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Event Selection Using TAGS (ELSSI)

- *Introduction—Event Selection in ATLAS*
- *TAGS—Content and Formats*
- *Using ELSSI—Demo*

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Introduction

- **Event selection in ATLAS—extract events that satisfy certain selection predicates:**
  - Use the TAG to select the final states that are of your interest and collect the selected events in a new set of ESD and AOD
  - Pseudo-SQL- to extract a list of events that satisfy your selection criteria:

```
SELECT <references to> {AOD | ESD | RAW}, other
attributes …
FROM tag_datatable(s)
WHERE e (EVENT TAG predicates) = TRUE
```

  - Return: a collection of events --whose tags satisfy a selection predicate e (with selected metadata and searched domain returned as well)
  - Subsequently do your analysis on the new ESD and AOD that contains ONLY the selected events
- **Metadata system:**
  - Run-level metadata
  - Luminosity-block-level metadata: detector status and quality info, trigger configuration info
  - Event-level metadata: passed triggers and physics content

Introduction – ATLAS TAGS

- **Event-level metadata system**
  - Event-by-event metadata and navigational data (references pointing to event headers in the data store)
- **Decided by 2006 Task force and stability maintained by the PAT group**
  - >200 variables for each event
  - variables are either copies of their AOD equivalents, or in a few cases are computed as simple combinations of these quantities
- **Produced in central ATLAS reconstruction**
  - (merged) AOD => ROOT file => TAG Database
  - RAW Data => ESD (~500 kB/event) => AOD (~100 kB/event) => TAG (~1kB/event)
- **Storage:**
  - File-based: ordinary ROOT files that can be opened in ROOT just like NTuples (distributed to all Tier 1 sites)
  - Relational: TAG content in Relational Databases (CERN and some Tier 1)
- **More details at**

https://twiki.cern.ch/twiki/bin/viewauth/AtlasProtected/TagForEventSelection

TAG Content

Event Quantities

Atribute Definition	Attribute Name	Atribute Type
Run Number	RunNumber	unsigned int
Event Number	EventNumber	unsigned int
Event Type	isCalibration	bool
Event Type	isTestBeam	bool
Event Type	isSimulation	bool
Event Type	isRealData	bool
Number of Tracks	NTrk	unsigned int
Number of Vertices	Nvx	unsigned int
Primary Vertex	VtxX, VtxY, VtxZ	float (each)
Streaming Criteria/Results	Stream	unsigned int
Random Number	RandomNumber	unsigned int
Time Stamp	TimeStamp	unsigned int
Bunch by bunch Luminosity	Luminosity	float
Luminosity block Number	LumiBlockN	unsigned int
Missing Energy	MissingET	float
Phi of Missing ET	MissingETPhi	float
Summed cell ET	SumET	float

- **The definition, attribute names and types and of the variables are grouped according to their content and summarized for each group.**

TAG Content

Event Quantities - Data Quality

Atribute Definition	Attribute Name	Atribute Type
Detector Status	StatusPIXB	unsigned short
Detector Status	StatusPIXEA	unsigned short
Detector Status	StatusPIXEC	unsigned short
Detector Status	StatusSCTB	unsigned short
Detector Status	StatusSCTEA	unsigned short
Detector Status	StatusSCTEC	unsigned short
Detector Status	StatusTRTB	unsigned short
Detector Status	StatusTRTEA	unsigned short
Detector Status	StatusTRTEC	unsigned short
Detector Status	StatusEMBA	unsigned short
Detector Status	StatusEMBC	unsigned short
Detector Status	StatusEMECA	unsigned short
Detector Status	StatusEMECC	unsigned short
Detector Status	StatusHECA	unsigned short
Detector Status	StatusHECC	unsigned short
Detector Status	StatusFCALA	unsigned short
Detector Status	StatusFCALC	unsigned short

- **The data quality information is currently a straightforward copy of the detector status flags. The flags include barrel and endcap for each subdetector (0, 1, 2, and 3 => unknown, red, yellow and green).**

TAG Content

Trigger Information

Atribute Definition	Attribute Name	Atribute Type
CTP Decisions	CTPWord	24 words, "unsigned int" each
Level 1 Trigger Type	Level1TriggerType	unsigned int
Level 2 Trigger Masks	L2PassedTrigMask	32 words, "unsigned int" each
Event Filter Masks	EFPassedTrigMask	32 words, "unsigned int" each

- Trigger words,CTP (= LVL1) and HLT are indexed from 0 to 23 or 31, i.e., CTPWord0, CTPWord1, etc. The above attributes contain the yes/no bit for the trigger decisions.

