

Setting up your workspace

Getting started with LArSoft

LArSoft Workshop 2024

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of EDINBURGH

Introduction

- This workshop aims to teach you how to...
 - ...Build your first sbndcode to use in other workshop sessions
 - ...Make a setup script
 - ...Test some LArSoft commands
- Commands on a black background are things you should run:

```
echo "welcome to larsoft"
```

(It may be useful to copy-paste using right-click rather than ctrl-c/ctrl-v!)



Thank you!

- Thank you to (Dr!) Charlie Batchelor for his slides from last year which these slides are heavily inspired by, and to all others who have given the tutorial over the past years

Good things to know: in the terminal

`mkdir <directory_name>`: creates a new directory of your chosen name

`cd <directory_name>`: navigates you to a named directory; you can also provide a full path here

`$`: indicates a global variable, visible throughout the program (e.g. `$HOME`)

Good things to know: text editors

vim

- `vim <filename>` to open file (creates file if it doesn't exist)
- `i` to edit (insert)
- `esc` to stop editing
- `:wq` to save and quit, or `:q` to quit without saving

emacs

- `emacs -nw <filename>` to open file (creates file if it doesn't exist; nw is 'no window')
- move your cursor to where you want and start typing
- `Ctrl-X Ctrl-C` to quit: when asked to save, type `y` for yes or `n` for no
- `Ctrl-X Ctrl-S` to save without closing

or, if you have another text editor that you like, use that!


