# SCT has developed a new ATLAS trigger card

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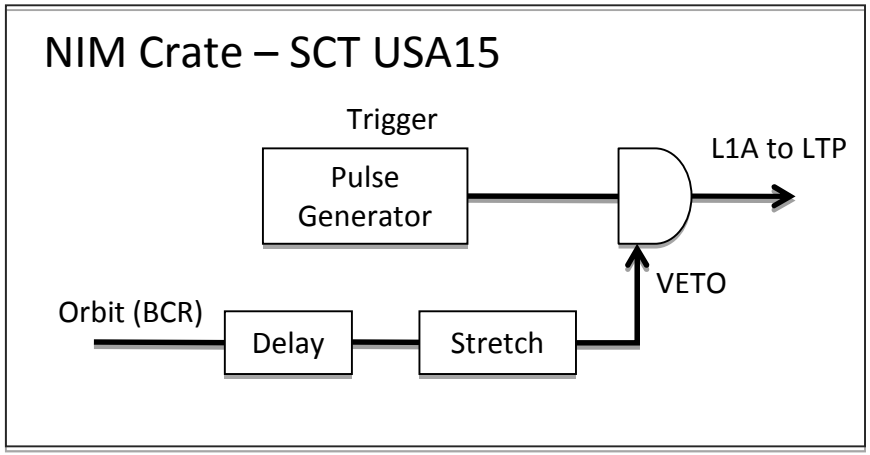
# What is it?

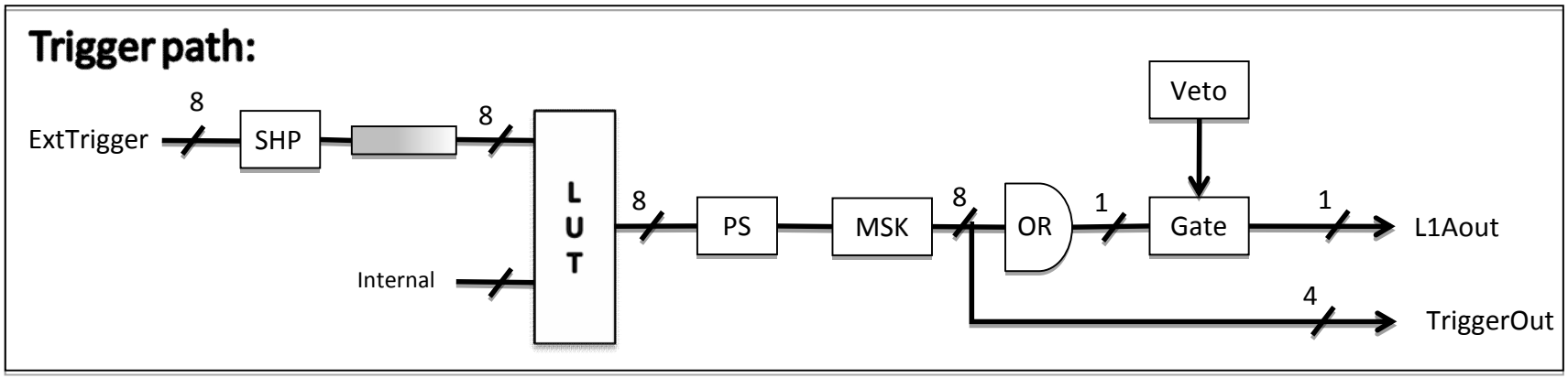
- 6U VME Digital Atlas VmeElectronics (DAVE) card
  (acronym reflects a certain sense of humour by our engineers)
- Design, production and firmware by UCL and Cambridge
  - Maurice Goodrick, Rick Shaw (Cambridge)
  - Matt Warren, Martin Postranecky (UCL)
- Support and encouragement from ATLAS
  - Strong support and ideas from ThiloPauly, Carolina Gabaldone
  - User case suggestions from IskanderIbragimov, Bruce Barnett, Andrej Gorisek

