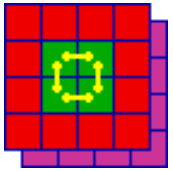
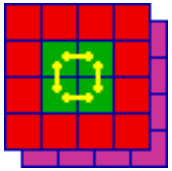
ATLAS Level-1 Calorimeter Trigger (L1Calo)



- Alan Watson
  - Offline software (simulation), UK Project Leadership
- Paul Thompson
  - DCS
- Richard Staley
  - Hardware/firmware development and maintenance
- Sasha Mazurov
  - Offline software (simulation, monitoring, infrastructure)
- Steve Hillier
  - Online software, general trouble-shooter
- Francesco Gonnella
  - Firmware for upgrade
- Juraj Bracinik
  - Online software, calibration

- Current students:
  - Rhys Owen, online software
  - Andrew Foster, calibration
  - James Kendrick, upgrade simulation

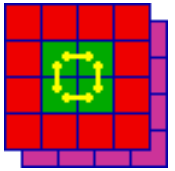
Last year in a nutshell

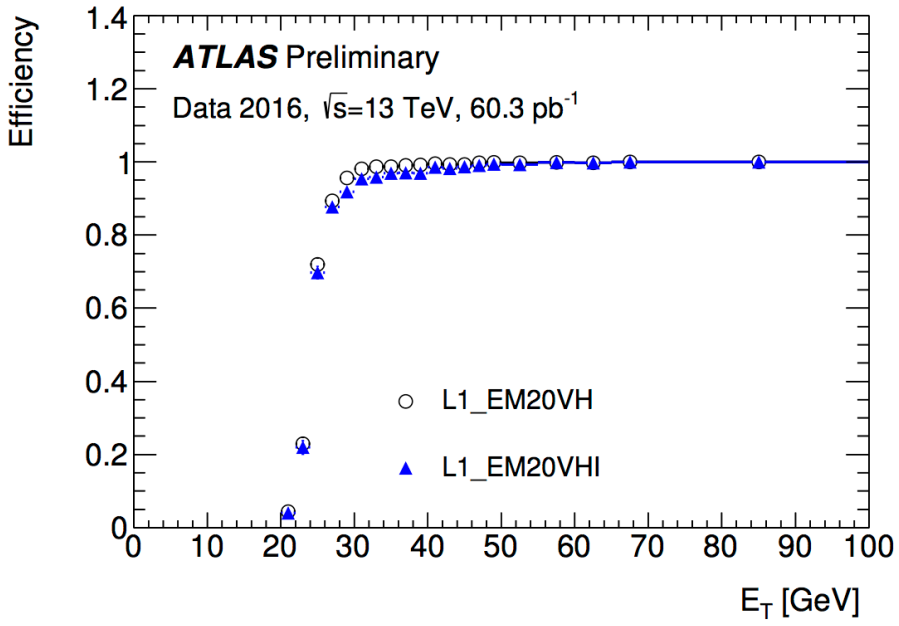


- **Lots of data**
  - Bulk of 2015 data (~4 fm^{-1}) came late in year
  - About 25 fm^{-1} and counting in 2016
  - All of this data taken at 25 ns bunch spacing and high pile-up (up to 40 collisions per bunch on average)
    - LHC finally reached design luminosity

- The high-mu and 25ns environment is challenging
  - But one that L1Calo was well prepared for
  - Nevertheless some teething troubles in 2015
  - Operation in 2016 has been very smooth
    - But requires constant vigilance and occasional interventions

