Science Run 2. (first half…)

Detector Timing

LSC 2003 Spring Meeting

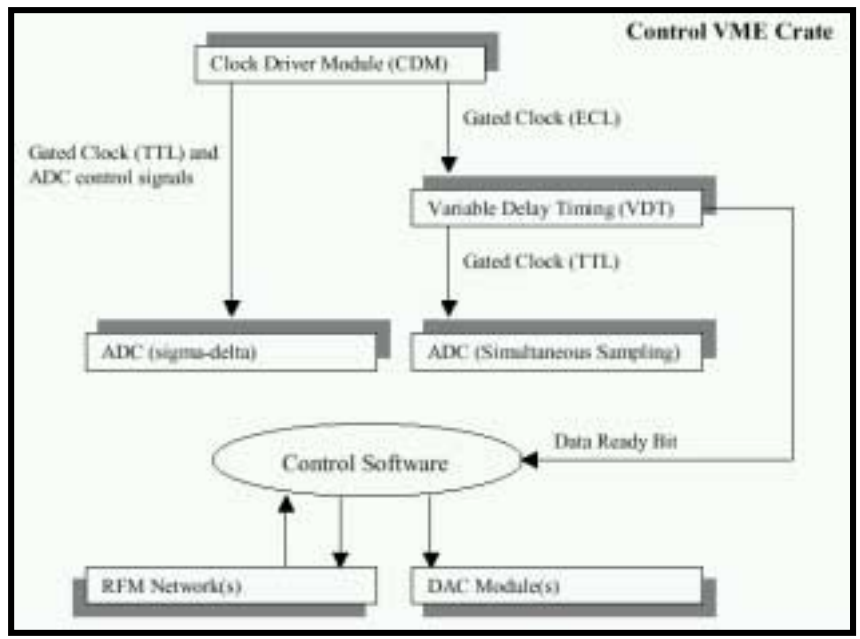
LIGO Livingston Observatory

Szabolcs Márka, Daniel Sigg

Real-time Timing

- **Initialization**
  - » GPS 1 PPS
- **Diagnostics**
  - » GPS Ramp => absolute
  - » CPU meter overload
    => lost IO cycles
  - » Polling ADC ready bit
    => missed ADC samples
  - » Resync counter
    => missed computing cycles
  - » Cycle count
    => inter-crate synchronization

- **Processing Time @ 16kHz**
  - » LSC: 46µs, LVEA LOS: 56µs,
    ETM: 45µs, MC2: 27µs



