The Spanish Distributed TIER-2 for the ATLAS experiment of LHC

Presented by
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6th March 2008

Reference: FPA2007-66708-C03-00
FPA2007-66708-C03-01/02/03

First Meeting of the Board for the Follow-up of GRID Spain Activities
Programa Nacional de Física de Partículas
Overview

1.- Resources: Present status and growing profile
2.- Availability and Performance
3.- Highlights on activities
4.- Local Analysis Facilities
5.- Experience and Perspectives
6.- Conclusions
Ramp-up of Tier-2 Resources (after LHC rescheduling) numbers are cumulative

Evolution of ALL ATLAS T-2 resources according to the estimations made by ATLAS CB (October 2006)

<table>
<thead>
<tr>
<th>Año</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPU(KSI2k)</td>
<td>925</td>
<td>2336.11</td>
<td>17494.51</td>
<td>26972.76</td>
<td>51544.64</td>
<td>69128.42</td>
<td>86712.2</td>
</tr>
<tr>
<td>Disk (TB)</td>
<td>289</td>
<td>1259.04</td>
<td>7744.37</td>
<td>13112.04</td>
<td>22132.3</td>
<td>31091.45</td>
<td>40050.92</td>
</tr>
</tbody>
</table>

Spanish ATLAS T-2 assuming a contribution of a 5% to the whole effort

<table>
<thead>
<tr>
<th>Year</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPU(KSI2k)</td>
<td>46</td>
<td>117</td>
<td>875</td>
<td>1349</td>
<td>2577</td>
<td>3456</td>
<td>4336</td>
</tr>
<tr>
<td>Disk (TB)</td>
<td>14</td>
<td>63</td>
<td>387</td>
<td>656</td>
<td>1107</td>
<td>1555</td>
<td>2003</td>
</tr>
</tbody>
</table>

Strong increase of resources

Present resources of the Spanish ATLAS T-2 (March ’08)
New acquisitions in progress to get the pledged resources

<table>
<thead>
<tr>
<th></th>
<th>IFAE</th>
<th>UAM</th>
<th>IFIC</th>
<th>T-2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Δ CPU(kSI2k)</td>
<td>230</td>
<td>219</td>
<td>438</td>
<td>887</td>
</tr>
<tr>
<td>Δ Disk(TB)</td>
<td>64</td>
<td>60</td>
<td>162</td>
<td>286</td>
</tr>
</tbody>
</table>

- **IFAE:**
  - CPU: equipment already at PIC
  - Disk: 2 Thumpers SUN
- **IFIC:**
  - CPU & Disk in acquisition phase
- **UAM:**
  - CPU & Disk in acquisition phase

Accounting values are normalized according to WLCG recommendantions.
Upgrade of IFIC Computing Room

- To increase surface from 90 m² to 150 m²
  - OK
- Upgrade UPS: 50 KVA to 250 KVA
  - To be delivered
- To install 70 lines of 16 Amps (3 lines/rack)
  - pending
- To increase the power for the building (Electrical 20KV transformer, DIESEL generator, Low Voltage distribution, …)
  - Public tendering in progress
- To change the air conditioning (impulsion on technical floor)
  - Waiting economical proposal
- New racks
  - Buying process
- Redistribution of all machines located at Computer Center
  - pending
- Execution: in progress and it will be ready by June’08
Upgrade UAM Lab Network to Gigabit

- All Worker Nodes and some of the servers had a 100 Mb/s ethernet link. In addition the Worker Nodes had internal IP numbers, which implied to have a NAT-server or router.

- These have been changed in the upgrade. At present, all machines are connected through 1 Gb/s ethernet links and have external IP numbers.