Part 1



Build your first sbndcode



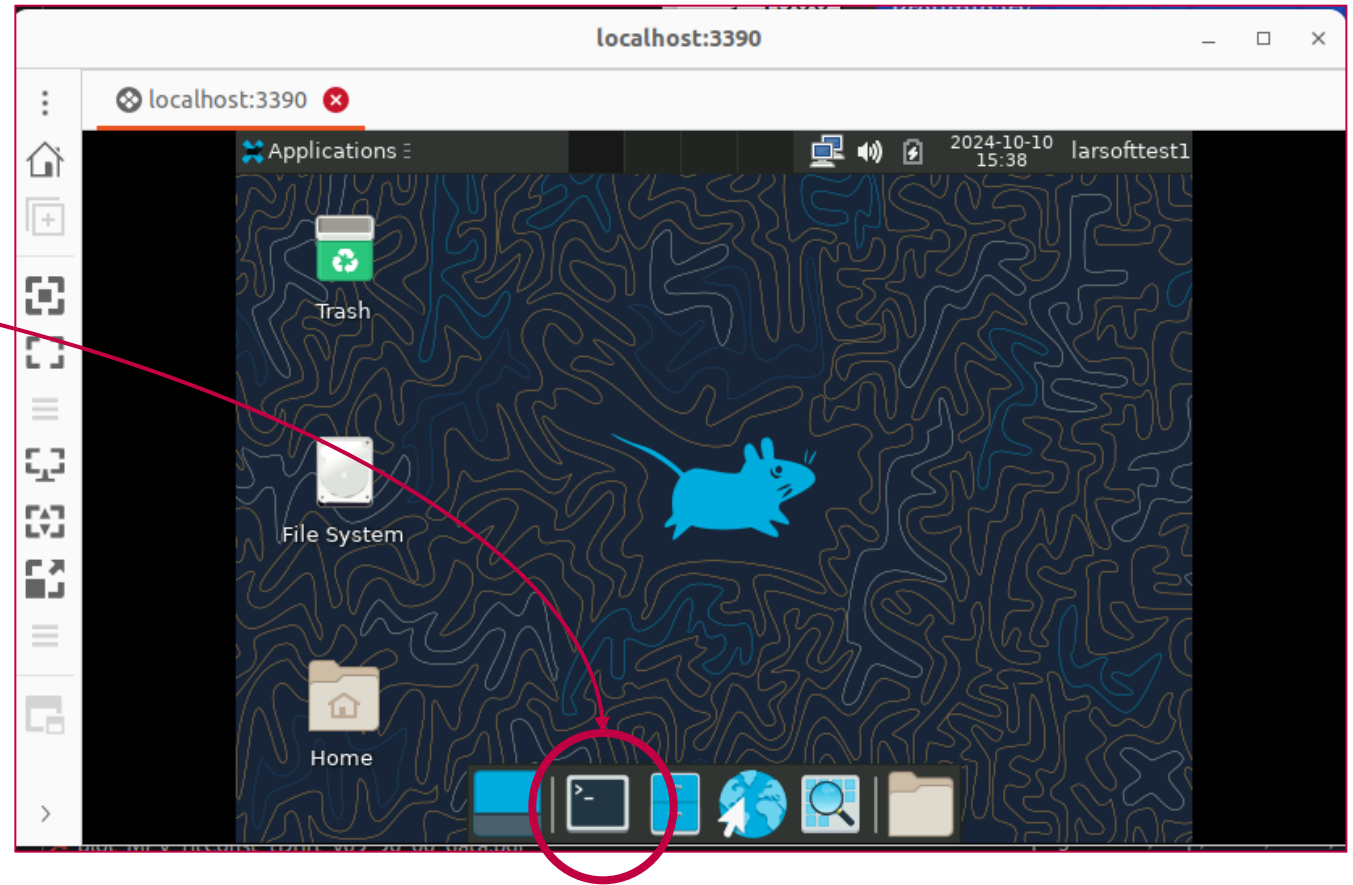
1. Log in



APACHE GUACAMOLE

2. Open your terminal

- Your desktop should look a little like this: open the terminal
- It might be useful to have these slides open in the remote session for reference!



3. Open a container

- As mentioned in Miquel's lecture, you will need to use a **container**
 - You should be able to run this entire tutorial in a container
- Download the container (**you'll only need to do this once!**):

```
appBox -ii fermilab/fnal-dev-sl7 -ip ./fermilab-sl7 -  
LayerCache /scratch/$USER/cache
```

```
Image: "fermilab/fnal-dev-sl7" installed at: "/home/tutor07/fermilab-sl7"  
To launch this sandbox, use:  
source /home/tutor07/fermilab-sl7/bin/activate
```

Then activate it:

```
source ./fermilab-sl7/bin/activate
```

```
Now Running [appBox] ! (sandbox based on image: fermilab/fnal-dev-sl7) as tutor07
```

4. Make a new directory

- Make sure you're in your home area:

```
cd $HOME environment variable!
```

- Create a new directory there, then move to it

```
mkdir larsoft_workshop
```

```
cd larsoft_workshop
```

5. Set up sbndcode with CVMFS

- Run this cvfms script to set up sbndcode:

```
source /cvmfs/sbnd.opensciencegrid.org/products/sbnd/setup_sbnd.sh
```

```
[[larsofttest3@t3-mw2 larsoft_workshop]$ source /cvmfs/sbnd.opensciencegrid.org/products/sbnd/setup_sbnd.sh
Setting up LArSoft from "CVMFS":
- executing '/cvmfs/larsoft.opensciencegrid.org/setup_larsoft.sh'
- appending '/cvmfs/fermilab.opensciencegrid.org/products/common/db'
Setting up artdaq from "CVMFS":
- appending '/cvmfs/fermilab.opensciencegrid.org/products/artdaq'
Setting up sbn from "CVMFS":
- appending '/cvmfs/sbn.opensciencegrid.org/products/sbn'
Setting up SBND from "CVMFS":
- prepending '/cvmfs/sbnd.opensciencegrid.org/products/sbnd'
```

Don't panic if you get an error from perl the first time— try again and it should work!

6. Create a new development area

- Run this command to make the current environment a **development area**

```
mrB newDev -v v09_91_02_01 -q prof:e26
```

