ESCAPE DAC21 After Action - MAGIC Use Cases

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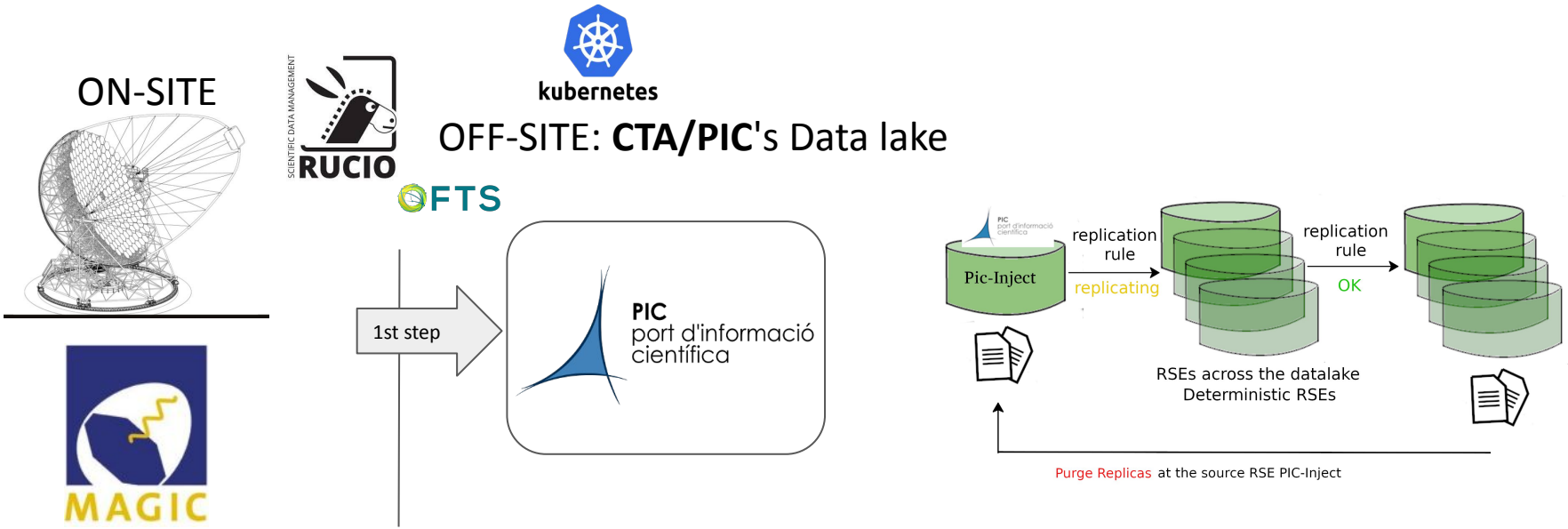
ESCAPE-The European Science Cluster of Astronomy & Particle Physics Infrastructures has received funding from the European Union's Horizon 2020 research and innovation programme under the Grant Agreement n1 824064

WP2 CTA Use case 1 : Long haul ingestion and replication

Description/Goal: Automatic detection and transfers of MAGIC data from a remote site (RSE non deterministic, ‘on-site’) produced from observation at la Palma, transfer and replication in off-site RSEs (PIC) and after replication deletion of the data at origin. Once the FTS transfers are successfully done, Rucio triggers the deletion of the files from the origin (La Palma).



WP2 Use case: Long haul ingestion and replication - SETUP

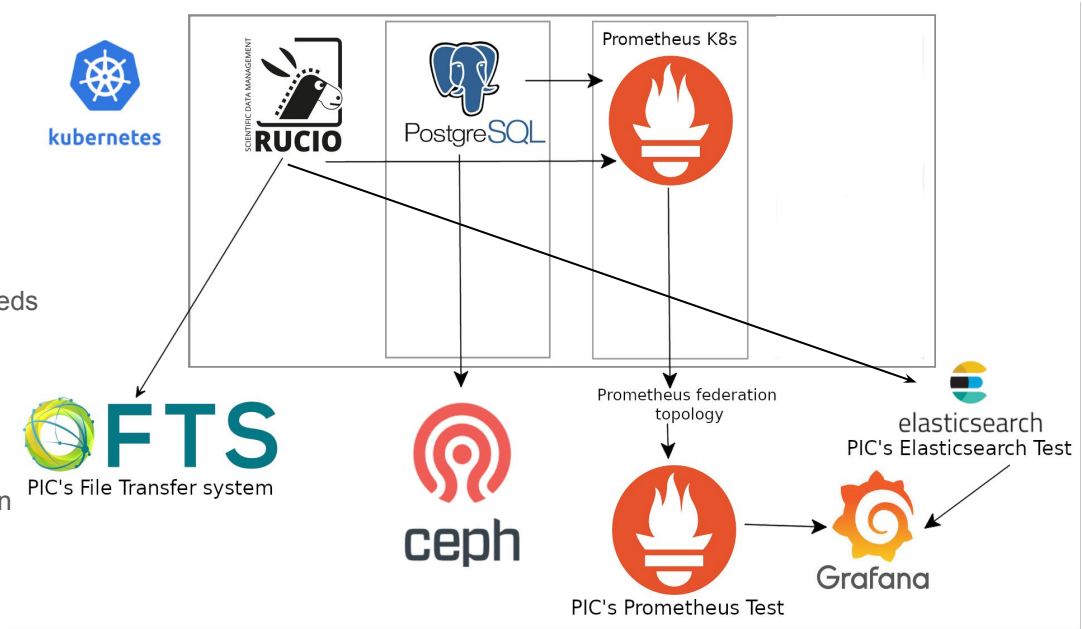
Base dataset

Real Magic Dataset
Number of files: 2763
Total Size: 631 GB, with mixed file size(1GB, MB)

Extended datasets generated to cover
the use case configurations/tests

Rucio: Kubernetes Cluster

- **Deployed with:**
  - The Rucio server and daemon services are fully packaged with Helm
    - V1.23.14
  - Available in : https://rucio.github.io/helm-charts/)
  - FTS
    - v3.10.1
- **Monitoring:**
  - Will be using Prometheus for all our monitoring needs
    - v2.11.1
- **Logging:**
  - Currently writing the logs using hermes2 in our own
  - Elasticsearch centralized instance
    - v7.12.1



WP2 Use case: Long haul ingestion and replication - SETUP

MAGIC side

- Network configurations:
  - Link: 1Gbps
  - Host: grid.magic.iac
  - Ports: according the endpoint configurations
  - GridFTP
  - IPs: disk doors and servers at PIC
- Transfer endpoint configurations:
  - Local User transfer
  - GSIFTP
- File System:
  - Data folder