Operation highlights

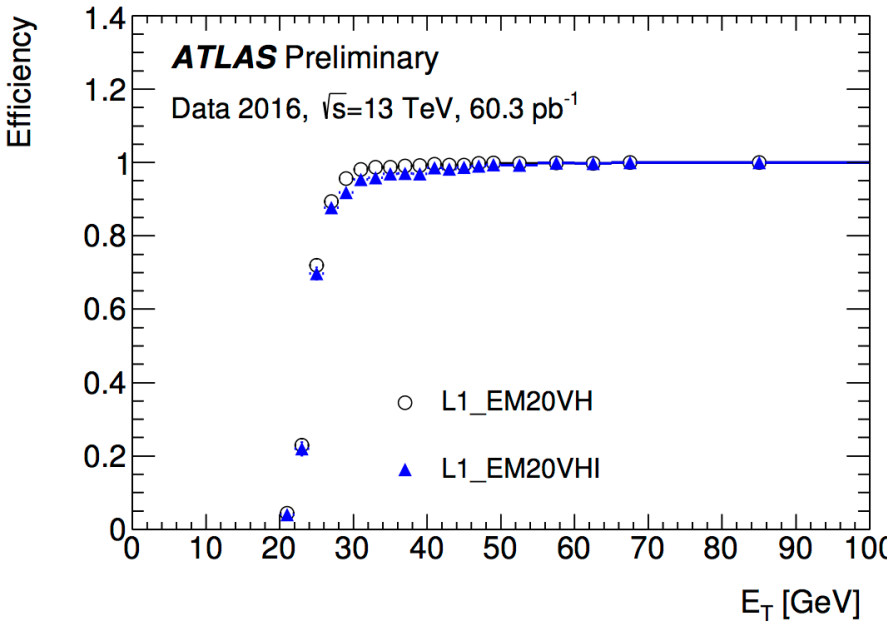


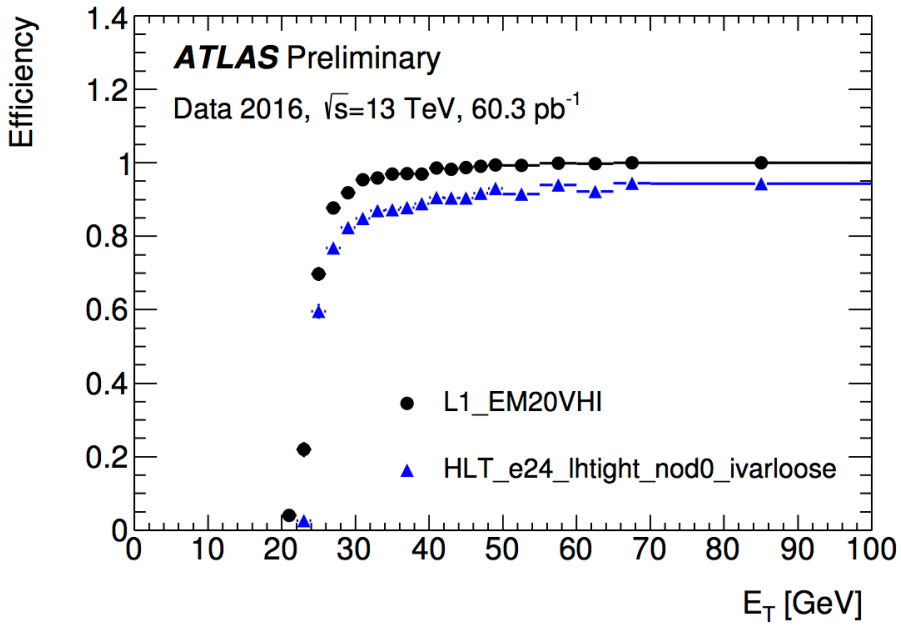


- Electron trigger using isolation
  - LS1 development by Richard et al
  - Studied by Rhys and others
  - Finally used seriously in 2016
- MET threshold maintained in 2016
  - Despite far harsher conditions
  - Similar or lower than end of Run 1
  - (ATLAS MET currently more HLT than Level-1 limited)
  - Birmingham contributed to ideas and performance studies for MET improvements