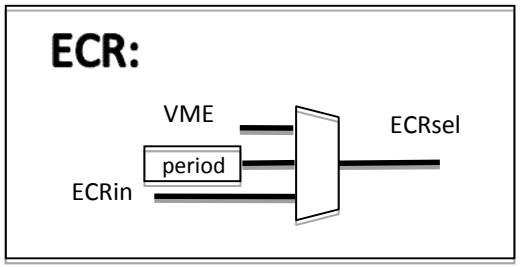
# Concept & Motivation

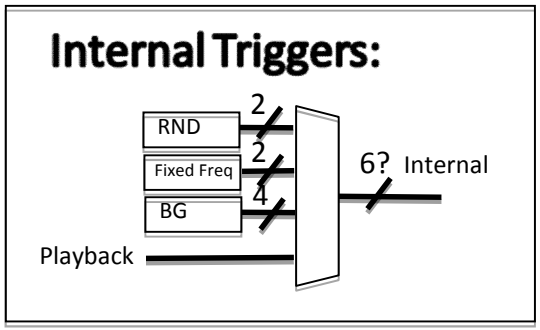


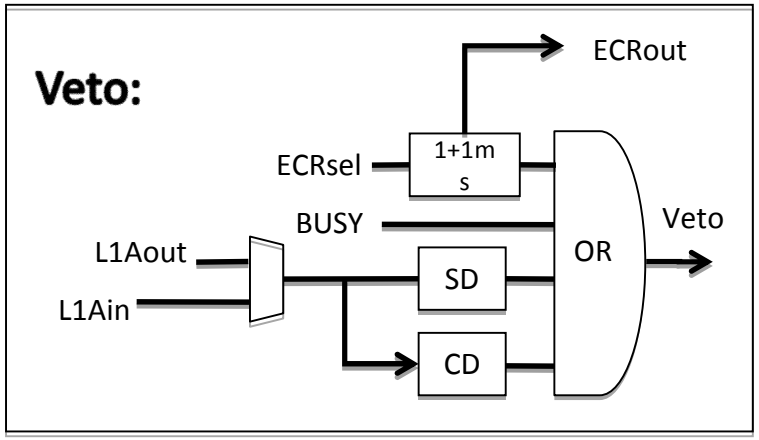

- We long wanted to eliminate use of a NIM crate in USA15 which provides our trigger for standalone physics runs
- Contains veto logic (prevent BCR/L1A clash) which drifts
- Need to go downstairs to adjust trigger rate
- Non-realistic conditions

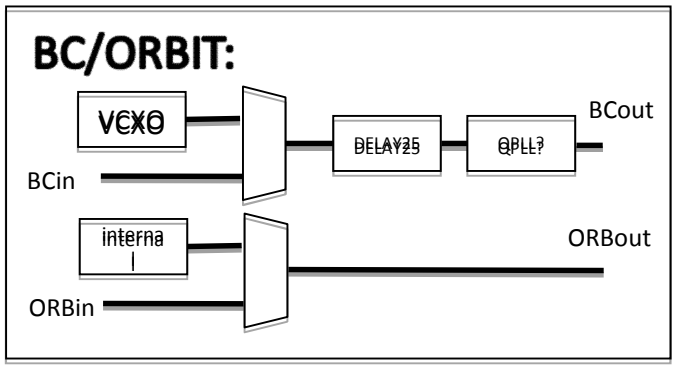
- First thoughts were replace this simple logic in a VME card
- Concept quickly grew to add more generic features
- Significant enhancement to adopt ATLAS CTP functionality to exactly duplicate running conditions, whilst incorporating much generic functionality, has evolved the card into a powerful and flexible logic card, potentially useful to all ATLAS subsystems as well as for non-ATLAS use



