficiencies are given separately for 11 radial regions.

Table 4: The steps of High-p_{T} jet SR selections for the Strong RPV model with the several masses of the $\tilde{g}$ and $\tilde{\chi}_1^0$ and $\tilde{\chi}_1^0$ lifetimes. The full sim. $\mathcal{A} \times \varepsilon$ is defined as the ratio of surviving events to the all generated events and is calculated using the full ATLAS simulation.

	Full Sim. $\mathcal{A} \times \varepsilon$ [%]			
Selection	$m(\tilde{g}) = 2000$ GeV $m(\tilde{\chi}_1^0) = 850$ GeV $\tau(\tilde{\chi}_1^0) = 0.01$ ns	$m(\tilde{g}) = 2000$ GeV $m(\tilde{\chi}_1^0) = 50$ GeV $\tau(\tilde{\chi}_1^0) = 0.1$ ns	$m(\tilde{g}) = 2400$ GeV $m(\tilde{\chi}_1^0) = 200$ GeV $\tau(\tilde{\chi}_1^0) = 1$ ns	$m(\tilde{g}) = 2000$ GeV $m(\tilde{\chi}_1^0) = 1250$ GeV $\tau(\tilde{\chi}_1^0) = 10$ ns
Multijet trigger	100	100	99.9	99.5
Filter	100	99.8	99.7	96.2
Jet selection	99.86	96.1	96.4	91.3
Event has ≥ 1 DV passing:				
$R_{xy} < 300$ mm and $\lvert z \rvert < 300$ mm	92.9	85.4	79.6	70.0
$\min(\lvert \vec{R}_{\mathrm{DV}} - \vec{R}_{\mathrm{CV}} \rvert) > 4$ mm	87.7	85.2	79.3	69.6
$\chi^2/n_{\mathrm{DoF}} < 5$	87.3	83.9	78.0	68.5
pass material map veto	57.8	51.6	43.7	38.7
$n_{\mathrm{Tracks}}^{\mathrm{DV}} \geq 5$	27.8	18.6	12.0	9.4
$m_{\mathrm{DV}} > 10$ GeV	27.8	14.4	11.5	9.2
$n_{\mathrm{Selected\ tracks}}^{\mathrm{DV}} \geq 2$	27.8	14.4	11.5	9.2

Table 5: The steps of Trackless jet SR selections for the EWK RPV model with the several masses and lifetimes of the $\tilde{\chi}_1^0$. The full sim. $\mathcal{A} \times \varepsilon$ is defined as the ratio of surviving events to the all generated events and is calculated using the full ATLAS simulation.

	Full Sim. $\mathcal{A} \times \varepsilon$ [%]			
Selection	$m(\tilde{\chi}_1^0) = 500$ GeV $\tau(\tilde{\chi}_1^0) = 0.1$ ns	$m(\tilde{\chi}_1^0) = 500$ GeV $\tau(\tilde{\chi}_1^0) = 1$ ns	$m(\tilde{\chi}_1^0) = 1300$ GeV $\tau(\tilde{\chi}_1^0) = 0.1$ ns	$m(\tilde{\chi}_1^0) = 1300$ GeV $\tau(\tilde{\chi}_1^0) = 1$ ns
Multijet trigger	89.9	86.9	99.9	99.9
Filter	86.0	86.7	93.9	99.7
Jet selection	40.6	39.9	15.4	17.2
Event has ≥ 1 DV passing:				
$R_{xy} < 300$ mm and $\lvert z \rvert < 300$ mm	40.2	34.8	15.3	16.2
$\min(\lvert \vec{R}_{\mathrm{DV}} - \vec{R}_{\mathrm{CV}} \rvert) > 4$ mm	39.5	34.5	14.9	16.1
$\chi^2/n_{\mathrm{DoF}} < 5$	39.3	33.5	14.9	15.7
pass material map veto	35.0	23.4	13.5	11.7
$n_{\mathrm{Tracks}}^{\mathrm{DV}} \geq 5$	31.3	14.5	12.3	8.3
$m_{\mathrm{DV}} > 10$ GeV	31.1	14.3	12.2	8.3
$n_{\mathrm{Selected\ tracks}}^{\mathrm{DV}} \geq 2$	31.1	14.3	12.2	8.3

to models with a fraction of 10% or more vertices that satisfy the event-level acceptance requirements and also satisfy the vertex-level acceptance requirements ($\mathcal{A}_{\text{event}}\mathcal{A}_{\text{vertex}} > 10\%$).