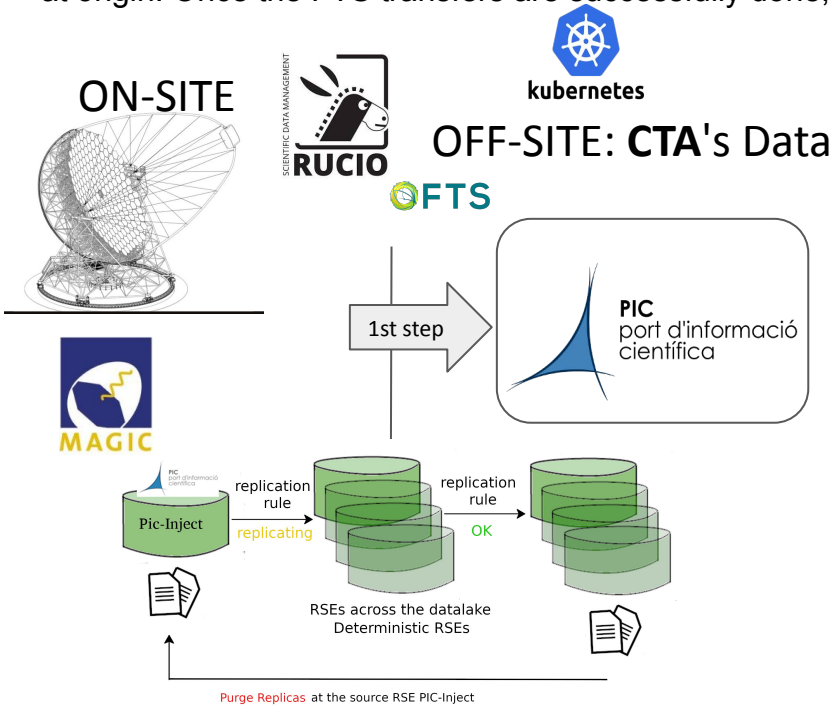
/data/Other/rucio_tmp/ESCAPE-DC21/Dataset/

PIC side

- Transfer interface machine
  - Host RUCIO client code “PIC Inject”
  - Connections to CTA side
  - User certificate
- RUCIO server
  - Kubernetes deploy
  - Trusted certificates
  - Orchestration rules
- FTS server: fts01.pic.es & fts02.pic.es
- Transfer endpoint configuration:
  - gridftp.pic.es
- File System:
  - dCache pools: tokens for disk & tape
- Grafana monitoring dashboard

WP2 Use case 1: Long haul ingestion and replication

Description/Goal: Automatic detection and transfers of MAGIC data from a remote site (RSE non deterministic, ‘on-site’) produced from observation at la Palma, transfer and replication in off-site RSEs (PIC) and after replication deletion of the data at origin. Once the FTS transfers are successfully done, Rucio triggers the deletion of the files from the origin (La Palma).



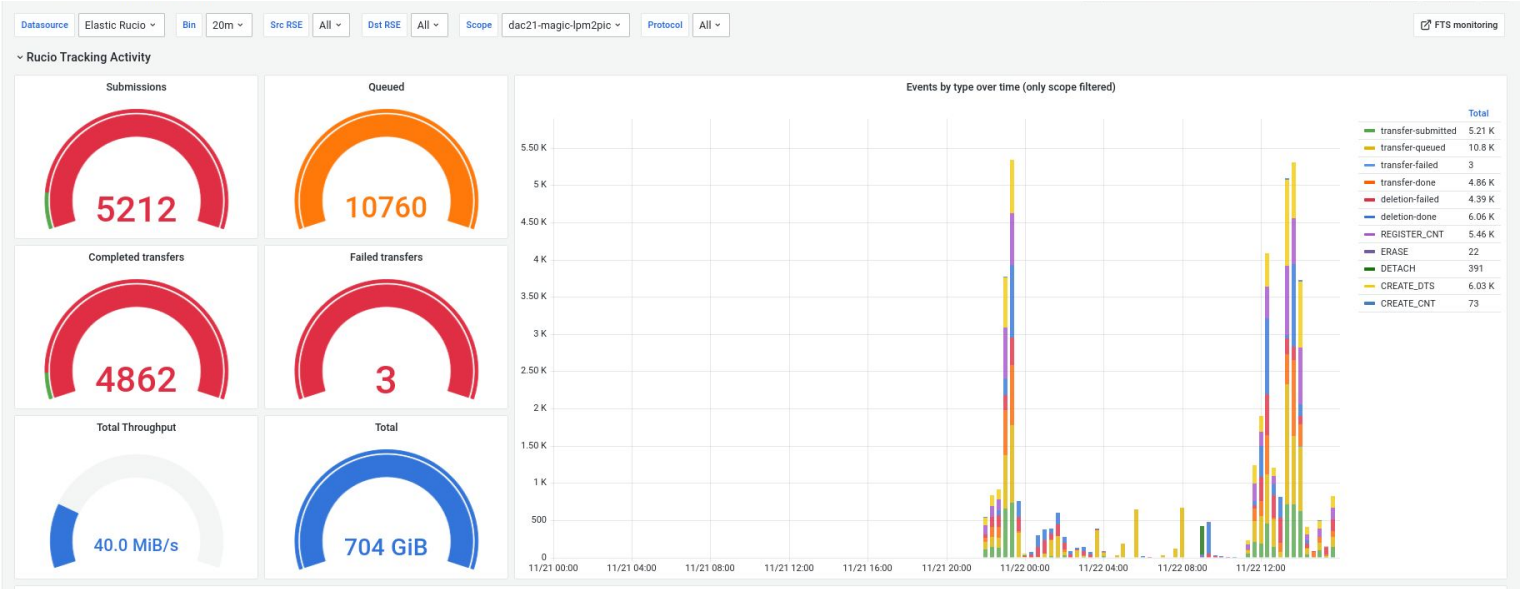
Test name	Protocol	Estimated #Files, data volume	STORAGE
Test 1	GSIFTP	631 GB	Disk
Test 2	GSIFTP	3155 GB	Disk

WP2 Use case: Long haul ingestion and replication

Experiment and point of contact	Usecase	Test name	Protocol	Method	Anticipated timeline Success metric	Estimated #Files, data volume	STORAGE	Replicas/RSEs
Agustin B, Jordi D, Gonzalo M	MAGIC01:	Test 1	GSIFTP	Python Cron	Data is successfully transferred, replicated, and file deleted on the origin RSE. Data transfer was monitored. Data can be discovered using the CTA-RUCIO instance	651 GB	Disk	CTA/PIC-RUCIO: non-deterministic and deterministic RSEs

WP2 Use case 1: Long haul ingestion and replication

TEST1 - MAGIC endpoint GridFTP, Dataset 651GB, Destination endpoint: disk storage, CTA/PIC Rucio context



Test1 executed on 23rd of November, completed within the expected time frame (< 8h)

WP2 Use case 1: Long haul ingestion and replication

TEST1 - MAGIC endpoint GridFTP, Dataset 651GB, Destination endpoint: custom definition of **metadata and namespace**:

> M1/ (data of the telescope MAGIC-1)
> DAQ (Acquired data by MAGIC-1)
> RAW (Data type)
> Night (YYYY_MM_DD)
> Files *.raw.gz
> OSA (Generated data by the On-site analysis)
> {Calibrated|Star} (Data type)
> YYYY
> MM
> DD
> Files *.root

Test1 executed on 23rd of November, completed within the expected time frame (< 8h)

