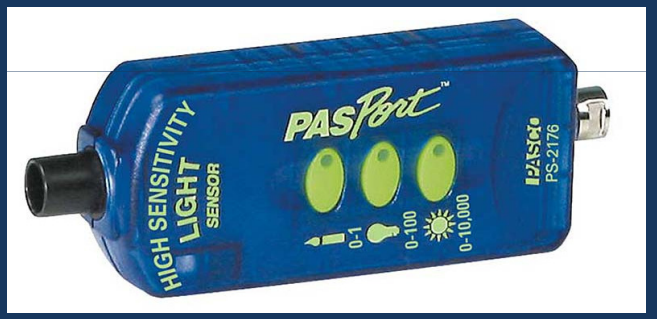
AstroFlash Timer @ 1kHz

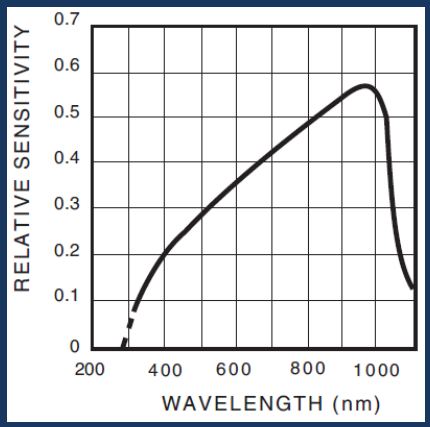
- Chad Ellington
- Lecturer of Physics
  - Maastricht Science Programme

Pasco Equipment

- 550 Universal Interface

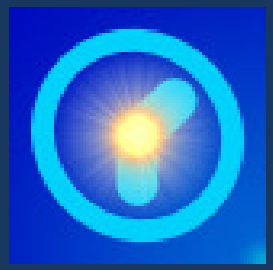
- PASport PS-2176
  High Sensitivity Light Sensor
  – maximum sample rate of 1kHz



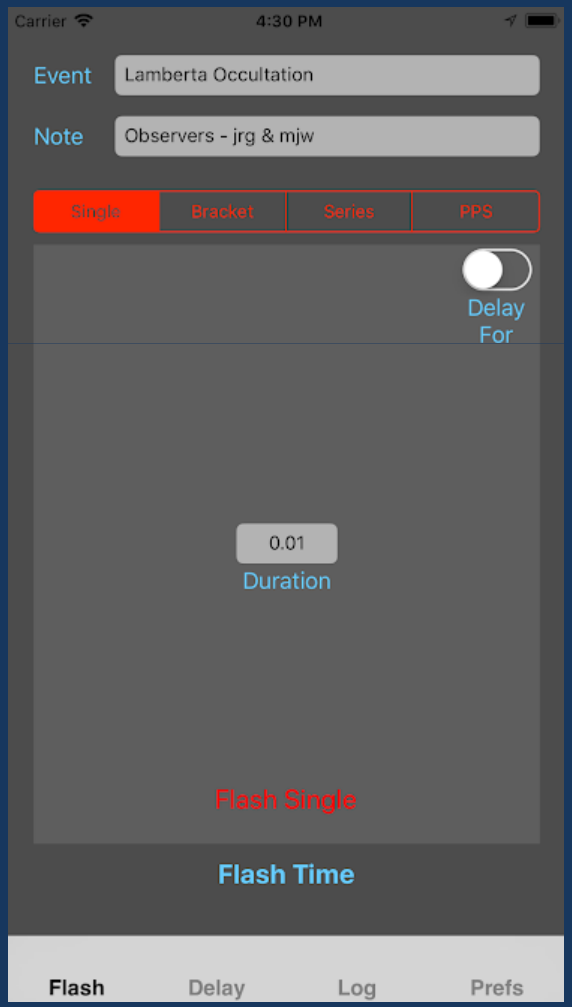


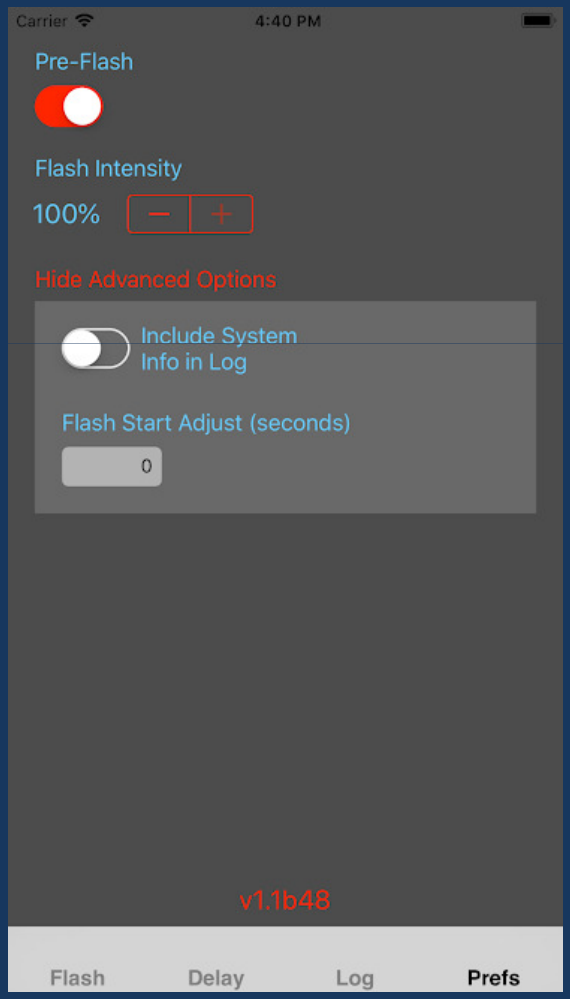
- Pasco Capstone Software

Software



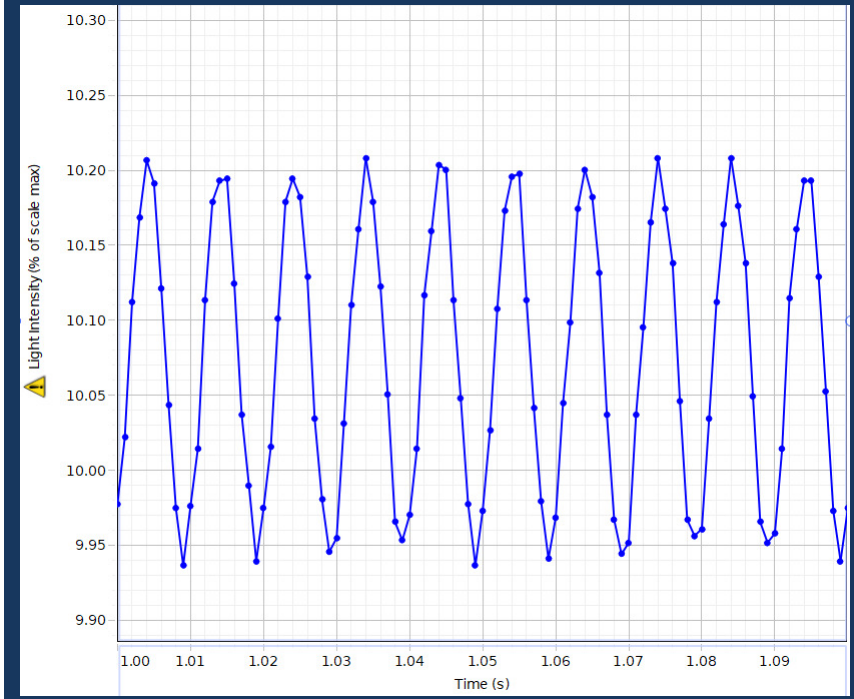
- iPhone 6S
  - AstroFlash Timer by John Grismore

