

# Derived Physics Data for Taus

Ulla Blumenschein



# Overview

## Primary DPDs: PrimaryDPDMaker

### - Physics DPDs: AOD, collision data

- Currently: Trigger-based tight Skims on AOD: **EI, Mu, Tau, Phot**
- More under development, e.g. in StandardModel WG

### - Cosmics DPDs: ESD, from cosmic data

ID (Pixel, SCT, any, proj.), Calo, Tile, RPC, TGC, EM cluster

**EGAMTAU: Electron-, Photon- or TauRecContainer object**

### - Performance DPDs: ESD or RoI-ESD, from collision data

**For Taus: SingleEI, SingleMu, LargeMet**

Others: Egamma, Muon, Jet, Photon+jets, Tracking, MinBias, PrescaledESD



Other D2PD or  
D3PD maker

Other D2PD or  
D3PD maker

Other D2PD or  
D3PD maker

## Secondary/Tertiary DPDs: TauDPDMaker

- from DPD, AOD and ESD
- **Secondary DPD: further skimmed DPD,**
  - Zleplep, Zjetjet, Di-jet, W->tau skims
- **Tertiary DPD: Flat N-tuple**
  - Detailed Tau variables
  - Basic Information to isolate Tau-Signal

# Cosmic DPDs for the Tau group

**Calo (CALOCOMM):** Guillaume Unal, Irene Vichou

- L1Calo and L1CaloEM streams
- Prescale 5
- FullESD

**EI/Phot/Tau (EGAMTAUCOMM):** Karsten Koenicke

- 71% of L1CaloEM, 2% of IDCosmics stream
- TauRecContainer (or Electron, Photon)
- Full ESD

*Produced in last cosmics  
reprocessing: December 2008  
Heavily being used*

## Slice weeks (April/May 2009):

- Produce DPDs centrally (probably with AtlasTier0-15.0.0.Y)
- Start with IDCOMM (Trackfilter) and CALOCOMM
- all ESDs available at CAF (atlcal disc pool)

# Performance DPDs for the Tau group

10 Performance DPDs are centrally produced  
3 DPDs of high interest for the Tau group:

## W/Z-> Muon (SINGLEMU): full ESD

- from the Muon trigger stream
- Staco/Muid muon ,  $PT > 10\text{GeV}$ , Calo and Track isolation (**cone 0.2**)  
**Separate Prescales for  $10\text{GeV} < PT < 15\text{GeV}$  and for  $PT > 15\text{GeV}$**
- for high-lumi in addition Z->mumu skim

Z  $\rightarrow$  tautau  $\rightarrow$  mu+had,  
Background

## W/Z-> Electron (SINGLEEEL): full ESD

- from the Egamma trigger stream
- Medium (IsEM) electron, author egamma,  $PT > 15\text{GeV}$   
**Separate prescales for  $10\text{GeV} < PT < 15\text{GeV}$ ,  $15\text{GeV} < PT < 15\text{GeV}$  and  $PT > 20\text{GeV}$**

Z  $\rightarrow$  tautau  $\rightarrow$  el+had,  
Background

## W/Z->Tau (LARGEMET): full ESD

- from the Jet/tau/Etmiss trigger stream
- MET\_RefFinal  $> 30\text{ GeV}$   
or prescaled Loose Tau (TauRecContainer),  $PT > 30\text{GeV}$
- entirely Tau group responsibility

W  $\rightarrow$  tau-had,  
Z  $\rightarrow$  hadhad, Background

*PrimaryDPDmaker runs in rel 15 on files with old and with new tau EDM*

# Performance DPDs: more details

- PrepRawData and Track Thinning:

- Keep PrepRawData (Pixel-Clusters, SCT-clusters, TRT hits) in Rol around **tau** jets
- Currently: Rol = 0.45 cone around any tau jet with  $PT > 15 \text{ GeV}$

Not working correctly ( see Antonios presentation)

- Cone is the wrong shape for taus
- many warnings (Pixel, SCT) when running the ThinningTool

