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DESY MicroTCA Solutions: FPGA- and SoC-Based Platforms for Science Community and Next-Generation Research Facilities

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In this talk, we present the DESY MicroTCA infrastructure and our MSK group digital hardware portfolio for scientific applications, with a focus on high-end RF analog and digital FPGA-based electronics deployed at facilities such as FLASH, XFEL, PETRA III, PETRA IV, and future DESY installations, all of which are based on the MicroTCA standard. A central element of the DESY MSK approach is cultivating an ecosystem in collaboration with industrial partners: maintaining core competencies in-house, sourcing standard components externally, and licensing hardware, firmware, and software to industry to simplify board procurement. The portfolio features a range of System-on-Chip (SoC)–based boards centered on the DMMC-STAMP, which provides MicroTCA management and a comprehensive software framework. This talk also reviews the recent MicroTCA cards, including the DAMC-FMC2ZUP ("Supercarrier"), the DAMC-UNIZUP (a universal, cost-optimized MPSoC board derived from the Supercarrier), the DAMC-DS5014DR (a high-speed, multi-channel gigasample digitizer based on AMD RFSoC), the DAMC-DS812ZUP (a 4- or 8-channel gigasample digitizer), and a MicroTCA motion controller that heterogeneously combines an MPSoC with a Kintex-7 FPGA. Finally, we discuss how our team actively supports the MicroTCA community by providing MicroTCA.4 and RTM design templates to encourage adoption and ensure board interoperability, as well as flexible laboratory development tools such as the MicroTCA Bring-up Adapter.

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