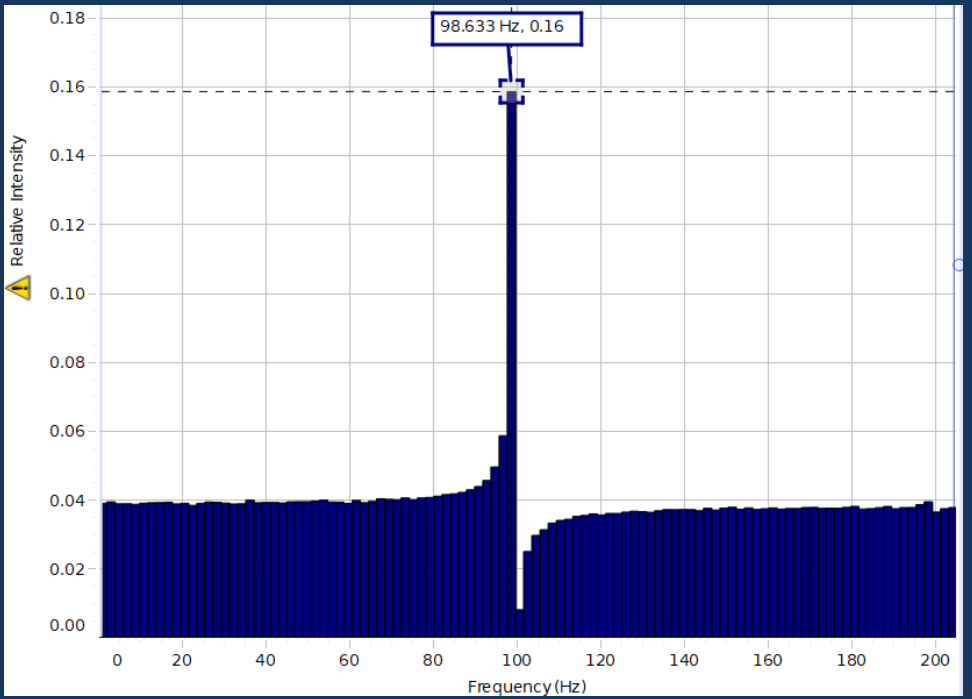




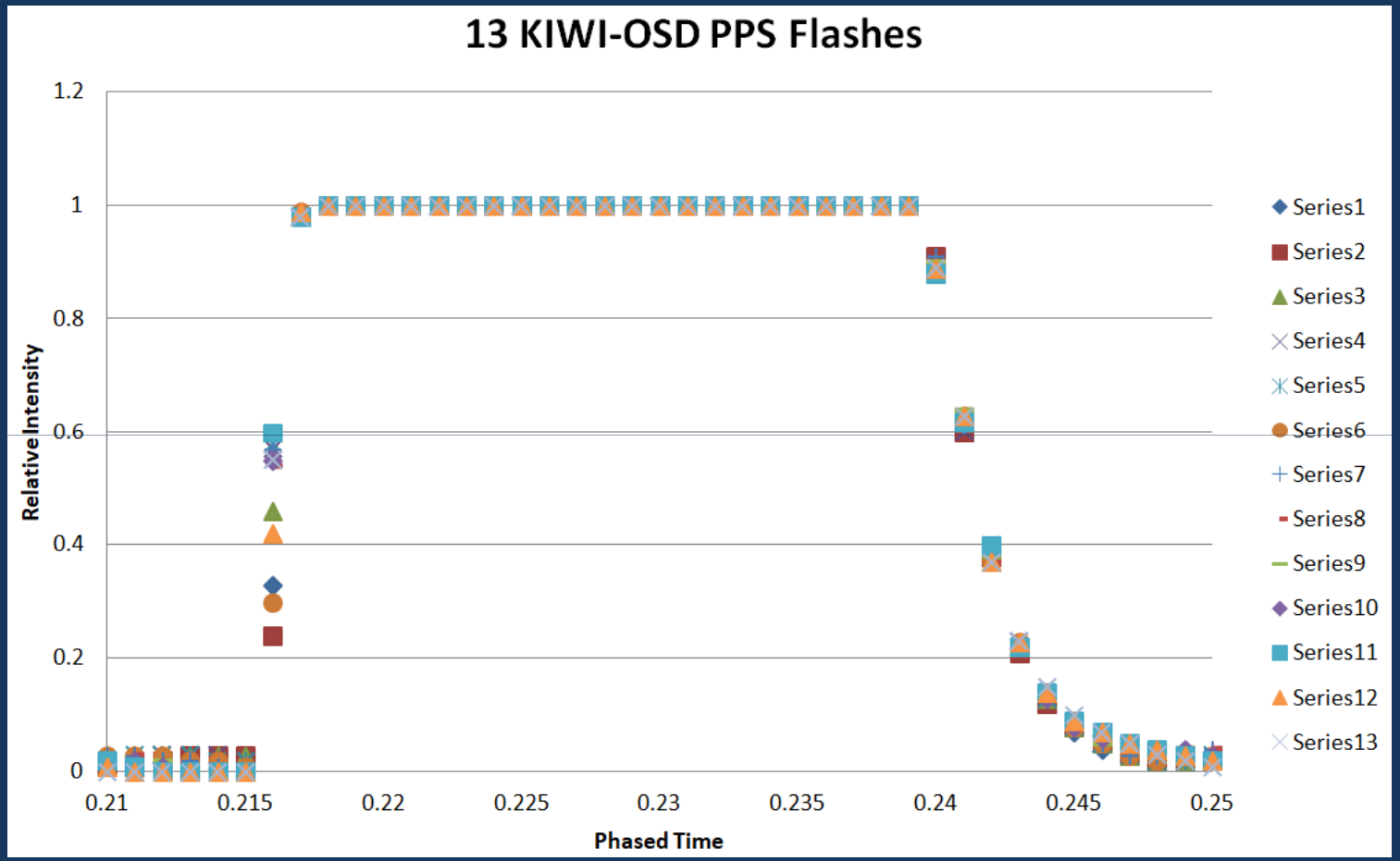
Capstone/PS-2176 really @ 1 kHz?

- Data tables shows 1000 points per sec
- Light curve of fluorescent tubes on a 50 Hz power system indicates ~100 Hz frequency



