Trigger Configuration

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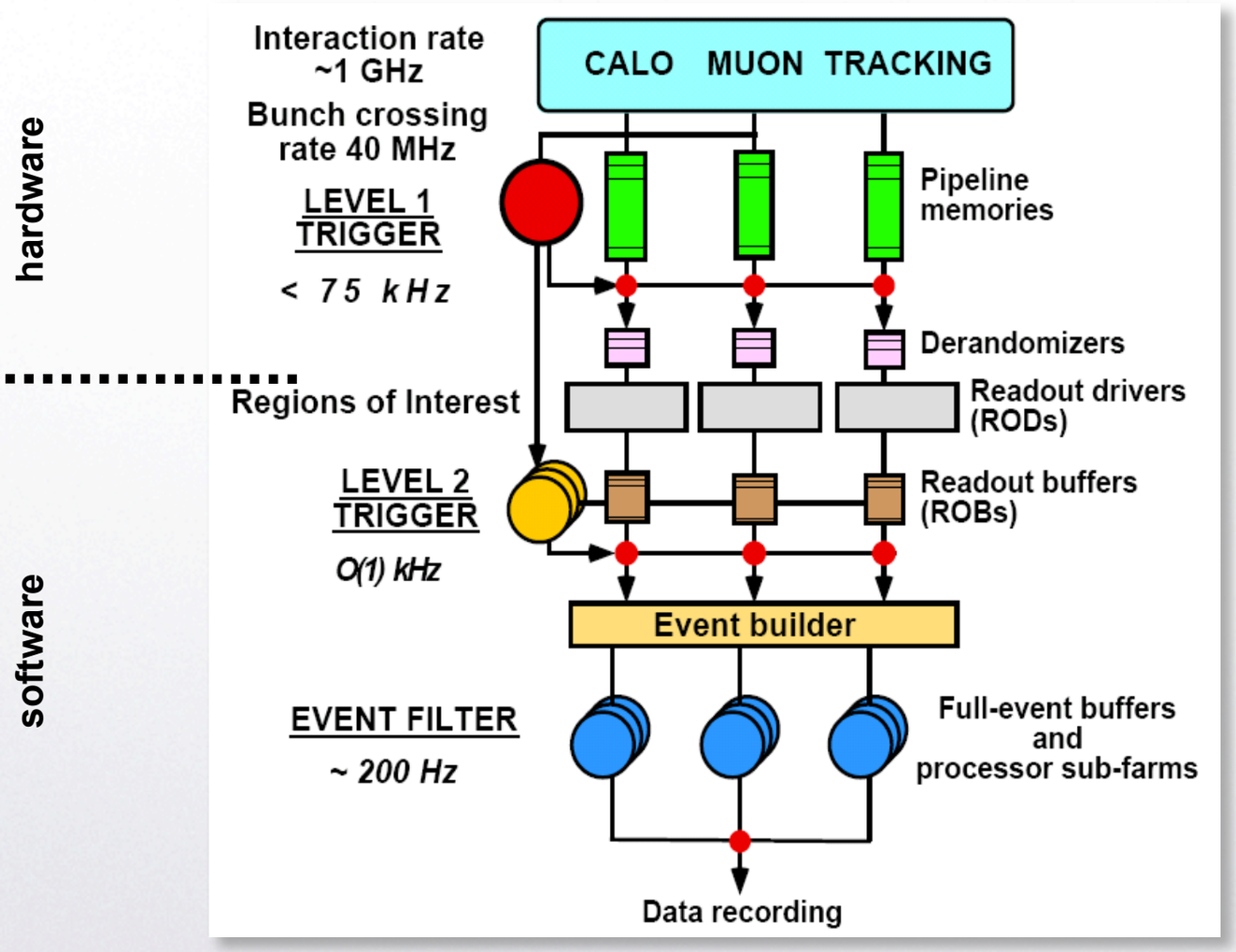
Introduction

- Trigger Configuration System
- Trigger DB
- Upload Scripts
- Trigger Tool
- Summary

Trigger Schema

3-Level Trigger System:



