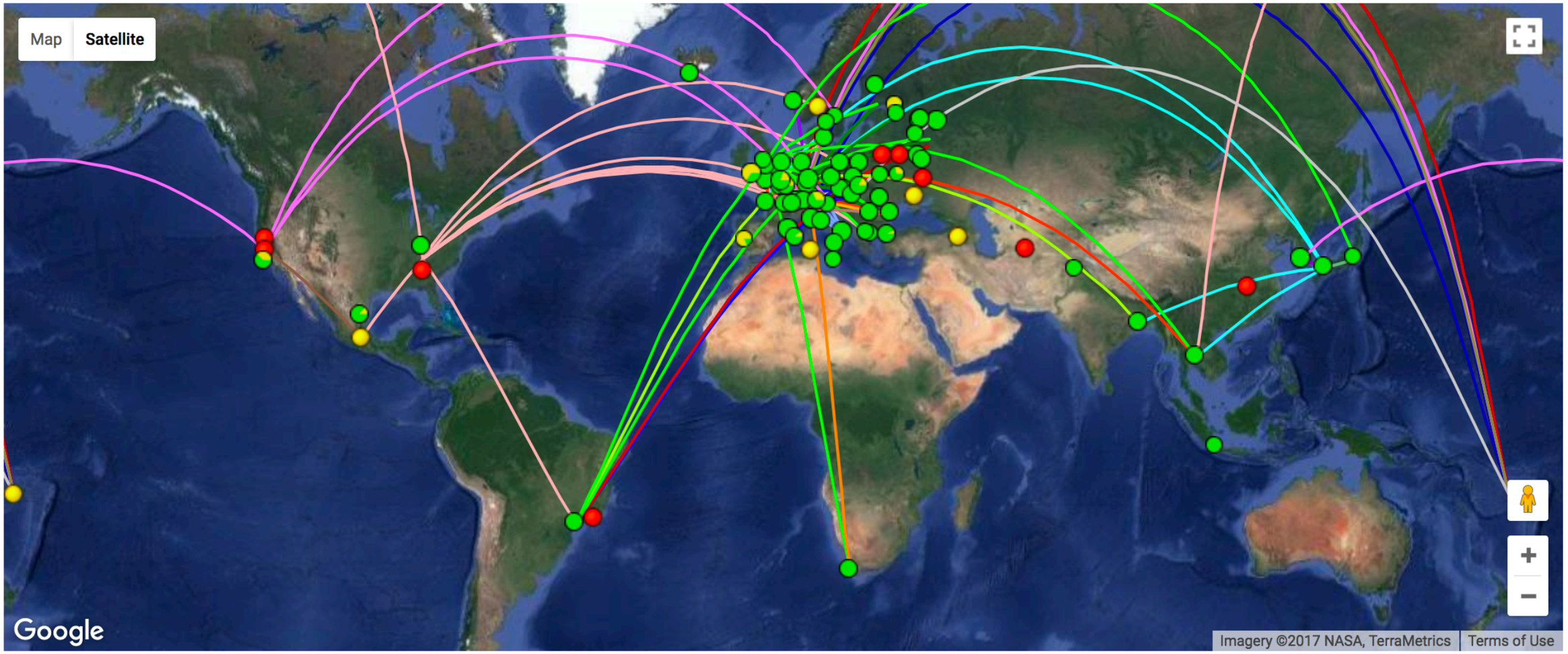
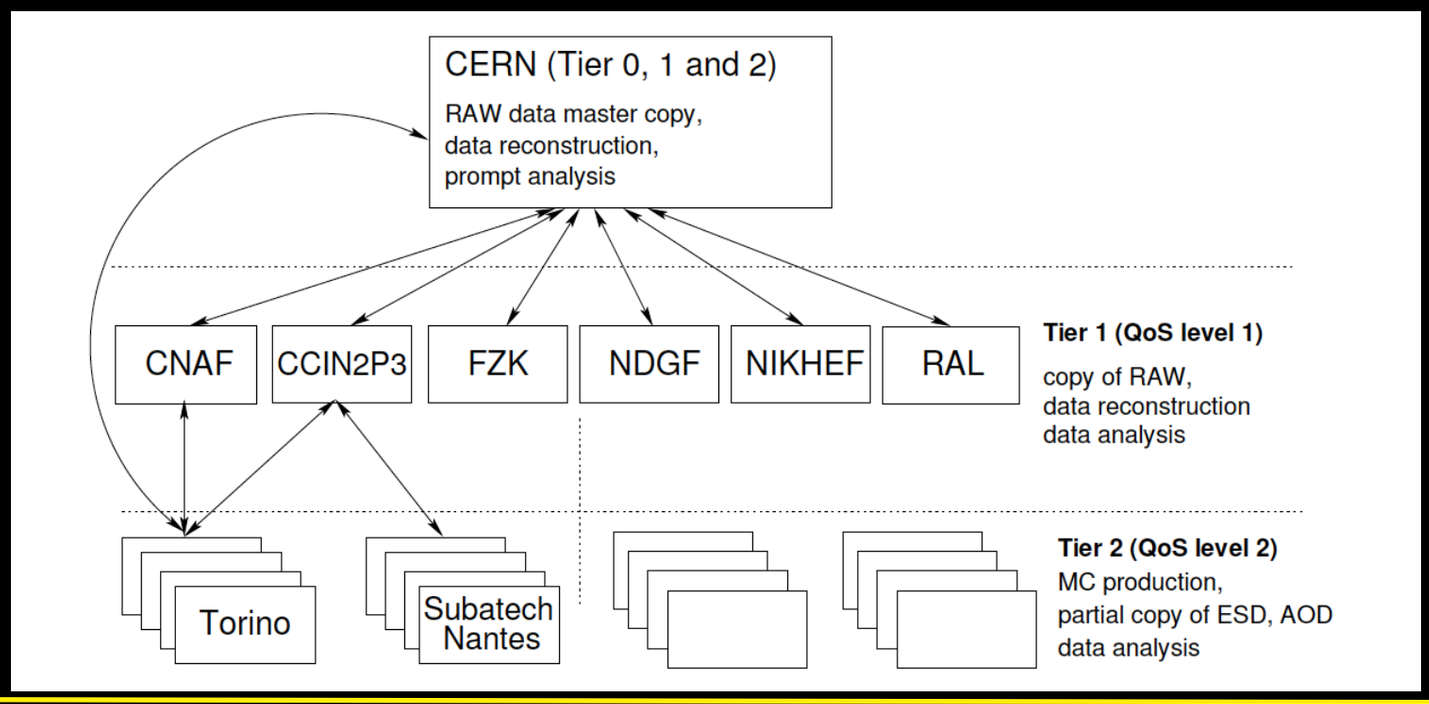
Introduction to running analysis on the GRID



What is the GRID?

- ✓ Storing and processing the data produced by the LHC experiments can not be done at a single computing centre
  - Raw data: storage, reconstruction, analysis
  - Monte Carlo: production, storage, analysis
- ✓ These resources (CPU, disk, tape) are distributed at the HEP computing facilities of the institutes and universities participating in the experiments
- ✓ The GRID is an assembly of distributed, non-uniform computing resources with a given hierarchy, connected together via a common framework
  - hierarchy of centres (Tiers): Tier-0 → CERN, Tier-1s → major computing centres which provide safe mass storage systems (MSS), Tier 2s → smaller regional computing centres

