Tier1 and HTCondor resources usage

R. Zarrella

XV FOOT General Meeting   Trento, 11-13/12/2023
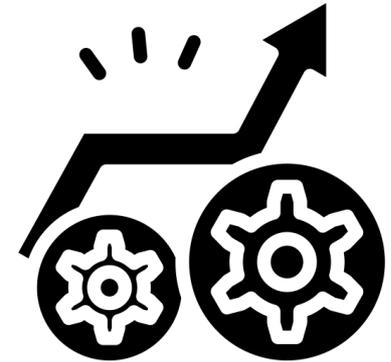
Tier1

From this year, we started moving all our files and resources to Tier1

- **Tier3 will not be our reference anymore**

- Tier1 is the main INFN computing service

- Login through bastion, two dedicated UIs for FOOT

  ➢ ui01-foot   (ui01-foot.cr.cnaf.infn.it)

  ➢ ui02-foot   (ui02-foot.cr.cnaf.infn.it)

- ROOT (6.26/08) already available (/opt/exp_software/foot/root)

- SHOE installation is very straightforward

- Detailed instructions on environment setup available on the
  [software page of the FOOT TWiki](#)

Tier1 – Storage

Each folder on the Tier1 has a specific task

➔ **Optimized for large files**

`/storage/gpfs_data/foot` : parent directory (~90 TB)
`/storage/gpfs_data/foot/shared` : Experimental data
`/storage/gpfs_data/foot/shared/SimulatedData` : MC simulation data
`/storage/gpfs_data/foot/${USER}` : User data **(create if not present!)**

DATA

➔ **Optimized for small files**

`/opt/exp_software/foot` : parent directory
`/opt/exp_software/foot/${USER}` : User software **(create if not present!)**

SW

➔ **Optimized for small files**
➔ **Daily backup but limited and shared by all the collaboration**

`/home/FOOT-T3` : parent directory (~110 GB)
`/home/FOOT-T3/${USER}` : User $HOME

HOME

Tier1 – Software

The UIs serve only as **interfaces**

- Not designed for demanding tasks

- Main purpose is I/O

- Limited resources (not more than a laptop)
  8 cpu, 16 GB RAM

- Shared by all people working in the experiment

Tier1 – Software

The UIs serve only as **interfaces**

- Not designed for demanding tasks
- Main purpose is I/O
- Limited resources (not more than a laptop)
  8 cpu, 16 GB RAM
- Shared by all people working in the experiment

<div style="border: 2px solid black; padding: 10px;">

BE CAREFUL WHAT YOU LAUNCH

ON THESE MACHINES!

</div>

*(maybe just avoid launching stuff here if you can...)*

So… How does one work on the Tier1?

Tier1 – HTCondor

The UIs are interfaced to the CNAF computing resources through the **HTCondor** batch system

- Best way to fully exploit the Tier1 resources
- From UI, a user can submit jobs to condor
- Job scheduler → handles the assignment and execution of the jobs
- What is needed to do that?
  - Executable file → command
  - Submit file → job parameters
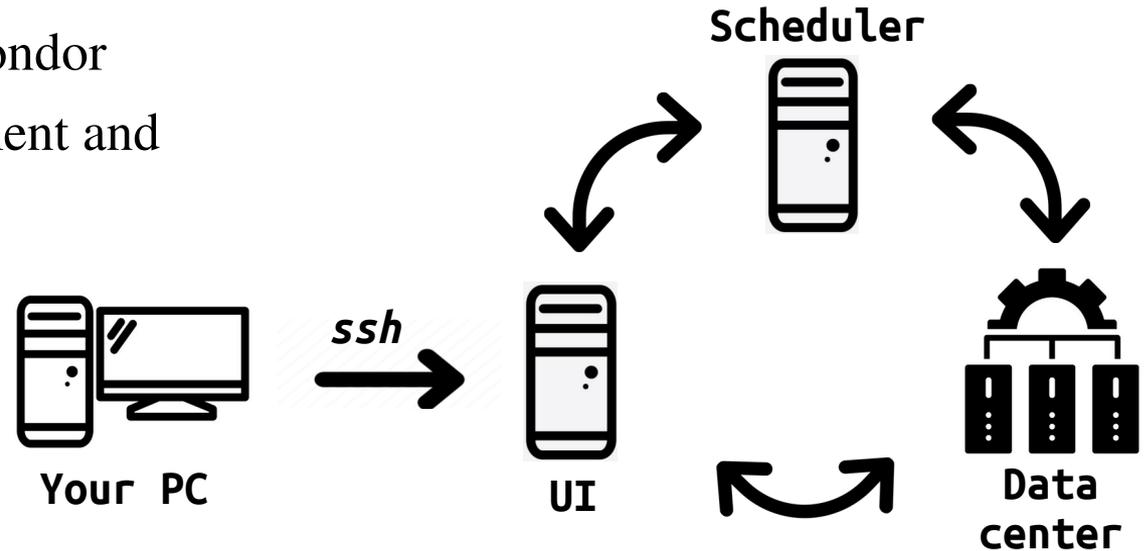
Scripts already available in SHOE to create aux files and submit jobs!