1) **LVL1** decision based on data from calorimeters and muon trigger chambers; synchronous at 40 MHz; bunch crossing identification

2) **LVL2** uses Regions of Interest (identified by LVL1) data (ca. 2%) with full granularity from all detectors

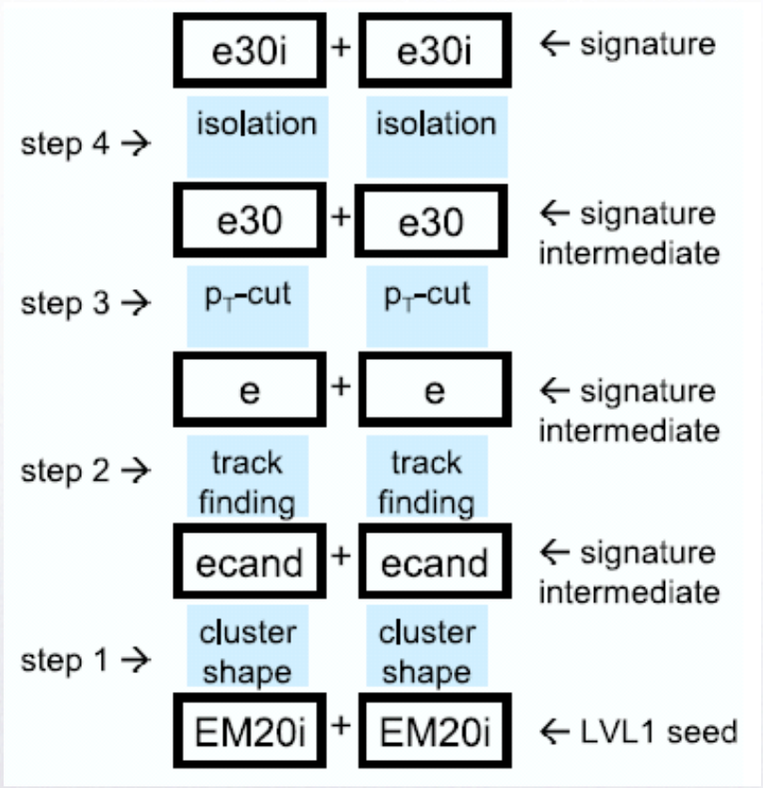
2) **Event Filter** has access to full event and can perform more refined event reconstruction

HLT Trigger

HLT strategy: refinement of TriggerElements (seeded from LVL1) in stepwise processing, perform stepwise decisions

example of step-wise processing:

Trigger Chain

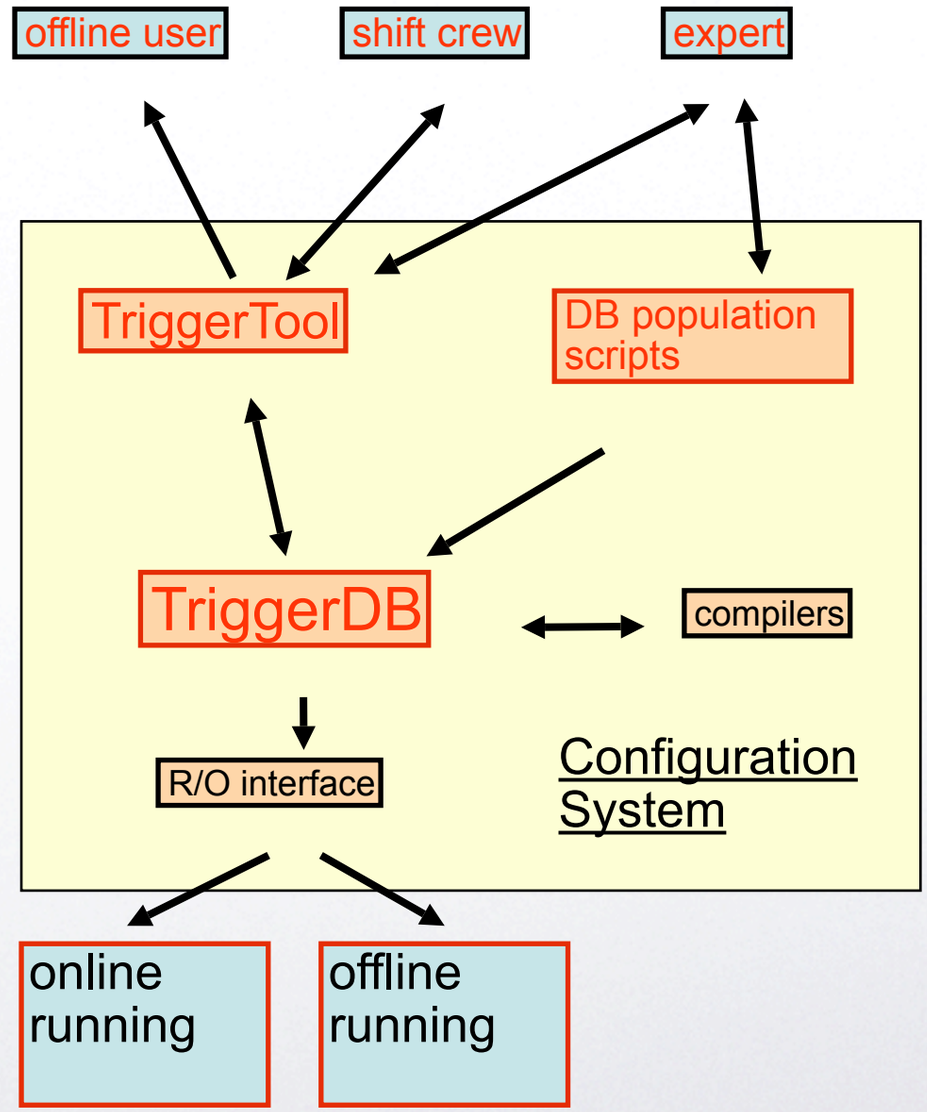


parts to be configured:

1) HLT Menu: determines which algorithms are called at which step and which signatures need to be fulfilled for accepted events
2) HLT Setup: all algorithms and their configuration parameters
3) Release information

Trigger Configuration System

- **TriggerTool**
  - Java Front-End to TriggerDB
  - modification, browsing of TriggerDB
- **TriggerDB**
  - relational DB (Oracle and MySQL)
    - complete description of online event selection
- **Clients:**
  - online: central trigger, L1Muon, L1Calo, all nodes of HLT farm
  - offline: simulation jobs, also from TriggerDB



Trigger Database Schema

LVL 1 Configuration

trigger_next_run
PK	tnr_id
FK1	tnr_super_master_table_id

super_master_table
PK	smt_id
FK1	smt_name smt_version smt_hlt_master_table_id smt_username smt_modified_time smt_used
FK2	l1mt_id

l1_master_table
PK	l1mt_id
FK1	l1mt_name l1mt_version l1mt_trigger_menu_id
FK8	l1mt_prescale_set_id
FK5	l1mt_dead_time_id
FK2	l1mt_muctpi_info_id
FK4	l1mt_random_id
FK3	l1mt_prescaled_clock_id
FK6	l1mt_trigger_type_id
FK7	l1mt_bunch_group_set_id
FK9	l1mt_calo_info_id l1mtl_username l1mt_modified_time l1mt_used

l1_prescale_set
PK	l1ps_id
FK1	l1ps_name l1ps_version l1ps_lumi l1ps_shift_safe l1ps_trigger_menu_id l1ps_val1 ... l1ps_val256 l1ps_username l1ps_modified_time l1ps_used

l1_trigger_menu
PK	l1tm_id
FK1 FK2	l1tm_name l1tm_version l1tm_phase l1tm_shift_safe l1tm_ctp_safe l1tm_ctp_files_id l1tm_ctp_smx_id l1tm_username l1tm_modified_time l1tm_used

l1_prescaled_clock
PK	l1pc_id
	l1pc_name l1pc_version l1pc_clock1 l1pc_clock2 l1pc_username l1pc_modified_time l1pc_used

l1_bunch_group_set
PK	l1bgs_id
	l1bgs_name l1bgs_version l1bgs_user_name l1bgs_modified_time l1bgs_used

