

Status & Plans of the TDWG

Dave Waters
University College London

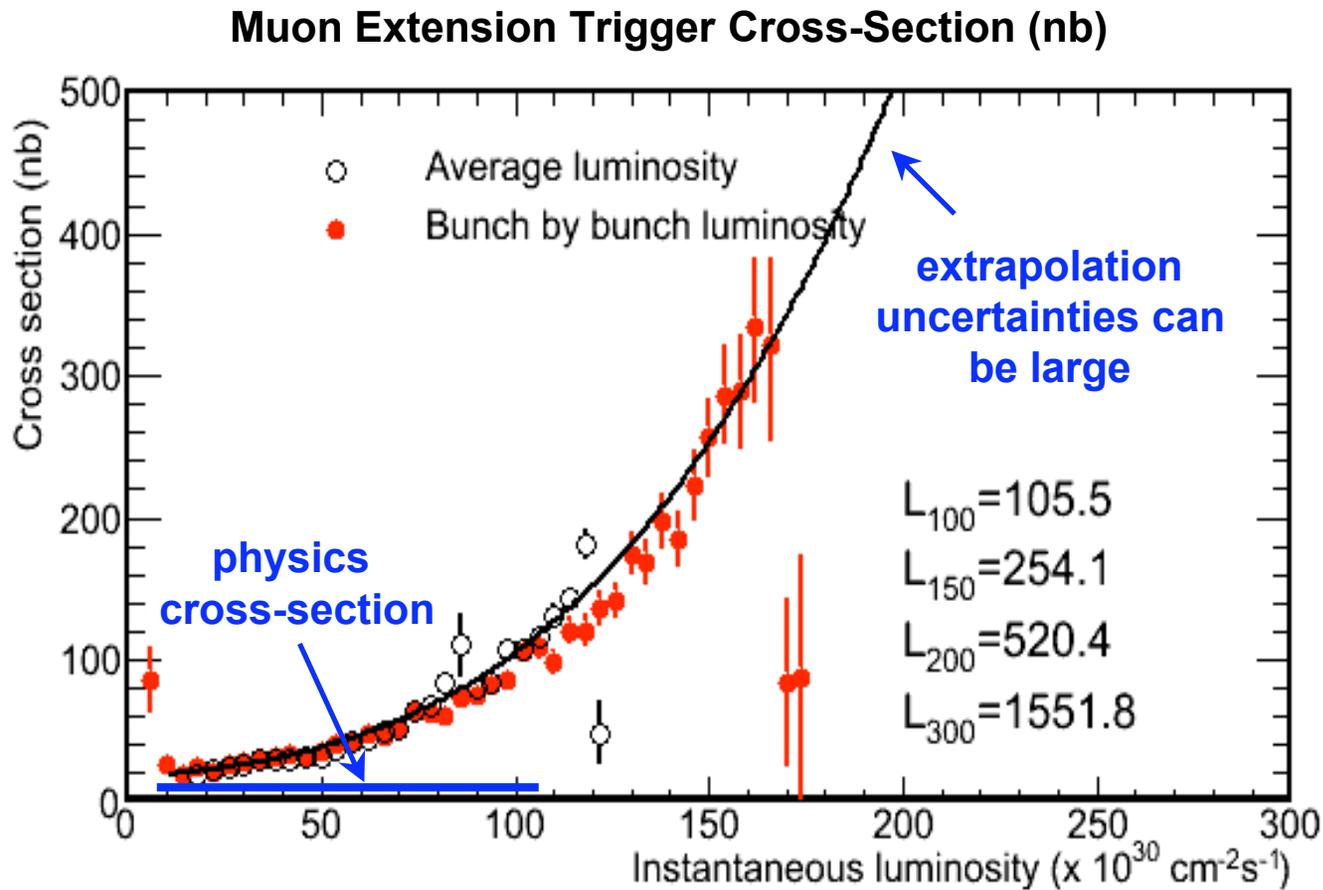
- Mission Statement
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Mission Statement

