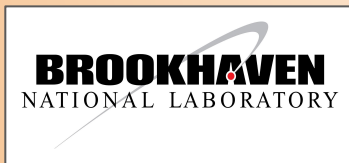


Data & Analysis Preservation: status update

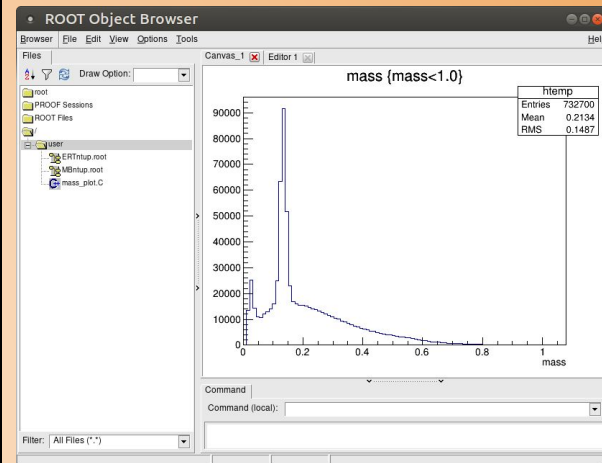
Maxim Potekhin

Nuclear and Particle Physics Software Group



PHENIX Conveners Meeting

03/03/2021



Overview

- Please see slides from my previous presentation in January 2021 for a broad overview of Data and Analysis Preservation in PHENIX
- https://docs.google.com/presentation/d/19ksQ05Y-pU3SuLxIciZsdydjgKJvHlh_UbwtXiQctn4/edit?usp=sharing
- Topics for today
 - Zenodo
 - Progress with the Open Data materials and submission status
 - HEPData
 - Docker images for PHENIX (quick overview)
 - Website updates
 - Management of the Analysis Notes

Zenodo (digital repository)

- Using the CERN instance for ~1.5 years
- Uploads happening at a brisk pace
- 310+ items as of today
- Half of them are PhD theses
- Growing number of conference presentations committed to Zenodo
 - Establishing a new workflow for preservation of these materials, instead of the aging legacy web page
- Documents, images, videos, software
- Thanks to Gabor for taking care of conference presentations and to Stacyann Nelson for the theses upload
- More keywords added to the official list as necessary
- Please consider leveraging Zenodo

Select Conference Presentations		
2021		
Workshop on forward physics and QCD 2021 Initial Stages 2021		PHENIX Presentations
2020		
Zimányi School 2020		PHENIX Presentations
17th International Workshop on Hadron Structure and Spectroscopy		PHENIX Presentations
The 36th Winter Workshop on Nuclear Dynamics		PHENIX Presentations
Santa Fe Jets and Heavy Flavor Workshop 2020		PHENIX Presentations
DNP Fall 2020 Meeting		PHENIX Presentations
Hard Probes 2020		PHENIX Presentations
2019		
Quark Matter 2019		PHENIX Presentations
Zimányi School 2019		PHENIX Presentations
DNP Fall 2019 Meeting		PHENIX Presentations
International Symposium on Multiparticle Dynamics 2019		PHENIX Presentations
2019 RHIC & AGS Annual Users Meeting		PHENIX Presentations
Strangeness in Quark Matter 2019		PHENIX Presentations
2018		
XIII Workshop on Particle Correlations and Femtoscopy		PHENIX Presentations
Hard Probes 2018		PHENIX Presentations
2017		
Strangeness in Quark Matter 2017		PHENIX Presentations
2016		
Strangeness in Quark Matter 2016		PHENIX Presentations

zenodo Search PHENIX Collaboration Upload Communities phenix-dap-i@lists.bnl.gov

PHENIX Collaboration

All versions Found 292 results. Sort by: Most recent asc

February 17, 2021 (v1) Software Open Access View

ROOT5 SL7 Docker Image
Potekhin, Maxim.
Included in this package are compressed tar(gz) archives of Docker images for a legacy version of ROOT (version 5) and its underlying images, all based on Scientific Linux 7. This package has been created as a part of the Data and Analysis Preservation effort in PHENIX, as a reference snapshot.
Uploaded on February 17, 2021

February 16, 2021 (v1) Presentation Open Access View

Recent Heavy Flavor Results Utilizing the FVXT in PHENIX at RHIC
Li, Xuan.
Talk presented at the Strangeness in Quark Matter 2016 conference.
Uploaded on February 15, 2021

February 16, 2021 (v1) Presentation Open Access View

Open Heavy Flavor and Quarkonia in the PHENIX Experiment at RHIC
Nouicer, Rachid.
Talk presented at the Strangeness in Quark Matter 2016 conference.
Uploaded on February 15, 2021

