

CREMLINplus Task 5.3 Development of software

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CREMLIN PLUS
Connecting Russian and European Measures
for Large-scale Research Infrastructures

Objectives

- A flexible software allowing to make motivated decisions about detector and its subsystems design.
- Featuring all common (offline) software tasks: event generation, full detector simulation with digitization, reconstruction and analysis.
- Initially agreed to be based on
 - ▶ Gaudi (overall framework),
 - ▶ Geant4 (simulation),
 - ▶ ROOT (data analysis, statistical interpretation, data storage),
 - ▶ DD4hep (flexible detector geometry description toolkit).
- Going to utilize as much of external software as possible (various HEP and general software packages, Belle2 analysis tools. . .)
- Looking forward to perform distributed computing with the DIRAC interware and publish the detector software via CVMFS.

The Aurora framework

- Generally inspired by ATLAS Athena.
- Based on standard tools (Gaudi, ROOT, Geant4, ...).
- Lots of adopted code (FCCSW, Belle2, ILC, ...).
- Includes (or should include)
 - ▶ physical generators
 - ▶ parameterized simulation,
 - ▶ full simulation,
 - ▶ digitization,
 - ▶ reconstruction of simulated (and real) events,
 - ▶ analysis tools,
 - ▶ visualization tools,
 - ▶ etc.
- Also provides
 - ▶ a build system,
 - ▶ an external software repository.

The Aurora framework organization

- The framework organized in packages, each package being responsible for a certain task.
- Concurrent variants of detector subsystems are implemented as separated packages which could be selected at runtime.
- A user is able to work with “pure” Aurora or add new packages or modify some of the existing ones.
- There is a set of wrapper packages to flawlessly incorporate external software into Aurora build system.
- The whole framework tree is hosted in the git repository, git being important part of the development workflow.

Aurora development

People at BINP

- Base software development team
 - ▶ design & develop general framework
 - ▶ provide users with examples and basic package version
 - ▶ implement modules when experts are unavailable
 - ▶ prepare build, test, visualization etc tools

— now 4 persons
- Subsystem experts
 - ▶ expected to prepare comprehensive parts of the code concerned with corresponding subsystem(s)
 - ▶ framework usage and feedback
- Physics & Analysis experts
 - ▶ event generation and analysis tools implementation
 - ▶ framework usage and feedback
- Parameterized simulation team

Aurora development

Hardware at BINP

BINP/General Computing Facility provides:

- general login servers,
- computing nodes & batch system,
- disk storage,
- git server,
- other things not related directly to Aurora.

BINP/GCF also features:

- exclusive Internet channel (with LHCone access)
 - to be used for heavy data flows,
- fast links to NSC computing centers.

The computing resources seem sufficient for the current project stage.

BINP/GCF team is 2 persons + CSD support.

Foreign contributions

- CERN team
 - ▶ full simulation and reconstruction of TPC as inner tracker
 - ▶ CVMFS repository at CERN
- Collaborators for detector subsystems
 - ▶ expected to participate in the corresponding subsystem activities

- Generators
 - ▶ a basic set implemented
- Parameterized simulation
 - ▶ standalone
 - ▶ generally ready to use
 - ▶ porting to Aurora is ongoing
- Detector geometry
 - ▶ at least basic description for all detector elements (most advanced for Calo & BeamPipe)
 - ▶ usable in full simulation
 - ▶ test & visualization tools implemented
- Full simulation
 - ▶ Sensitive Detectors are under development
 - ▶ stereolayers-featuring DC segmentation is being implemented
 - ▶ EDM is not finalized yet (proposed to converge to EDM4hep)
 - ▶ simplified digitization modules are to be implemented this year

Aurora status (2)

- Analysis activities
 - ▶ porting Belle2 tools
 - ▶ ...
- Collaboration with foreign teams
 - ▶ stalled
- Build system
 - ▶ ready to use...
 - ▶ ...and evolves further
- External software
 - ▶ lcgmake-based builds are routine
 - ▶ updated and expanded according to demands

Task 5.3 Deliverables

Month 18 Status report on the software for the SCT detector
Also the release of SCT software

Month 44 Final report on the software for the SCT detector

Also need to publish a general paper describing the SCT detector software.