# Policy for Trigger Menu Deployment

## 1 Introduction

This document outlines the procedure for developing and deploying trigger menus for data-taking. The policy for modifying, removing or introducing individual triggers is described at https://twiki.cern.ch/twiki/pub/CMS/TSG_16_V_08/trigger_change_policy.pdf.

## 2 Trigger Menu Deployment Procedure

The various steps followed by the Trigger Studies Group (TSG) [1] – starting from the initial design of the candidate menu to its final deployment online – are described below.

**Step 1:**
The Trigger Menu Development (TMD) group should create the conceptual design of the next version of the trigger menu to be deployed online. This design should be based on discussion within the TSG and should include new triggers proposed by the PO/PA/DP group contacts (following procedure as described in the "Trigger Change Policy" document) [2]. The Level 1 Software and Technical Coordinators should also take part in the development of the candidate trigger menu in order to ensure L1 and HLT compliance.

**Step 2:**
The candidate menu should be developed by the TMD group. "OpenHLT" [3] or other similar tools can be used for this development. Rates and prescales for the new menu should be determined using previously collected "good" data. At the same time the proponent of a new trigger (or the relevant PO/PA/DP group contact) should implement the trigger configuration in ConfDB [4]. The developer should also verify the configuration by ensuring the trigger path runs to completion on a set of good data. The trigger proponent is also responsible for defining the appropriate Stream and Primary Dataset for the proposed trigger.

**Step 3a:**
After the completion of "Step 2", the HLT Code Integration (HCI) group assembles a full working menu from the components available in ConfDB. While the responsibility for ensuring that the appropriate configuration is available in ConfDB lies with the POG/PAG/DPG trigger developers, the HCI group should:

- check for inconsistencies or illegal dependencies between HLT paths,
- run small-scale tests to ensure that the menu runs successfully on both good and problematic data events (every path runs to completion at least once),
- cross-check that every trigger is assigned to its appropriate Stream and Primary Dataset,

- collect tags that need to be applied on top of the online release and inform the Event Filter and Trigger Menu Integration (TMI) groups,
- apply appropriate prescales (as determined by the TMD group) to the menu in ConfDB.

**Step 3b:**
After the completion of "Step 2", the Trigger Performance (TP) group receives a list of triggers from the TMD group. The TP group should then integrate monitoring (as provided by the PO/PA/DP group developers) for the new triggers. If modifications are required to the ConfDB menu (e.g. changes to Event Content), this group should provide the necessary information to the HCI group.

Steps 3(a) and 3(b) should occur in parallel and should be followed by the validation procedure described below.

**Step 4: Validation**
The HCI group is expected to catch major configuration errors during "Step 3(a)" above. In the event that a proposed trigger (e.g. a dedicated SUSY/Exotica trigger) is not expected to run to completion in the standard HCI test samples, the PO/PA/DP group developers are required to provide valid test samples to HCI. The coordinators of the HCI group should sign off on the new trigger menu upon successful completion of "Step 3(a)". Thereafter, the following additional validation should take place in parallel:

- The TMD group should verify that the rates predicted by "OpenHLT" are confirmed by the ConfDB menu assembled by HCI. The coordinators of the TMD group should sign off on the new trigger menu upon completion of this verification task.

- The TP group should ensure that appropriate reference histograms are available for monitoring the performance of the new trigger menu. Following this step, the coordinators of the TP group should sign off on the new trigger menu.

- The TMI group should run the ConfDB menu offline on problematic real-data events (e.g. events with missing/noisy detectors, corrupt data) and the Error Stream. This step should catch rare pathological configuration errors.

If a problem is uncovered during this validation the menu undergoes a re-configuration or a re-design depending on the severity or the exact nature of the problem. Otherwise, the TMI group moves on to a final round of validation online prior to deployment.

**Step 5:**
The TMI group is responsible for ensuring the compatibility of the trigger menu with the online environment. A series of tasks should be performed on the High Level Trigger Online (HiLTOn) farm following successful TMD and TMI validation of the ConfDB menu in "Step 4":

- Run large-scale tests on recent data and check for errors and warnings;

- Ensure robustness of the Trigger Menu by running on sets of pathological events and on the error stream;
- Evaluate cpu performance (timing, memory consumption);
- Estimate data size for each Stream and Primary Dataset;
- Compare offline and HiLTOn trigger results and check for consistency.

If any problems are discovered during validation on the HiLTOn farm, the menu is again subject to re-configuration or re-design depending on the nature of the problem.

**Step 6:**
Upon successful completion of "Step 5", and the sign off of the TP group with regards to monitoring histograms for the new triggers, the new trigger menu is ready to be deployed online. The deployment is done upon sign-off by the TMI group and in coordination with the Event Filter group and Run Coordination. Documentation is made available which lists the changes incorporated into the new version of the trigger menu and the date of deployment. Furthermore, any change to the definition of Streams or Primary Datasets is communicated beforehand to the Data Operations/Tier-0 team.

**Step 7:**
Once the trigger menu has been deployed online, the TP group coordinates with the PO/PA/DP group developers to provide fast feedback from online and offline DQM. If a problem or unexpected behavior is discovered during this process, the TP group informs the relevant trigger developer (or proponent) who is then responsible for debugging and/or fixing the problem. Depending on the severity of the problem, it may be decided to either disable a particular trigger (while it is being debugged) or go back to a previously run trigger menu.

In the event that an immediate change in HLT is necessitated by an urgent change in L1, the deployment procedure may be shortened to include only the HiLTOn validation ("Step 5") and the subsequent Steps 6 and 7. The trigger menu design should, therefore, include a pre-approved contingency plan such that a L1 threshold change can be immediately followed by an appropriate change at HLT.

## References:


[1] https://twiki.cern.ch/twiki/pub/CMS/TriggerStudies/TrCoor-orgchart.pdf

[2] https://twiki.cern.ch/twiki/bin/view/CMS/TriggerStudies#Contacts

[3] https://twiki.cern.ch/twiki/bin/view/CMS/WorkBookHLTTutorial#OpenHLT

[4] https://twiki.cern.ch/twiki/bin/view/CMS/EvfConfDBGUI