l1_trigger_type
PK	l1tty_id
	l1tty_name l1tty_version l1tty_bit0 l1tty_bit1 l1tty_bit2 l1tty_bit2 l1tty_bit3 l1tty_bit4 l1tty_bit5 l1tty_bit6 l1tty_bit7 l1tty_username l1tty_modified_time l1tty_used

l1_dead_time
PK	l1dt_id
	l1dt_name l1dt_version l1dt_simple l1dt_complex1 l1dt_complex2 l1dt_username l1dt_modified_time l1dt_used

l1_random
PK	l1r_id
	l1r_name l1r_version l1r_rate1 l1r_rate2 l1r_username l1r_modified_time l1r_used

l1_muctpi_info
PK	l1mi_id
	l1mi_name l1mi_version l1mi_low_pt l1mi_high_pt l1mi_max_cand l1mi_username l1mi_modified_time l1mi_used

l1_tm_to_ti
PK	l1tm2ti_id
FK1 FK2	l1tm2ti_trigger_item_id l1tm2ti_trigger_menu_id l1tm2ti_ctp_id

l1_ctp_files
PK	l1cf_id
	l1cf_name l1cf_version l1cf_lut l1cf_cam l1cf_username l1cf_modified_time l1cf_used

l1_bgs_to_bg
PK	l1bgs2bg_id
FK1 FK2	l1bgs2bg_bunch_group_set_id l1bgs2bg_bunch_group_id l1bgs2bg_internal_number

l1_calo_info
PK	l1ci_id
	l1ci_name l1ci_version l1ci_global_scale l1ci_jet_weight1 ... l1ci_jet_weight12 l1ci_username l1ci_modified_time l1ci_used

l1_trigger_item
PK	l1ti_id
	l1ti_name l1ti_version l1ti_definition l1ti_group l1ti_priority l1ti_group l1ti_username l1ti_modified_time l1ti_used

l1_ctp_smx
PK	l1smx_id
	l1smx_name l1smx_version l1smx_output l1smx_vhdl_slot7 l1smx_vhdl_slot8 l1smx_vhdl_slot9 l1smc_bin_slot7 l1smc_bin_slot8 l1smc_bin_slot9 l1smx_username l1smx_modified_time l1smc_used

l1_bunch_group
PK	l1bg_id
	l1bg_name l1bg_version l1bg_username l1bg_modified_time l1bg_used

l1_ci_to_csc
PK	l1ci2csc_id
FK1 FK2	l1ci2csc_calo_info_id l1ci2csc_calo_sin_cos_id

l1_tt_to_tt_force
PK	l1tm2tt_id
FK1 FK2	l1tm2tt_trigger_threshold_id l1tm2tt_trigger_menu_id l1tm2tt_cable_name l1tm2tt_cable_start l1tm2tt_cable_end l1tm2tt_cable_ctpin l1tm2tt_cable_connector

l1_ti_to_tt
PK	l1ti2tt_id
FK1 FK2	l1ti2tt_trigger_threshold_id l1ti2tt_trigger_item_id l1ti2tt_multiplicity l1ti2tt_position

l1_tm_to_tt_forced
PK	l1tm2ttf_id
FK2 FK1	l1tm2ttf_trigger_menu_id l1tm2ttf_trigger_threshold_id

l1_trigger_threshold
PK	l1tt_id
	l1tt_name l1tt_version l1tt_type l1tt_bitnum l1tt_username l1tt_modified_time l1tt_used

l1_tt_to_ttv
PK	l1tt2ttv_id
FK1	l1tt2ttv_trigger_threshold_id l1tt2ttv_trig_thresh_value_id

l1_trigger_threshold_value
PK	l1ttv_id
	l1ttv_name l1ttv_version l1ttv_type l1ttv_pt_cut l1ttv_eta_min l1ttv_eta_max l1ttv_phi_min l1ttv_phi_max l1ttv_em_isolation l1ttv_had_isolation l1ttv_had_veto l1ttv_window l1ttv_priority l1ttv_username l1ttv_modified_time l1ttv_used

l1_bg_to_b
PK	l1bg2b_id
FK1	l1bg2b_bunch_group_id l1bg2b_bunch_number

l1_calo_sin_cos
PK	l1csc_id
	l1csc_name 1csc_version l1csc_val1 ... l1csc_val8 l1csc_eta_min l1csc_eta_max l1csc_phi_min l1csc_phi_max l1csc_username l1csc_modified_time l1csc_used

