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Run 2 trigger changelog

This page tries to collect the key changes that occurred in the L0, HLT1, and HLT2 systems throughout Run 2 that may be particularly relevant for analysts. It is currently very far from being comprehensive. The ultimate authority is always the contents of the TCK.

HLT1

2015

2016

Track and TwoTrack lines

The Hlt1TrackMVA and Hlt1TwoTrackMVA lines ran all year with no prescale but with two different configurations (sets of cuts).

In the nominal TCKs, the selections were considered tight. A set of loose TCKs relaxed some MVA parameters, and have Loose in their names.

The HLT1 TCKs were changed according to the status of the disk buffer. If the simulations projected a big enough chance of the buffer becoming full, the tight TCK was used. Otherwise, the loose TCK was used.

This setup changed in 2017.

2017 + 2018

Track and TwoTrack lines

In contrast to 2016, in 2017 two versions of each of the Hlt1TrackMVA and Hlt1TwoTrackMVA lines were run continually throughout the year.

The tight variations of the lines, Hlt1TrackMVATight and Hlt1TwoTrackMVATight, always run with the same configuration and prescale (of 1). The loose variants, Hlt1TrackMVA and Hlt1TwoTrackMVA, have a prescale that depends on the TCK.

The tight TCKs set the prescale of the loose lines to 0.01 and have Tight in their names. The prescale for the loose lines is 1 for nominal TCKs. The prescale for the Tight lines is always one.

Unlike in 2016, this means there are new trigger lines that analysts should consider when looking at the data, e.g. with TupleToolTISTOS.

Any HLT2 lines making requirements on the HLT1 Track lines were modified to accept both variants in 2017.

Note: the Tight TCKs were never used to take data in 2017 nor 2018.

HLT2
**2015 + 2017**

**AALLSAMEBPV functor bug**

Some trigger lines, including the topological B lines, were affected by a bug in the `AALLSAMEBPV` functor. This can in principle affect all analyses.

**2016**

**HLT2 SelReports in Turbo stream**

The HLT2 SelReports were discarded in Tesla, and so are not available for TIS/TOS'ing.

The motivation for this was to reduce the event size. Most of the time, TIS/TOS'ing HLT2 in the Turbo stream is not very useful as the selections that did not produce your Turbo candidate are orthogonal. One can not TIS/TOS on Stripping lines for the same reason.

**Identical track objects in PersistReco**

The PersistReco option for Turbo HLT2 lines was introduced in 2016, which saves the full HLT2 reconstruction in addition to the usual Turbo information (the candidate that fired the HLT2 line).

Due to an implementation detail, the `LHCb::Track` objects that are directly associated to Turbo candidates are saved in a separate location from the container that contains all `Track` objects. When performing a naive track overlap check, by comparing the track's key in its container, a Turbo candidate track and a PersistReco track can then pass the check despite being truly 'identical'. This can create problems offline, where performing Turbo+PersistReco combinatorics can result in the same track being used twice in a single candidate.

To work around this, a more robust overlap checking tool should be used, which compares the set of `LHCbID` objects associated to each track. One such tool is `LoKi::CheckOverlap`. A `CombineParticles` configuration using that tool looks like this:

```python
combiner = CombineParticles(
    'CombinerForSomething',
    # ...
    CheckOverlapTool='LoKi::CheckOverlap'
)
```

More details can be found in the corresponding JIRA task and merge request, LHCBPS-1537 and Phys!74.

**2017**

**HLT2 SelReports in Turbo stream**

After being removed completely in 2016, the HLT2 SelReports were re-introduced for a specific subset of lines. The list is defined in a Tesla options file, copied here for reference:

```plaintext
Hlt2CharmHadInclDst2PiD02HHXBTDDecision
Hlt2CharmHadInclLcpToKmPpPipBTDDecision
Hlt2CharmHadInclSigc2Pilc2HHXBTDDecision
Hlt2Topo2BodyDecision
Hlt2Topo3BodyDecision
Hlt2Topo4BodyDecision
Hlt2TopoE2BodyDecision
Hlt2TopoE3BodyDecision
```
Identical track objects in PersistReco

Unlike in 2017, LHCb::Track objects associated directly to Turbo candidates are now stored in the same container in the TES as PersistReco objects. This means the standard overlap check tool is sufficient for standard use cases. The LoKi::CheckOverlap tool can still be used if desired.

2018

AALLSAMEBPV functor bug

The bug was fixed before the beginning of 2018 data-taking.