February 15, 2021 (v1) Presentation Open Access View

Experiment review in small system collectivity and thermalization
Huang, Shengli.
Talk presented at the Strangeness in Quark Matter 2016 conference.
Uploaded on February 15, 2021

February 15, 2021 (v1) Presentation Open Access View

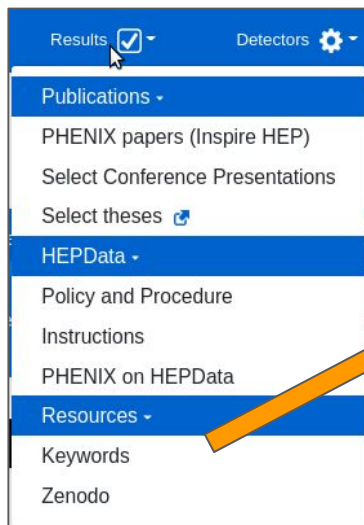
Highlights from PHENIX at RHIC
Nouicer, Rachid.
Overview talk presented at the Strangeness in Quark Matter 2017 conference.
Uploaded on February 15, 2021

February 15, 2021 (v1) Presentation Open Access View

PHENIX results on open heavy flavor production
Hachiya, Takashi.

Keywords

- Maintaining a curated list of keywords is important
- NB. Complex queries involving combination of keywords are possible, and the “elastic search” is built in
- Please check the “Keywords” item under “Results” on the website
- Each keyword is a working link



General (8 items)	
Keyword	Description
alice	ALICE - an experiment at CERN
bup	Beam Use Proposal
decadal plan	Two long-term proposals for the PHENIX research program
phenix	Pioneering High Energy Nuclear Interaction Experiment (PHENIX)
phobos	PHOBOS - an experiment at RHIC
rhic	Relativistic Heavy Ion Collider (RHIC)
star	STAR - an experiment at RHIC
wa98	WA98 - an experiment at CERN

Conferences (21 items)	
Keyword	Description
aum19	2019 RHIC & AGS Annual Users Meeting
drp19	DNP (2019)
drp20	DNP (2020)
fwph21	Workshop on forward physics and QCD (2021)
hp18	Hard Probes 2018
hp20	Hard Probes 2020
icntp19	International Conference on New Frontiers in Physics 2919
is19	Initial Stages (2019)
is21	Initial Stages (2021)
ismd19	International Symposium on Multiparticle Dynamics (2019)
iwhss2020	17th International Workshop on Hadron Structure and Spectroscopy
qm18	Quark Matter 2018
qm2019	Quark Matter 2019
stjh20	Santa Fe Jets and Heavy Flavor Workshop (2020)
sqm16	Strangeness in Quark Matter 2016
sqm17	Strangeness in Quark Matter 2017
sqm19	Strangeness in Quark Matter 2019
wpc2018	XIII Workshop on Particle Correlations and Femtoscopy
wwnd2020	The 36th Winter Workshop on Nuclear Dynamics (2020)
zs19	Zimányi School 2019
zs20	Zimányi School (2020)

Physics (93 items)	
Keyword	Description
3he+au	Helium3-on-gold collisions
anisotropy	Anisotropy
asymmetry	Asymmetry
au+au	Gold-on-gold collisions
azimuthal	Azimuthal
b meson	B meson

The legacy database situation

- Upload of conference presentation is broken
- Fixing that will likely take too much time for our budget
- For some months now we've been uploading conference materials to Zenodo
- A managed keyword list (including conferences)
- Is this a good time to switch to the new process?



Results <input checked="" type="checkbox"/> Detectors Software Analysis	
Conferences (15 items)	
Keyword	Description
aum19	2019 RHIC & AGS Annual Users Meeting
dnp19	DNP (2019)
dnp20	DNP (2020)
fwph21	Workshop on forward physics and QCD (2021)
hp18	Hard Probes 2018
hp20	Hard Probes 2020
is21	Initial Stages (2021)
ismd19	International Symposium on Multiparticle Dynamics (2019)
lwshs2020	17th International Workshop on Hadron Structure and Spectroscopy
qm2019	Quark Matter (2019)
sfjht20	Santa Fe Jets and Heavy Flavor Workshop (2020)
wpcf2018	XIII Workshop on Particle Correlations and Femtoscopy
wwnd2020	The 36th Winter Workshop on Nuclear Dynamics (2020)
zs19	Zimányi School (2019)
zs20	Zimányi School (2020)

