

# The ATLAS Computing activities and developments of the Italian Cloud

## Overview of the 2011/2012 data taking period

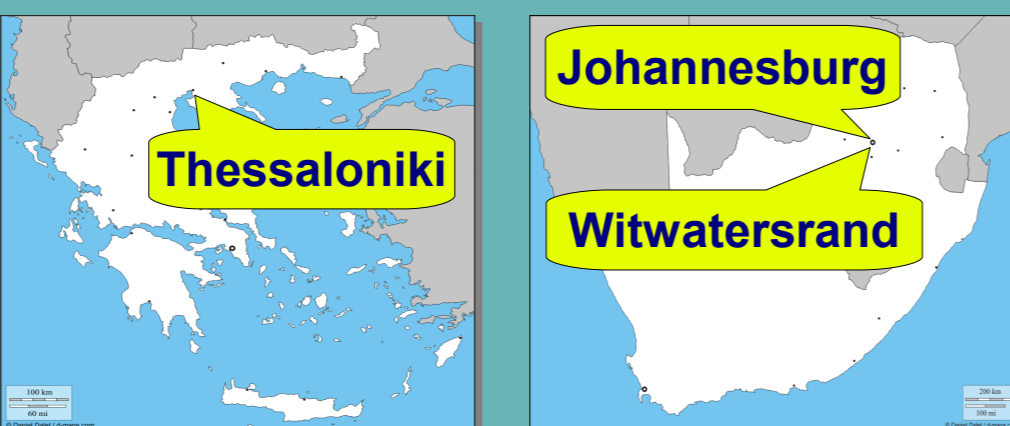
Prepared for the Computing in High Energy and Nuclear Physics Conference, CHEP 2012, May 21<sup>st</sup> - 25<sup>th</sup>, New York, United States



### The Italian Cloud

The Italian Grid Computing Cloud consists of several computing centers located at the Italian Universities and National Institute of Nuclear Physics (INFN) departments. Recently, the Universities of WITwatersrand and Johannesburg (ZA) and Thessaloniki (GR) joined to the Italian Cloud

In average, 10% of the ATLAS Computing activities (Data Processing, Physics Analysis, Simulation and Software Development) are performed in the Italian Cloud



### Tier-2s

#### ATLAS activities at Tier-2s

- Storage of analysis suitable data (AOD, NTUP, D3PD, user)
- MC simulation
- User and group analysis

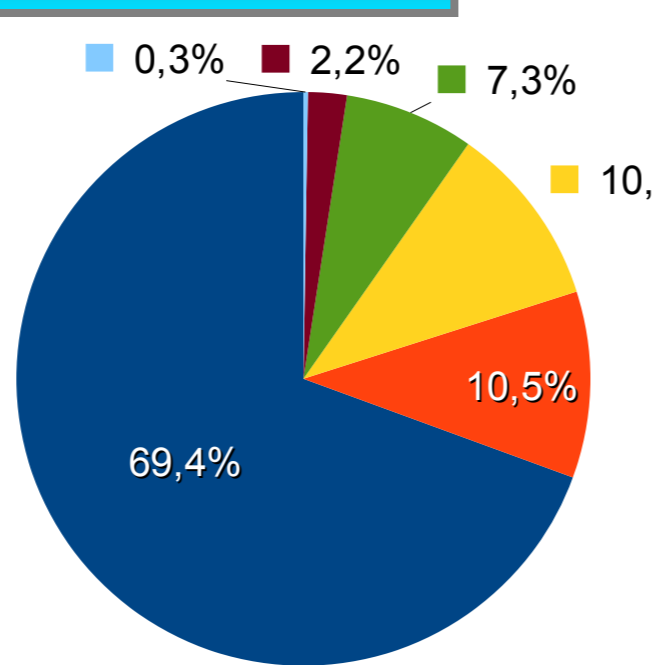
- Storage and analysis of local sub-detector data (calibration, alignment)
- Test and development

| IT Tier2-s<br>2012 total<br>ATLAS<br>resources | Computing |         |              | Storage       |          |                  |
|--|-----------|---------|--------------|---------------|----------|------------------|
|  | Cores     | HePSpec | Batch system | Capacity (TB) | SRM type | Bandwidth (Gbps) |
| Frascati                                       | 870       | 8300    | PBS          | 420           | DPM      | 10               |
| Milano (T2D)                                   | 1050      | 10900   | PBS/Condor   | 1100          | StoRM    | 10               |
| Napoli (T2D)                                   | 1200      | 12400   | PBS          | 1100          | DPM      | 10               |
| Roma1 (T2D)                                    | 1300      | 13100   | LSF          | 1040          | DPM      | 10               |