WP2 Use case 1: Long haul ingestion and replication

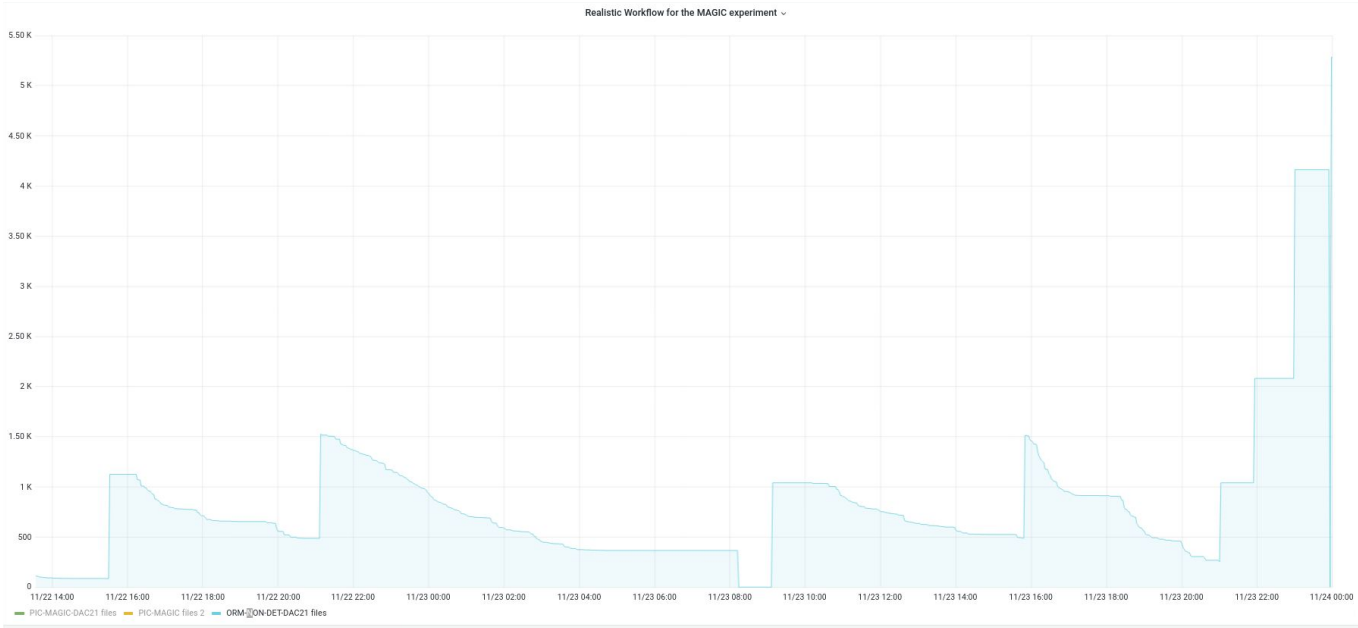
TEST1 - MAGIC endpoint GridFTP, Dataset 651GB, Destination endpoint: custom definition of **metadata and namespace**:

```
[bruzzese@rucio03 ~]$ rucio list-dids-extended --filter "telescope=M1" dac21-magic-lpm2pic-v2:* | more
+------------------------------------------------------------------------------------------------------------------------+----------------------------------+
| SCOPE:NAME                                                                                                             | [DID TYPE]                       |
|------------------------------------------------------------------------------------------------------------------------+----------------------------------|
| dac21-magic-lpm2pic-v2:Calibrated_M1/1ES2344-514/2021_07_15/05073900/20211203_M1_05073900.016_D_1ES2344_514-W0.40_000.root | Info not available in JSON Plugin |
| dac21-magic-lpm2pic-v2:RAW_M1/UrsaMinor/2021_12_06/05039477/20211206_M1_05039477.008_D_UrsaMinor-W0.40_180.raw.gz      | Info not available in JSON Plugin |
| dac21-magic-lpm2pic-v2:RAW_M1/4FGLJ1723.5-/2021_12_06/05028537/20211206_M1_05028537.010_D_4FGLJ1723.5--W0.70_270.raw.gz | Info not available in JSON Plugin |
| dac21-magic-lpm2pic-v2:Calibrated_M1/1ES2344-514/2021_07_15/05036952/20211207_M1_05036952.010_D_1ES2344_514-W0.40_270.root | Info not available in JSON Plugin |
| dac21-magic-lpm2pic-v2:RAW_M1/4FGLJ1723.5-/2021_12_06/05072762/20211206_M1_05072762.004_D_4FGLJ1723.5--W0.70_270.raw.gz | Info not available in JSON Plugin |
| dac21-magic-lpm2pic-v2:RAW_M1/UrsaMinor/2021_12_06/05093584/20211206_M1_05093584.013_D_UrsaMinor-W0.40_270.raw.gz      | Info not available in JSON Plugin |
| dac21-magic-lpm2pic-v2:Star_M1/UrsaMinor/2021_07_15/05058680/20211208_M1_05058680.006_I_UrsaMinor-W0.40_270.root        | Info not available in JSON Plugin |
| dac21-magic-lpm2pic-v2:RAW_M1/1ES2344-514/2021_12_06/05061184/20211206_M1_05061184.002_D_1ES2344_514-W0.40_270.raw.gz  | Info not available in JSON Plugin |
| dac21-magic-lpm2pic-v2:RAW_M1/4FGLJ1723.5-/2021_12_06/05039095/20211206_M1_05039095.003_D_4FGLJ1723.5--W0.70_000.raw.gz | Info not available in JSON Plugin |
| dac21-magic-lpm2pic-v2:Calibrated_M1/Mrk501/2021_07_15/05050384/20211211_M1_05050384.006_D_Mrk501-W0.40_180.root        | Info not available in JSON Plugin |
| dac21-magic-lpm2pic-v2:RAW_M1/Mrk501/2021_12_06/05089044/20211206_M1_05089044.006_D_Mrk501-W0.40_000.raw.gz            | Info not available in JSON Plugin |
| dac21-magic-lpm2pic-v2:RAW_M1/4FGLJ1723.5-/2021_12_06/05081367/20211206_M1_05081367.001_P_4FGLJ1723.5--W0.70_090.raw.gz | Info not available in JSON Plugin |
| dac21-magic-lpm2pic-v2:RAW_M1/UrsaMinor/2021_12_06/05065267/20211206_M1_05065267.010_D_UrsaMinor-W0.40_090.raw.gz      | Info not available in JSON Plugin |
| dac21-magic-lpm2pic-v2:RAW_M1/1ES2344-514/2021_12_06/05034148/20211206_M1_05034148.008_D_1ES2344_514-W0.40_270.raw.gz  | Info not available in JSON Plugin |
| dac21-magic-lpm2pic-v2:Calibrated_M1/UrsaMinor/2021_07_15/05050044/20211203_M1_05050044.004_Y_UrsaMinor-W0.40_090.root | Info not available in JSON Plugin |
| dac21-magic-lpm2pic-v2:RAW_M1/1ES2344-514/2021_12_06/05064607/20211206_M1_05064607.001_D_1ES2344_514-W0.40_090.raw.gz  | Info not available in JSON Plugin |
| dac21-magic-lpm2pic-v2:Calibrated_M1/ssignal/2021_07_15/05099186/ssignal05099186.001_M1.root                          | Info not available in JSON Plugin |
| dac21-magic-lpm2pic-v2:Star_M1/UrsaMinor/2021_07_15/05026180/20211209_M1_05026180.007_I_UrsaMinor-W0.40_090.root        | Info not available in JSON Plugin |
| dac21-magic-lpm2pic-v2:Calibrated_M1/UrsaMinor/2021_07_15/05059309/20211210_M1_05059309.008_D_UrsaMinor-W0.40_180.root | Info not available in JSON Plugin |
| dac21-magic-lpm2pic-v2:RAW_M1/4FGLJ1723.5-/2021_12_06/05073142/20211206_M1_05073142.015_D_4FGLJ1723.5--W0.70_270.raw.gz | Info not available in JSON Plugin |
| dac21-magic-lpm2pic-v2:RAW_M1/UrsaMinor/2021_12_06/05053019/20211206_M1_05053019.002_D_UrsaMinor-W0.40_000.raw.gz      | Info not available in JSON Plugin |
| dac21-magic-lpm2pic-v2:RAW_M1/4FGLJ1723.5-/2021_12_06/05057287/20211206_M1_05057287.017_D_4FGLJ1723.5--W0.70_000.raw.gz | Info not available in JSON Plugin |
| dac21-magic-lpm2pic-v2:RAW_M1/1ES2344-514/2021_12_03/05013811/20211203_M1_05013811.001_P_1ES2344_514-W0.40_090.raw.gz  | Info not available in JSON Plugin |
| dac21-magic-lpm2pic-v2:RAW_M1/1ES2344-514/2021_12_08/05044381/20211208_M1_05044381.010_D_1ES2344_514-W0.40_270.raw.gz  | Info not available in JSON Plugin |
| dac21-magic-lpm2pic-v2:RAW_M1/UrsaMinor/2021_12_03/05038952/20211203_M1_05038952.009_D_UrsaMinor-W0.40_000.raw.gz      | Info not available in JSON Plugin |
| dac21-magic-lpm2pic-v2:Calibrated_M1/UrsaMinor/2021_07_15/05086460/20211207_M1_05086460.002_D_UrsaMinor-W0.40_000.root | Info not available in JSON Plugin |
| dac21-magic-lpm2pic-v2:Calibrated_M1/Mrk501/2021_07_15/05068435/20211203_M1_05068435.003_D_Mrk501-W0.40_090.root        | Info not available in JSON Plugin |
| dac21-magic-lpm2pic-v2:RAW_M1/Benetnasch/2021_12_06/05017273/20211206_M1_05017273.006_B_Benetnasch.raw.gz              | Info not available in JSON Plugin |
| dac21-magic-lpm2pic-v2:RAW_M1/4FGLJ1723.5-/2021_12_06/05067866/20211206_M1_05067866.002_D_4FGLJ1723.5--W0.70_000.raw.gz | Info not available in JSON Plugin |
| dac21-magic-lpm2pic-v2:RAW_M1/UrsaMinor/2021_12_06/05083077/20211206_M1_05083077.004_D_UrsaMinor-W0.40_000.raw.gz      | Info not available in JSON Plugin |
```