HLT Menu

hlt_master_table
PK	hmt_id
FK1 FK2 FK4 FK3	hmt_name hmt_version hmt_prescale_set_id hmt_trigger_menu_id hmt_forced_setup_id hmt_release_id hmt_username hmt_modified_time hmt_used

hlt_prescale_set
PK	hps_id
	hps_name hps_version hps_username hps_modified_time hps_used
FK1	hps_trigger_menu_id

hlt_trigger_menu
PK	htm_id
	htm_name htm_version htm_phase htm_shift_safe htm_username htm_modified_time htm_used

hlt_force_dll
PK	hfd_id
	hfd_dll_name

hlt_release
PK	hre_id
	hre_name hre_version hre_username hre_modified_time hre_used

hlt_prescale
PK	hpr_id
FK1	hpr_prescale_set_id hpr_chain_counter hpr_prescale

hlt_tm_to_tc
PK	htm2tc_id
FK2 FK1	htm2tc_trigger_menu_id htm2tc_trigger_chain_id htm2tc_chain_counter

hlt_fs_to_st
PK	hfd2fs_id
FK1 FK2	hfd2fs_force_dll_id hfd2st_setup_id

hlt_re_to_dl
PK	hre2dl_id
FK1 FK2	hre2dl_release_id hre2dl_dll_id

hlt_trigger_chain
PK	htc_id
FK1	htc_name htc_version htc_lower_chain_name htc_l2_or_ef htc_fa_rate htc_setup_id htc_username htc_modified_time htc_used

hlt_setup
PK	hst_id
	hst_name hst_version hst_username hst_modified_time hst_used

hlt_dll
PK	hdl_id
	hdl_name hdl_package hdl_cmt_version hdl_username hdl_modified_time hdl_used

hlt_st_to_cp
PK	hst2cp_id
FK1 FK2	hst2cp_setup_id hst2cp_component_id

hlt_so_to_dl
PK	hso2dl_id
FK1 FK2	hso2dl_source_id hso2dl_dll_id

hlt_trigger_signature
PK	hts_id
	hts_logic hts_username hts_modified_time hts_used

hlt_tc_to_ts
PK	htc2ts_id
FK1 FK2	htc2ts_trigger_chain_id htc2ts_trigger_step_id htc2ts_signature_counter

hlt_te_to_cp
PK	hte2cp_id
FK1 FK2	hte2cp_trigger_element_id hte2cp_component_id hte2cp_algorithm_counter

hlt_component
PK	hcp_id
	hcp_name hcp_version hcp_alias hcp_topalg hcp_flag hcp_username hcp_modified_time hcp_used

hlt_source
PK	hso_id
	hso_name hso_gaudi_type hso_username hso_modified_time hso_used

hlt_dl_to_en
PK	hdl2en_environment_id
FK1 FK2	hdl2en_dll_id hdl2en_environment_id

hlt_environment
PK	hen_id
	hen_name hen_version hen_value hen_username hen_modified_time hen_used

hlt_ts_to_te
PK	hts2te_id
FK1 FK2	hts2te_trigger_signature_id hts2te_trigger_element_id hts2te_element_counter

hlt_trigger_element
PK	hte_id
	hte_name hte_version hte_username hte_modified_time hte_used

hlt_cp_to_pa
PK	hcp2pa_id
FK1 FK2	hcp2pa_component_id hcp2pa_parameter_id

hlt_so_to_py
PK	hso2py_id
FK2 FK1	hso2py_source_id hso2py_property_id

hlt_te_to_te
PK	hte2te_id
FK1	hte2te_trigger_element_id hte2t2_trigger_element_inp_id

hlt_parameter
PK	hpa_id
	hpa_name hpa_value hpa_op hpa_username hpa_modified_time hpa_used

hlt_property
PK	hpy_id
	hpy_name hpy_type hpy_vlaue hpy_username hprymodified_time hpy_used

