Inter-comparison of various timing devices against a single SR timer (Herstmonceux – D)

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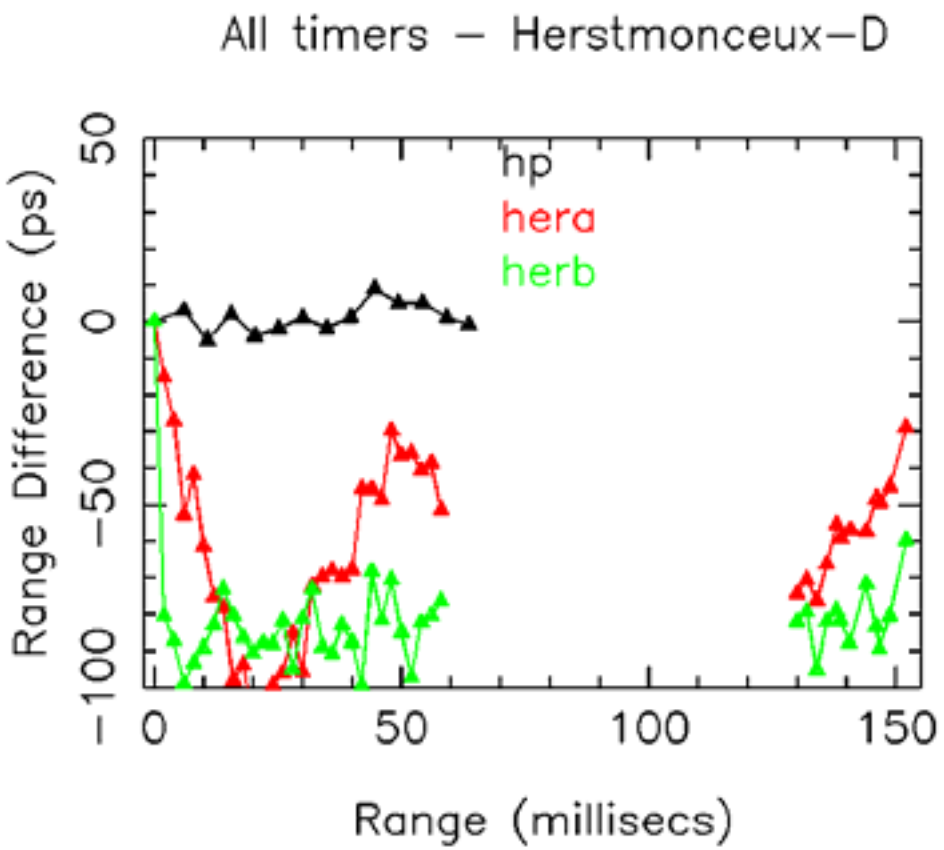
Herstmonceux SR620 experience

- SR timers are cheap,user friendly and very stable devices.
- We have been aware for sometime that each of our SR timers at Herstmonceux have range dependant biases and that these are different for each SR timer. These biases are within the spec given in the SR manual.
- Over a long period of monitoring the behaviour of each device has remained constant.

Behaviour of Herstmonceux timers

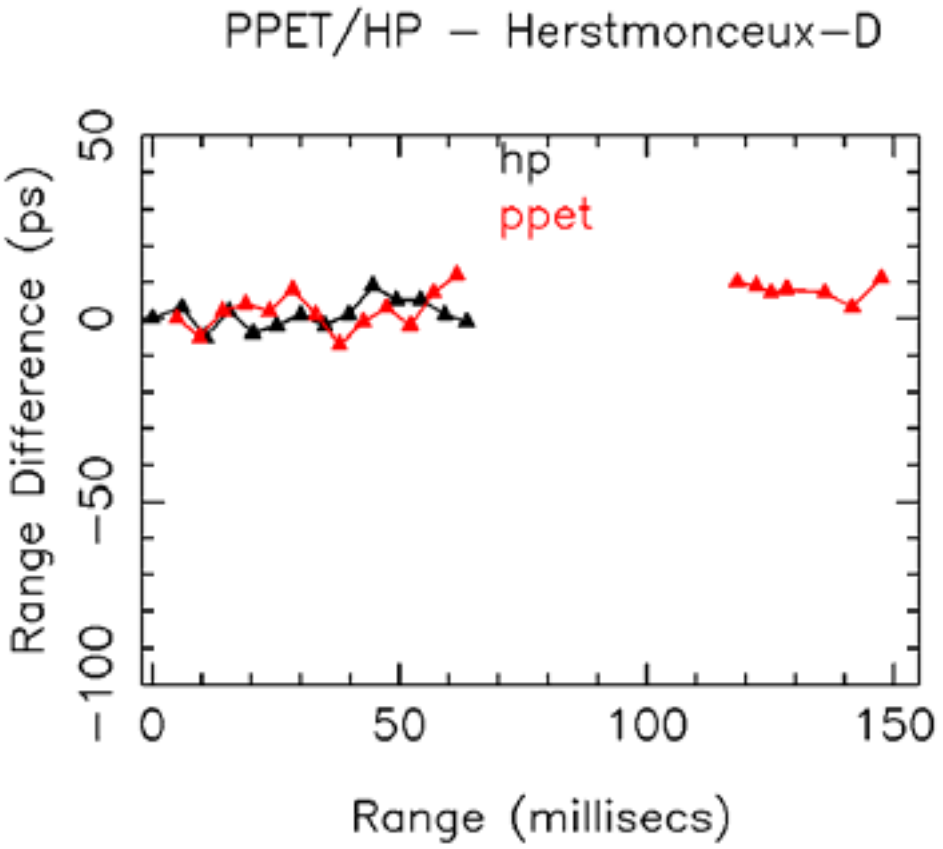


Comparison with PPET (Portable pico-second event timer)

- Although we knew the relative behaviour of the timers we did not know the absolute truth.
- We believe that the PPET enabled us to determine the absolute offsets for each of our SR timers.
- The agreement between the PPET and HP strengthened our belief.