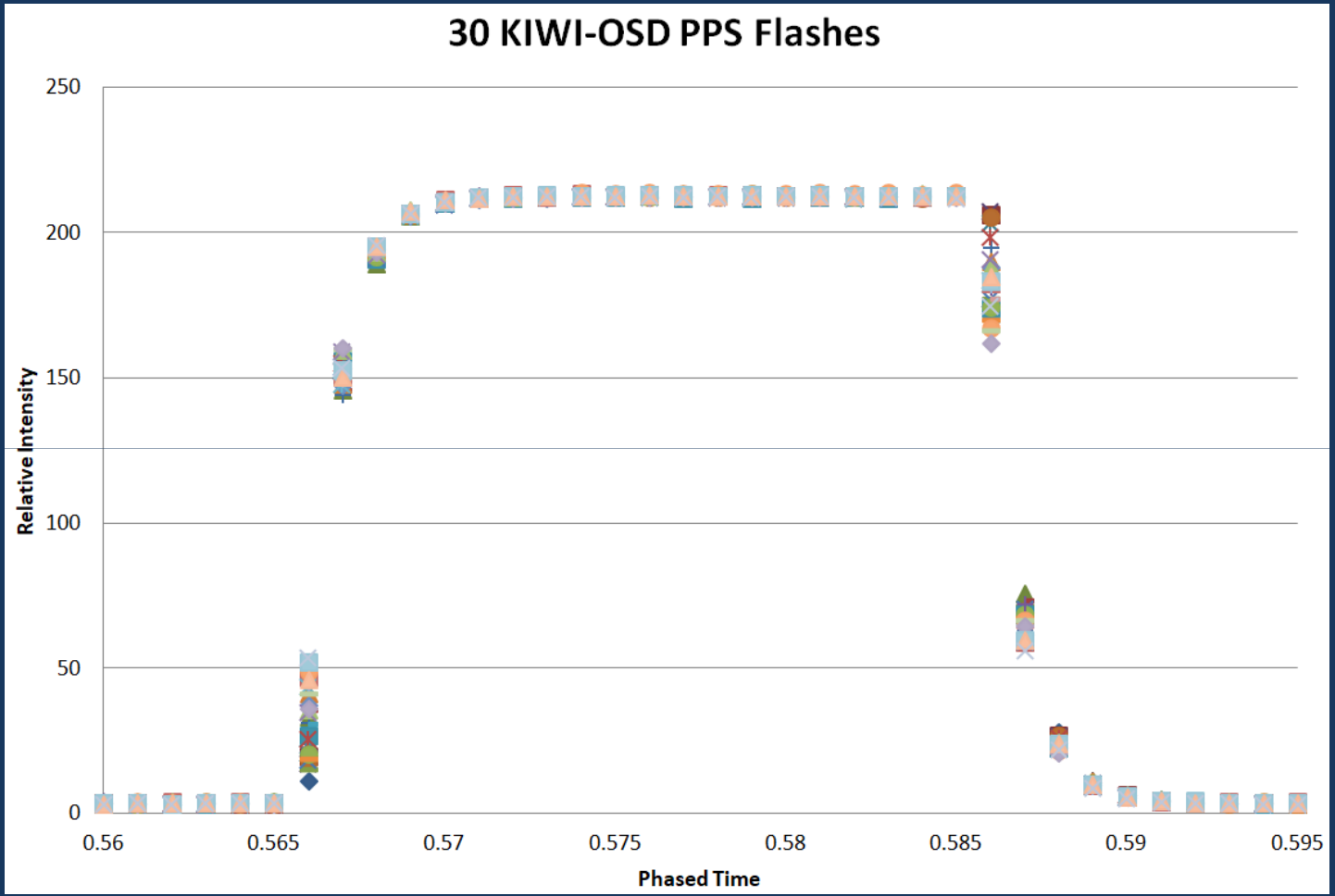


KIWI-OSD PPS Flashes



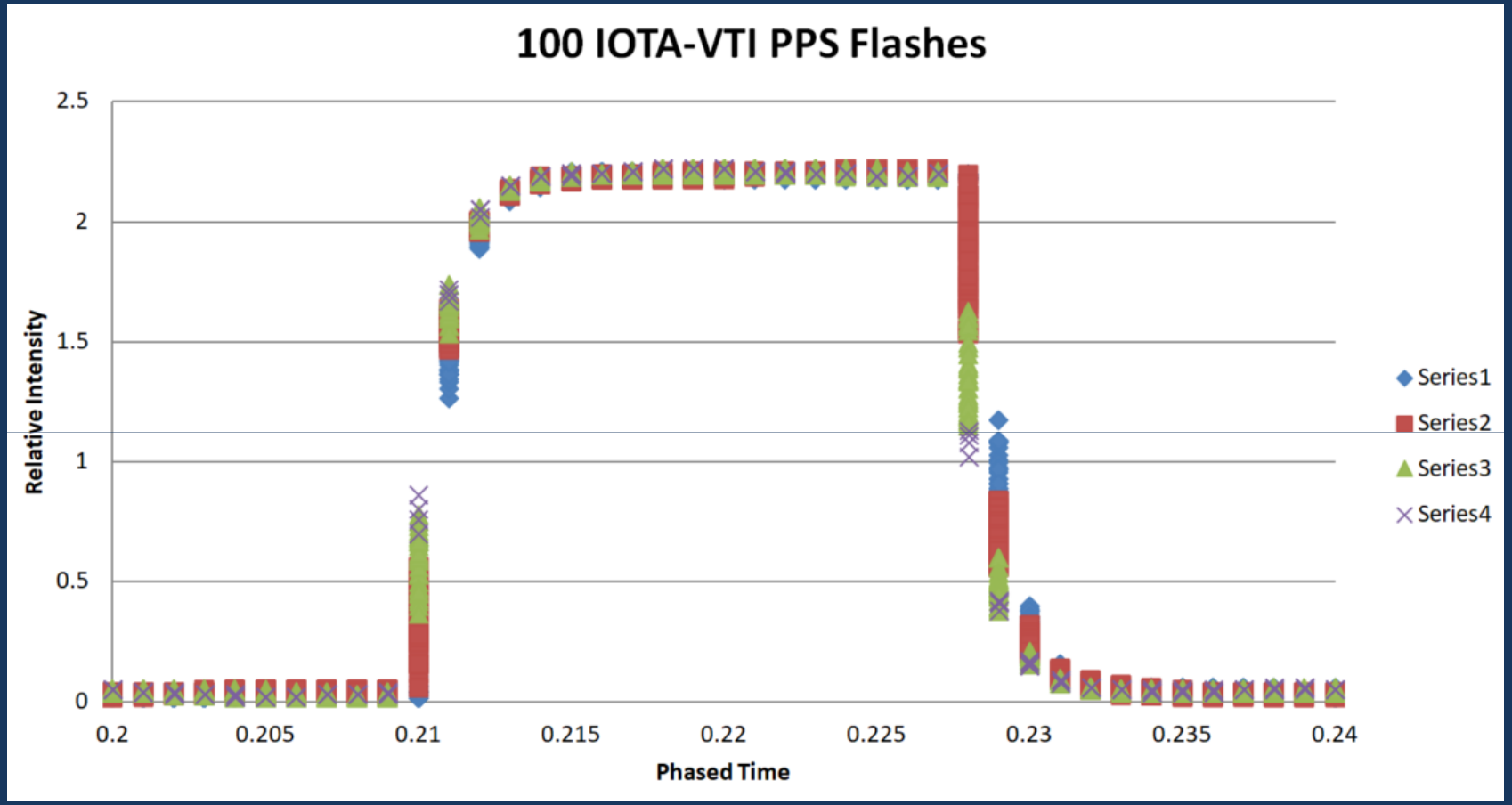
- No millisecond deviation observed

KIWI-OSD PPS Flashes



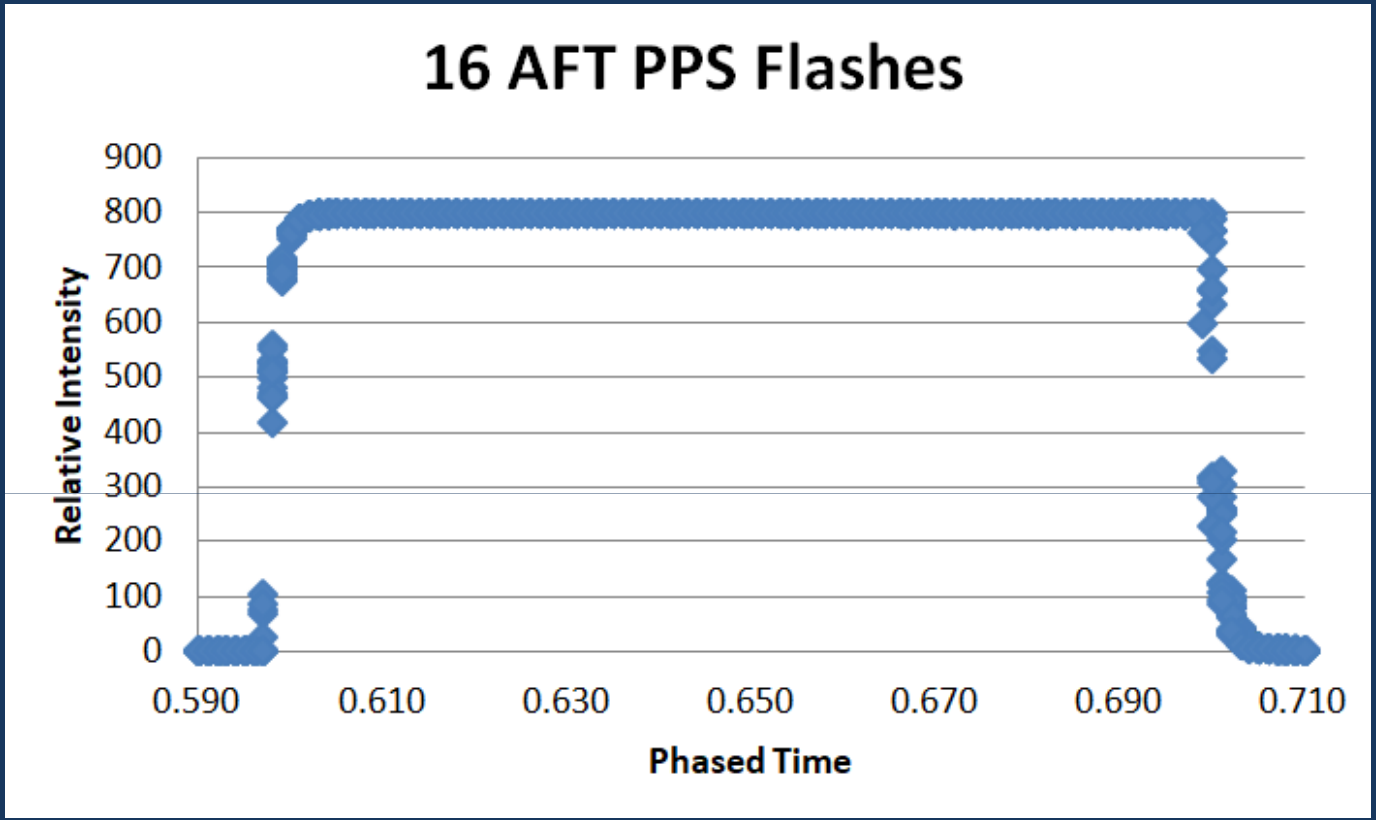
- No millisecond deviation found

IOTA-VTI PPS Flashes



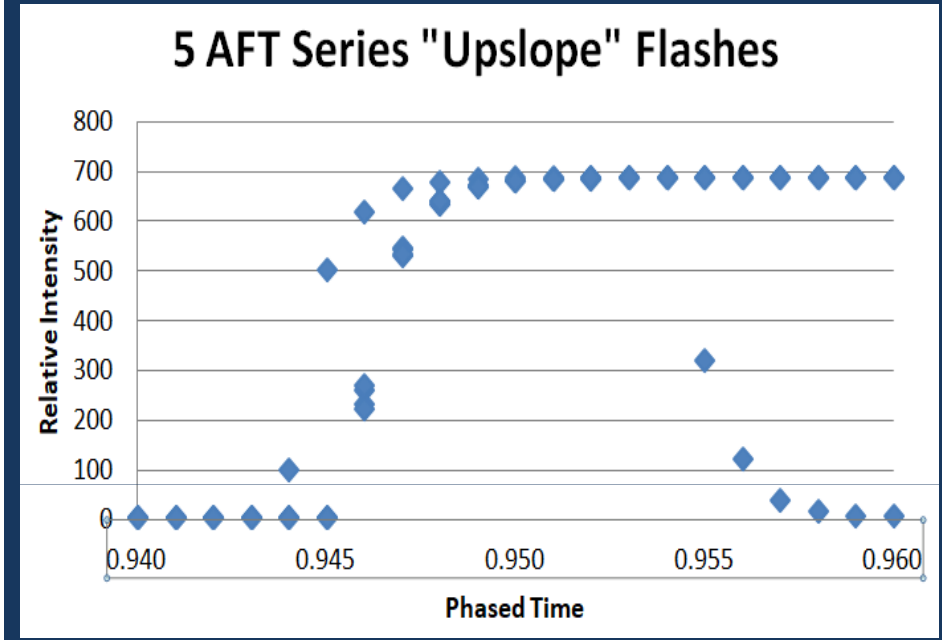
- Again…no millisecond deviations observed