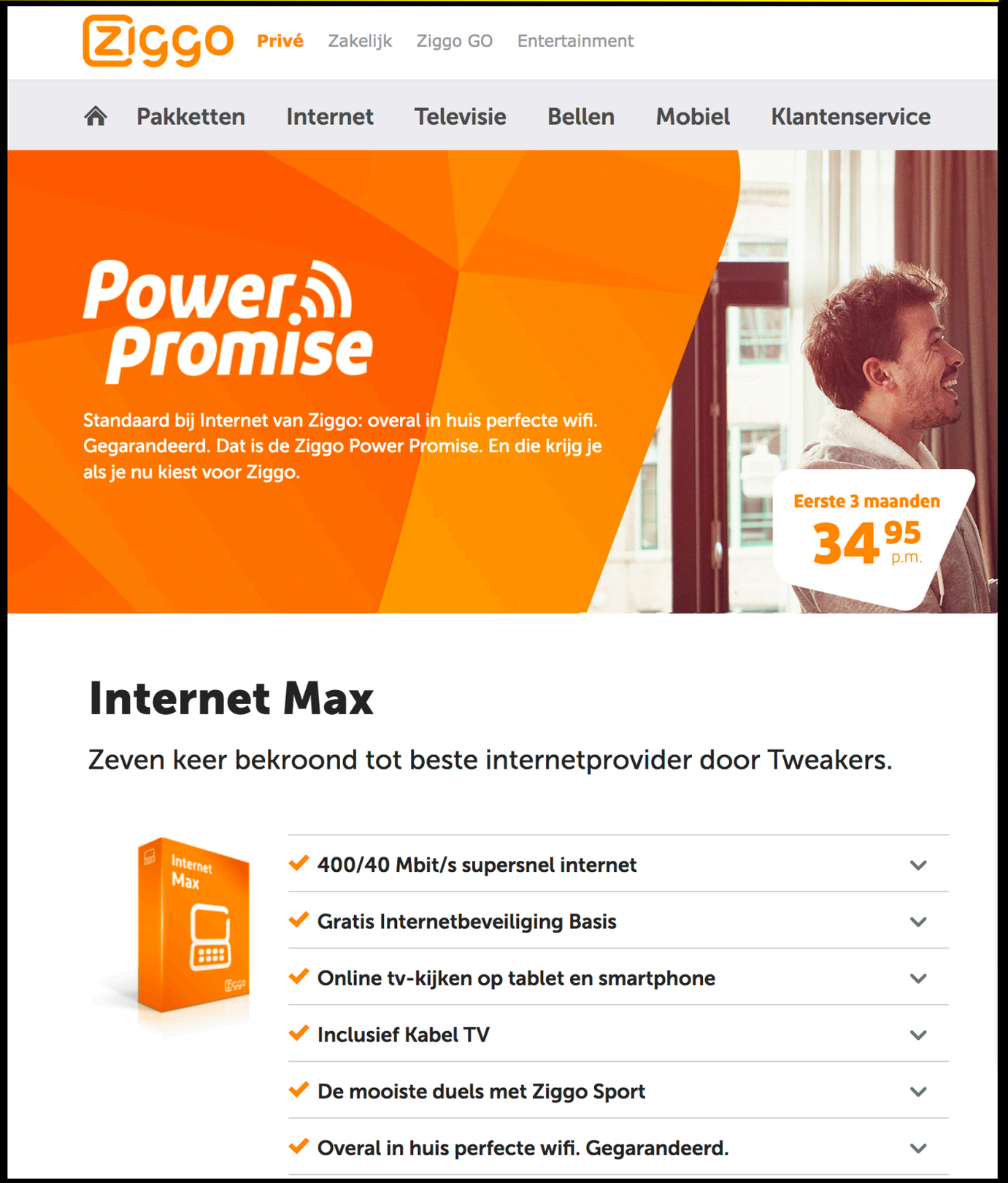


Why distributed computing resources?

- A typical data rate from the detectors to the LDCs can go above 13 GB/s.
  - A DVD is about 4.7 GB → 2.5 DVD/second

Why distributed computing resources?

- Fun fact:
  - 13 GB/s → 124 Gb/s
  - Ziggo max abonnement: 400 Mb/s down + 40 Mb/s upload
    - Alice have the summed bandwidth of ~282 homes
    - I can watch HD movies with my 100 Mb/s download option at home…



Why do I need the GRID as an ALICE member?

- ✓ Data samples can be copied locally (e.g. what we do with dcache) but…
  - Every sample has many AOD productions
  - Many samples have been recorded
  - And then…there is also MC
- ✓ As an example: the LHC10h sample copied on dcache holds 7.5TB
  - 90% of the production was copied
  - Not the latest AOD production
- ✓ The only way to systematically analyse entire data samples (e.g. AOD LHC15o) and produce papers
- ✓ Publicly available productions for all ALICE members important for the reproducibility of published results and analyses

Getting a GRID certificate

The lines assume that you have already registered at CERN

- ✓ Visit this link and follow carefully the instructions
- ✓ Registering with the ALICE virtual organisation
  - Obtain a valid personal certificate by visiting this link
    - In all steps use your NICE (CERN) account
  - Install your certificate to the browser (preferably use Mozilla/Firefox)
  - Export the certificate from your browser and store it at $HOME/.globus
    - Use myCert.p12 as a name (or whichever name you like)
    - If the directory does not exist, you have to create it yourselves
    - Convert the p12 certificate into a .pem key pair:
      - openssl pkcs12 -clcerts -nokeys -in myCert.p12 -out usercert.pem
      - openssl pkcs12 -nocerts -in myCert.p12 -out userkey.pem
      - chmod 400 userkey.pem
  - Register your certificate with the ALICE-VO admin (always use the same browser!!!)

The whole procedure might last a day

Using AliEn

Getting a token

```
bash|stbc-i1> alienv enter VO_ALICE@AliPhysics::vAN-20171013-1
[AliPhysics/vAN-20171013-1] data > alien-token-init pchrist
------------------------------------------------------------
Setting central config:
============================================================
export alien_API_SERVER_LIST="pcapiserv03.cern.ch:10000|pcapiserv08.cern.ch:10000|"
export TERMINFO=/usr/share/terminfo
============================================================
------------------------------------------------------------
Setting closest site to: NIKHEF
============================================================
Using X509_CERT_DIR=/cvmfs/alice.cern.ch/x86_64-2.6-gnu-4.1.2/Packages/AliEn-Runtime/v2-19-le-30/globus/share/certificates
**************************************************************************
Attention: You don't have a valid grid proxy ( or less than 1 hour left ) - doing xrdgsiproxy init for you ...
**************************************************************************
Enter PEM pass phrase:

++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
file        : /tmp/x509up_u7815
issuer      : /DC=ch/DC=cern/OU=Organic Units/OU=Users/CN=pchrista/CN=614196/CN=Panos Christakoglou
subject     : /DC=ch/DC=cern/OU=Organic Units/OU=Users/CN=pchrista/CN=614196/CN=Panos Christakoglou/CN=1305533243
path length : 0
bits        : 512
time left   : 12h:0m:0s
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
=> Trying to connect to Server [1] root://pcapiserv08.cern.ch:10000 as User pchrist
/alice/cern.ch/user/p/psarma/tutorial/output_data_tof_final_tail-10/
/alice/cern.ch/user/p/pchrist/
MONALISA_DOMAIN="nikhef.nl"
MONALISA_NAME="LCG"
MONALISA_SHOULDUPDATE="false"
MONALISA_LOCATION="Amsterdam"
MONALISA_COUNTRY="The Netherlands"
MONALISA_JAVAOPTS="-Xms2G -Xmx2G"
MONALISA_OU="LCG"
MONALISA_ADMINISTRATOR="Maarten Litmaath <maarten.litmaath@cern.ch>"
MONALISA_HOST="erf.nikhef.nl"
APMON_CONFIG=erf.nikhef.nl
Your identity: pchrist
Creating token ..................................... Done
Your token is valid until: Sun Oct 15 21:57:46 2017
[AliPhysics/vAN-20171013-1] data >
```

Accessing the alien shell + basic actions

Do not be afraid! It's just a type of bash shell…

```
[[AliPhysics/vAN-20171013-1] data >
[[AliPhysics/vAN-20171013-1] data > aliensh
  [ aliensh 1.0.140x (C) ARDA/Alice: Andreas.Joachim.Peters@cern.ch/Derek.Feichtinger@cern.ch]
[aliensh:[alice] [1] /alice/cern.ch/user/p/pchrist/ >ls
 bin
 Flow
 recycle
 SSD
 aliensh:[alice] [2] /alice/cern.ch/user/p/pchrist/ >
```

```
[aliensh:[alice] [3] /alice/cern.ch/user/p/pchrist/ >mkdir test
[aliensh:[alice] [4] /alice/cern.ch/user/p/pchrist/ >ls
 bin
 Flow
 recycle
 SSD
 test
[aliensh:[alice] [5] /alice/cern.ch/user/p/pchrist/ >cat bin/stdout
 error: (cp) cannot access source: /alice/cern.ch/user/p/pchrist/bin/stdout
 error: couldn't get the file bin/stdout
```

```
[aliensh:[alice] [6] /alice/cern.ch/user/p/pchrist/ >cat bin/rootBaryons.sh
 #!/bin/bash
 export GCLIENT_SERVER_LIST="pcapiserv04.cern.ch:10000|pcapiserv05.cern.ch:10000|pcapiserv06.cern.ch:10000|pcapiserv07.cern.ch:1000
 0"
 echo ============================
 echo $PATH
 echo $ROOTSYS
 echo $LD_LIBRARY_PATH
 echo ============================

 root -b -x runProtonAnalysisQA.C;

 aliensh:[alice] [7] /alice/cern.ch/user/p/pchrist/ >
```

```
[aliensh:[alice] [6] /alice/cern.ch/user/p/pchrist/Tutorial/LHC15o/output/ >
[aliensh:[alice] [6] /alice/cern.ch/user/p/pchrist/Tutorial/LHC15o/output/ >
[aliensh:[alice] [6] /alice/cern.ch/user/p/pchrist/Tutorial/LHC15o/output/ >exit
exit
 [AliPhysics/vAN-20171013-1] output >
```