Upgrade of IFAE

- The IFAE site has the same hardware upgrade schema of PIC. The power line connected to the racks are being increased and upgrades from 16 A to 32 A per connector to be able to use blade technology
2.- Availability and Performance

Tier-2 Availability & Reliability Report

- Availability and Performance

January Report

- Very good %
- Well placed in the ranking (14th in a List of 60 TIER-2 sites)

UAM out of service: Intervention for cabling
Human Resources of the Spanish ATLAS TIER-2

• UAM:
  – José del Peso (PL)
  – Juanjo Pardo (*)
  – Luís Muñoz
  – Pablo Fernández (*T.MEC)

• IFAE:
  – Andreu Pacheco (PL)
  – Xavier Espinal (PIC)
  – Jordi Nadal (*)
  – Carlos Borrego (<-)
  – Marc Campos (*)
  – Hegoi Garaitogandia (NIKHEF)

• IFIC
  – José Salt (PL and Coordinator)
  – Javier Sánchez (Tier-2 Operation Coordination)
  – Santiago González
  – Alvaro Fernández
  – Mohammed Kaci (*T.MEC)
  – Luis March (*)
  – Farida Fassi (*) (FR Tier-1)
  – Alejandro Lamas (*)

Total FTE = 14 FTEs

(*) means payed by the Tier-2 project
Networking at the sites

IFIC

• Connection at 1 Gbps to University backbone (10 Gbps)
• Universitat de València hosts the RedIris PoP in the Comunitat Valenciana
• Bought a new equipment:
  • Cisco Catalyst 4506
    • Will connect at 10 Gpbs to University backbone (inminent)
    • Aggregate WNs and Diskservers
• Public IP addresses in the subnet 147.156.116.0 / 24 (to be increase to 23 bits) reserved to Tier2

UAM

• Internal speed inside laboratory: 1Gb/s
• Direct connection from Laboratory to UAM backbone at 10 Gb/s
• Connection of UAM to Madrid-Ring at 1Gb/s public network
• Connection of Madrid-Ring to RedIris at 1Gb/s public network

IFAE

• Direct gigabit connection to PIC backbone (Cisco 6509E 100x1Gb, 8x10Gb)
• PIC hosts the 10 Gbs link to LHCOPN (CERN) and 2 Gbs to Tier2 / Internet
• It is provided by the Spanish NREN RedIRIS
  - Connection at 1 Gbps to University backbone
  - 10 Gbps among RedIRIS POP in Valencia, Madrid and Catalunya

• Atlas collaboration:
  - More than 9 PetaBytes (> 10 million of files) transferred in the last 6 months among Tiers
  - The ATLAS link requirement between Tier1 and Tiers-2 has to be 50 MBytes/s (400 Mbps) in a real data taken scenario.

Data transfer from CASTOR (IFIC) for a TICAL private production. We reached 720 Mbps (plateau) in about 20 hours (4th March 08) High rate is possible
Site User Support has started at the end of 2006: first feedback from ‘end-users’ was studied at the 3 sites

In next months it’s needed to go towards a ‘coordinated User Support’ for our distributed Tier-2:
- On-line/direct support
  - Off-line support using a simple ticketing system and providing an internal tree-structure to solve different class of problems (T-2 Helpdesk)

To provide periodical tutorials/hands on software tools for analysis

https://twiki.ific.uv.es/twiki/bin/view/Atlas/AtlasTier2
**Quattor System (QS)**

- Quattor. UAM developments in the last year
  - All (Automatic Installation Infrastructure) reprogrammed:
    - Faster
    - More modular
    - Allow for customization
    - LVM and RAID support
- Components:
  - ncm-filesystems, ncm-lib-blockdevices, ncm-syslogng, ncm-nagios, ncm-nrpe
- New description for file systems and block devices
- Contributions to security
  - ncm-sudo, ncm-useraccess, fix of vulnerabilities detected in some modules

**Data Movement Management (DMM)**

Distributed data management exercises at Tier-2

Cosmic rays data taking (Tier-1 => Tier-2)

1) End Sept. 2007: M4 exercise (ESD & CBNT)
2) End Oct. – begin Nov 2007: M5 exercise (ESD & CBNT)
3) 12 Feb. 2008: FDR-1 (fdr08_run1, AOD)
4) 25 Feb. 2008: CCRC08 (ccrc08_t0, AOD)
• Results from FDR-1 (12 Feb. 2008):