Results <input checked="" type="checkbox"/> Detectors Software Analysis	
Select Conference Presentations	
2021	
Workshop on forward physics and QCD 2021	PHENIX Presentations
Initial Stages 2021	PHENIX Presentations
2020	
Zimányi School 2020	PHENIX Presentations
17th International Workshop on Hadron Structure and Spectroscopy	PHENIX Presentations
The 36th Winter Workshop on Nuclear Dynamics	PHENIX Presentations
Santa Fe Jets and Heavy Flavor Workshop 2020	PHENIX Presentations
DNP Fall 2020 Meeting	PHENIX Presentations
Hard Probes 2020	PHENIX Presentations
2019	
Quark Matter 2019	PHENIX Presentations
Zimányi School 2019	PHENIX Presentations
DNP Fall 2019 Meeting	PHENIX Presentations
International Symposium on Multiparticle Dynamics 2019	PHENIX Presentations
2019 RHIC & AGS Annual Users Meeting	PHENIX Presentations
2018	
XIII Workshop on Particle Correlations and Femtoscopy	PHENIX Presentations
Hard Probes 2018	PHENIX Presentations

Open Data: a flexible DAP platform

Explore more than **two petabytes** of open data from particle physics!

Start typing...

search examples: [collision datasets](#), [keywords:education](#), [energy:7TeV](#)

Explore

[datasets](#)
[software](#)
[environments](#)
[documentation](#)

Focus on

[ATLAS](#)
[ALICE](#)
[CMS](#)
[LHCb](#)
[OPERA](#)
[Data Science](#)

PHENIX to be here soon

Get started

How can you use this?

If you do not have the CERN Virtual Machine for 2010 CMS data installed, follow the instructions in step 1 at [How to install a CERN Virtual Machine](#). Then install and run the Demo (demo analyzer) program following the instructions at [How to Test & Validate](#).

To run the "di-muon spectrum" demo:

1. Create directory `datasets` under `Demo/DemoAnalyzer`.
2. Download the index files for the `/Mu/Run2010B-Apr21ReReco-v1/AOD` primary datasets and store them in `Demo/DemoAnalyzer/datasets/`.
3. Download the JSON file from [CMS Validated Runs](#) and save it to the `Demo/DemoAnalyzer/datasets` directory.
4. Replace the three files `BuildFile.xml`, `demoanalyzer_cfg.py`, `src/DemoAnalyzer.cc` with the ones from this record and read the comments in `DemoAnalyzer.cc` if you want to understand what the program does.
5. Recompile (`scram b`) and rerun (`cmsRun ...`) exactly as shown before in [How to Test & Validate](#).
6. You should get an output file `Mu.root`, which contains histograms for 10000 input events (a small subset of the data). These can be looked at using a ROOT Browser (see above, under Description). The most interesting histogram is `GM_mass_log`. In order to compare it with the invariant-mass spectrum of di-muons in `MUO-10-004`, it should be viewed with the `logy` option. Of course with 10000 events the comparison is poor, but the J/ψ (at $\log_{10}(\text{mass})=0.5$), Y (at $\log_{10}(\text{mass})=0.98$) and Z (at $\log_{10}(\text{mass})=1.95$, one event only) peaks should be visible.
7. Finally, to run over more or even the full data, edit the relevant parts of the Python file `demoanalyzer_cfg.py` (see comments therein) and rerun. Add up the output histograms from different (non-overlapping) input index files using ROOT tools.

Files

Filename	Size	
BuildFile.xml	342.0 bytes	Download
DemoAnalyzer.cc	14.3 kB	Download
demoanalyzer_cfg.py	3.4 kB	Download
Mudemo.root	14.6 kB	Download

Open Data - PHENIX engagement

- PHENIX was granted rights to host on the CERN OpenData portal
 - This is a first for an experiment based outside of CERN (and of Europe)
 - The upload mechanism tested, it's simple and reliable (XRootD)
- π^0/γ analysis case captured, materials uploaded - Ntuples, PDF, macros
 - Gabor and Maxim's effort <https://github.com/PhenixCollaboration/opendata>
- After the initial upload our CERN contacts made a number of suggestions about how to improve the material
- We invested more effort and are close to finalizing this entry
 - Refactored the data
 - Updated the write-up
 - Developed ROOT macros for both legacy (ROOT5) environment and also for ROOT6
 - A Docker image for SL7/ROOT5 has been built