Copying files from/to the file catalogue

```
[aliensh:[alice] [2] /alice/cern.ch/user/p/pchrist/Flow/vn_32_50-100/output/000246989/ >
[aliensh:[alice] [2] /alice/cern.ch/user/p/pchrist/Flow/vn_32_50-100/output/000246989/ >cp AnalysisResults.root file:/project/alice
/users/pchrist/
[xrootd] Total 70.18 MB |====================| 100.00 % [21.3 MB/s]
[aliensh:[alice] [3] /alice/cern.ch/user/p/pchrist/Flow/vn_32_50-100/output/000246989/ >exit
exit
[[AliPhysics/vAN-20171013-1] data > ls /project/alice/users/p[
ls: cannot access /project/alice/users/p[: No such file or directory
[[AliPhysics/vAN-20171013-1] data > ls /project/alice/users/pchrist/
AnalysisResults.root  BW   cpp         Flow  Lectures  PYTHIA8  Tags  tmp      VZEROCalibration
BalanceFunction       CME  EventPlane  ITS   OpenDag   SSD      test  Upgrade
[AliPhysics/vAN-20171013-1] data >
```

```
[[AliPhysics/vAN-20171013-1] ~ > aliensh
  [ aliensh 1.0.140x (C) ARDA/Alice: Andreas.Joachim.Peters@cern.ch/Derek.Feichtinger@cern.ch]
[aliensh:[alice] [1] /alice/cern.ch/user/p/pchrist/Flow/vn_32_50-100/output/000246989/ >cd
[aliensh:[alice] [2] /alice/cern.ch/user/p/pchrist/ >cp file:/user/panosch/eve_config eve_config
=> Creating replica 1/2 ...
[xrootd] Total 0.01 MB  |====================| 100.00 % [3.0 MB/s]
=> Creating replica 2/2 ...
[xrootd] Total 0.01 MB  |====================| 100.00 % [inf MB/s]
aliensh:[alice] [3] /alice/cern.ch/user/p/pchrist/ >
```

Running user analysis on the GRID: requirements

- ✓ A task (header and source files)
  - Use the one from the previous exercise
- ✓ An AddTask macro to setup your task
  - Use the one from the previous exercise
- ✓ A run macro
  - Use the one from the previous exercise but you need to modify it a bit (see next slides)
- ✓ A piece of code to enable and setup the AliEn plugin
  - A CreateAlienHandler.C macro (see next slides)
- ✓ A data sample to analyse
  - Use MonaLisa to figure this out (see next slides)

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Grid sites monitoring map - A

alimonitor.cern.ch/map.jsp

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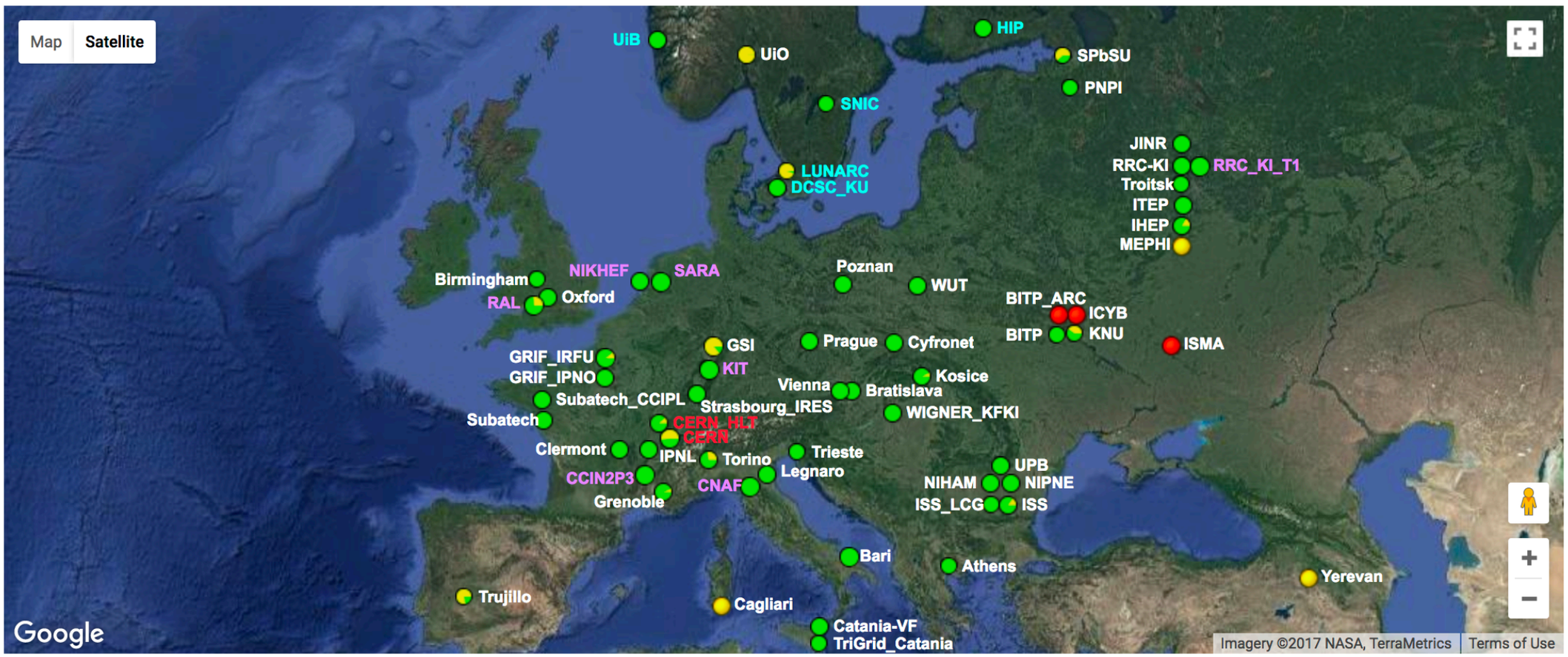

Running jobs | Running jobs but no ML info | Site service problem(s) prevents job execution | No jobs match the site resources | ML service down & no running jobs | Find your location

Map options

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Active jobs trend

Run Condition Table

TWiki page of **LHC17o** »

LHC17o	Beam						Bunches			Triggers							
Run#	**Bunches**	**Scheme**	**Fill #**	**Energy per beam**	**Intensity per bunch**	**Mu**	**B B**	**B A**	**B C**	**MB Interaction**	**Rate (Hz)**	**MB Beam-Empty**	**MB Empty-Empty**	**Muon Interaction**	**High multiplicity trigger**	**EMCAL**	**Cal**
280374 L	363	25ns_1868b_1866_1089_1749_128bpi_17i8b4e	6,300	6,499			1089	779	779	1,097,860	99.72			752,032		197,885	
280352 L	363	25ns_1868b_1866_1089_1749_128bpi_17i8b4e	6,298	6,499			1089	779	779	1,466,947	96.89			1,016,356		262,500	
280351 L	363	25ns_1868b_1866_1089_1749_128bpi_17i8b4e	6,298	6,499			1089	779	779	655,402	79			544,633		115,794	
280350 L	363	25ns_1868b_1866_1089_1749_128bpi_17i8b4e	6,298	6,499			1089	779	779	3,431,764	101.85			2,255,234		610,825	
280349 L	363	25ns_1868b_1866_1089_1749_128bpi_17i8b4e	6,298	6,499			1089	779	779	167,272	97.82			109,372		29,982	
280348 L	363	25ns_1868b_1866_1089_1749_128bpi_17i8b4e	6,298	6,499			1089	779	779	73,716	91.12			49,907		13,236	
280312 L	363	25ns_1868b_1866_1089_1749_128bpi_17i8b4e	6,297	6,499			1089	779	779	327,594	105.71			202,297			
280310 L	363	25ns_1868b_1866_1089_1749_128bpi_17i8b4e	6,297	6,499			1089	779	779	365,625	101.82			234,697		57,726	
280290 L	363	25ns_1868b_1866_1089_1749_128bpi_17i8b4e	6,297	6,499			1089	779	779	420,940	107.66			260,967			
280286 L	363	25ns_1868b_1866_1089_1749_128bpi_17i8b4e	6,297	6,499			1089	779	779	2,659,047	102.37			1,610,667		478,709	
280285 L	363	25ns_1868b_1866_1089_1749_128bpi_17i8b4e	6,297	6,499			1089	779	779	506,040	101.13			350,889		92,843	
280284 L	363	25ns_1868b_1866_1089_1749_128bpi_17i8b4e	6,297	6,499			1089	779	779	63,120	93.79			44,618		11,616	
280283 L	363	25ns_1868b_1866_1089_1749_128bpi_17i8b4e	6,297	6,499			1089	779	779	407,066	107.95			265,418		75,202	
280282 L	363	25ns_1868b_1866_1089_1749_128bpi_17i8b4e	6,297	6,499			1089	779	779	96,110	87.06			69,523		17,257	
14	**14**									**11,738,503**	**99.66**			**7,766,610**		**1,963,575**	
OPTIONS	Show list of runs	Save XML collection of files to AliEn (Pass 1)	Save XML collection of files to AliEn (Pass 2)														

