

TRGSim++ status

TRGSim++ is a set of (C++) packages emulating the various trigger levels decision steps (CDF trigger is fully digital)
No random numbers!

Trigger decision steps: A_C++ modules, organized in packages:

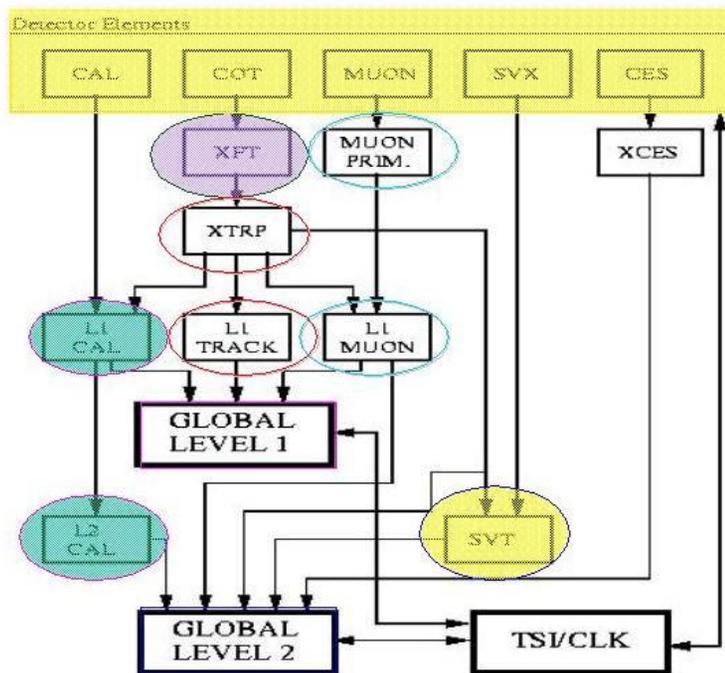
CalTrigger -> CalTriggerExe
MuonTrigger -> MuonTriggerExe
XFTSim -> XFTTest (tbin)
svtsim -> svtsimtest (tbin)
XTRPSim -> XTRPSimExe(tbin)
L2GlobalTrigger -> L2Sim
L1GlobalTrigger -> FredSim
TriggerMods -> TRGSim++
TriggerObjects -> trigger banks

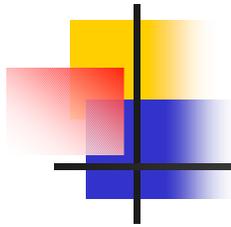
TRGSim++ modules run off detector raw data and produce emulated trigger data identical to real hardware data.

(It also runs off COTQ and CalData, and now . PadSqz::COTQ and PadSqz::SVXQ)



RUN II TRIGGER SYSTEM





Documentation and examples

<http://ncdf70.fnal.gov:8001/trigsim/trgsim.html>

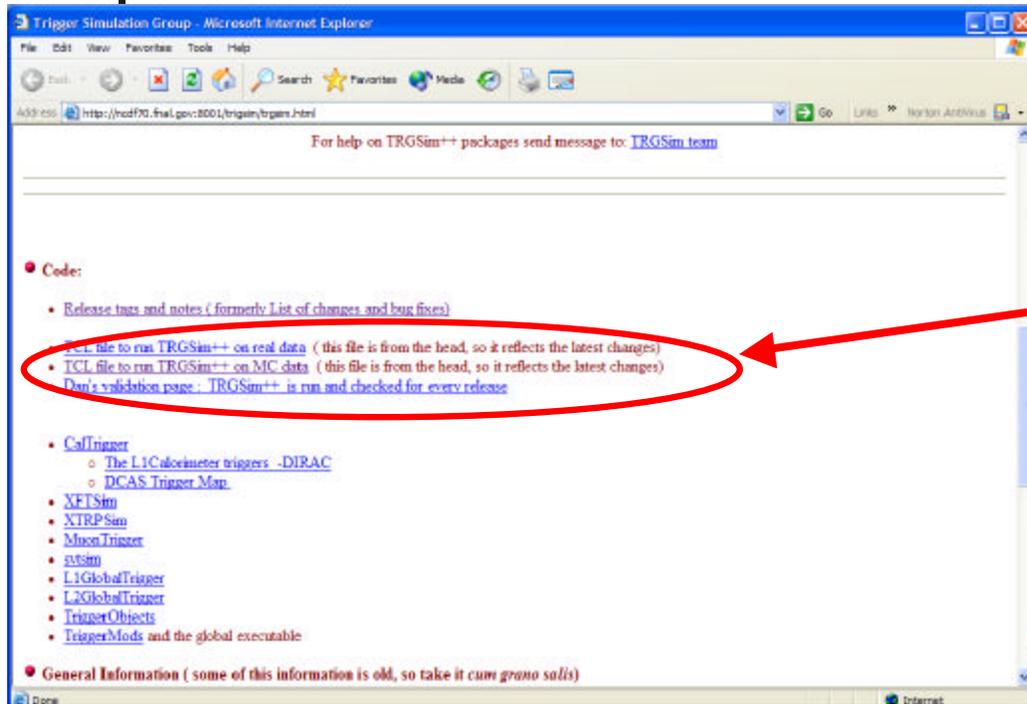
[accessible from the CDF FastNavigator](#)