→ **currently switched off: writing full ESD**

Antonio Limosani will have a look into the Thinning Svc

- Loosening Cuts on SingleElectron and SingleMuon DPD for first data

- SingleEl and SingleMu triggers at the beginning at  $PT > 10 \text{ GeV}$ , sufficientlt efficient
- Caterine and Donatella: substancially larger fraction of  $Z \rightarrow \tau\tau \rightarrow lh$  with  $PT > 10 \text{ GeV}$  cuts on electron/muon (background ok, QCD rates pending..)
- **Added  $PT > 10 \text{ GeV}$  skim for electrons and Muons with a prescale that can be adjusted independently (currently 1)**
- **reduced cone size for muon isolation from 0.5 to 0.2 ( all cuts to be finetuned later...)**
- **Rates: from Catarina & Donatellas offline studies : the step  $15 \text{ GeV} \rightarrow 10 \text{ GeV}$  doubles the rate ( 27 k vs 14k events in  $1 \text{ pb}^{-1}$ )**

# Performance DPDs: more details

## ToDo:



- Update rate estimate  
Cannot use FDR samples anymore because we have now lower trigger thresholds
- Check if Tau-people can run all parts of the analysis on DPD
  - signals selection ✓
  - background determination from data
  - systematic checks
- Simplify Muon selection (use official selection as soon as it becomes available)
- IDPrepRaw data thinning → Antonio
- Complete validation scheme

## More information:

- **General PrimaryDPD wiki page: contains link to PerformanceDPD page:**  
<https://twiki.cern.ch/twiki/bin/view/AtlasProtected/PrimaryDPDMaker>
- **Primary DPDs of interest for Tau:**  
<https://twiki.cern.ch/twiki/bin/view/AtlasProtected/TauDPDSamples>
  - **Test files:** <http://physik2.uni-goettingen.de/~ulla/DPD/>
  - **Manual how to produce the DPD (heavy development, check for updates)**

# Plans for Validation

Request from DPD task force to validate Performance DPDs within Perf. WG

## Manpower:

**Jyothsna Rani Komaragiri**

**Antonio Limosani:** Has already started Thinning validation of LargeMet DPD

## Proposal:

- **General checks:**
  - **Slimming validation:** presence of Containers
  - **Skimming validation:** correct position of cuts
- **More detailed skimming and thinning validation:**
  - **Rerun tracking and TauRec on DPD**
  - **Compare with results from AOD/ESD**

