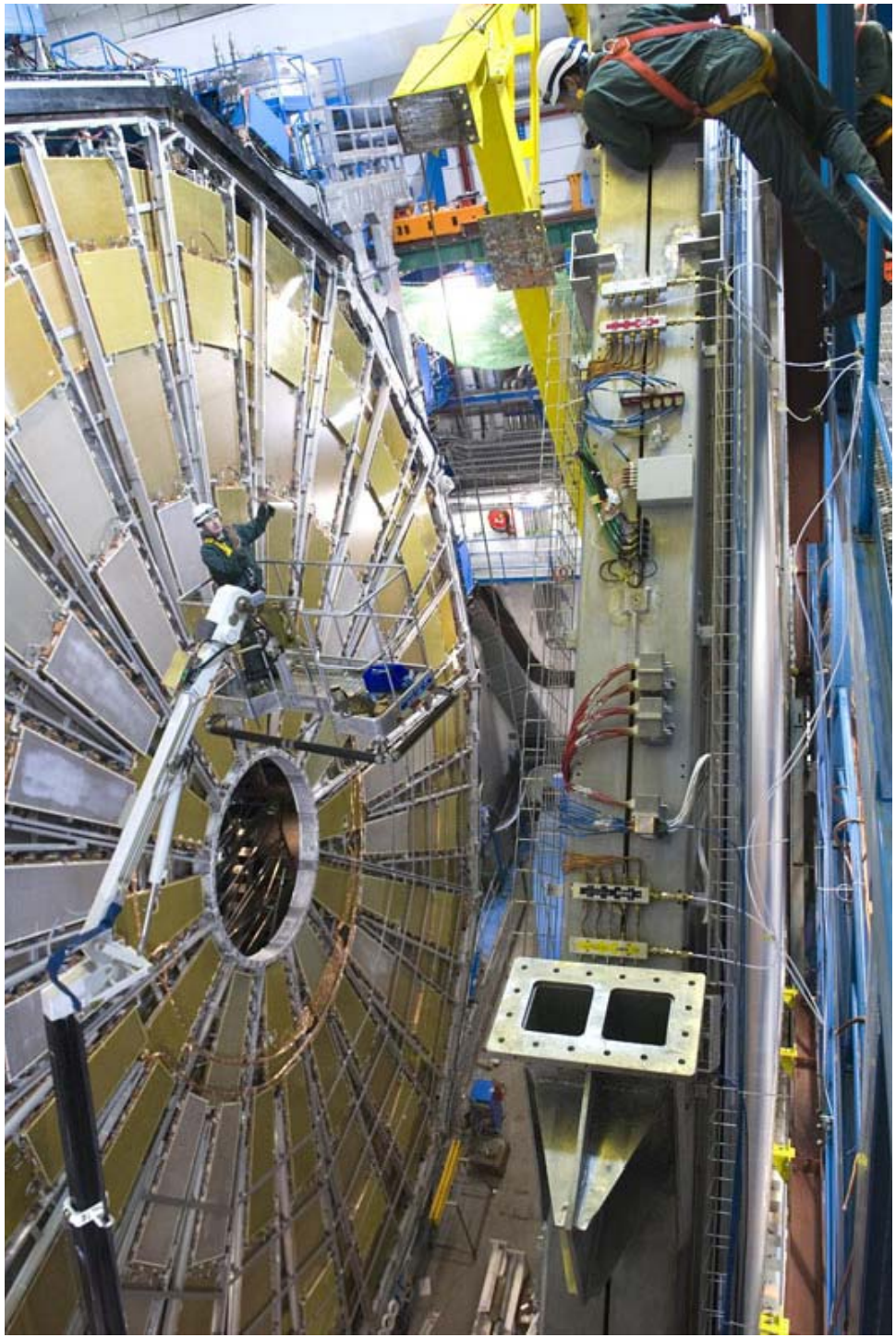


Trigger News

Outline:

- Introduction & Release plans
- Next FDR round and streaming
- For reference:
  - New trigger naming convention
- Progress in menus for $10^{31}cm^{-2}s^{-1}$

Ricardo Gonçalo (RHUL)
Higgs WG meeting – 17th July, 2007

Introduction & Release Plans

- Progress towards initial menu continuing
  - Expect information on trigger rates plus overlaps available in ~3 weeks

- Trigger talks in Glasgow Overview week (TDAQ session): good sources to find status
  - http://indico.cern.ch/conferenceDisplay.py?confId=12732#17

- Latest release plans (& trigger objectives):
  - Build release 13.0.20 this week
    - Aim for **stable running** even if some features are missing (needed for M4 cosmics tests)
  - Build 13.0.30 in late August
    - Aim to have **more realistic menu** (for 10^{31}; more complete and optimised than 12.0.7)

FDR and Streaming

- The next Final Dress Rehearsal round will focus on 10^{31}-10^{32} and will have:
  - 5-6 streams based on **trigger** result
  - + 1 calibration stream
  - + 1 express stream (using a subset of the trigger menu)

- Will use rel 13 menus for 10^{32} (begin run) 10^{31} (end of run)
  - 10^{32} menu will be a rough approximation
  - 10^{31} menu wll be much more realistic (default menu in rel 13?)

- Streaming based on trigger: essential to determine signature overlap => stream overlap
  - Will be done with rel 12.0.7 as a first approximation

- Express stream will use subset of the physics menu
  - Aim to find problems early (first stream to be reconstructed) but can also find "hot" events (high-pT cuts)
  - see talk by Szymon Gadomski last T&P week: http://indico.cern.ch/conferenceDisplay.py?confId=16155#1

New trigger naming convention: L1

- Applied from release 13 (but not yet uniformly)
  - Not so different from what already exists in rel.12
  - But with some improvements & more systematic
  - See Srini Rajagopalan, TAPMCG 5 March

- Level 1 menu Items: L1_(MULT)(TYPE)(THRESHOLD)(ADD INFO)
  - TYPE
    - **EM** = electromagnetic
    - **TAU** = tau
    - **MU** = muon
    - **J** = jet; JF = forward jet (+z); JB = backward jet (-z)
    - **TE** = total transverse energy
    - **JE** = total energy from jets
    - **XE** = missing transverse energy
- For example: L1_2EM20i, L1_TAU30i_XE20

New trigger naming convention: HLT

- High-Level Trigger Signatures (as in 12.0.x) are now Chains…well, more or less
  - A chain is a list of 1 or more sequences
  - A sequence is for example: reconstruction algorithm (FEX) -> testing algorithm (HYPO)

- HLT names: (LEVEL)_(MULT)(TYPE)(THRESH)(ADD INFO)_repeat
  - TYPE
    - **e** = electron; g = photon; em= e.m. object (not yet classfied)
    - **tau** = tau
    - **mu** = muon
    - **j** = jet; jf = forward jet
    - **te** = total transverse energy
    - **je** = total energy from jets
    - **xe** = missing transverse energy
  - If a trigger has multiple chains (e.g. tau + E_T^{miss}) add chain names separated by "_":
    - Example: EF_tau20i_xe20

- Configuration:
  - Chain names and configuration will be stored in the trigger DB and available offline
  - Each chain will have a more or less static ID (known as "Chain Counter"); e.g. 32 could be L2_tau35

Progress with 10^{31} menu

M-A Dufour's talk last week:
http://indico.cern.ch/conferenceDisplay.py?confId=12732#17

- Aims:
  - Detector and trigger commissioning
  - Early physics
  - Is and will be evolving
- In practice:
  - Calibration triggers included
  - Loose and redundant triggers included
  - Passthrough and prescales included
- Need to estimate rates and overlaps for all triggers

Low p_T			High p_T		
Threshold	Rates (Hz)		Threshold	Rates (Hz)	
	L1	HLT		L1	HLT
MU4	1000	1	MU15	19	19
MU6	227	1	MU20	14	14
MU10	112	1	MU40	8	8
2MU4	~9	~9	2MU20	<1	<1
2MU6	4	4	2MU40	<1	<1
2MU10	~1	~1			