SHOE scripts – MC simulation processing

shoe/Reconstruction/scripts/runShoeBatchT1_MC.sh

- MC files processing
- Documentation inside the file
- **Can be run from any directory**
- **1 job = 20k events**
- **Campaign and run number are retrieved automatically!**
- Possible to process multiple files for a single run (-f option)
- **Mandatory to pre-set the FootGlobal.par and all configurations/calibrations!**
  (Maybe test DecodeGlb w/ ~100 evts before launching the script)

-i	**Input file** (in /storage/gpfs_data/foot/shared/SimulatedData)
-o	**Output directory** (in /storage/gpfs_data/foot/${USER})
-m	**Merge output files** (optional, default "0")
-f	**Use full statistics** (optional, default "0")

Example

```
./runShoeBatchT1_MC.sh -i /storage/gpfs_data/foot/shared/SimulatedData/12C_200_2023v2/12C_C_200_1_shoereg.root -o
/storage/gpfs_data/foot/${USER}/results -m 1 -f 1
```

SHOE scripts – Experimental data processing

shoe/Reconstruction/scripts/runShoeBatchT1.sh

- Experimental data processing
- Documentation inside the file
- **Can be run from any directory**
- **1 job = 1 subfile**
- Possible to process multiple runs (even all!!) for a single campaign
- **Mandatory to pre-set the FootGlobal.par and all configurations/calibrations** (Maybe test DecodeGlb w/ ~100 evts before launching the script)

Arguments

-i	**Input directory** (in /storage/gpfs_data/foot/shared
-o	**Output directory** (in /storage/gpfs_data/foot/${USER})
-c	**Campaign name**
-r	**First run number**
-l	**Last run number** (optional)
-m	**Merge output files** (optional, default "0")

Example

```
./runShoeBatchT1.sh -i /storage/gpfs_data/foot/shared/DataGSI2021sync/ -o /storage/gpfs_data/foot/${USER}/results
-c GSI2021 -r 4306 -l 4310 -m 1
```

HTCondor jobs monitoring and handling

Jobs can be monitored through the "condor_q" command:

```
condor_q -name sn-02
```

```
-- Schedd: sn-02.cr.cnaf.infn.it : <131.154.192.42:9618?... @ 11/27/23 17:23:48
OWNER            BATCH_NAME       SUBMITTED    DONE    RUN    IDLE   TOTAL JOB_IDS
zarrellafoott3 ID: 9934116   11/27 17:22     _      90     _      122 9934116.0-121
zarrellafoott3 ID: 9934118   11/27 17:22     _      _      1        1 9934118.0
zarrellafoott3 ID: 9934119   11/27 17:22     _      93     _       93 9934119.0-92
zarrellafoott3 ID: 9934120   11/27 17:22     _      _      1        1 9934120.0
zarrellafoott3 ID: 9934121   11/27 17:22     _     125     8      133 9934121.0-132
zarrellafoott3 ID: 9934123   11/27 17:22     _      _      1        1 9934123.0

Total for query: 351 jobs; 32 completed, 0 removed, 11 idle, 308 running, 0 held, 0 suspended
Total for zarrellafoott3: 351 jobs; 32 completed, 0 removed, 11 idle, 308 running, 0 held, 0 suspended
Total for all users: 29350 jobs; 27389 completed, 0 removed, 305 idle, 998 running, 658 held, 0 suspended
```

```
condor_q -name sn-02 -nobatch
```  ⟶  Do not group jobs on same cluster

```
condor_q -name sn-02 -run
```  ⟶  Display only running jobs with their runtime