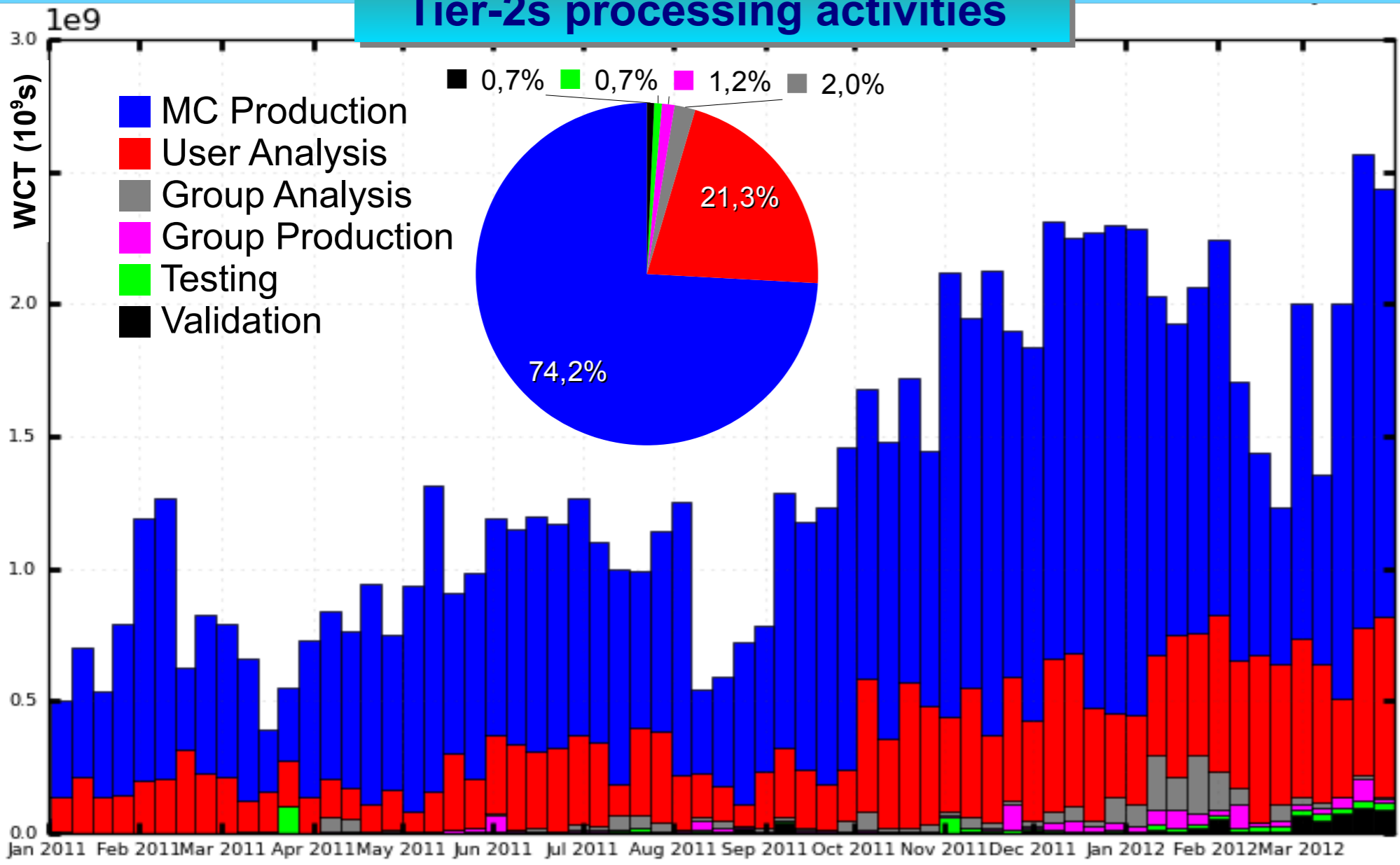
T2D sites are topologically connected to all ATLAS Tier-1s and T2Ds, in order to optimize data distribution and analysis

#### Tier-2s Storage Usage

- Experiment data
- User analysis
- Group analysis
- Calibration
- Scratch area
- Simulation buffer



#### Tier-2s processing activities

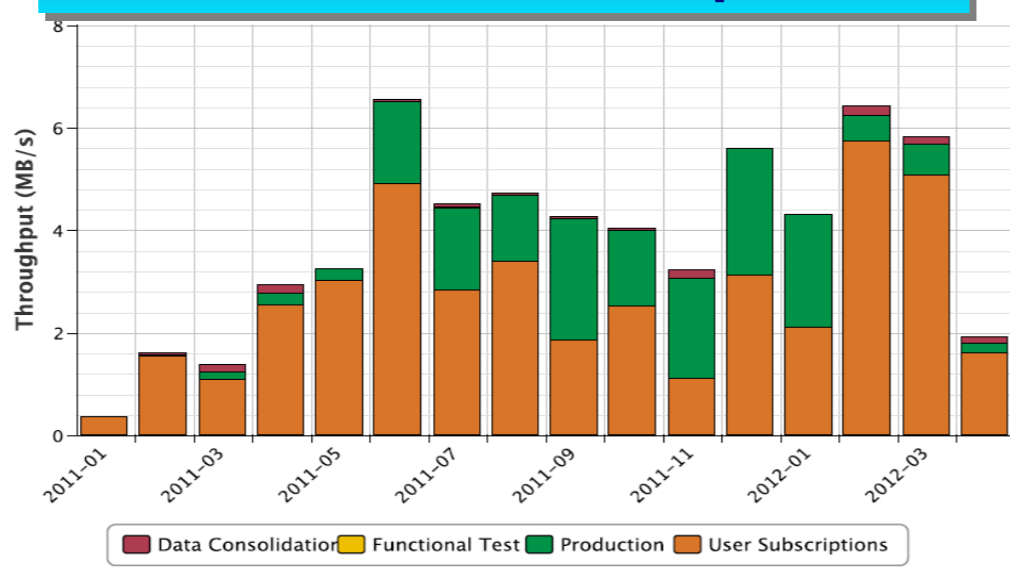


### Tier-3s

An ATLAS Tier-3 is a local institutes Grid-enabled computing center (no pledged resources).