HLT Setup

HLT Release

Contents of Trigger data in DB

- Master key for each configured menu
  (It is used by most of the applications as an input)
- Unique name, version and id for every item stored in DB
- Complete content of trigger configuration is stored on DB. e.g. Trigger elements, prescales, algorithms, parameters
- Intervals of validity (IOVs) of trigger data
  - Run : Masterkey, LVL1 items/HLT chains; HLT prescale/pass-through rates (Stored in DB)
  - LB : LVL1 prescale
  - Event : trigger decisions, algorithm instances, trigger elements, features

Trigger configuration Upload scripts

MySQL or Oracle

xml files:

EF Setup
L2 Setup
HLT Signature
HLT Sequence
HLT Release

python scripts:

xml2db.py

DB

python scripts:

db2xml.py

xml files:

EF Setup
L2 Setup
HLT Signature
HLT Sequence
HLT Release

Small differences between databases.
For both is used SQL language.
Small problems remaining

Trigger Tool

- **Central tool for the operation of the Trigger**
- **Stand-alone, Java-based GUI to the TriggerDB**
- **Functionality:**
  - **Browse the TriggerDB**
  - **Make new configurations**
  - **Modify existing configurations**
  - **Store the configurations in the TriggerDB**
  - **Consistency checks, etc.**
- **Usage:**
  - **user (shift)** – read only, browse DB
  - **expert** – access to all details

Trigger Tool (Example)

TriggerTool: TriggerMeister trigtester@pcatr13.cern.ch using MySQL

File Mode

HLT Master Table | Find all | TriggerToogle | Search | Advanced

ID	Name	Version	Used
1	master	1	false

New | Copy | Edit | Delete | Children | Read XML | Write XML | Set Used

Selected Item Details

- Start
  - HLT MASTER: ID=1, Name=master, Version=1
    - HLT RELEASE: ID=1, Name=12.0.5-HLT, Version=V1
    - HLT PRESCALE SET: ID=1, Name=prB_lumi1, Version=1
    - HLT MENU: ID=1, Name=TMlumi_1, Version=1
      - HLT PRESCALE SET: ID=1, Name=prB_lumi1, Version=1
      - HLT CHAIN: ID=1, Name=e10_L2, Version=1
        - STEP: Counter=1, Output TE=teL2em10cl, Input TE=EM01
          - HLT TRIGGER ELEMENT: ID=1, Name=teL2em10cl, Version=
            - HLT COMPONENT: ID=51, Alias=T2CaloEgamma_g4_L2,
        - STEP: Counter=2, Output TE=teL2em10clhy, Input TE=teL2em1
        - STEP: Counter=3, Output TE=teL2em25trIDSCAN, Input TE=teL2
        - STEP: Counter=4, Output TE=teL2em25trSiTrack, Input TE=teL2

Field	
ID	1
Username	altrig
Modified	2007-
Used	false
Name	teL2em
Version	1

Edit HLT Menu

Selected Menu

ID	1
Modified	2007-06-27 14:09:35.085
Username	altrig
Used	false
Name	TMlumi_1
Version	1
Shift Safe	false
Phase	lumi

Current Chains

ID	Name	Version	L2 or EF	Chain Co...
1	e10_L2	1		0
2	g10_L2	1		0
3	e10_EF	1		0
4	g10_EF	1		0

