INTRODUCTION TO THE NAIA DST

GET THE PROJECT

- Hosted on CERN gitlab:

```
❯ git clone ssh://git@gitlab.cern.ch:7999/ams-italy/naia.git
```

- @CNAF: Setup the environment

```
❯ source setenvs/setenv_gcc6.18_cc7.sh
```

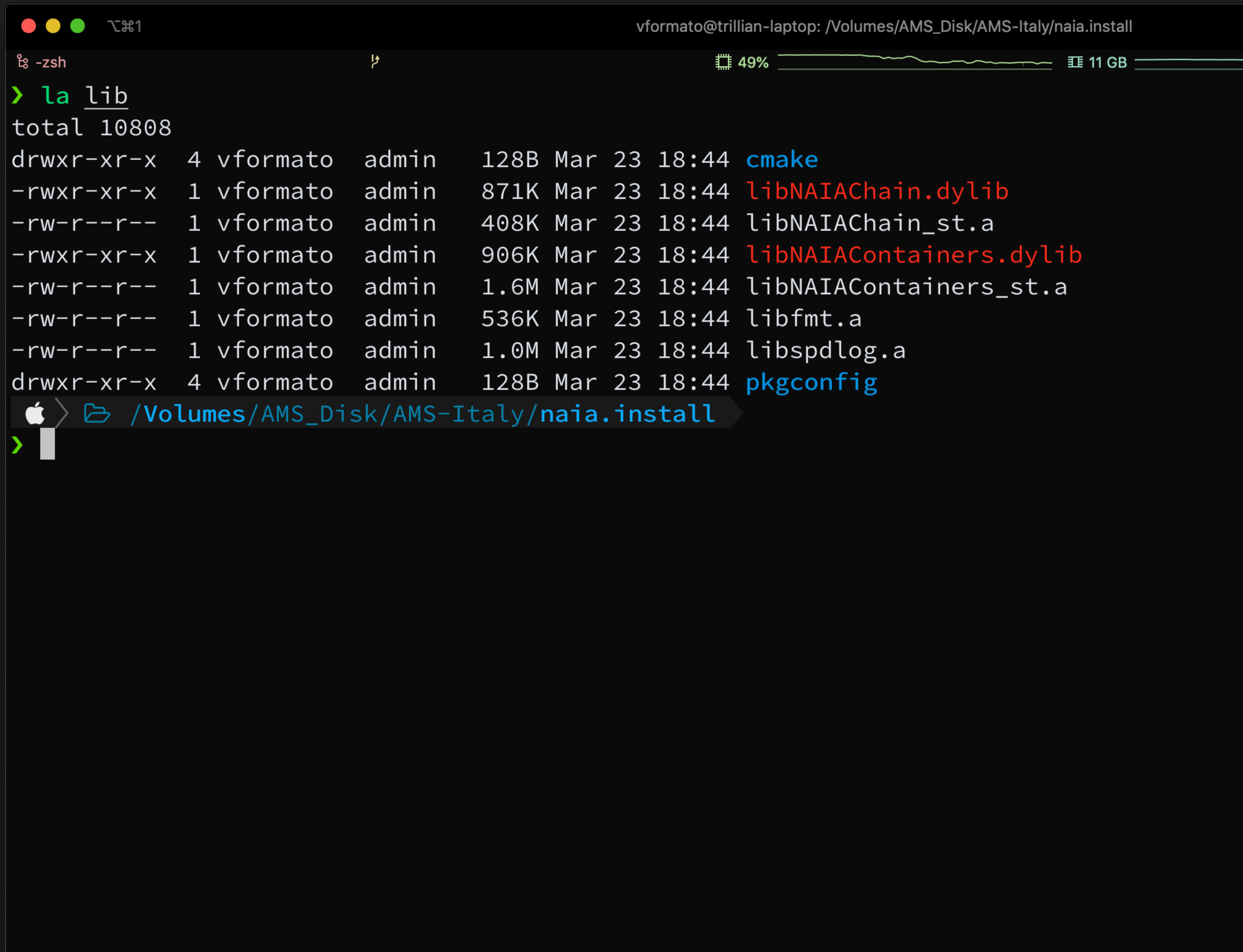
- or: on your own machine, make sure you have ROOT in your env (check that $ROOTSYS is set)

- build

```
❯ mkdir build; cd build; cmake .. -DCMAKE_INSTALL_PREFIX=../../naia.install;
make all install
```