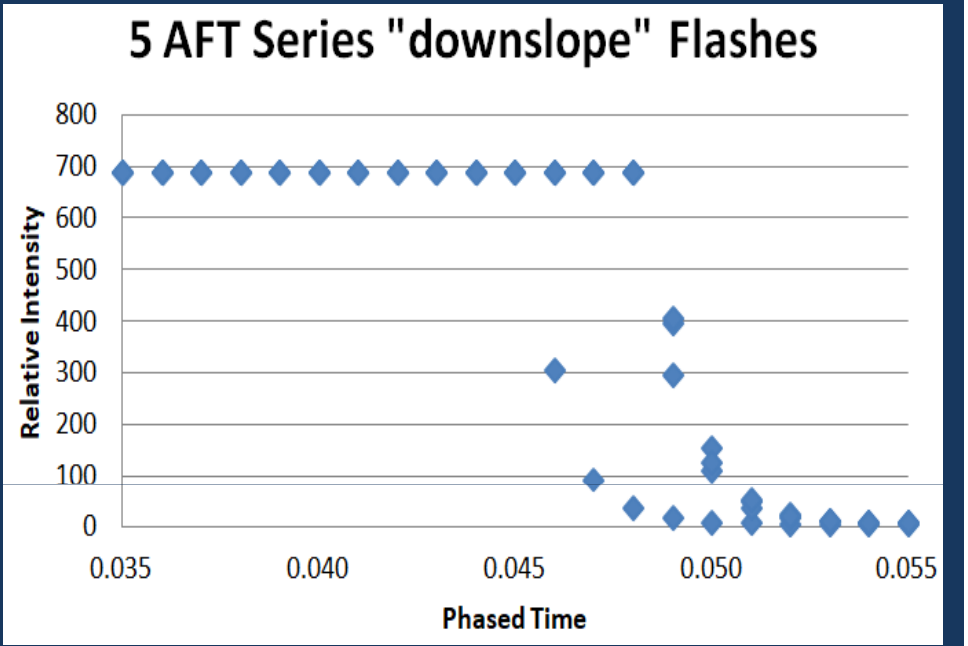
AFT PPS Flashes



- Collected at work physics lab w/ excellent WiFi access
- AFT data log showed no ‘jitter’ over 20s, believed to encompass this collected data. (Lack of technique.)

