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A bin-per-bin dead-time control technique for time-of-flight measurements in the G^0 experiment: The differential buddy

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Abstract. The general principle is presented. The application to the G^0 experiment [1] was enabled by the specificity of the time encoding ASIC component. On the poster, some encountered difficulties are exposed, together with a possible software remedy. An internal report is in preparation [2].

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Since PAVI02 the G^0 experiment successfully passed its commissioning and the first phase of data taking at forward angles [3]. This poster contribution aims to depict an experimental approach to control the dead-time in the time-of-flight histogramming of events.
Every part of the electronics - Constant Fraction Discriminator (CFD), Mean Timer (MT) and Time to Digital Converter (TDC) - has its own dead-time contributing. Different types of events must be considered: single CFD (only one of the left or right CFDs sees an event), single MT (only one of the Front or Back MTs sees an event) and good events (4 CFD signals leading to TDC encoding). Only the last type is subject to the *differential buddy* treatment. The correction for dead-time from other types of events is done with the help of a slow, event by event, acquisition made in parallel with a fastbus setup, and giving the probability of each kind of event [4] . The standard procedure of linear regression [5] for helicity correlated beam properties will help to remove residual dead-time effects. The idea, here, is to measure the loss of good events resulting from acquisition blocking. The direct counting of these events is impossible because they occur when the electronics is busy, analyzing a previous event, but an image can be obtained by checking, for each event if an associated detector (buddy), supposed to count identically, is busy or not. This is experimentally possible because it involves two different channels. However, as one needs time to process the signals, the comparison is made after a delay corresponding exactly to one pulse of beam duration. There are two basic assumptions: that counting is identical despite a spatial rotation (180°) and a time translation (32 nsec).

After solving tuning and analyzing problems, it is possible to use the data from the *buddy histograms* to estimate the dead-time of each detector and its stability (see figures below). The dead-time is the ratio, within proton peak limits, of the corrected number of events having encountered the buddy busy, to the total number of events.

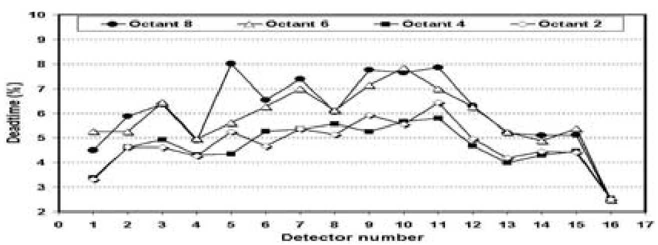

Fig. 1. Measured dead-time according to detector number

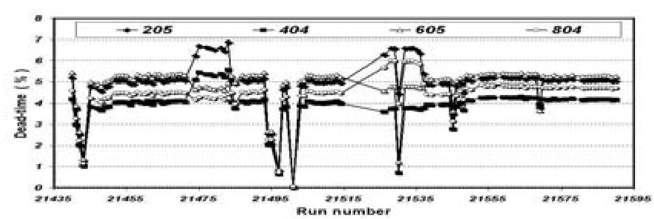

Fig. 2. Evolution of measured dead-time for specific channels

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