AFTER INSTALL

- This is what you should find in your install dir, under "lib"
- The two libraries are the ones needed for the analysis



⌥⌘1
vformato@trillian-laptop: /Volumes/AMS_Disk/AMS-Italy/naia.install
-zsh
49%
11 GB

```
❯ la lib
total 10808
drwxr-xr-x  4 vformato  admin   128B Mar 23 18:44 cmake
-rwxr-xr-x  1 vformato  admin   871K Mar 23 18:44 libNAIAChain.dylib
-rw-r--r--  1 vformato  admin   408K Mar 23 18:44 libNAIAChain_st.a
-rwxr-xr-x  1 vformato  admin   906K Mar 23 18:44 libNAIAContainers.dylib
-rw-r--r--  1 vformato  admin   1.6M Mar 23 18:44 libNAIAContainers_st.a
-rw-r--r--  1 vformato  admin   536K Mar 23 18:44 libfmt.a
-rw-r--r--  1 vformato  admin   1.0M Mar 23 18:44 libspdlog.a
drwxr-xr-x  4 vformato  admin   128B Mar 23 18:44 pkgconfig
  /Volumes/AMS_Disk/AMS-Italy/naia.install
❯
```

AFTER INSTALL

- This is what you should find in your install dir, under "lib"
- The two libraries are the ones needed for the analysis
- From here, choose your poison:
    - CMake (yes 😍)

```
cmake_minimum_required(VERSION 3.13)

project(testNAIA)

message(STATUS "ROOTSYS: $ENV{ROOTSYS}")
list(APPEND CMAKE_PREFIX_PATH $ENV{ROOTSYS})
find_package(ROOT REQUIRED)
# this file already adds ROOT_INCLUDE_DIRS
# to include_directories
include(${ROOT_USE_FILE})

find_package(NAIA REQUIRED)

add_executable(testReadNtp src/testReadNtp.cpp)
target_link_libraries(testReadNtp PUBLIC NAIA::NAIAChain)
```

AFTER INSTALL

- This is what you should find in your install dir, under "lib"
- The two libraries are the ones needed for the analysis
- From here, choose your poison:
  - CMake (yes 😍)
  - Makefile (ok, boomer… 🤨)