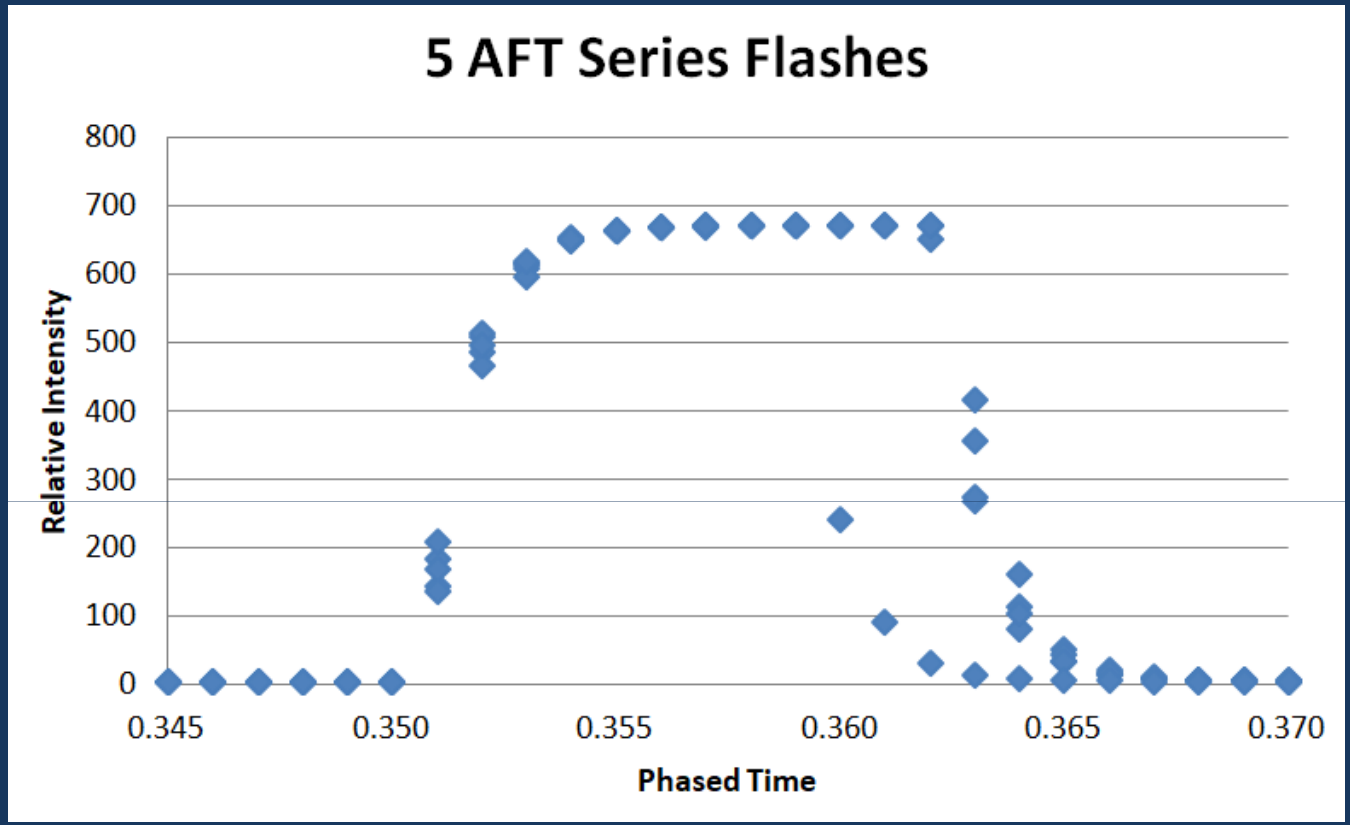
AFT Series Flashes





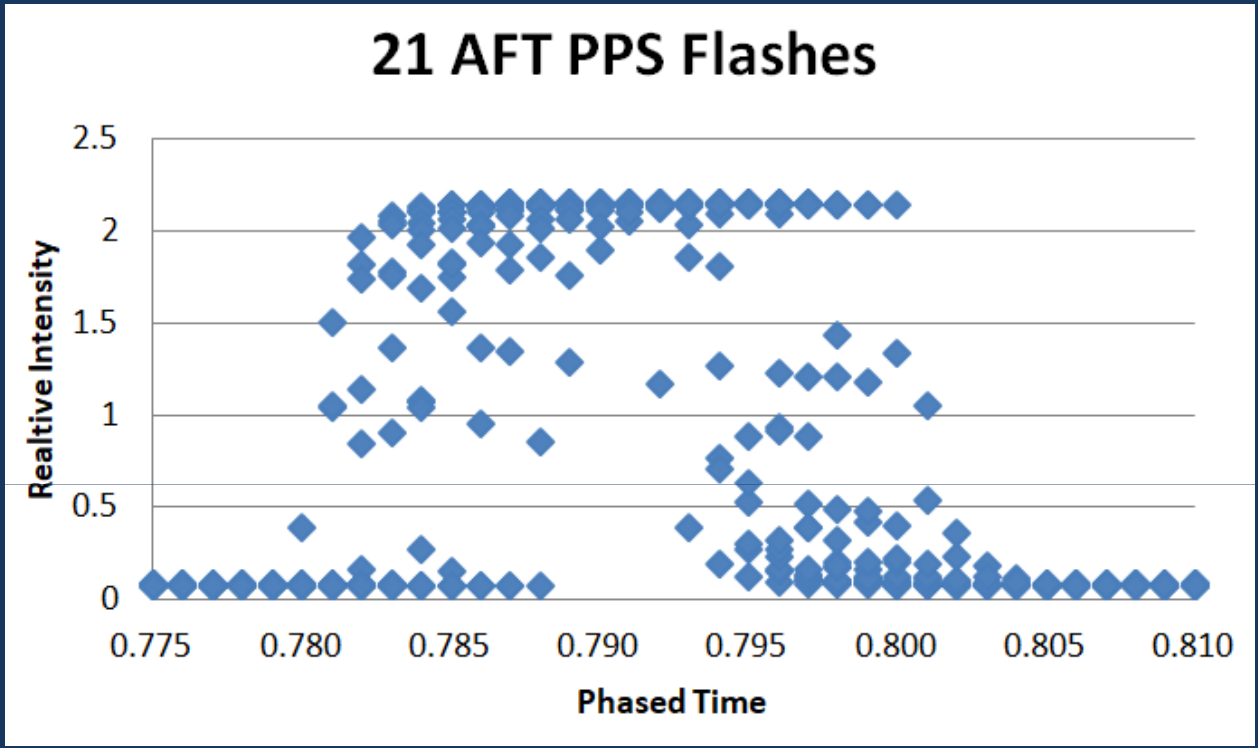
- Last flash substantially shorter than others
- Although one flash was 2ms early, AFT logged it correctly as being such
- 0.1s flashes seemed too long…so no more

AFT Series Flashes



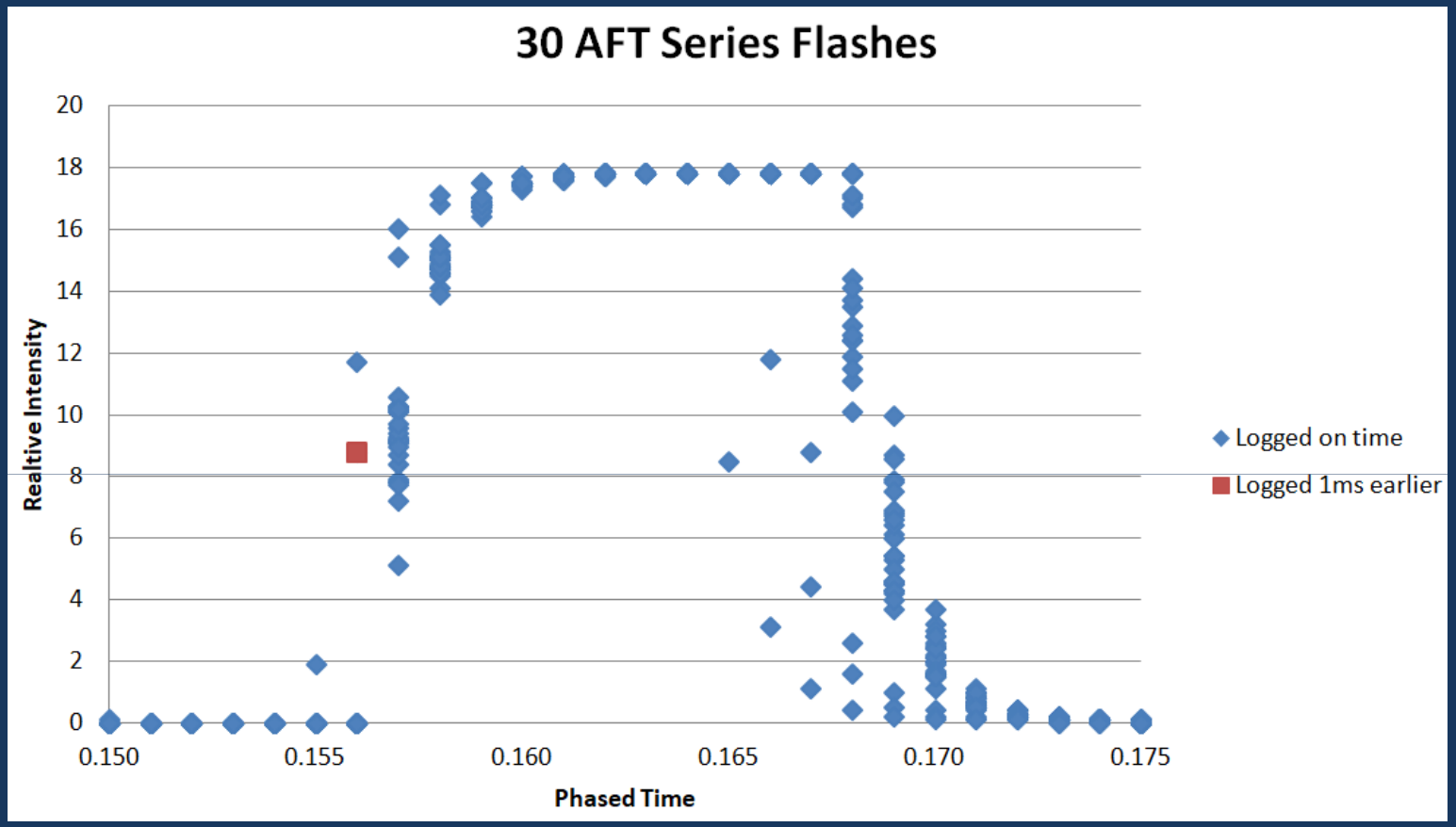
- Last flash of a shorter duration than the others
- All these flashes correctly logged by AFT

Using Portable Pasco Xplorer GLX?



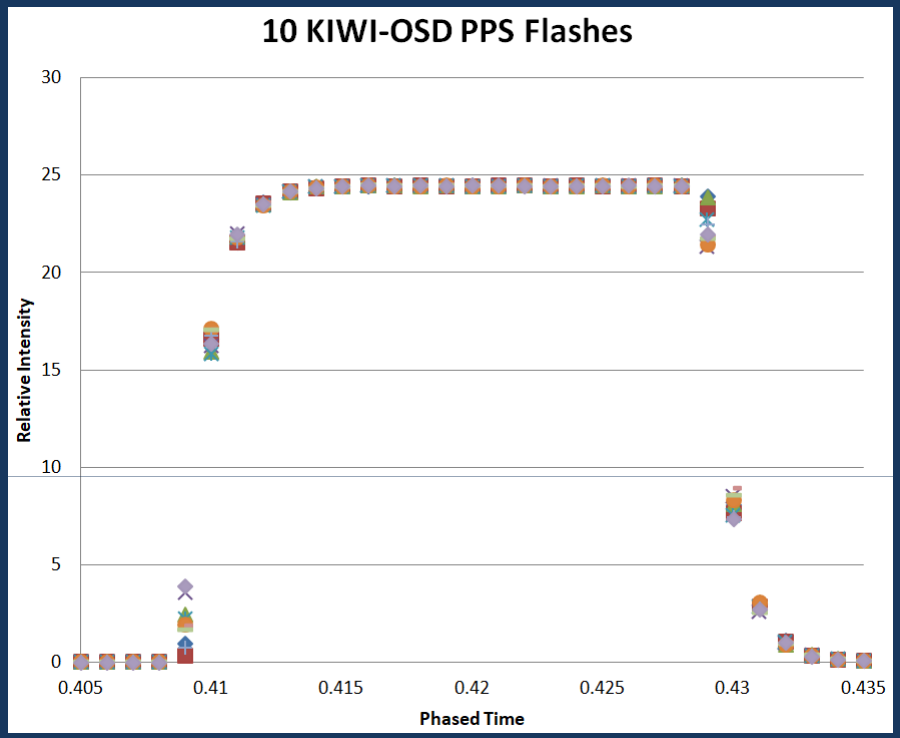
- AFT data log showed all flashes within 2 ms
- Conclusion…don't use the handheld data logger