Results for PPET

- Shown here are the results from the comparison with the PPET made in October 1996



Herstmonceux data

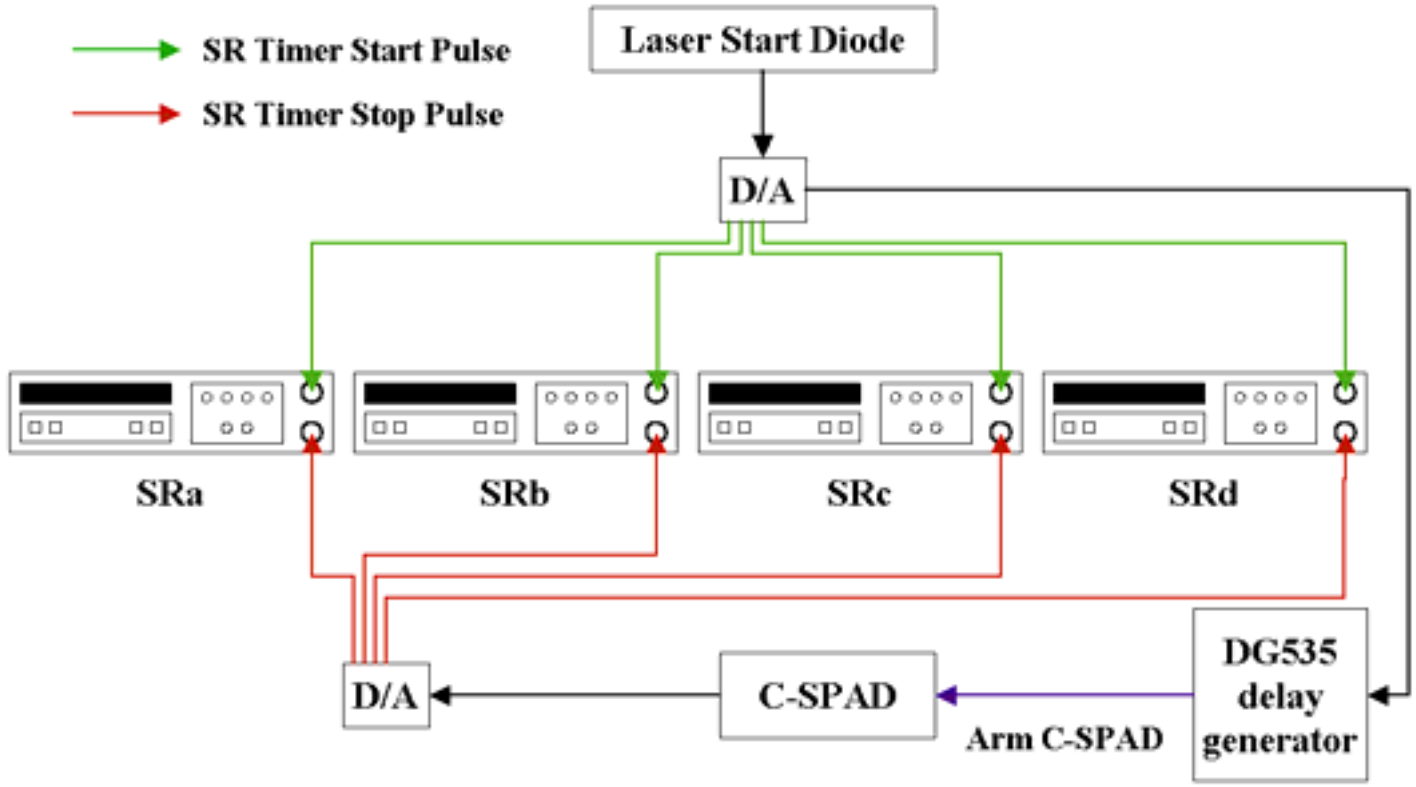
- Using the offsets between our SR timers we corrected our data to our original SR timer (A).
- With the purchase of two HP5370b timers we were able to confirm the results obtained from our original HP and PPET.
- As from 2002 Feb 1st our data has been sent out on PPET system. An announcement of this along with a correction table for all our previous data was given in SLRMAIL 0891

Eurolas Workshop

- At the Eurolas workshop held at Herstmonceux in March 2002 several stations brought their SR timers for comparison with Herstmonceux-D timer. Graz sent one of their SR timers later.
- In the time permitted each SR timer had 1 warm-up test and at least 2 proper tests.
- The warm-up tests have not been used as they generally stand well off.