“Implement a trigger that maximizes the physics return on the luminosity delivered to CDF”

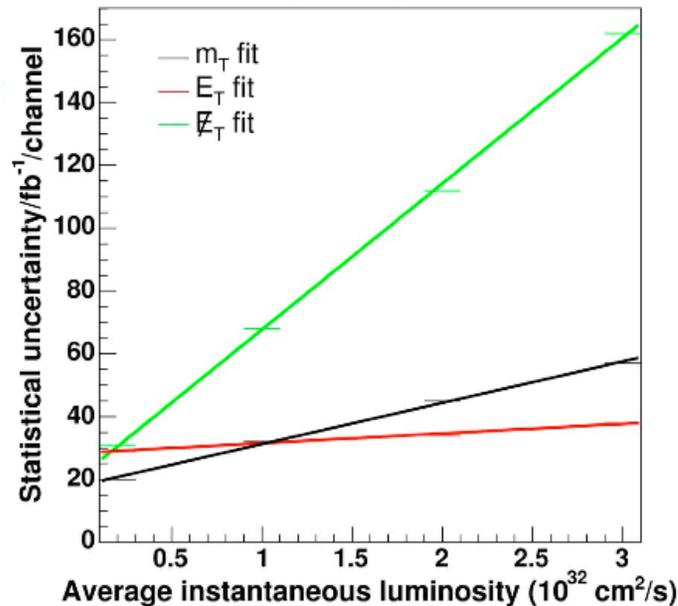
- Assumes that physics priorities are identified & agreed upon.
 - ▶ Often this is clear (e.g. M_{TOP} , M_W , B_S), but sometimes not.
- Implies minimizing deadtime even at highest L_{INST} .
- Requires an understanding of the sensitivity of different measurements to instantaneous luminosity.
 - ▶ Hard, especially for precision measurements.
- Requires an understanding of the back-up trigger requirements of the various analyses.
 - ▶ Even harder.
- Implies ease of analysis of resulting datasets.

The Problem



Luminosity Dependence ... Examples

Chris Hays



M_W

- Switch to lepton fit when MET resolution is too degraded.

M_{top}

U-K. Yang

- Effect of additional min-bias events is well accounted for by jet corrections (function of N_{VTX}).
- O(100) MeV uncertainty.
- Will need sufficient backups to properly determine & validate jet corrections in the presence of several overlapping MB events.

Studies indicate that these analyses can use all available luminosities.

What Do We Have To Guide Us ?

- **Inertia** : Physics Table **N** is based on Physics Table **N-1**.
- RunIIb Physics Priority & Triggers Committee's **Straw Table** :

Straw Table @ 3E32; Ristori et al.