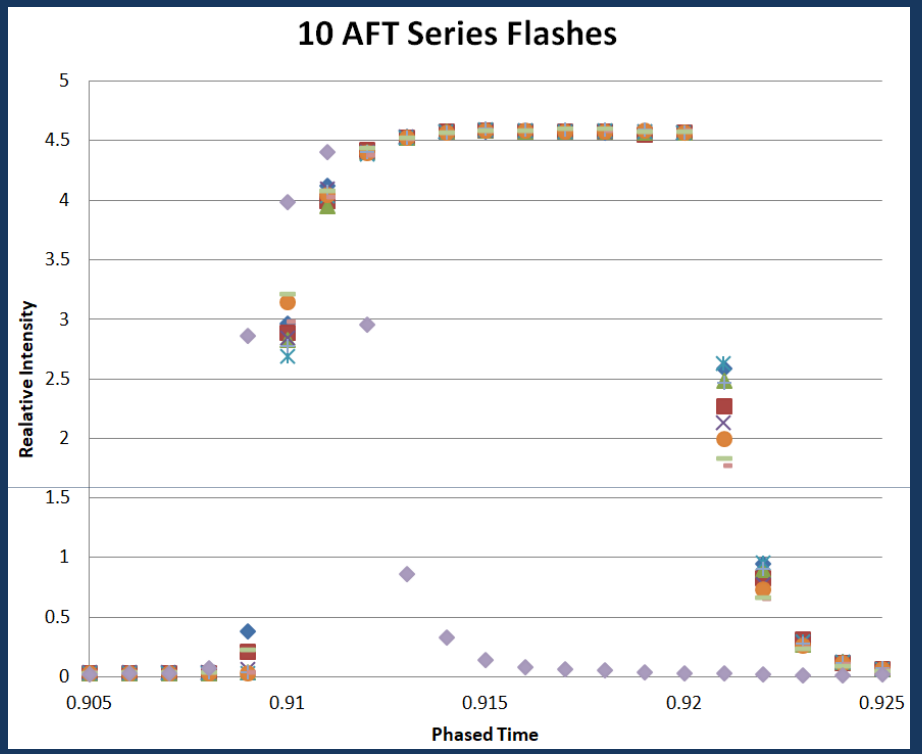
AFT self consistency



- 1 flash incorrectly logged but only by 1 ms off
- Minor variation in flash durations.

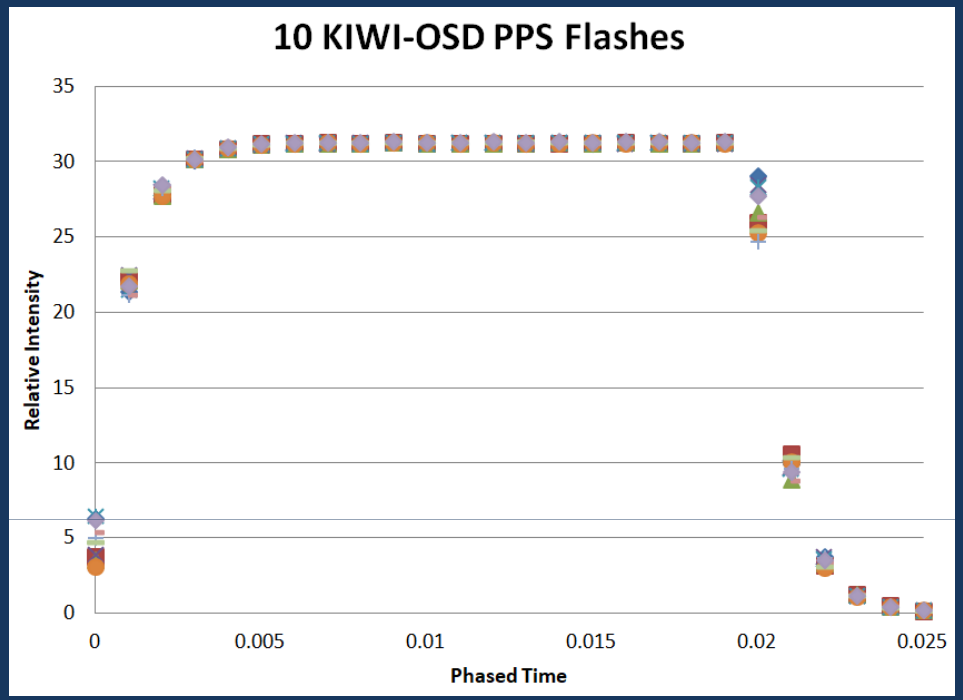
KIWI-OSD vs AFT Series Flashes

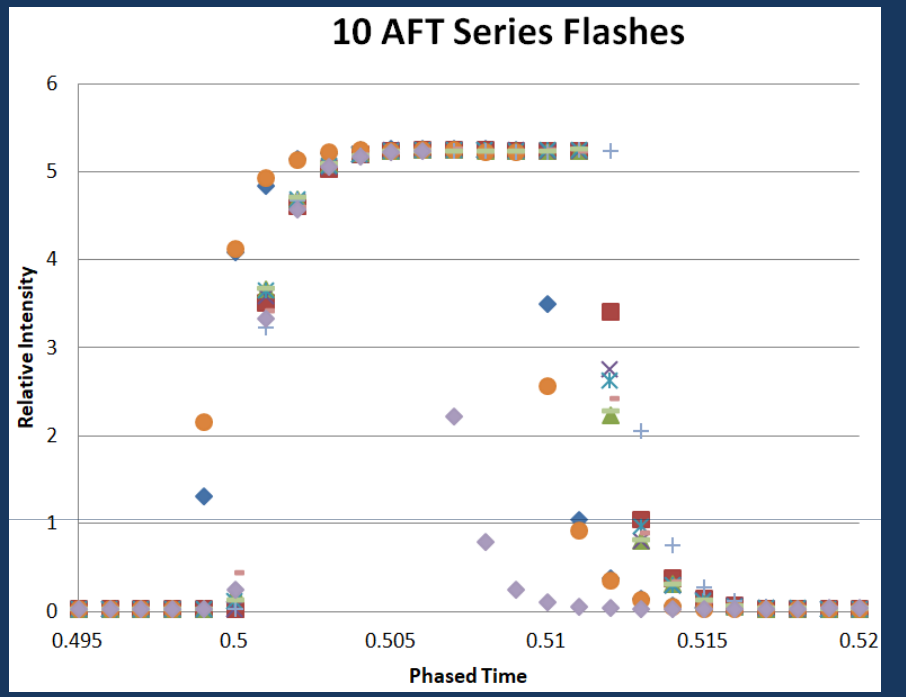




- "Simultaneous" data capture: -489ms AFT offset
- KIWI once again consistent
- AFT last flash 1ms early (correctly logged) but once again of substantially shorter duration

KIWI-OSD vs AFT Series Redux





- "Simultaneous" data capture: -489ms AFT offset
- KIWI once again consistent
- AFT early flashes incorrectly logged another ms earlier. Last flash of series of shorter duration

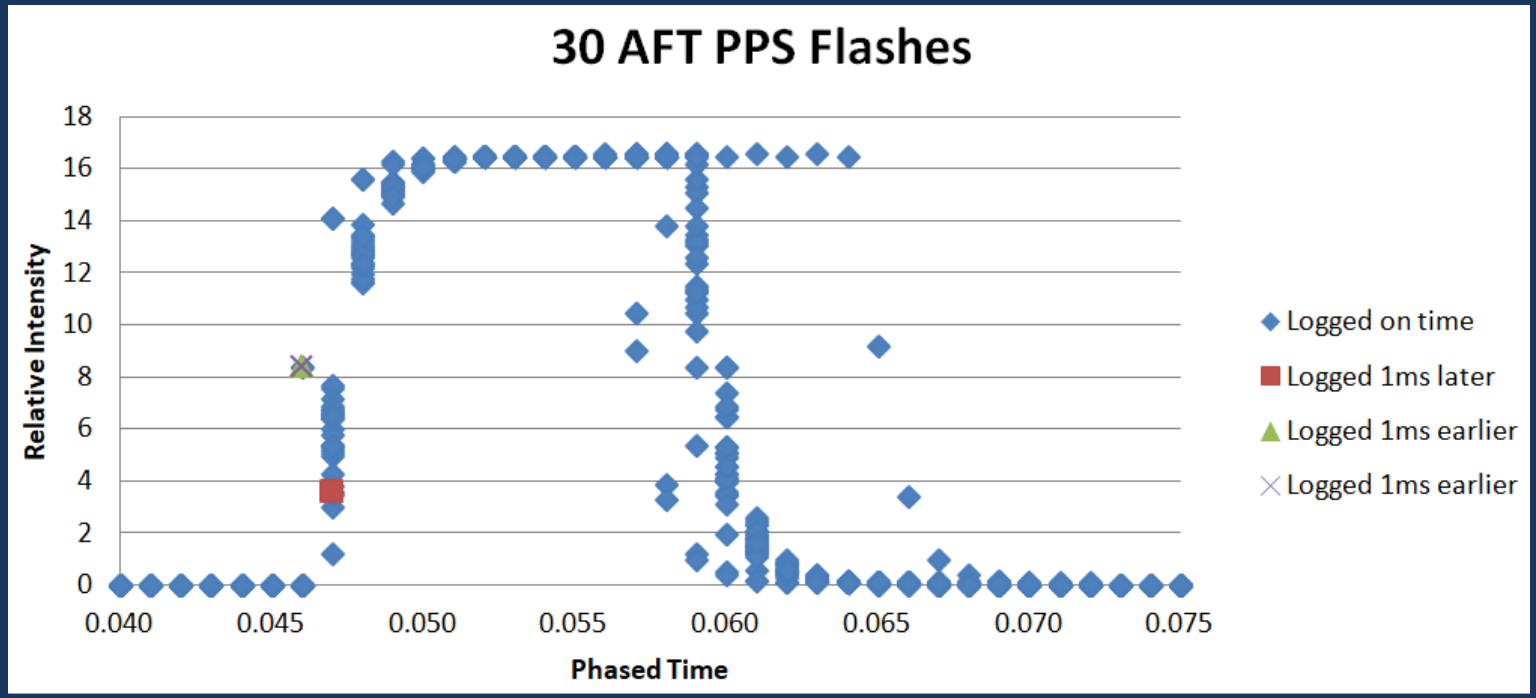
AFT erroneous flash?