Stations

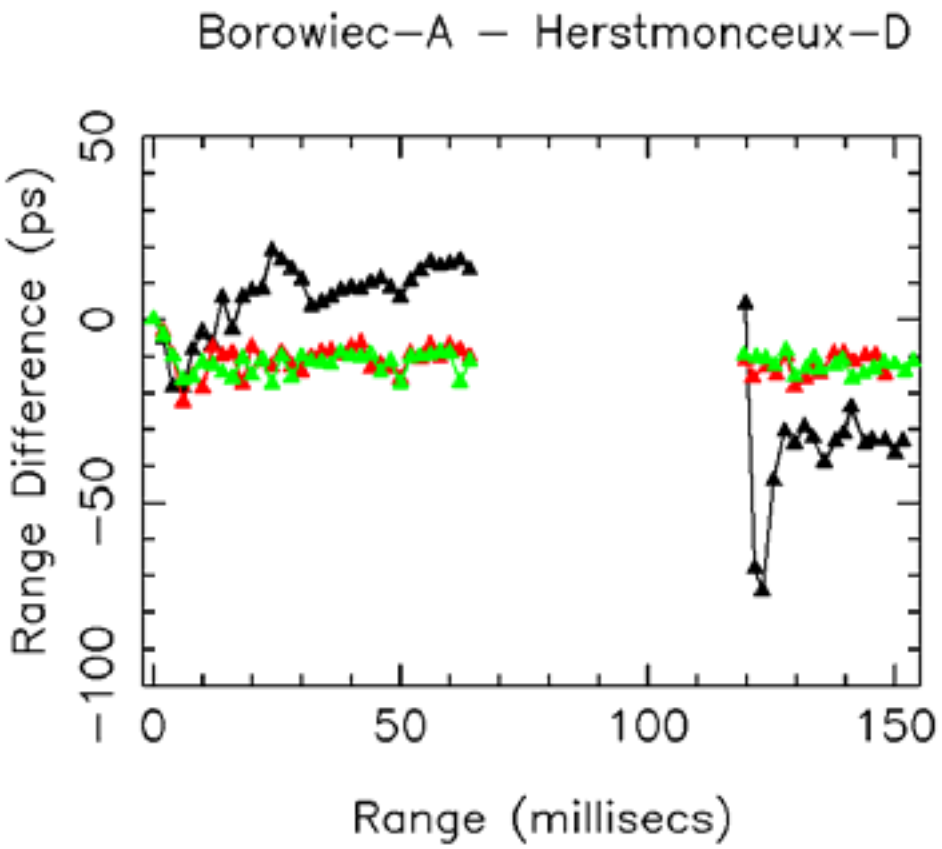
- Borowiec (2 timers)
- Potsdam
- San Fernando
- Zimmerwald
- Graz (after workshop)
- Herstmonceux



- The system layout for the tests is exactly the same as for observing. The DG535 is used to gate the C-SPAD at the required ranges. Rather than true returns the C-SPAD is exposed to daylight