2. The event-level acceptance requirements for the Trackless jet SR do not include the "fail high-p_{T} jet selection" requirement. Therefore, in addition to the conditions for $\mathcal{A}_{\text{event}}\mathcal{A}_{\text{vertex}}$ above, the parameterized efficiencies of the Trackless jet SR should not be used for models where 90% or more of the events pass the event-level acceptance requirements for the High-p_{T} jet SR.

3. LLP lifetimes of less than 10 ns are recommended for models where jets primarily originate from the decay of LLPs. This is because the parameterization is not accurate in cases where all LLPs decay inside or after the calorimeter.

When the above conditions are met, across the signal models considered in this search, this procedure gives event yields that agree with the detailed analysis within roughly 13% in both of the High-p_{T} jet SR and the Trackless jet SR.

Cutflows of the full SR selection are shown in Table 4 (Table 5) for several Strong (EWK) RPV models considered in this search. The acceptance $\times$ efficiency is defined as the ratio of surviving events to the all generated events and is calculated using the full ATLAS simulation (Full Sim. $\mathcal{A} \times \varepsilon$). Tables 6 and 7 show the comparison between the $\mathcal{A} \times \varepsilon$ calculated with the full ATLAS simulation and calculated with parameterized efficiencies (Param. $\mathcal{A} \times \varepsilon$) for the High-$p_{\mathrm{T}}$ jet SR and Trackless jet SR, respectively. *Non-closure* is defined as (Param. $\mathcal{A} \times \varepsilon$ − Full Sim. $\mathcal{A} \times \varepsilon$)/Full Sim. $\mathcal{A} \times \varepsilon$.

Table 6: The value of Full Sim. $\mathcal{A} \times \varepsilon$, Param. $\mathcal{A} \times \varepsilon$, and non-closure between these for the Strong RPV model with the several masses of the $\tilde{g}$ and $\tilde{\chi}_1^0$ and $\tilde{\chi}_1^0$ lifetimes in the High-p_{T} jet SR.

$m(\tilde{g})$, $m(\tilde{\chi}_1^0)$, $\tau(\tilde{\chi}_1^0)$	Full Sim. $\mathcal{A} \times \varepsilon$ [%]	Param. $\mathcal{A} \times \varepsilon$ [%]	Non-closure [%]
2000 GeV, 850 GeV, 0.01 ns	27.8	26.0	-6
2000 GeV, 50 GeV, 0.1 ns	14.4	13.8	-4
2400 GeV, 200 GeV, 1 ns	11.5	11.5	0
2000 GeV, 1250 GeV, 10 ns	9.2	8.6	-7

Table 7: The value of Full Sim. $\mathcal{A} \times \varepsilon$, Param. $\mathcal{A} \times \varepsilon$, and non-closure between these for the EWK RPV model with the several masses and lifetimes of the $\tilde{\chi}_1^0$ in the Trackless jet SR.

$m(\tilde{\chi}_1^0)$, $\tau(\tilde{\chi}_1^0)$	Full Sim. $\mathcal{A} \times \varepsilon$ [%]	Param. $\mathcal{A} \times \varepsilon$ [%]	Non-closure [%]
500 GeV, 0.1 ns	31.1	28.1	-10
500 GeV, 1 ns	14.3	14.3	0
1300 GeV, 0.1 ns	12.2	11.7	-4
1300 GeV, 1 ns	8.3	7.9	-5

Application to models with LLP decays to heavy-flavor quarks

The parameterized efficiencies can be applied to models containing LLPs that decay into heavy-flavor quarks with almost the same accuracy as the light-flavor case. Tables 8 – 11 show the steps of acceptance selections and SR selections for the signal models containing LLPs that decay into heavy-flavor quarks. Table 12 and 13 shows the comparison between the Full Sim. $\mathcal{A} \times \varepsilon$ and the Param. $\mathcal{A} \times \varepsilon$. The highest non-closure is 17%, and the accuracy is similar to the light-flavor case.

