STAR ☆ ONLINE CONTROL SYSTEMS & EXPERIMENT STATUS

Keeping track of what's going on from near and far...

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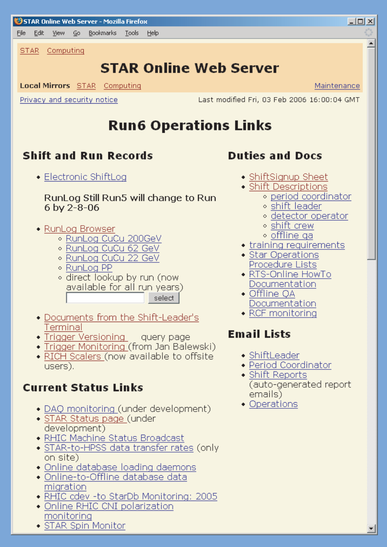
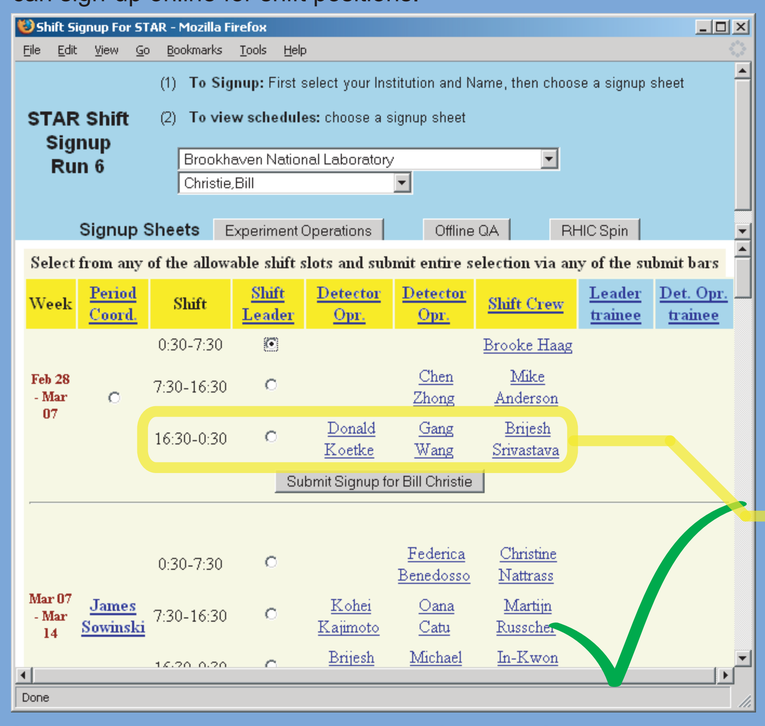
STAR operations simultaneously call for and generate a large amount of diverse information beyond the raw physics data. STAR uses a variety of readily available and inexpensive tools, relying heavily on a LAMP infrastructure (Linux, Apache, MySQL, Perl/PHP/Python), to bring as much of this information as possible into the Control Room as well as the worldwide offices of collaborators. Ranging from dynamic event-by-event details upon which decisions are made in the Control Room to somewhat mundane matters like 24-hour shift crew sign-up, the various techniques and information greatly enhance the data-taking efficiency and subsequent data analysis. Shown below are several components of our own creation that we find especially valuable, as we follow a typical collaborator's path through our online systems.

Starting from STAR's online home page, our collaborators can find links to information for prospective crew members, such as the duties and required qualifications for the various roles.



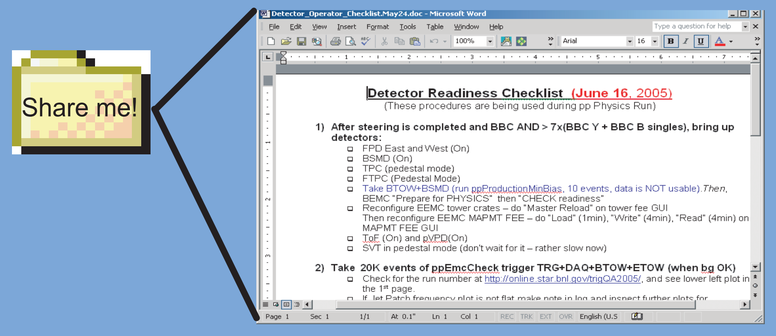
Once a collaborator is ready to begin analyzing data and making recommendations for future operations, this site is a portal to a wealth of information about what has been done to date.

