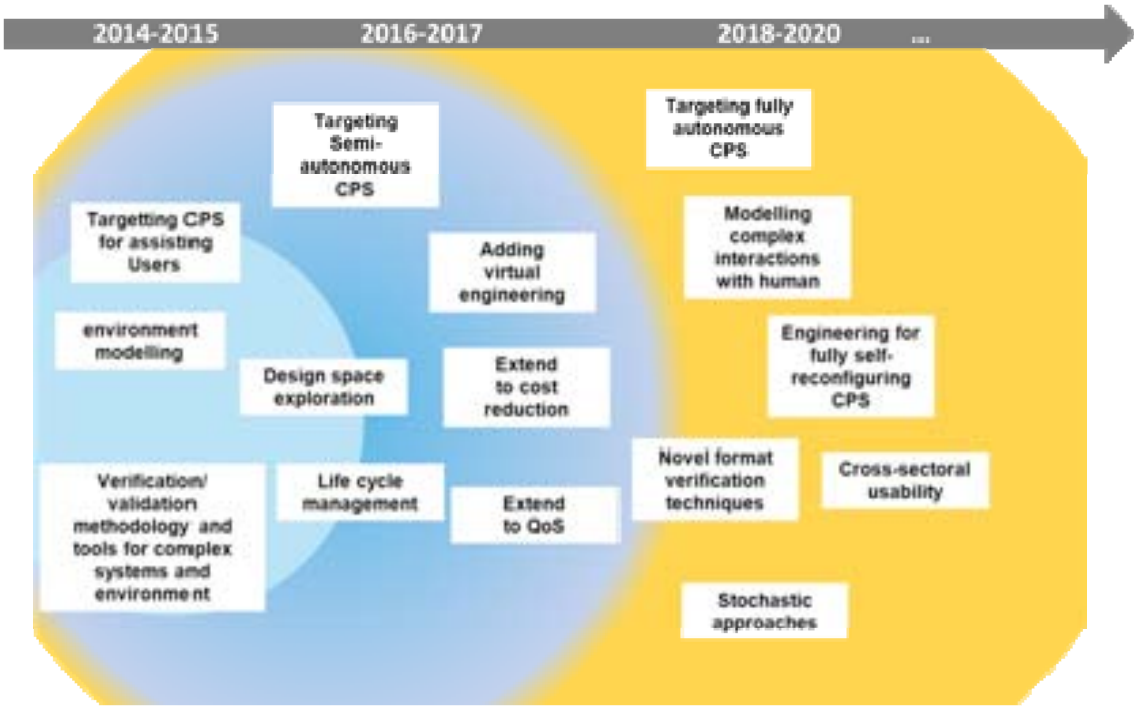
B- **<u>System Design, modelling and virtual engineering for Cyber-Physical Systems</u>**

- **Short term:** for targeting CPS for assisting users: integrating environment modelling, design space exploration, verification and validation methodology and tools for complex systems and environments as well as Life cycle management.

- **Medium term**: for targeting semi-autonomous CPS: adding virtual engineering extending design space exploration for cost reduction/ Quality of Services tradeoffs.

- **Longer-term**: for targeting fully autonomous (including bio-inspired approaches) CPS, modelling complex interactions with humans. Addressing engineering of fully self-reconfiguring CPS, adopting novel format verification techniques, including stochastic approaches, developing of cross-sectorial usability.



Research Challenge	Expected Impact (Sub-Challenges)	Ph1 2014 - 2015	Ph2 2016 - 2017	Ph3 2018 - 2020	Cross reference to Annex1
B - System Design, modeling and virtual engineering for CPS					
6. Modeling and simulation techniques for efficient methods (including RTP) and tools .	Reduced cost and cycle of system design. Manage the complexity increase of 100% with 20% effort reduction				
B.1 Life Cycle management for CPS-based products	Interoperability of tools throughout the entire product life-cycle; full traceability, Improved logistic support (e.g., configuration management);				4.6
B.2 Virtual engineering of CPS	Multi-domain engineering (hydraulics, electrical, mechanical, communication) methods and tools, including reference platforms and tool chains for complex, multi-critical, multi-manufacturer Systems/CPS; Cost reduction of system design, increased quality of services and cross-sectors usability; New standards for global cost reduction				4.1; 4.2; 4.3
B.3 Verification and validation methodology and tools for Complex CPS	Methods to select relevant test scenarios and define test coverage, stochastic testing, models of environment (e.g. traffic simulation), creation of test scenarios, formal verification.				
B.4 Integration of environment modeling and simulation into the HW and SW design flow	Efficient modeling and simulation of environmental effects on embedded systems in large complex systems; Reduction of the product development cycle while increasing product and service quality				6.1; 6.2
B.5 Provide complete tool-chains for Model-Based Design	Efficient modeling and simulation of human being and their interaction in the CPS				
B.6 Provide complete tool-chains for Model-Based Design	Practical architectural exploration and development tools based on common meta models; Provide tool facilities to detect problems earlier in the development life cycle; multi-disciplinary modeling tools; Improve Quality of Service; reduce effort and time for re-validation and re-certification after change;				6.3; 6.4; 6.5

Research Challenge	Expected Impact (Sub-Challenges)	Ph1 2014 - 2015	Ph2 2016 - 2017	Ph3 2018 - 2020	Cross reference to Annex1
B.7 Engineering for complex systems and environment	Managing the complexity and reducing design costs. Complexity management of embedded systems interactions Intelligent interfaces and artifacts Reuse of low level software elements, sub-systems, and design and validation tasks Enable development of systems which are several times more complex than the current ones and that are needed to solve societal problems without increasing development cost; Enable navigation through the development cycle; Standardization of meta-model to achieve interoperability between tools; provide capabilities to easily integrate specific process, meta-model, profile or architecture in development tools; Achieve cross-sectoral reusability of designs and models.				4.4; 4.5; 4.3; 6.6; 6.7; 6.8; 6.9