Proposal for Software WG (DRD4 : WG 4.4)

DRD4 community meeting

From DRD4 preparation team

Science and Technology Facilities Council

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15-06-2023

Preamble

- Main goals:
  - Address the software issues related to the next generation of detectors developed in DRD4
  - Develop software packages of common interest for the DRD4 community
  - Share experiences from software developments in different projects
- Previous survey:
  - Six institutes already put forward projects/topics of interest for this WG.
  - Another ten institutes expressed an interest in participating in this WG.
- The projects suggested so far include:
  - Using new software architectures such as GPUs, to speed up the simulation and reconstruction of data
  - Using ‘Machine Learning’ and other novel methods for particle identification(PID) algorithms
  - Developing a framework to test software developed in the new architectures
    Developing methods to evaluate the performance of the novel PID algorithms
  - Creating tools that enable fast simulation of the optical layout of a new detector
- Work Packages (WP):
  - Some of these projects may become WPs within DRDT 4.3. A WP is normally proposed by multiple institutes.
    At present most of these do not have more than one institute listed. Names of 3 WPs suggested are listed on page 4.
  - These projects can be topics of discussion in the WG, regardless of whether they become WPs or not.
- In the future more projects may be created.

General plans

- WG members may work on design and implementation of new software tools relevant for the next generation of Cherenkov detectors.

- This may also help with the development of PID techniques foreseen in WG 4.2.

- The WG members may collaborate with other software organizations such as HSF and WLCG, whenever needed.

- WG gives opportunities to share experiences from different experiments and provide help to new members. However, this requires provisions to be made so that experts in different aspects of software are available to provide the necessary support. At present there are only a limited number of experts.

- Initial validation of some of the software tools developed in the WG:
  - To facilitate this, a good option would be to create two examples of RICH detector description in the WG. These will be for:
    - ❖ a detector in the forward geometry
    - ❖ a detector in the barrel geometry

- Spin-off
  - Developing software in the GPUs and developing machine learning techniques have applications outside HEP.
  - The simulation of optical photons is not limited to Cherenkov detectors and can be used for different detectors that use optical photons.

Projects proposed as WPs

1: Reconstruction and PID from RICH/TORCH using novel architectures such as GPU

- WP proposed (Cambridge) :
  - *WP 1.1: Exploitation of novel processor architectures for PID*
  - *WP 1.2: Development of testbench/framework to facilitate the evaluation of novel architectures. Using real world algorithms, evaluate their performance and resource usage*

Bristol: interested in fast pattern recognition

2: Accelerated computing (using GPUs) for the simulation of Cherenkov detectors

- WP proposed (STFC-RAL):
  - *WP 2.1 Use GPUs for the optical photon simulation in RICH detectors*

3: Development of PID algorithms using machine learning techniques and other novel methods

- WP proposed (Cambridge):
  - WP 3.1: Exploitation of novel reconstruction algorithms for RICH PID
  - WP 3.2: Development of detector-agnostic software framework for the evaluation of new PID algorithms

QMUL (London), JSI , Genoa: interested in machine learning techniques for PID