Make sure you add

```
${NAIA_install_dir}/include
```

to the list of included directories and

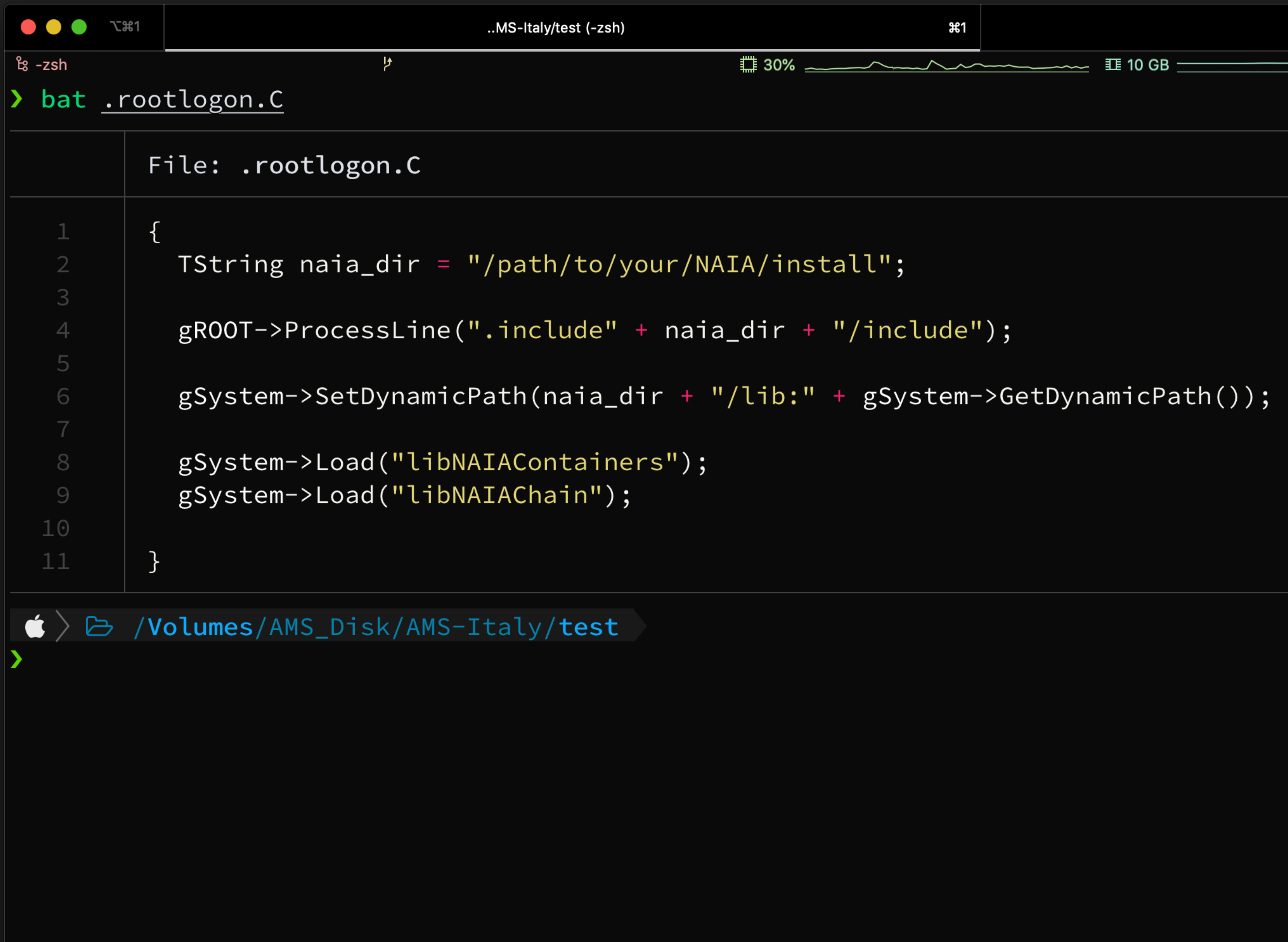
```
${NAIA_install_dir}/lib
```

to the link directories. Then link the two libraries

```
-lNAIAChain -lNAIAContainers
```

AFTER INSTALL

- This is what you should find in your install dir, under "lib"
- The two libraries are the ones needed for the analysis
- From here, choose your poison:
  - CMake (yes 😍)
  - Makefile (ok, boomer… 🤨)
  - ROOT macro (please no, we're adults here 😠)



```
❯ bat .rootlogon.C

File: .rootlogon.C

{
  TString naia_dir = "/path/to/your/NAIA/install";

  gROOT->ProcessLine(".include" + naia_dir + "/include");

  gSystem->SetDynamicPath(naia_dir + "/lib:" + gSystem->GetDynamicPath());

  gSystem->Load("libNAIAContainers");
  gSystem->Load("libNAIAChain");

}

 /Volumes/AMS_Disk/AMS-Italy/test
❯
```

OPENING A FILE

- NAIAChain works pretty much like AMSChain
- But you need to call SetupBranches after adding files to the chain
- p.s: You have access to the fmt library for python-like text formatting and spdlog for logging (which uses fmt as well)!

```cpp
// dependencies headers
#include "spdlog/sinks/stdout_color_sinks.h"
#include "spdlog/spdlog.h"

// NAIA headers
#include "Chain/NAIAChain.h"

using namespace NAIA;

int main(int argc, char const *argv[]) {
  NAIAChain chain(SingleTreeChain::AccessMode::Read);
  chain.Add("SOMEFILE.root");

  chain.SetupBranches();

  spdlog::info("{} entries in the chain", chain.GetEntries());

  unsigned long long nEntries = chain.GetEntries();
  for (unsigned long long iEv = 0; iEv < nEntries; iEv++) {
    auto event = chain.GetEvent(iEv);

  }

  return 0;
}
```