•A lot of work has been going into this, to get a better knowledge of the trigger selection

•Will be essential with first data

Trigger menu for 10^{31} cm^{-2} s^{-1}

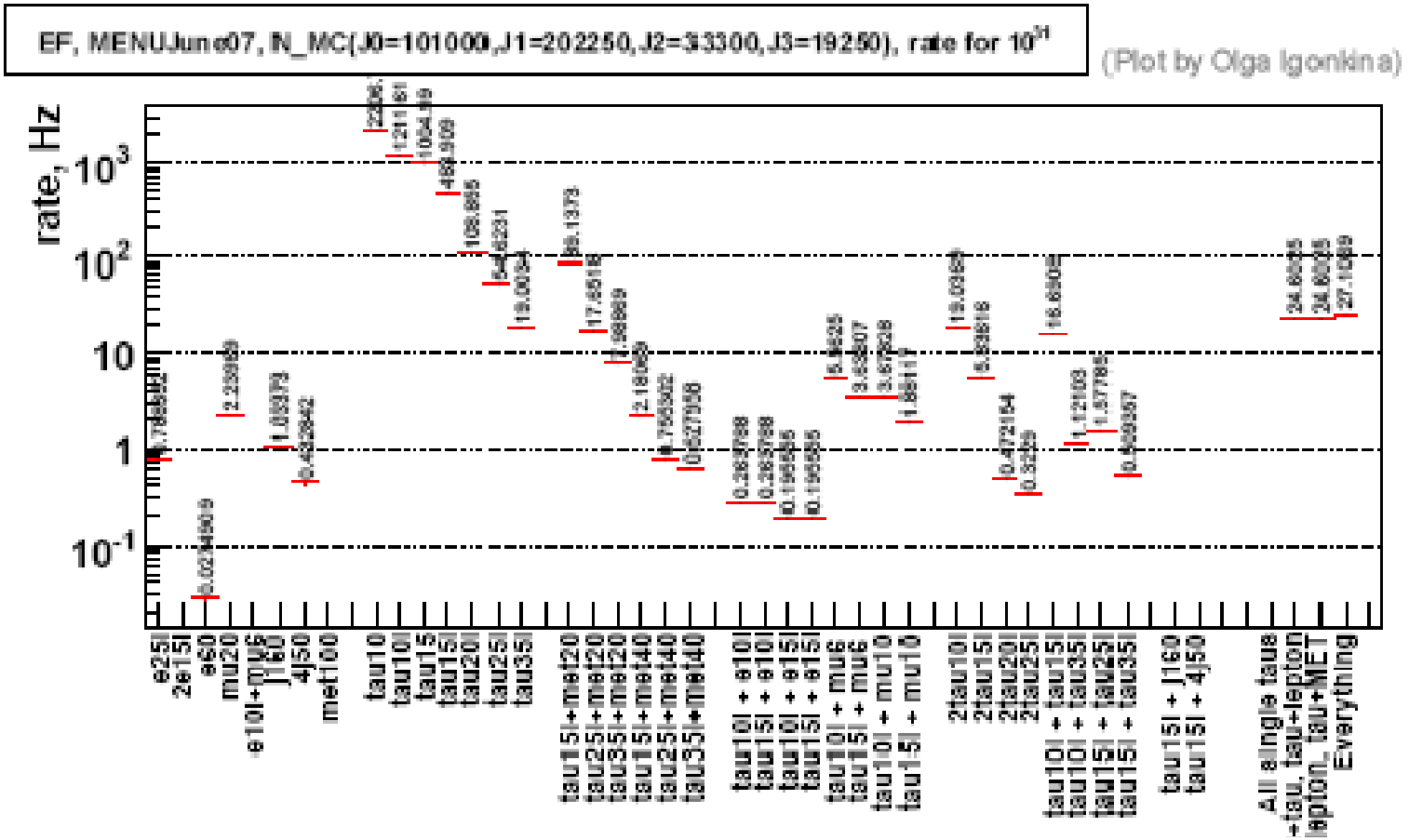
Description	L1 Items	HLT Items	Potential Motivations
Low p_T	EM3, EM8, EM13, EM13i	e8, e10, e15, e15i, g15, g15i	e from b,c; hadronic calibration, inclusive and di-photon cross section
High p_T	EM18, EM18i, EM23i, EM100	e20i, e25, e100, g20, g20i, g25i, g120	W→ev decay, Z→ee, exotics; direct photon, SUSY, unknown, hadronic calibration
di-electron/photon	2EM8, 2EM13, 2EM18	2e5, 2e10, 2g10i, 2g10, 2g15, 2g15i, 2g20, 2g20i, 2g120	J/Psi, DY, Z→ee; di-photon cross section, exotics