-v: version

this is the version of sbndcode
we're using

-q: qualifier

this specifies which
compiler to use

We can only do this after Step 5, as executing that script has given us **mrB**

6. Create a new development area

```
[larsofttest3@t3-mw2 larsoft_workshop]$ mrb newDev -v v09_91_02_01 -q prof:e26

building development area for larsoft v09_91_02_01 -q prof:e26
.

The following configuration is defined:
  The top level directory is .
  The source code directory will be under .
  The build directory will be under .
  The local product directory will be under .

MRB_BUILDDIR is /home/larsofttest3/larsoft_workshop/build_slf7.x86_64
MRB_SOURCE is /home/larsofttest3/larsoft_workshop/srcs
perl: warning: Setting locale failed.
perl: warning: Please check that your locale settings:
  LANGUAGE = "en_GB:en",
  LC_ALL = (unset),
  LANG = "C.UTF-8"
  are supported and installed on your system.
perl: warning: Falling back to the standard locale ("C").
INFO: cannot find larsoft/v09_91_02_01/releaseDB/base_dependency_database
      or larsoftcode/v09_91_02_01/releaseDB/base_dependency_database
      mrb checkDeps and pullDeps will not have complete information

IMPORTANT: You must type
  source /home/larsofttest3/larsoft_workshop/localProducts_larsoft_v09_91_02_01_prof_e26/setup
NOW and whenever you log in
```

7. Source local products

- Source the local products (the terminal will have suggested this!)

```
source localProducts_larsoft_v09_91_02_01_prof_e26/setup
```

```
[[larsofttest3@t3-mw2 larsoft_workshop]$ source localProducts_larsoft_v09_91_02_01_prof_e26/setup

MRB_PROJECT=larsoft
MRB_PROJECT_VERSION=v09_91_02_01
MRB_QUALS=prof:e26
MRB_TOP=/home/larsofttest3/larsoft_workshop
MRB_SOURCE=/home/larsofttest3/larsoft_workshop/srcs
MRB_BUILDDIR=/home/larsofttest3/larsoft_workshop/build_slf7.x86_64
MRB_INSTALL=/home/larsofttest3/larsoft_workshop/localProducts_larsoft_v09_91_02_01_prof_e26

PRODUCTS=/home/larsofttest3/larsoft_workshop/localProducts_larsoft_v09_91_02_01_prof_e26:/cvmfs/sbnd.opensciencegrid.org/products/sbnd:/cvmfs/sbnd.opensciencegrid.org/products/sbnd:/cvmfs/sbnd.opensciencegrid.org/products/sbnd:/cvmfs/larsoft.opensciencegrid.org/products:/cvmfs/larsoft.opensciencegrid.org/packages:/cvmfs/fermilab.opensciencegrid.org/products/common/db:/cvmfs/fermilab.opensciencegrid.org/products/artdaq:/cvmfs/sbn.opensciencegrid.org/products/sbn:/cvmfs/larsoft.opensciencegrid.org/packages:/cvmfs/fermilab.opensciencegrid.org/products/common/db:/cvmfs/fermilab.opensciencegrid.org/products/artdaq:/cvmfs/sbn.opensciencegrid.org/products/sbn:/cvmfs/larsoft.opensciencegrid.org/packages:/cvmfs/fermilab.opensciencegrid.org/products/common/db:/cvmfs/fermilab.opensciencegrid.org/products/artdaq:/cvmfs/sbn.opensciencegrid.org/products/sbn
CETPKG_INSTALL=/home/larsofttest3/larsoft_workshop/localProducts_larsoft_v09_91_02_01_prof_e26
```

8. Clone sbndcode from git

- Move into the 'srcs' directory:

```
cd srcs
```

- Clone the sbndcode repository:

```
mrbs g sbndcode
```

```
Cloning into 'sbndcode'...
remote: Enumerating objects: 46436, done.
remote: Counting objects: 100% (6637/6637), done.
remote: Compressing objects: 100% (2068/2068), done.
remote: Total 46436 (delta 4947), reused 6013 (delta 4557), pack-reused 39799 (from 1)
Receiving objects: 100% (46436/46436), 125.19 MiB | 8.80 MiB/s, done.
Resolving deltas: 100% (32451/32451), done.
NOTICE: Adding sbndcode to CMakeLists.txt file
```

again, don't panic if you see perl: warning: Setting locale failed – this is a non-fatal error

9. Checkout workshop branch

- Move to the srcs/sbndcode directory:

```
cd $MRB_SOURCE/sbndcode
```

- Check out the git workshop branch:

```
git checkout uk_larsoft_workshop_2024
```

```
[larsofttest3@t3-mw2 sbndcode]$ git checkout uk_larsoft_workshop_2024  
branch 'uk_larsoft_workshop_2024' set up to track 'origin/uk_larsoft_workshop_2024'.  
Switched to a new branch 'uk_larsoft_workshop_2024'
```


