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Towards a flexible brain implant with 10.000 independent channels

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ABSTRACT

Electronic implants are becoming a valuable tool to explore as well as regulate neural activity, potentially overcoming neural disabilities that are not yet curable. For effective exploration and regulation, it has become increasingly necessary to cover larger areas of neural tissue and to interact at a higher resolution by means of electrode arrays. Application specific integrated circuits (ASICs) are often employed to accommodate the interaction with these electrodes but these are limited in size, which consequently limits the amount of individual recording or stimulation channels. The de facto solution that allows for the connection of an electrode array to an ASIC is to multiplex high numbers of electrodes to a single ASIC channel. However, due to switching and signal latencies only a limited number of electrodes can be multiplexed per channel. Multiple channels on an ASIC are therefore desirable to accommodate implants with a high electrode count.

Due to recent miniaturization advances, an ever-increasing number of channels can be made available on a single ASIC and the urgency arises to investigate technological complications of connecting these channels to electrodes. In this work we will investigate the technological complications of assembling a flexible electrode array substrate to an ASIC with a high number of independent channels. Our aim is to manufacture a biocompatible multi-layer substrate-ASIC assembly that can route 10.000 independent recording and/or stimulating sites to an array of electrodes covering a large area of the brain.