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PRODUCTION CYCLES

Production type: AOD

Production info							Jobs status						
ID	Tag	Status	Done%	Cfg	Out	Links	Total	Done	Active	Waiting	Runs	Output events	Filte eve
12660	FILTER_Pb-Pb_194_LHC15o	Running	20%				35879	7417	4551	23139	26 (244917 - 246392)	17,426,909	6,
12662	FILTER_Pb-Pb_194_LHC15o_Stage1	Completed	100%				123	123	0	0	4 (244917 - 244980)		
12663	FILTER_Pb-Pb_194_LHC15o_Stage5	Completed	100%				9	9	0	0	4 (244917 - 244980)	4,642,333	
12647	AODmerge_LHC17n_5	Completed	100%				75	75			2 (280234 - 280235)	0	
12644	AODmerge_LHC15b2_test	Running	99%				7928	7909	1	0	23 (270940 - 271777)	155,064,400	155,
12630	AODmerge_LHC17e_21	Completed	100%				46	46			1 (270830 - 270830)	1,893,671	1,
12604	AODmerge_LHC17i6b	Completed	99%				2780	2774			1 (246751 - 246751)	819,981	
12601	AODmerge_LHC17i7c1	Completed	100%				97	97			2 (246488 - 246980)	11,010,000	
12595	AODmerge_LHC17i7b1	Completed	100%				79	79			2 (246488 - 246980)	10,830,000	
12591	AODmerge_LHC17i7a1	Completed	100%				84	84			2 (246488 - 246980)	10,920,000	
12574	AODmerge_LHC17i7a2	Completed	100%				40	40			2 (246488 - 246980)	1,060,000	
12572	AODmerge_LHC17i7b2	Completed	100%				36	36			2 (246488 - 246980)	1,100,000	
12565	AODmerge_LHC17i7c2	Completed	100%				33	33			2 (246488 - 246980)	1,110,000	

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PRODUCTION CYCLES

Production type: AOD

Production info							Jobs status							
	LHC15o													
ID	Tag	Status	Done%	Cfg	Out	Links	Total	Done	Active	Waiting	Runs	Output events	Filtered events	Produc
12660	FILTER_Pb-Pb_194_LHC15o	Running	20%				35879	7417	4551	23139	26 (244917 - 246392)	17,426,909	6,582,258	FILTER_Pb-Pb_ AODs + deltas
12662	FILTER_Pb-Pb_194_LHC15o_Stage1	Completed	100%				123	123	0	0	4 (244917 - 244980)			
12663	FILTER_Pb-Pb_194_LHC15o_Stage5	Completed	100%				9	9	0	0	4 (244917 - 244980)	4,642,333	871,005	
12272	FILTER_Pb-Pb_192_LHC15o	Completed	81%				212	172			1 (244918 - 244918)	562,749	142,422	FILTER_Pb-Pb_ AODs + deltas
12306	FILTER_Pb-Pb_192_LHC15o_Stage1	Completed	100%				60	60			1 (244918 - 244918)			
12313	FILTER_Pb-Pb_192_LHC15o_Stage2	Completed	100%				20	20			1 (244918 - 244918)			
12314	FILTER_Pb-Pb_192_LHC15o_Stage5	Completed	100%				1	1			1 (244918 - 244918)	562,749	142,422	
10336	AODmerge_LHC15o_61	Completed	99%				5763	5759			13 (244917 - 246392)	9,583,785	4,912,920	AODmerge_LHC (LHC15o_pass5
9498	AODmerge_LHC15o_51	Completed	98%				5772	5672			12 (244918 - 246392)	0	0	AODmerge_LHC (LHC15o_pass4
9314	AODmerge_LHC15o_41	Completed	99%				5883	5875			13 (244917 - 246392)	0	0	AODmerge_LHC (LHC15o_pass3
9179	AODmerge_LHC15o_2	Completed	99%				66471	65863			42 (245145 - 245554)	0	0	AODmerge_LHC (LHC15o_pass1
8609	AODmerge_LHC15o_25	Completed	99%				688	687			13 (244917 - 246392)	9,591,704	4,788,692	AODmerge_LHC (LHC15o_lowIR

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Production details: **FILTER_Pb-Pb_194_LHC15o: Standard AODs + deltas**

Job info		Events				Software versions				
PID	Run no.	Input	Processed	%	Filtered	AliDPG	ROOT	AliROOT	AliPhysics	Output directory
1001343211	246392	1,496,794	364,790	24.37%	260,252	v5-34-30-alice8-1	v5-09-17-1	v5-09-17-01-1	/alice/data/2015/LHC15o/000246392/pass2_lowIR/AOD194	
1001257380	246392	1,499,134	17,780	1.186%	12,722	v5-34-30-alice8-1	v5-09-17-1	v5-09-17-01-1	/alice/data/2015/LHC15o/000246392/pass5_lowIR/AOD194	
1001257376	246392	1,496,784	9,495	0.634%	6,839	v5-34-30-alice8-1	v5-09-17-1	v5-09-17-01-1	/alice/data/2015/LHC15o/000246392/pass3_lowIR_pidfix/AOD194	
1001253795	246392	1,500,988	583,835	38.9%	416,488	v5-34-30-alice8-1	v5-09-17-1	v5-09-17-01-1	/alice/data/2015/LHC15o/000246392/lowIR_standaloneITS/AOD194	
1001192111	246392	1,497,964	1,772	0.118%	1,247	v5-34-30-alice8-1	v5-09-17-1	v5-09-17-01-1	/alice/data/2015/LHC15o/000246392/pass4_lowIR_pidfix_cookdedx/	
1001242029	246391	1,329,526	936,773	70.46%	636,044	v5-34-30-alice8-1	v5-09-17-1	v5-09-17-01-1	/alice/data/2015/LHC15o/000246391/lowIR_standaloneITS/AOD194	
1001242028	246391	1,325,551	5,916	0.446%	4,074	v5-34-30-alice8-1	v5-09-17-1	v5-09-17-01-1	/alice/data/2015/LHC15o/000246391/pass2_lowIR/AOD194	
1001211518	246391	1,330,445	40,121	3.016%	27,107	v5-34-30-alice8-1	v5-09-17-1	v5-09-17-01-1	/alice/data/2015/LHC15o/000246391/pass5_lowIR/AOD194	
1001204759	246391	1,326,916	7,797	0.588%	5,342	v5-34-30-alice8-1	v5-09-17-1	v5-09-17-01-1	/alice/data/2015/LHC15o/000246391/pass3_lowIR_pidfix/AOD194	
1001190627	246391	1,324,390	3,136	0.237%	2,150	v5-34-30-alice8-1	v5-09-17-1	v5-09-17-01-1	/alice/data/2015/LHC15o/000246391/pass4_lowIR_pidfix_cookdedx/	
1001192071	246390	390,224	18,996	4.868%	13,710	v5-34-30-alice8-1	v5-09-17-1	v5-09-17-01-1	/alice/data/2015/LHC15o/000246390/lowIR_standaloneITS/AOD194	
1001191947	246390	389,869	22,505	5.772%	16,439	v5-34-30-alice8-1	v5-09-17-1	v5-09-17-01-1	/alice/data/2015/LHC15o/000246390/pass5_lowIR/AOD194	
1001191030	246390	388,049	7,357	1.896%	5,315	v5-34-30-alice8-1	v5-09-17-1	v5-09-17-01-1	/alice/data/2015/LHC15o/000246390/pass2_lowIR/AOD194	
1001190781	246390	389,831	7,812	2.004%	5,748	v5-34-30-alice8-1	v5-09-17-1	v5-09-17-01-1	/alice/data/2015/LHC15o/000246390/pass3_lowIR_pidfix/AOD194	
1001190624	246390	389,398	208	0.053%	160	v5-34-30-alice8-1	v5-09-17-1	v5-09-17-01-1	/alice/data/2015/LHC15o/000246390/pass4_lowIR_pidfix_cookdedx/	
1001343294	245347	3,246,247	33,798	1.041%	22,826	v5-34-30-alice8-1	v5-09-17-1	v5-09-17-01-1	/alice/data/2015/LHC15o/000245347/pass1_pidfix/AOD194	
1001343291	245346	687,154	9,103	1.325%	6,226	v5-34-30-alice8-1	v5-09-17-1	v5-09-17-01-1	/alice/data/2015/LHC15o/000245346/pass1_pidfix/AOD194	