Test1 executed on 23rd of November, completed within the expected time frame (< 8h)

WP2 Use case 1: Long haul ingestion and replication

TEST1 - MAGIC endpoint GridFTP, Dataset 651GB, Destination endpoint: disk storage, CTA/PIC Rucio context



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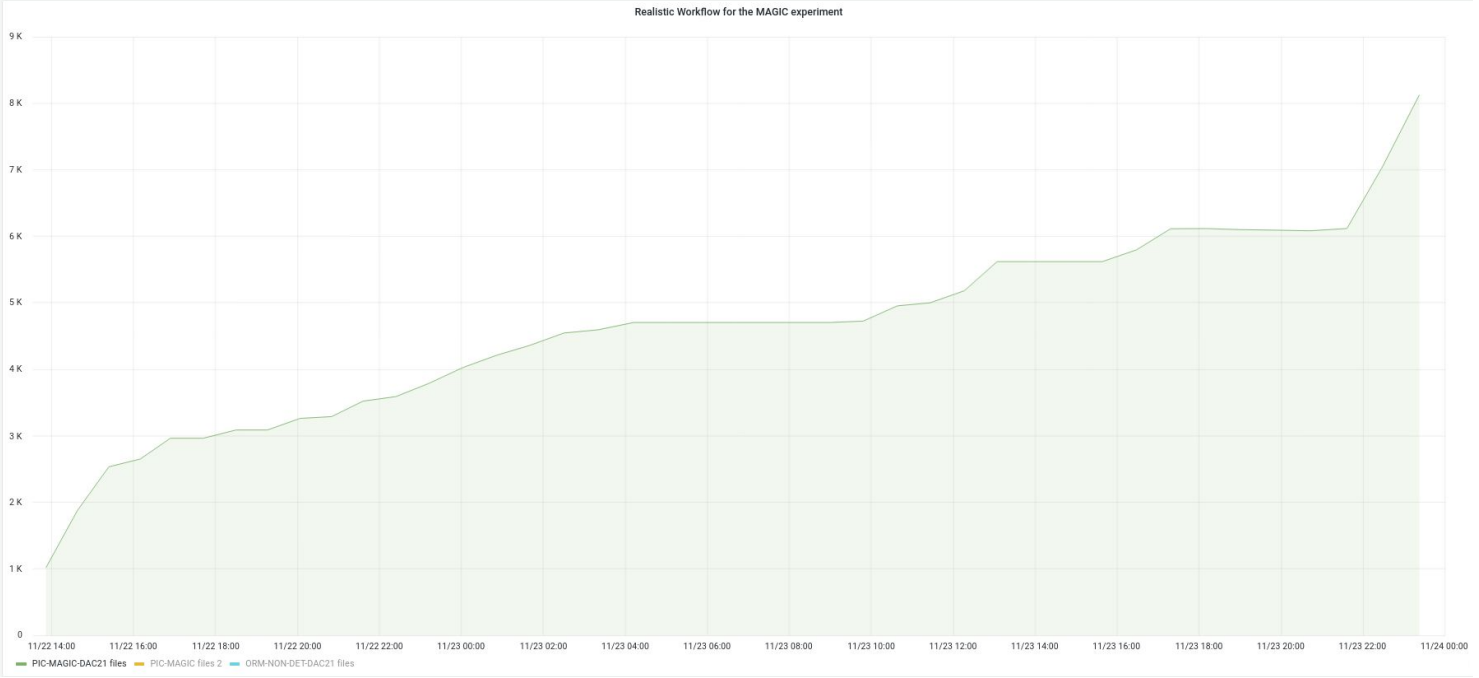