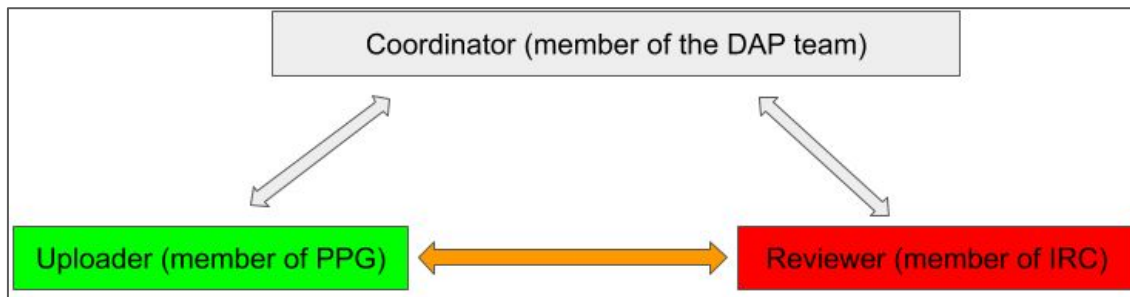
Open Data - going forward

- When time permits, please take a look at the CERN Open Data portal
- A powerful DAP platform which can be leveraged for training and other purposes (future PHENIX Schools?)
- Great publicity for PHENIX
- Question: can we find volunteers to create preserved examples of PHENIX analyses, similar to what we did with π^0/γ ?
 - For ROOT-based final stages of analyses creating a package is fairly straightforward
- NB. The LHC experiments are leveraging [XRootD](#)/EOS for hosting/shipping data samples - not a requirement but a major convenience. PHENIX does not have that - would be a good idea to get this piece in place going forward

HEPData

- Ongoing work, good participation of the PHENIX community, does take effort
- Contact Maxim and Christine if you have questions or need help

PPG	Contact	Contact e-mail	PPG Uploader name	PPG Uploader e-mail	IRC Reviewer name	IRC Reviewer e-mail	Status/Comments	arXiv	InspireHEP ID	HEPData ID
023	Abdulla Alsayegh	abdullah.alsayegh@protonmail.com					Early draft	308006	625472	
071	K.Smith	kis15k@my.fsu.edu					An older entry, corrections/Conflict: Inspire and Phys.Rev abstracts	801.022	776624	57327
081	Reem Alreshdi	reemalreshdi@outlook.com, cnattras	Zaida Conesa del Valle	zaida.conesa.del.valle@cern.ch			Under sandbox review by Zaida	903.2041	815217	57350
083	C.Nattrass	cnattras@utk.edu	Jiangyong Jia	jiangyong.jia@stonybrook.edu			Resubmitted and finalized. Done.		778396	96764
115	C.Nattrass	cnattras@utk.edu					Complete/Done by Dylan Rotunno at UTK			
119	M.Wysocki	matthew.g.wysocki@gmail.com					In preparation	1910.14487	894560	
147	Takahito Todoroki	todoroki@bnl.gov	Takahito Todoroki	todoroki@bnl.gov				1412.1038	1332239	
173	C.Nattrass	cnattras@utk.edu	Takahito Todoroki	todoroki@bnl.gov			Assigned: Christine Nattrass -> Jason Spriggs; decimal places	1803.01749	1658594	
202	Gabor						In preparation, IRC is unclear			
209	S.Zharko	zharkosergey94@gmail.com	S.Zharko	zharkosergey94@gmail.com			Discussion of round off/Pending Sergei's additional edits	1805.04389	1672859	100192 (not public)
210	C.Nattrass	cnattras@utk.edu	C.Nattrass	cnattras@utk.edu	A.Hodges	ahodges21@student.gsu.edu	PNG's corrected for quality. Done.	2005.14270	1798493	101752
235	N.Lewis	nialewis@umich.edu	Nicole Lewis	nialewis@umich.edu	Xiaochun He	xhe@gsu.edu	Comment period ended			



Docker: the purpose and the challenges

- Keep/capture snapshots of individual stages of analyses - with proper containers a lot can be done on laptops/workstations - preserve the software environment
 - cf. legacy ROOT, compilers as they exist on interactive and batch nodes now
- Aid in capturing workflows with REANA
- Challenge: **building** the software - regardless whether it's for Docker images or other purposes - if you can build it, you can containerize it
 - Build procedures in PHENIX became rather monolithic and complex over time
 - Looking into it
- Copying over .so's is an option if you can be sure of all dependencies
- CVMFS might be an option as well

Docker

- Created a new GitHub repository for PHENIX: “containers”
 - e.g. for Dockerfiles
 - For management of materials needed to build various images - Docker, Singularity as needed
- Current ROOT 6+ versions are provided by the ROOT team - but not ROOT5
 - <https://hub.docker.com/u/rootproject> - runs out of the box
- Built a ROOT 5.34/36 image - the PHENIX standard
 - Configuration kept on GitHub
 - PHENIX organization created on Docker Hub, custom images built and pushed to the repo
 - They also include compatible versions of gcc and g++, same as on interactive nodes
 - Available to anyone
- Documented added as the new pages on the website

Docker - GitHub and Docker Hub

The image shows a Dockerfile in a code editor on the left and its Docker Hub repository page on the right. An orange arrow points from the Dockerfile to the repository page.