Add new chain... | Remove chain

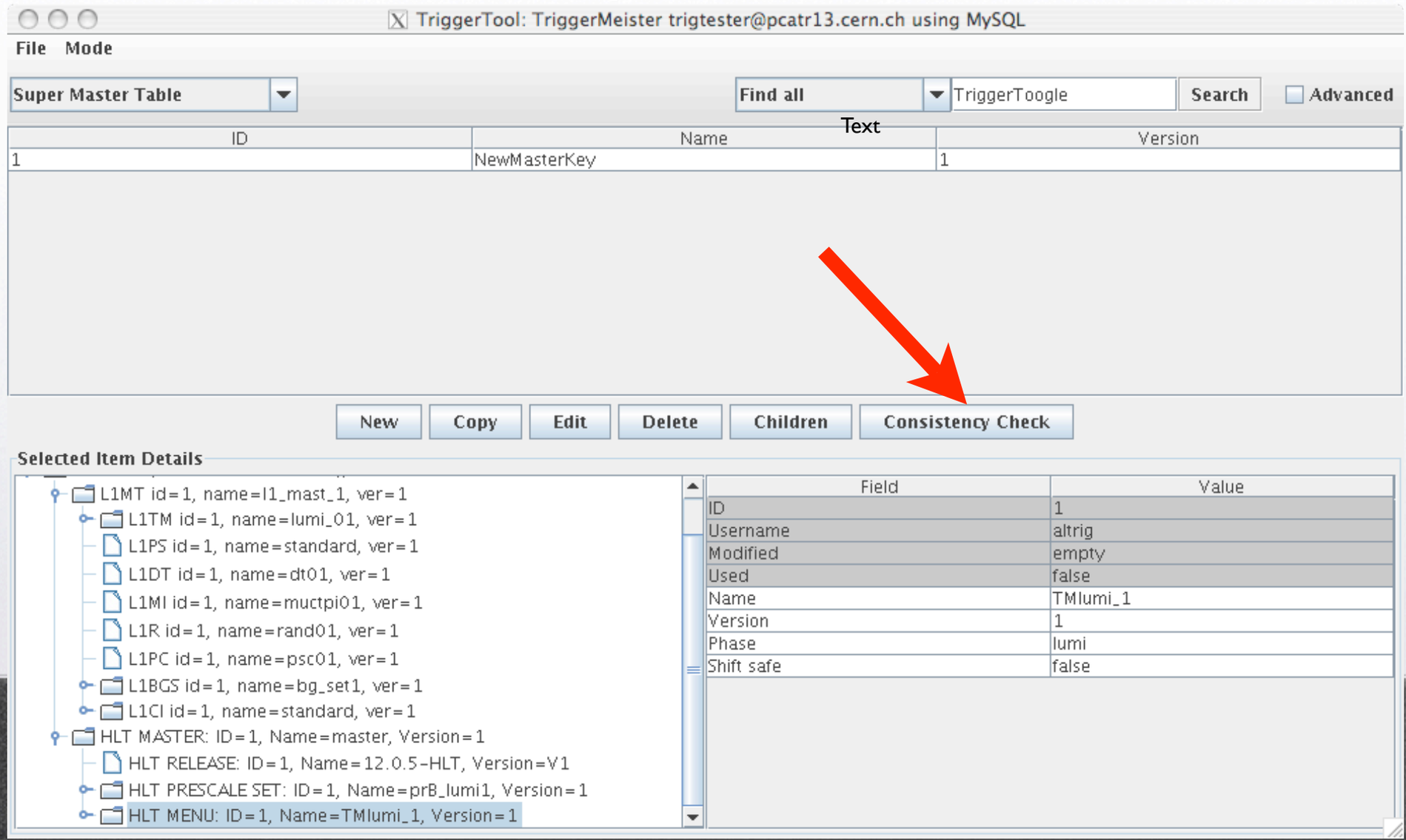
Save | Cancel

Trigger Tool Consistency check

Crosscheck between LVL1 and LVL2 menus:
Trigger Condition of the LVL2 must be consistent with the LVL1

* The LVL1 item required by LVL2 chain exists in the LVL1 menu (prevents each LVL2 chain from never running due to human error of forgetting to define the corresponding item at LVL1)

* The RoIs required by LVL2 chain is defined as the corresponding threshold in the LVL1 menu. (is needed due to the RoI mechanism, to make sure that the LVL2 algorithm in the chain is called as intended.)



Summary

- Tools tested in technical runs
- Trigger Configuration under development
- Trigger Tool
  - Consistency check (LVL1<->LVL2 finished)
  - Read/Write XML to be improved
    (Upload scripts and Trigger Tool)

Backup Slides

TDAQ , Trigger DB, Data Flow