Filling Pattern Measurements at Alba Using Time Correlated Single Photon Counting

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ALBA-CELLS

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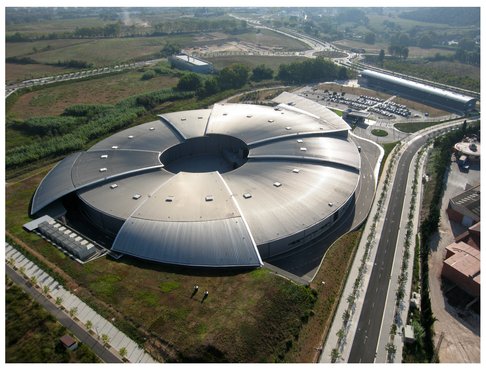
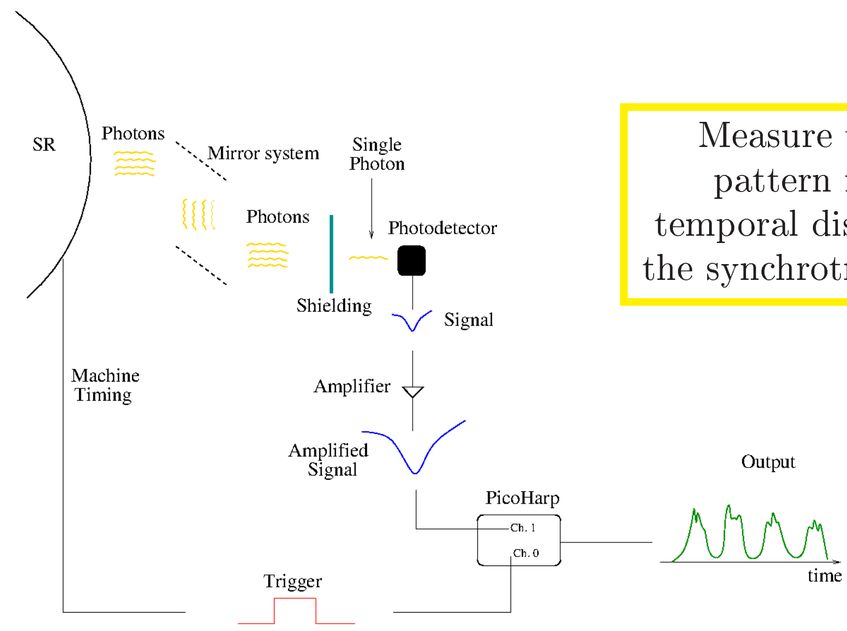
Alba Synchrotron Light Source



Alba is a 3 GeV third generation synchrotron light source located in Cerdanyola del Vallès (Barcelona) and operative since 2012. By the end of this year Alba is going to operate in Top-Up mode that will provide a constant current and consequently a constant flux of radiation. A further upgrade in the near future foresees a bunch by bunch top-up in which the refill will be selective starting from the emptiest bunches. This will provide a flat filling pattern and improve the beam stability.

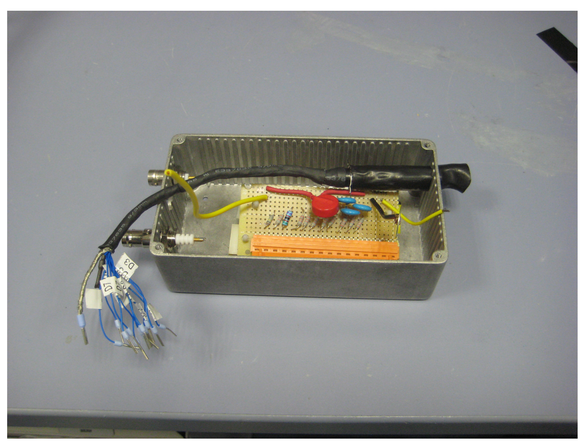
Time Correlated Single Photon Counting



Measure the filling pattern from the temporal distribution of the synchrotron radiation