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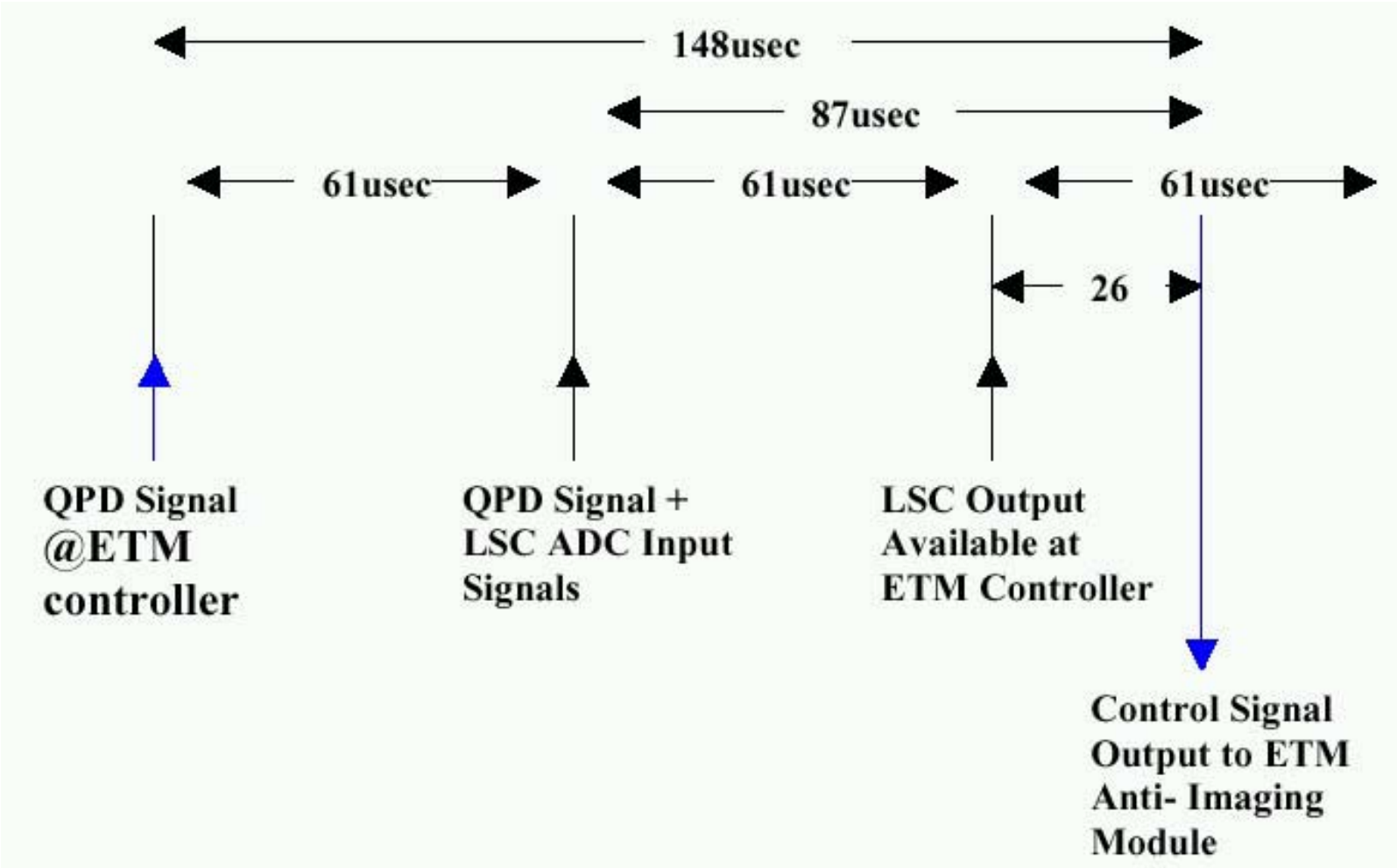
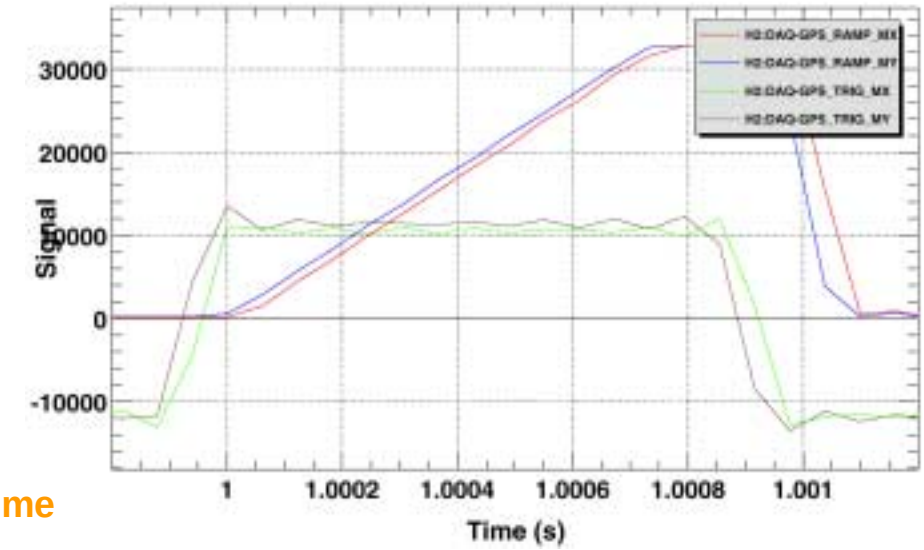
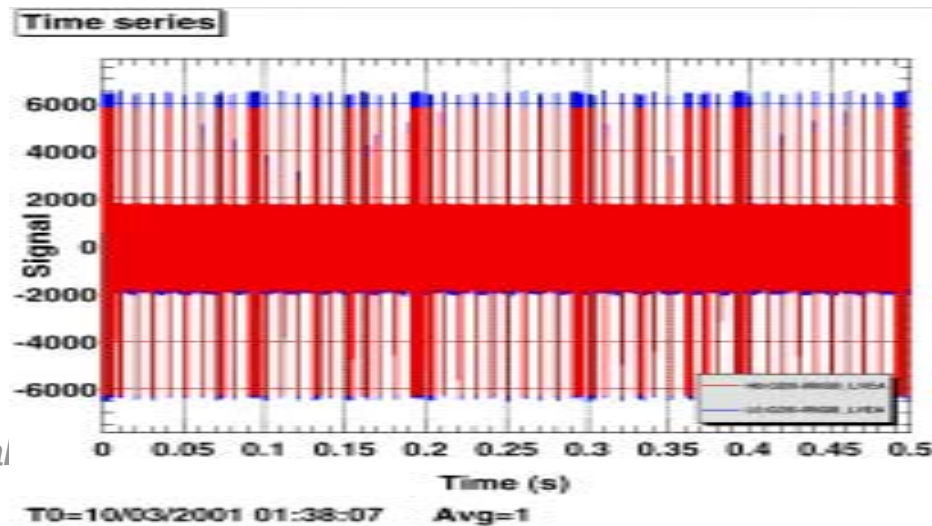
Real-time Timing (2)



How can we measure …?

