STAR - environment setup

Particle physics users workshop:
from STAR to EIC

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Everything for Mac, Win, and Linux

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Git: Installation

Debian-based systems (Debian, Ubuntu, ...):

```
sudo apt update
sudo apt upgrade
sudo apt install git
```

Red Hat-based systems (Red Hat, CentOS, Fedora, ...):

```
sudo yum upgrade
sudo yum install git
```

macOS System:

```
/bin/bash -c "$(curl -fsSL
    https://raw.githubusercontent.com/Homebrew/install/HEAD/install.sh)"
brew doctor
brew install git
```

Windows System:
Download and install: `https://gitforwindows.org/`

GitHub

- Register on GitHub
  - https://github.com/signup
- GitHub Education: https://education.github.com
- GitHub Repository:
  - https://github.com/aprozo/star_workshop
- To get the necessary scripts for this presentation, use the following commands:

```
git clone git@github.com:aprozo/star_workshop.git
```

RCF Account

- RCF - RHIC Computing Facility
- Procedure described here:
  `https://drupal.star.bnl.gov/STAR/comp/sofi/facility-access/general-access`
- First, the council representative of your university must send information about you to BNL Liz (**Elizabeth Mogavero**)
- Check that you are in the phone directory (**Phone Book**), here:
  `https://www.star.bnl.gov/central/collaboration/phonebook.php`
  - Sometimes errors occur, and you are not listed. In that case, RCF may work, but you will not have an assigned space. Contact Liz to resolve this.
- You will also need a Guest ID (Takes a long time, even for renewal, about 30 - 90 days)
  - Apply here: `https://guest.bnl.gov/` → New registration
  - Purpose of visit: Research
  - Facility Code: RHIC
  - Type of Research: STAR
  - Type of Access Requested: Open research
  - Subject Code for this Visit/Assignment: General Physics
  - You will need to submit a CV
  - Date of arrival: Even if you are not going, choose the latest possible date

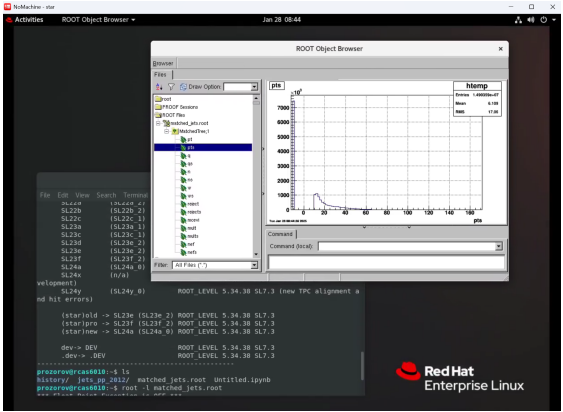
RCF Connection - SSH Key

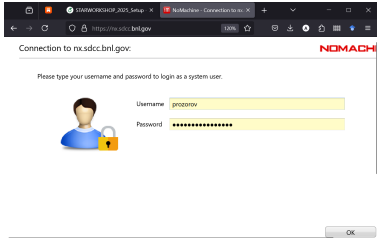
- SSH - Secure Shell
- A unique key for your computer. You cannot (easily) connect from another computer
- More information at: `https://www.sdcc.bnl.gov/information/ssh/generate-ssh-key-pairs`

Windows:

- PuTTY - download and run puttygen.exe
- `https://www.chiark.greenend.org.uk/~sgtatham/putty/latest.html`
- Generate → enter Passphrase → save Key fingerprint to a text file
- "Save public key" as rsa_putty.pub, "Save private key" as rsa_putty.ppk
- Conversions → Export OpenSSH key, Conversions → Export ssh.com key
- 4 files: public and private keys for PuTTY and private keys for ssh.com and OpenSSH
- Upload the fingerprint and OpenSSH public key here:
  `https://web.sdcc.bnl.gov/Facility/SshKeys/UploadSshKey.php`

No Machine service





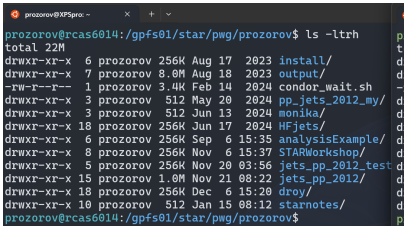
- Do remote work on servers in your browser
- Better then X11 option in *ssh*
- Inspect large root files without waiting
- Run scripts in background and return to machine state anytime