- Tier-3 sites mainly used for User Analysis and testing; also enabled for central MC production
- 11 Tier-3s in the Italian Cloud (8 in Italy, 2 in South Africa and 1 in Greece)
- Total of 730 job slots and 200 TB space on disk (starting from Summer 2011)

#### Tier-3 data transfer input rate



### Networking

| INFN-T1 2012 connectivity |           |                              |                             |
|---------------------------|-----------|------------------------------|-----------------------------|
| Network                   | Bandwidth | Traffic                      |                             |
| LHCOPN                    | 10Gb/s    | Tier-0/Tier-1, Tier-1/Tier-1 | Now 20Gbps shared logically |
| LHCONE                    | 10Gb/s    | Tier-1/Tier-2 /Tier-3        |                             |
| General IP                | 30 Gb/s   | Tier-1/*                     |                             |

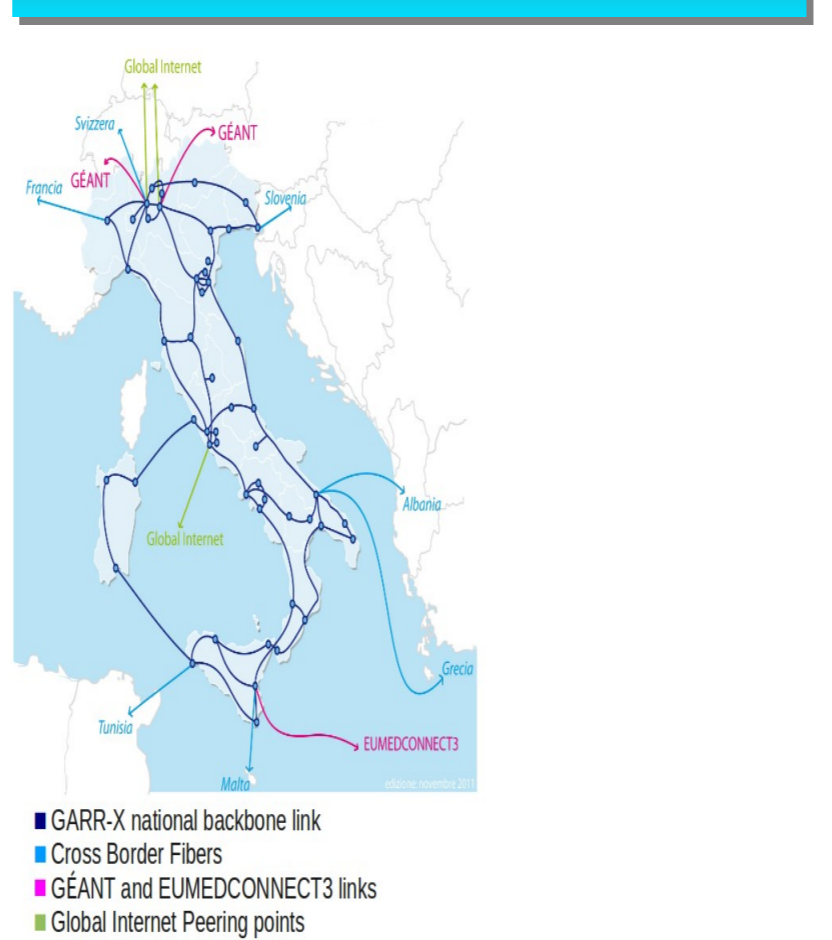
| Tier-2   | Q2 - 2012       | Q4 - 2012 (GARR-X) |
|----------|-----------------|--------------------|
| Frascati | 1Gb/s           | 10 Gb/s            |
| Milano   | 2 Gb/s          | 10 Gb/s            |
| Napoli   | 2 Gb/s (LHCONE) | 10 Gb/s            |
| Roma1    | 2Gb/s           | 10 Gb/s            |

### LHCONE (LHC Open Network Environment)

- provide a private network for Tier1/2/3 traffic
- designed to guarantee high performance and reliability in the data transfers
- no additional resources required to those already provided by the various national research networks, in particular new backbones.

After a preliminary phase of study and experimentation, the ATLAS experiment has identified 14 pilot sites to start deployment and test of this new generation network, and the ATLAS Tier2 of Naples is among them.