HLT Item	Rate (Hz)		HLT Item	Rate (Hz)
	Raw	Prescaled		
e3		~20	2e5	5-10
e10	~180	~10	2e10	1
e15	~40	~10		
e15i	~30	~10		
e20i	~10	~10		
e25	~10	~10		
e100	~1	~1		
g15	35	0.7	2g15	~1
g15i	28	0.6	2g15i	~1
g20	6	6	2g20	0.1
g20i	5	5	2g20i	<1
g25i	2	2	2g120	≪1
g100	<1	<1		

- Electron and photon menu
- Individual rates only (overlaps should reduce rate)

Tau slice

Description	$10^{31}\,cm^{-2}s^{-1}$ Menu	Potential Motivations
2 tau & tau + lepton	tau10i+tau25i or 2tau15i, tau10i+e10(i), tau10i+mu6	$Z \rightarrow \tau\tau$, Higgs, some SUSY
tau + missing E_T	tau15i+MET30	$10^{31}\,cm^{-2}s^{-1}$ (low thresholds): $W \rightarrow \tau\nu$, commissioning $10^{33}\,cm^{-2}s^{-1}$ (higher thresholds): top (decay to tau), SUSY , Higgs
tau + jets	tau10i+jetXX, tau10i+4jetYY, tau10i+bjet	top (decay to tau), SUSY, charged Higgs



(Plot by Olga Igonkina)

Trigger menu for 10^{31} cm^{-2} s^{-1}

- Multijet triggers also included in menu:
  - 3J10, 3J18, 4J10, 4J18, 4J23
- In addition to 8 L1 ETmiss thresholds, also:
- Four L1 ETsum thresholds
- Four L1 Jet ETsum thresholds

Thr.	Prescale	Rate (Hz)	Thr.	Prescale	Rate (Hz)
J5	1000000	~0	J35	500	1.1
J10	42000	1.1	J42	50	5.4
J18	6000	0.65	J70	5	5.5
J23	2000	1.6	J100	1	8.9

L1 Item	Rate (Hz)	L1 Item	Rate (Hz)
XE12	121095	TE100	428165
XE20	10862	TE200	9030
XE24	2851	TE304	95
XE32	333	TE380	~ 10
XE36	168		
XE44	36		
XE52	~ 10		
XE72	~ 1		

Trigger menu for 10^{31} cm^{-2} s^{-1}

- In addition, rel 13 and the new menus will bring:
- Mixed triggers: lepton+E_T^{miss}, e+μ
- Topological triggers: $Z \rightarrow e^+e^-$, $J/\Psi \rightarrow \mu\mu$
- Being more exclusive, these triggers are very useful to get better background rejection with small rates.
- But they need joint optimisation
  - I.e. the μ+E_T^{miss} signature needs to be optimised, not just the μ and the E_T^{miss} separately

Conclusions

- This talk focused mainly on rel.13
- There's a more well defined naming convention for trigger chains
- The next release (13.0.20) is aimed (from the trigger side) at stability
- 13.0.30 is aimed at adding new features and a complete & realistic menu in preparation for the FDR