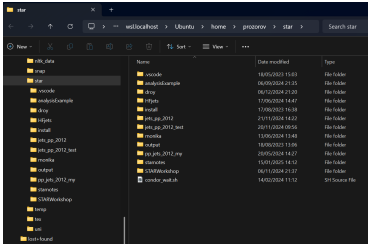
`https://www.sdcc.bnl.gov/information/nxnomachine-service-sdcc`
`https://nx.sdcc.bnl.gov/`

SSHFS Mounting

Replace your account name in example below:

```
sudo apt install sshfs
mkdir ~/star
alias starmount='sshfs -o
    reconnect,ServerAliveInterval=15,ServerAliveCountMax=3
    prozorov@sftp.sdcc.bnl.gov:/gpfs01/star/pwg/prozorov ~
    /star' # add this line to your .bashrc or .bash_aliases
starmount
```





SFTP

- For secure downloading or uploading of files to RCF, it is advantageous to use the SSH File Transfer Protocol (SFTP).
- Login via terminal, download, and upload files:

```
sftp username@sftp.sdcc.bnl.gov
get file.txt
put file2.root
```

```
exit                        Quit sftp
get [-afpR] remote [local]  Download file
help                        Display this help text
lcd path                    Change local directory to 'path'
lls [ls-options [path]]     Display local directory listing
lmkdir path                 Create local directory
ln [-s] oldpath newpath     Link remote file (-s for symlink)
lpwd                        Print local working directory
ls [-1afhlnrSt] [path]      Display remote directory listing
lumask umask                Set local umask to 'umask'
mkdir path                  Create remote directory
progress                    Toggle display of progress meter
put [-afpR] local [remote]  Upload file
pwd                         Display remote working directory
quit                        Quit sftp
```

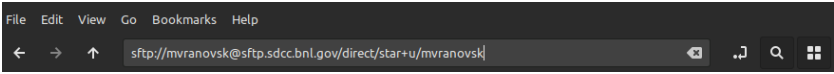
- Commands are similar to SSH, and by adding "l"before each command, you can control the local computer.
- Alternatively, if downloading just a single file:

```
sftp username@sftp.sdcc.bnl.gov:/path/to/file/on/RCF/file.root /local/path/.
```

- Or define a function in your local `.bashrc` to simplify downloading:

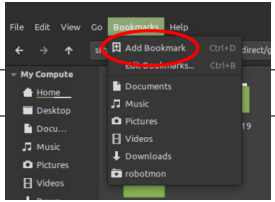
```
getFile() {
    sftp username@sftp.sdcc.bnl.gov:$1 $2
}
getFile /star/u/path/to/file /local/path/.
```

File Browser

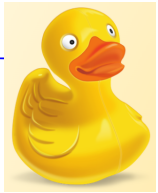


- SFTP can also be used in a file browser.
- For Linux, enter the following in the "location entry":

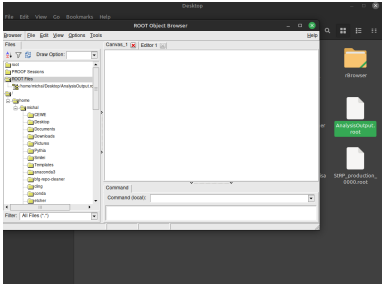
```
sftp://username@sftp.sdcc.bnl.gov/direct/star+u/username
```



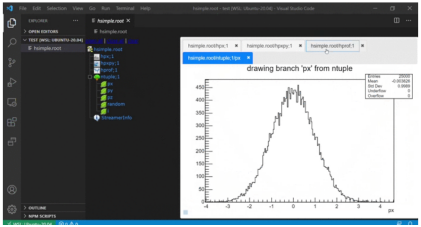
- Then, add a bookmark by pressing `Ctrl + D`.
- For Windows and Mac, it is more complicated; an SFTP client is required.
- The most commonly used client for Windows is WinSCP.
- For Mac, several options are available, such as Cyberduck, FileZilla, and CrossFT