### GARR-X backbone fiber



### INFN-CNAF Tier-1

The Italian Tier-1 is located at the INFN-CNAF in Bologna and serves the computing activities of the four LHC experiments and other communities supported by the INFN

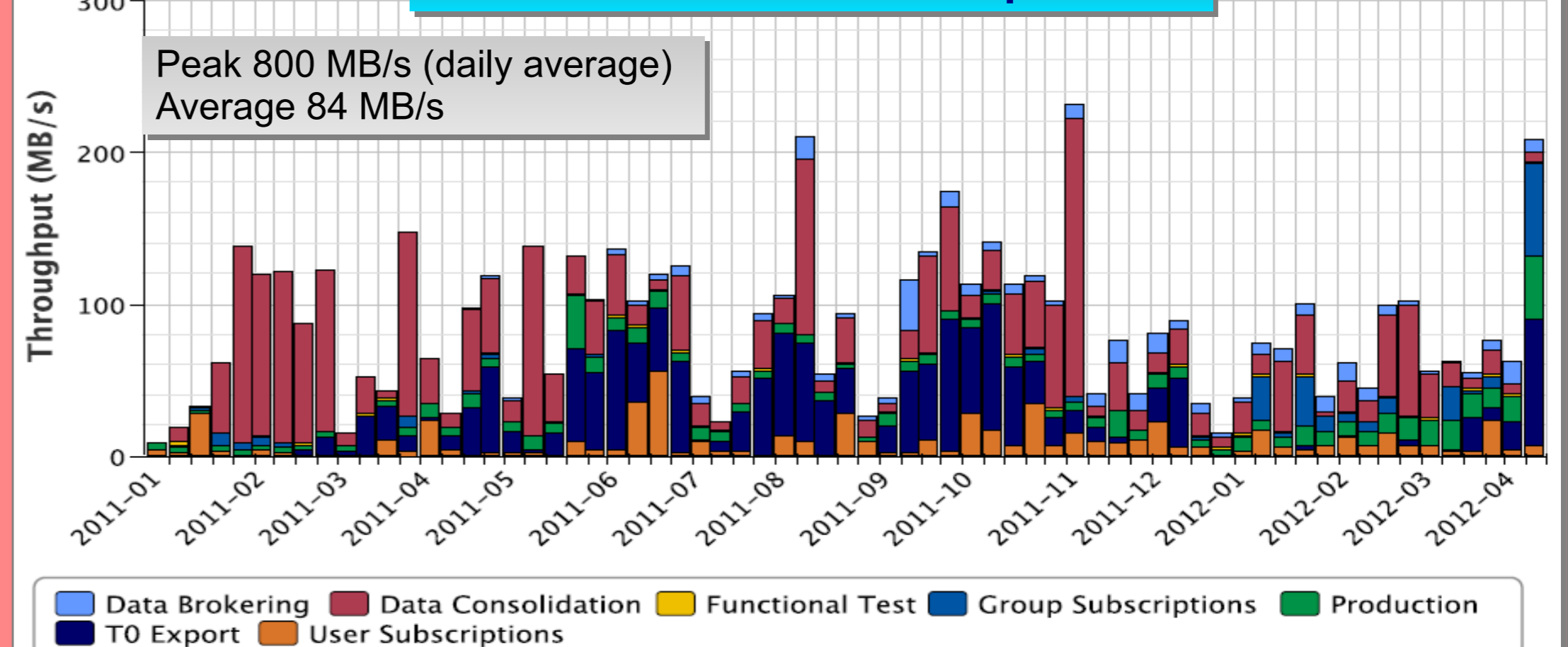
#### INFN Tier-1 ATLAS 2012 resources

| Computing |         |              | Storage                   |                |           |
|-----------|---------|--------------|---------------------------|----------------|-----------|
| Job slots | HePSpec | Batch system | Capacity                  | SRM type       | Bandwidth |
| 3000      | 35000   | LSF          | 2.7 PB disk + 3.6 PB tape | StoRM+GPFS+TSM | 10 GB     |

