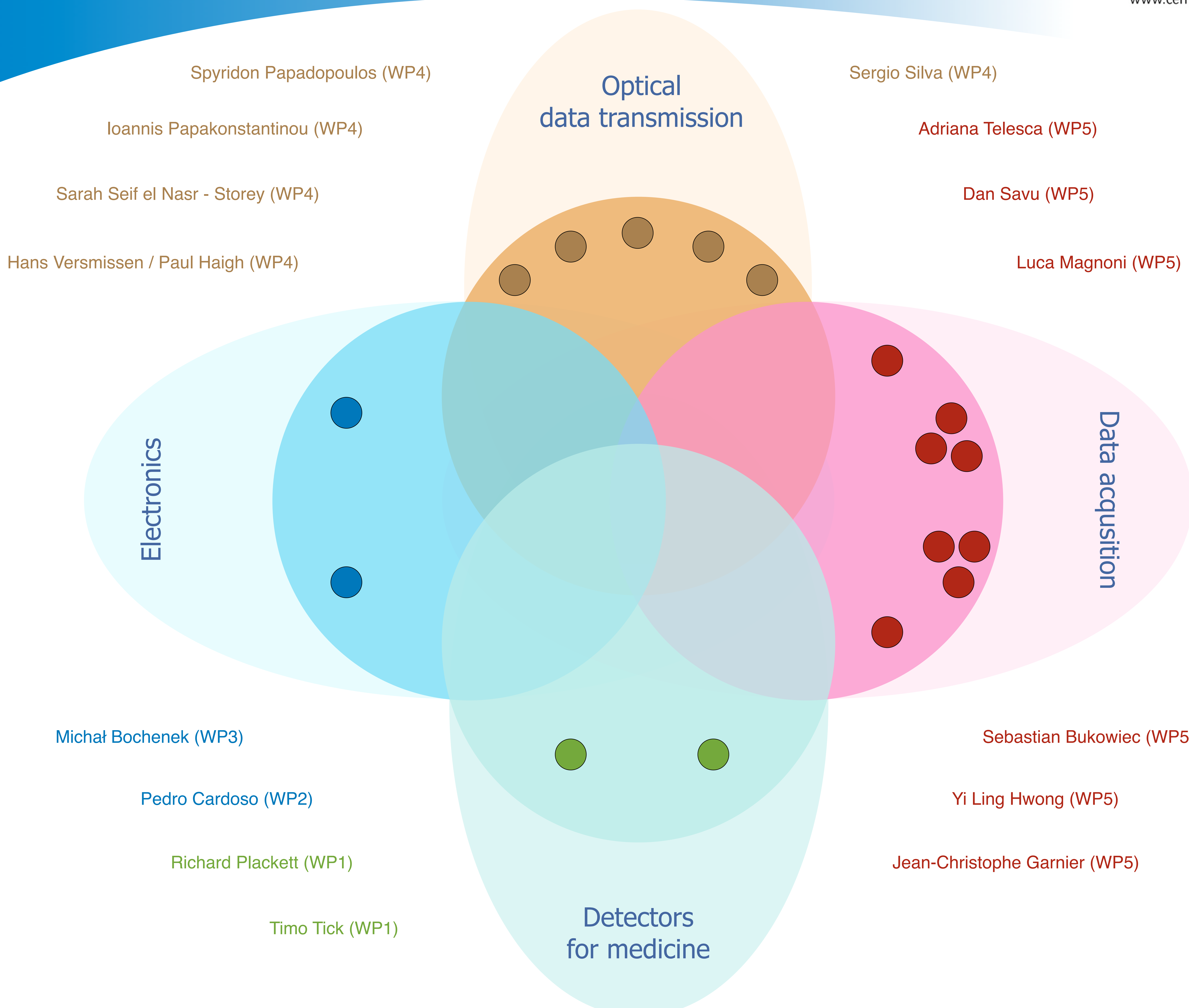


# ACEOLE Project

Data Acquisition, Electronics, and Optoelectronics for LHC Experiments



## Work Package 1

- Development of experiments covering large areas with existing pixel detector tiles for X-ray imaging, X-ray diffraction.
- Study of potential moderately large area tiling solutions; design of low-mass assemblies suitable for tiling moderately large areas of pixel arrays; construction and evaluation of demonstrator assemblies implementing the most promising tiling solution(s) for particle tracking and/or photon counting applications.

## Work Package 2

- Development of one or more of the required low-power, ultra-radiation-hard ASIC building blocks or functions (in first instance a PLL) in 130nm CMOS technology. Study of the radiation-tolerant design methodology and CAE tools and establishing a specification; design of a prototype ASIC; electrical and functional characterization before and after irradiation; design, fabrication, characterization and documentation of a final version.

## Work Package 3

Design and development of radiation-tolerant ASIC building blocks compatible with architectures employing serial powering and/or the local DC-DC conversion approach for an upgraded front-end readout circuit for the ATLAS tracker. Design of a prototype building block, fabrication, electrical, functional and radiation characterization. Optimization of the building block and integration into a full ATLAS tracker demonstrator ASIC.

## Work Package 4

- A tracking detector operating at the SLHC will require ten times more readout data bandwidth and radiation tolerance than at the current LHC detectors. As described above it is important to limit the amount of material in the detector, therefore the work package will develop versatile multi-Gigabit speed, radiation-tolerant, low-mass, high density, non-magnetic optical link technology to cover data transmission requirements for SLHC.
- Network architectures for particle physics applications: Point to Point (P2P) and Passive Optical Network (PON) standards, simplified protocols, system simulations and prototyping, test procedures and tools.
- Characterization and analysis of electro-optic components in isolation and embedded in their package..
- Assessment of radiation resistant transceiver ASICs, test and qualification of packaged optoelectronic components. Estimation of components' and system reliability through activation energy calculation and accelerated aging tests. Establishment of irradiation methodology and development of test setups; irradiation runs, analysis.
- Dense assembly of high speed electronic and optoelectronic components, light in- and out-coupling, high frequency electrical connectors, signal integrity, Electro Magnetic Interference (EMI) reduction, thermal conductivity, low-mass non-magnetic rugged packaging.

## Work Package 5

- Initial ramp-up of the DAQ networks to full production size; development of techniques for profiling and monitoring the network performance and the optimization of the routed network.
- Inclusion of fault handling in the DAQ systems in order to achieve high data taking efficiency. Fault tolerance needs to be addressed at all levels, from transmission errors of event data through the switching fabric up to failures of computing nodes, and provides projects ranging from low levels, such as device drivers, up to the high level overall experiment run control system.
- Optimization of the networked data storage system in the areas of data reliability and storage virtualization.
- Studies for DAQ Upgrades for SLHC Experiments: tracking of networking technology and an R&D effort on constructing an event collection system with multi-Gbps links.

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