Head (exactly): The Decay head	
Contains (an or). Particles in decay	Show only selected:
Event Type V Production Method V	Production Cuts
$\pi^0  ightarrow \gamma\gamma$ [Event Type: 56200001 ?	
$\pi^0  ightarrow (H^0_3  ightarrow e^+e^-) \gamma$ 12 DecFiles	
$K^- \to e^+ e^- \pi^-$ Event Type: 37123000 ? Event Type: 37123001 ?	
$K^-  o e^- e^- \pi^+$ Event Type: 37123010 ? Event Type: 37123011 ?	
$K^+  ightarrow e^+ e^+ \pi^-$	
LHCb Simulation Wizard	Alexia Alexander Wight King's College London

### Agenda

Open Data & Accessibility LHCb Simulation Wizard Workflow Metadata Decay Search Wizard Outcomes LHCb vs Open Data Annotated Decfiles



L Н С b

SIMULATION

WIZARD

Production configu	ration	Decay search	Event Type V Production Mathed	# <u>Descriptor</u> : pi0 => gamma gamma	
+ 1	Stripping line v 🕐 Bookkeeping path v 🕫	Head (stactb):*         Decay head         ∨         Contains (all of):*         Particles in decay         ∨         Show only selected:           Tags (none of):*         underlese unstale: x: (stege-uniting x: X: ∨         Stropping line         ∨	$ \begin{array}{c} \hline \qquad $	# <u>NickName</u> : pi8,fixE=CaloAcc # # <u>Cuts</u> : LHCbAcceptance	
γ→ε <sup>+</sup> ε + ±		$\square  \frac{\gamma \to e^+ e^-}{\text{Estrenge time (regative - 4-value)}}$	Event Type: 56200001 ?	# Momentum: 1.0*GeV 5.0*GeV 10.0*GeV 16.8*GeV 33.8*GeV 50.0*GeV 100.0*GeV 168.0*GeV	E E
$K^+ \to \pi^+ \mu^- e^+$	Stripping line V 0 Bookkeeping path V 8	$\square  K^+ \to \pi^+ e^+ e^-$	$\pi^0  ightarrow (H_3^0  ightarrow e^+ e^-) \gamma$ 12 DecFiles	Biochantrastani even y ite ini yartate yan yamas ni utrisini energies in even imeters Endocumentation # PhysicsWG: Sim	C b
+ 1. $K^+ \rightarrow \pi^- \mu^+ e^+$	Stripping line v 0 Bookkeeping path v 1	$\square \begin{array}{ c c c } K^+ \rightarrow \pi^+ \pi^+ \pi^+ \\ \hline \\ $	$K^- \rightarrow e^+e^-\pi^-$ Event Ture: 37123000 2 Event Ture: 37123001 2	# Tested: Yes # Responsible: Liming Zhang, Adam Davis # Email: Lthang@cern.ch # Date: 27818923	s S
+ 🗹 🔍 😃 Title MyAnalysis		$\square K^+ \rightarrow \pi^+ \mu^- e^+$	$K^- \rightarrow e^- e^- \pi^+$	ere: zuresz CVUIme: < lmin #	
Email name@example.com		$\begin{tabular}{lllllllllllllllllllllllllllllllllll$	N	Alias piðsig pið Decav piðsig	

# LHCb Simulation Wizard

A web tool designed to make it easier for people to access existing simulation samples and request/produce new ones.

#### **Open Data & Accessibility**

All CERN research should be fully accessible, inclusive, democratic and transparent.

"able to technically get to the file" != accessible

Accessibility is about removing barriers to access – reducing the learning curve.

ndata	
CERIN	
Explore more than <b>three</b> of open data from partie	e petabytes cle physics!
Ştart typing	Search
search examples: collision dataset	s, <u>keywords:education, energy:7TeV</u>
Explore	Focus on
<u>dotasets</u>	ATLAS
software	ALICE
<u>environments</u>	<u>CMS</u>
<u>documentation</u>	<u>LHCb</u>
	<u>OPERA</u>
	PHENIX Data Science
	<u>Due sance</u>
Learn	Analyse
Discover the world of open data	Run your own physics analyses,

KCP LHCb NT	uple Wizard				Abou
Decay sea	arch				
Head (exactly): 🔻	Decay head	~	Contains (all of): 🔻	Particles in decay	~ Show
Tags (none of): 🔻	undefined-unstable X	charge-violatir	ig x X	<ul> <li>Stripping line</li> </ul>	
$\Box \qquad \begin{array}{c} \gamma \rightarrow e^+ \\ \hline 2 \text{ Strippi} \end{array}$	e <sup>—</sup> ng lines negative-Q-value	e			
$igsquare$ $K^+  ightarrow$ 2 Strippi	$\pi^+ e^+ e^-$ ng lines				
$igsquare$ $K^+  o$ 2 Strippi	$\pi^-e^+e^+$ ng lines (lepton-flavour-v	iolating lept	on-number-violating		
$\square  \begin{array}{c} K^+ \rightarrow \\ \textbf{2 Strippi} \end{array}$	$\pi^+\mu^-e^+$ ng lines (lepton-flavour-v	iolating			
$igcap K^+  o$ 2 Strippi	$\pi^-\mu^+e^+$ ng lines (lepton-flavour-v	iolating lept	on-number-violating		
$K^+ \rightarrow$	$\pi^+\mu^+\mu^-$				