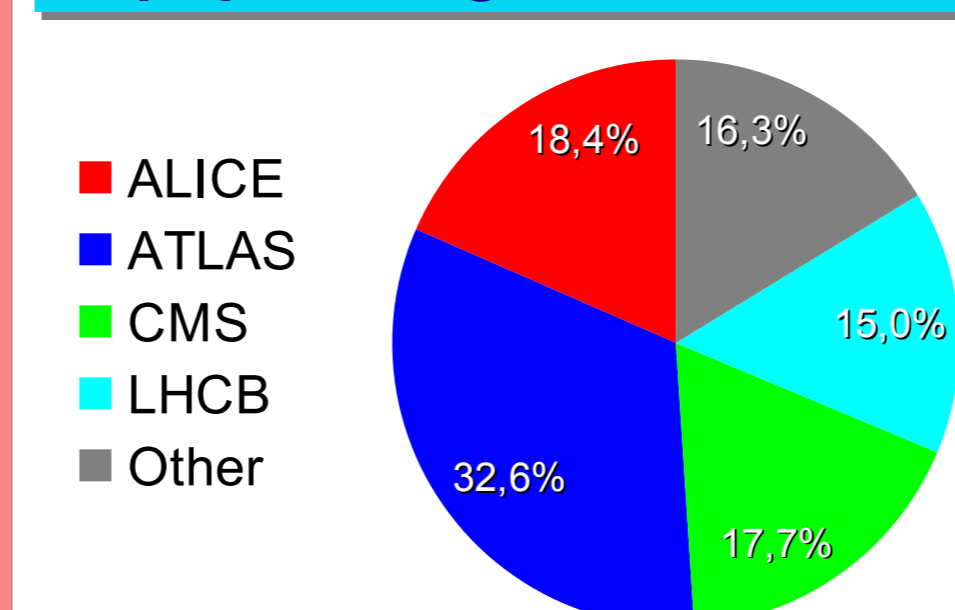
#### ATLAS activities at INFN Tier-1

- Long term access and storage on tape of a fraction of RAW data
- Reprocessing and reconstruction of the stored RAW data
- Storage on disk of a fraction of derived data sample (ESD, AOD, TAG)
- Archival of the simulated data produced in the cloud
- Production of simulated data samples
- Group and User analysis

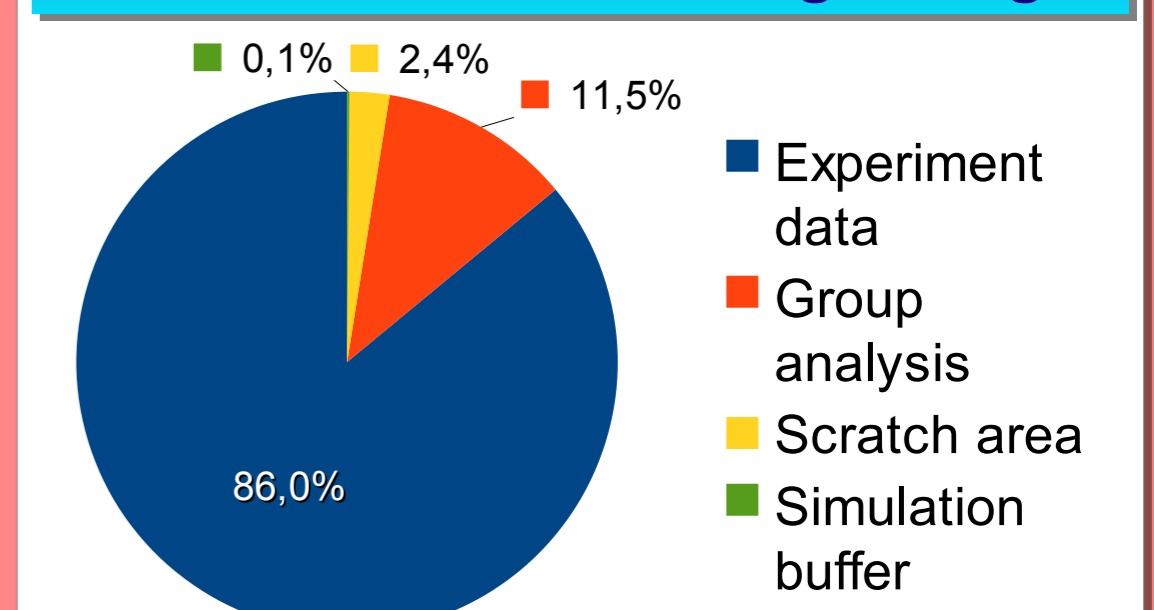
#### INFN Tier-1 data transfer input rate