Dockerfile (Left):

```
FROM ubuntu:16.04
MAINTAINER buddhasystem
CHECKPOINT Work in progress - no shared memory option works for ROOT ...
ADD . /
RUN apt-get update && apt-get install -y x11-xserver-utils && rm -rf /var/lib/apt/lists/*
```

Docker Hub Repository (Right):

Repository: phenixcollaboration / tools

Tags and Scans

TAG	OS	PULLED	PUSHED
sl7_root5	linux/amd64	6 days ago	6 days ago
sl7_basic	linux/amd64	6 days ago	6 days ago

Docker commands

```
docker push phenixcollaboration/tools:tagname
```

Recent builds

Link a source provider and run a build to see build results here.

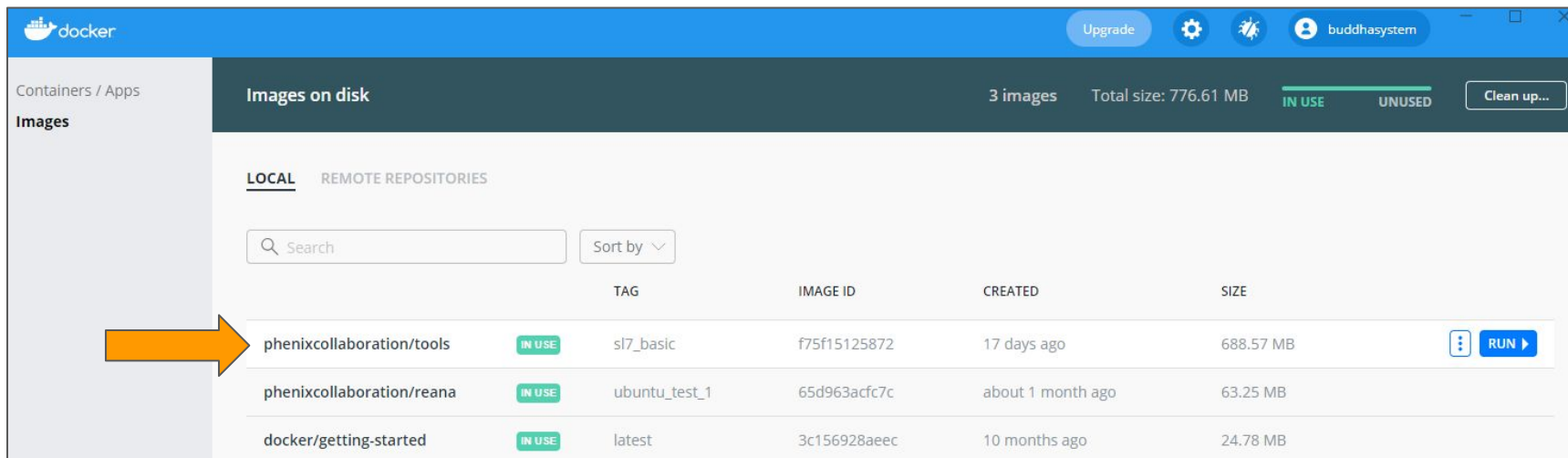
Readme

Repository description is empty. Click [here](#) to edit.

Can run in the familiar SL7 on any version of Linux, MacOS and Windows

Docker on Windows

- Reasonable installation procedure (a couple of updates and restarts)
- Runs under WSL 2 - a Linux environment - closer to the kernel than a VM
- Features a desktop application plus full command-line functionality



The screenshot shows the Docker Desktop application window. The top bar is blue with the Docker logo, an 'Upgrade' button, and icons for settings, Docker status, and the user 'buddhasystem'. The main area is titled 'Images on disk' and shows '3 images' with a 'Total size: 776.61 MB'. A progress bar indicates 'IN USE' and 'UNUSED' space. Below this, there are tabs for 'LOCAL' and 'REMOTE REPOSITORIES'. A search bar and a 'Sort by' dropdown are present. A table lists the images:

	TAG	IMAGE ID	CREATED	SIZE
phenixcollaboration/tools	sl7_basic	f75f15125872	17 days ago	688.57 MB
phenixcollaboration/reana	ubuntu_test_1	65d963acfc7c	about 1 month ago	63.25 MB
docker/getting-started	latest	3c156928aeec	10 months ago	24.78 MB