Once familiar with what he is getting himself into, a collaborator can sign-up online for shift positions.



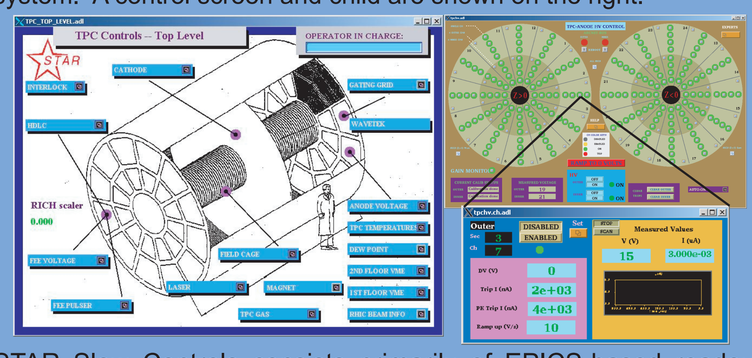
Organizing 24-hour, multi-person shift crews for a multi-national collaboration can be a challenge. A php-based shift-sign up system allows collaborators to sign-up for shift positions online. Behind the scenes, a database keeps track of the sign-ups, as well as the institution and qualifications of the collaborators, preventing a member from signing up for shifts for which he is not approved or qualified. Another benefit of this approach is the possibility to do a quick end-of-run shift tally to assign credit to participating institutions.

Before and during his shifts, our collaborator can look over what previous shift leaders deem especially important about how things are done, such as the checklist shown here:

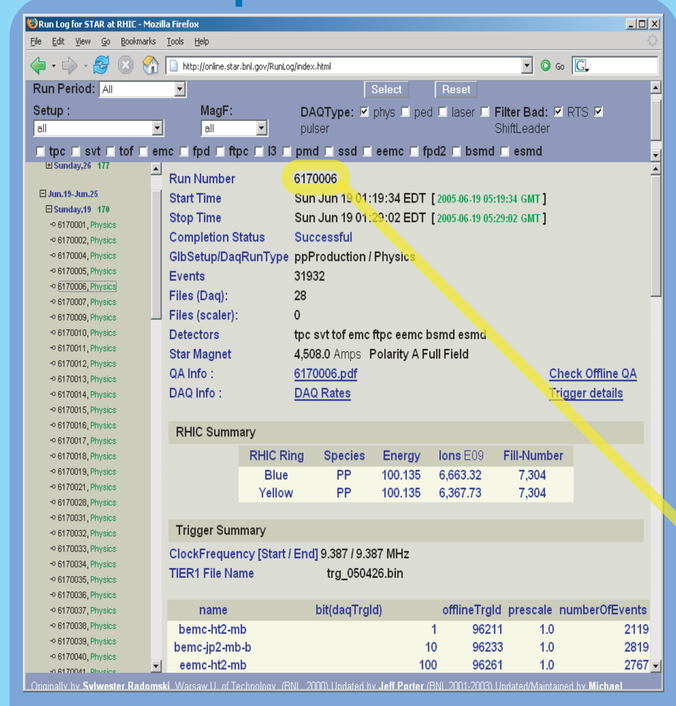


The shift leaders' terminal includes a desktop folder in which they can place documents for immediate online viewing, with a relatively easy to recall URL, such as http://server/shift-leader/xyz.doc.

Once on shift, crew members have the reigns of the detector subsystems in their hands in the form of "Slow Controls". They will spend a lot of time looking at screens such as those shown below. On the left is the top level graphical menu of the STAR TPC control system. A control screen and child are shown on the right.