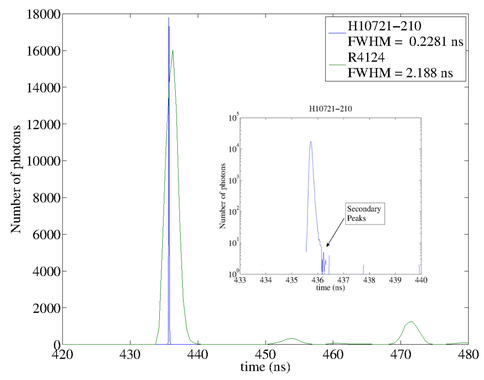
Photomultipliers

	H10721-210	R4124
Photocathode Material	Ultra Bialkali	Bialkali
Spectral Response	230-700 nm	300-650 nm
Dark Current	10 nA	1-15 nA
Rise Time	0.57 ns	1.1 ns
Transit Time Spread	0.2281 ns	2.188 ns



Transit Time Spread

The TTS is defined as the FWHM of electron transit time fluctuation between the arrival time of the photon to the photocatode and the signal generation, and can be identified as the time jitter of the output pulse.



TTS measured using the machine in single bunch mode

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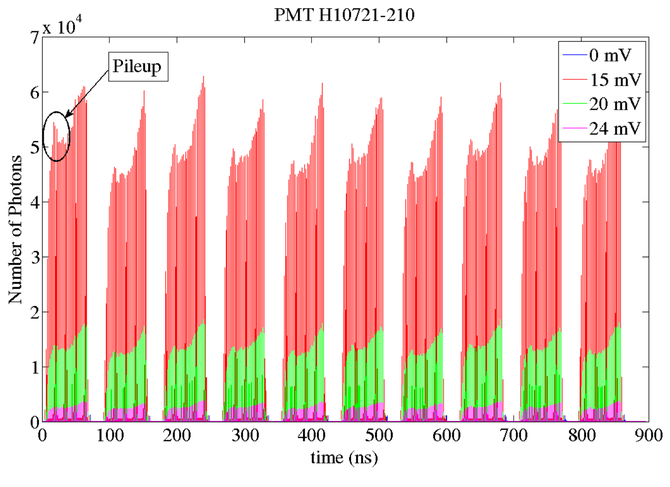
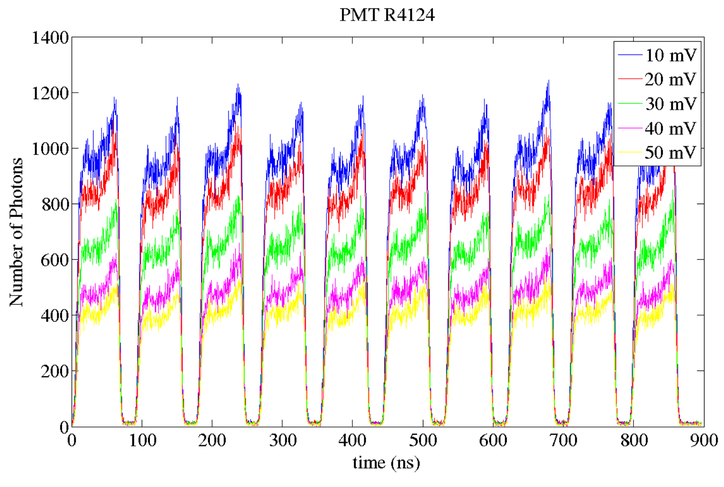
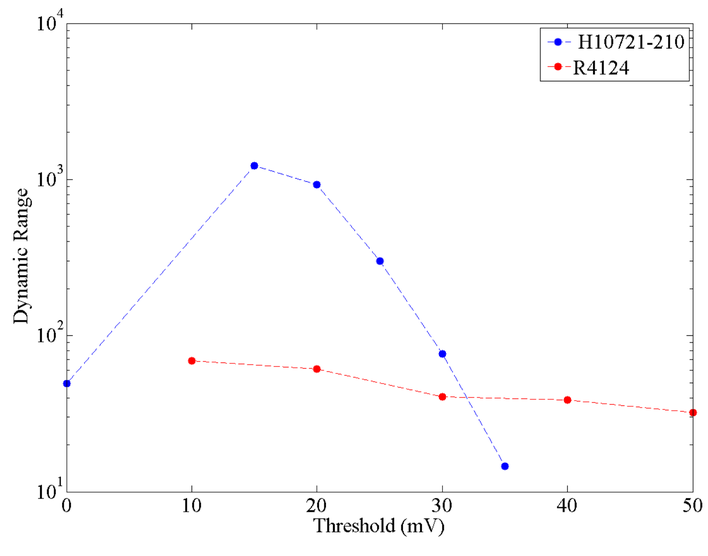
Single bunch ⇔Point source