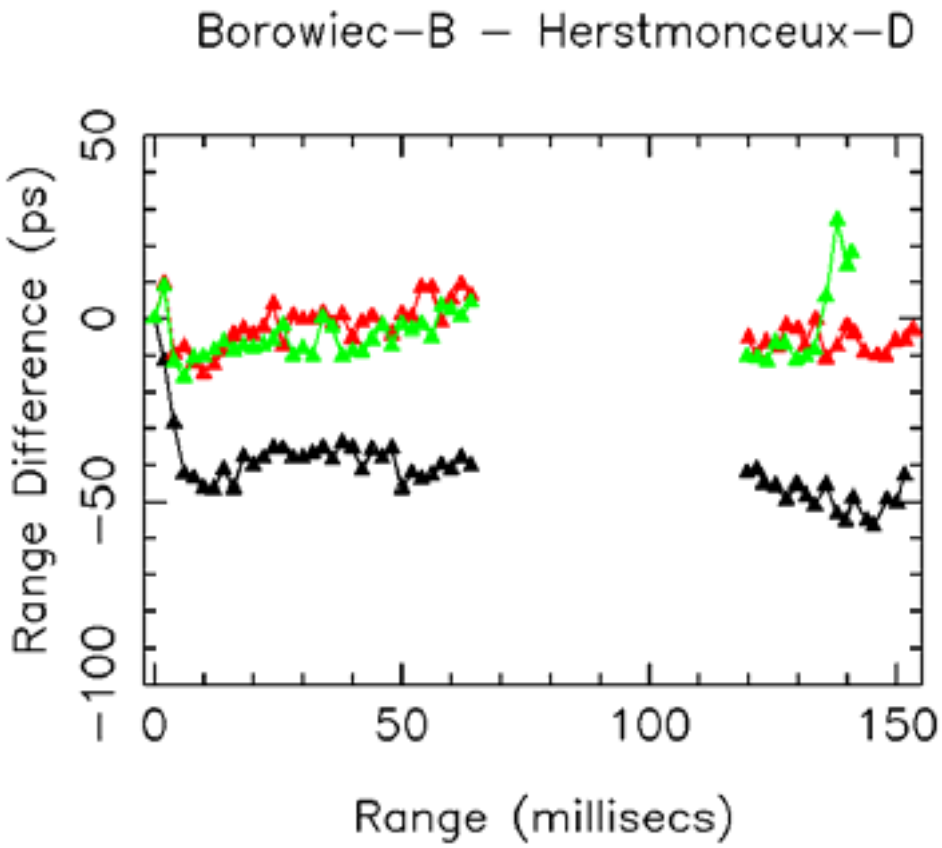
Results for Borowiec-A

Note that the warm-up test (black) stands well off from the other tests

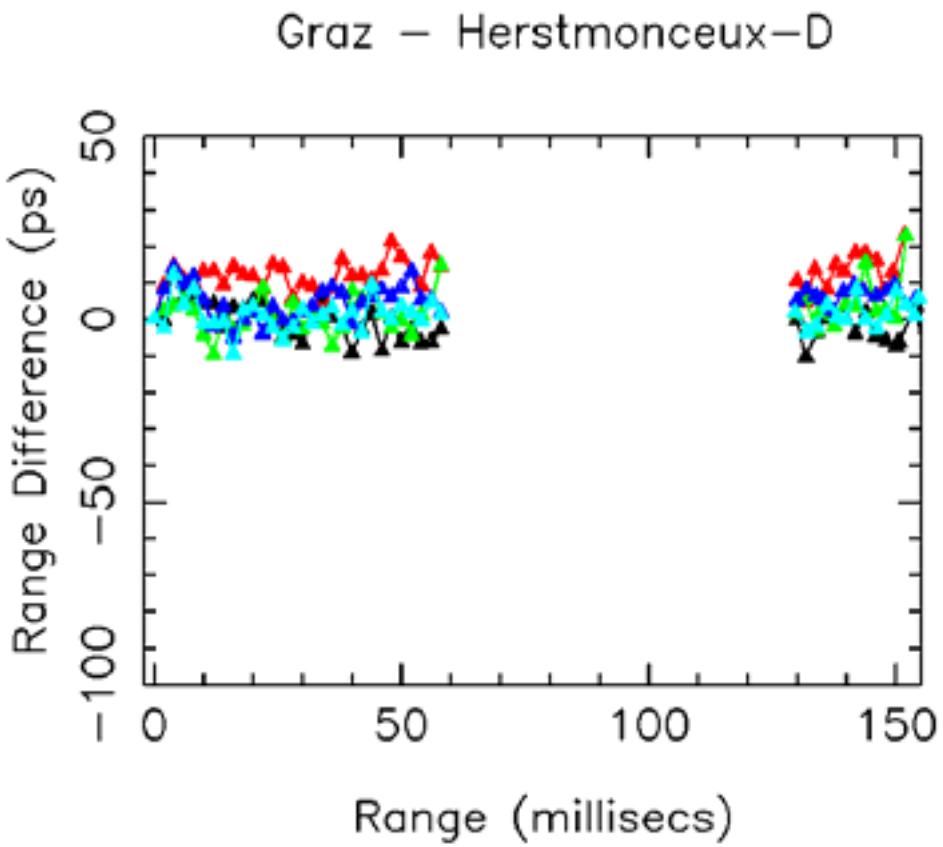


Results for Borowiec-B

- Again note how the warm-up test stands off

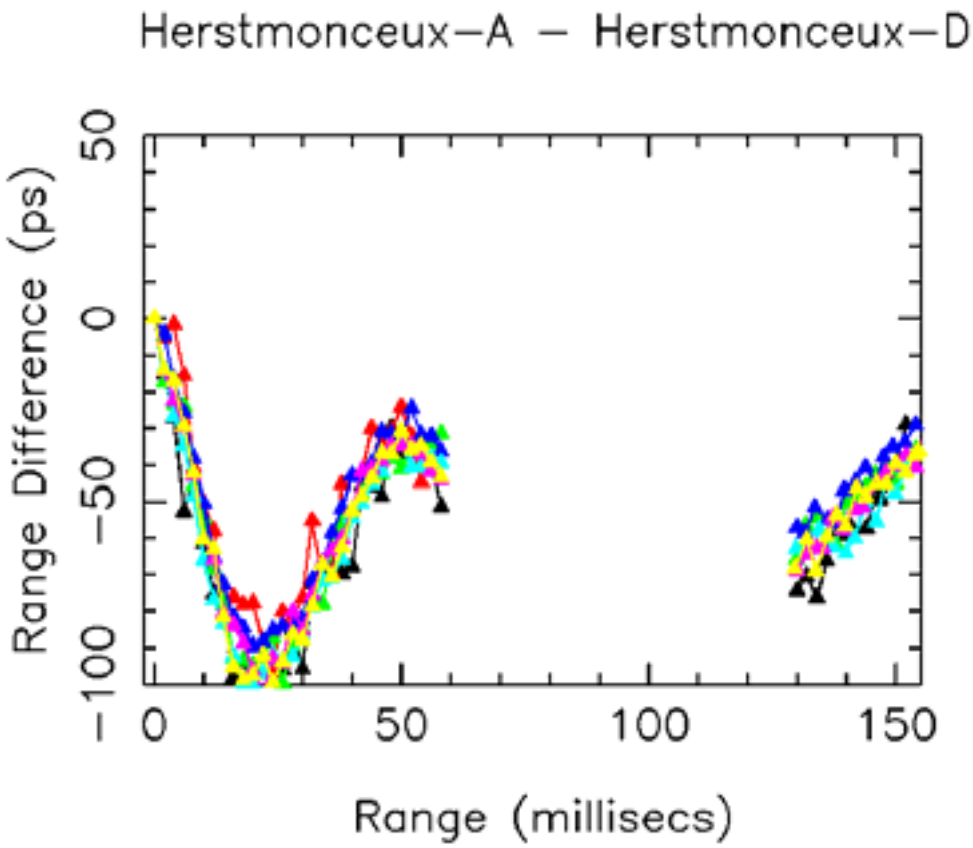


Results for Graz