Running user analysis on the GRID: requirements

- ✓ A task (header and source files)
  - Use the one from the previous exercise
- ✓ An AddTask macro to setup your task
  - Use the one from the previous exercise
- ✓ A run macro
  - Use the one from the previous exercise but you need to modify it a bit (see next slides)
- ✓ A piece of code to enable and setup the AliEn plugin
  - A CreateAlienHandler.C macro (see next slides)
- ✓ A data sample to analyse
  - Use MonaLisa to figure this out (see next slides)

The AliEn plugin

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File Edit Options Buffers Tools C++ Help

```
AliAnalysisGrid* CreateAlienHandler(const char *lhcPeriod = "LHC15o") {
  // Check if user has a valid token, otherwise make one. This has limitations.
  // One can always follow the standard procedure of calling alien-token-init then
  //   source /tmp/gclient_env_$UID in the current shell.
  AliAnalysisAlien *plugin = new AliAnalysisAlien();

  // Set the run mode (can be "full", "test", "offline", "submit" or "terminate")
  //plugin->SetRunMode("test");
  //plugin->SetRunMode("offline");
  //plugin->SetRunMode("submit");
  //plugin->SetRunMode("full");
  plugin->SetRunMode("terminate");
  plugin->SetNtestFiles(5); // Relevant only for run mode "test"

  // Set versions of used packages
  plugin->SetAPIVersion("V1.1x");
  plugin->SetAliPhysicsVersion("vAN-20171015-1");

// Declare input data to be processed - can be done in two ways:
TString periodIdentifier = "/alice/data/2015/";
periodIdentifier += lhcPeriod;
plugin->SetGridDataDir(periodIdentifier.Data());
plugin->SetDataPattern("*pass2_lowIR/AOD/*AliAOD.root");
plugin->SetRunPrefix("000"); // IMPORTANT!

Int_t runNumber = 0;
Int_t runCounter = 0;
TString runListFileName = lhcPeriod; runListFileName += ".txt";
ifstream inputFile;
inputFile.open(runListFileName);
while(true) {
  inputFile >> runNumber;
  if(inputFile.eof()) break;

  Printf("========================================");
  Printf("Run %d added",runNumber);
  plugin->AddRunNumber(runNumber);
  runCounter += 1;
}
plugin->SetOutputToRunNo();
```

The AliEn plugin (cont.)

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File Edit Options Buffers Tools C++ Help

```
   // Define alien work directory where all files will be copied. Relative to alien $
HOME.
   TString outputDirectory = "Tutorial/"; outputDirectory += lhcPeriod;
   plugin->SetGridWorkingDir(outputDirectory.Data());
   // Declare alien output directory. Relative to working directory.
   plugin->SetGridOutputDir("output"); // In this case will be $HOME/work/output
   // Declare the analysis source files names separated by blancs. To be compiled run
time
   // using ACLiC on the worker nodes.
   plugin->SetAnalysisSource("AliAnalysisTaskPtSpectra.cxx");
   // Declare all libraries (other than the default ones for the framework. These wil
l be
   // loaded by the generated analysis macro. Add all extra files (task .cxx/.h) here
.
   plugin->SetAdditionalLibs("AliAnalysisTaskPtSpectra.h AliAnalysisTaskPtSpectra.cxx
");

   // Do not specify your outputs by hand anymore:
   plugin->SetDefaultOutputs(kTRUE);
   // Optionally set a name for the generated analysis macro (default MyAnalysis.C)
   plugin->SetAnalysisMacro("taskTutorialAnalysis.C");
   // Optionally set maximum number of input files/subjob (default 100, put 0 to igno
re)
   plugin->SetSplitMaxInputFileNumber(100);
   // Optionally set number of runs per masterjob:
   plugin->SetNrunsPerMaster(1);

   // Optionally set time to live (default 30000 sec)
   plugin->SetTTL(30000);
   // Optionally set input format (default xml-single)
   plugin->SetInputFormat("xml-single");
   // Optionally modify the name of the generated JDL (default analysis.jdl)
   plugin->SetJDLName("taskTutorialAnalysis.jdl");
   // Optionally modify job price (default 1)
   plugin->SetPrice(1);
   // Optionally modify split mode (default 'se')
   plugin->SetSplitMode("se");

   //Merging
   plugin->SetMergeViaJDL(kTRUE);

   return plugin;
}
```

Running user analysis on the GRID: requirements

- ✓ A task (header and source files)
  - Use the one from the previous exercise
- ✓ An AddTask macro to setup your task
  - Use the one from the previous exercise
- ✓ A run macro
  - Use the one from the previous exercise but you need to modify it a bit (see next slides)
- ✓ A piece of code to enable and setup the AliEn plugin
  - A CreateAlienHandler.C macro (see next slides)
- ✓ A data sample to analyse
  - Use MonaLisa to figure this out (see next slides)

Modifications to the run macro

- ✓ You need to add an identifier, passed as an argument to the run macro (one of the options), to distinguish between the different analysis modes:
  - Local (interactive, batch on stoomboot) and GRID
- ✓ You then need to call the CreateAlienHandler.C macro
  - This macro can take as an argument the text file containing the list of runs

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File Edit Options Buffers Tools C++ Help

```
enum anaModes {mLocal,mGrid};
//mLocal: Analyze locally files in your computer using aliroot
//mGrid: Analyze files on Grid via AliEn plug-in and using precompiled FLOW librarie
s
void runPtSpectra(Int_t mode = mGrid,
                  UInt_t gFilterBit = 768,
                  const char* lhcPeriod = "LHC15o",
                  const char* directoryFile = "/dcache/alice/panosch/alice/data/2015
/LHC15o/000244917/pass2_lowIR/"){
  // Time:

  TStopwatch timer;
  timer.Start();
```

Modifications to the run macro (cont.)

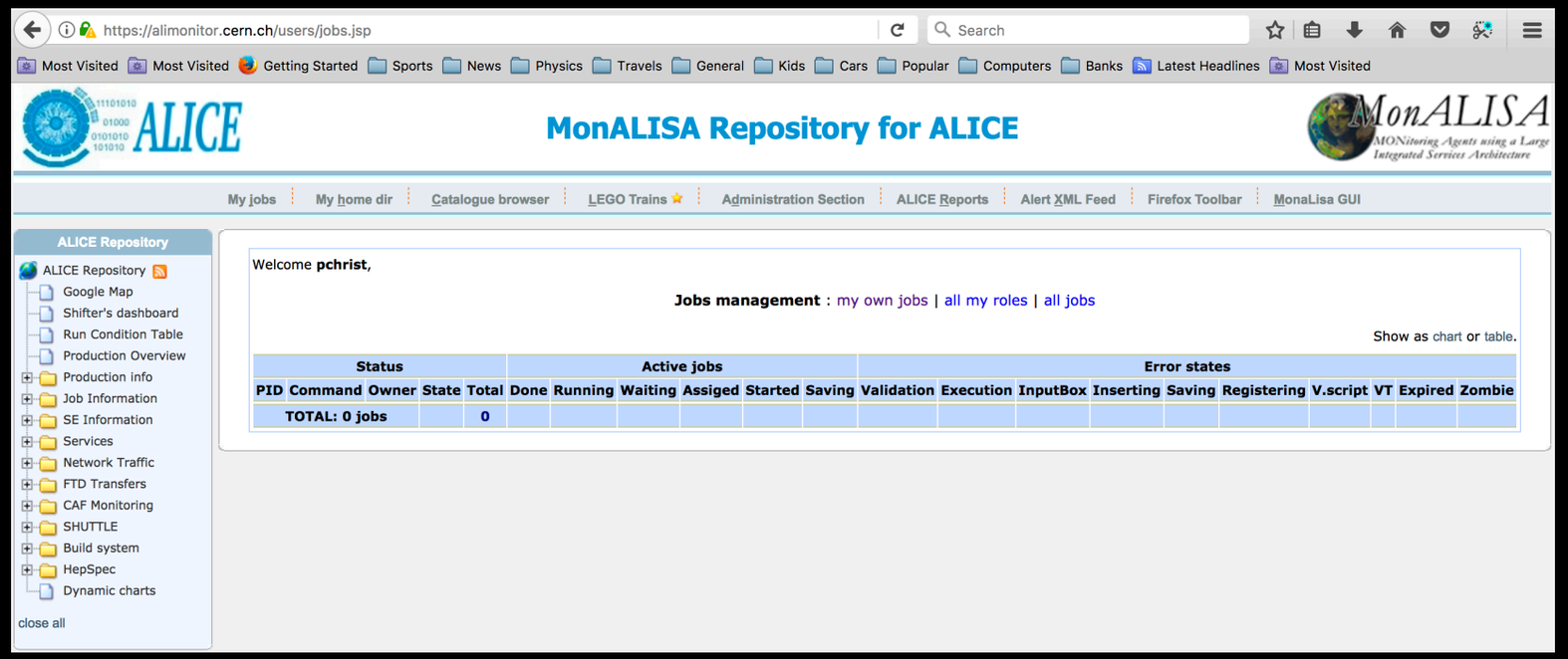
- You need to add an identifier, passed as an argument to the run macro (one of the options), to distinguish between the different analysis modes:
  - Local (interactive, batch on stoomboot) and GRID
- You then need to call the CreateAlienHandler.C macro
  - This macro can take as an argument the text file containing the list of runs

```
if(mode == mGrid)
  mgr->SetGridHandler(alienHandler);

gROOT->LoadMacro("AliAnalysisTaskPtSpectra.cxx++g");
gROOT->LoadMacro("AddTaskPtSpectra.C");

AliAnalysisTaskPtSpectra *task = AddTaskPtSpectra(gFilterBit);

// Run the analysis:
if(!mgr->InitAnalysis()){return;}
mgr->PrintStatus();
if(mode == mLocal)
  mgr->StartAnalysis("local",chain);
else if(mode == mGrid || mode == mGridPAR)
  mgr->StartAnalysis("grid");

// Print real and CPU time used for analysis:
timer.Stop();
timer.Print();
}
```