10. Set your environment

- Use this command to set the development environment:

mrbsenv

```
[[larsofttest3@t3-mw2 sbndcode]$ mrbsenv
The working build directory is /home/larsofttest3/larsoft_workshop/build_slf7.x86_64
The source code directory is /home/larsofttest3/larsoft_workshop/srcs
----- check this block for errors -----
-----
To inspect build variable settings, execute /home/larsofttest3/larsoft_workshop/build_slf7.x86_64/cetpkg_info.sh

Please use "buildtool" (or "mrbs b") to configure and build MRB project "larsoft", e.g.:

    buildtool -vTl [-jN]

See "buildtool --usage" (short usage help) or "buildtool -h|--help"
(full help) for more details.
```

again, don't panic if you see perl: warning: Setting locale failed – this is a non-fatal error

11. Build sbndcode

- Use this command to build and install sbndcode:

```
mrb i -j4
```

i: install

-jn: n is number of
cores used

```
-- Installing: /home/larsofttest3/larsoft_workshop/localProducts_larsoft_v09_91_02_01_prof_e26/sbndcode/v09_91_02_02/slf7.x86_64.e26.prof/lib/sbndcode/cmake/sbndcodeTargets.cmake
-- Up-to-date: /home/larsofttest3/larsoft_workshop/localProducts_larsoft_v09_91_02_01_prof_e26/sbndcode/v09_91_02_02/slf7.x86_64.e26.prof/lib/sbndcode/cmake/sbndcodeTargets-relwithdebinfocmake
-- Installing: /home/larsofttest3/larsoft_workshop/localProducts_larsoft_v09_91_02_01_prof_e26/sbndcode/v09_91_02_02/slf7.x86_64.e26.prof/lib/sbndcode/cmake/sbndcodeConfig.cmake
-- Up-to-date: /home/larsofttest3/larsoft_workshop/localProducts_larsoft_v09_91_02_01_prof_e26/sbndcode/v09_91_02_02/slf7.x86_64.e26.prof/lib/sbndcode/cmake/sbndcodeConfigVersion.cmake
-- tidying legacy installations: relocate sbndcode/v09_91_02_02/*
-- in /home/larsofttest3/larsoft_workshop/localProducts_larsoft_v09_91_02_01_prof_e26/sbndcode/v09_91_02_02: x
./
x ./test/
x ./test/fcl_file_checks.list
```

```
-----
INFO: stage install SUCCESS for MRB project larsoft v09_91_02_01
-----
```

IMPORTANT BIT!

```
[larsofttest3@t3-mw2 sbndcode]$
```



11. Build sbndcode

If you don't right-click copy/paste the build command, you might get an error for using the wrong dash

```
x ./test/  
x ./test/fcl_file_checks.list  
gmake: *** No rule to make target '-j4'. Stop.
```

```
FATAL ERROR: stage install FAILED for MRB project larsoft v09_91_02_01 with code 2
```



12. Set up local install

- Use this command to setup local products ('slp'):

```
mrbslp
```

```
[[larsofttest3@t3-mw2 sbndcode]$ mrbslp
local product directory is /home/larsofttest3/larsoft_workshop/localProducts_larsoft_v09_91_02_01_prof_e26
----- this block should be empty -----
[[larsofttest3@t3-mw2 sbndcode]$
```



Congratulations– you’ve built your first development area!

13. Make it easier!

- Now we can make a script so we don't have to do all of this from the top for each workshop!

```
cd $MRB_TOP
```

```
vim setup.sh (or, use a text editor of your choice)
```

And then paste these lines into the file:

```
source /cvmfs/sbnd.opensciencegrid.org/products/sbnd/setup_sbnd.sh
```

```
source localProducts_*/setup
```

```
mrbsetenv
```

```
mrbslp
```

Save and close

14. Test your setup script

- Open a new terminal, open a container (Step 3) and go to the directory you made in Step 4:

```
cd $HOME/larsoft_workshop
```