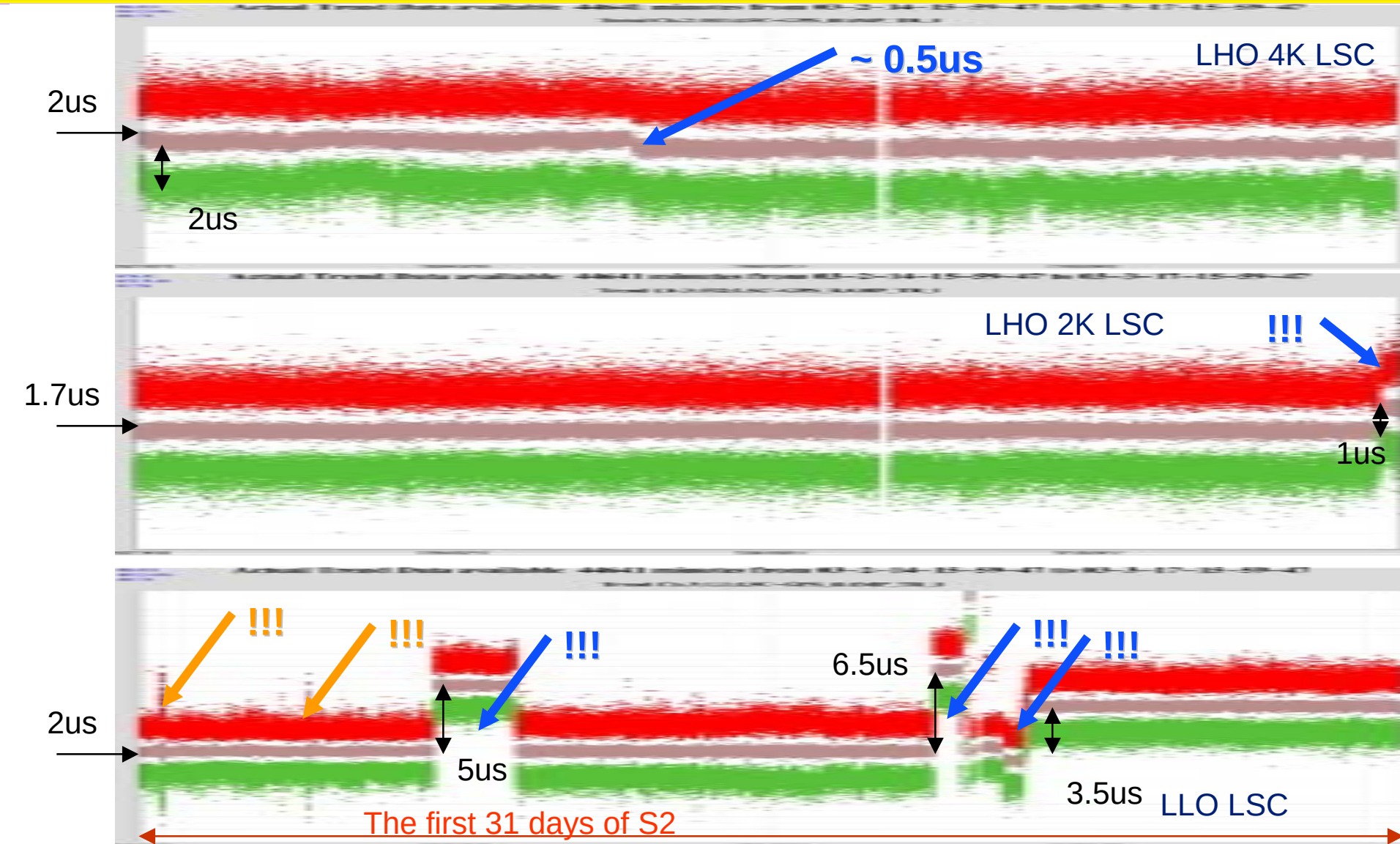
- **Special signal to measure DAQ timing**
  - » **GPS TRIG**
    - – 1 ms long square wave
  - » **GPS RAMP**
    - – 1 ms long steep ramp
  - » **The GPS second tic is aligned with**
    - – the rising edge of the square wave
    - – the zero crossing of the ramp
  - » **Fit the RAMP and compute the zero crossing**
  - » **Determine delay between GPS tic and DAQ time stamp**
    - – Practical experience: O(100ns) measurements are achievable!
  - » **Similar procedure for the IRIG-B signal**
    - + we extract the date
  - » **DMT monitors do the job**





