# THÈSE

présentée par

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## *Approche et environnement fondés sur les styles architecturaux pour le développement de logiciels propres à des domaines spécifiques*

*Application au domaine de la supervision du redémarrage d'accélérateurs de particules*

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# Abstract

Software development techniques were, at first, dedicated to the design of single applications, satisfying specific requirements. Today it is necessary, for cost and "time to market" reasons, to define and implement a set of methods allowing the development of families of software that share common characteristics.

The issue considered in this thesis concerns the definition of a domain-specific development model, as well as its exploitation and evolution in a dedicated software environment. The research philosophy chosen to reach this goal was the use of architectural development techniques including the definition of architectural styles. An architectural style allows the specification of the common characteristics of software families, and the production of applications satisfying the properties defined at the style level.

Concerning existing works, the classical process used to define and to exploit the architectural styles assumes that the application domain expertise is complete and that the style can be directly and entirely defined and can be used to produce applications that satisfy clearly established requirements. However, in most cases, the domain expertise is available (e.g. prototype applications) but incomplete, and the user requirements are not static, but they are expected to evolve frequently. On the subject of the definition and the formalisation of architectural styles, many techniques and languages are available. However, even if some techniques allow the use of styles in the parameterisation of generic development environments in order to specialise them for domain-specific development, there is no single approach allowing the production development environment from styles.

In this context, this thesis defines:
- an inductive process that allows the definition of an architectural style from prototype applications, and the evolution of the style according to the evolution of the requirements concerning the applications constructed from this style;
- an environment dedicated to the development of domain-specific software that satisfies the constraints of an architectural style;
- a new monitoring software design and production approach (the application domain of this thesis), based on the definition and the use of architectural styles.

The approaches and processes proposed in this thesis have been validated in the implementation of a development environment, SEAM (Software for the Engineering of Accelerator Monitoring), which guides and enables the optimisation of particle accelerator monitoring software production.

**Keywords:** Software Architectures, Architectural Styles, Domain-Specific Software Architectures, Software Evolution and Monitoring Software.