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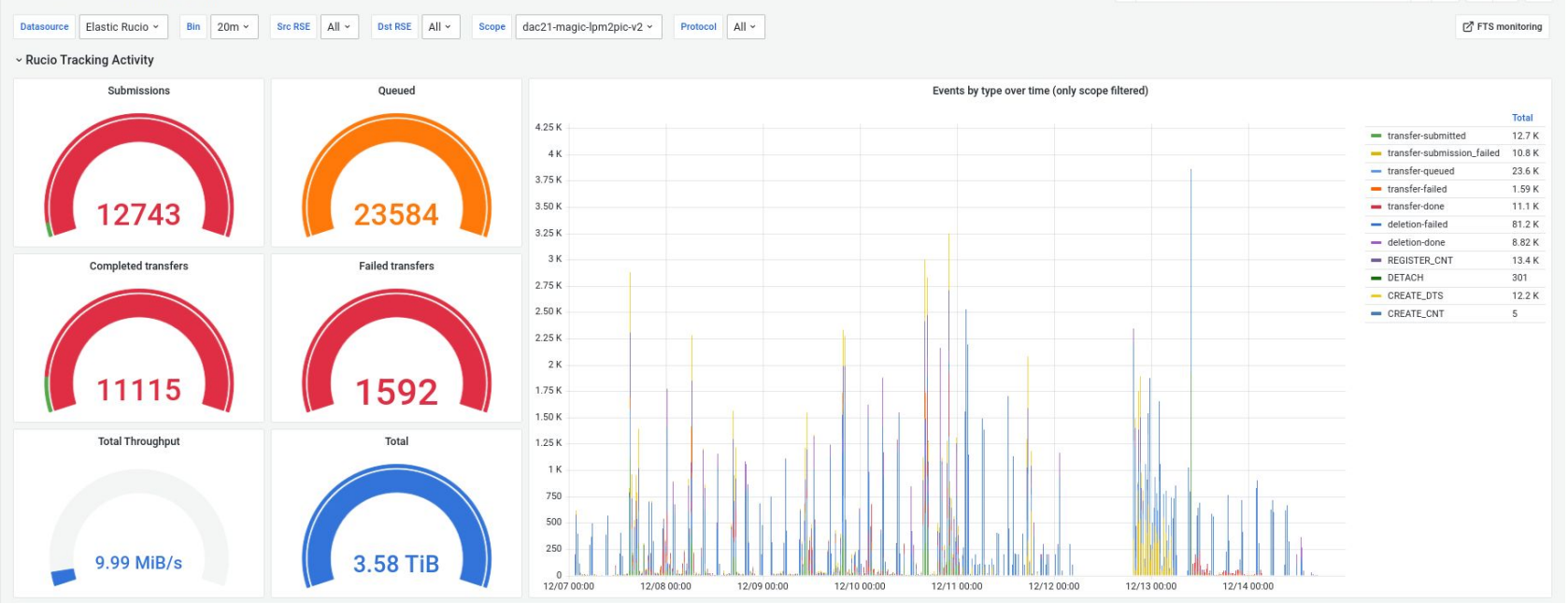
WP2 Use case: Long haul ingestion and replication

Experiment and point of contact	Usecase	Test name	Protocol	Method	Anticipated timeline Success metric	Estimated #Files, data volume	STORAGE	Replicas/RSEs
Agustin B, Jordi D, Gonzalo M	MAGIC01	Test 2	GSIFTP	Python Cron	Data is successfully transferred, replicated, and file deleted on the origin RSE. Data transfer was monitored. Data can be discovered using the CTA/PIC-RUCIO instance	3155 GB	Disk	CTA/PIC-RUCIO: non-deterministic and deterministic RSEs

WP2 Use case 1: Long haul ingestion and replication

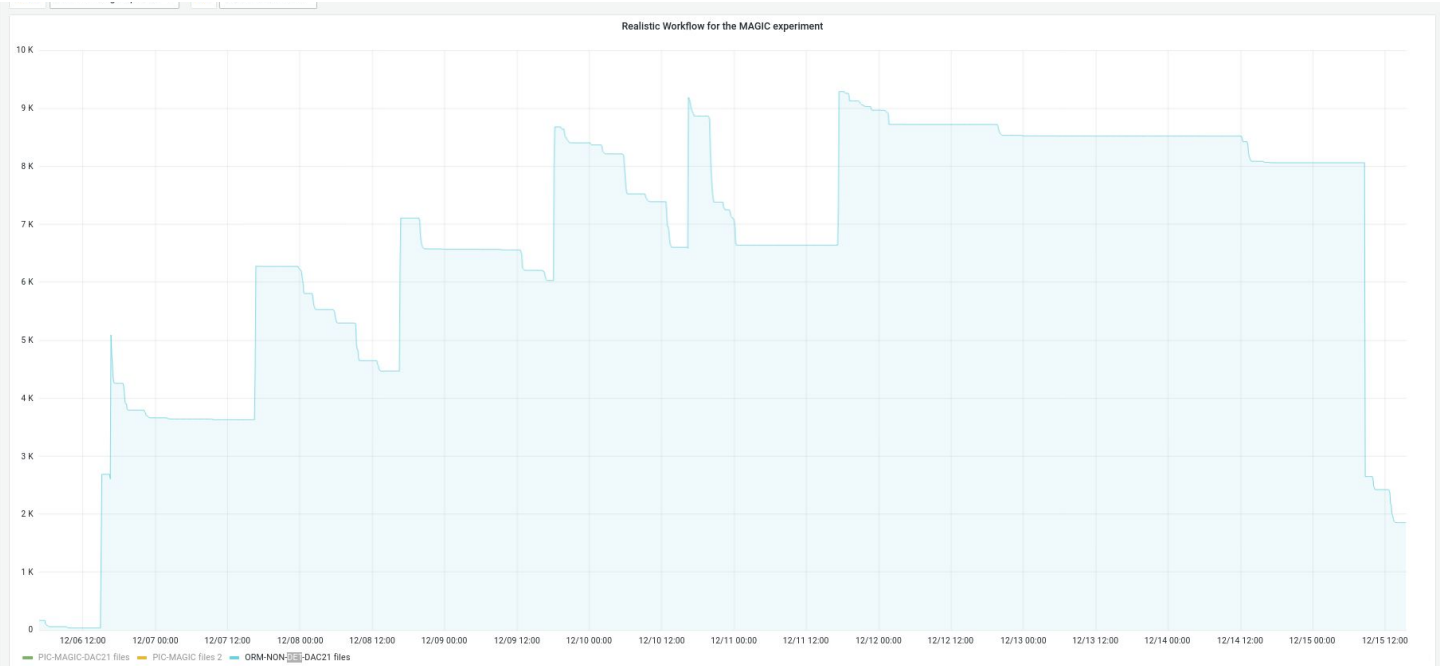
TEST2 - MAGIC endpoint GridFTP, Dataset 3155GB, Destination endpoint: disk storage, CTA/PIC Rucio context



Test1 executed on 7th December, completed within the expected time frame (5 days)

