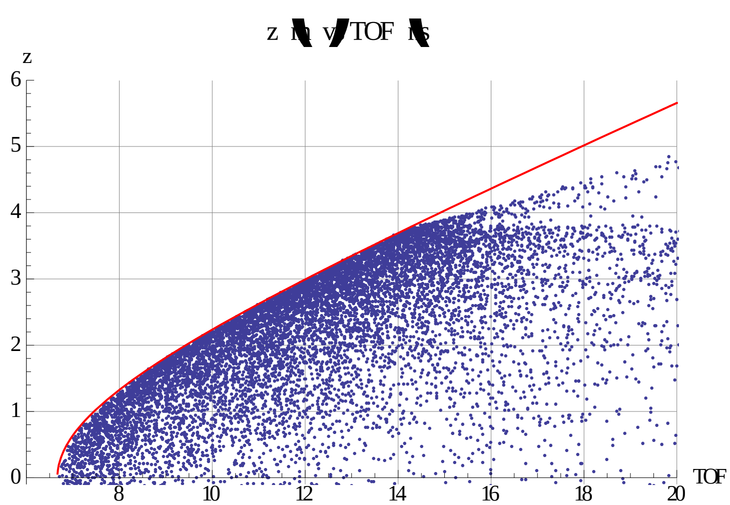
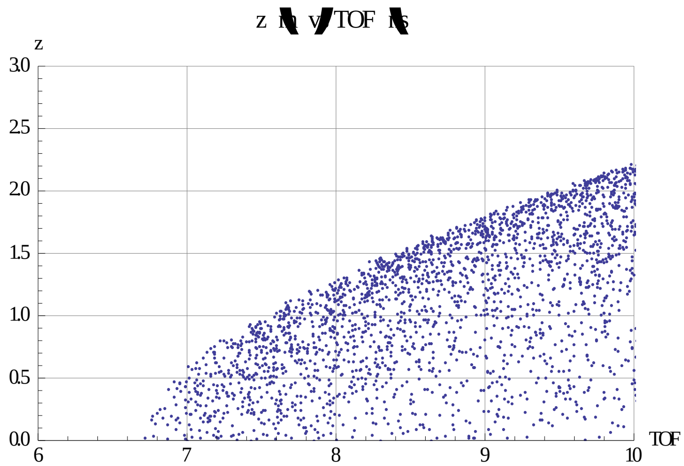
Here is a suggestion for the trigger for fixed-target runs. A component of the trigger is to use the downstream VPD and the downstream BBC in delayed coincidence in addition to the already-reported veto from the upstream BBC. The VPD is at |z|= 570 cm while the BBC is at |z|= 370 cm. So the leading edge of the pile-up in the VPD would be 6.7 ns later than the leading edge of the pile-up in the BBC. Furthermore the actual time of either of those leading edges would give the z of the vertex. A question is whether there are sufficient numbers of relativistic particles in those small solid angles to do this job for the low-energy beams needed for some fixed-target runs. I looked at URQMD for 3.85 GeV AuAu for these small solid angles and there would be >~ 1 dozen of such particles in each of these two detectors for impact parameters as much as 13 fm. I don't know what fraction of relativistic particles survive after traversing the downstream BBC but I conjecture that it's not a show-stopper. The 3.85 GeV Au beam energy was used because such lower beam energies may be necessary in search of the QCD critical point.

Study of the above veto from the upstream BBC was posted recently at nuclear.ucdavis.edu/~draper. The purpose of this veto is to reduce substantially the background from beam that collides upstream of the target with the beampipe. This was a problem in BES runs like 7.7 GeV AuAu.

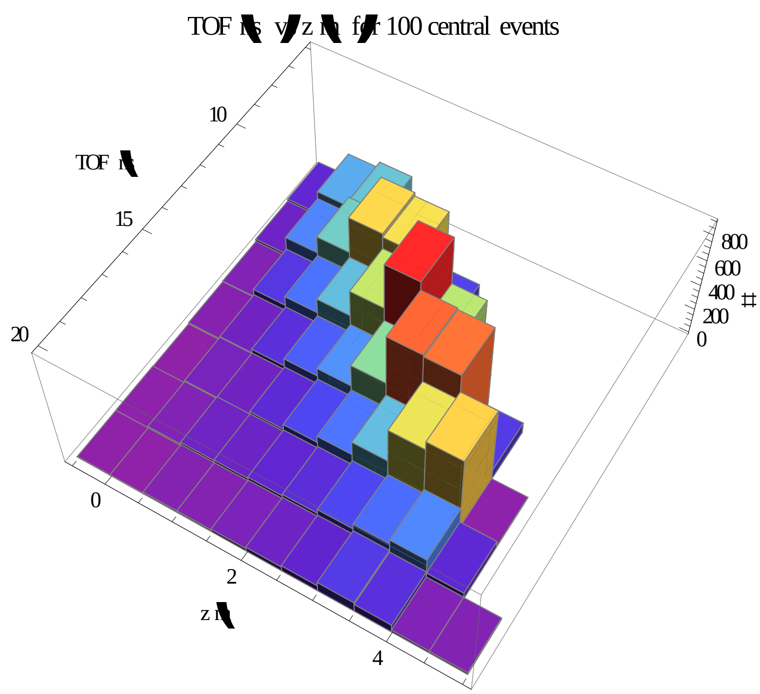
An important consideration is that for more central collisions the amount of beam hitting the downstream BBC and the downstream VPD is considerably reduced, as seen in URQMD. However this is accompanied by particles traveling in the direction of the TOF system. As I have not seen information about the flight time vs z of hits in the TOF, I used 100 of central URQMD (b=1 fm) AuAu events to explore the correlation of flight time vs z in TOF. Account was taken of the helical trajectory of charged particles enroute to TOF. The fixed target was placed 2 m upstream of the central membrane. (The eastward-traveling beam also illuminates the downstream EEMC). Measured from this target location, the TOF extends from z~ -0.2 to ~+3 m. If nearly all of each MRCP is sensitive, the venitian-blind arrangement of TOF MRCPs would not be a problem for the half of TOF eastward of the TPC central membrane and probably not much of a problem for most of the remainder of the TOF. Somewhat arbitrarily I chose URQMD momenta as pz/p = -0.0872 to +0.883. (The largest z for the TOF would then be ~3.5 m but this limit was not used in the program). An overview of the results is:



The red curve above (all the way to z=0) is for for all particles being of neglegible mass and the traveled (circular) portion of the helix being replaced by its chord.   I took the radius of TOF as being 2 m so the smallest flight time is 2/0.3 = 6.7 ns.   The departure of the dots from the red curve beginning at flight time ~14 ns is caused by the above limit of 0.883 for pz/p.   The next plot is a still smaller portion to give a better view of the density of dots near minimum flight time and to reconcile the 3D histogram following it.



The next Fig. is a 3D histogram of a portion of the above plot.



The most intense block above has 827 counts which averages 8.27 counts per event in this 2-ns span. Note that all times here are flight times and have nothing to do with the electronics of TOF.   The least intense block (farthest to the left) above has 5 counts.

The overall time resolution of TOF is ~0.1 ns.   I do not know what is the delay between charged particle arrival and earliest suitable output pulse.

CONCLUSION: It seems that TOF can do well as a component of the trigger for fixed-target runs.   My proposal for such a trigger is (BBC, probably inner, and VPD in delayed coincidence) along with an OR of the earliest pulses from TOF, all of which is vetoed by the upstream full BBC when above threshold.