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# A high-level language for specifying detector coincidences

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The muCap experiment at the Paul Scherrer Institut (PSI) will measure the rate of muon capture on the proton to a precision of 1% by comparing the apparent lifetimes of positive and negative muons in hydrogen. This rate may be related to the induced pseudoscalar weak form factor of the proton.

Superficially, the muCap apparatus looks something like a miniature model of a collider detector. Muons pass through several beam counters before reaching a hydrogen-filled time projection chamber (TPC) at its core, which acts as both a stopping target and the primary muon detector. It is surrounded by cylindrical wire chambers and a scintillator hodoscope to observe the Michel electrons that emerge from muon decay. The first key step in the analysis of our data is the proper definition of coincidence events across these many detector layers, maximizing the signal significance by suppressing accidental and pileup backgrounds. Part of our analysis software is written in a special-purpose high-level language, called "muon query language" (MQL), in which these coincidences may be specified cleanly. It uses a variant of the relational model, representing the data as a set of tables upon which selection and join operations may be performed. ROOT histograms and trees are defined based on the contents of tables. A preprocessor generates optimized C++ code that implements the operations described in the MQL file, which is suitable for incorporation into our analyzer framework. This talk will describe the MQL approach and our collaboration's experience with it.

**Primary author:**   GRAY, F. (UNIVERSITY OF CALIFORNIA, BERKELEY)

**Presenter:**   GRAY, F. (UNIVERSITY OF CALIFORNIA, BERKELEY)

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