In practice

- ✓ You first test your analysis locally
  - Use the interactive nodes of stoomboot for this
  - You need this step to validate that your code works and produces what you expect
- ✓ Submit your job on the grid first in a “test” mode over 2-3 files
  - Inspect the produced root file and make sure that everything looks ok
- ✓ If there are no problems in the step before, submit the same code in “full” mode
- ✓ Babysit your job

Look at MonALISA under “My jobs”



Job status

			Active jobs						Error states									
Owner	State	Total	Done	Running	Waiting	Assiged	Started	Saving	Validation	Execution	InputBox	Inserting	Saving	Registering	V.script	VT	Expired	Zombie
aliprod	SPLIT	10			10													
aliprod	SPLIT	10			10													
alitrain	DONE	137	113						9	3							3	
alitrain	DONE	74	65						8	1								
alitrain	DONE	76	65						6	1							1	
alitrain	DONE	72	57						7	1							3	
alitrain	DONE	76	57						12	3							1	
alitrain	DONE	59	48						6				1				1	
alitrain	DONE	65	60						3								2	
alitrain	DONE	71	52						10	2								
alitrain	DONE	60	52						6	2								
alitrain	DONE	61	47						8								1	
alitrain	DONE	58	51						2	1								
alitrain	DONE	57	48						7	1								
alitrain	DONE	49	45						4									
alitrain	DONE	54	45						6	1								
alitrain	DONE	50	44						4	1								
alitrain	DONE	51	43						6									
alitrain	DONE	54	44						7								1	
alitrain	DONE	51	42						7								1	

User quota

https://alimonitor.cern.ch/users/quotas.jsp

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ALICE

MonALISA Repository for ALICE

MonALISA
MONitoring Agents using a Large Integrated Services Architecture

My jobs | My home dir | Catalogue browser | LEGO Trains | Administration Section | ALICE Reports | Alert XML Feed | Firefox Toolbar | MonaLisa GUI

ALICE Repository

- ALICE Repository
  - Google Map
  - Shifter's dashboard
  - Run Condition Table
  - Production Overview
  - Production info
  - Job Information
    - Site views
    - User views
      - Aggregated info
      - Per user history
      - All users history
      - Grid packages
      - Quotas
    - Task queue
    - Job timings
    - Memory profiles
    - Federation views
    - JobAgents
  - SE Information
  - Services
  - Network Traffic
  - FTD Transfers
  - CAF Monitoring
  - SHUTTLE
  - Build system
  - HepSpec
  - Dynamic charts

close all

Quotas for pchrist

File quota

No. of files		Disk space	
Current:	47,001	Current:	381.9 GB
Quota:	300,000	Quota:	400.5 GB

Job quota

Unfinished jobs		Running time (last 24h)		CPU cost (last 24h)	
Current:	0	Current:	-	Current:	-
Quota:	1,500	Quota:	115d 17:46	Quota:	115d 17:46

In practice (part 2)

- ✓ Once you are satisfied with the number of jobs reaching the DONE state, start merging
- ✓ Submit the same job with the option “terminate”
- ✓ This you need to do as many times as needed to get the final merged root file for each run
  - The amount of submissions needed to produce the final merged file depends on the split options selected initially
- ✓ In the example that we provide, you are supposed to have one merged root file per run
- ✓ Copy these root files from the file catalogue to the local system
  - Create a suitable directory structure to store the root file of each run
- ✓ Then merge the locally stored root files (e.g. using the hadd command) on your own
  - The final root file will contain the statistics of all the runs you analysed on the GRID

Submitting the job (“full” mode)

pchrist — ssh -X -Y panosch@stbc-i1 — 127×63

~ — bash … | ~ — ssh -X -Y panosch@stbc-i1 | ~ — ssh -X -Y panosch@stbc-i1

```
[TFile::Cp] Total 0.00 MB       |====================| 100.00 % [4.2 MB/s]
I-AliAnalysisAlien::WriteValidationScript:
#####   Copying validation script <analysis_validation.sh> to your AliEn working space
[TFile::Cp] Total 0.00 MB       |====================| 100.00 % [16.8 MB/s]
I-AliAnalysisAlien::WriteMergingMacro:
#####   Copying merging macro: <analysis_merge.C> to your alien workspace
[TFile::Cp] Total 0.00 MB       |====================| 100.00 % [14.7 MB/s]
I-AliAnalysisAlien::WriteMergeExecutable:
#####   Copying executable file <analysis_merge.sh> to your AliEn bin directory
[TFile::Cp] Total 0.00 MB       |====================| 100.00 % [5.8 MB/s]
I-AliAnalysisAlien::WriteValidationScript:
#####   Copying validation script <analysis_validation_merge.sh> to your AliEn working space
[TFile::Cp] Total 0.00 MB       |====================| 100.00 % [9.9 MB/s]
I-AliAnalysisAlien::CreateJDL:
#####   Created alien output directory /alice/cern.ch/user/p/pchrist//Tutorial/LHC15o/output
I-AliAnalysisAlien::WriteJDL:
#####   Copying JDL file <taskTutorialAnalysis.jdl> to your AliEn output directory
[TFile::Cp] Total 0.00 MB       |====================| 100.00 % [6.5 MB/s]
I-AliAnalysisAlien::WriteJDL:
#####   Copying merging JDL files <analysis_merge.jdl> to your AliEn output directory
[TFile::Cp] Total 0.00 MB       |====================| 100.00 % [8.4 MB/s]
[TFile::Cp] Total 0.00 MB       |====================| 100.00 % [7.6 MB/s]
I-AliAnalysisAlien::CreateJDL:
#####   Copying dependency: <AliAnalysisTaskPtSpectra.h> to your alien workspace
[TFile::Cp] Total 0.00 MB       |====================| 100.00 % [4.7 MB/s]
I-AliAnalysisAlien::CreateJDL:
#####   Copying dependency: <AliAnalysisTaskPtSpectra.cxx> to your alien workspace
[TFile::Cp] Total 0.00 MB       |====================| 100.00 % [12.5 MB/s]
********** submit taskTutorialAnalysis.jdl 000246391.xml 000246391
I-AliAnalysisAlien::StartAnalysis:
_____________________________________________________________________
#####   Your JDL taskTutorialAnalysis.jdl submitted (3 to go).
THE JOB ID IS: 1002378306
_____________________________________________________________________
********** submit taskTutorialAnalysis.jdl 000246390.xml 000246390
I-AliAnalysisAlien::StartAnalysis:
_____________________________________________________________________
#####   Your JDL taskTutorialAnalysis.jdl submitted (2 to go).
THE JOB ID IS: 1002378424
_____________________________________________________________________
********** submit taskTutorialAnalysis.jdl 000245068.xml 000245068
I-AliAnalysisAlien::StartAnalysis:
_____________________________________________________________________
#####   Your JDL taskTutorialAnalysis.jdl submitted (1 to go).
THE JOB ID IS: 1002378449
_____________________________________________________________________
********** submit taskTutorialAnalysis.jdl 000245068.xml 000245068
I-AliAnalysisAlien::StartAnalysis:
_____________________________________________________________________
#####   Your JDL taskTutorialAnalysis.jdl submitted (0 to go).
THE JOB ID IS: 1002378450
_____________________________________________________________________
I-AliAnalysisAlien::StartAnalysis:
#### STARTING AN ALIEN SHELL FOR YOU. EXIT WHEN YOUR JOB 1002378306 1002378424 1002378449 1002378450 HAS FINISHED. ####
 You may exit at any time and terminate the job later using the option <terminate>
 ##########################################################################
  [ aliensh 1.0.140x (C) ARDA/Alice: Andreas.Joachim.Peters@cern.ch/Derek.Feichtinger@cern.ch]
[aliensh:[alice] [1] /alice/cern.ch/user/p/pchrist/ >                                    ]
[aliensh:[alice] [1] /alice/cern.ch/user/p/pchrist/ >                                    ]
[aliensh:[alice] [1] /alice/cern.ch/user/p/pchrist/ >                                    ]
[aliensh:[alice] [1] /alice/cern.ch/user/p/pchrist/ >                                    ]
[aliensh:[alice] [1] /alice/cern.ch/user/p/pchrist/ >                                    ]
 aliensh:[alice] [1] /alice/cern.ch/user/p/pchrist/ >>
```