CDF Fast Navigator [by Martin Hennecke](#)

CDF Home	Online				
Shift tools	Beam status	MCR e-log	Shift e-log	e-logs	Run summary
	DAQ Ace	Mon Ace	CO	SciCo	Expert phone list
Operation	BO Home	CDF Weekly Meeting	Ops Manager Weekly Plan		CDF Safety
Detector	Detector Groups				Upgrades
	Silicon COI	Calorimeter Muon	CLC TOF	Forward Detectors	Run IIa / Run IIb Run IIb Task Force
Trigger	Trigger Home	L2 / L3	Trigger WG	B Trigger	Exotics Trigger
Data quality	DQM Home	Goodrun lists	Consumer Home		

	Computing				
Software	Code management Validation	Codebrowser DB Browser Calib DB	MC production	Stntuple / evtNtuple TopEventModule TopNtuple / PAX	cdfSim / TrigSim Event Display CR Tagger
	Hardware	CAF Home Active CAF queues	SAM / Grid Grid mails	Data Handling Enstore	CDF System Status Printers

Documentation and examples (II)



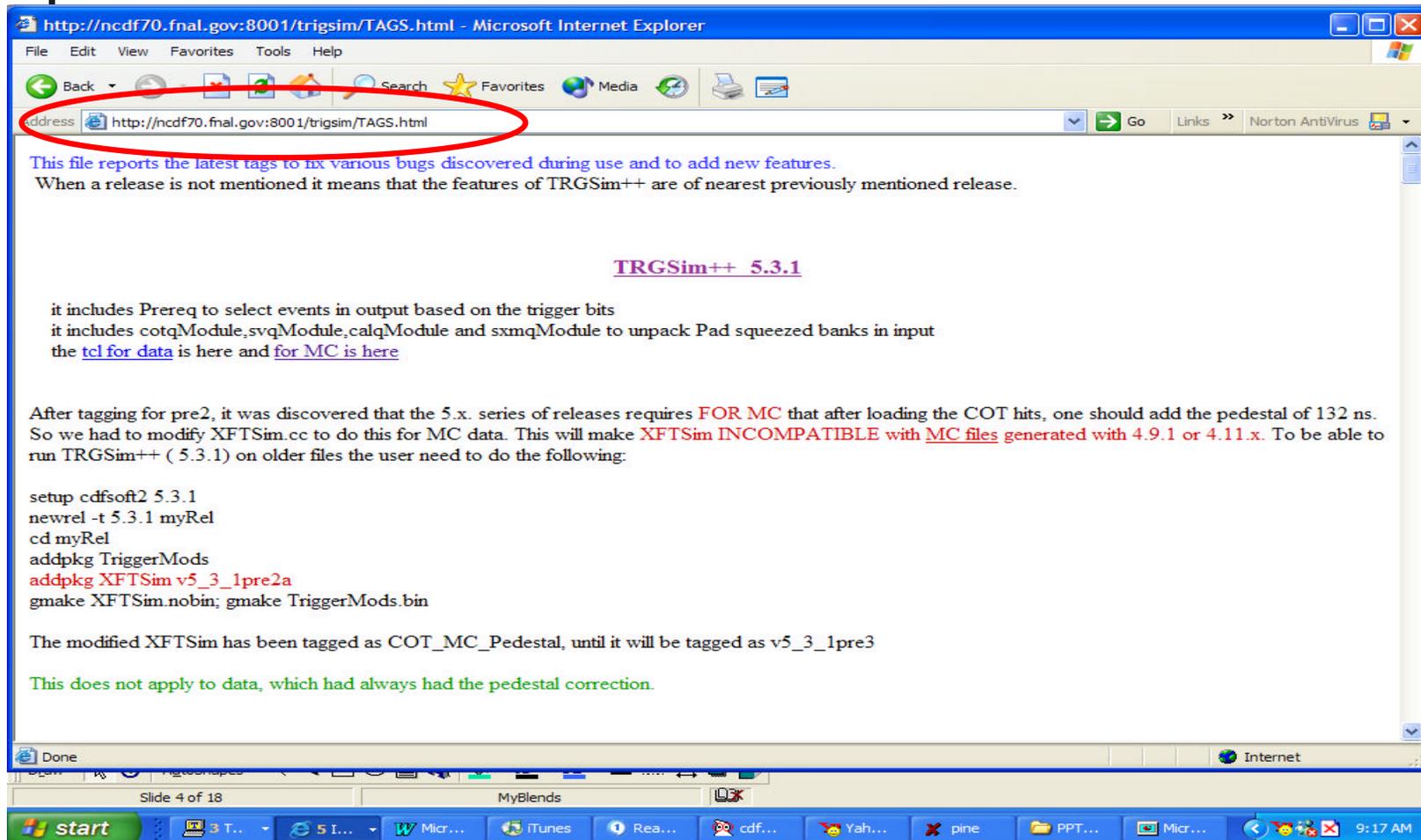
To run TRGSim++ ALWAYS look at the tcl's on the web page. They are the only which are constantly updated for users reference

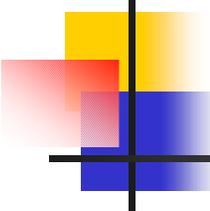
They are also available from the head of the repository

http://cdfcodebrowser.fnal.gov/CdfCode/source/TriggerMods/test/run_TRGSim++.tcl

http://cdfcodebrowser.fnal.gov/CdfCode/source/TriggerMods/test/run_TRGSim++_MC.tcl

