A proper account of signal propagation in neuronal networks is the key to developing a genuine understanding of information processing accomplished by the brain. The data can often be in the form of the complex activity of neuronal assemblies and their spiking patterns. Under particular circumstances, neuronal assemblies produce a coordinated synchronized activity with the profile of travelling waves. These have been shown to represent the information processing of, e.g., perceptual sensitivity. We decided to model the phenomenon of the travelling wave by using a spiking neural network model of 1mm^2 of primate's early visual cortices. The modelled neural column was employed to generate synchronized activity. By interconnecting said columns, we were able to model the travelling wave. In order to describe its dynamics, we developed several event-detection algorithms to identify such a travelling wave from simulated neural columns. We discovered that methods based on the detection of local dynamics in moving windows rendered most adequately the intuitive idea of the travelling wave. After establishing our event-detection approach, we shifted the focus to causal inference. Signal propagation is commonly inferred by abstract theoretical concepts like the Granger causality or transfer entropy. In this work, we explore an alternative causal inference based on the notion of a mechanism. To achieve this, we have built an event coincidence causal inference (ECCI) framework. The methodological approach employs an expanded event coincidence analysis with causal windows to form a directional statistical association. Our causal argument lies in the comparison of the two models. The first is the detected statistical association, the second is created by a counterfactual intervention. We show that with ECCI, we can infer causal chains in such a way they capture non-linear and nonstationary relationships that bear answers to, "What is propagating?" and, "When it is happening?" and should be explored as a suitable alternative to the traditional approaches.