A Monte Carlo feasibility study of the CBM event reconstruction at high interaction rates based on time information. *

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A Monte-Carlo simulation was performed in order to study the feasibility of event reconstruction at high interaction rates based on the timing information provided by the Silicon Tracking System (STS). A parameter which could be used for event separation is the reconstructed interaction time T_0. In our study, the resolution of the reconstructed T_0 is determined mostly by the time resolution of the STS which is in the order of 5 ns. We will study the separation of events in time-base simulations using a cut in ΔT_0 for a reaction rate of $10^7/s$. We have to take into account two different situations: if ΔT_0 of two different interactions is smaller than the ΔT_0 cut value, there is the possibility to combine reconstructed tracks of particles from two different interactions in one event; If the T_0 reconstruction resolution is greater than ΔT_0 cut value, there is the possibility to divide the reconstructed tracks of particles from the same interaction in two different events. In Figure 1 the relative numbers of combined and divided events are presented as function of the ΔT_0 cut value, the assumed T_0 resolution is 5 ns. It can be seen that with a ΔT_0 cut value of 5 ns for example the number of divided events (red squares) is about 15%, and the number of combined events (black circles) is about 6%. With increasing ΔT_0 cut value the number of divided events decreases dramatically, but the number of combined events increases up to 20% for a ΔT_0 cut value of 20 ns. It is clear, that for event separation at interaction rates as high as $10^7/s$ an additional cut variable is needed.

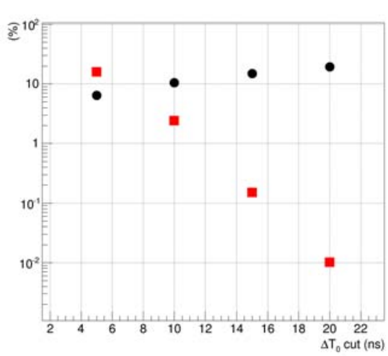

Figure 1: Number of combined (black circles) and divided (red squares) events as a function of the ΔT_0 cut value for a resolution of the reconstructed interaction time of 5 ns.

The separation of different events can be improved by using the information on the different positions of the primary vertices in addition to the reconstructed T_0 values. For the simulation we assume a Gaussian distribution of the beam particles at the target (i.e. of the primary vertices) with a FWHM of 1cm. In figure 2 the distribution of the primary vertices in horizontal (upper plot) and vertical position (lower plot) is shown as function of time. The height and the length of the symbols correspond to a vertex resolution of 100μm and a reconstruction resolution of 20 ns, respectively. It can be seen that the events are clearly separated in space and time for an interaction rate of $10^7/s$. Taking into account the position information of the primary vertex it is possible to reduce the number of combined events by up to 2 orders of magnitude.

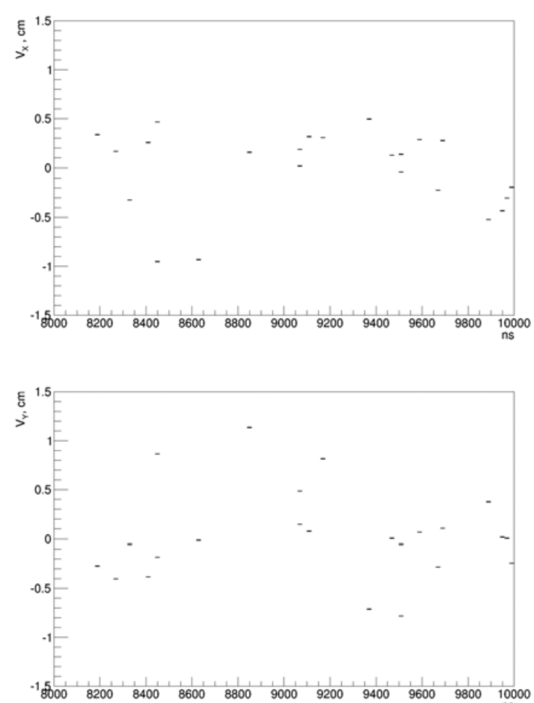

Figure 2: Primary vertex distribution in horizontal (upper plot) and vertical (lower plot) direction for a Gaussian distribution of the beam particles with FWHM = 1 cm for an interaction rate of $10^7/s$ as function of time. The symbol size corresponds to a vertex resolution of 100μm, and a resolution of the interaction time of 20 ns.

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