Analysis using SUSY D3PDs & Effect of pileup on MET performance

Graham Sellers University of Liverpool

Introduction to D3PDs

- D3PDs are a type of dataset that predominantly contain a collection of flat ntuples
- Produced using 'D3PDMaker' software
- Currently produced directly from AODs
 Soon to be AOD -> D2PD -> D3PD

Introduction to D3PDs

• Have ~1500 branches! - (some documentation)

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- <u> </u>		Option 💽		
Contents of "/ROOT Files//hepstore/store4/gsellers/TestD3PD/Data/run_155073/user.bsamset.SUSYD3PD.data10_7TeV.00155073.physics_L1Ca				
trig_L1_emtau_L1_2EM2	🔖 trig_L1_emtau_hadCore	🔖 trig_L1_jet_et6×6		
🔖 trig_L1_emtau_L1_2EM3	🔖 trig_L1_emtau_hadIsol	🔖 trig_L1_jet_et8x8		
🔖 trig_L1_emtau_L1_2EM4	🔖 trig_L1_emtau_n	🔖 trig_L1_jet_eta		
🔖 trig_L1_emtau_L1_2EM5	騻 trig_L1_emtau_phi	🔖 trig_L1_jet_n		
🔖 trig_L1_emtau_L1_EM10	💸 trig_L1_emtau_tauClus	🔖 trig_L1_jet_phi		
እ trig_L1_emtau_L1_EM10I	🔀 trig_L1_emtau_thr Names	🔀 trig_L1_jet_thrNam		
trig_L1_emtau_L1_EM14	💸 trig_L1_emtau_thrPattern	💸 trig_L1_jet_thrPatti		
🔖 trig_L1_emtau_L1_EM2	🔀 trig_L1_emtau_thrValues	🔀 trig_L1_jet_thrValue		
trig_L1_emtau_L1_EM2_UNPAIRED	騻 trig_L1_esum_RoIWord0	🔀 trig_L1 _jetet_thr Na		
🔖 trig_L1_emtau_L1_EM3	💸 trig_L1_esum_RoIWord1	💸 trig_L1_jetet_thrPa		
trig_L1_emtau_L1_EM3_EMPTV	騻 trig_L1_esum_RoIWord2	🔖 trig_L2_el_E		
trig_L1_emtau_L1_EM3_FIRSTEMPTY	💸 trig_L1_esum_energyT	🔖 trig_L2_el_Eratio		
🍾 trig_L1_emtau_L1_EM3_MV	💸 trig_L1_esum_energyX	🔖 trig_L2_el_Et		
Trig_L1_emtau_L1_EM3_UNPAIRED	騻 trig_L1_esum_energyY	🔖 trig_L2_el_EtOverF		
🔖 trig_L1_emtau_L1_EM4	💸 trig_L1_esum_overflowT	🔖 trig_L2_el_Ethad1		
🔖 trig_L1_emtau_L1_EM5	💸 trig_L1_esum_overflowX	🔖 trig_L2_el_L2_2e3_		
🍢 trig_L1_emtau_L1_EM5I	騻 trig_L1_esum_overflowY	🔖 trig_L2_el_L2_2e3_		
🔖 trig_L1_emtau_core	🔀 trig_L1_esum_thrNames	🔖 trig_L2_el_L2_2e3_		
🔖 trig_L1_emtau_eta	🗽 trig_L1_jet_et4x4	🔖 trig_L2_el_L2_2e5_		
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D3PDs continued...

- Uploaded onto the grid after production
- Can be read directly by ROOT for analysis
- Fast and efficient
- Typical sizes:

	D3PD	AOD
Data	~16kb/event	~100kb/event
МС	~70kb/event	

D3PD Reader

- Also the option for using a "D3PD Reader"
 - Purpose made to improve usability of D3PDs
- Possible advantages include
 - Dynamic loading of leaves (accounts for change in content)
 - Read files in parallel
 - Useful functions for specific analysis tasks
- Disadvantage
 - Relying on central production
 - Maybe doesn't suit each need

The Effects of Pile-up

- The LHC will see high levels of pile-up as luminosity increases
- Pile-up is the occurrence of multiple p-p interactions in the same bunch crossing
- Hinders successful reconstruction of events
- Already seeing presence of pile-up in first data

The Effects of Pile-up

• Identifying pile-up involves looking for extra reconstructed primary vertices in an event

 Also important to distinguish position of vertex to help identify real pile-up



Datasets

- From the May reprocessing:
 - user.bsamset.SUSYD3PD.data10_7TeV.
 00155073.physics L1Calo.merge.AOD.r1299 p161.000503.V1
 - user.bsamset.SUSYD3PD.data10_7TeV.

00155112.physics_L1Calo.merge.AOD.r1299_p161.000503.V1

• user.bsamset.SUSYD3PD.data10_7TeV.

00155116.physics_L1Calo.merge.AOD.r1299_p161.000503.V1

• user.bsamset.SUSYD3PD.data10_7TeV.

00155160.physics_L1Calo.merge.AOD.r1299_p161.000503.V1

Number of Vertices



~ 10% of events involve pile-up like events in these runs (from Apr-May) Require both $N_v > 1$ and $N_v^{trk} > 4$ for multiple well reconstructed vertices

Total	7 094 072	
1 Vertex	6 396 851	90.17%
2 Vertex	490 285	6.91%
3 Vertices	182 320	2.57%
>3 Vertices	24 616	0.35%

Number of Vertices - various runs



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Number of Tracks – a comparison









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Separation of Vertices



Minimum and maximum separation of vertices in $N_v \ge 3$ events



Missing Et



Component of RefFinal CellOut



Component of Final CorrTopo



• D3PDs used to study pile-up events

- Agreement with previous results
- Relatively even spread of vertex separations
- Missing Et differs between pile-up and non pileup events