TAG Content

Number of Objects - Electrons, Photons, Muons, Tau-Jets and Jets

Object	Number
Electrons	4
Photons	2
Muons	4
Taus	2
Jets	6

Atribute Definition	Attribute Name	Atribute Type
Total number of loose electrons	NLooseElectron	unsigned int
Loose electron Pt	LooseElectronPt	float
Loose electron eta	LooseElectronEta	float
Loose electron phi	LooseElectronPhi	float
Loose electron Tightness	LooseElectronTightness	unsigned int

Total number of loose photons	NLoosePhoton	unsigned int
Total number of loose converted photons	NLooseConvertedPhoton	unsigned int
Loose photon Pt	LoosePhotonPt	float
Loose photon eta	LoosePhotonEta	float
Loose photon phi	LoosePhotonPhi	float
Loose photon Tightness	LoosePhotonTightness	unsigned int

Total number of loose muons	NLooseMuon	unsigned int
Loose muon Pt	LooseMuonPt	float
Loose muon eta	LooseMuonEta	float
Loose muon phi	LooseMuonPhi	float
Loose muon Tightness	LooseMuonTightness	unsigned int
Loose muon Isolation ET	LooseMuonIsolEt	float
Loose muon Track Isolation	LooseMuonIsolN	unsigned int

TAG Content

Jets and Tau-Jets attributes

Atribute Definition	Attribute Name	Atribute Type
Total number of tau jets	NTau	unsigned int
Tau Jet Pt	TauJetPt	float
Tau Jet eta	TauJetEta	float
Tau Jet phi	TauJetPhi	float
Tau Jet number of tracks	TauJetNTrk	unsigned int
Tau Jet likelihood	TauJetLikelhood	float

Total number Jets	NJet	unsigned int
Total number b-tagged Jets	NBJet	unsigned int
Jet PT	JetPt	float
Jet eta	JetEta	float
Jet phi	JetPhi	float
B-tag likelihood	BJetLikelihood	float
Summed ET over Jets	JetSumET	float

TAG Content

Physics TAG Attributes

Atribute Definition	Attribute Name	Atribute Type
Electron/Photon Identification	EgammaWord	unsigned int
Muon Identification	CombinedMuonWord	unsigned int
Jet Missing Et Identification	JetMissingEtWord	unsigned int
Tau Identification	TauIdWord	unsigned int
Jet Tagging	JetTagWord	unsigned int
B-Physics Analysis	BPhysWord	unsigned int
Exotic Physics Analysis	ExoticWord	unsigned int
Higgs Physics Analysis	HiggsWord	unsigned int
SUSY Physics Analysis	SUSYWord	unsigned int
SM Physics Analysis	SMWord	unsigned int
Top Physics Analysis	TopWord	unsigned int
Heavy Ion Analysis	HeavyIonWord	unsigned int

- It is recommended to have a 32-bit word for each physics or performance group to flag the interesting events for their analysis. Each group will maintain a documentation on the definition of each bit position in the their word.

TAG Content

Collection Information

Atribute Definition	Attribute Name	Atribute Type
AOD Reference	StreamAOD_ref	link table
ESD Reference	StreamESD_ref	string
RDO Reference	Stream1_ref	string

- References to AOD/ ESD/RAW data; these are saved in the TAG to allow for back navigation to the correct AOD, ESD and RDO to retrieve the event.

Event Selection with ELSSI-demo

- **ELSSI:** Event Level Selection Service Interface
- **Tutorials:**
  - https://twiki.cern.ch/twiki/bin/view/Atlas/EventTagTutorials
- **Datasets:**
  - FDR2c: https://lxvm0341.cern.ch/tagservices/dev/qzhang/runbased_obj/index.htm
  - TOPMIX: https://lxvm0341.cern.ch/tagservices/dev/qzhang/mycvs/topmixing/index.htm
  - COSMAG-COMM: https://lxvm0341.cern.ch/tagservices/dev/qzhang/mycvs/commisioning/index.htm

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