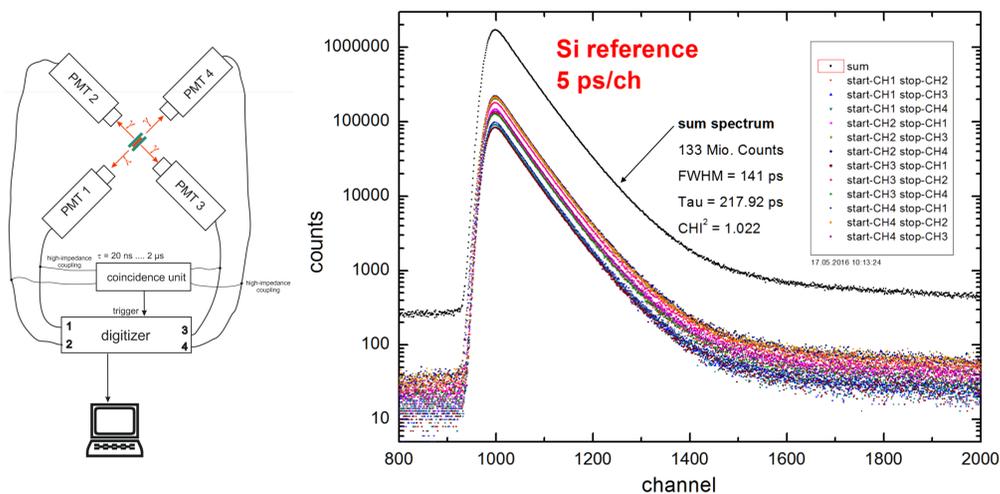


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A 4-tube and 12-spectra digital positron lifetime spectrometer

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This poster shows a 4-tube positron lifetime spectrometer with a self-developed 4-fold coincidence unit. 12 spectra can be measured simultaneously.



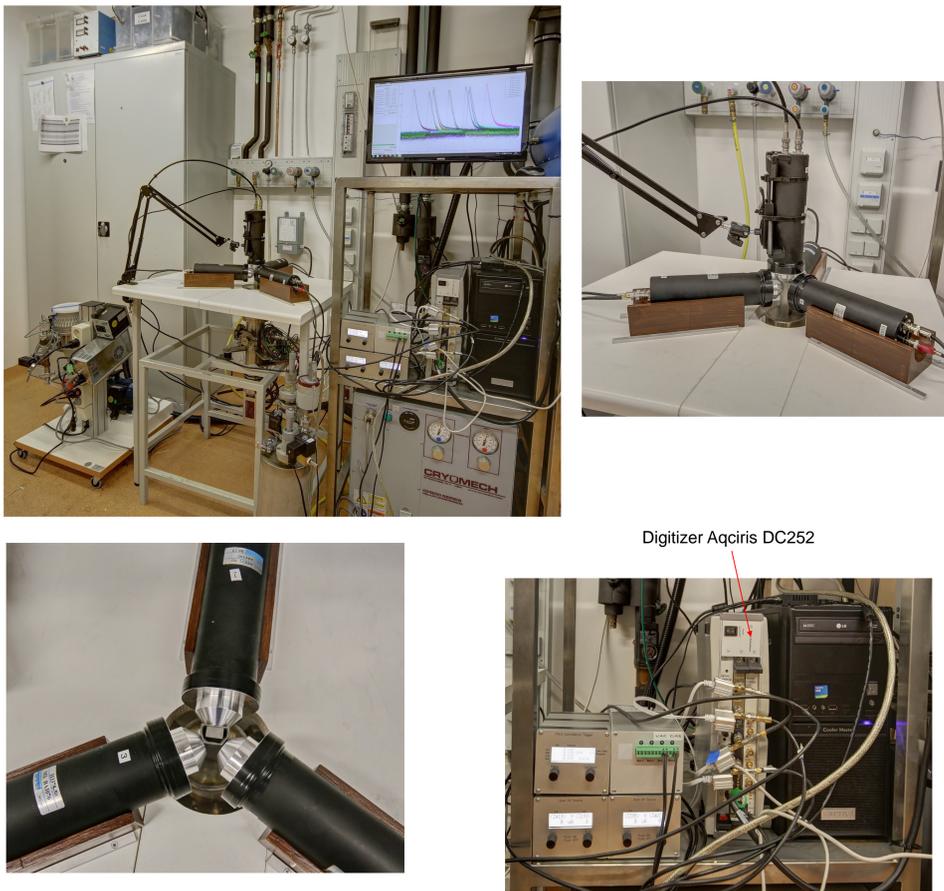
Hamamatsu PMTs H-3378 are combined with EJ-232Q plastic scintillators (conical shape – diameters: 40 and 19 mm, height 28mm). The anode pulses are digitized by an Acqiris DC252 digitizers. Both PMTs act as start and stop detector, thus 12 spectra are collected at the same time using 4 PMTs. The software is self-made (QT & C++).