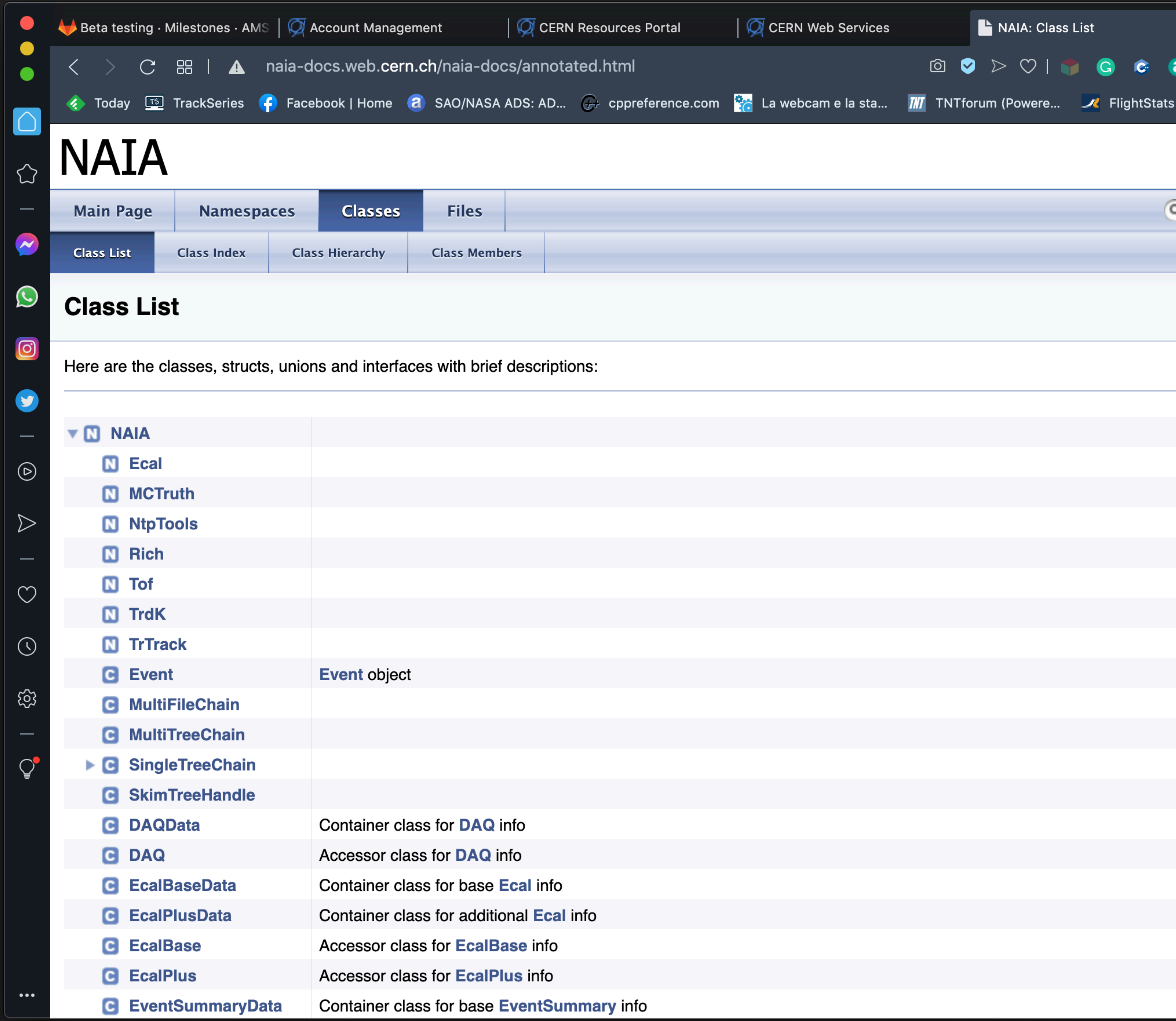
CONTAINERS

- Get the current event
- Access the desired container always using -> ! Basically treat containers as they are always pointers.
- Always use the corresponding enum to select the type of a quantity.

```
unsigned long long nEntries = chain.GetEntries();
for (unsigned long long iEv = 0; iEv < nEntries; iEv++) {
  auto event = chain.GetEvent(iEv);

  float tofCharge, innerCharge, rigidity;

  if (KeyExists(Tof::ChargeType::Upper, event.tofBase->Charge))
    tofCharge = event.tofBase->Charge[Tof::ChargeType::Upper];

  innerCharge = event.trTrackBase->Charge[TrTrack::ChargeRecoType::YJ];

  if (event.trTrackBase->FitIDExists(TrTrack::Fit::Kalman, TrTrack::Span::InnerOnly))
    rigidity = event.trTrackBase->RigidityCorr[TrTrack::Fit::Kalman][TrTrack::Span::InnerOnly];
}
```

DOXYGEN

- http://naia-docs.web.cern.ch/
- I won't go into the details but all the containers and enum types are described here.
- If there's something missing let me know!