## Software:

- **TauRec**
- **Tau validation package**
- **D23PDValidation ?**

## Needs:

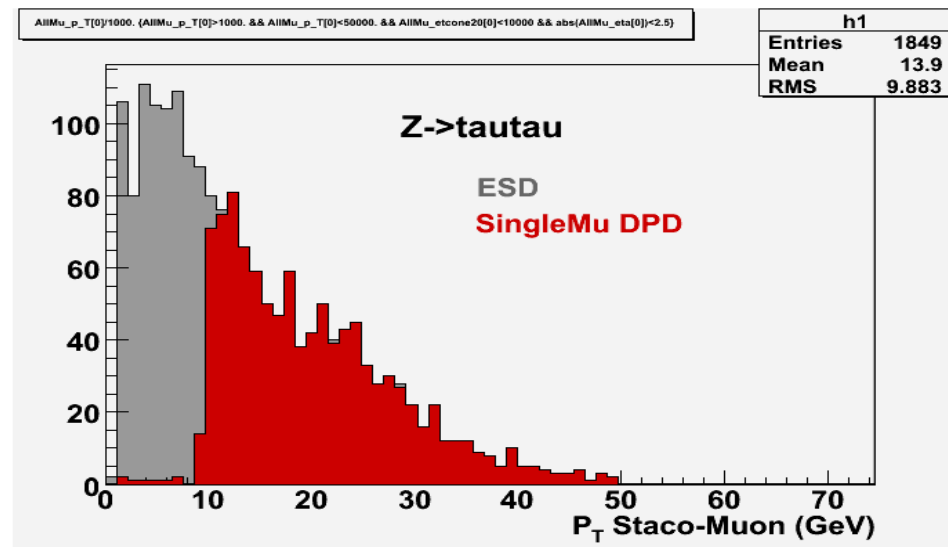
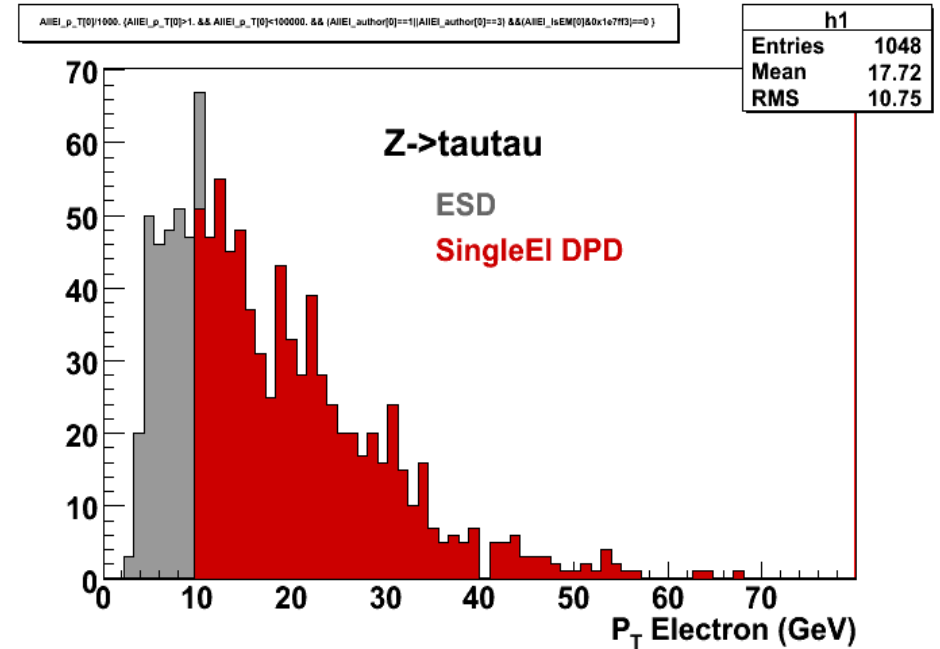
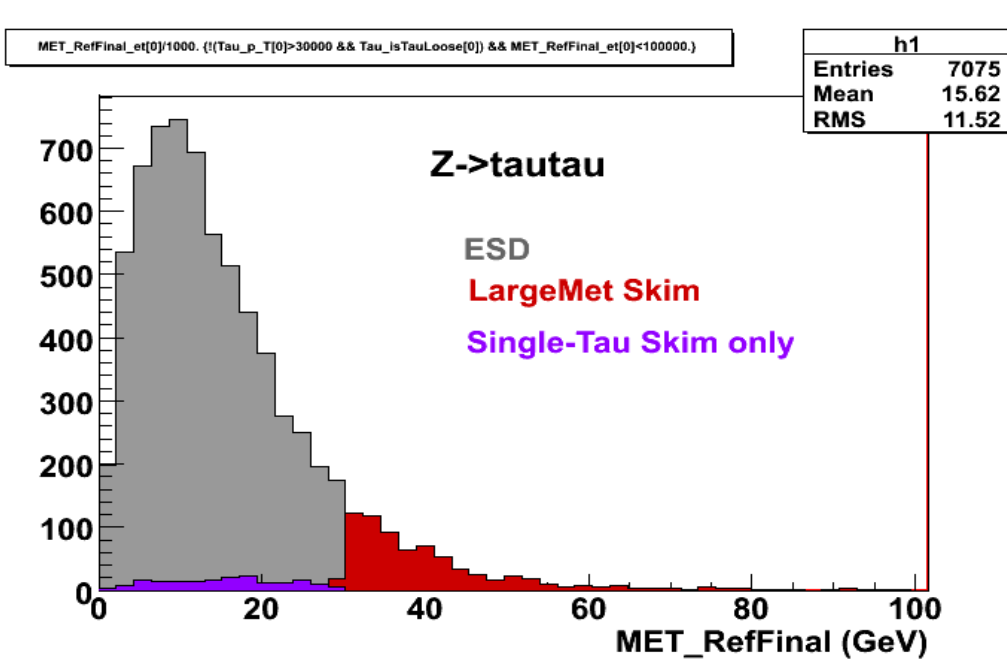
- **The DPD and the corresponding ESD for comparisons**

## First steps:

- **Email discussion with Jyothsna and Antonio**
- **Provided test samples in order to develop the validation software**

# Cross checks with current head version: Ztautau

mc08.106052.PythiaZtautau.recon.ESD.e347\_s462\_r604, 8727 evts





# D2PDs and D3PDs (ntuple): TauDPDMaker

- ▶ Configures EventView
  - ▶ Can run in rel14 and 15 with old and new EDM
- Currently recommended: 14.5.1.4,AtlasProduction
- TauDPDMaker-00-04-16
  - EventViewUserData-14-05-00-11 (branch for rel14)
- ▶ Secondary DPD: A few Skim examples, barely used so far
  - ▶ ControlSample Ntuple: Slim default, additional flags for more detailed variables, heavily used.

