

# DELPHES Cards Comparison (ATLAS/CMS) and Snowmass Proposal

Card files compared are posted at

[http://www.snowmass2013.org/tiki-index.php?page=Energy\\_Frontier\\_FastSimulation](http://www.snowmass2013.org/tiki-index.php?page=Energy_Frontier_FastSimulation)

And following tables reflect these cards except when superseded by expert feedback

**DELPHES2 and DELPHES3 have been verified to be identical by Sergei Chekanov, Kalanand Mishra, Sanjay Padhi and John Stupak**

DELPHES3 contains more flexible muon efficiency parameterization and handling of pileup, favoring the use of DELPHES3 for Snowmass exercise

# DELPHES cards - acceptance

attribute	ATLAS	CMS	Snowmass
tracker rapidity coverage	2.5	2.5	2.5
Central calorimeter rapidity coverage	3.2	3.0	3.1
Forward calorimeter rapidity coverage	4.9	5.0	5.0
Muon rapidity coverage	2.7	2.4	2.6
Number of calorimeter towers	38	40	40

Central = barrel + endcap

(ATLAS cards separate into barrel & endcap, CMS cards do not)

# DELPHES cards – EM resolution

attribute	ATLAS	CMS	Snowmass
Central noise term	0/0	0.25 GeV	0.25 GeV
Central sampling term	10/15 %	5%	8%
Central constant term	1/1.5 %	0.5%	0.5%
Forward noise term	0	0	0
Forward sampling term	28.5%	150%	90%
Forward constant term	3.5%	9%	3.5%
ZDC noise term	0	0	0
ZDC sampling term	70%	70%	70%
ZDC constant term	8%	8%	8%

Central = barrel + endcap

(ATLAS cards separate into barrel & endcap, CMS cards do not)

ZDC = zero degree calorimeter

# DELPHES cards – Hadronic resolution

attribute	ATLAS	CMS	Snowmass
Central noise term	1.59/0 GeV	0 GeV	1.6 GeV
Central sampling term	52/70.6 %	60%	60%
Central constant term	3/5 %	3%	3%
Forward noise term	0	0	0
Forward sampling term	94.2%	210%	150%
Forward constant term	7.5%	11%	7.5%
ZDC noise term	0	0	0
ZDC sampling term	138%	138%	138%
ZDC constant term	13%	13%	13%

Central = barrel + endcap

(ATLAS cards separate into barrel & endcap, CMS cards do not)

ZDC = zero degree calorimeter

# DELPHES cards – tracking

attribute	ATLAS	CMS	Snowmass
Minimum track $p_T$ to reach calorimeter	0.5 GeV	0.7 GeV	0.6 GeV
Tracking efficiency (DELPHES2)	97%	95%	96%
Muon Efficiency (DELPHES3)	95% / 85%	95% / 85%	95% / 85%
Muon Efficiency (upgrade)	95% / 85%	95% / 85%	95% / 85%
Electron & Pion Efficiency (upgrade)	95% / 85%	95% / 85%	95% / 85%
Momentum resolution @100 GeV (upgrade)	2%	1.5%	1.5%

Muon Efficiency parameterization in DELPHES3:

$p_T < 5$  GeV: zero efficiency

$p_T > 5$  GeV: quoted values for  $\eta < 1.5$  and  $\eta > 1.5$  respectively

Red = anticipated upgraded detector

# DELPHES cards – object cuts

attribute	ATLAS	CMS	Snowmass
Electron $p_T$ cut	10 GeV	10 GeV	10 GeV
Muon $p_T$ cut	5 GeV	5 GeV	5 GeV
Jet $p_T$ cut	20 GeV	20 GeV	20 GeV
Photon $p_T$ cut	10 GeV	10 GeV	10 GeV
Tau jet $p_T$ cut	10 GeV	10 GeV	10 GeV
Minimum $p_T$ of track for isolation	1 GeV	2 GeV	1.5 GeV
Track isolation cone	0.3	0.3	0.3
Calorimeter isolation cone	0.3	0.3	0.3
Minimum tower $E_T$ for isolation	0.5 GeV	Off	0.5 GeV
Calorimeter NxN grid for isolation	3	3	3

# DELPHES cards –jet variables

attribute	ATLAS	CMS	Snowmass
Jet cone radius	0.4 or 0.6	0.5	0.5
Jet algorithm	Anti- $k_T$	Anti- $k_T$	Anti- $k_T5$
Minimum seed energy for jet	1 GeV	1 GeV	1 GeV

# DELPHES cards – $b$ tagging

attribute	ATLAS	CMS	Snowmass
B tagging efficiency	70 (65) %	70 (65) %	70 (65) %
Charm mistag rate	15%	15%	15%
Light jet mistag rate	2% (1) %	2.5 (1) %	2% (1%)
Light jet mistag rate (upgrade)	0.5 (0.25) %	1 (0.5) %	0.5 (0.25) %

Two choices of operating points ( $b$  tag efficiency vs light jet mistag rate) are presented

Red = anticipated upgraded detector



# DELPHES cards – flags

attribute	ATLAS	CMS	Snowmass
Run B-field propagation	Yes	Yes	yes
Run very forward detectors	Yes	Yes	yes
Run trigger selection	Yes	Yes	Yes
Run FROG event display	Yes	No	Yes
Run LHCO	No	No	No

For B-field propagation:

attribute	ATLAS	CMS	Snowmass
Radius of B-field coverage	115 cm	129 cm	122 cm
Half-length of B-field coverage	351 cm	300 cm	325 cm
B-field strength	2 T	3.8 T	3 T
	Yes	No	Yes
Run LHCO	No	No	No