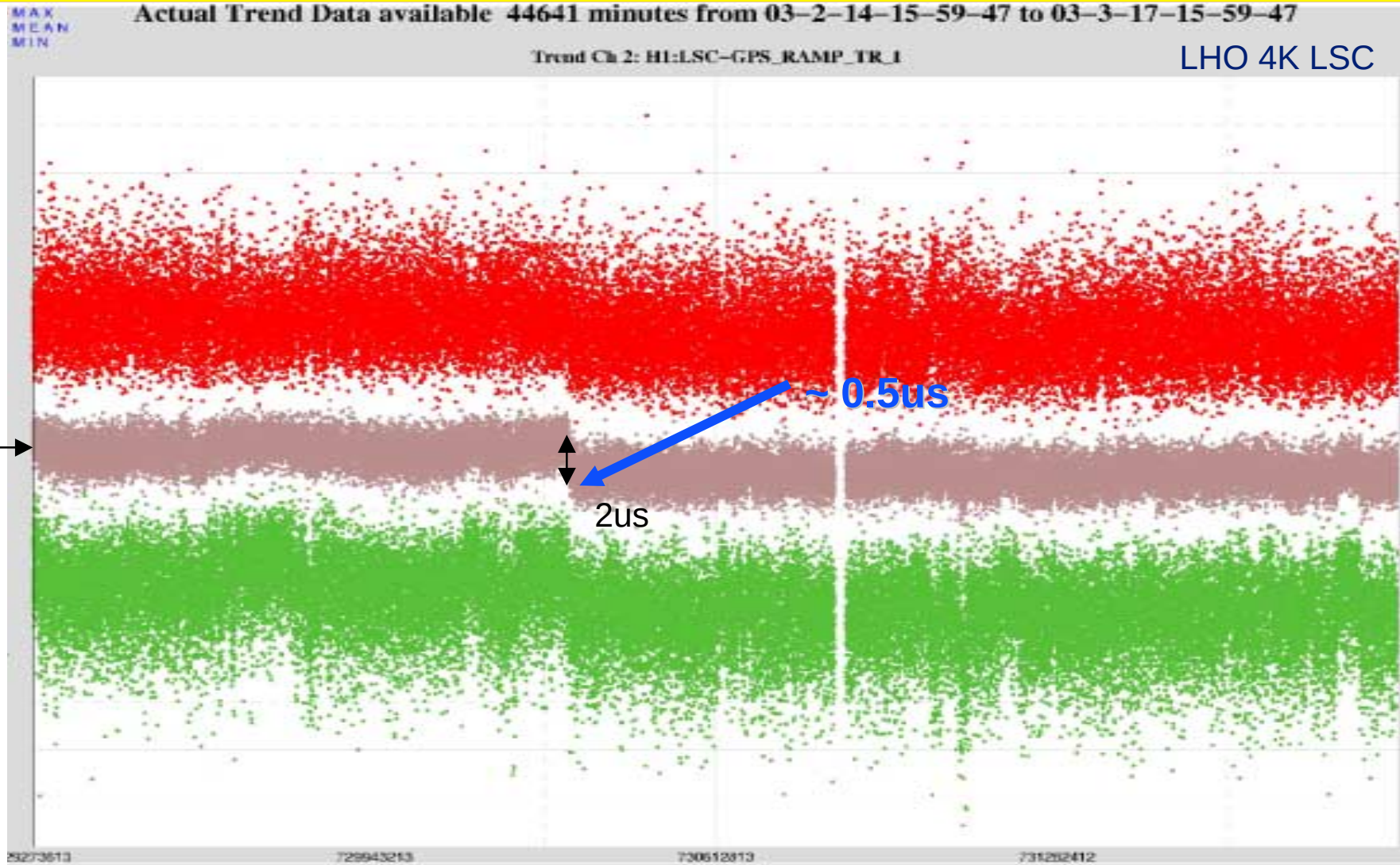
Timing performance of LIGO LSC systems

Max
Mean
Min



Timing performance of LHO 4K LSC systems

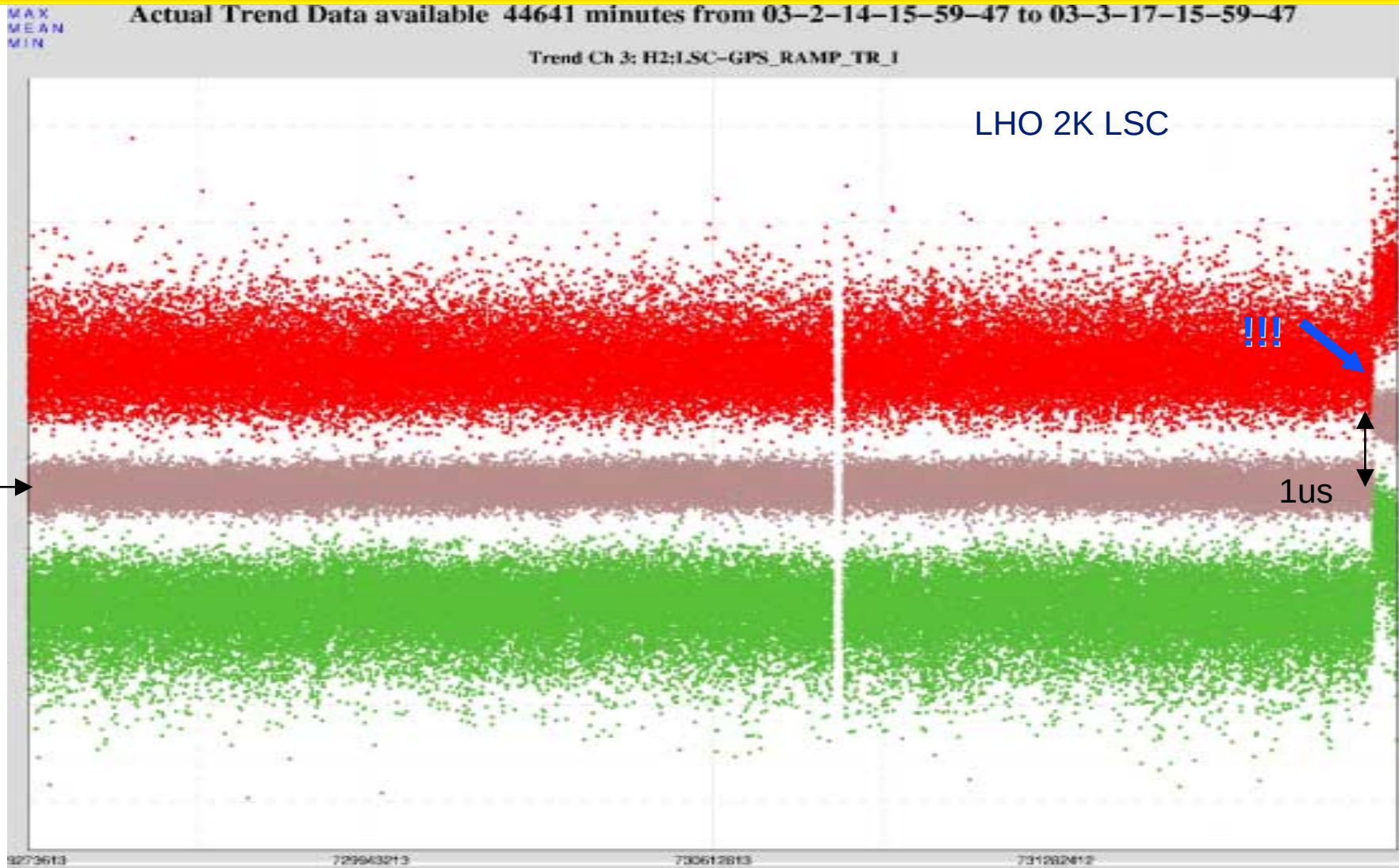
Max
Mean