You can check the output of a single running job in real time via "condor_tail"

```
condor_tail -name sn-02 -f jobId
```

```
jobId = 9934116.0
        9934116.3
        9934121.130
```

The "-f" option lets you follow the output, you can omit it if you want a single printout

HTCondor jobs monitoring and handling

Once all your jobs are completed, you **need** to remove them from the queue

```
condor_rm -name sn-02 $USER
```

```
condor_rm -name sn-02 -all
```

The "-name sn-02" can be omitted by adding the following line to your ~/.bash_profile

```
export _condor_SCHEDD_HOST=sn-02.cr.cnaf.infn.it
```

If for some reason your jobs run for too long (>~1 hour), it is likely that something broke

✺ Usually SHOE's "fault" → check if output files are creates + condor_tail

✺ Some jobs **will** go on "hold" after 2-3h → intended to free resources

✺ Other possible issues can be pointed out in the auxiliary files of each job (.out/.err/.log)

```
condor_transfer_data -name sn-02 -all
```

Further info and commands in the CNAF-Tier1 and the HTCondor documentations

HTCondor jobs monitoring and handling

Once all your jobs are completed, you **need** to remove them from the queue

```
condor_rm -name sn-02 $USER
```

```
condor_rm -name sn-02 -all
```

The "-name sn-02" can be omitted by adding the following line to your ~/.bash_profile

```
export _condor_SCHEDD_HOST=sn-02.cr.cnaf.infn.it
```

If for some reason your jobs run for too long (>~1 hour), it is likely that something broke

✺ Usually SHOE's "fault" → check if output files are creates + condor_tail

✺ Some jobs **will** go on "hold" after 2-3h → intended to free resources

✺ Other possible issues can be pointed out in the auxiliary files of each job (.out/.err/.log)

```
condor_transfer_data -name sn-02 -all
```

If you can't find out why it is failing, try harder! And then obviously ask me if you need!

A possibility for production (finally!)

We now have the tools to process entire campaigns!

```
./runShoeBatchT1.sh -i /storage/gpfs_data/foot/shared/DataCNAO2023sync/ -o
/storage/gpfs_data/foot/${USER}/results -c CNAO2023 -r 5957 -l 6313 -m 1
```

→ **Process CNAO2023!**

Need to agree on a set of reconstruction parameters → **production!**   *(default in SHOE repo?)*

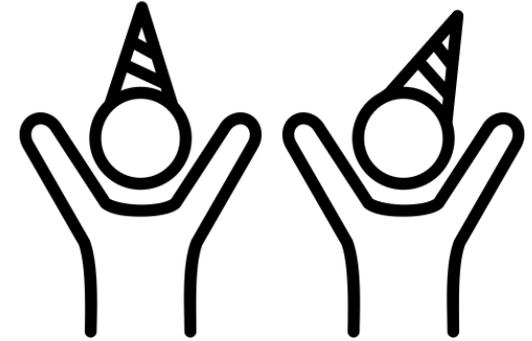| I/O	Global Reco	Detectors	
EnableTree: y	EnableKalman: ?	IncludeDI:	y
EnableFlatTree: n	Kalman preselection strategy: ?	IncludeST:	y
EnableHisto: y	N measure in global tracking: ?	IncludeBM:	y
EnableTracking: y		IncludeTG:	y
	IncludeTOE: ?	IncludeVT:	y
EnableSaveHits: y	TOE cuts: ?	IncludeIT:	y
EnableRootObject: y		IncludeMSD:	y
EnableRegionMc: y	IncludeStraight: ?	IncludeTW:	y
EnableElecNoiseMc: ?	Parameters: ?	IncludeCA:	y