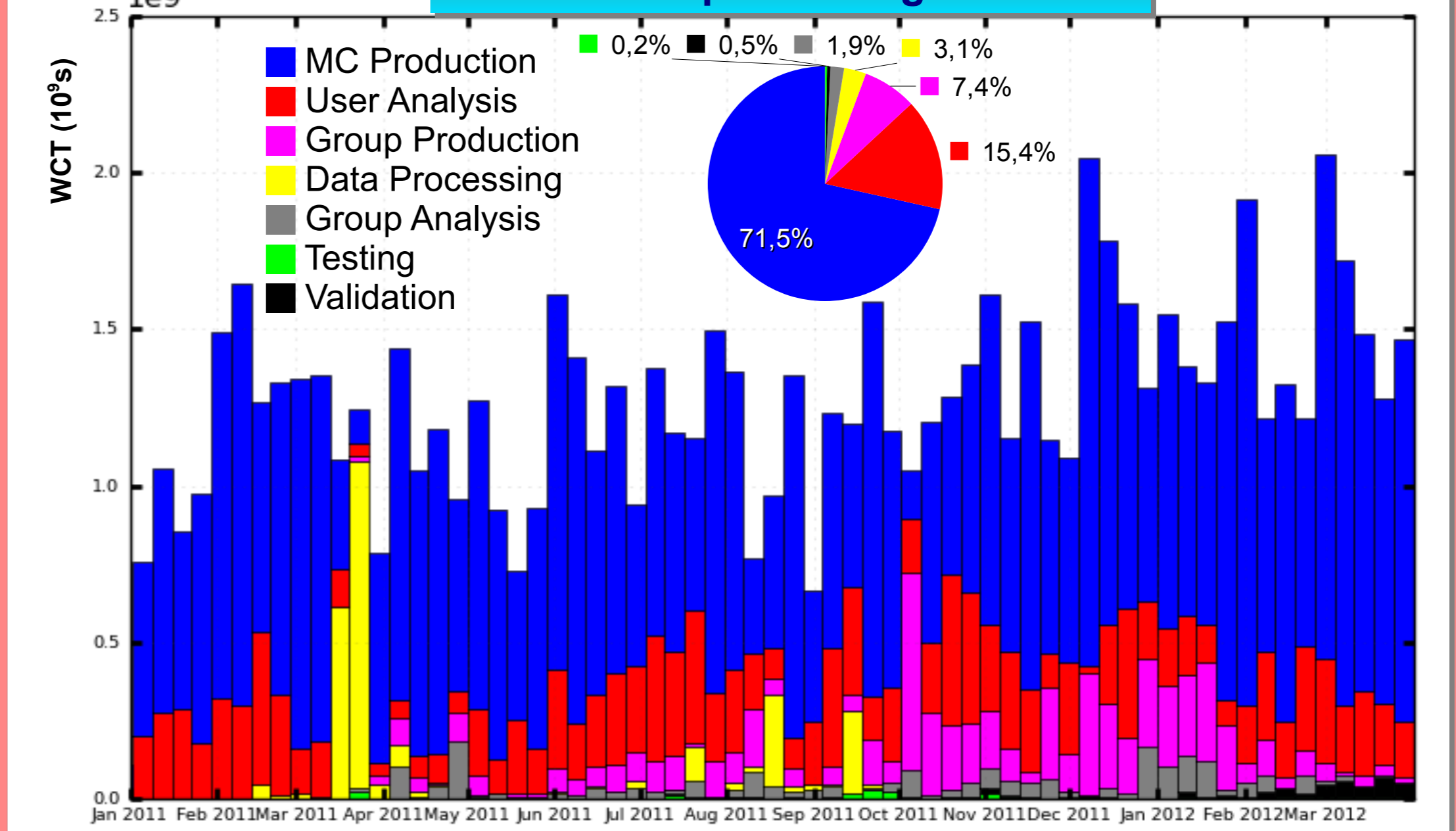
#### HepSpec Usage at INFN Tier-1



#### INFN Tier-1 ATLAS Storage Usage

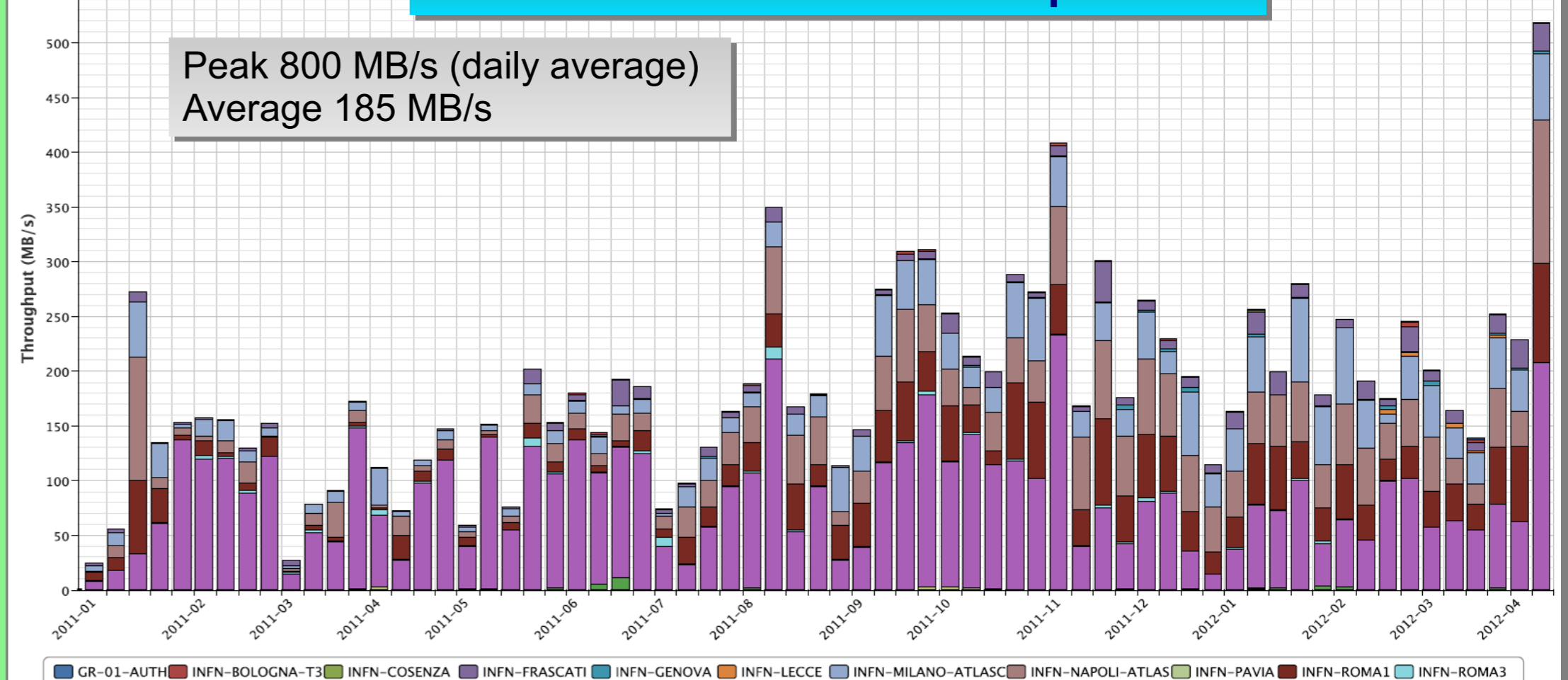