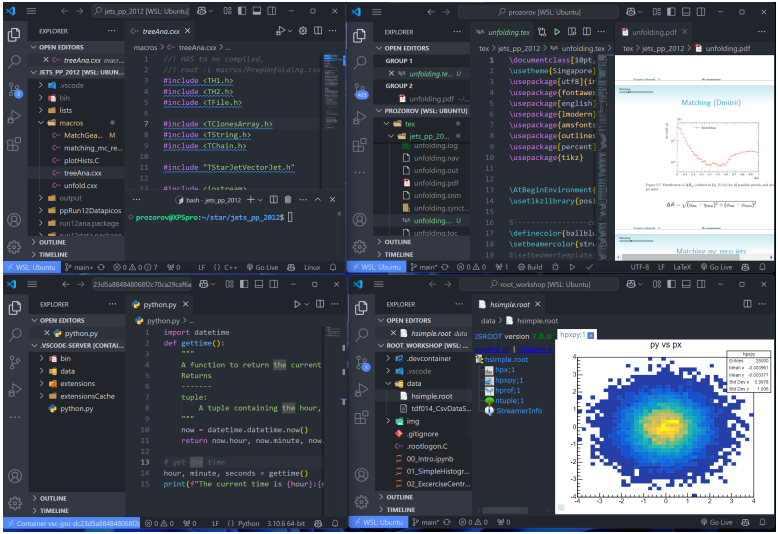
RootFileOpener



- **What is this?** Opening `.root` files in TBrowser directly from the file browser
- For Mac and Linux: Instructions and code on GitHub
- There is no equivalent for Windows, BUT `.root` files can be viewed in VS Code. Instructions.



IDE: VS Code



Some features (out of infinity)

- Run/compile cpp code
- Terminal built-in
- Latex environment
- All other languages(python example here)
- Containerization
- ROOT extension for inspecting files
- Extensions (inc. Copilot)

Everything-in-one setup (and free)

IDE: VS Code

Visual Studio Code https://code.visualstudio.com/download
(please, download and install Windows version for WSL2)
Then open a terminal and test it:

```
code .
```

Helpful extensions (paste inside WSL2/Linux/Mac terminal):

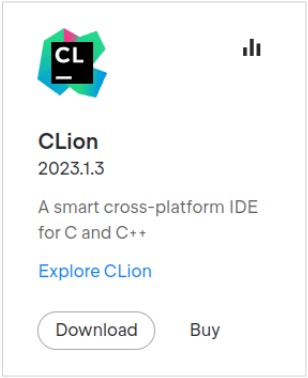
```
code --install-extension albertopdrf.root-file-viewer  # root trees explorer
code --install-extension GitHub.copilot # copilot
code --install-extension tomoki1207.pdf # view pdf files
code --install-extension ms-vscode.cmake-tools # for C++ highlightning
code --install-extension ms-vscode.cpptools # for C++ highlightning
code --install-extension ms-vscode.cpptools-extension-pack # for C++ highlightning
code --install-extension ms-vscode.cpptools-themes # for C++ highlightning
code --install-extension xaver.clang-format # beautify  C++ code in universal style
```

IDE: CLion

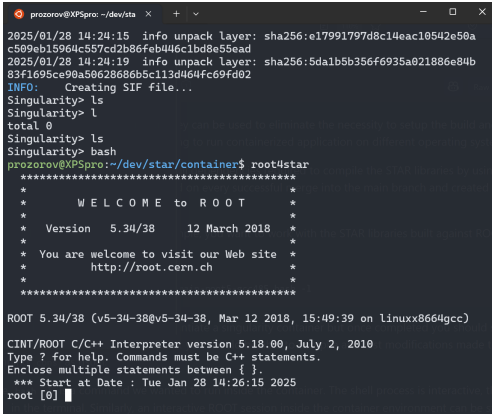
- You can use CLion as your development environment (for C++) or PyCharm (for Python)
- Link here
- Download and install
- On Linux, you can simply use: sudo snap install clion –classic
- Log into CLion using your JetBrains account
- New project/create

Advantages

- Free for students
- Integrated command line within the environment
- GitHub Copilot can be installed
- Advanced debugger
- CMake support



How to run locally StRoot with cons



Container for STAR

- Here is the README file for containers for star-software click
- Then you can compile your StRoot files using *cons* command as in SDCC but locally without connecting to SDCC itself
- A link on how to install singularity.

In short:

```
singularity run docker://ghcr.io/star-bnl/star-sw:main-root5-gcc485 bash -l
```