WP2 Use case 1: Long haul ingestion and replication

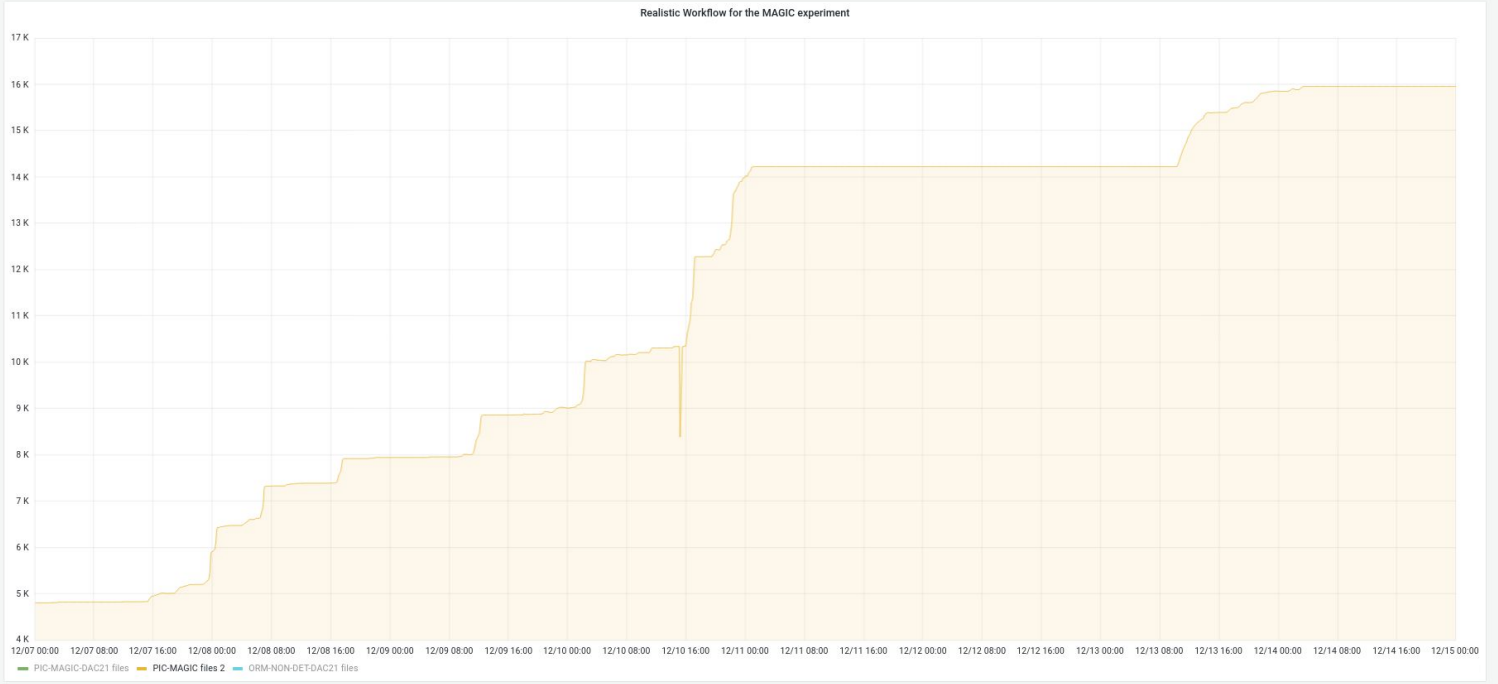
TEST2 - MAGIC endpoint GridFTP, Dataset 3155GB, Destination endpoint: disk storage, CTA/PIC Rucio context



Test1 executed on 7th December, completed within the expected time frame (< 5 days)

WP2 Use case 1: Long haul ingestion and replication

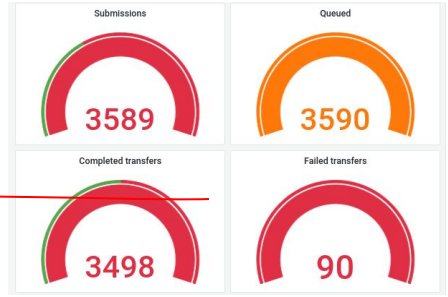
TEST2 - MAGIC endpoint GridFTP, Dataset 3155GB, Destination endpoint: disk storage, CTA/PIC Rucio context



Test1 executed on 7th December, completed within the expected time frame (< 5 days)

WP2 Use case 1: Problems

- Transfer errors :




```
INFO    Wed, 15 Dec 2021 14:58:38 +0100; [1639576718878] SOURCE GSIFTP  CHECKSUM ENTER  ADLER32
INFO    Wed, 15 Dec 2021 14:58:45 +0100; [1639576725307] SOURCE GSIFTP  CHECKSUM EXIT   ADLER32=3790306e
INFO    Wed, 15 Dec 2021 14:58:45 +0100; [1639576725308] BOTH GSIFTP    TRANSFER ENTER  (161.72.130.238:2811) gsiftp://grid.magic.iac.es:2811//data/Other/rucio_tmp/ESCAPE-DC21/To_transfer/M1/DAQ/RAW/2021_12_15/20211215_M1_05010894.015_D_1ES2344+514-
W0.40+270.raw.gz => (193.109.172.155:2811) gsiftp://door05.pic.es:2811//pnfs/pic.es/data/escape/dac21/magic/disk/dac21-magic-lpm2pic-v2/RAW_M1/1ES2344-514/2021_12_15/05010894/20211215_M1_05010894.015_D_1ES2344_514-W0.40_270.raw.gz
INFO    Wed, 15 Dec 2021 14:58:45 +0100; [1639576725308] BOTH GSIFTP    TRANSFER TYPE   3rd push
WARNING Wed, 15 Dec 2021 15:04:46 +0100; Timeout stopped
ERR     Wed, 15 Dec 2021 15:04:46 +0100; Recoverable error: [110] TRANSFER  Transfer canceled because the gsiftp performance marker timeout of 360 seconds has been exceeded, or all performance markers during that period indicated zero bytes transferred
```