NAIA

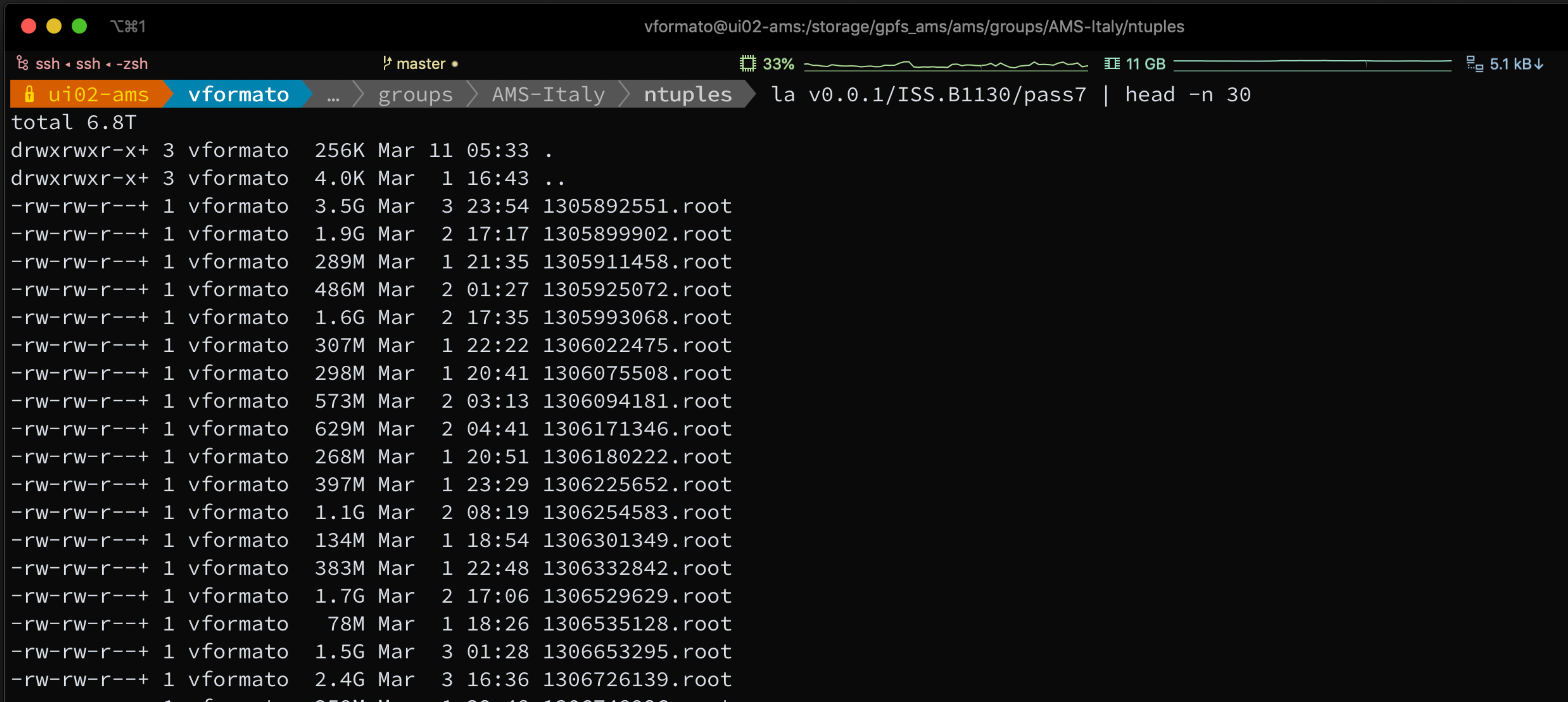
Class List

Here are the classes, structs, unions and interfaces with brief descriptions:

▼ N NAIA	
N Ecal	
N MCTruth	
N NtpTools	
N Rich	
N Tof	
N TrdK	
N TrTrack	
C Event	Event object
C MultiFileChain	
C MultiTreeChain	
▶ C SingleTreeChain	
C SkimTreeHandle	
C DAQData	Container class for DAQ info
C DAQ	Accessor class for DAQ info
C EcalBaseData	Container class for base Ecal info
C EcalPlusData	Container class for additional Ecal info
C EcalBase	Accessor class for EcalBase info
C EcalPlus	Accessor class for EcalPlus info
C EventSummaryData	Container class for base EventSummary info