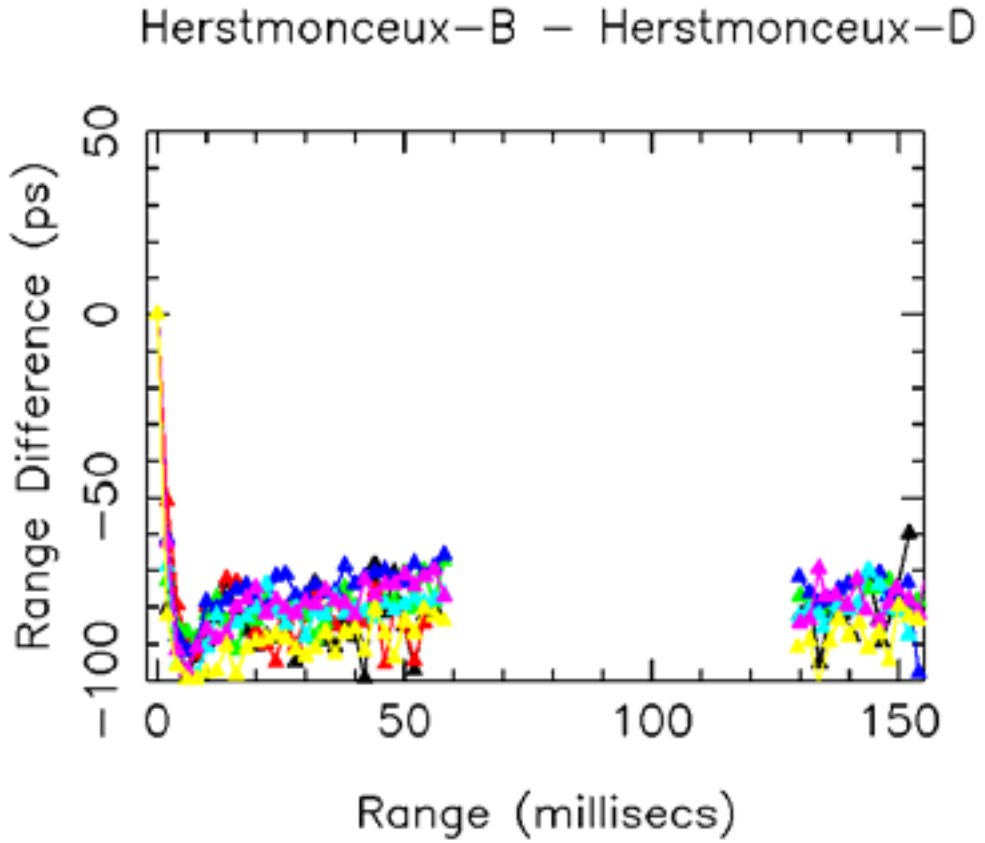
Results for Herstmonceux

- The behaviour displayed here has been consistent throughout.



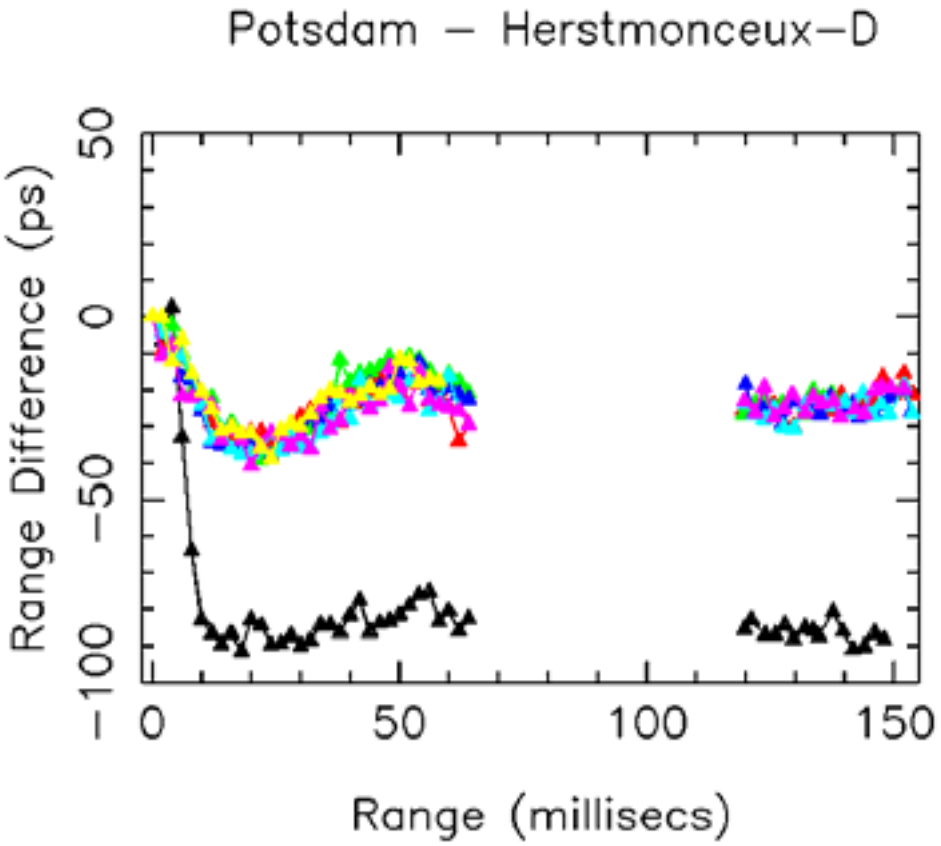
Results for Herstmonceux

- Likewise the results for this timer have always been the same. HerB and HerD were purchased at the same time.