Min



The first 31 days of S2

Timing performance of LHO 2K LSC systems

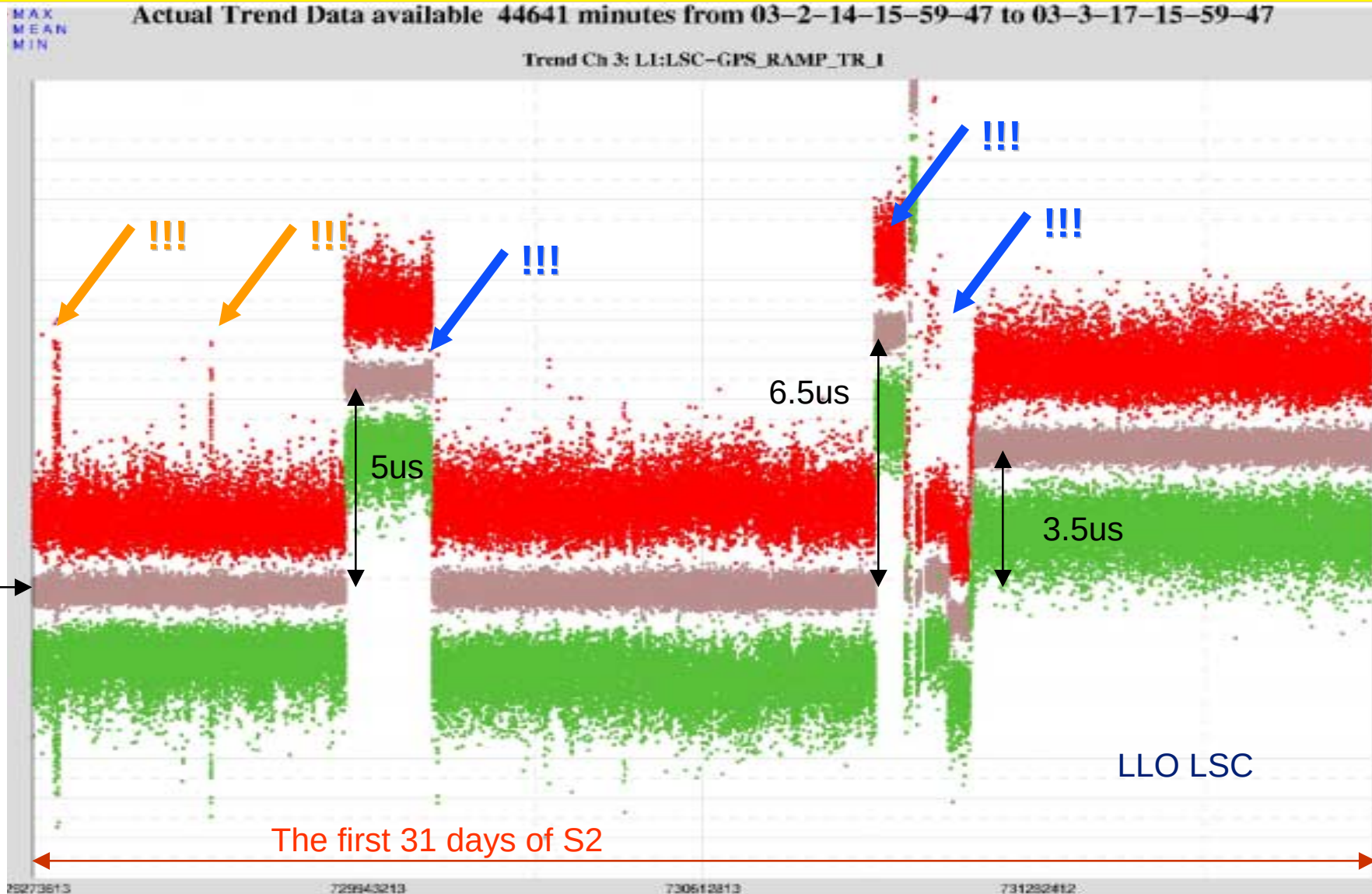
Max
Mean
Min



The first 31 days of S2

Timing performance of LLO 4K LSC systems