- Source your new setup script:

```
source setup.sh
```

```
[larsofttest3@t3-mw2 larsoft_workshop]$ source setup.sh
Setting up LArSoft from "CVMFS":
- executing '/cvmfs/larsoft.opensciencegrid.org/setup_larsoft.sh'
- appending '/cvmfs/fermilab.opensciencegrid.org/products/common/db'
Setting up artdaq from "CVMFS":
- appending '/cvmfs/fermilab.opensciencegrid.org/products/artdaq'
Setting up sbn from "CVMFS":
- appending '/cvmfs/sbn.opensciencegrid.org/products/sbn'
Setting up SBND from "CVMFS":
- prepending '/cvmfs/sbnd.opensciencegrid.org/products/sbnd'

MRB_PROJECT=larsoft
MRB_PROJECT_VERSION=v09_91_02_01
MRB_QUALS=prof:e26
MRB_TOP=/home/larsofttest3/larsoft_workshop
MRB_SOURCE=/home/larsofttest3/larsoft_workshop/srcs
MRB_BUILDDIR=/home/larsofttest3/larsoft_workshop/build_slf7.x86_64
MRB_INSTALL=/home/larsofttest3/larsoft_workshop/localProducts_larsoft_v09_91_02_01_prof_e26

PRODUCTS=/home/larsofttest3/larsoft_workshop/localProducts_larsoft_v09_91_02_01_prof_e26:/cvmfs/sbnd.opensciencegrid.org/products/sbnd:/home/larsofttest3/larsoft_w
orkshop/localProducts_larsoft_v09_91_02_01_prof_e26:/cvmfs/sbnd.opensciencegrid.org/products/sbnd:/cvmfs/sbnd.opensciencegrid.org/products/sbnd:/cvmfs/lar
soft.opensciencegrid.org/products:/cvmfs/larsoft.opensciencegrid.org/packages:/cvmfs/fermilab.opensciencegrid.org/products/common/db:/cvmfs/fermilab.opensciencegri
d.org/products/artdaq:/cvmfs/sbn.opensciencegrid.org/products/sbn:/cvmfs/larsoft.opensciencegrid.org/packages:/cvmfs/fermilab.opensciencegrid.org/products/common/d
b:/cvmfs/fermilab.opensciencegrid.org/products/artdaq:/cvmfs/sbn.opensciencegrid.org/products/sbn:/cvmfs/larsoft.opensciencegrid.org/packages:/cvmfs/fermilab.opens
ciencegrid.org/products/common/db:/cvmfs/fermilab.opensciencegrid.org/products/artdaq:/cvmfs/sbn.opensciencegrid.org/products/sbn:/cvmfs/larsoft.opensciencegrid.or
g/packages:/cvmfs/fermilab.opensciencegrid.org/products/common/db:/cvmfs/fermilab.opensciencegrid.org/products/artdaq:/cvmfs/sbn.opensciencegrid.org/products/sbn:/c
vmfs/larsoft.opensciencegrid.org/packages:/cvmfs/fermilab.opensciencegrid.org/products/common/db:/cvmfs/fermilab.opensciencegrid.org/products/artdaq:/cvmfs/sbn.op
ensciencegrid.org/products/sbn
CETPKG_INSTALL=/home/larsofttest3/larsoft_workshop/localProducts_larsoft_v09_91_02_01_prof_e26

The working build directory is /home/larsofttest3/larsoft_workshop/build_slf7.x86_64
The source code directory is /home/larsofttest3/larsoft_workshop/srcs
----- check this block for errors -----

To inspect build variable settings, execute /home/larsofttest3/larsoft_workshop/build_slf7.x86_64/cetpkg_info.sh

Please use "buildtool" (or "mrb b") to configure and build MRB project "larsoft", e.g.:

    buildtool -vT1 [-jN]

See "buildtool --usage" (short usage help) or "buildtool -h|--help"
(full help) for more details.

local product directory is /home/larsofttest3/larsoft_workshop/localProducts_larsoft_v09_91_02_01_prof_e26
----- this block should be empty -----
```

If this works, you now have your own development area and setup script 😊

Part 2



Test some LArSoft commands



1. Make a new test area

- Open a new terminal, and go to your home directory:

```
cd $HOME
```

- Create a new test directory, then move to it

```
mkdir larsoft_testing
```

```
cd larsoft_testing
```

- Repeat Steps 3 and 5 – 12 from Task 1 (build and install in new development area)

2. Make a data directory

- Go back to your home directory, make a data directory and go to it

```
cd $HOME
```

```
mkdir data
```

```
cd data
```