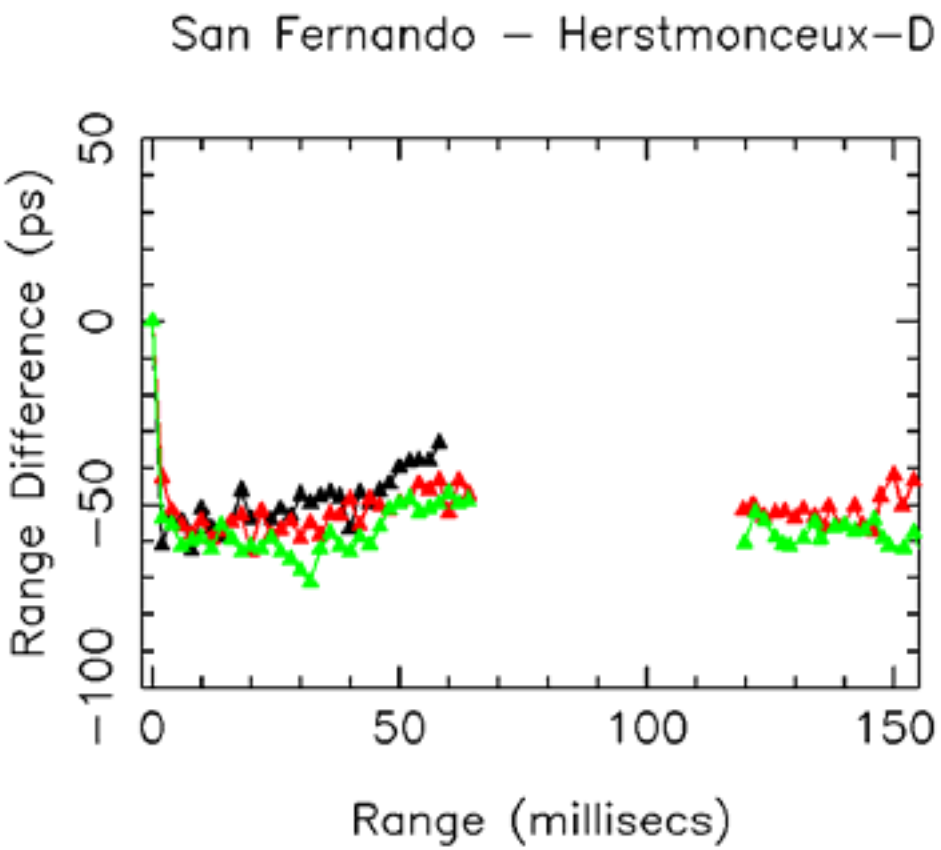


Results for Potsdam

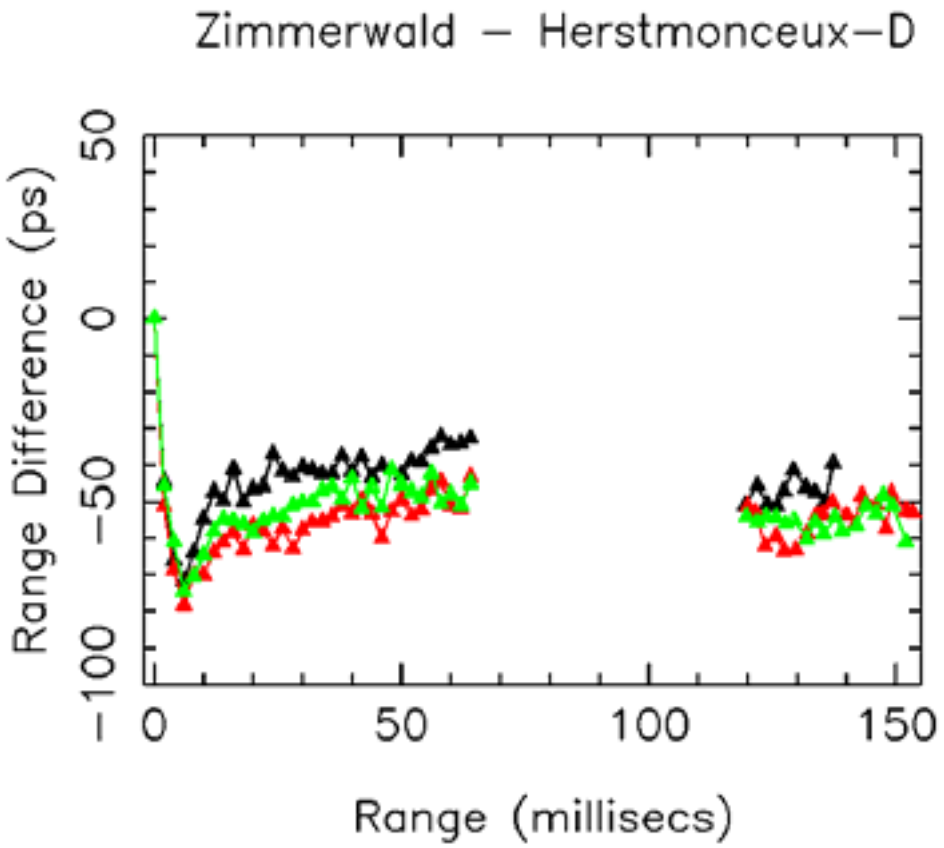
- Note how the warm-up test stands off..



