Handling calibration parameters

Subatomic physics / computing project

Background

Reaction studies with relativisic, exotic nuclei are performed with the LAND setup (Large Area Neutron Detector) at GSI, Germany. During a one-week experimental run, about 5 TB of raw data is recorded. This data is then carefully analysed. One major ingredient in the analysis are calibration parameters for each of the about 10000 electronic channels of the 10 different detectors. Due to the time-wise slightly varying characteristics of the equipment during the experimental campaigns, the amount of information can increase by another factor 10.

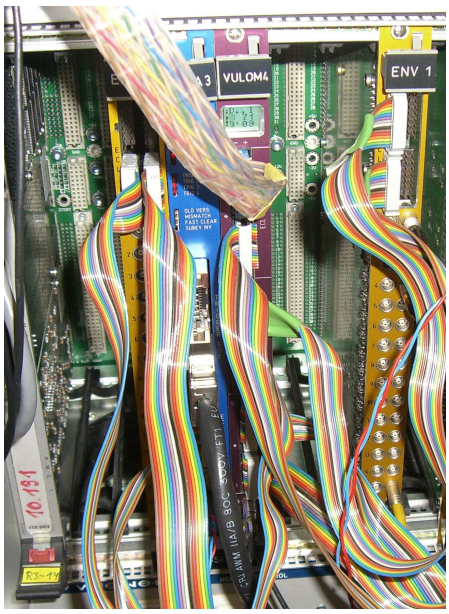
The parameters are stored in text files, and injected into the analysis process by a `lex/yacc` (`flex/bison`)-based lexer-parser stage. The absolute majority of the parameters are determined by special programs in the analysis chain, producing formatted text output. The parameter files are maintained by source code versioning tools, and we are quite happy with the workflow this approach enables.

As the setup now is transforming into R^3B (Reactions with Relativistic Radioactive Beams), the channel count is growing by an order of magnitude. Also, the increased complexity is likely to require the use of more parameters per channel than before.

The current implemention surrounding the lexer-parser is already limiting analysis speeds in some cases, and will not scale nicely with the increased amount of information. A next generation tool is therefore needed. In addition, a number of missing features in the current system have been identified, such as more flexible unit handling. These would be ideal to introduce with a new system.

Project description

The main part of the project is to implement a next generation parameter parser. By devising an efficient intermediate (volatile) binary file format, the injection can be broken out to a parse-and-sort stage akin to a compile-link chain. The preprocessed information would then be digested by the more time-critical analysis using a light-weight access library.



For maximum reusability, the code shall be written in C, and preferably have no external library dependencies. Naturally, `lex` and `yacc` would be part of the build process (governed by `make` and some scripts).

Knowledge in C(/C++) is necessary, as well as familiarity with (or interest in learing) lexer-parser use. The project is large enough for several students (certainly more than one term), perhaps combining the skills of physicists and computer scientists / software engineers.

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