Electron isolation, Level-1 and HLT

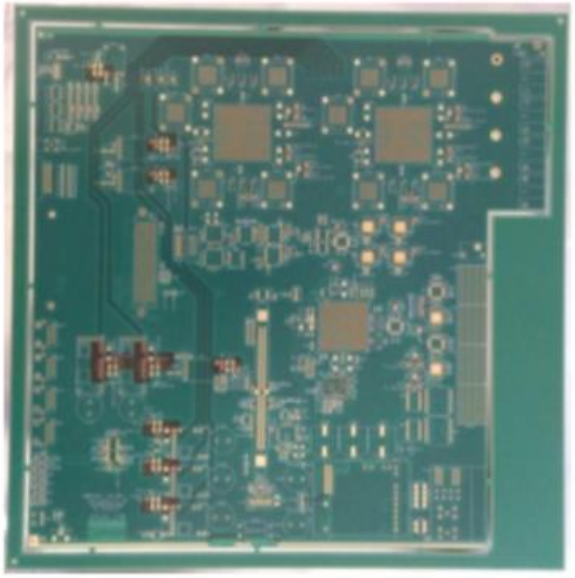
- At Level-1, about 2% loss in efficiency
  - In electron p_t range 20-50 GeV
  - Rate reduction close to factor of two
  - Nevertheless, electron trigger takes ~20% of Level-1 bandwidth
    - Hence the need to upgrade





Phase-1 Upgrade: eFEX and FTM

- Current electron/gamma processors to be replaced by new eFEX
  - Hardware design RAL, algorithm firmware B'ham
  - Birmingham designed test module FTM
- FTM status:



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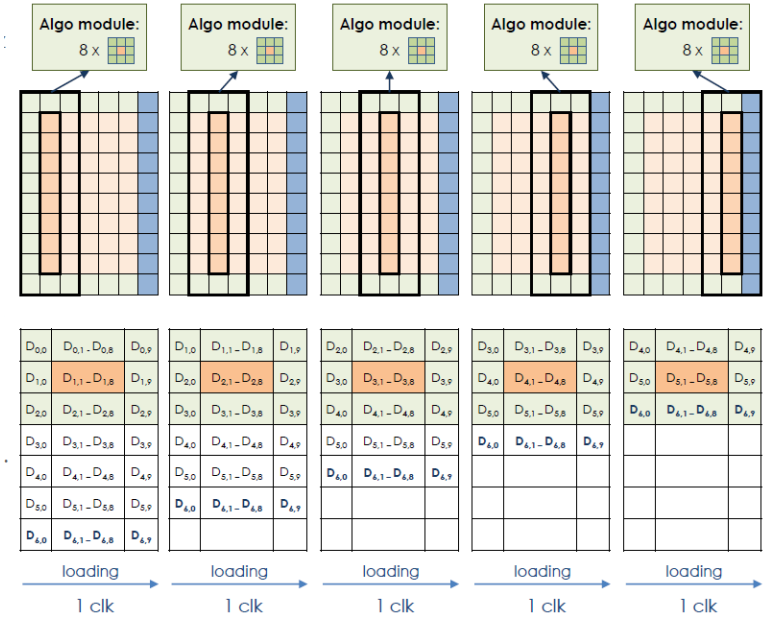
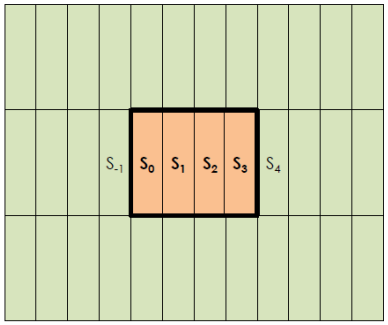
Phase-1 Upgrade

- Francesco getting teeth into algorithm in firmware
- James making progress on simulation

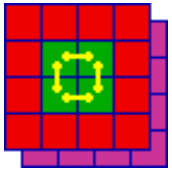
- Timescale:
  - Will keep all of us very busy for at least 5 years
  - Prototyping/production in next two years
  - Installation/commissioning over LS2 (2019-2020)





Comparison	0	1	2	3
$S_0 > S_{-1}$	T			
$S_1 > S_0$	F	T		
$S_2 > S_1$		F	T	
$S_3 > S_2$			F	T
$S_4 > S_3$				F
$S_3 > S_1$		F		T
$S_3 > S_0$	F			T
$S_2 > S_0$	F		T	

Phase-2 Upgrade



- Difficult to summarise the current situation
  - ATLAS is discussing 3 triggering scenarios
  - Most crucially 1 or 2 level hardware trigger
    - Has big impact on need for future hardware development
  - In principle, decision should be soon
    - Then have to quickly take a position on UK involvement
  - A bit of a head-ache for Alan
    - More news in a few weeks, hopefully