FILES AT CNAF

- /storage/gpfs_ams/ams/groups/AMS-Italy/ntuples
  - 5000 runs selected randomly
  - Have fun! 🙃

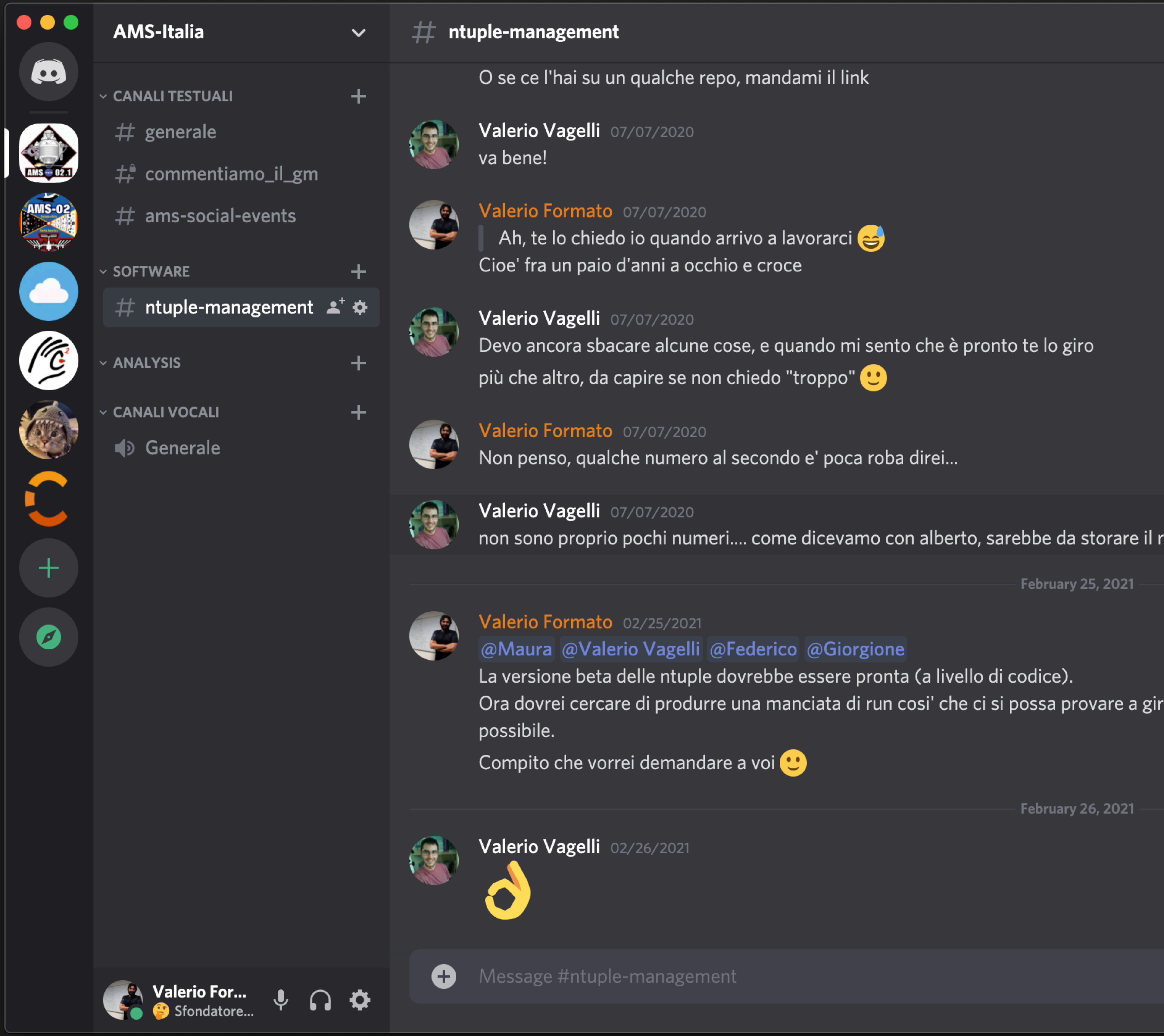


⌥⌘1
vformato@ui02-ams:/storage/gpfs_ams/ams/groups/AMS-Italy/ntuples
ssh ◂ ssh ◂ -zsh
master ●
33%
11 GB
5.1 kB↓

```
ui02-ams  vformato  …  groups  AMS-Italy  ntuples  la v0.0.1/ISS.B1130/pass7 | head -n 30
total 6.8T
drwxrwxr-x+ 3 vformato  256K Mar 11 05:33 .
drwxrwxr-x+ 3 vformato  4.0K Mar  1 16:43 ..
-rw-rw-r--+ 1 vformato  3.5G Mar  3 23:54 1305892551.root
-rw-rw-r--+ 1 vformato  1.9G Mar  2 17:17 1305899902.root
-rw-rw-r--+ 1 vformato  289M Mar  1 21:35 1305911458.root
-rw-rw-r--+ 1 vformato  486M Mar  2 01:27 1305925072.root
-rw-rw-r--+ 1 vformato  1.6G Mar  2 17:35 1305993068.root
-rw-rw-r--+ 1 vformato  307M Mar  1 22:22 1306022475.root
-rw-rw-r--+ 1 vformato  298M Mar  1 20:41 1306075508.root
-rw-rw-r--+ 1 vformato  573M Mar  2 03:13 1306094181.root
-rw-rw-r--+ 1 vformato  629M Mar  2 04:41 1306171346.root
-rw-rw-r--+ 1 vformato  268M Mar  1 20:51 1306180222.root
-rw-rw-r--+ 1 vformato  397M Mar  1 23:29 1306225652.root
-rw-rw-r--+ 1 vformato  1.1G Mar  2 08:19 1306254583.root
-rw-rw-r--+ 1 vformato  134M Mar  1 18:54 1306301349.root
-rw-rw-r--+ 1 vformato  383M Mar  1 22:48 1306332842.root