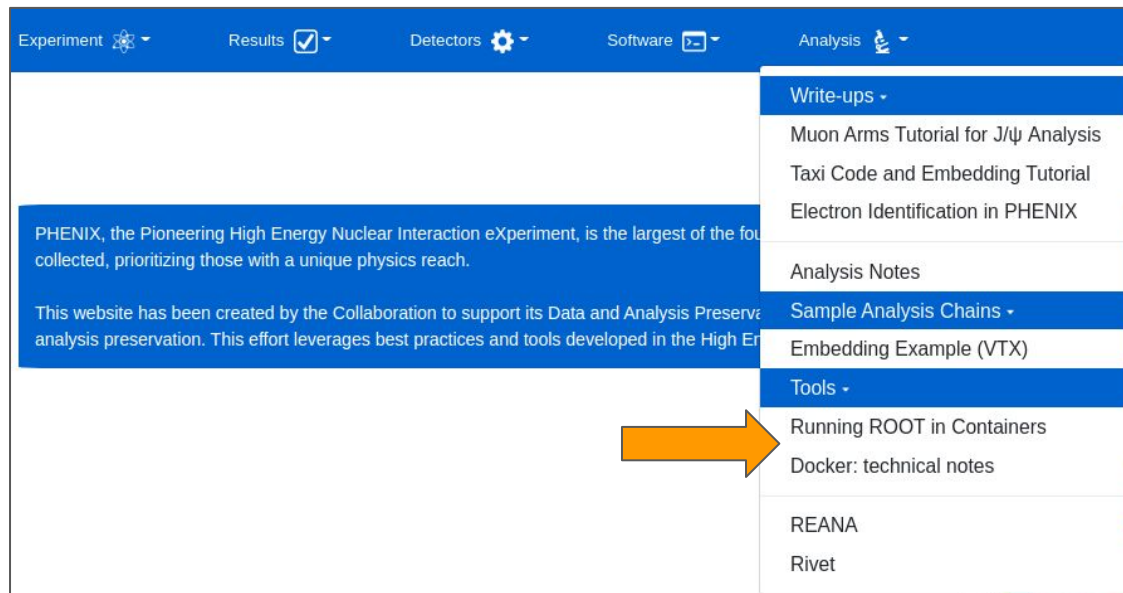
An orange arrow points to the 'phenixcollaboration/tools' image. Each image row has a green 'IN USE' badge and a 'RUN' button.

Docker on Mac

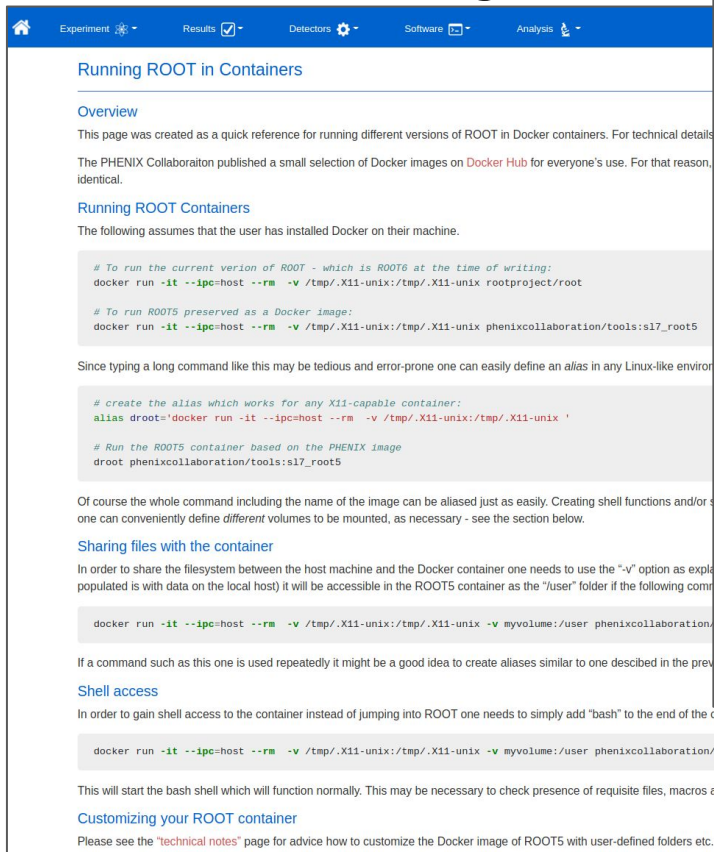
- I don't have a Mac so can't report on experience
- Many users have Macs - any volunteers to try it out?
- Can have a complete SL7 environment without installing complex software
 - Same gcc, g++, emacs, xterm, ROOT as on the RACF nodes

Website updates

- Docker pages created, fair amount of material added
 - Quick start + Technical details



Website: Docker Pages



The screenshot shows the 'Running ROOT in Containers' page. It includes an overview, a section on running ROOT containers with terminal commands for ROOT6 and ROOT5, and a section on sharing files with the container. The page is part of a website with a blue header and navigation tabs.