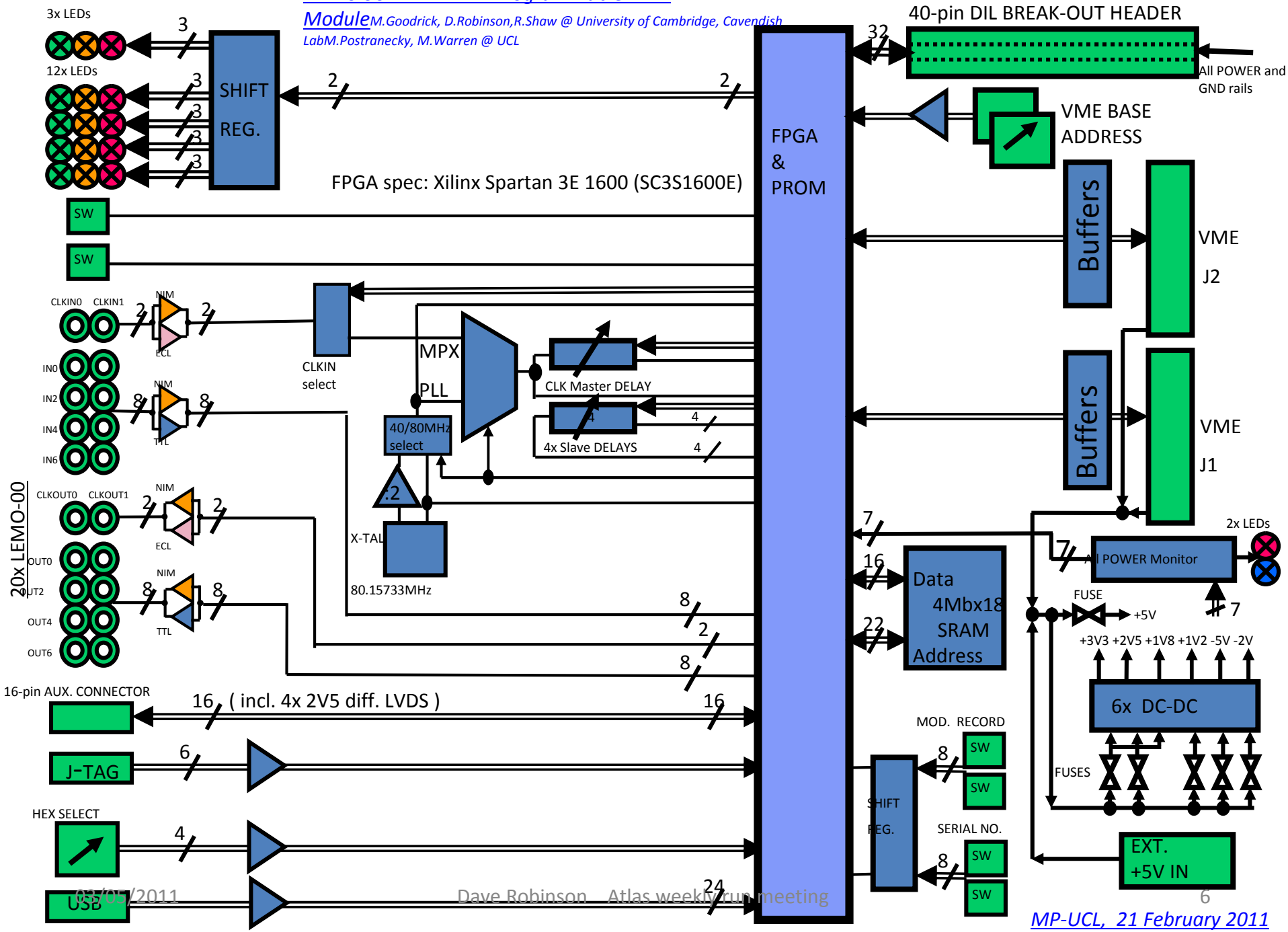



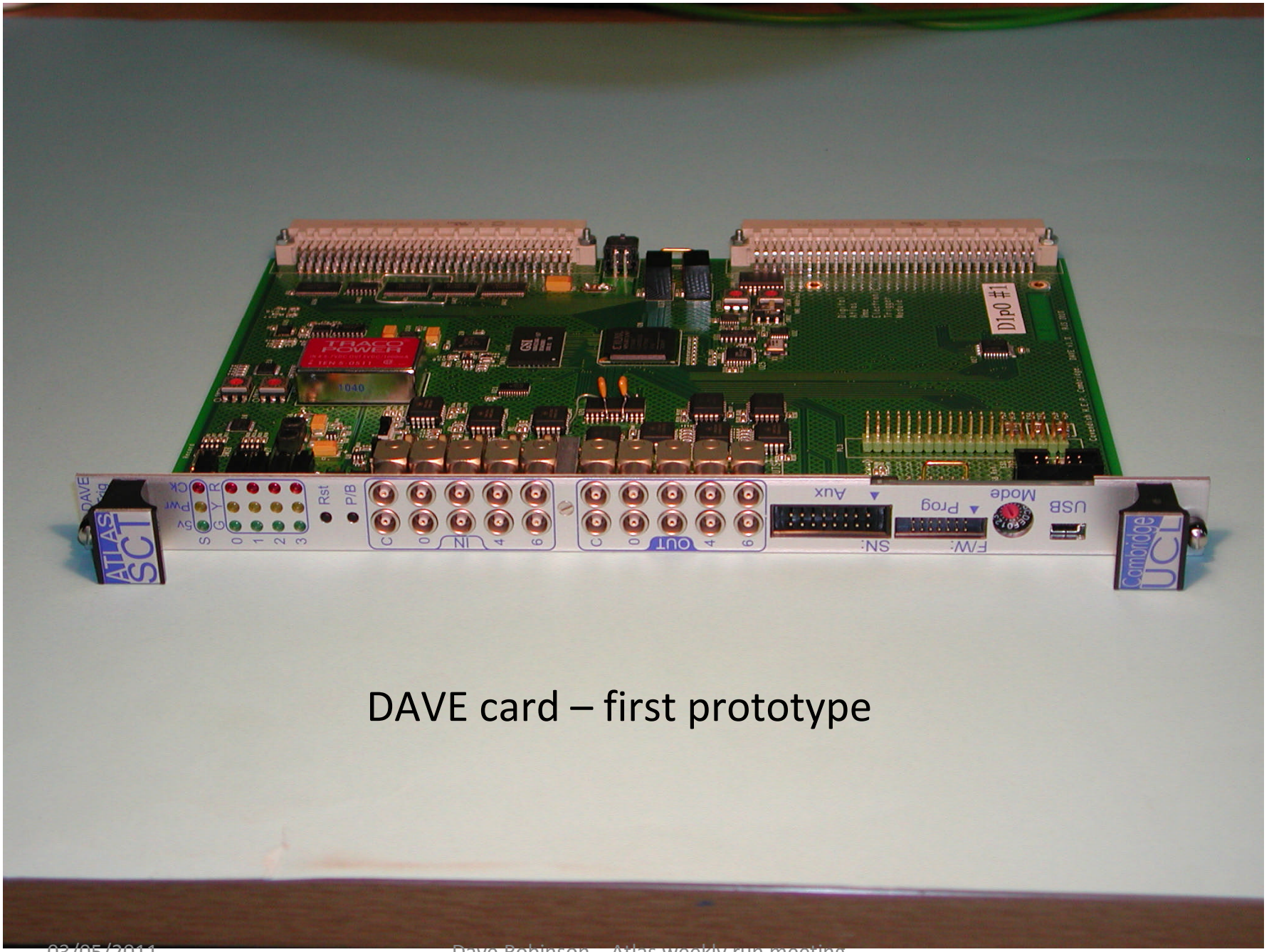

DAVE card: examples of CTP Functionality

# Interesting use-cases

- Trigger generator for LTP (via LEMO)
  - no busy gating, feed-forward of deadtime to LTP
- Standalone trigger generator without LTP
  - busy gating
- ECR generator
- VETO generator
- L1A (or other signal) sequence analyser
- Sequence playback
  - Eg capture and replay trigger sequences that causes susbsystem busy etc