Releases status -web page





Release status

- **TRGSim++ 5.3.1 (January 2004)**

it includes Prereq to select events in output based on the trigger bits
it includes cotqModule,svqModule,calqModule and sxmqModule to unpack Pad squeezed banks in input

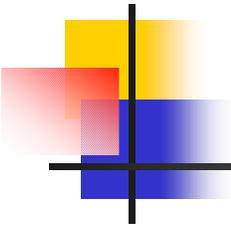
- **TRGSim++ 5.3.0 (Fall 2003)**

it does not include Prereq to select events in output based on the trigger bits. Corrections were added for the IMU maps in XTRPSim

- **TRGSim++ 5.2.0int2(Fall 2002)**

it includes infrastructure changes to improve the database connection and a fix for the Sumet thresholds used in the CalTrigger Prefred simulation - the sumet bits are correctly set.

Starting with 5.2.0int2 XFTSim should not produce random crashes at the end of job, as a major rewriting of the code has been made by Ben Whitehouse.



Release status (cont'd)

- **TRGSim++ 4.10.x and 4.11.1 (Spring 2003)**

it includes a change in the FRED bits scheme. Incorrect Sumet and MET thresholds, values are correct, bits are incorrect.

- if you want to correctly emulate the Sumet bits with this release (not Sumet value!)
add the package CalTrigger : [addpkg CalTrigger PreFred_091103](#)
- better to use 5.x releases!