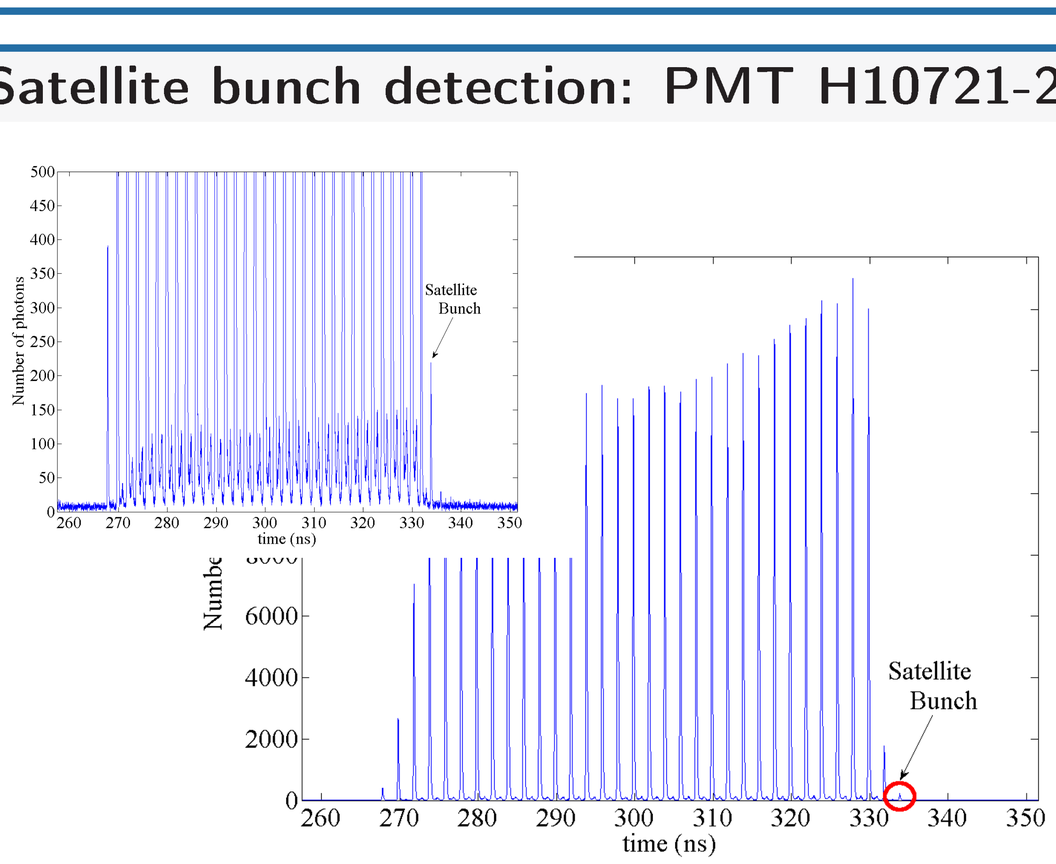
Threshold Scan







Satellite bunch detection: PMT H10721-210



Conclusions

We tested two different photomultipliers to be used as photon-detector for the TCSPC technique. The PMT H10721-210 presents a good response time but the auto-gain system causes some mismatching in the filling pattern reconstruction. The estimated dynamic range of the measurements with this device was higher than 10^3. The PMT R4124 provided a reliable filling pattern but the dynamic range was estimated to be around 10^2. In terms of costs versus performance both the PTMs prvide an effective choice.

References

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[3] C.A. Thomas et al. "Bunch Purity Measurements for DIAMOND" Nucl.Instum.Meth., A 566 (2006) 762-766

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