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The brain as a trigger system

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There are significant analogies between the issues related to real-time event selection in HEP, and the issues faced by the human visual system. In fact, the visual system needs to extract rapidly the most important elements of the external world from a large flux of information, for survival purposes. A rapid and reliable detection of visual stimuli is essential for triggering autonomic responses to emotive stimuli, for initiating adaptive behaviors and for orienting towards potentially interesting/ dangerous stimuli. The speed of visual processing can be as fast as 20 ms, about only 20 times the duration of the elementary information exchanges by the action potential.

The limitations to the brain capacity to process visual information, imposed by intrinsic energetic costs of neuronal activity, and ecological limits to the size of the skull, require a strong data reduction at an early stage, by creating a compact summary of relevant information, the so called "primal sketch", to be handled by further levels of processing. This is quite similar to the problem of experimental HEP of providing fast data reduction at a reasonable monetary cost, and with a practical device size.

As a result of a joint effort of HEP physicists and practicing vision scientists, we recently found evidence that not only the problems are similar, but the solutions adopted in the two cases also have strong similarities, and their parallel study can actually shed light on each other.

Modeling the visual system as a trigger processor leads to a deeper understanding, and even very specific predictions of its functionality. Conversely, the insights gained from this new approach to vision, can lead to new ideas for enhancing the capabilities of artificial vision systems, and HEP trigger systems as well.

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