LT results for 12 individual spectra and the sum spectrum

| Spectrum | τ_1 | Fit | fwhm ₁ | shift ₁ | Statistic |
|--------------------|----------|--------|-------------------|--------------------|-------------|
| LT10 SUM spectrum | 0.21792 | 1.0218 | 0.14077 | -0.062312 | 132.580 mln |
| start-CH1 stop-CH2 | 0.21858 | 0.9867 | 0.1331 | -0.058434 | 9.984 mln |
| start-CH1 stop-CH3 | 0.2184 | 1.0112 | 0.1606 | -0.068468 | 6.755 mln |
| start-CH1 stop-CH4 | 0.2188 | 1.0196 | 0.1390 | -0.064645 | 7.053 mln |
| start-CH2 stop-CH1 | 0.2163 | 1.0743 | 0.1321 | -0.060984 | 10.943 mln |
| start-CH2 stop-CH3 | 0.21643 | 1.0954 | 0.1524 | -0.068967 | 16.035 mln |
| start-CH2 stop-CH4 | 0.21809 | 1.0269 | 0.13303 | -0.05991 | 16.831 mln |
| start-CH3 stop-CH1 | 0.2178 | 0.9863 | 0.1418 | -0.066553 | 6.476 mln |
| start-CH3 stop-CH2 | 0.21769 | 1.0026 | 0.1377 | -0.060601 | 13.763 mln |
| start-CH3 stop-CH4 | 0.2191 | 1.0143 | 0.1411 | -0.068502 | 9.877 mln |
| start-CH4 stop-CH1 | 0.2187 | 1.0107 | 0.1350 | -0.067133 | 7.490 mln |
| start-CH4 stop-CH2 | 0.21784 | 1.0118 | 0.13236 | -0.067108 | 16.329 mln |
| start-CH4 stop-CH3 | 0.2188 | 1.0271 | 0.1612 | -0.071546 | 11.155 mln |

The average of the Si lifetimes of all 12 spectra is $\tau_{Si} = 218.04 \pm 0.1$ ps.
 The analysis of the sum spectrum gives $\tau_{Si} = 217.92 \pm 0.03$ ps

The completed 4-PMT spectrometer with He-cryostat, vacuum system and temperature control unit.



Further four digital lifetime spectrometer each equipped with two PMTs and cryostat.



4-fold Coincidence Unit and HV Unit

The coincidence unit provides a trigger output when fast PMT anode signals are detected above a selectable trigger level (8mV...5V, leading edge discrimination) in several modes. No signal splitter is used for the coincidence unit to avoid the 3dB signal loss. Instead, the signals are obtained by capacitive high-impedance "sniffer" units followed by an amplifier, straight at the digitizer input. The coincidence time can be adjusted in 7 steps from 20 ns (defect research) to 2 μ s (porosimetry). The unit can be used for digital positron lifetime spectroscopy, but can be used also in analog setups to provide an additional coincidence circuitry. The trigger output pulse is a TTL pulse (2.5V @ 50 Ω ; pulse length 25 ns). The unit is fully remote controllable (USB).



Two-fold High Voltage Unit

The dual high-voltage power supply is designed for use with photo-multiplier tubes with a divider current up to 1 mA. Maximum voltage is 4 kV but this voltage can be limited by software to any smaller value to protect the PMT. The box contains two independent high-voltage modules with low ripple (typ. < 20 mV_{p-p}) and high stability (< 5 $\times 10^{-4} \times V_{nom}$) especially designed für PMTs. The modules are overload and short circuit protected. The HV supply can be operated manually but also remote controlled (USB2).



Both units are commercially available (Contact: R. Krause-Rehberg)

Poster is available at <http://positron.physik.uni-halle.de>
 Contact: reinhard.krause-rehberg@physik.uni-halle.de