ALICE

MonALISA Repository for ALICE

MonALISA

My jobs | My home dir | Catalogue browser | LEGO Trains | Administration Section | ALICE Reports | Alert XML Feed | Firefox Toolbar | MonaLisa GUI

ALICE Repository

- ALICE Repository
  - Google Map
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  - Services
  - Network Traffic
  - FTD Transfers
  - CAF Monitoring
  - SHUTTLE
  - Build system
  - HepSpec
  - Dynamic charts

close all

Active jobs trend

Welcome **pchrist**,

Jobs management : my own jobs | all my roles | all jobs

Show as chart or table

Status					Active jobs						Error states									
PID	Command	Owner	State	Total	Done	Running	Waiting	Assiged	Started	Saving	Validation	Execution	InputBox	Inserting	Saving	Registering	V.script	VT	Expired	Zombie
1002378306	analysis.sh	pchrist	DONE	16							16									
1002378424	analysis.sh	pchrist	DONE	16							16									
1002378449	analysis.sh	pchrist	DONE	10							10									
1002378450	analysis.sh	pchrist	DONE	10							10									
1002386932	analysis.sh	pchrist	SPLIT	16	8	8														
1002386933	analysis.sh	pchrist	SPLIT	16	14	2														
1002386935	analysis.sh	pchrist	SPLIT	10	7	1									2					
1002386936	analysis.sh	pchrist	DONE	10	3										3	4				
TOTAL: 8 jobs				**104**	**32**	**11**					**52**				**5**	**4**				

Merging via jdl

```
[aliensh:[alice] [5] /alice/cern.ch/user/p/pchrist/ >ls Tutorial/LHC15o/output/000*
001
002
003
004
005
006
007
008
009
010
011
012
013
014
015
016
AnalysisResults.root
root_archive.zip
Stage_1.xml
001
002
003
004
005
006
007
008
009
010
AnalysisResults.root
root_archive.zip
Stage_1.xml
001
003
004
005
007
008
009
010
011
012
013
014
015
016
AnalysisResults.root
root_archive.zip
Stage_1.xml
aliensh:[alice] [6] /alice/cern.ch/user/p/pchrist/ >
```

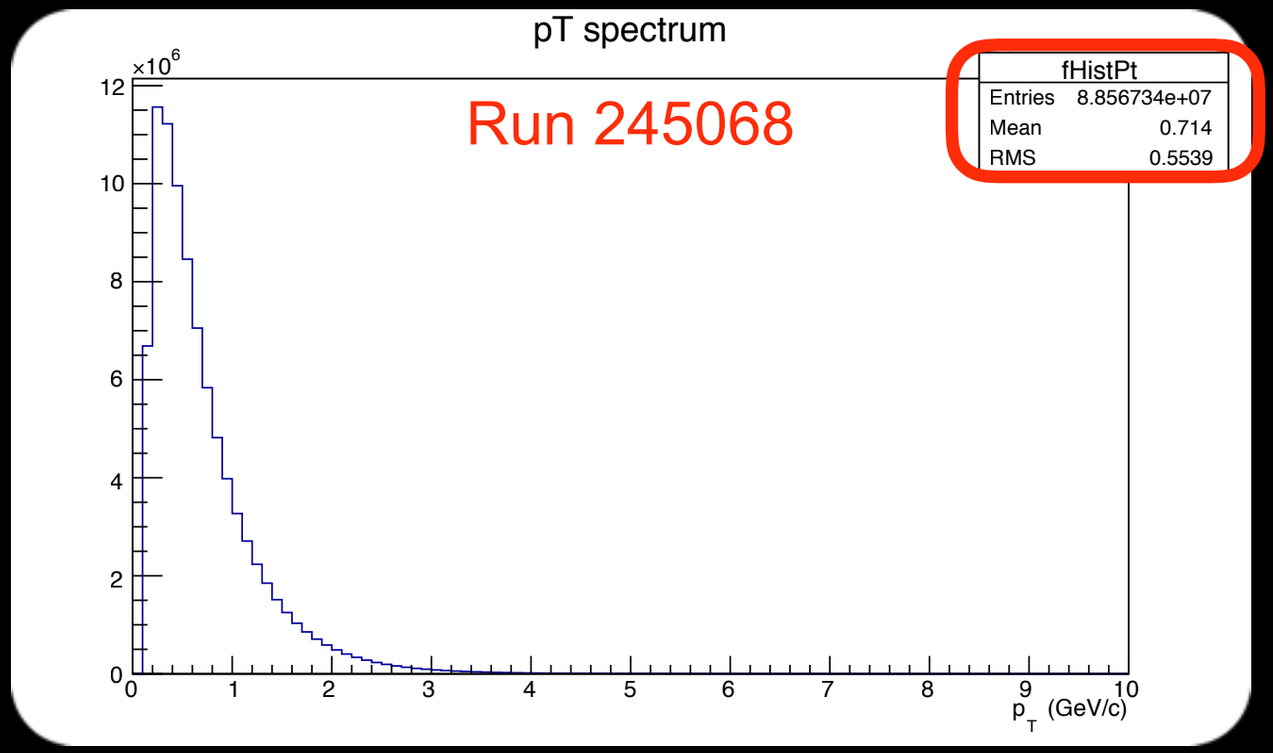
Copying the files locally and merging

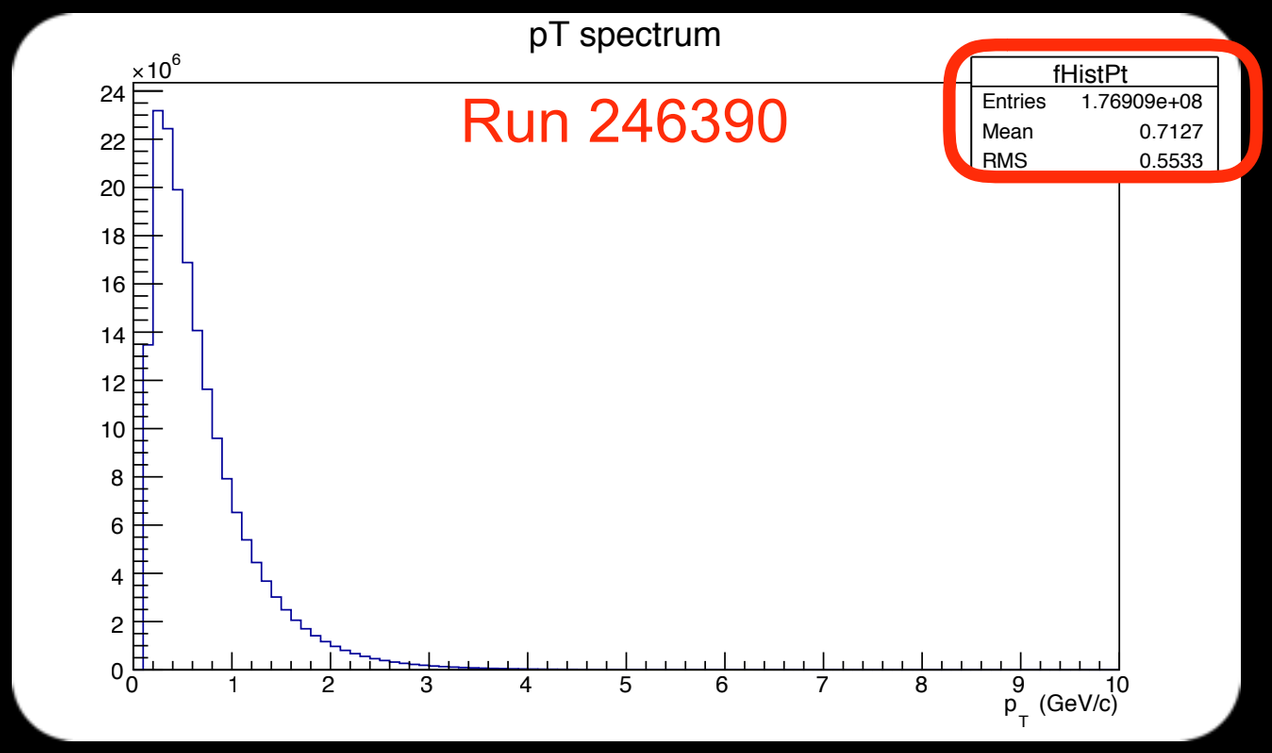
```
[aliensh:[alice] [3] /alice/cern.ch/user/p/pchrist/Tutorial/LHC15o/output/ >cp 000245068/AnalysisResults.root file:/project/alice/users/pchrist/Lectures/MSc/Grid/output/run1/
 [xrootd] Total 0.00 MB  |====================| 100.00 % [0.1 MB/s]
[aliensh:[alice] [4] /alice/cern.ch/user/p/pchrist/Tutorial/LHC15o/output/ >cp 000246390/AnalysisResults.root file:/project/alice/users/pchrist/Lectures/MSc/Grid/output/run2/
 [xrootd] Total 0.00 MB  |====================| 100.00 % [0.1 MB/s]
[aliensh:[alice] [5] /alice/cern.ch/user/p/pchrist/Tutorial/LHC15o/output/ >cp 000246391/AnalysisResults.root file:/project/alice/users/pchrist/Lectures/MSc/Grid/output/run3/
 [xrootd] Total 0.00 MB  |====================| 100.00 % [0.1 MB/s]
 aliensh:[alice] [6] /alice/cern.ch/user/p/pchrist/Tutorial/LHC15o/output/ >
```

