Little helpers for your experiment - NOBUGS2002/013

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The World Wide Web (WWW) is a wonderful tool to provide users with documentation and tools that make the preparation and running of an experiment a little easier. We present a set of tools that allow one to estimate the activation of a sample in the neutron beam, or to calculate the absorption of a sample. Ever tried to figure out the time for the next sample change - here our scheduler can help. In addition there is a simple database that can be used to keep track of all the data files collected at various facilities. We present these little tools, but also demonstrate how easy it is to create new WWW based tools that make the life of users easier.

I. INTRODUCTION

Visiting a user facility such as a synchrotron or neutron source for the first time to carry out an experiment can be a overwhelming experience. One of the major stepping stones is to learn how to use the control software for the instrument and how to extract, process and view the data collected. But there are also minor issues such as, how do I find out about the activation of my sample after a two day neutron diffraction experiment. The World Wide Web (WWW) is a great tool to provide documentation that help users to prepare for an experiment and to find answers to common questions during the experiment. While much can be accomplished by static WWW documents, a lot of useful help can be added by including interactive WWW pages. A perfect example are the various interactive pages offered to users by the Institut Laue-Langevin in Grenoble, France at http://barns.ill.fr. Another example is a diffraction physics tutorial1 which allows students to simulate disordered structures and explore the corresponding scattering pattern. This is achieved by interfacing the diffuse scattering simulation program DISCUS2 with a WWW based form allowing students to change various parameters of the simulation.

In this paper we will briefly show how easy it is to add a WWW form interface to a given program and we present three of our own examples. Here we are mainly concerned with the WWW interface, in a separate paper3 we discuss how old programs can be improved by adding a graphical users interface.

II. SIMPLE EXAMPLE

As a simple example, we will present a WWW based tool that converts temperatures from Fahrenheit to Celsius. The conversion is

$$T_C = \frac{5}{9}(T_F - 32.0) \quad (1)$$

The first part is to create the WWW page that contains the form that allows one to enter the parameters, in our case the temperature in F. The HTML code for our example page is listed in Fig. 1. After the usual HTML header lines, the form is started with the tag form. The field action specifies the location of the script that will process the form input. Obviously one needs to have a WWW server running that allows one to run scripts in the cgi-bin directory. The tag input specifies the input field for the temperature that we want to convert. Note the field name="TEMP" which labels this input field. This label will be used later in the script that is called once the Convert to C button is pressed. The actual appearance of our little form in a WWW browser is shown in Fig. 2.

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FIG. 1: HTML code for input WWW page of the temperature converter.

FIG. 2: Input page in WWW browser.
use CGI;
$cgi=CGI::new();
$ftemp=$cgi->param('TEMP');
$ctemp=5.0/9.0*($ftemp-32.0);
print $cgi->header()."\n";
print $cgi->start_html(-title=>'T. converter');
print "<hr><h1>$ftemp F = $ctemp C</h1><hr>
print$cgi->end_html()."\n";

FIG. 3: CGI script of the temperature converter.

98 F = 36.666666666666667 C

FIG. 4: Output of temperature converter

ment $ftemp=$cgi->param('TEMP'). Note that TEMP is the value of the name field of the corresponding input field in the HTML page listed above (Fig. 1). Next we calculate the corresponding temperature in degrees Celsius using Eq. 1. The last four lines of the script produce the HTML output. First a correct HTML header is written, followed by the title and the line containing the result. Finally the HTML document is closed. The output from our conversion script as is appears in a WWW browser is shown in Fig. 4. Hopefully this simple example has illustrated how easy it is to create interactive WWW pages. As we have mentioned before, a script called by a WWW form can also execute more complex external programs, allowing one to use the WWW as a computer platform independent graphical users interface. Obviously the result can also be in graphical form (see interactive guide on diffraction physics\(^1\)). There is also a large number of books about creating WWW pages.

III. EXAMPLES

In this section we will briefly discuss three scripts that we think are useful to users. The scripts and more information can be obtained by contacting the authors.

A. Activate

Before putting a sample in the beam of an instrument at a spallation neutron source, it is helpful to estimate how active the sample will get as a result of being irradiated by neutrons for the duration of the experiment. Although this estimate is straightforward and in many cases the needed material constants, are listed in the beamline documentation, it is still a barrier to the experimentalist who has to worry about many details of the experiment. To make the activation estimate as easy as possible, we have developed a WWW interface that allows one to enter sample composition, sample mass and neutron beam current. As a result the estimated storage time as well as additional information is listed. The script also displays an extensive help text that aids users to understand the resulting numbers and it also emphasizes that fact that this is a simple estimate and not a details activation calculation.

B. Beam time scheduler

Another common task during an experiment is to estimate a schedule of the experiment taking into account sample cooling and warming rates, measuring time and the time required to change a sample. This helps to determine when the experimenter needs to be back at the instrument to e.g. change the sample and how many temperature points one can fit in the given beam time allocation. However, as things change during the experiment, this schedule needs to be updated and one might need to decide to drop a temperature point or reduce the measurement time. A WWW based tool that aids these estimates is the beam time scheduler. A screen shot is shown in Fig. 5. The tool allows one to specify sample cooling and warming rates as well as the typical sample change time. Then the sample compositions and measurement times are entered. By comparing temperatures and sample compositions, the script determines the total
time required for a measurement and calculated starting data and time for each experiment. Once a run is started, the real starting time is entered and all the following times are recalculated. This way one has always as accurate as possible estimate of the starting times for all subsequent measurements, assuming of course nothing goes wrong. The authors have used this tool many times and found it to be a very helpful tool. The printer format button creates a table suitable for printing and adding to the experiment log book.

C. Experimental data database

The last tool available is a database for experimental data. Although most user facilities have data bases for all experimental data collected, a single research group might collect data at many different facilities. The experimental data data base PDFsearchN is a simple WWW based tool to search a local data base of experimental data. The WWW search tool is accompanied by a check-in and check-out script for those data. The idea is that after an experiment is done, the data and all relevant experiment information are entered. This way the information written down in individual experiment log books become easily available to the research group and finding data several years after they were measured becomes very simple.

IV. CONCLUSIONS

The WWW is the perfect way to distribute documentation and interactive tools in a simple and computer platform independent way. Most people are familiar with using a WWW browser and having the information “on the net” also allows users to learn about a particular instrument before they actually arrive at the facility. Apart from documentation, there are many examples of helpful tools that can be implemented as interactive WWW forms. In this paper we have presented a simple example of a temperature converter, illustrating how easy it is to develop those interactive WWW based tools. We also have shown three simple tools that might be particularly helpful to users of large radiation facilities. Comments or requests for software or more information are welcome by the authors.

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