WP2 Use case 1: Problems

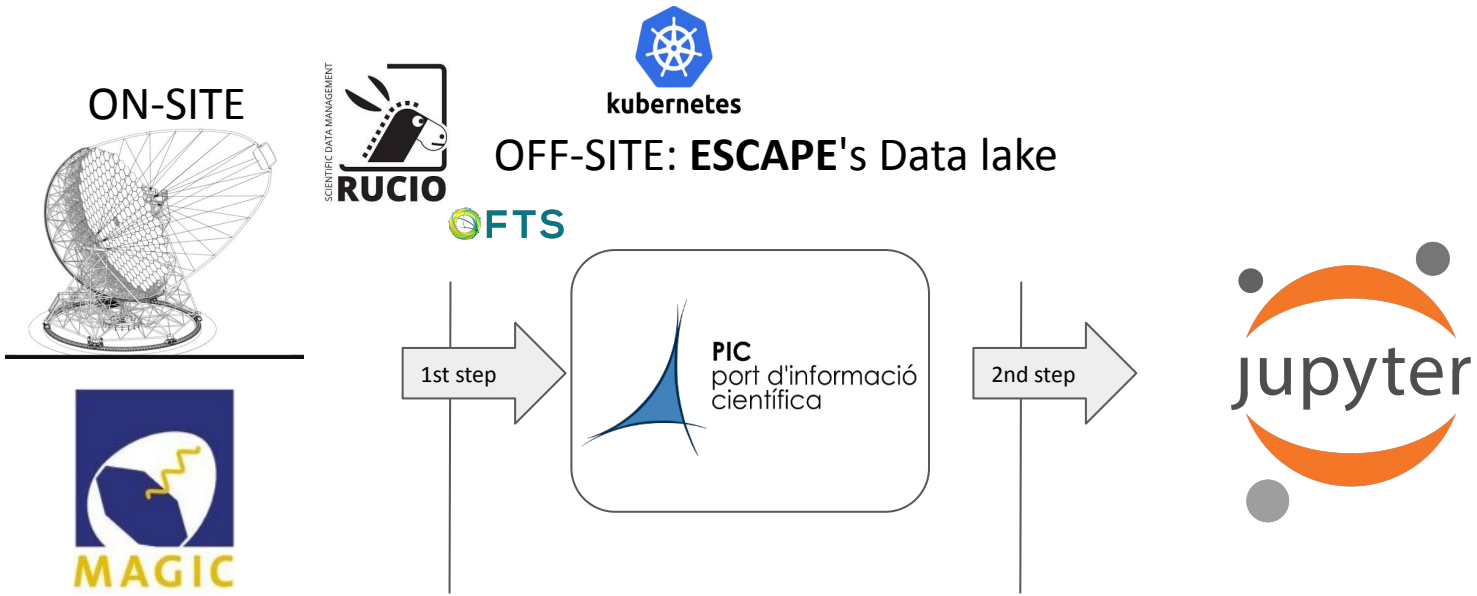
- The tests carried out on 22 November had to be repeated.

WP2 Use case 1: Problems

- The tests carried out on 22 November had to be repeated.

WP2 CTA Use case 2 : Data reprocessing

Description/Goal: We wanted implement a use case associated with GammaHub, an initiative that IFAE-PIC is developing in the context of WP5 and that aims to offer interactive analysis tools using the Gammapy package and the emerging standard in Gamma-ray astronomy, the DL3 format files.



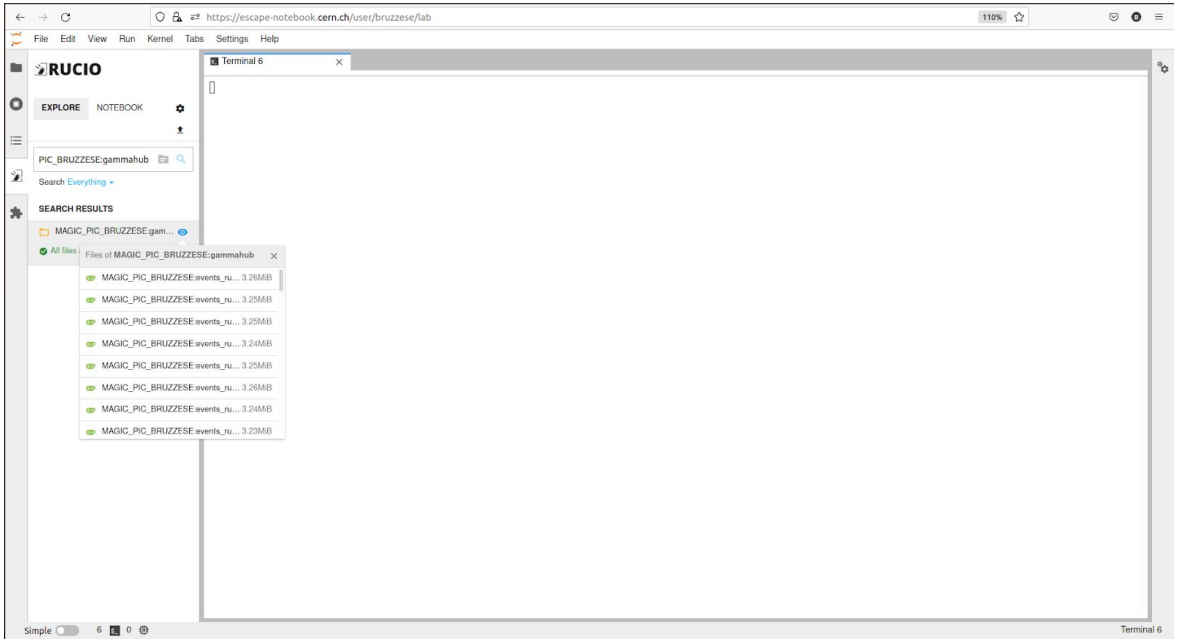
WP2 Use case 2: Data reprocessing

Experiment and point of contact	Usecase	Test name	Method	Anticipated timeline Success metric	Estimated #Files, data volume	STORAGE	Replicas/RSEs
Agustin B, Jordi D, Alba V, Gonzalo M,	MAGIC02	Test 1	Python Cron Jupyter notebooks	Replication of DL3 file. Validating the reading access of the samples via de Jupyter rucio extension. Multiple analysis using gammapy library.	675MB	Disk	ESCAPE-RUCIO

WP2 Use case 2: Data reprocessing

TEST1 - MAGIC endpoint, Dataset 675MB (200 DL3 files), Destination endpoint: disk storage, ESCAPE Rucio context

- The files were registered attached and uploaded to PIC-DCACHE
- Subsequently, they were referenced on the jupyter platform for analysis.



Test1 executed on 30rd of November, completed within the expected time frame (< 24h)

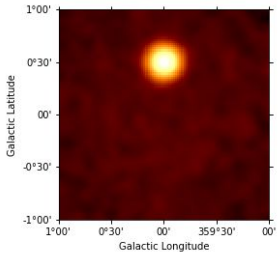
WP2 Use case 2: Data reprocessing

TEST1 - MAGIC endpoint, Dataset 675MB (200 DL3 files), Destination endpoint: disk storage, ESCAPE Rucio context

```
[37]: # let's check just the first observations
counts = analysis.datasets["stacked"].counts
counts.smooth("0.05 deg").plot_interactive()
```

Select energy: 1.00e+02 GeV - 1.58e+02

Select stretch: linear / sqrt / log




```
[38]: # we can also compute the significance of our source
analysis.get_excess_map()
analysis.excess_map["sqrt_ts"].plot(add_cbar=True);
```

```
Computing excess maps.
Position <SkyCoord (Galactic): (l, b) in deg
    (0., 0.)> is outside valid IRF map range, using nearest IRF defined within
```

```
[38]: # we can also compute the significance of our source
analysis.get_excess_map()
analysis.excess_map["sqrt_ts"].plot(add_cbar=True);
```