#### INFN Tier-1 processing activities

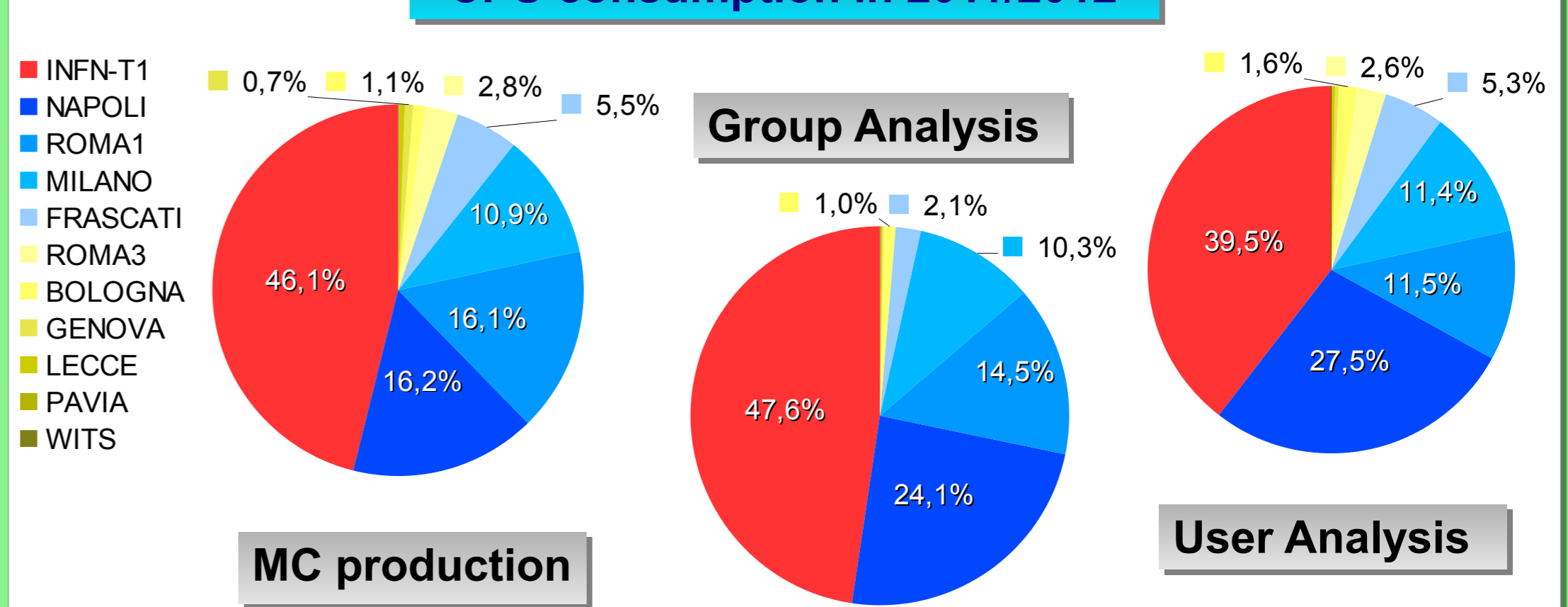


### Italian Cloud overall activities

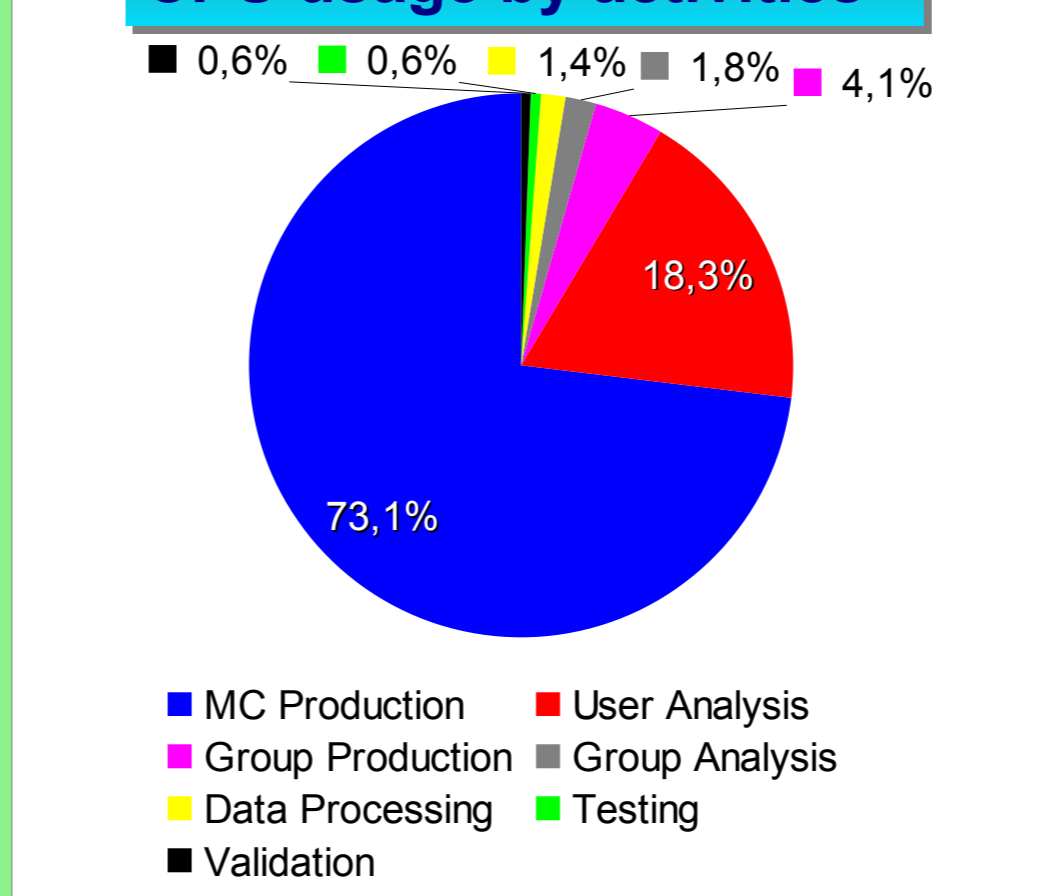
#### Italian Cloud data transfer input