#### Decay search

-						
Head (exactly): -	Decay head	Contains (all of): -	Particles i decav	n   ~	Show only selected:	
Event Type	~	Production Method		Produ	ction Cuts	~
$\pi^0  ightarrow \gamma\gamma$ Event Type: 56	6200001 ?					
$\pi^0  o (H_3^0 -$ 12 DecFiles	$ ightarrow e^+e^-)\gamma$					
$K^-  ightarrow e^+ e^-$ Event Type: 37	π <sup>-</sup> 7123000 ? Ε	vent Type: 37123001				
$K^-  ightarrow e^- e^-$ Event Type: 37	π <sup>+</sup> 7123010 ? Ε	vent Type: 37123011 ?				
$K^+  ightarrow e^+ e^+$ Event Type: 37	π <sup>-</sup> 7123010 ? Ε	vent Type: 37123011 ?				

# NTuple Wizard vs Simulation Wizard

The same core structure – SW has the NW as a dependency.

NW configures a production of derived datasets suitable for physics analysis ("ntuples").

#### Metadata

**simulation\_decay.json:** keys are decays, and contains decay descriptors and event types.

**decfiles.json:** keys are event type, and contains Decfile-specific information.

Metadata came from parsing all **7800** Decfiles using the <u>decaylanguage package from scikit-hep</u>.

# 6001\n#

"text": "# EventType: 13506001\n#\n# Descr
"signal\_particles": [
 "B\_s0",
 "B\_s~0"

'13506001": {

1.

"full\_decays": [
 "B\_s0 -> (tau+ -> nu\_tau~ pi+ pi+ pi-)
 "B\_s~0 -> (tau+ -> nu\_tau~ pi+ pi+ pi-)

"production": "Pythia8",
"cuts": [
 "DaughtersInLHCb"

'13506002": {
 "text": "# EventType: 13506002\n#\n# Descr
 "signal\_particles": [
 "B\_s0",
 "B\_s~0"



# Decay search

#### Filters:

- Decay head
- Particles in decay
- Event Type
- Production Method
- Production Cuts

Selection is via **Event Type**, not decay.

			_
Head (exactly): -	Decay head		Co
$\pi^{\circ}  ightarrow (H_3^{\circ}  ightarrow (H_3^{\circ$	$\Rightarrow e^+e^-)\gamma$ $\pi^-$ 7123000 ? Event Type: 37123001 ?	?	
$K^-  ightarrow e^- e^-$ Event Type: 33	π <sup>+</sup> 7123010 ? Event Type: 37123011 ?		
$K^+  ightarrow e^+ e^+$	π		

Annotated Decfile	
# <u>EventType</u> : 37113020	
#	
<pre># Descriptor: {[K+ =&gt; pi+ e- mu+]cc, [K+ =&gt; pi+ mu- e+]cc}</pre>	
#	
<pre># <u>NickName</u>: K+_pi+e-mu+=DecProdCut</pre>	
# Specifies which one of a	
# <u>Cuts</u> : predetermined set of cut	
# tools are used.	
<pre># Documentation: Forces a K+ to pi+ e- mu+ (LFV)</pre>	
# EndDocumentation	
#	
# PhysicsWG: RD	
# Tested: Yes	
# Responsible: Lukas Calefice	
<pre># Email: lukas.calefice@cern.ch</pre>	
# Date: 20210117	
# CPUTime: 2 min	
#	
Decay K+sig	
0.500 pi+ e- mu+ <u>Phsp;</u>	
0.500 pi+ e+ mu- <u>Phsp</u> ;	
Enddecay	
CDecay K-sig	
#	
End	

 $\times$ 



#### **Annotated Decfile**

Whole raw text of decay file viewable in a pop-up modal.

Keywords all have hover-activated pop-ups that give definitions.

#### Wizard Outcomes



#### LHCb vs Open Data

#### LHCb Users

- Can get a list of bookkeeping paths
- Can use the YAML file to make a production request directly using <u>the</u> <u>MC Request repository</u>.

#### **Open Data Users**

 Have to find a way to produce samples themselves (but all necessary information is contained in the output of LbMCSubmit) – we are **not** taking production requests!

#### References

#### Software repositories:

- Simulation Wizard
- NTuple Wizard
- <u>DecFiles</u>

#### Papers & Posters:

- NTuple Wizard Paper
- <u>Simulation Wizard Poster</u>

Event Type			
	Production Method	V Production Cuts	
$\pi^0  ightarrow \gamma \gamma$ Event Type: 56200001 ?			
$\pi^0  ightarrow (H^0_3  ightarrow e^+ e^-) \gamma$ 12 DecFiles			
$egin{array}{c} K^-  ightarrow e^+ e^- \pi^- \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \$	7123001 ?		
$ \begin{array}{c} K^- \rightarrow e^- e^- \pi^+ \\ \hline \\ \text{Event Type: 37123010} \end{array} \end{array}  \left[ \begin{array}{c} \text{Event Type: 37} \end{array} \right] $	123011 ?		
$K^+  ightarrow e^+ e^+ \pi^-$ Event Type: 37123010 ? Event Type: 37	123011 ?		

# Cb SIMULATION WIZARD

Ξ

# LHCb Simulation Wizard

# Thank you

Special thanks to my supervisors, Adam Morris and Chris Burr, and the summer student team.

#### Any questions?

Alexia Alexander Wight • @missneutrino • alexia.alexander\_wight@kcl.ac.uk



L Н С b

SIMULATION

WIZARD