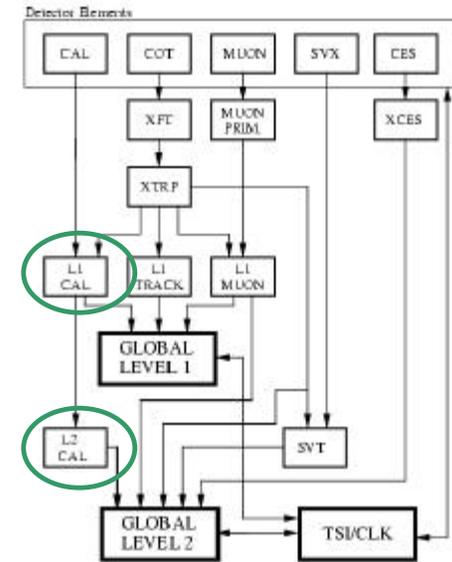
- **TRGSim++ 4.9.x (Fall 2002)**

it includes modifications to the db connection (tcl changes to CalibrationManager talk-to from 4.9.1 to 4.9.1pms)

- possibly not to use because of Database infrastructure problems

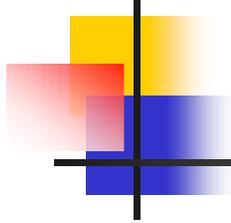
Code: CalTrigger

- Trigger Tower energies (TC2D – first word)
 - <http://ncdf70.fnal.gov:8001/trigsim/DCAS.html>
- L1 DIRAC Triggers (TC1D)
 - http://ncdf70.fnal.gov:8001/trigsim/dirac_trigger.html
- L2 clustering and Iso sums (TC2D – second word)



- database access for trigger definition - real data
 - TriggerDB DOWNLOADS Table
 - possibility to run on simulated run with conditions from real run: the value is fetched from the event record or in talk-to

```
use_software_CAL_banks set t
use_xtrp set t
use_hardware_xtrd set f
use_hardware_L1 set f
run_Number set 151435
```

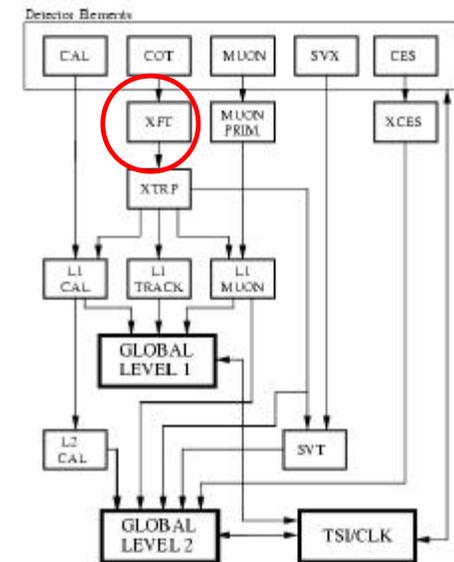


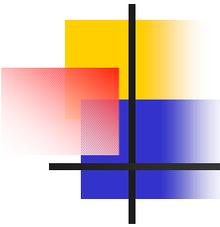
CalTrigger input/output

- Calorimeter D-banks: [CEMD, CHAD, PEMD, PHAD, WHAD.](#)
 - It alternatively reads CalData and puffs it into D-banks, via a call to CalorimetryModule.
- Track input from [XTRD_StorableBank.](#)
 - 2 options to get the track input controlled by the parameter "standalone" in the talk-to:
 - from real data (standalone = 1)
 - from a simulated XTRD (standalone = 0).
- Output :
 - **TC2D** with the list of trigger tower energies and clustering summary word for each tower, description "**Simulated Trigger Bank**";
 - **TC1D** with the results of the DIRAC triggers: description "**Simulated Trigger Bank**" ;
 - **TL1D** with the PreFred bits for CalTrigger and SumEt: description "**CalTrig_Simulated_Trigger_Bank**", it used later by TL1DMaker and dropped in output
 - **TL2D** where the only block filled is the clustering block: description "**Calorimeter_TL2D_Bank**", used by L2Sim later and dropped in output

Code: XFTSim

- XFT tracks :
 - XFLD and XFFD diagnostic banks
 - XTRD (from XTRPSim) includes the tracks parameters
- DB access
- Real run conditions applied to simulated run:
 - For the Road and Mask files one can set the file types. So one can mimic exactly what was run.