Running ROOT in Containers

Overview

This page was created as a quick reference for running different versions of ROOT in Docker containers. For technical details The PHENIX Collaboration published a small selection of Docker images on [Docker Hub](#) for everyone's use. For that reason, it is ideal.

Running ROOT Containers

The following assumes that the user has installed Docker on their machine.

```
# To run the current version of ROOT - which is ROOT6 at the time of writing:
docker run -it --ipc=host --rm -v /tmp/.X11-unix:/tmp/.X11-unix rootproject/root

# To run ROOT5 preserved as a Docker image:
docker run -it --ipc=host --rm -v /tmp/.X11-unix:/tmp/.X11-unix phenixcollaboration/tools:s17_root5
```

Since typing a long command like this may be tedious and error-prone one can easily define an alias in any Linux-like environment.

```
# create the alias which works for any X11-capable container:
alias droot="docker run -it --ipc=host --rm -v /tmp/.X11-unix:/tmp/.X11-unix '

# Run the ROOT5 container based on the PHENIX image
droot phenixcollaboration/tools:s17_root5
```

Of course the whole command including the name of the image can be aliased just as easily. Creating shell functions and/or one can conveniently define *different* volumes to be mounted, as necessary - see the section below.

Sharing files with the container

In order to share the filesystem between the host machine and the Docker container one needs to use the "-v" option as explained above. If the container is populated with data on the local host) it will be accessible in the ROOT5 container as the "user" folder if the following command is used:

```
docker run -it --ipc=host --rm -v /tmp/.X11-unix:/tmp/.X11-unix -v myvolume:/user phenixcollaboration/tools:s17_root5
```

If a command such as this one is used repeatedly it might be a good idea to create aliases similar to one described in the previous section.

Shell access

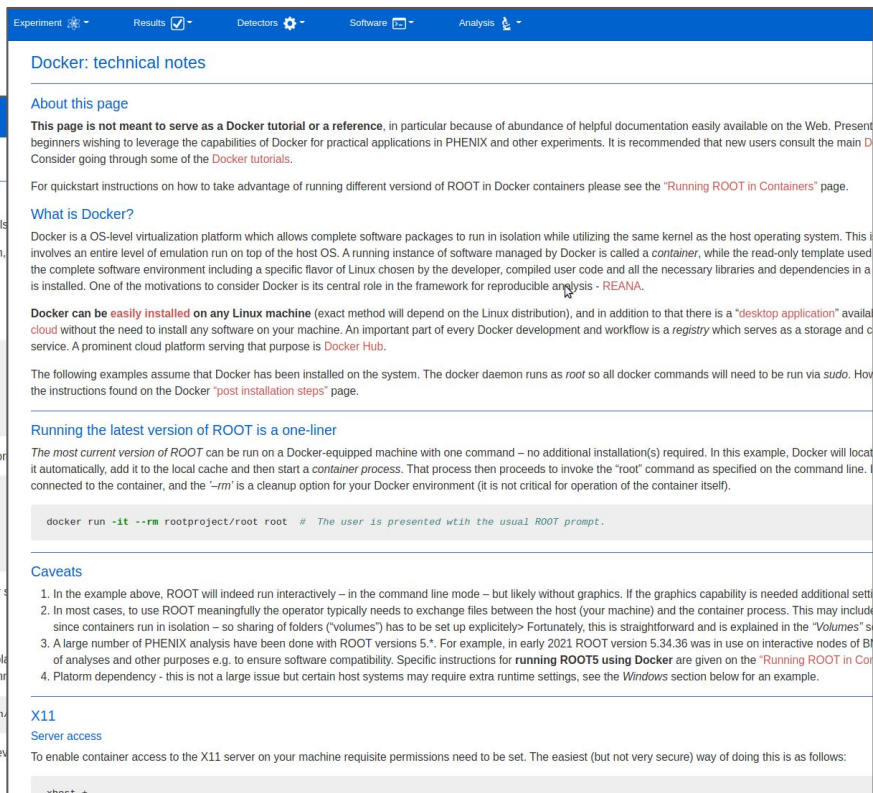
In order to gain shell access to the container instead of jumping into ROOT one needs to simply add "bash" to the end of the command line:

```
docker run -it --ipc=host --rm -v /tmp/.X11-unix:/tmp/.X11-unix -v myvolume:/user phenixcollaboration/tools:s17_root5 bash
```

This will start the bash shell which will function normally. This may be necessary to check presence of requisite files, macros and other settings.

Customizing your ROOT container

Please see the ["technical notes"](#) page for advice how to customize the Docker image of ROOT5 with user-defined folders etc.



The screenshot shows the 'Docker: technical notes' page. It includes an overview, a section on running ROOT containers with terminal commands for ROOT6 and ROOT5, and a section on sharing files with the container. The page is part of a website with a blue header and navigation tabs.