- Occasionally AFT logged a flash as having occurred some 4-11ms after the first PPS flash after a pair of pre-flashes.

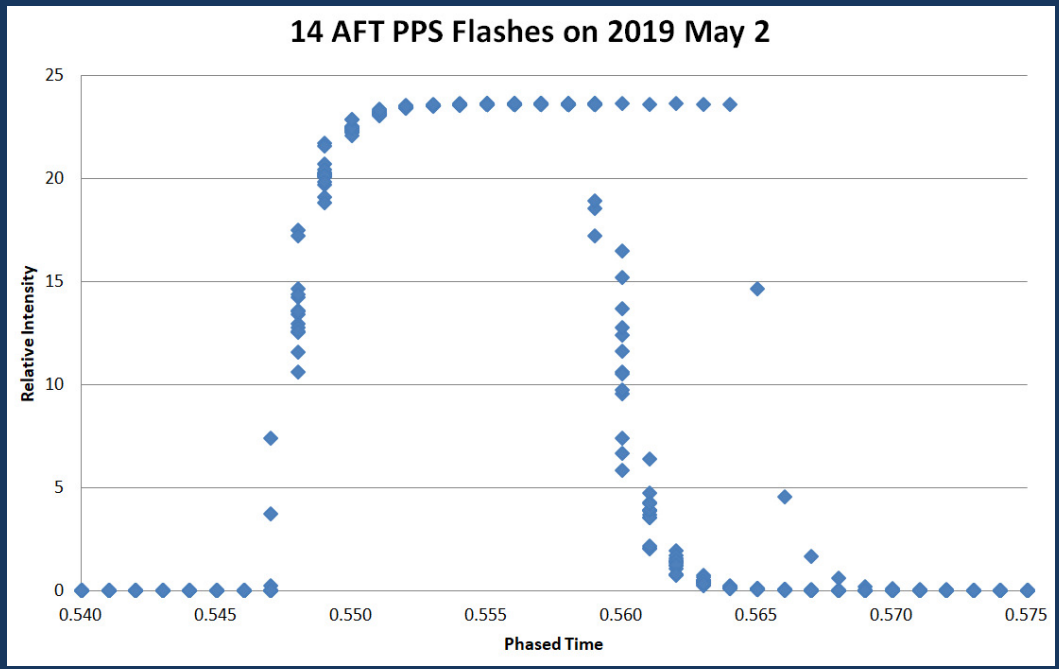
Flash #	Flash Type	Date (local)	Flash time (local)	Flash time (UTC)	Latitude
1	preFlash	04/23/2019	12:57:04.831	10:57:04.831	50.98423
2	preFlash	04/23/2019	12:57:04.962	10:57:04.962	50.98423
3	PPS	04/23/2019	12:57:05.998	10:57:05.998	50.98423
4	PPS	04/23/2019	12:57:06.002	10:57:06.002	50.98423
5	PPS	04/23/2019	12:57:07.000	10:57:07.000	50.98423
6	PPS	04/23/2019	12:57:08.000	10:57:08.000	50.98423
7	PPS	04/23/2019	12:57:09.000	10:57:09.000	50.98423

Erroneously logged flash?

- Phase plots of AFT flashes revealed that these erroneous flashes appear to actually happen concurrently, increasing the overall flash duration.
- Focus on the up-slope timing didn’t reveal this as it was only present only on the down-slope side of flashes…
- Phase plots showed a single extended plateau.



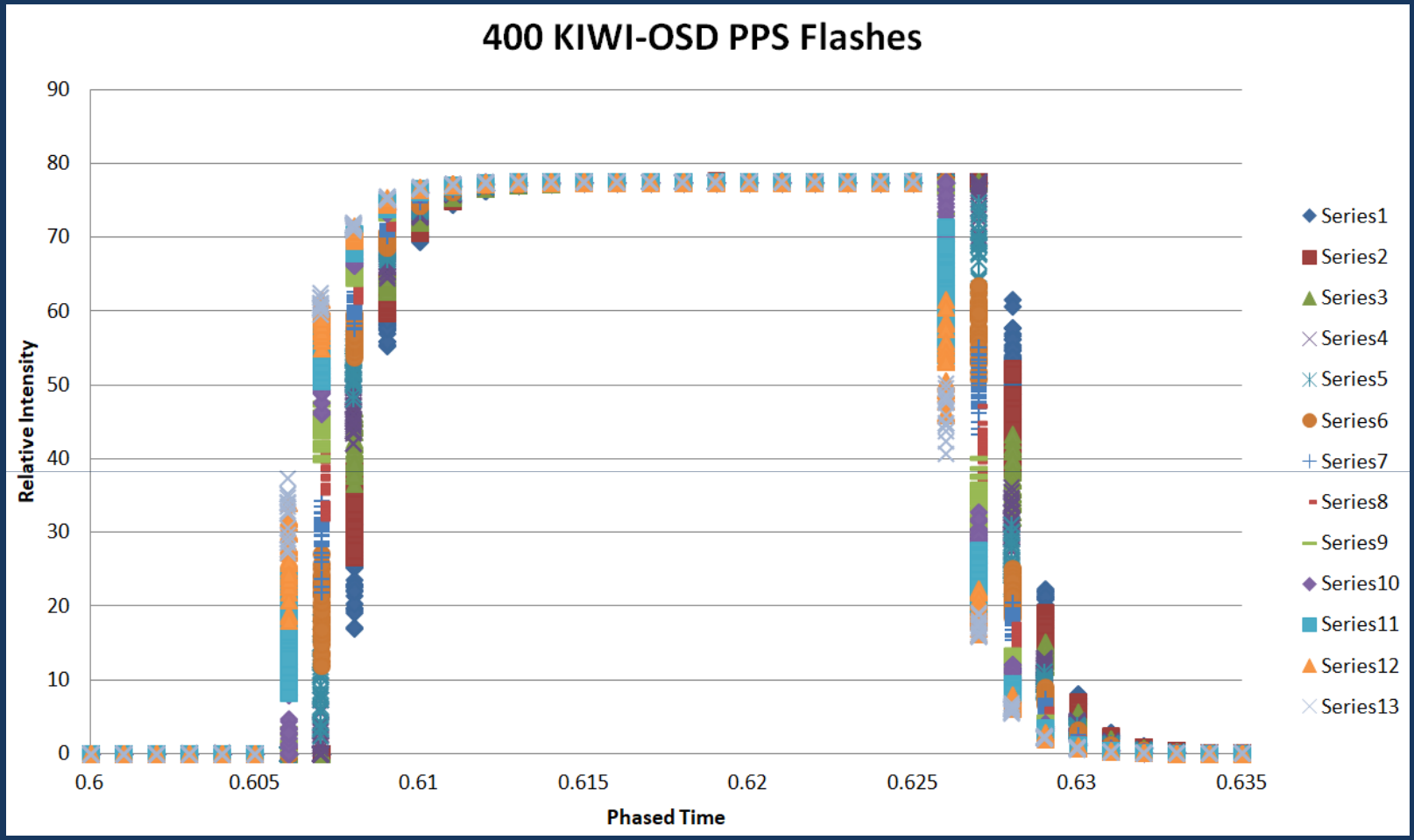
- Every phase plot having this single plateau has a “concurrent” flash in the AFT log