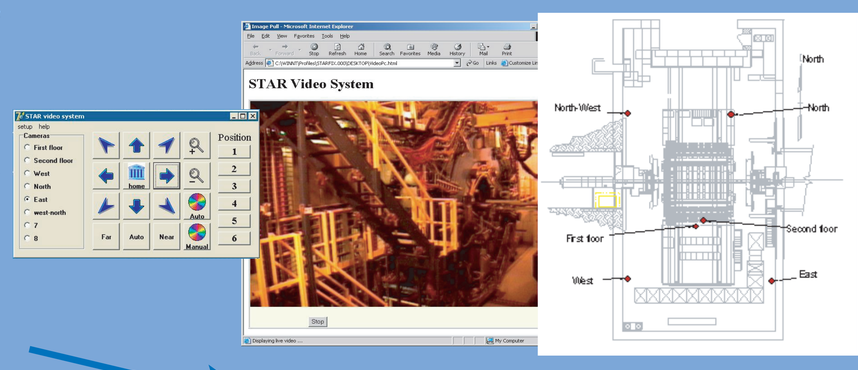
STAR Slow Controls consists primarily of EPICS-based readout and control of most subsystem parameters, though some subsystems rely on LabVIEW and various home-grown software. EPICS, hosted at Argonne National Laboratory, is a collaboratively developed set of Open Source software to create distributed soft real-time control systems.



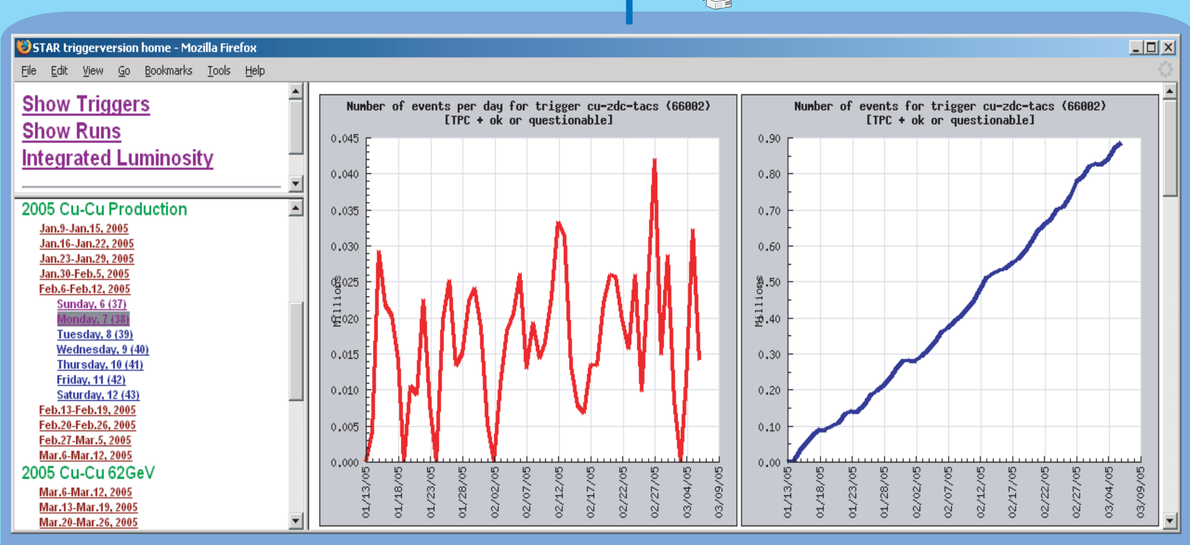
A frequently used tool to extract DAQ and run information is our PHP-based RunLog Browser. Essentially every detail about any particular run is available, such as detector states, number of events by trigger, collider status, and file storage, plus the software can create summary information covering multiple runs. Having helped collect this data, our collaborator's work has just begun, and he may return to these tools many times as he works to understand the experiment and the physics.

MySQL databases are key components behind the scenes. They allow inter-connections and integration between the various tools and subsytems.