Docker: technical notes

About this page

This page is not meant to serve as a Docker tutorial or a reference, in particular because of abundance of helpful documentation easily available on the Web. Present beginners wishing to leverage the capabilities of Docker for practical applications in PHENIX and other experiments. It is recommended that new users consult the main [Docker page](#). Consider going through some of the [Docker tutorials](#).

For quickstart instructions on how to take advantage of running different versions of ROOT in Docker containers please see the ["Running ROOT in Containers"](#) page.

What is Docker?

Docker is an OS-level virtualization platform which allows complete software packages to run in isolation while utilizing the same kernel as the host operating system. This involves an entire level of emulation run on top of the host OS. A running instance of software managed by Docker is called a *container*, while the read-only templates used to create the complete software environment including a specific flavor of Linux chosen by the developer, compiled user code and all the necessary libraries and dependencies in a container is called a *image*. One of the motivations to consider Docker is its central role in the framework for reproducible analysis - [REANA](#).

Docker can be easily installed on any Linux machine (exact method will depend on the Linux distribution), and in addition to that there is a ["desktop application"](#) available without the need to install any software on your machine. An important part of every Docker development and workflow is a registry which serves as a storage and distribution service. A prominent cloud platform serving that purpose is [Docker Hub](#).

The following examples assume that Docker has been installed on the system. The docker daemon runs as root so all docker commands will need to be run via `sudo`. How to install Docker is explained in the instructions found on the Docker ["post installation steps"](#) page.

Running the latest version of ROOT is a one-liner

The most current version of ROOT can be run on a Docker-equipped machine with one command - no additional installation(s) required. In this example, Docker will locate it automatically, add it to the local cache and then start a *container* process. That process then proceeds to invoke the "root" command as specified on the command line, connected to the container, and the "-rm" is a cleanup option for your Docker environment (it is not critical for operation of the container itself).

```
docker run -it --rm rootproject/root root # The user is presented with the usual ROOT prompt.
```

Caveats

1. In the example above, ROOT will indeed run interactively - in the command line mode - but likely without graphics. If the graphics capability is needed additional settings are required.
2. In most cases, to use ROOT meaningfully the operator typically needs to exchange files between the host (your machine) and the container process. This may include the use of ["Volumes"](#) since containers run in isolation - so sharing of folders ("volumes") has to be set up explicitly. Fortunately, this is straightforward and is explained in the ["Volumes"](#) section of the Docker documentation.
3. A large number of PHENIX analysis have been done with ROOT versions 5.*. For example, in early 2021 ROOT version 5.34.36 was in use on interactive nodes of BNL's [PHENIX](#) and other purposes e.g. to ensure software compatibility. Specific instructions for [running ROOT5 using Docker](#) are given on the ["Running ROOT in Containers"](#) page.
4. Platform dependency - this is not a large issue but certain host systems may require extra runtime settings, see the [Windows](#) section below for an example.

X11 Server access

To enable container access to the X11 server on your machine requisite permissions need to be set. The easiest (but not very secure) way of doing this is as follows:

```
sudo xhost +
```


Analysis notes

- Long-standing requirements for data privacy and access controls
- Discoverability for authorized users, cross-reference
- Aging infrastructure (legacy web pages) - need durable long-term solutions

Analysis notes: all options (details on the next slide)

- Any type of file sharing option - with encryption
 - Passwords can be circulated to select participants only
 - Finding a truly portable solution may be a bit of a challenge, openssl is a strong contender (all platforms)
- Zenodo - private access option
 - Access on demand, decided by the PHENIX Zenodo curators
 - The only solution offering proper built-in indexing and search capabilities
- GitHub - a private repository
 - Accessible to users on a managed list
 - GitHub tags can be used for indexing (like keywords)
- BNLbox
 - Broadly speaking, an equivalent of Dropbox with vastly larger storage available
 - Web UI
 - File upload and download using a CLI script is possible
 - A fairly capable access control system

Analysis notes options: the shortlist

- Zenodo - private access option
 - Access on demand, decided by the PHENIX Zenodo curators
 - Per-person, per item action - this can only work if there are <20 interested people or so for a given note
 - Designed for “close to final” or “final” versions of documents i.e. not as a workflow mechanism
 - The only solution offering proper built-in indexing and search capabilities
 - References to prior notes on same topics can be handled organically
 - No convenient folder structure i.e. directory trees
- GitHub - a private repository
 - PHENIX does have an organization on GitHub i.e. everything can be properly managed
 - Accessible to users on a managed list
 - Easier management of access, no individual action per item/person
 - Flexible folder structure
 - Designed for revisions/workflows
 - GitHub tags can be used for indexing (like keywords)