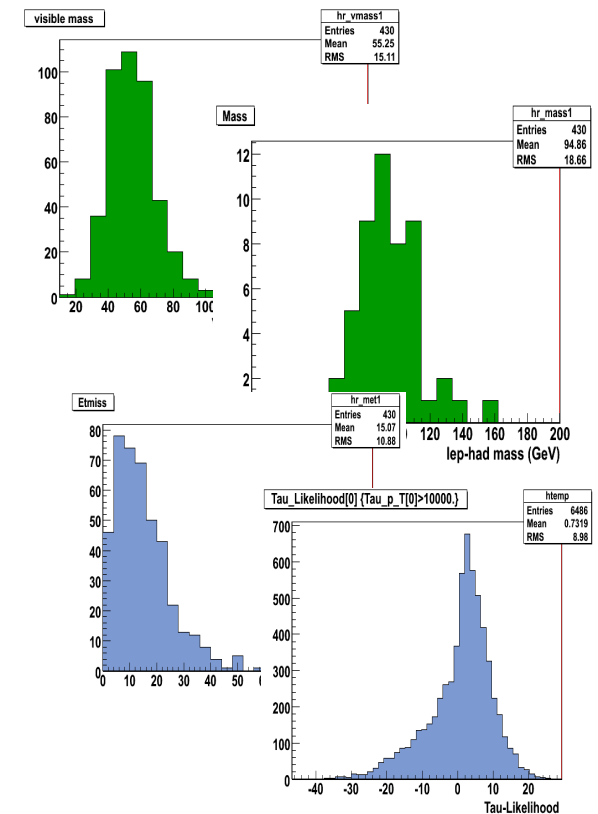
Several features removed and recent upgrades in both EventViewUserData and TauDPDMaker

- ▶ For more information on TauDPDMaker see:

<https://twiki.cern.ch/twiki/bin/view/AtlasProtected/TauDPDMaker>

Many thanks for all the contributions from the users of TauDPDMaker !

- ▶ Important: validate trigger objects!
- ▶ Next step: Validate release 15 implementation (new Tau EDM, backwards compatibility...)



- ▶ *If you are interested in additional features:*

- *Implement more associators*
- *New ways to implement Tau variables*
- ....

→ *please volunteers - I will be happy to assist !*

# Summary

- Many recent developments in the Primary DPDMaker:  
Aim for a major DPD production soon
- PrimaryDPDMaker and TauDPDMaker run on files with old and on new tau EDM
- Requests from Tau (Ztautau selection) group have been implemented .
  - Need reliable rate estimates for new selection
  - Need feedback for usage in background determination and for systematic checks
- Started to setup a validation scheme for DPDs (in particular LargeMet DPD)
  - Jyothsna, Antonio
- D3PD maker from TauDPDMaker heavily being used, several recent updates

# Performance DPDs for the Tau group

► **For more information on Primary DPDs see:**

General PrimaryDPD wiki page: contains link to PerformanceDPD page:  
<https://twiki.cern.ch/twiki/bin/view/AtlasProtected/PrimaryDPDMaker>

Sample produced for the Tau group, with manual how to produce your own test DPDs:  
<https://twiki.cern.ch/twiki/bin/view/AtlasProtected/TauDPDSamples>

Primary DPDMaker in CVS:  
<http://atlas-sw.cern.ch/cgi-bin/viewcvs-atlas.cgi/offline/PhysicsAnalysis/PrimaryDPDMaker>

Configuration of the DPDs in CVS:  
<http://atlas-sw.cern.ch/cgi-bin/viewcvs-atlas.cgi/offline/PhysicsAnalysis/PrimaryDPDMaker/share/>

Last DPD Task force meeting:  
<http://indico.cern.ch/conferenceDisplay.py?confId=51063>

► **For more information on TauDPDMaker see:**

<https://twiki.cern.ch/twiki/bin/view/AtlasProtected/TauDPDMaker>

Invariant Mass  
Analysis  
Lepton  $p_T > 10\text{GeV}$

- ~240 evts in the mass bin after cuts
- Gain a factor of 1.7 in signal, no difference in background :  $S/B \approx 15$