Max
Mean
Min

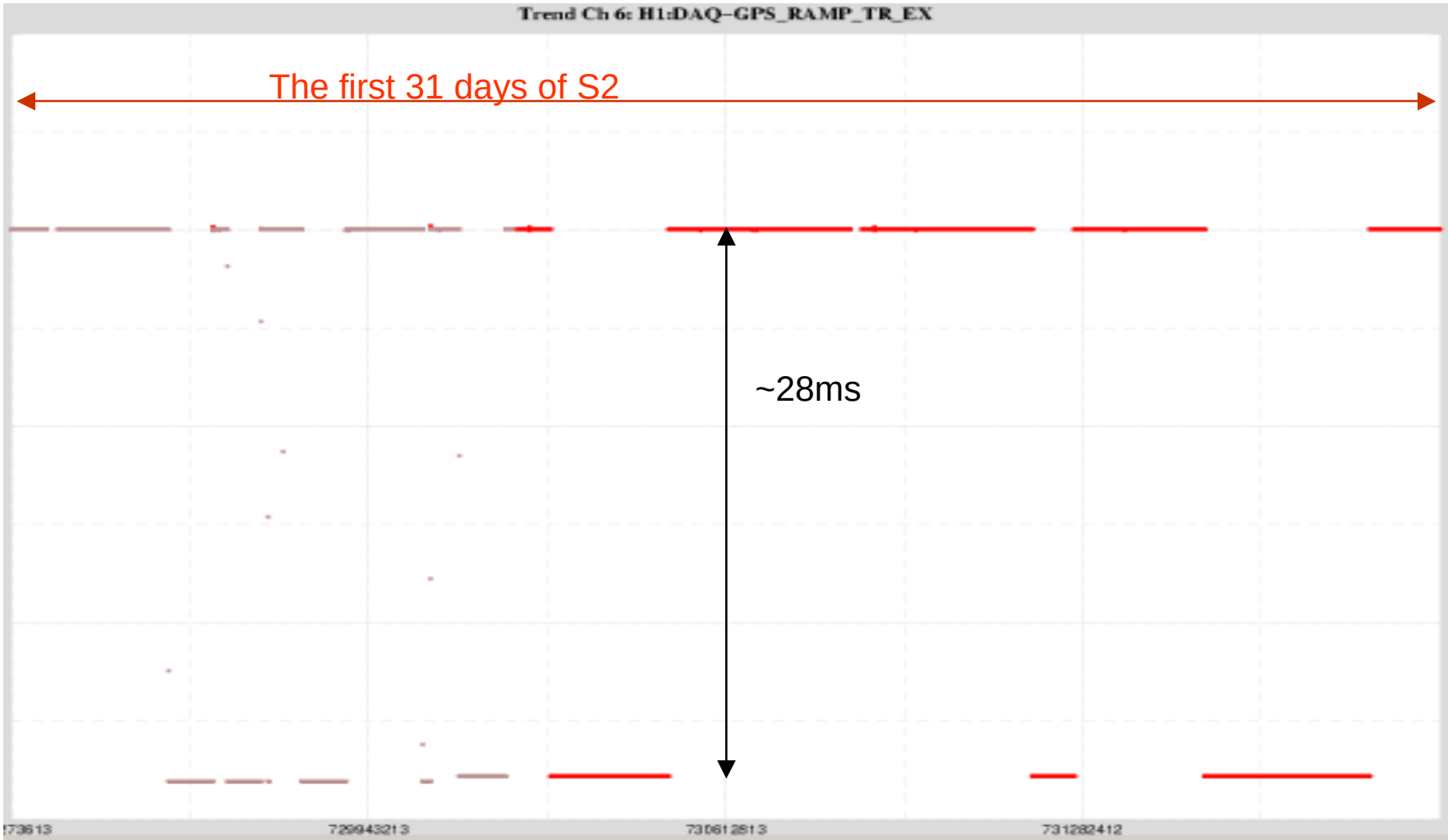


Timing performance of LHO EX system

Max

Mean

Min

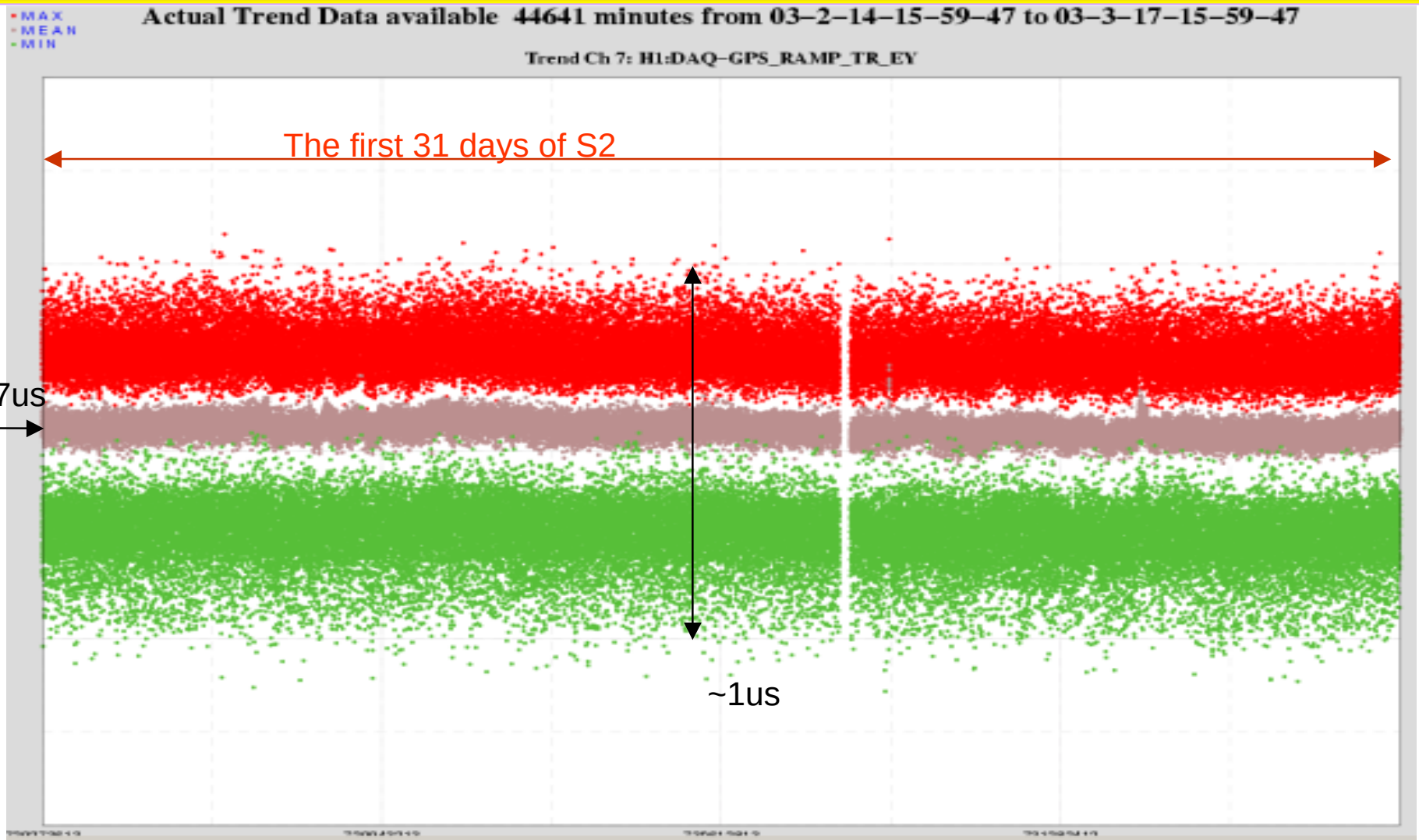


Timing performance of LHO EY system

