STAR Trigger Goals

The heart of the STAR detector system is the TPC. This detector is designed to return data on particle trajectories and types in the region of $-2<\eta<2$, from which we hope to glean an unambiguous signal of the formation of a quark-gluon plasma (QGP). The signature of this new state of matter is unknown, however, making it difficult to design a trigger to detect the QGP. As a result, we have designed a trigger that is very flexible, that can learn for itself the normal distributions of particles within events, and that can be programmed to select events that are outside the normal distributions. As part of the investigation we expect to study the approach to the QGP through both pp and pA collisions as well.

The STAR baseline system includes the TPC and the trigger detectors. Additional detectors include a silicon vertex tracker (SVT), an external TPC (XTPC), an electromagnetic calorimeter (EMC), a time-of-flight (TOF) system, and additional calorimetry at large pseudo-rapidity (η) regions. Our trigger must be able to treat each of the subsystems independently to allow us to extract information from the detectors independent of the operation of the TPC. This results from the fact that the TPC is a slow device and it should be possible to learn much about the distributions from the other faster detectors to help in selecting events for the finer analysis afforded by the TPC.

The goals of the trigger system can be summarized as follows:

1. Select high multiplicity events since these typically have the largest number of interacting nucleons. The assumption is that new phenomena will result from the collective interaction of the largest number of participants.
2. Select events whose particle distributions suggest local inhomogeneity such as expected when a portion of the interaction volume encloses a plasma.
3. Select events having unusual concentrations of strangeness, since strangeness and anti-strangeness production levels may herald passage through the QGP phase.
4. Provide for a variety of different trigger types, such as for calibration events, cosmic ray events, high multiplicity, asymmetry, and others.
5. Be easily adapted to include new detectors
6. Be easily adapted to include new understanding of the physics
7. Reject beam-gas interactions
8. Select events in pp and pA for analysis, much as in AA

The constraints on the system include:

1. Must provide a signal to open the TPC amplification grid within 1 micro-sec of the occurrence of the interaction
2. Must locate events to an accuracy of +/-3cm in interaction diamond
3. Must select events based on particles produced in $-2<\eta<2$ interval
4. Must allow understanding of any trigger bias introduced in event selection