- If you work on a Fermilab experiment, you will have your own data directory on the Fermilab gpvms at `/exp/sbnd/data`— this is for storing data rather than a place to work or store code

3. Run a LArSoft command!

```
lar -c singles_sbnd.fcl -n 5 -o test.root
```

command that
runs LArSoft

-c: configuration

define your job, using a .fcl file
(you'll learn more about these!)
If the previous steps have all worked, the
.fcl should be found

-n: number of events
choose how many events to
run the process on

-o: output
choose the name of your output file

Right-click copy/paste this one! It might use the wrong dash

3. Run a LArSoft command!

```
[larsofttest3@t3-mw2 larsoft_workshop]$ lar -c singles_sbnd.fcl -n 5 -o test.root
INFO: using default process_name of "DUMMY".
The following module label is either not assigned to any path,
or it has been assigned to ignored path(s):
  generator
%MSG-i MF_INIT_OK: Early 10-Oct-2024 16:42:10 BST JobSetup
MessageLogger initialization complete.
%MSG
Begin processing the 1st record. run: 1 subRun: 0 event: 1 at 10-Oct-2024 16:42:11 BST
10-Oct-2024 16:42:11 BST Opened output file with pattern "test.root"
%MSG-w FastCloning: PostProcessEvent 10-Oct-2024 16:42:11 BST run: 1 subRun: 0 event: 1
Fast cloning has been deactivated for the following reasons:
- Input source does not read art/ROOT files.
%MSG
Begin processing the 2nd record. run: 1 subRun: 0 event: 2 at 10-Oct-2024 16:42:11 BST
Begin processing the 3rd record. run: 1 subRun: 0 event: 3 at 10-Oct-2024 16:42:11 BST
Begin processing the 4th record. run: 1 subRun: 0 event: 4 at 10-Oct-2024 16:42:11 BST
Begin processing the 5th record. run: 1 subRun: 0 event: 5 at 10-Oct-2024 16:42:11 BST
10-Oct-2024 16:42:12 BST Closed output file "test.root"

TrigReport ----- Event summary -----
TrigReport Events total = 5 passed = 5 failed = 0

TrigReport ----- Modules in End-path -----
TrigReport      Run      Success      Error Name
TrigReport      5         5          0 out

TimeReport ----- Time summary [sec] -----
TimeReport CPU = 0.670808 Real = 1.125261

MemReport ----- Memory summary [base-10 MB] -----
MemReport VmPeak = 884.949 VmHWM = 464.773

Art has completed and will exit with status 0.
```

'status 0' means it worked!

4. Take a look

- If you have enough time, open the root file you've made!

```
root -l test.root
```

```
[[larssofttest3@t3-mw2 larsoft_workshop]$ root -l test.root  
root [0]  
Attaching file test.root as _file0...  
(TFile *) 0x31e8ab70
```

```
new TBrowser
```

This should bring up a new window where you can inspect the file contents

`.q` *to exit root!*

Tutorial complete!

- You now have your own working area for the rest of the workshop and can build sbndcode!

you before, when LArSoft was difficult



you now, able to set up LArSoft
and run commands



Backup



Full chain of commands

```
cd $HOME
```

```
mkdir larsoft_workshop
```

```
cd larsoft_workshop
```

```
source /cvmfs/sbnd.opensciencegrid.org/products/sbnd/setup_sbnd.sh
```

```
mrbs newDev -v v09_91_02_01 -q prof:e26
```

```
source localProducts_larsoft_v09_91_02_01_prof_e26/setup
```

```
cd srcs
```

```
mrbs g sbndcode
```

```
cd $MRB_SOURCE/sbndcode
```

```
git checkout uk_larsoft_workshop_2024
```

```
mrbs setenv
```

```
mrbs i -j4
```

```
mrbs lp
```

Open container before running these!

Setup script

- If for whatever reason your setup script doesn't work, here's one I made earlier:

```
/mnt/gridpp/poolhomes/PPEGroup/LAR24/getting_started/setup.sh
```

- You can copy it to your home directory:

```
cp /mnt/gridpp/poolhomes/PPEGroup/LAR24/getting_started/setup.sh  
$HOME/larsoft_workshop
```

(all one line!)