Max

Mean

Min

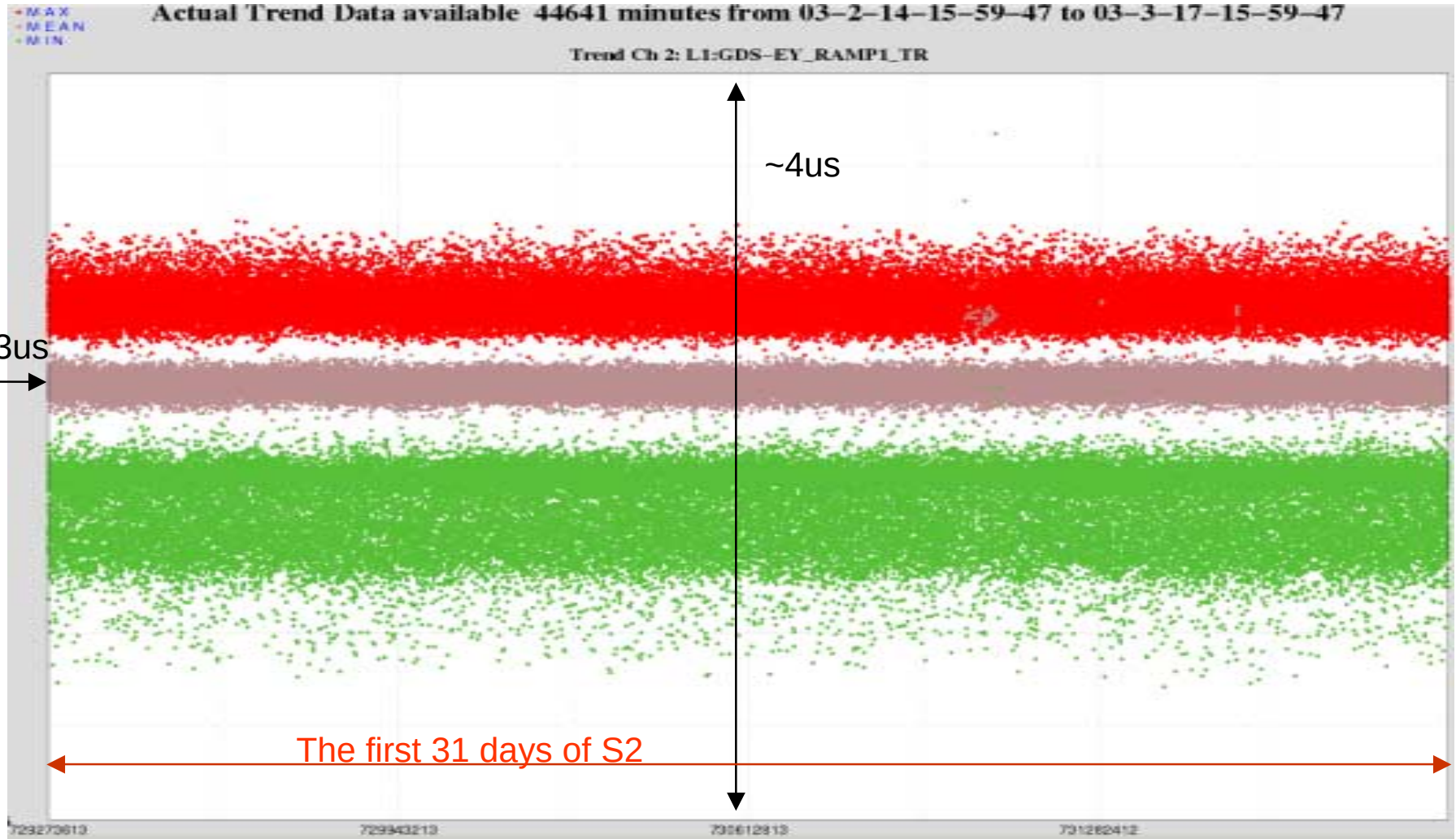


Timing performance of LLO EY system

Max

Mean

Min



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Summary

- We have not seen major problems with LSC timing
  - Small jumps of ~5us are observed
- There are problems with LHO EX
  - Timing problems are also good indicators of “channel hopping”