Results for San Fernando

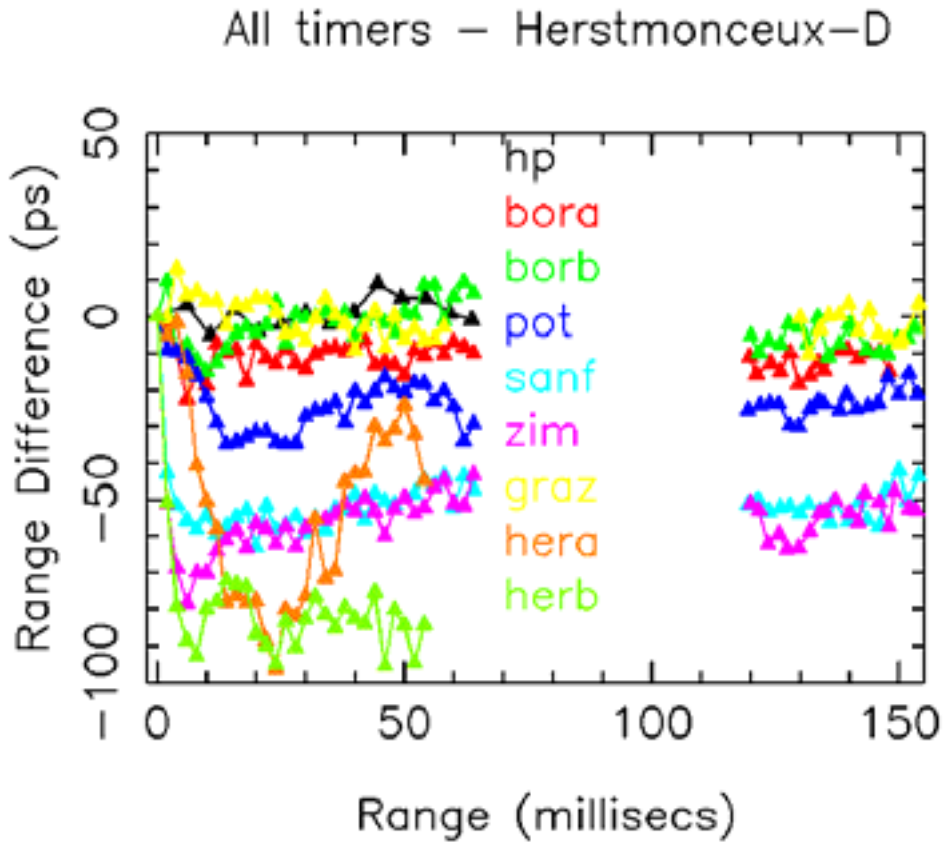


Results for Zimmerwald



Global plot

- Shown here is a summary plot of all the devices.

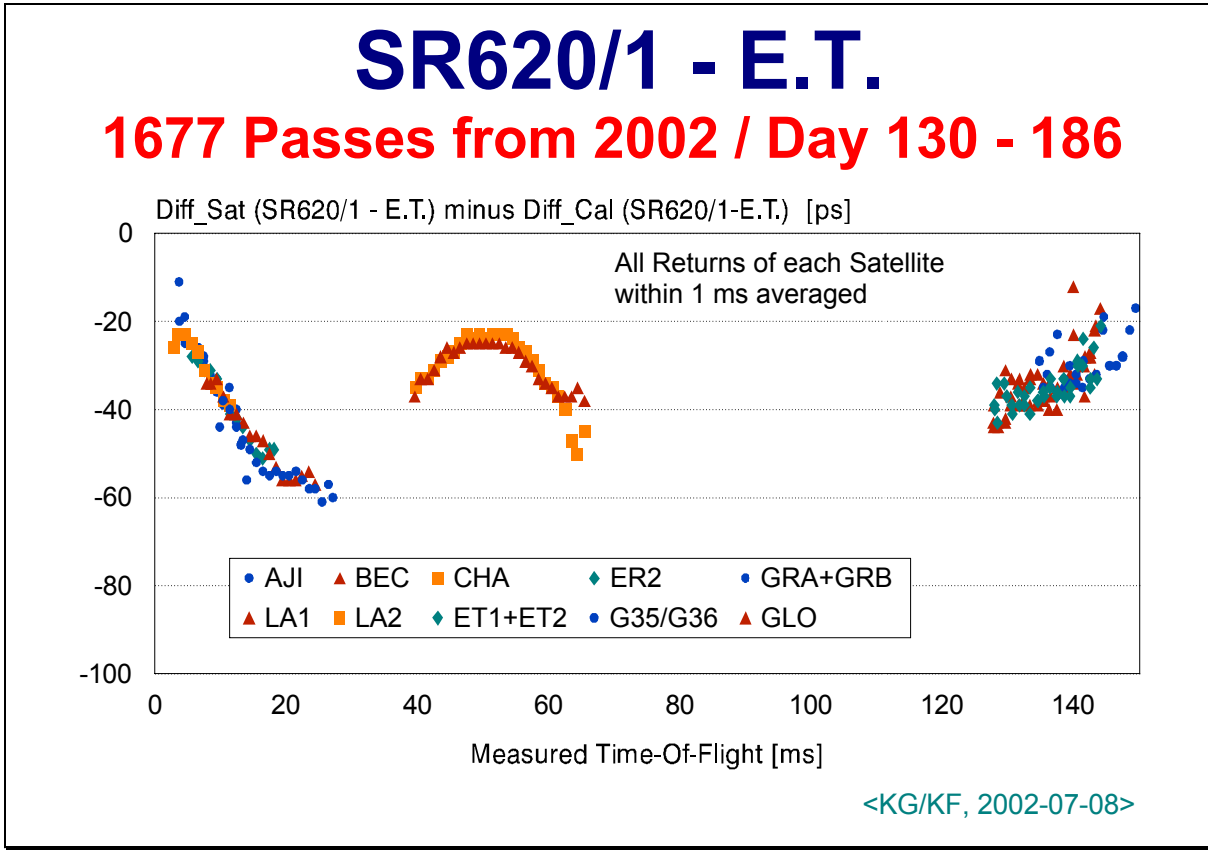


Follow-up to workshop

- As a result of the workshop, stations with a multi-timer environment were asked to make their own comparison tests if possible.
- Given below are the results from Graz.
- Zimmerwald results will be given separately.