Cuts	$Z \rightarrow \tau\tau$	$W \rightarrow e\nu$	$W \rightarrow \mu\nu$	Jall	tt	Zee	$Z\mu\mu$
Isol lepton (e, $\mu$ )	22741	568701	691848	2389070	23959	81433	95162
$E_T^{\text{miss}} > 20$	6772	476310	620244	687749	21939	2348	27565
$m_T^{\text{lep}, E_T^{\text{miss}}} < 50$	5524	72664	80600	657203	6732	1046	7088
$\Sigma E_T < 400$	5384	71886	80177	522060	3066	962	7048
b-jet veto	5384	71886	80177	522060	3066	962	7048
Mass comb. with $\tau$ -cand	1084 $\pm$ 25	293 $\pm$ 18	275 $\pm$ 19	4628	223 $\pm$ 4	17 $\pm$ 3	51 $\pm$ 5
$\Delta\phi < 2.8$	571 $\pm$ 18	257 $\pm$ 16	227 $\pm$ 17	3703	196 $\pm$ 4	10 $\pm$ 3	34 $\pm$ 4
Invariant Mass $> 0$	330 $\pm$ 14	20 $\pm$ 5	15 $\pm$ 4	2777	64 $\pm$ 2	1 $\pm$ 1	3 $\pm$ 1
$1 < \Delta\phi$	307 $\pm$ 13	19 $\pm$ 4	15 $\pm$ 4	926	60 $\pm$ 2	1 $\pm$ 1	3 $\pm$ 1
OS events	301 $\pm$ 13	14 $\pm$ 4	10 $\pm$ 4	926 $\pm$ 926	48 $\pm$ 2	1 $\pm$ 1	3 $\pm$ 1
$m^{\text{lep}, \tau_{had}} 0-200$	297 $\pm$ 13	6 $\pm$ 3	4 $\pm$ 2	926 $\pm$ 926	28 $\pm$ 2	1 $\pm$ 1	2 $\pm$ 1
$m^{\text{lep}, \tau_{had}} 66-116$	242 $\pm$ 12	4 $\pm$ 2	3 $\pm$ 2	0 $\pm$ 0	8 $\pm$ 1	0 $\pm$ 0	1 $\pm$ 1
SS events	6 $\pm$ 2	5 $\pm$ 2	5 $\pm$ 3	0 $\pm$ 0	11 $\pm$ 1	0 $\pm$ 0	0 $\pm$ 0
$m^{\text{lep}, \tau_{had}} 0-200$	4 $\pm$ 1	4 $\pm$ 2	1 $\pm$ 1	0 $\pm$ 0	7 $\pm$ 1	0 $\pm$ 0	0 $\pm$ 0
$m^{\text{lep}, \tau_{had}} 66-116$	1 $\pm$ 1	1 $\pm$ 1	0 $\pm$ 0	0 $\pm$ 0	3 $\pm$ 0	0 $\pm$ 0	0 $\pm$ 0

→ Lowering the  $p_T$  lepton threshold gives a better  $S/B$ , but QCD contribution still to be checked

Invariant Mass  
Analysis  
Lepton  $p_T > 15$  GeV  
100pb-1

- Low statistics for QCD : still waiting for dedicated production (lepton filter)
- ~140 evts in the mass bin after cuts
- S/B=9

Cuts	$Z \rightarrow \tau\tau$	$W \rightarrow e\nu$	$W \rightarrow \mu\nu$	Jett	tt	Zee	Zμμ
Isol lepton (e,μ)	15701	534907	691848	1066340	22186	77790	91043
$E_T^{miss} > 20$	4699	463814	620244	341561	20272	2252	26379
$m_T^{lep, E_T^{miss}} < 50$	3468	61414	80600	312866	5668	950	5947
$\Sigma E_T < 400$	3346	60664	80177	253625	2518	868	5907
b-jet veto	3346	60664	80177	253625	2518	868	5907
Mass comb. with $\tau$ -cand	608±19	233±16	275±19	2777	172±4	13±3	47±6
$\Delta\phi < 2.8$	341±14	204±15	227±17	2777	150±4	8±2	29±4
Invariant Mass >0	203±11	19±4	15±4	1851	52±2	0±0	2±1
$1 < \Delta\phi$	186±10	18±4	15±4	0	48±2	0±0	2±1
OS events	182±10	14±4	10±4	0±0	40±2	0±0	2±1
$m^{lep, \tau cand} 0-200$	180±10	6±3	4±2	0±0	23±1	0±0	1±1
$m^{lep, \tau cand} 66-116$	141±9	4±2	3±2	0±0	7±1	0±0	1±1
SS events	5±2	4±2	5±3	0±0	8±1	0±0	0±0
$m^{lep, \tau cand} 0-200$	3±1	3±2	1±1	0±0	5±1	0±0	0±0
$m^{lep, \tau cand} 66-116$	1±1	1±1	0±0	0±0	2±0	0±0	0±0