- BC/ORBIT source, fine-delay (dt=0.5-1ns) for timing scans
- Generic delay line
- Generic counter facility
  - a few counters
  - per-bunch counters?
- Generic logic unit
  - Programmable "NIM crate"

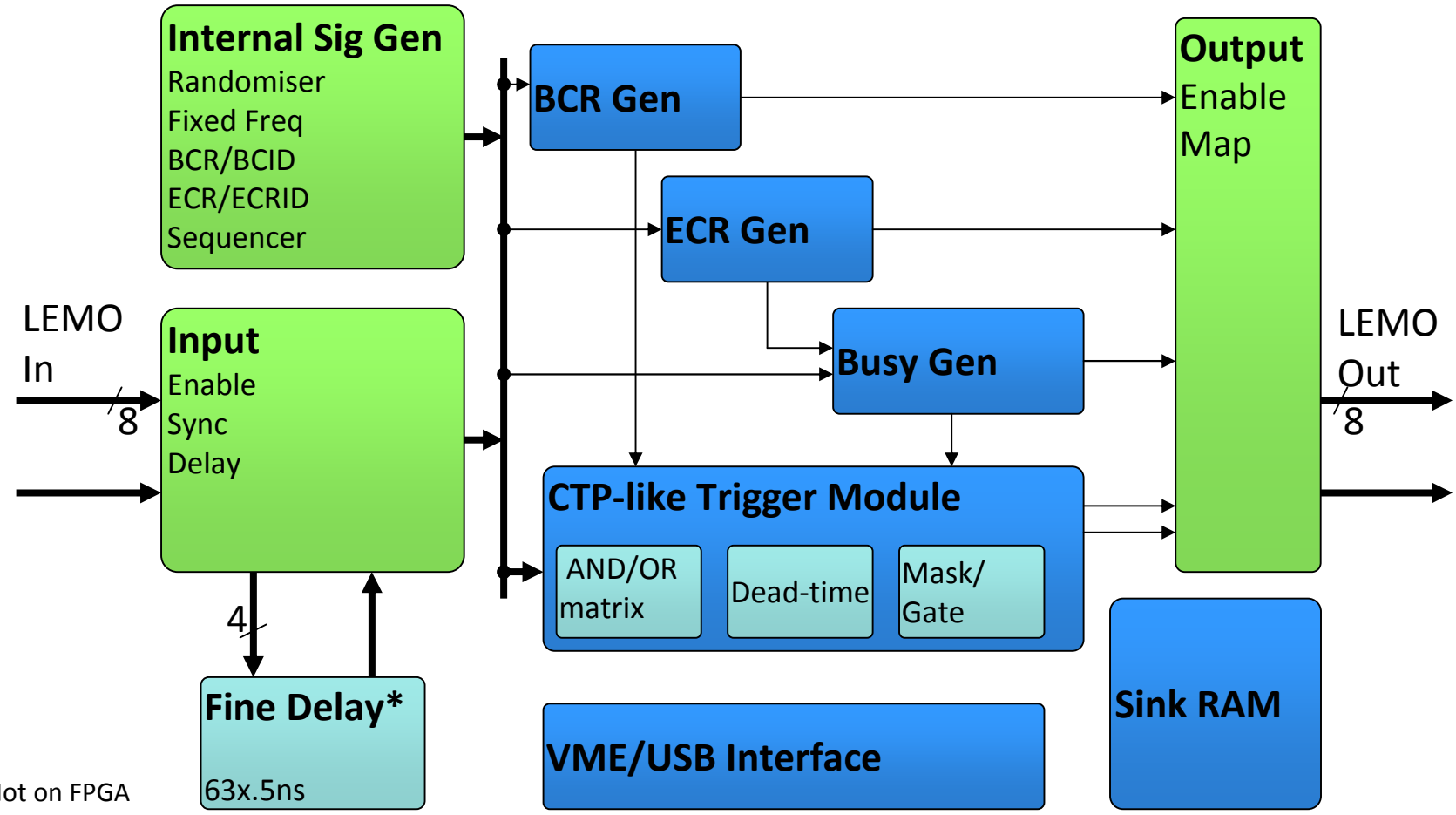
SCT Use:
- Trigger generator to LTP via lemo
- Programmable random rate up to 100kHz
- BGS appropriate to take care of BCR/L1A clash
- feed-forward of deadtime (simple/complex) to LTP