-rw-rw-r--+ 1 vformato  1.7G Mar  2 17:06 1306529629.root
-rw-rw-r--+ 1 vformato   78M Mar  1 18:26 1306535128.root
-rw-rw-r--+ 1 vformato  1.5G Mar  3 01:28 1306653295.root
-rw-rw-r--+ 1 vformato  2.4G Mar  3 16:36 1306726139.root
```

COMMUNICATION

- There will be bugs, there will be doubts, there will be problems
  - Feel free to write and ask anything on discord



O se ce l'hai su un qualche repo, mandami il link

Valerio Vagelli 07/07/2020
va bene!

Valerio Formato 07/07/2020
> Ah, te lo chiedo io quando arrivo a lavorarci 😅

Cioe' fra un paio d'anni a occhio e croce

Valerio Vagelli 07/07/2020
Devo ancora sbacare alcune cose, e quando mi sento che è pronto te lo giro più che altro, da capire se non chiedo "troppo" 🙂

Valerio Formato 07/07/2020
Non penso, qualche numero al secondo e' poca roba direi...

Valerio Vagelli 07/07/2020
non sono proprio pochi numeri.... come dicevamo con alberto, sarebbe da storare il r

February 25, 2021

Valerio Formato 02/25/2021
@Maura @Valerio Vagelli @Federico @Giorgione
La versione beta delle ntuple dovrebbe essere pronta (a livello di codice).
Ora dovrei cercare di produrre una manciata di run cosi' che ci si possa provare a gir possibile.
Compito che vorrei demandare a voi 🙂