Level 1					Level 2		
		<i>nb</i>	<i>Hz</i>	<i>ovl</i>		<i>nb</i>	<i>Hz</i>
Central Electron	CEM8_PT8	3259	978	1	CEM18_PT8_A_R	96	29
Central Muon	CMUP6_PT4	7437	2231	1	CMUP6_PT16	285	86
Muon Extension	CMX6_PT8_CSX	3272	982	1	CMX6_PT15_JET10	200	60
Single Jet/Electron-70	JET20	2800	840	0.37	JET90_NOROF	40	12
Single Isolated Photon	EM12	5000	1500	1	PHOTON_25	123	37
Missing Et	MET25	8045	2414	1	MET35_JET5	79	24
e-central e-central	TWO_CEM4_PT4	3855	1157	1	CEM4_CEM8	50	15
e-central mu-central	CEM4_PT4 & CMU1.5_PT4	2000	600	1	CEM8_CMUP4+CEM4_CMUP8	8	2
e-central mu-extension	CEM4_PT4 & CMX1.5_PT4_CSX	450	135	1	CEM8_CMX4+CEM4_CMX8	16	5
e-central e-plug	TWO_EM8	3400	1020	1	CEM4_PEM8	137	41
mu-central mu-central	TWO_CMU1.5_PT4	2000	600	1	CMUP4_CMUP8	4	1
mu-central mu-extension	CMU1.5_PT_4_CMX1.5_PT4_CSX	700	210	1	CMUP4_CMX4	6	2
e-plug mu-central	EM8 & CMU1.5_PT4	700	210	1	CMUP4_PEM8	13	4
e-plug mu-extension	EM8 & CMX1.5_PT4_CSX	160	48	1	CMX4_PEM8	20	6
Tau+electron	CEM8_PT8	3259	978	0	CEM+TAU	158	47
Tau+muon central	CMUP6_PT4	7437	2231	0	CMUP+TAU	106	32
Tau+muon extension	CMX6_PT8_CSX	3272	982	0	CMX+TAU	122	37
Plug e + Missing Et	EM12	5000	1500	0	MET15_PEM20	50	15
Super Photon-70	JET20	2800	840	0	EM70	60	18
Di-Gamma/Z-notrack	EM12	5000	1500	0	TWO_EM_16	17	5
Top Multijet	JEY20	2800	840	0	FOUR_JET15_SUMET175	57	17
		TOTAL	12395.8			TOTAL	495

Caveats

- Has anything changed regarding the assumptions made by Luciano's committee ?
 - ▶ Performance of the planned upgrades : still to be determined.
 - ▶ Trigger rate extrapolations assume continuity (no “phase changes”).
 - ▶ Always new ideas for new triggers & upgrades that could further enhance overall performance.
- What's missing or incomplete ?
 - ▶ Detailed understanding of high priority exotics triggers on the “waiting list”, and what needs to be done to ensure they can run at the highest luminosities. e.g. triggers for Higgs searches (MET + jets; Higgs multijet)
 - ▶ A real understanding of backup triggers : requirements & rates.
 - ▶ Understand where B-physics triggers fit in at high luminosity.

The Backup Trigger Problem

Veronique Boisvert

Backup Trigger	Needed for	L2A @ 3E32 (XMON)
ELECTRON_CENTRAL_8_L2_DPS	SecVtx, elec. trig. eff., CEM uniformity	
MUON_CMUP8_DPS	SecVtx	
JET_20,50,70,100	SecVtx, fakes, jet corrections, etc. ...	240 Hz
MUON_CMUP8_DPS, MUON_CMUP8_NOL2	SLT	
B_SEMI_CMUP4_TRACK2_D120_DPS	SLT	
B_SEMI_L3PS50_L2_TRK2_D120_L1_CMUP6_PT4	SLT	60 Hz
MUON_PS1000_L1_CMUP6_PT4, MUON_CMUP4	SLT	
W_NOTRACK	XFT & track eff.	35 Hz
W_NOTRACK_NO_L2 , L1_EM8	cal. trig. eff.	10 Hz
PHOTON_25_ISO_PASS4	jet corrections	20 Hz
JPSI_CMU2_CMX2_PS2	Momentum Scale	265 Hz
JPSI_CMUCMU2_PS2	Momentum Scale	300 Hz
UPSILON_CMUP_CMU_DPS	Momentum Scale	
UPSILON_CMUP_CMX_DPS	Momentum Scale	
DIELECTRON_CENTRAL_4	Energy Scale	90 Hz
DIMUON_CMUP4_CMX4	Momentum Scale	12 Hz
DIMUON_CMUPCMUP4	Momentum Scale	10 Hz
	TOTAL:	365 Hz
	TOTAL:	677 Hz