ATLAS-SCT "DAVE-1" Programmable VME Module
M.Goodrick, D.Robinson,R.Shaw @ University of Cambridge, Cavendish LabM.Postranecky, M.Warren @ UCL
3x LEDs
12x LEDs
SHIFT REG.
FPGA spec: Xilinx Spartan 3E 1600 (SC3S1600E)
FPGA & PROM
40-pin DIL BREAK-OUT HEADER
All POWER and GND rails
VME BASE ADDRESS
SW
SW
Buffers
VME J2
Buffers
VME J1
CLKIN0 CLKIN1
NIM
ECL
CLKIN select
MPX
PLL
CLK Master DELAY
4x Slave DELAYS
40/80MHz select
X2
X-TAL
80.15733MHz
IN0
IN2
IN4
IN6
NIM
TTL
20x LEMO-00
CLKOUT0 CLKOUT1
OUT0
OUT2
OUT4
OUT6
16-pin AUX. CONNECTOR
16 ( incl. 4x 2V5 diff. LVDS )
J-TAG
HEX SELECT
USB
Data 4Mbx18 SRAM Address
2x LEDs
POWER Monitor
FUSE
+5V
+3V3 +2V5 +1V8 +1V2 -5V -2V
6x DC-DC
FUSES
EXT. +5V IN
MOD. RECORD
SERIAL NO.
SHIFT REG.
SW




DAVE card – first prototype

# DAVE card Firmware Blocks




- Not on FPGA
- using CERN Delay25 chip

Firmware mainly by Matt, USB by Maurice, testing by Rick
CTP blocks originally by Stefan Haas.
Higher level software to be provided by ThiloPauly and/or Dave Robinson

# Production

- 3 prototypes already built Jan/Feb
  - Some minor design iterations were identified
    - Corrections made by wire-tack
- Firmware already well underway and some basic functionality demonstrated
  - USB functionality still pending
- Final design iterations in place
- Production is underway
- A further 17 production modules to be built
  - Delivery by late summer
- Production cost ~ 1.6K CHF per module

# ATLAS Orders

- SCT
- TRT
- Pixels
- BCM
- ATLAS central trigger
- Strong interest by L1Calo and LAr
- …others are likely?
  - Interest too from outside ATLAS!

# Summary - Key Points

- Communication by VME or USB
  - In vme/TTC crate or on desktop with power supply
- Exact CTP functionality
  - Random trigger, simple and complex deadtime, ECR, BCR etc to give exact same conditions in standalone as experienced in combined runs
- Trigger sequence playback
  - 64M word SRAM gives us up to 52 seconds history of trigger playback for 75kHz L1 rate (eg on interrupt by system BUSY)
- Powerful generic functionality
- Available by late summer
- … when you will see them in TTC crates in USA15!