Table 8: The steps of truth-level acceptance selections for the models containing LLPs that decay into heavy-flavor quarks that the neutralino mass is 700 GeV in the Trackless jet SR. The acceptance value is defined as the ratio of surviving events to the all generated events.

	Acceptance [%]		
Selection	$m(\tilde{\chi}_1^0) = 700$ GeV $\tau(\tilde{\chi}_1^0) = 0.032$ ns	$m(\tilde{\chi}_1^0) = 700$ GeV $\tau(\tilde{\chi}_1^0) = 0.1$ ns	$m(\tilde{\chi}_1^0) = 700$ GeV $\tau(\tilde{\chi}_1^0) = 1$ ns
Jet selection	69.8	74.1	74.7
Event has ≥ 1 DV passing:			
$R_{xy} < 300$ mm and $\lvert z \rvert < 300$ mm	69.8	74.1	64.7
Transverse distance from the primary vertex > 4 mm	48.4	68.1	62.9
Have at least 1 charged particle with $\lvert d_0 \rvert > 2$ mm	48.4	68.1	62.9
$n_{selected\ decay\ products} \geq 5$	48.4	68.1	62.9
Invariant mass > 10 GeV	48.4	68.1	62.9

Table 9: The steps of truth-level acceptance selections for the models containing LLPs that decay into heavy-flavor quarks that the neutralino mass is 1500 GeV in the High-p_{T} jet SR. The acceptance value is defined as the ratio of surviving events to the all generated events.

Selection	Acceptance [%]		
	$m(\tilde{\chi}_1^0) = 1500$ GeV, $\tau(\tilde{\chi}_1^0) = 0.032$ ns	$m(\tilde{\chi}_1^0) = 1500$ GeV, $\tau(\tilde{\chi}_1^0) = 0.1$ ns	$m(\tilde{\chi}_1^0) = 1500$ GeV, $\tau(\tilde{\chi}_1^0) = 1$ ns
Jet selection	84.7	84.7	84.7
Event has ≥ 1 DV passing:			
$R_{xy} < 300$ mm and $\lvert z\rvert < 300$ mm	84.7	84.7	80.1
Transverse distance from the primary vertex > 4 mm	45.7	73.3	78.4
Have at least 1 charged particle with $\lvert d_0\rvert > 2$ mm	45.7	73.3	78.4
$n_{selected\ decay\ products} \geq 5$	45.7	73.3	78.4
Invariant mass > 10 GeV	45.7	73.3	78.4

Table 10: The steps of Trackless jet SR selections for the models containing LLPs that decay into heavy-flavor quarks that the neutralino mass is 700 GeV. The full sim. $\mathcal{A} \times \varepsilon$ is defined as the ratio of surviving events to the all generated events and is calculated using the full ATLAS simulation.