rate



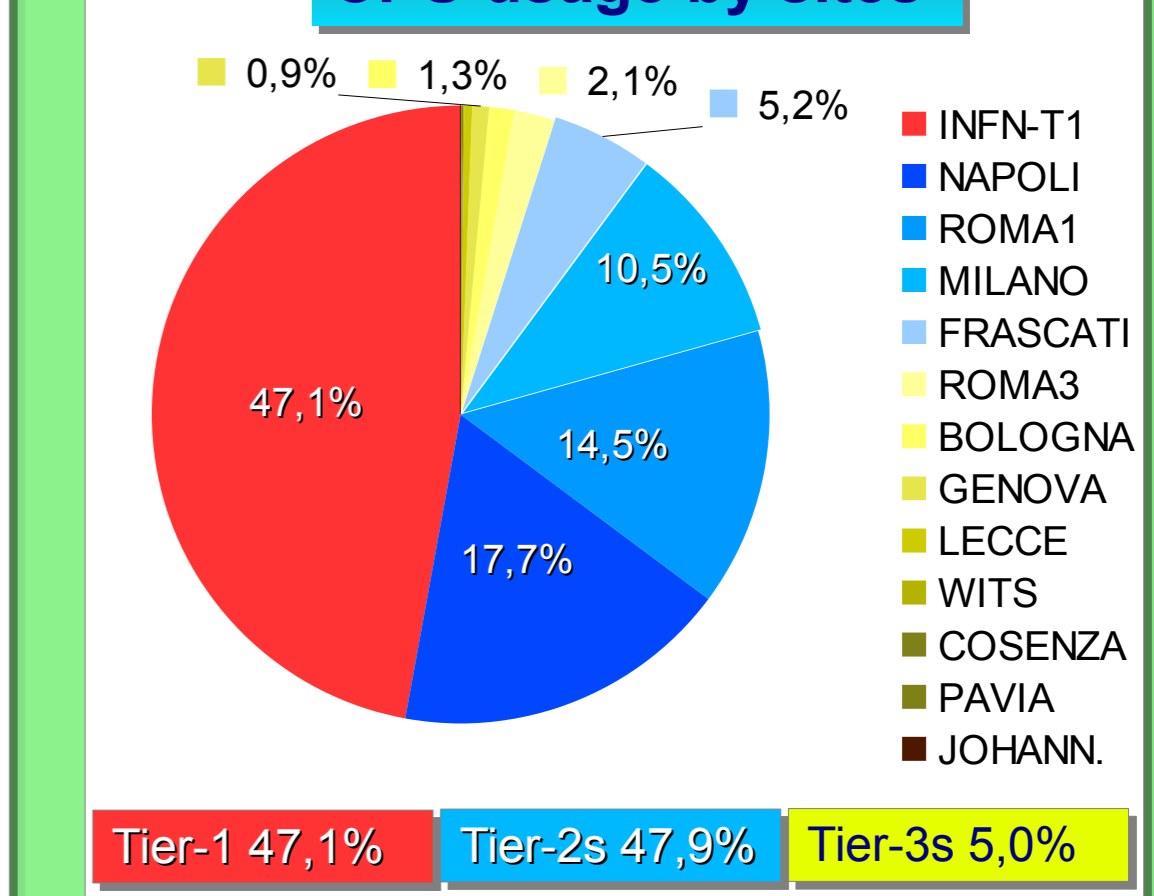
#### CPU consumption in 2011/2012



#### CPU usage by activities



#### CPU usage by sites



Tier-1 47,1% Tier-2s 47,9% Tier-3s 5,0%