

New “L0/L0Checker” Package

Eduardo Rodrigues, CERN

Purpose:

- check the performance and provide information for subsequent studies of L0

Main checks:

- L0 output rate
- rates after the global event cuts
- inclusive and exclusive sub-trigger rates
- E_T / P_T distributions of the L0 calorimeter and muon candidates
- Monte Carlo association to the L0 calorimeter and muon candidates

Extra information:

- algorithm is configurable
 - ↳ histograms produced by default (list is given hereafter)
 - ↳ an ntuple can also be produced if requested (details hereafter)

New “L0/L0Checker” Package

Package contents:

- main algorithm “LOCheck”
- tool “LOCandidateMCTool” to facilitate the access to the MC information
 - ↳ can be used in other algorithms for standard access to MCParticles associated with LO candidates

Package versions:

Version	Comments
v2r1	-latest version for use with DC'04 data
v1r0	-only for use with TDR data -to run typically with DaVinci v9r4

→ v1r0 allows to run over TDR data for quick comparisons with new data ...

New “L0/L0Checker” Package

Configurable options

```
ApplicationMgr.DLLs    += { "L0Checker" };
ApplicationMgr.TopAlg += { "L0Check" };
```

← 2 only lines needed for “standard” run

```
L0Check.OutputLevel = 3;
```

```
//L0Check.HistogramFlag = false;    // default = true
//L0Check.NtupleFlag    = true;      // default = false
//L0Check.NtupleName    = "1";       // default = ""
```

```
// configurable options of the "VisPrimVertTool" tool (here set to their defaults)
// L0Check.VisPrimVertTool.TrackNum = 2;
// L0Check.VisPrimVertTool.VeloAndSeed = true;
// L0Check.VisPrimVertTool.OutputLevel = 3;
```

! For version v1r0 the following extra line is compulsory:

```
L0Check.L0CandidateMCTool.L0Calo2MCP.Location = "Rec/Relations/L0CaloCandidates";
```

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List of Histograms:

Hadron Et	: Et of L0 highest-Et hadron candidate
2nd Hadron Et	: Et of L0 second highest-Et hadron candidate
Electron Et	: Et of L0 electron candidate
Photon Et	: Et of L0 photon candidate
Pi0 Local Et	: Et of L0 π^0 Local candidate
Pi0 Global Et	: Et of L0 π^0 Global candidate
Muon1 Pt	: Pt of L0 highest-Pt muon candidate
Muon2 Pt	: Pt of L0 second highest-Pt muon candidate
Muon3 Pt	: Pt of L0 third highest-Pt muon candidate
SumMuon Pt	: Σ Pt of the 2 highest-Pt muon candidates
Sum Et	: Σ Et (in hadronic calorimeter)
PuVeto SumPeak1	: SumPeak1 value from the Pile-up system
PuVeto SumPeak2	: SumPeak2 value from the Pile-up system
PuVeto ZPosPeak1	: z-position of the first peak returned by the Pile-up System
PuVeto ZPosPeak2	: z-position of the second peak returned by the Pile-up System
PuVeto Multiplicity	: Pile-up System multiplicity
SPD Multiplicity	: SPD multiplicity

Histograms produced by default !

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Ntuple entries (1/2):

Run	: run number
Event	: event number
L0Decision	: L0 decision
L0HadronEt	: Et of L0 highest-Et hadron candidate
L0Hadron2Et	: Et of L0 second highest-Et hadron candidate
L0ElectronEt	: Et of L0 electron candidate
L0PhotonEt	: Et of L0 photon candidate
L0Pi0LocalEt	: Et of L0 π^0 Local candidate
L0Pi0GlobEt	: Et of L0 π^0 Global candidate
LOMuon1Pt	: Pt of L0 highest-Pt muon candidate
LOMuon2Pt	: Pt of L0 second highest-Pt muon candidate
LOMuon3Pt	: Pt of L0 third highest-Pt muon candidate
LOSumMuonPt	: Σ Pt of the 2 highest-Pt muon candidates
LOSumEt	: Σ Et (in hadronic calorimeter)
PuVetoSumPeak1	: SumPeak1 value from the Pile-up system
PuVetoSumPeak2	: SumPeak2 value from the Pile-up system
PuVetoZPeak1	: z-position of the first peak returned by the Pile-up System
PuVetoZPeak2	: z-position of the second peak returned by the Pile-up System
PuVetoMult	: Pile-up System multiplicity
SpdMult	: SPD multiplicity
SelFlag	: flag for offline selection (0/1 = does not pass/passes offline selection algorithm)