Conclusions

Migrated to Tier1 resources

✔ SHOE installation straightforward

✔ Scripts for data and MC simulation processing w/ HTCondor available in SHOE
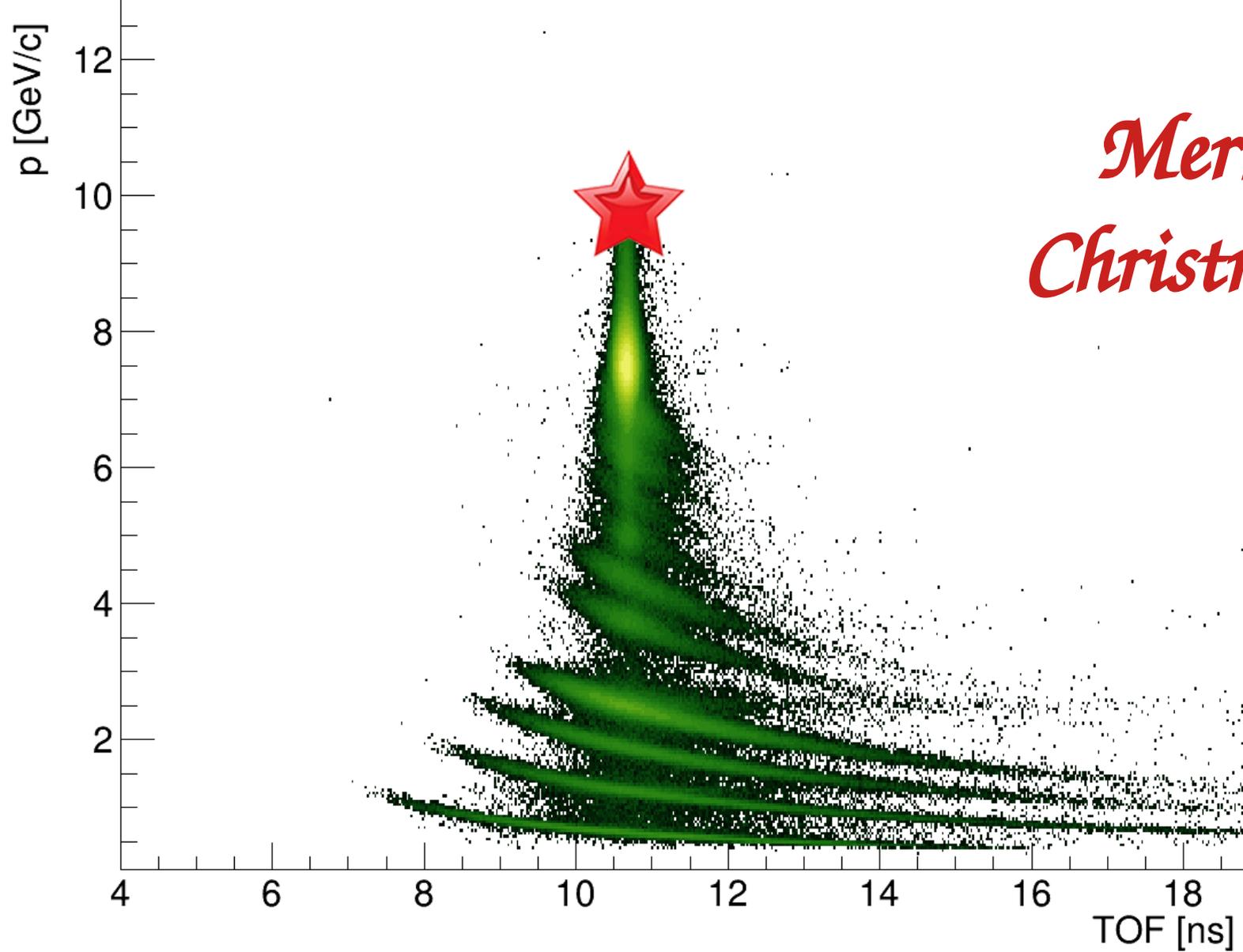
✔ Possibility now to go in production

> Process everything w/ SHOE master branch

> Make processed files available for analysis

> Need for config/calib files ASA(R)P!

💡 Script for running macros on condor is in the works

💡 Need to decide workflow for MC input files production (FLUKA on Tier1?)

Anyone who wants to contribute is welcome!!