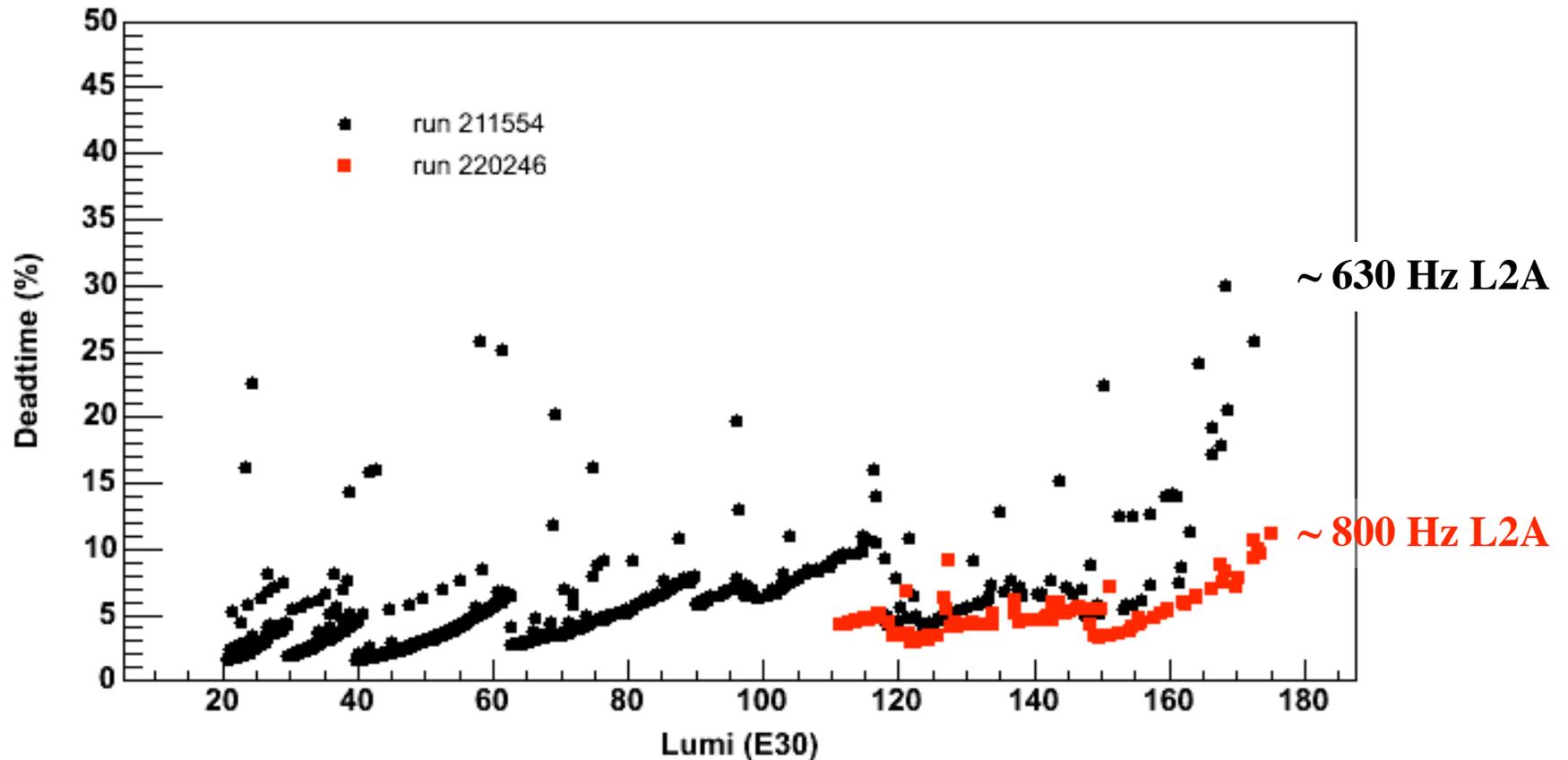
overlap with
mainline signal
triggers ~ 10-20%

- A small selection of existing top & electroweak backup triggers fills up spare bandwidth.
- The main lesson at this point is that we can't do nothing - some hard work required to figure out which of these we really need at high luminosity.
- Potentially still some gaps : limited statistics for b-tagging studies & p-scale from Υ .