Ntuple not produced by default

-> need to request it in options file

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Ntuple entries (2/2):

SpillOverP : spill-over from “previous” event (0/1 = spill-over non-/present)
 SpillOverPP : spill-over from “previous previous” event
 SpillOverN : spill-over from “next” event
 SpillOverNN : spill-over from “next next” event
 InstLumi : instantaneous luminosity
 EvtType : event type number
 NrMCColls : number of MC collisions in the event
 MCProcType : MC process type number (Pythia's ISUB value)
 xMCPriVtx : x-position of MC primary vertex
 yMCPriVtx : y-position of MC primary vertex
 zMCPriVtx : z-position of MC primary vertex
 MCCollIsVis : flags whether the collision is visible
 MCCollHasB : flags whether the collision contains a b-hadron
 NrVisTracks : number of visible tracks
 NrVisPrimVtx : number of visible primary vertices
 MCLOHadrEt : Et of MC particle associated to the L0 highest-Et hadron candidate
 MCLOHad2Et : Et of MC particle associated to the L0 second highest-Et hadron
 MCLOElecEt : Et of MC particle associated to the L0 electron candidate
 MCLOPhotEt : Et of MC particle associated to the L0 photon candidate
 MCLOPi0LEt : Et of MC particle associated to the L0 π^0 Local candidate
 MCLOMuon1Pt : Pt of MC particle associated to the L0 highest-Pt muon candidate
 MCLOMuon2Pt : Pt of MC particle associated to the L0 second highest-Pt muon candidate
 MCLOMuon3Pt : Pt of MC particle associated to the L0 third highest-Pt muon candidate

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Example of output - case of TDR data:

```

LOCheck      INFO ===== LOCheck Summary =====
LOCheck      INFO  Total # of events :      200000
LOCheck      INFO  -----
LOCheck      INFO  L0-pass      :      13368      6.68 %
LOCheck      INFO  -----
LOCheck      INFO  Electron    :      1390      0.70 %  excl    368      0.18 %
LOCheck      INFO  Photon      :      1700      0.85 %  excl    593      0.30 %
LOCheck      INFO  Hadron      :      9488      4.74 %  excl   7560      3.78 %
LOCheck      INFO  Pi0 Local   :      1481      0.74 %  excl     99      0.05 %
LOCheck      INFO  Pi0 Global  :      1949      0.97 %  excl    196      0.10 %
LOCheck      INFO  Any Pi0     :      2338      1.17 %  excl    393      0.20 %
LOCheck      INFO  Muon        :      1478      0.74 %  excl    175      0.09 %
LOCheck      INFO  Sum Muon    :      1949      0.97 %  excl    688      0.34 %
LOCheck      INFO  -----
LOCheck      INFO  Veto from
LOCheck      INFO  Global Event Cuts      :      105663      52.83 %
LOCheck      INFO  * SumEt Cut            :      88177      44.09 %
LOCheck      INFO  * Global Veto Cuts     :      17806      8.90 %
LOCheck      INFO  - Pile-Up Veto (SumPeak2) :      16153      8.08 %
LOCheck      INFO  - Pile-Up Multiplicity :      2311      1.16 %
LOCheck      INFO  - Spd Multiplicity     :      3374      1.69 %
LOCheck      INFO  =====
  
```

(All percentages normalized to total # of events)



All these veto-related numbers are inclusive ...

New “L0/L0Checker” Package

Remarks:

- Provides a central / common package for L0 studies
 - ↳ easy to maintain / debug / contribute to
 - ↳ easy access to L0 basic information for all end users (not just trigger experts)

- Up-to-date information & details in:
<http://cern.ch/eduardo.rodriques/lhcb/L0/L0Checker/>

Future plans:

- Introduce - in a configurable way - extra information as needed / suggested
 - ↳ e.g. pad info on muons, and MC-associated particles, etc., for muon performance studies, ...

- Feedback / comments / suggestions welcome ... as usual ...