



A Veto Selection Criterion for Burst Searches

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An Ineffective Veto

- Vetos divide time T , events N into two sets
 - » N_V vetoed events, N_0 unvetoed events
 - » T_V deadtime, T_0 livetime
- An ineffective veto is uncorrelated with events
 - » Rate of vetoed events in deadtime equal to rate of unvetoed events in livetime

$$R_V = \frac{\overline{N}_V}{\overline{T}_V}$$

$$R_0 = \frac{\overline{N}_0}{\overline{T}_0}$$

$$\overline{R}_0 = \overline{R}_V$$

An Effective Veto

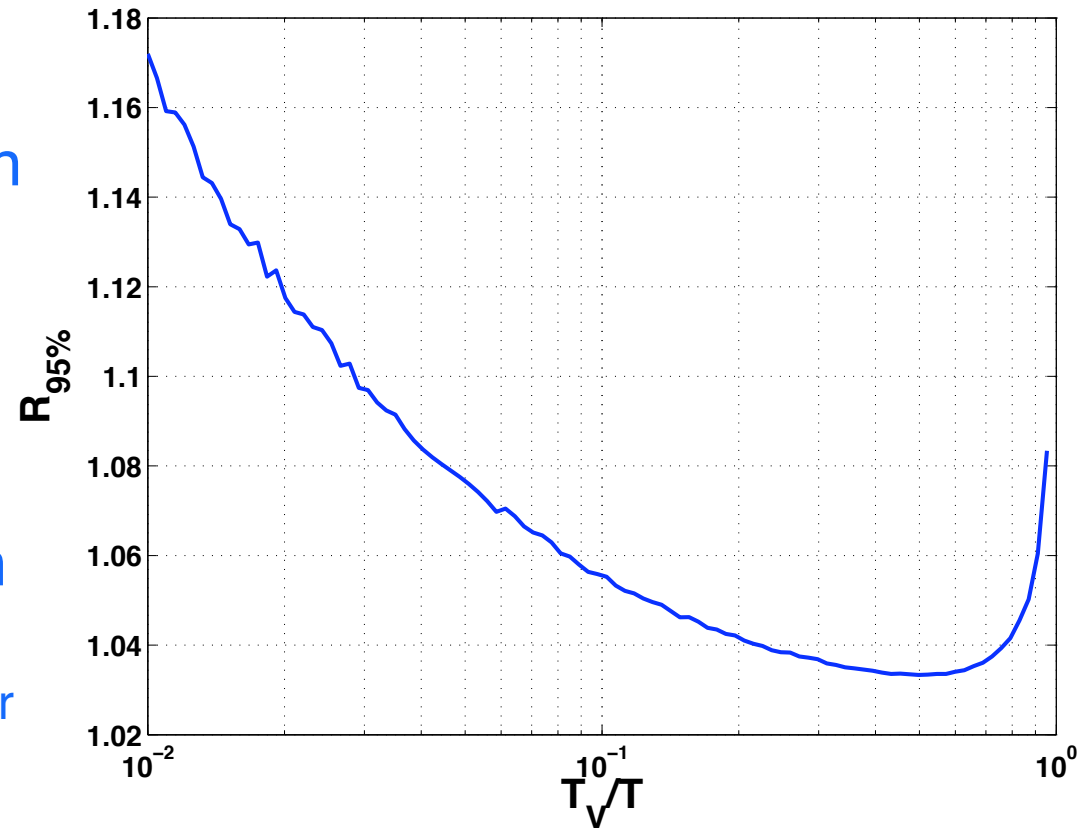
- An effective veto removes more events relative to deadtime than it leaves events relative to livetime
 - » Ratio of vetoed rate to unvetoed rate greater than unity
- Effective vetos set aside more events than would be expected by chance

$$\mathcal{R} \equiv \frac{N_V}{T_V} \frac{T_0}{N_0}$$

Effective Veto: $\mathcal{R} > 1$

When is $\mathcal{R} > 1$?

- \mathcal{R} is a sample from an ensemble. When is \mathcal{R} statistically greater than unity?
 - » Find \mathcal{R}_p such that, just by chance, $\mathcal{R} > \mathcal{R}_p$ with probability p (e.g., 5%)
- Approach by simulation
 - » N Poisson
 - » N_V binomially distributed for fixed N , T_V/T



Summary

- How to recognize an effective veto?
 - » Related: how to tune a veto for greatest effectiveness
- Vetos divide data into two disjoint sets
 - » Vetoes events, “deadtime”; unvetoes events, “livedtime”
- Ineffective Veto?
 - » Rate of events in veto set same as rate of events in unvetoes data
- Effective Veto?
 - » Removes more events per unit deadtime than leaves events per unit livedtime
- Straightforward figure of merit (ratio of rates) and criteria to establish when rate difference is statistically significant
- See Technical Note T030181 for details