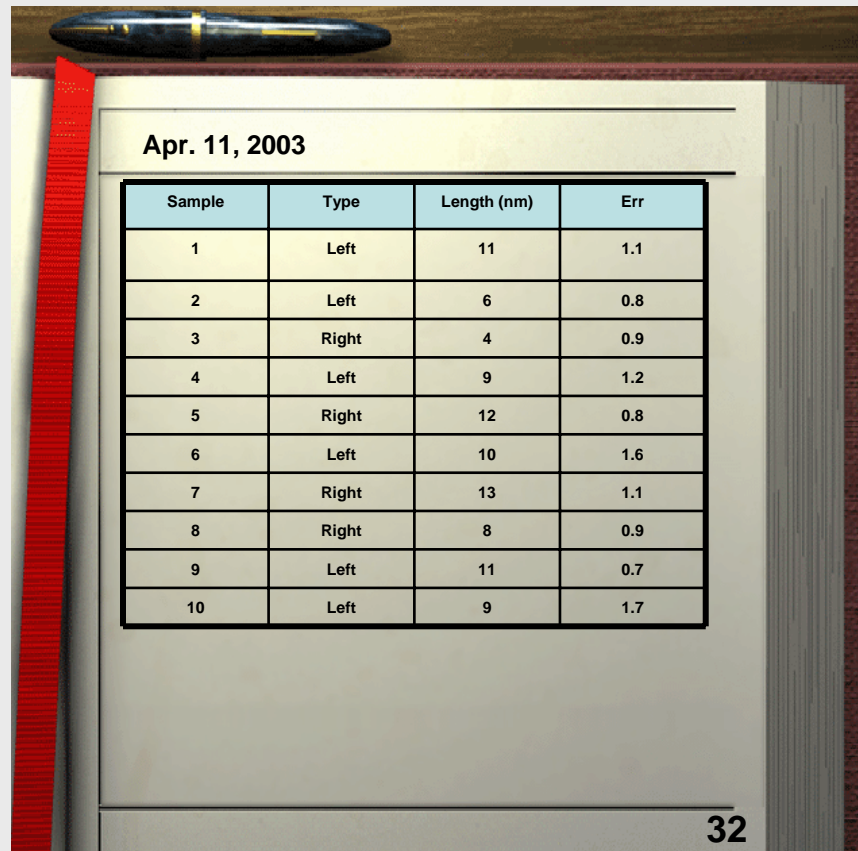


Documenting your research: logbooks, online reports, code archive

One of the most difficult things to learn, yet one of the most important for future success in physics research, is mastering the "art" of maintaining a proper log book.



Apr. 11, 2003

Sample	Type	Length (nm)	Err
1	Left	11	1.1
2	Left	6	0.8
3	Right	4	0.9
4	Left	9	1.2
5	Right	12	0.8
6	Left	10	1.6
7	Right	13	1.1
8	Right	8	0.9
9	Left	11	0.7
10	Left	9	1.7

32

Lance Cooper
David Hertzog

Laboratory experimental logbooks keep records of measurements, tests, samples, data taking

Often a “shared” resource:

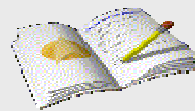
Obligation to explain, write neatly, date entries

This book is a recognized scientific record

- data selection (recall ethics discussion)
- conditions of test or measurement
- record of external events (power, heat, etc.)
- “who” did the work : initial *all* entries !

Logbook never leaves the lab. Copies are allowed.

Authors date and initial entries.



Often, modern logbooks are “electronic”

Example 1: [Phys 403 Modern Physics Lab](#)

Example 2: [MuLan Experiment](#) (resource: <http://midas.psi.ch/elog/>)

Example 2: [nPol Experiment](#)

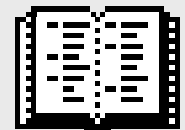
Personal logbooks keep your records of progress, findings, analysis, code changes, techniques

Your “diary” – Make it useful and meaningful

- Daily entries keep track of flow of project:

“Today (3/10/03) I moved the voltmeter to the AC setting to look for background 60 Hz. Was less than 2 mV. Added standard cables and jumped to 20 mV. Spent afternoon shielding the system...now better, always less than 2 mV. Important when I change setup to always check this...”

“Changed the integration routine in the standard part of the code to 4th order RK. This seems better so I'll keep it. Archived old code as starsearch1.cpp in the /project directory. New one called starsearch2.cpp; same dir.”



Compute-intensive projects require a special organizational effort.

Disk space is CHEAP.

Copy files, codes, often.

Keep the whole code so you can backtrack

NEVER modify your only version of a working code

make a copy first, then modify

Take the time and anticipate the directory structure. Group common items, use dated or name-identified subdirectories

```
/macros
/inputs
  /data
  /parameters
    /apr01
    /inpact_b01_h02
/output
  /logfiles
  /hists
```

Or, by date is often quite excellent if things are moving fast and your LOGBOOK is dated and refers to this work

```
/Apr01
/Apr02
/Apr03
/Apr04 ...etc..
```

Personal notebooks can also categorize and store useful physics experiences you might otherwise forget

“Things which I have convinced myself of” (P. Debevec)

Derivations

Geometry and coordinate system manipulations

Algorithms, other basic methods or techniques

Seminar Notebooks (many people keep these)

Take notes during all talks; Make entries in a logbook so that someday you might recall them. Don't worry about “wasting paper”

Computer “tricks” (many)

Learning a new language, big program, etc?