KIWI-OSD and IOTA-VTI in summary

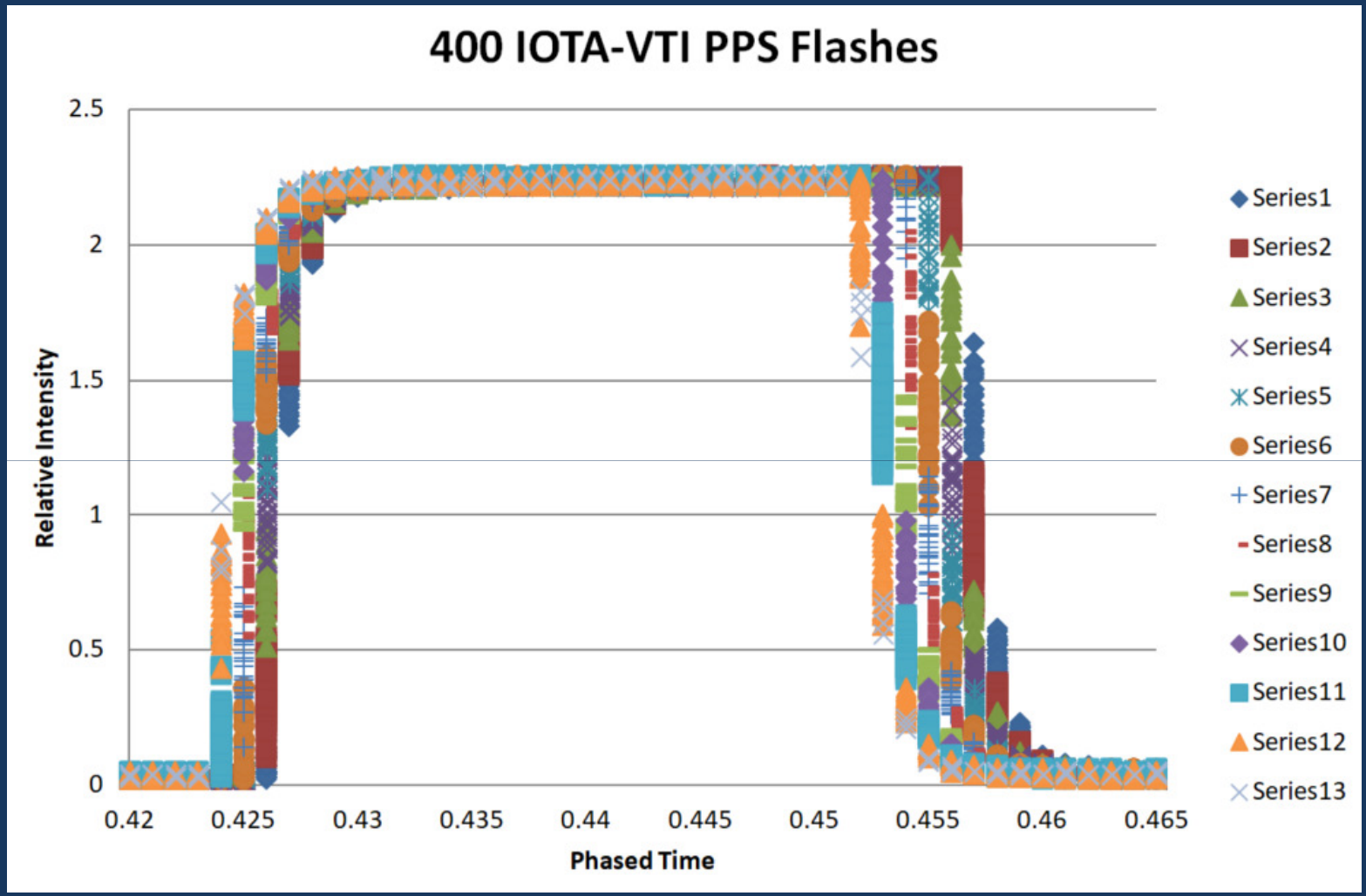
- Incredibly stable, didn't see them deviating by more than a 1 ms from one second to the next!
- Seemed too good to be true…
- These are separate devices…the KIWI-OSD and/or IOTA-VTI generating flashes and the Pasco PS-2176 logging light readings at 1kHz.
- Certainly one of them is incapable of maintaining such precision for longer periods of time…

KIWI-OSD over 400 seconds



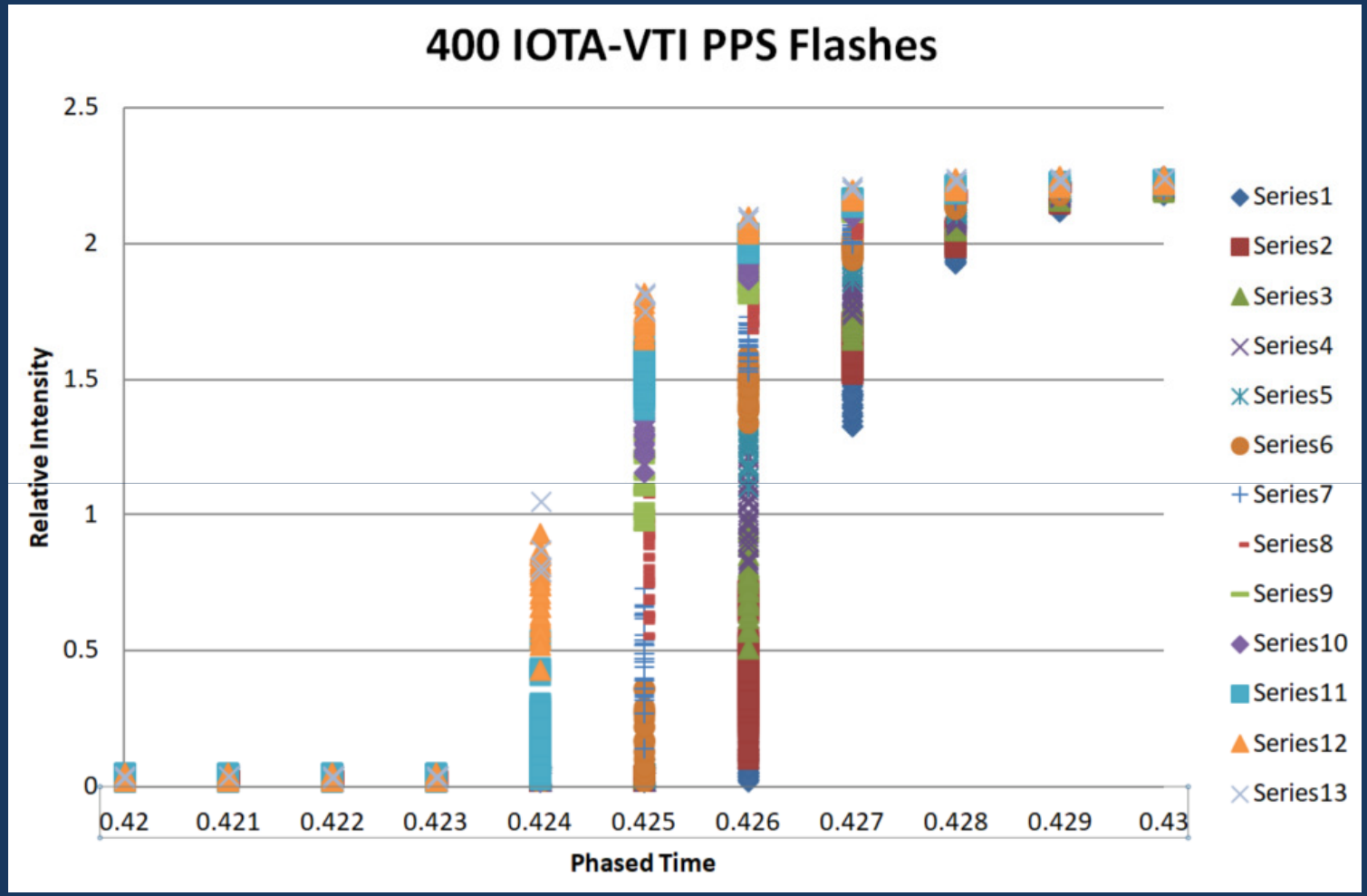
- Indeed…collecting data over longer time periods started to put in some dents…

“IOTA-VTI” over 400 seconds



- Upslope “break” spread across 3 ms

IOTA-VTI 400s



- Which device is to blame for the measured jitter?

AFT in summary

- Some jitter of flashes from ‘on the second’ of the order of 1 ms, occasionally 2 ms…though mostly logged correctly as being such

- Flash durations do vary from anticipated flash duration…especially the last one in a series.

AFT in summary

- Occasionally logs a flash that never occurs after there having been a pre-flash?!
  - Accounted for by the longer duration of what appears to have been one flash
  - Would merely confuse those relying on data log
- Log appears to be occasionally wrong by 1 ms, but have yet to see any off by more than 1 ms.
  - *so was the KIWI-OSD and IOTA-VTI over 400s?*

AFT future measurements

- Switch iPhone to Europe settings?
  - Access Europe NTP servers instead
- Compare measurements with
  - WiFi off
  - Airplane mode
- Longer duration observations
- Compare AFT series, single, PPS vs bracket