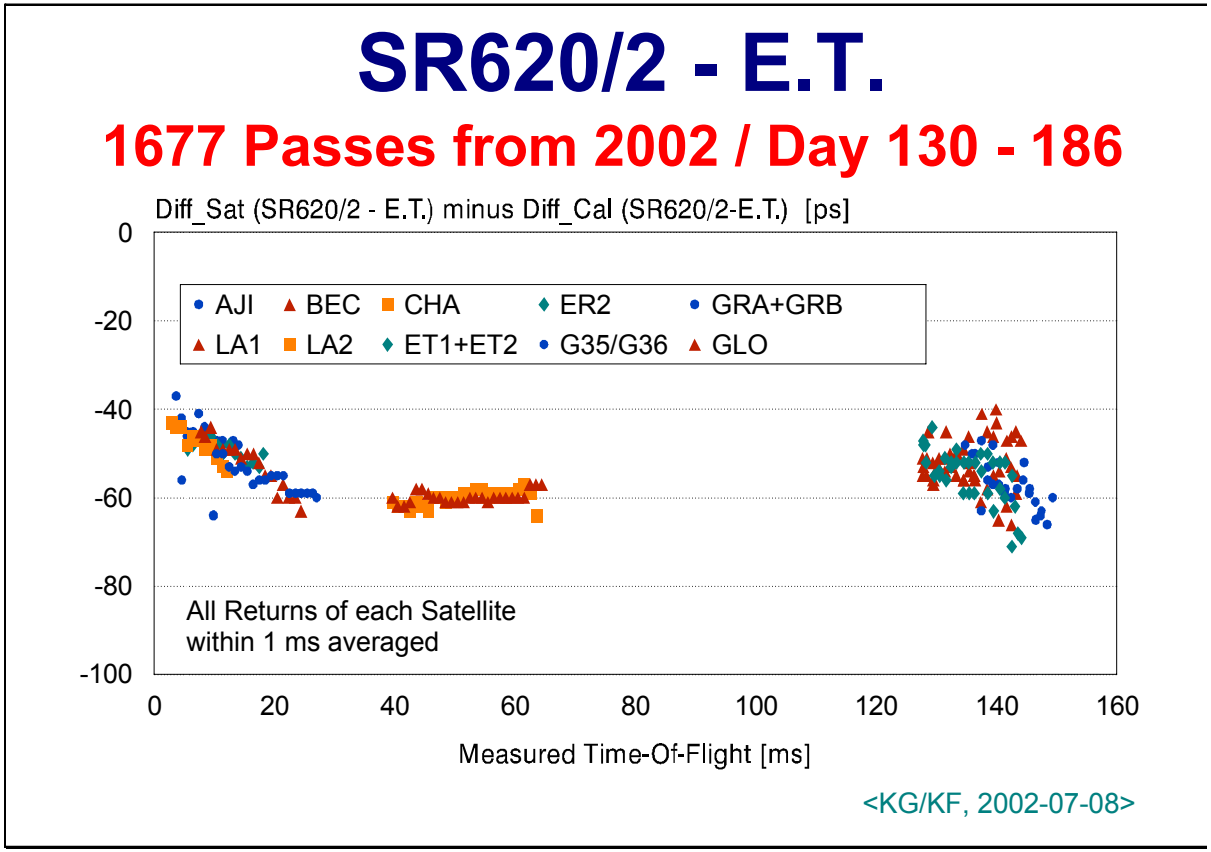
Graz comparisons

The three interval timers at Graz were compared with an event timer developed and built at Graz



Graz comparisons

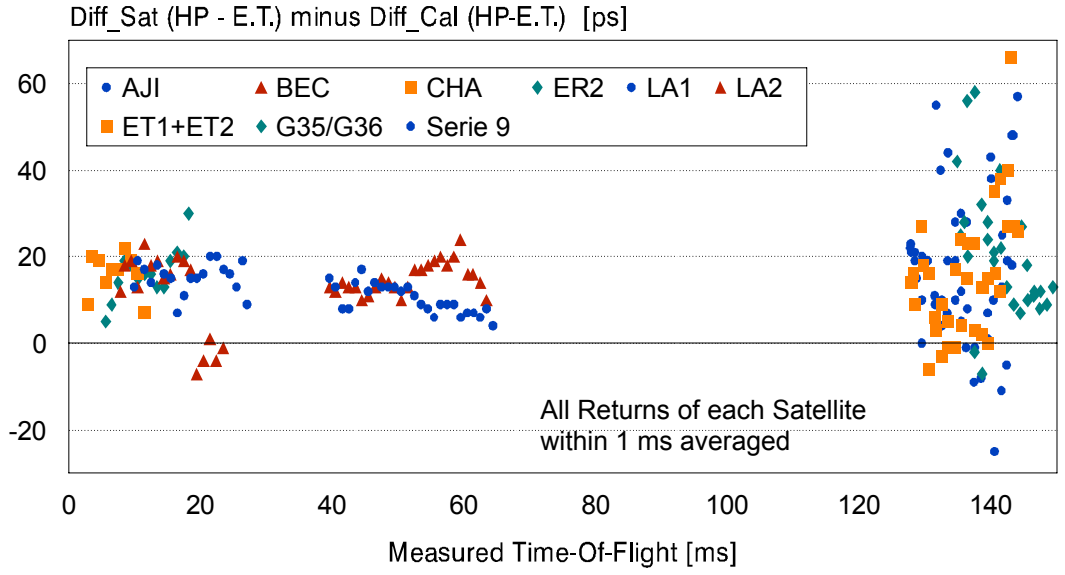
The results were obtained by differencing calibrated satellite data



Graz comparisons

HP5370A - E.T.

1677 Passes from 2002 / Day 130 - 186



<KG/KF, 2002-07-08>

Conclusions

- Clearly SR timers have a large variety of range biases.
- These biases would appear to be very stable over a long period of time.
- To achieve mm accuracy we need to measure these biases.
- We need to co-ordinate a global program to measure the biases for all SR timers relative to some standard device.
- The ultimate goal should be to calibrate all timing devices against some standard device.