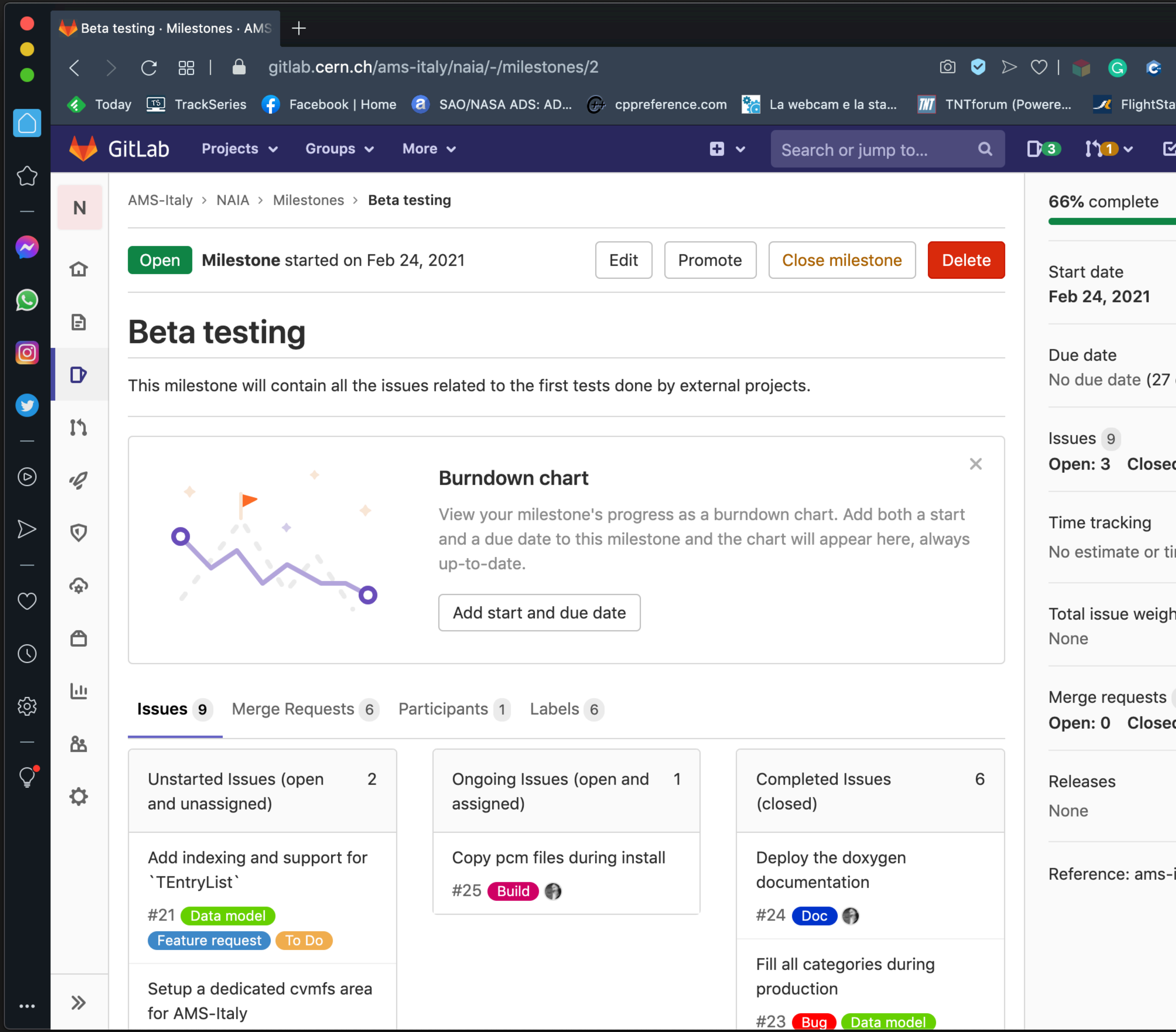
February 26, 2021

Valerio Vagelli 02/26/2021
👌

Message #ntuple-management

COMMUNICATION

- There will be bugs, there will be doubts, there will be problems
  - Feel free to write and ask anything on discord
  - We well keep track of all bugs / feature requests on gitlab. There is a dedicated milestone for these tests.



AMS-Italy › NAIA › Milestones › **Beta testing**

Open **Milestone** started on Feb 24, 2021

Edit | Promote | Close milestone | Delete

Beta testing

This milestone will contain all the issues related to the first tests done by external projects.

Burndown chart

View your milestone's progress as a burndown chart. Add both a start and a due date to this milestone and the chart will appear here, always up-to-date.

Add start and due date

Issues 9 | Merge Requests 6 | Participants 1 | Labels 6

Unstarted Issues (open and unassigned) 2

- Add indexing and support for `TEntryList`
  #21 Data model Feature request To Do
- Setup a dedicated cvmfs area for AMS-Italy

Ongoing Issues (open and assigned) 1

- Copy pcm files during install
  #25 Build

Completed Issues (closed) 6

- Deploy the doxygen documentation
  #24 Doc
- Fill all categories during production
  #23 Bug Data model

66% complete

Start date
Feb 24, 2021

Due date
No due date (27

Issues 9
Open: 3 Closed

Time tracking
No estimate or ti

Total issue weigh
None

Merge requests
Open: 0 Closed

Releases
None

Reference: ams-i