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 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.

Note that more MagUp data than MagDown was taken with the tight TCK (and conversely, more MagDown than MagUp with the loose TCK) and so selection/detection asymmetries may not cancel fully when averaging MagUp and MagDown.

This setup changed in 2017.

Very loose Hlt1 TCKs beginning of 2016

<table>
<thead>
<tr>
<th>Run ID</th>
<th>Event Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0x11291603</td>
<td>('Physics_pp_May2016', 'MOORE_v25r2', 'Hlt1, Physics_pp_May2016, 0x1603, 1200 colliding bunches, CEP hadron prescaled to 15%')</td>
</tr>
<tr>
<td>0x11291604</td>
<td>('Physics_pp_May2016', 'MOORE_v25r2', 'Hlt1, Physics_pp_May2016, 0x1604, 1600 colliding bunches, CEP hadron prescaled to 3%')</td>
</tr>
<tr>
<td>0x11291605</td>
<td>('Physics_pp_May2016', 'MOORE_v25r2', 'Hlt1, Physics_pp_May2016, 0x1605, 2000 colliding bunches, CEP hadron prescaled to 3%')</td>
</tr>
<tr>
<td>0x11321609</td>
<td>('Physics_pp_June2016', 'MOORE_v25r3', 'Hlt1, Physics pp June 2016, 1715 bunches L0, with SumETPrev')</td>
</tr>
</tbody>
</table>

Tight Hlt1 TCKs Summer 2016

<table>
<thead>
<tr>
<th>Run ID</th>
<th>Event Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0x11351609</td>
<td>('Physics_pp_LateJune2016', 'MOORE_v25r3', 'Hlt1, Physics pp Late June 2016, 1715 bunches L0, optimized speed and rate, LHCBPSCS-1569')</td>
</tr>
<tr>
<td>0x11371606</td>
<td>('Physics_pp_July', 'MOORE_v25r4', 'Hlt1, Physics pp August 2016, 2000 bunches L0, JIRA-LHCBPS-1615')</td>
</tr>
<tr>
<td>0x11371609</td>
<td>('Physics_pp_July', 'MOORE_v25r4', 'Hlt1, Physics pp August 2016, 1715 bunches L0, JIRA-LHCBPS-1615')</td>
</tr>
<tr>
<td>0x11341609</td>
<td>('Physics_pp_MidJune2016', 'MOORE_v25r3', 'Hlt1, Physics pp Mid June 2016, 1715 bunches L0, reduced Hlt1 rate (LHCBPSCS-1558)')</td>
</tr>
<tr>
<td>0x11361609</td>
<td>('Physics_pp_July2016', 'MOORE_v25r3', 'Hlt1, Physics pp Late June 2016, 1715 bunches L0, optimized speed and rate, incl LowMult, LHCBPSCS-1600')</td>
</tr>
</tbody>
</table>

Loose Hlt1 TCKs Autumn 2016

Run 2 trigger changelog
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

A general selection misconfiguration issue affected the creation of refitted PVs for several Charm Turbo lines. More information is available on the TurboPVRefittingBug page.

### 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.
CHARMSPEC stream prescaling

The CHARMSPEC stream is an output stream of Tesla, which processes the TURBO stream output of HLT2. CHARMSPEC contained lines that reconstruct abundantly-produced Cabibbo-favoured final states.

Because the data volume was so large in 2016, initially only a subset of the stream was made available on tape. This stream was called CHARMSPECRESERVED. The full dataset was 'parked' on tape, and was called CHARMSPECDIRECT. Sometime in 2017, enough disk space became available that a replica of the parked stream could be created on disk. The CHARMSPECRESERVED stream contains all data collected by the CHARMSPEC lines in 2016. Analysts should use this stream if they wish to examine all the data.

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

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:

```c
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:

```
Hlt2CharmHadInclDst2PiD02HHXBDTDecision
Hlt2CharmHadInclLcpToKmPpPipBDTDecision
Hlt2CharmHadInclSigm2PiLc2HHXBDTDecision
Hlt2Topo2BodyDecision
Hlt2Topo3BodyDecision
Hlt2Topo4BodyDecision
Hlt2Topo2BodyDecision
Hlt2Topo3BodyDecision
```

CHARMSPEC stream prescaling
Identical track objects in

Unlike in 2016, `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.

Missing

The persistence of `RelatedInfo`, e.g. isolation variables, was missing in 2017. It was re-added in 2018 before data-taking began.

objects missing links to associated

CaloHypo objects and their related CaloCluster objects were persisted in 2017, but a bug caused the explicit link between the two to be lost, as described in LHCBPS-1842. This can affect some physics measurements that rely on the information from the CaloCluster objects.

2018

AALLSAMEBPV functor bug

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

L0

2015

2016

2017

2018