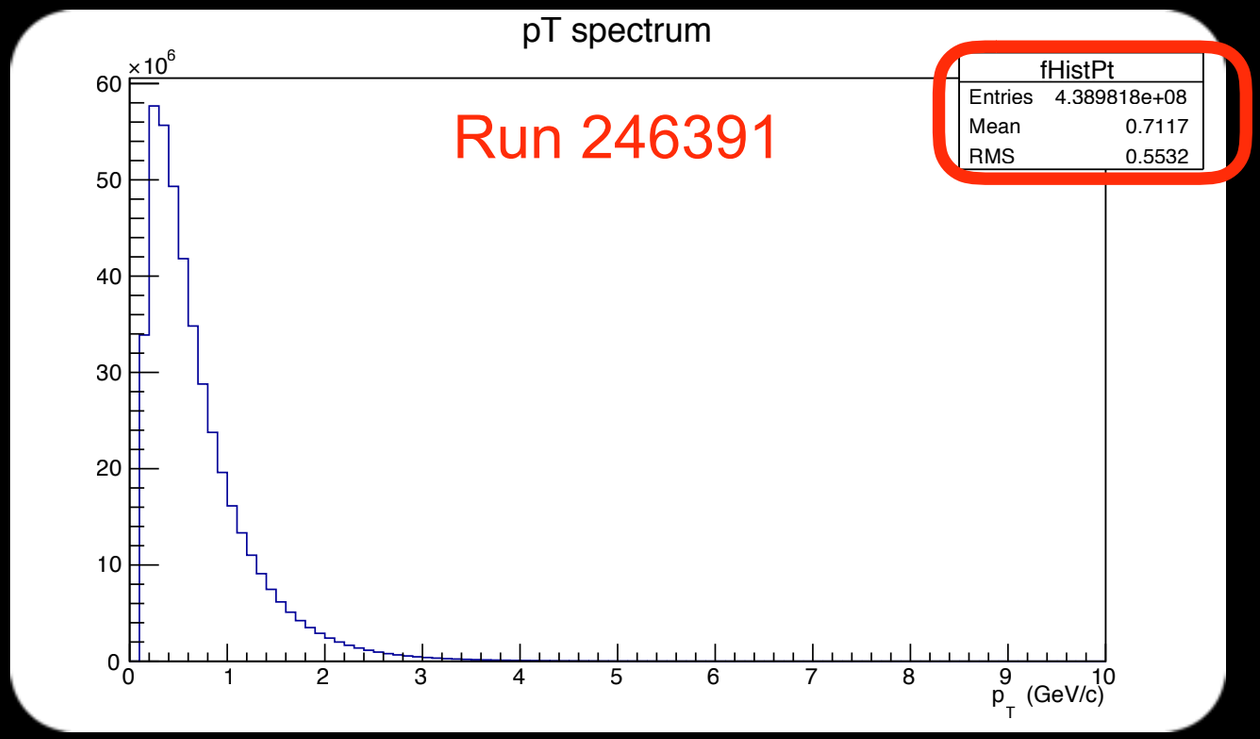
```
[[AliPhysics/vAN-20171013-1] output > ls run*
 run1:
 AnalysisResults.root

 run2:
 AnalysisResults.root

 run3:
 AnalysisResults.root
 [AliPhysics/vAN-20171013-1] output >
```

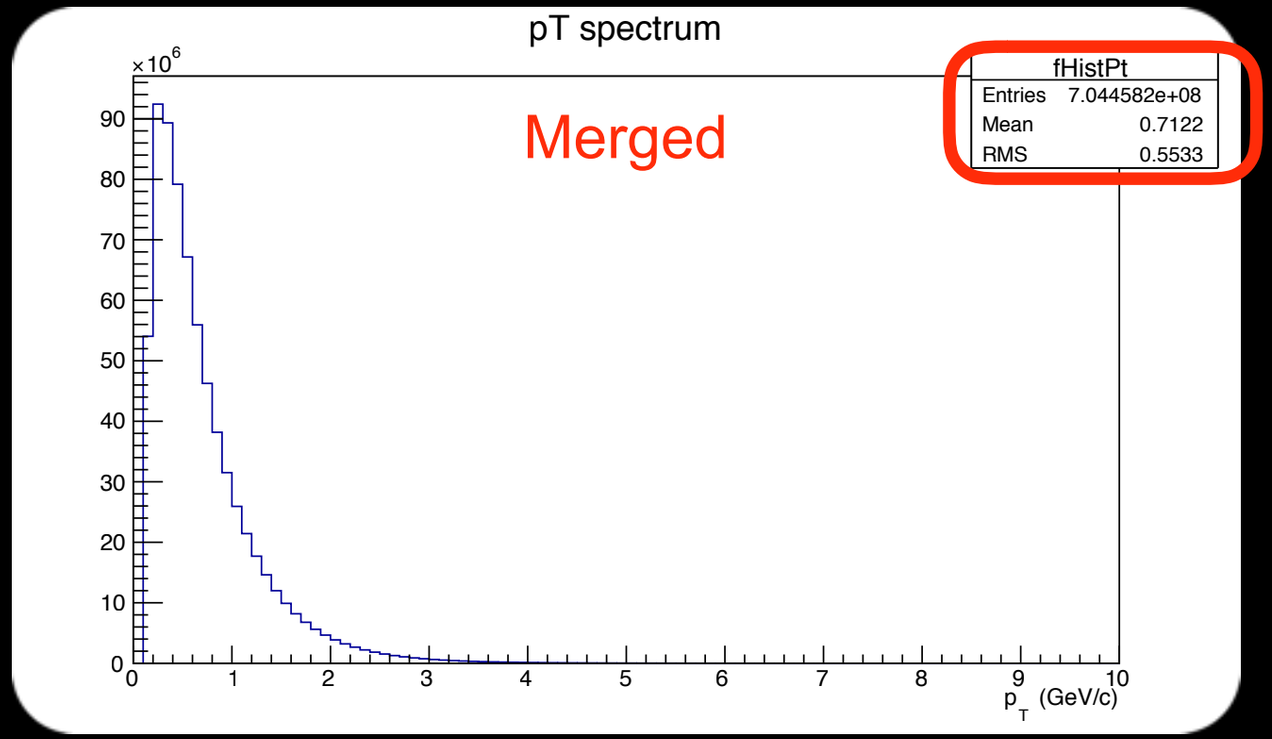
```
[[AliPhysics/vAN-20171013-1] output > ls run*
run1:
AnalysisResults.root

run2:
AnalysisResults.root

run3:
AnalysisResults.root
[AliPhysics/vAN-20171013-1] output >
```

Final result









Good luck…