Selection	Full Sim. $\mathcal{A} \times \varepsilon$ [%]		
	$m(\tilde{\chi}_1^0) = 700$ GeV, $\tau(\tilde{\chi}_1^0) = 0.032$ ns	$m(\tilde{\chi}_1^0) = 700$ GeV, $\tau(\tilde{\chi}_1^0) = 0.1$ ns	$m(\tilde{\chi}_1^0) = 700$ GeV, $\tau(\tilde{\chi}_1^0) = 1$ ns
Multijet trigger	96.9	96.9	95.8
Filter	76.7	92.0	95.6
Jet selection	41.6	49.8	52.2
Event has ≥ 1 DV passing:			
$R_{xy} < 300$ mm and $\lvert z\rvert < 300$ mm	40.1	49.3	46.7
$\min(\lvert\vec{R}_{\mathrm{DV}} - \vec{R}_{\mathrm{CV}}\rvert) > 4$ mm	38.1	48.5	46.4
$\chi^2/n_{\mathrm{DoF}} < 5$	37.8	48.5	44.7
pass material map veto	33.1	43.2	32.2
$n^{\mathrm{DV}}_{\mathrm{Tracks}} \geq 5$	27.0	37.8	20.4
$m_{\mathrm{DV}} > 10$ GeV	26.6	37.5	20.0
$n^{\mathrm{DV}}_{\mathrm{Selected\ tracks}} \geq 2$	26.6	37.5	20.0

Table 11: The steps of High-p_{T} jet SR selections for the models containing LLPs that decay into heavy-flavor quarks that the neutralino mass is 1500 GeV. The full sim. $\mathcal{A} \times \varepsilon$ is defined as the ratio of surviving events to the all generated events and is calculated using the full ATLAS simulation.

Selection	Full Sim. $\mathcal{A} \times \varepsilon$ [%]		
	$m(\tilde{\chi}_1^0) = 1500$ GeV, $\tau(\tilde{\chi}_1^0) = 0.032$ ns	$m(\tilde{\chi}_1^0) = 1500$ GeV, $\tau(\tilde{\chi}_1^0) = 0.1$ ns	$m(\tilde{\chi}_1^0) = 1500$ GeV, $\tau(\tilde{\chi}_1^0) = 1$ ns
Multijet trigger	99.9	99.9	99.9
Filter	96.5	96.6	96.2
Jet selection	80.2	77.6	77.8
Event has ≥ 1 DV passing:			
$R_{xy} < 300$ mm and $\lvert z\rvert < 300$ mm	75.9	76.5	73.9
$\min(\lvert\vec{R}_{\mathrm{DV}} - \vec{R}_{\mathrm{CV}}\rvert) > 4$ mm	71.5	74.9	73.5
$\chi^2/n_{\mathrm{DoF}} < 5$	71.1	74.5	71.7
pass material map veto	56.3	66.2	54.2
$n^{\mathrm{DV}}_{\mathrm{Tracks}} \geq 5$	39.9	58.0	37.1
$m_{\mathrm{DV}} > 10$ GeV	39.6	57.7	36.7
$n^{\mathrm{DV}}_{\mathrm{Selected\ tracks}} \geq 2$	39.6	57.7	36.7

Table 12: The value of Full Sim. $\mathcal{A} \times \varepsilon$, Param. $\mathcal{A} \times \varepsilon$, and non-closure between these for the models containing LLPs that decay into heavy-flavor quarks that the neutralino mass is 700 GeV in the Trackless jet SR.

$m(\tilde{\chi}_1^0)$, $\tau(\tilde{\chi}_1^0)$	Full Sim. $\mathcal{A} \times \varepsilon$ [%]	Param. $\mathcal{A} \times \varepsilon$ [%]	Non-closure [%]
700 GeV, 0.032 ns	26.6	28.2	6
700 GeV, 0.1 ns	37.5	36.7	-2
700 GeV, 1 ns	20.0	21.1	6

Table 13: The value of Full Sim. $\mathcal{A} \times \varepsilon$, Param. $\mathcal{A} \times \varepsilon$, and non-closure between these for the models containing LLPs that decay into heavy-flavor quarks that the neutralino mass is 1500 GeV in the High-p_{T} jet SR.

$m(\tilde{\chi}_1^0)$, $\tau(\tilde{\chi}_1^0)$	Full Sim. $\mathcal{A} \times \varepsilon$ [%]	Param. $\mathcal{A} \times \varepsilon$ [%]	Non-closure [%]
1500 GeV, 0.032 ns	39.6	42.7	8
1500 GeV, 0.1 ns	57.7	62.7	9
1500 GeV, 1 ns	36.7	43.0	17