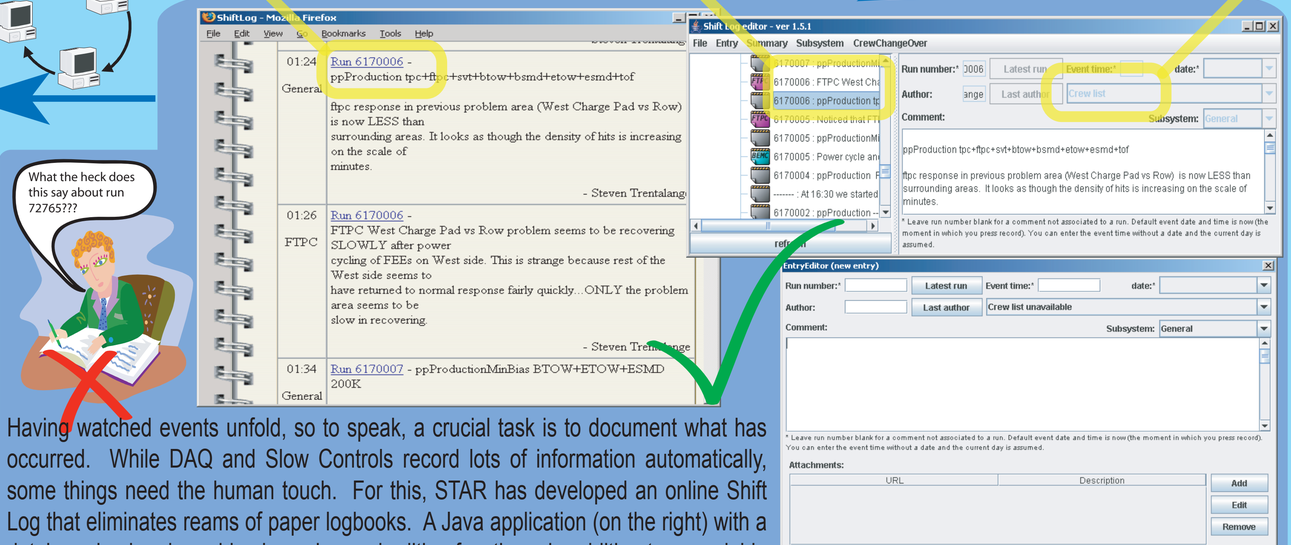
The STAR detector area is off-limits for long periods of time. But sometimes a look at what's happening is essential. A system of six remotely controlled video cameras often does the trick. In the Control Room a remote control for the cameras allows camera selection, aiming, focusing and zooming. Preset positions allow quick selection of commonly requested views, which can include individual instruments in remarkable detail. The current video selection is available via a web server. Shown here are the camera control window, a sample image of STAR from the southeast and the camera map.



While running, an event pool is continuously filled with events (at a few Hertz, while the main event rate for tracking detectors is ~60-90Hz). From the event pool, online QA analysis is done (which can include quick passes on particle tracking) allowing runs to be marked good or bad in nearly real-time. The shift crew even gets to look in on what's happening with two large wall-mounted plasma displays shown here with OpenGL-based renderings of events complete with online tracking. This also makes a great educational tool for visitors to the Control Room (and beyond -- for example, during running in 2005, for some time a version of live STAR events was displayed on the side of a building in Germany and watched by a live WebCam!)



While the shift crew keep the logbook, the DAQ system stores run and trigger information for just about everything it does in online databases. Many different interfaces to this information are possible, allowing integration with things such as the Shift Log discussed to the right as well as stand-alone type queries that are relatively easy to create. Shown here for example is a page depicting the trigger rate and cumulative number of triggers for a particular trigger type during a selected period of time. These graphs are dynamically generated by php code.



Having watched events unfold, so to speak, a crucial task is to document what has occurred. While DAQ and Slow Controls record lots of information automatically, some things need the human touch. For this, STAR has developed an online Shift Log that eliminates reams of paper logbooks. A Java application (on the right) with a database backend provides browsing and editing functions, in addition to a readable logbook served through a web server (shown above). Entries can be associated with individual subsystems, effectively creating multiple logbooks in one. Other features of the system include automatic creation of links to run information, creation of Shift Summary reports, the inclusion of attachments, checklists for Shift Changeovers and even keeping track of crew members by checking the shift-sign up database.