Current Trigger Status

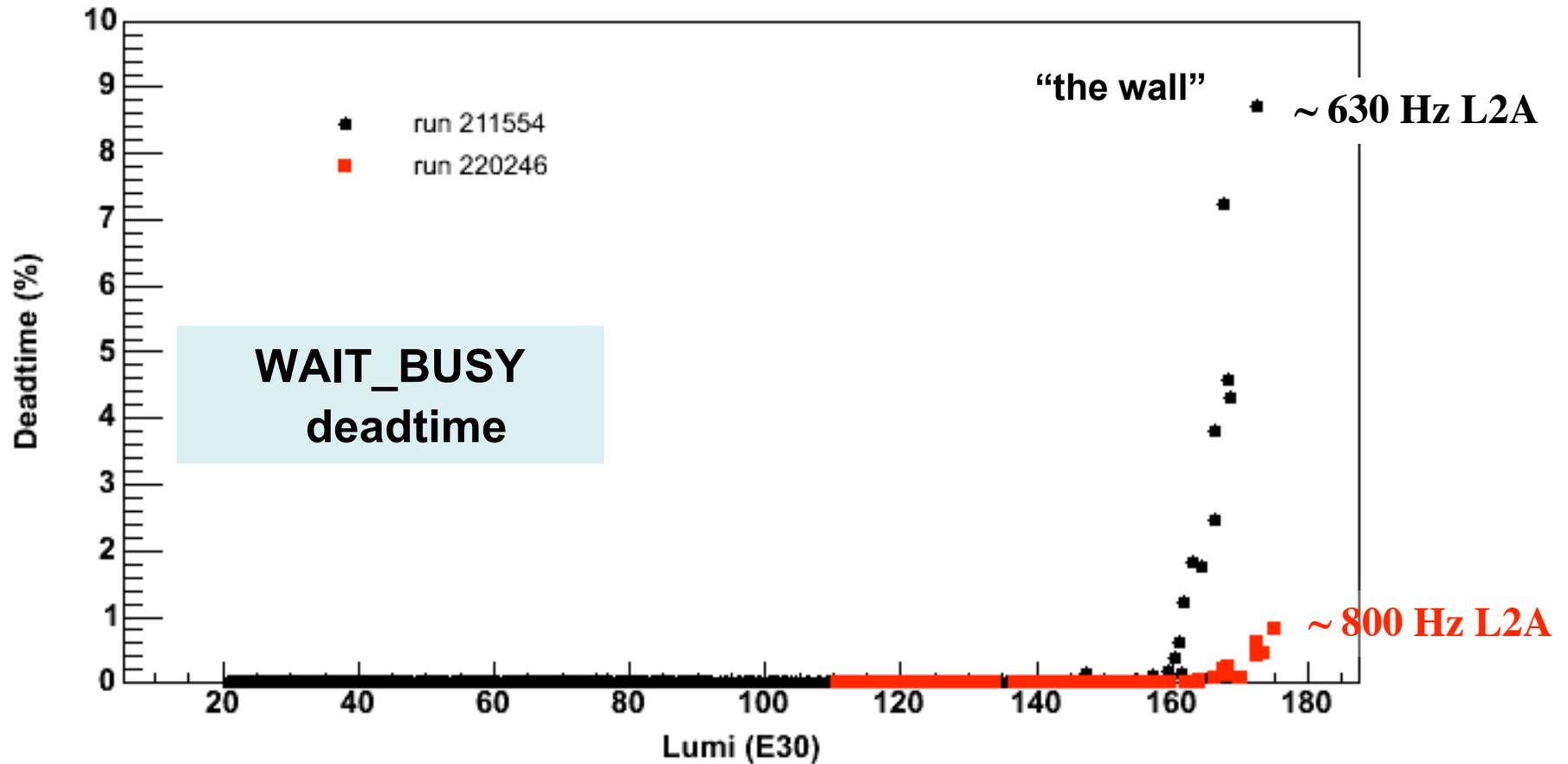
- We are in the epoch of grand-unification (Kirsten, Ted & Veronica) :
 - ▶ we run a single trigger table at all luminosities
 - ▶ use all tools available to achieve that (DPS, UPS, lumi-enable, CLCM)
- We're up to date : run 6.1.2/SL @ Level-3. Hopefully the last (but one ?) change in online software version - it's a major exercise to upgrade.
- We have implemented or are busy implementing the less controversial recommendations of the Run IIb committee :
 - ▶ changes to EM & Jet L1 thresholds
 - ▶ drop RP & single-gap triggers
 - ▶ SUSY dilepton triggers → (4,8) GeV asymmetric cuts
- Implementation of core Run IIb trigger table by **November**.
- We're not just cutting but still adding triggers where it makes sense or people have good ideas :
 - ▶ CMP (muon ϕ -gap) trigger.
 - ▶ extended ϕ trigger.