XFT input/output

- **Input:**

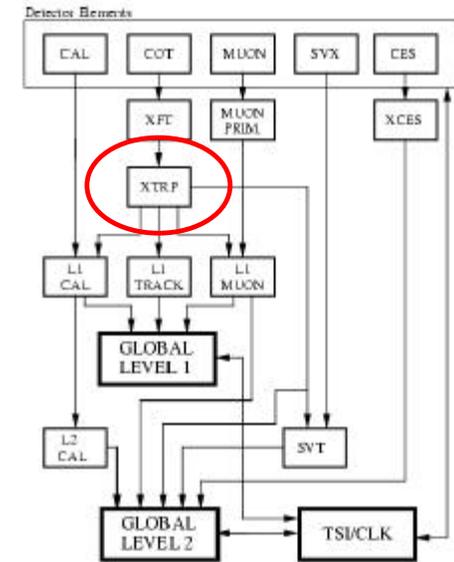
- **COTD hit information** (void XFTSim::getInputData())
- COTQ if COTD is not found in data stream
- 5.x releases requires **FOR MC** that after loading the COT hits, one should add the pedestal of 132 ns.
- 5.3.1 release require the use of cotqModule to unpuff
PadSqz::COTQ

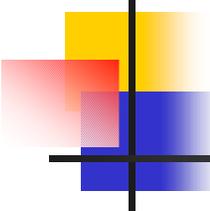
- **Output:**

- XFFD - XFT Finder bank
 - XFLD - XFT Linker bank
- } **Input to XTRPSim**

Code : XTRPSim

- XTRP tracks:
 - XTRD
- database access for trigger definition - r
 - TriggerDB DOWNLOADS Table : XFT_PT
 - possibility to run on simulated run with conditions from real run: the value is fetched from event record or in talk-to
 - standalone set f
 - run_Number set 151435
- It is possible to set the muon pt thresholds by hand, overwriting the database values.



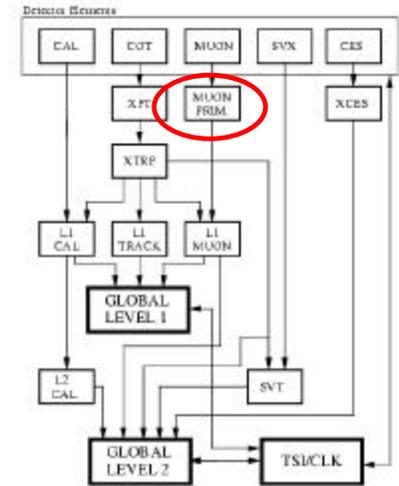


XTRPSim input/output

- **Input : XFLD _StorableBank**
 - real or simulated controlled via talk-to parameter *standalone*
- **output XTRD _StorableBank:**
 - track data: 2 blocks:
 - first block: 12 cards (2 wedges per card)
 - Track data:
 - ϕ
 - p_T
 - Isolation bit
 - short track bit
 - XTRP/Calorimeter bus
 - 2nd block: track trigger bits word

Code: MuonTrigger

- It emulates muon primitives:
 - Xtrapolation with XTRP done
 - stubs thresholds hardwired (no db access)



Detector	Basic Unit	Unit	CARD	Algorithm Description	# Outputs
CMU	Wire pair	1.25°	MUIT	Hi, low P_t , plus a "lefover to 384ns" determined from differential timing.	288 x 2 x 2 $\phi \times \eta \times P_t$
CMF	4 tube stack	0.6° 1.2°	MP II	2 or 3 out of 4 hits for patterns from radial tracks	336 ϕ
CMX	Wire pair	1.25°	MXIT	Hi, low P_t , plus a "lefover to 384ns" determined from differential timing	288 x 2 x 2 $\phi \times \eta \times P_t$
CSX	Coincidence	15°/8	MS IX	Coted Mean Time from 1/2 overlapped scintillators	192 x 2 $\phi \times \eta$
CSP	Scintillator	1.2° 2.4°	MS IP	Coted Scintillator hit	168 x 2 $\phi \times \eta$
HAD	Calorimeter	15°	MHIT	Signal in calorimeter PHIT for η intervals 0/4, 4/5 and 6/9	24 x 6 $\phi \times \eta$