Write down the “tips” people help you with and the examples, which allow you to do something useful.

They often come up again (e.g., the many commands in analysis programs)

Ideas for future experiments

Important results from other papers

Some logbook tips from Rex Tayloe

(UIUC Ph.D., now Asst. Prof. at IU)

Use a bound notebook (type #43-64x or equivalent), not loose sheets of paper. Extra material, such as computer printout, photographs, etc., may be pasted or taped into the book.

Make sure your logbook has numbered pages.

Skip the first page or two to use for a Table of Contents.

Date every page, and record the time of the day for each important entry.

Always write directly into your log; NEVER work on loose scraps of paper, and then copy things into the book. Even 'mistakes' often turn out to be important!

For the same reason, do not use pencil. If you discover that something was wrong, "X" it out so that it is clearly marked as being in error, but is still legible. Never use White-out, paste over, or (worst of all) remove pages!

What should be entered into your logbook is largely a matter of personal taste, but ...

When you start a project, **state briefly what its goal is** -- just a few key phrases to remind yourself exactly what you will be trying to do. This will get you in the documentation mood.

As you go along, jot down enough information to indicate **what you are doing at that moment**. Remember to note the times.

Provide **diagrams** (sketches, electronic schematics) of the apparatus, with complete information on **settings** of controls and other relevant instrumental data.

As a rule of thumb, entries should be sufficiently detailed that you (or someone else) would have **no trouble reproducing your experimental setup**.

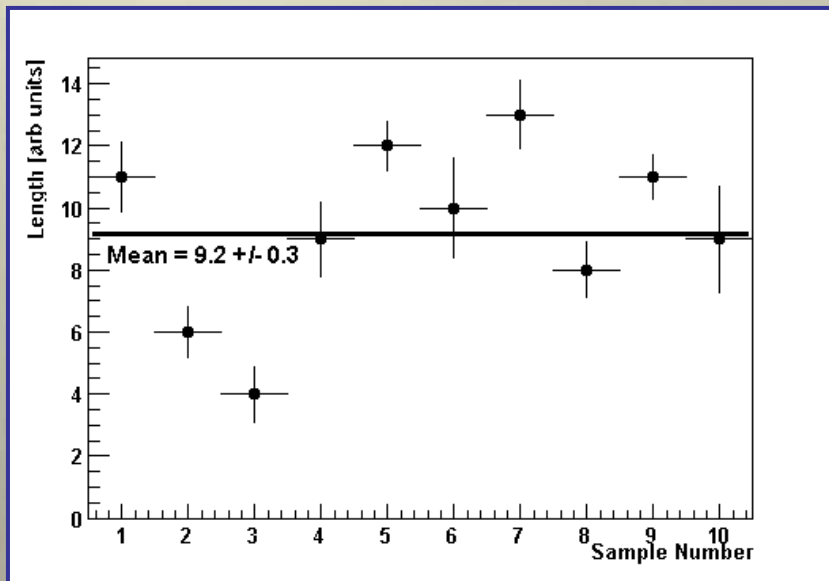
All **measurements should be recorded immediately** and directly.

Cutout and glue in plots. You will refer to these later as you make additional progress

Apr. 12, 2003

$$\bar{x} = \frac{\sum w_i x_i}{\sum w_i}; \quad w_i = \frac{1}{\sigma_i^2}$$

Plot of sample lengths so far. Seems I've got some outliers... will repeat with slower scanning speed. This one done at 0.1 um/s



Sometimes, leave a blank page for calculations and plots ... then make sure you paste them in !

Other electronic alternatives to the traditional paper logbook ... just make a web page

For shared projects or projects that require frequent feedback from someone else (often remote), an electronic “web” form can be quite handy.

Advantages: You can store a lot of plots, update frequently, and have multiple people provide entries. Access is easy.

Here’s a technique some people use

<http://zeus.phys.uconn.edu/jetset/pwa/thiswork.shtml>

www.npl.uiuc.edu/~hertzog/FSD2001Study/FSD_Logbook.html

And the rest of them, what do they do?

The “file method”

Start a **loose file** for a given project and stuff in all relevant information.

Big project?

Get a **full drawer** and separate into different file folders

Always have a **literature folder** relevant to the project

“Archive? The **code is the archive!**”

Believe it or not, some people rely on this ... (not me!)

“Notes? The **published paper is the note**”

Yes, this too. Difficult when challenged. Difficult to reproduce results or calculations unless you do them over

**No written down art or rules on this but
documentation of process is mandatory !!**

You need to develop your own style.

Start making use of your new stitched lab notebook!

**Impress your summer advisor by keeping careful notes
on a daily basis**

Be diligent !

