On the Wiener disorder problem

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In the Wiener disorder problem, the drift of a Wiener process changes suddenly at some unknown and unobservable disorder time. The objective is to detect this change as quickly as possible after it happens. Earlier work on the Bayesian formulation of this problem brings optimal detection rules assuming that the prior distribution of the change time is given at time zero, and additional information is received by observing the Wiener process only. In this talk, we consider a different information structure where possible causes of this disorder are observed. More precisely, we assume that we also observe an arrival/counting process representing external shocks. The disorder happens because of these shocks, and the change time coincides with one of the arrival times. Such a formulation may arise, for instance, from detecting a change in financial data caused by major financial events/crises. We will formulate the problem in a Bayesian framework assuming that those observable shocks form a Poisson process. We will present an optimal detection rule that minimizes a linear Bayes risk, which includes the expected detection delay and the probability of early false alarms.