MuonPrimitive0

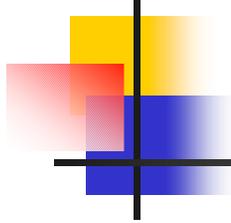
MuonPrimitive1

MuonPrimitive2

MuonPrimitive3

MuonPrimitive4

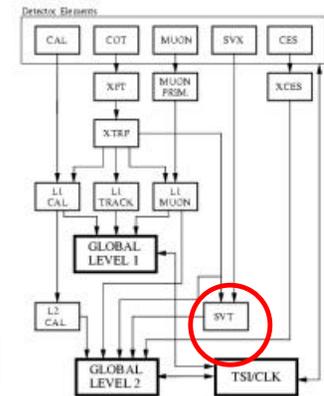
MuonPrimitive5



MuonTrigger input/output

- **Input:**
 - CMUD _StorableBank
 - CMXD _StorableBank
 - CMPD _StorableBank
 - XTRPMatchBoxData
- **Output:**
 - TCMD_StorableBank

Code: svtsim



- It produces SVT tracks, it does not emulate the decision;
- No private version, the one in the repository is the only general use version;
- Ability to run MC realistic simulation with SVT beamlines.

Input

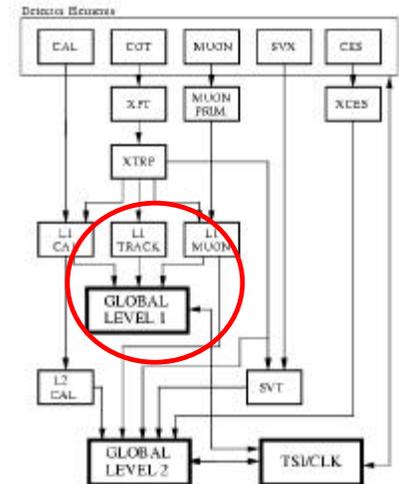
SIXD and XFLD

Output: SVTD

```
module talk svtsim
  writeBank set true
  useDB set true
  debugPrint set f
  sixdProcessName set "NSIM"
  sixdDescription set "CORRECTED"
  BeamMenu
    useBeamLineFromDatabase set t
    beamDatabaseFileName set "$env(CDFSOFT2_DIR)/svtsim/test/testSVTBeam"
  exit
exit
```

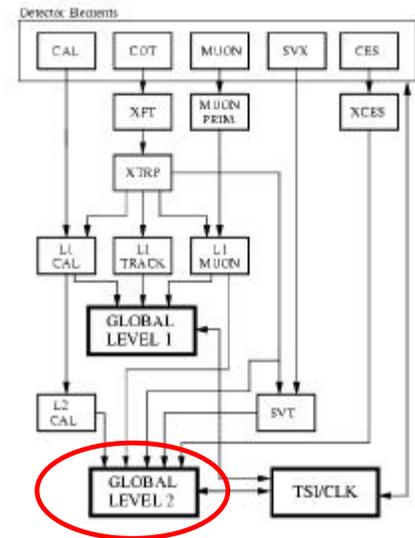
Code: L1GlobalTrigger

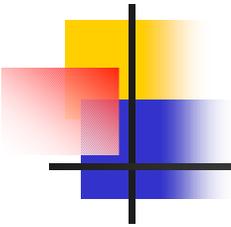
- TL1DMaker : it collects the prefred bits from cal, muon and track input. It produces TL1D_StorableBank
- FredSim: L1 bits
- Input : TL1D_StorableBank preFred bits
- database access for trigger definition - real data
 - TriggerDB DOWNLOADS Table : bits mapping
 - possibility to run on simulated run with conditions from real run: fetched from the event record or in talk-to
 - use_simTL1D set t
 - run_Number set 151435
- Output: TFRD



Code: L2GlobalTrigger

- L2Sim: L2 bits + L2 quantities
 - The online alpha code has been ported to offline
 - TL2D simulated includes:
 - L1 Trigger Card
 - L2 Trigger Card
 - Reces - XCES Trigger Card
 - SVT - SVT Card
 - Cluster Card
 - Isolation Cluster Card
 - XTRP Card (match word not filled)
 - L2 triggers emulated, after getting their definition from TriggerDB
 - Input: everything upstream....
 - Output: TL2D