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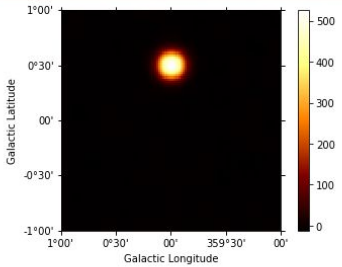
Computing excess maps.
Position <SkyCoord (Galactic): (l, b) in deg
    (0., 0.)> is outside valid IRF map range, using nearest IRF defined within
```



perform the fit

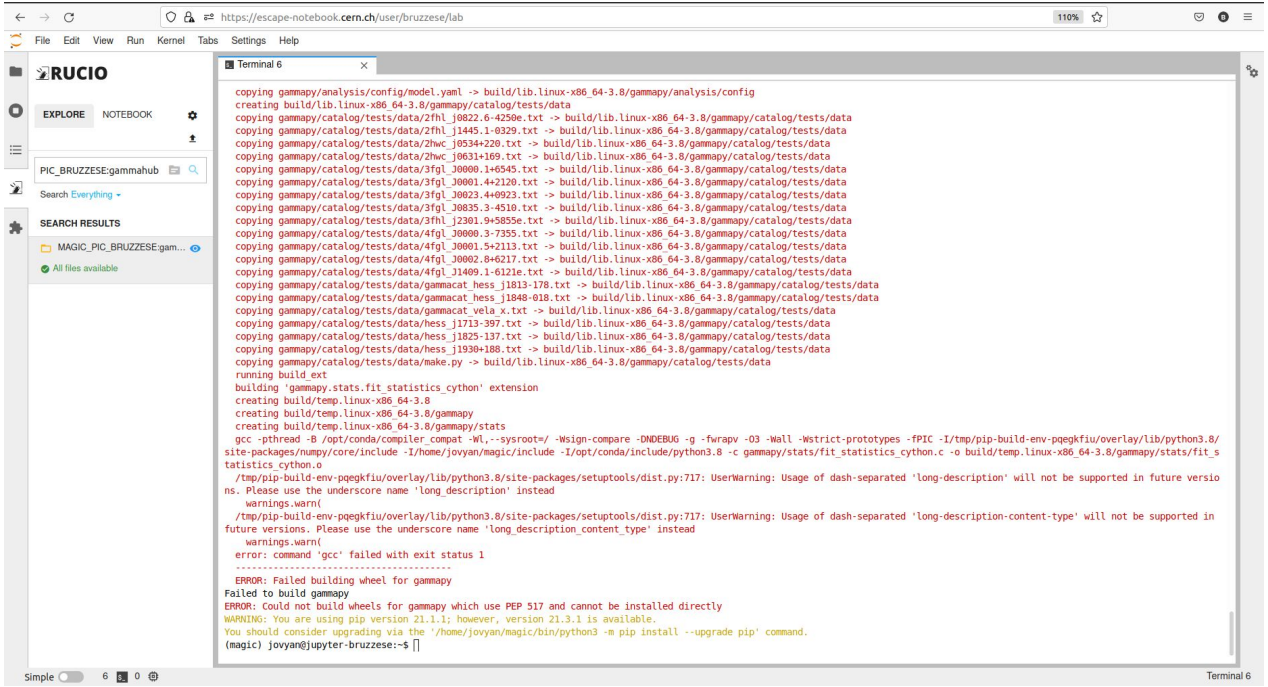
As a final step we fit the spectrum of the source, and we compare to the one we actually used for simulation

```
[43]: # let us load the model we used for the simulation
models = Models.read("./data/models/point-source-pwl.yaml")
# let us create a copy of the spectral model for later comparison
original_spectral_model = models[0].spectral_model.copy()
```

Test1 executed on 30rd of November, completed within the expected time frame (< 24h)

WP2 Use case 2: Problems

- In order to have the gammapy library on DLaaS, gcc has to be installed.



WP2 MAGIC Use case: Long haul ingestion and replication and Data reprocessing Summary

Use Case	Test name	Context	Estimated #Files, data volume	STORAGE	Replicas/RSEs	Results	Observations
MAGIC01	Test 1	CTA/PIC-RUCIO	631 GB	Disk	non-deterministic and deterministic RSEs	Completed successfully.	
	Test 2	CTA/PIC-RUCIO	3155 GB	Disk		Completed successfully.	We had to repeat the test due to some deletions in the target RSE.
MAGIC02	Test 1	ESCAPE-RUCIO	675MB			Completed successfully.	In order to have the gammapy library on DLaaS, gcc has to be installed.

Acknowledgements

This success of this work was possible with help of many people

PIC Operations Team
- Vanessa Acín - Network
- Elena Planas - dCache
- Esther Acción - Enstore
- Ricard Cruz - Kubernetes
- Carles Acosta - xrootd

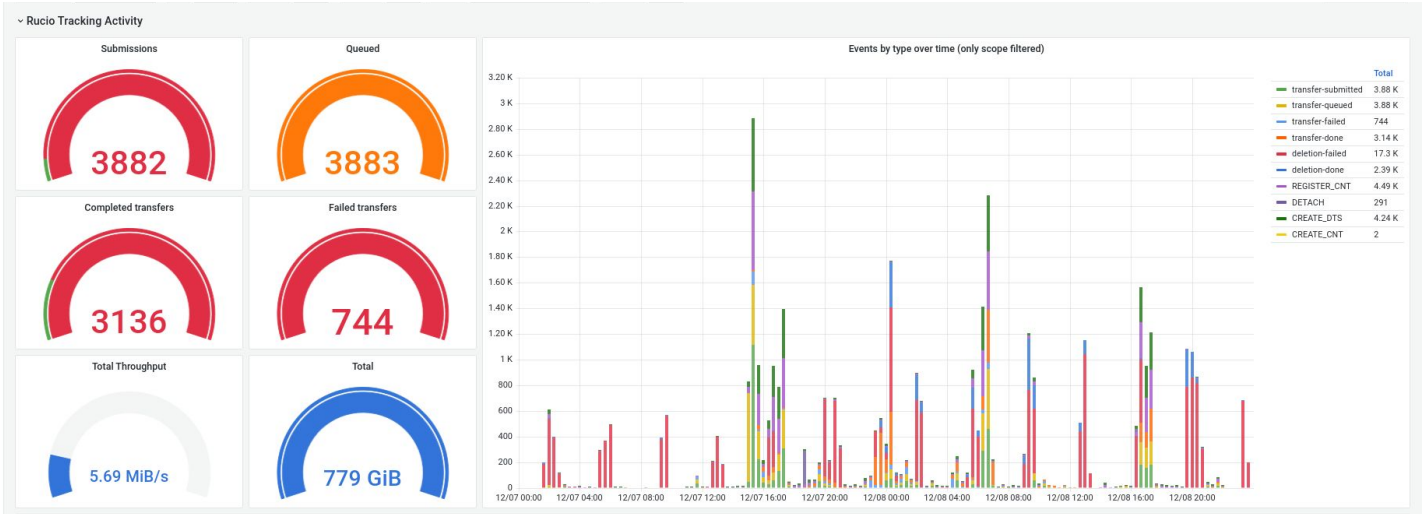
And also other people from ESCAPE partners
- Alba Vendrell
- Rizart Dona
- Riccardo di Maria
- Xavier Espinal

Thanks for listening!
Questions?

ESCAPE-The European Science Cluster of Astronomy & Particle Physics Infrastructures has received funding from the European Union's Horizon 2020 research and innovation programme under the Grant Agreement n1 824064

WP2 Use case 1: Long haul ingestion and replication

TEST1 - MAGIC endpoint GridFTP, Dataset 651GB, Destination endpoint: disk storage



Test1 executed on 7 of December, completed within the expected time frame (< 8h)