Current Trigger Performance

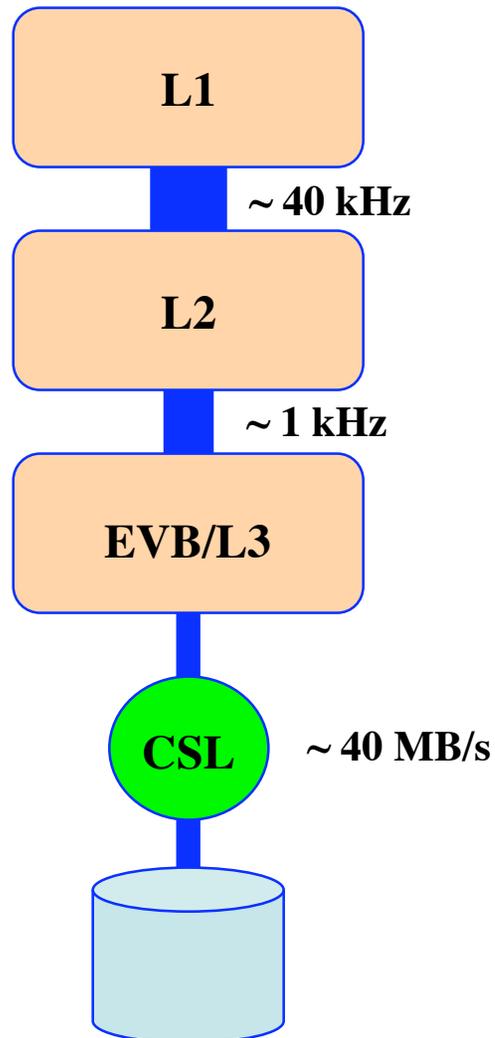


- Shutdown work : new converter nodes & load balancing / system-optimisation.
- Will soon start probing the acceptance phase space @ ~ 1 kHz (function of L).

Current Trigger Performance



Recent & Ongoing Upgrades



- L2 Pulsar & SVT : **complete**.

- XFT stereo @ L1 & conf. @ L2
- 3D tracking & matching @ L2
- **Timescale** : complete hardware commissioning by 1st September.

- EVB : 1kHz @ highest luminosity : **complete**.
- L3 processing → 2.4 THz : **complete**.

- CSL : 40-80 MB/s
- **Timescale** : commissioning by 30th September.

N.B. this is *not* a complete list : TDC's, L3 performance optimisation ...

Summary

- We do have a plan for dealing with the highest luminosities.
- Some significant gaps remain - e.g. full understanding of backup trigger requirements.
- Not much breathing space to react to the unknown :
 - ▶ Rates grow faster than expected.
 - ▶ Reduction factors from upgrades are smaller than expected.
 - ▶ Discovery ;-)
- Other considerations for maximising physics reach :
 - ▶ Keeping triggers simple and straightforward to simulate.
 - ▶ Minimising numbers of trigger changes.
 - ▶ Dataset continuity.

The End