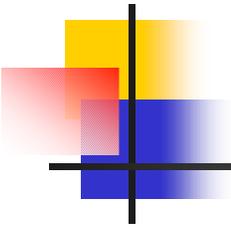
Code: TriggerMods

TriggerMods is the
placeholder
package for the
global executable,
TRGSim++

```
AppUserBuild::AppUserBuild( AppFramework* theFramework )
: AppBuild( theFramework )
{
// framework
addCDFRequiredModules(this);
addAllStorableObjects(); // production / physics objects
addMiscStorableObjects(); // everything else
addXTRPSim(); // XTRPMatchData
// dump
add(new EventDump("EventDump", "EventDump" ));
// several inputs
add(new YbosDiskFileInputModule("YbosDiskFileInput", "Input Module for TRYBOS files" ));
add(new XXXDiskFileInputModule("XXXDiskFileInput", "Input Module for XXX files" ));
add(new APPConsumerInputModule("ConsumerInput", "Consumer Input Module"));
// Puffing modules
add (new CalqModule());
add (new SmxqModule());
add (new CotqModule());
add (new SvqxModule());
// Trigger emulation modules
add(new CalorimetryModule ( "CalorimetryModule", "CalModule "));
add(new XFTSim("XFTSim", "XFT trigger simulation Module" ));
add(new XTRPSimModule("XTRPSim", "XTRP trigger simulation Module" ));
add(new svtsimmodule("svtsim", "SVT trigger simulation Module" ));
add(new calor::CalTriggerDataMaker( "CalTriggerDataMaker", "Calorimeter trigger simulation Module" ));
add(new muon::MuonTriggerMaker( "MuonTriggerMaker", "Muon trigger simulation Module" ));
add(new TL1DMaker("TL1DMaker", "TL1D simulation module" ));
add(new L1GlobalTriggerMaker( "FredSim", "Fred trigger simulation Module" ));
add(new SpikeFilter("SpikeFilter", " Filter for trigger towers energy below th"));
add(new L2SimModule("L2Sim", "L2 trigger simulation Module" ));

// monitoring code - necessary for data
add(new NewTrigSimModule("TrigSimModule", "TrigSim for a consumer program" ));

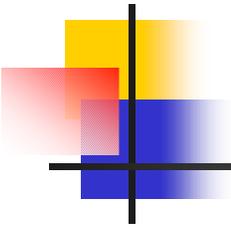
// Prereq filter
add(new Prereq());
```



Trigger banks

- TriggerObjects
 - trigger banks as in [cdf_note4152](#)
 - simple accessors (`get_word (int, int, int)`)
 - named accessors (depending on the bank)
 - look at the code browser
 - Examples of accessors: TriggerObjects/ntuple
- Trigger banks have been ntuplized in eN:
 - trigger towers energies, MET and SumEt
 - XTRP tracks
 - SVT track
 - L1 trigger bits (prescaled and uprescaled)

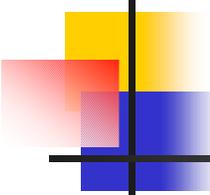
<http://ncdf70.fnal.gov:8001/talks/eN/eN.html>



Conclusions

- TRGSim++ has been used since October 2000 (commissioning run!)
- In its present form and functionality it provides emulation of all trigger steps since Summer 2002 (when the last piece was added, L2Sim)
- It is routinely built as part of all the integration releases and frozen releases.
- Just added to nightly validation
- And of course it runs in control room as part of TrigMon

<http://ncdf70.fnal.gov:8001/trigsim/trigsim.html>



Final remarks...

- If the input to TRGSim++ is incorrect, the output is incorrect or null...
 - Recent COTD rewriting (5.3.x) was causing XFTSim to fail
- TRGSim++ uses infrastructure/framework code :
 - If the code is weak, TRGSim++ will suffer the same
 - Database API, finally fixed for release 5.2.x
- Several happy customers (those who follow the official instructions...)
 - SUSY dilepton group, Higgs sumet + jets, Hadronic top, multijets triggers
- The unhappy ones are in general using unofficial versions/copies/patches...lack of communications with the authors and misinformation.