<table>
<thead>
<tr>
<th>Tier-2</th>
<th>datasets</th>
<th>Total files in datasets</th>
</tr>
</thead>
<tbody>
<tr>
<td>IFAE</td>
<td>26</td>
<td>52</td>
</tr>
<tr>
<td>IFICDISK</td>
<td>44</td>
<td>87</td>
</tr>
<tr>
<td>UAM</td>
<td>26</td>
<td>52</td>
</tr>
</tbody>
</table>

More info: 
- Data stored at the Spanish ATLAS Tier-2:

**Data at UAM**

<table>
<thead>
<tr>
<th>Dataset type</th>
<th># sets</th>
<th>#files DDM</th>
<th>#files site</th>
<th>Total size (GB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>EVNT</td>
<td>195</td>
<td>62662</td>
<td>47688</td>
<td>1340.281</td>
</tr>
<tr>
<td>HITS</td>
<td>217</td>
<td>1183416</td>
<td>17840</td>
<td>533.531</td>
</tr>
<tr>
<td>RDO</td>
<td>229</td>
<td>1202356</td>
<td>35108</td>
<td>1866.045</td>
</tr>
<tr>
<td>ESD</td>
<td>257</td>
<td>171088</td>
<td>47274</td>
<td>9366.014</td>
</tr>
<tr>
<td>AOD</td>
<td>798</td>
<td>323228</td>
<td>278102</td>
<td>8764.454</td>
</tr>
<tr>
<td>SAN</td>
<td>18</td>
<td>3908</td>
<td>86</td>
<td>4.625</td>
</tr>
<tr>
<td>HPTV</td>
<td>13</td>
<td>3494</td>
<td>72</td>
<td>2.484</td>
</tr>
<tr>
<td>CBNT</td>
<td>5</td>
<td>3624</td>
<td>2164</td>
<td>79.533</td>
</tr>
<tr>
<td>HIST</td>
<td>32</td>
<td>5124</td>
<td>650</td>
<td>0.000</td>
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<tr>
<td>TAG</td>
<td>10</td>
<td>3540</td>
<td>66</td>
<td>0.027</td>
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<tr>
<td>TOTAL</td>
<td>1774</td>
<td>296680</td>
<td>429050</td>
<td>21956.995</td>
</tr>
</tbody>
</table>

**Data at IFIC**

<table>
<thead>
<tr>
<th>Dataset type</th>
<th># sets</th>
<th>#files DDM</th>
<th>#files site</th>
<th>Total size (GB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>EVNT</td>
<td>100</td>
<td>18372</td>
<td>2832</td>
<td>184.107</td>
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<tr>
<td>HITS</td>
<td>239</td>
<td>1195548</td>
<td>37344</td>
<td>1009.845</td>
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<tr>
<td>RDO</td>
<td>245</td>
<td>1134850</td>
<td>64008</td>
<td>3152.508</td>
</tr>
<tr>
<td>ESD</td>
<td>176</td>
<td>158180</td>
<td>17950</td>
<td>3202.048</td>
</tr>
<tr>
<td>AOD</td>
<td>703</td>
<td>517582</td>
<td>170522</td>
<td>3587.666</td>
</tr>
<tr>
<td>SAN</td>
<td>18</td>
<td>3698</td>
<td>140</td>
<td>10.779</td>
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<tr>
<td>HPTV</td>
<td>27</td>
<td>3788</td>
<td>154</td>
<td>5.935</td>
</tr>
<tr>
<td>CBNT</td>
<td>4</td>
<td>352</td>
<td>350</td>
<td>4.909</td>
</tr>
<tr>
<td>HIST</td>
<td>42</td>
<td>5524</td>
<td>610</td>
<td>0.000</td>
</tr>
<tr>
<td>TAG</td>
<td>22</td>
<td>3768</td>
<td>124</td>
<td>0.053</td>
</tr>
<tr>
<td>TOTAL</td>
<td>1576</td>
<td>3041662</td>
<td>294034</td>
<td>11157.850</td>
</tr>
</tbody>
</table>

**Data at IFAE**

<table>
<thead>
<tr>
<th>Dataset type</th>
<th># sets</th>
<th>#files DDM</th>
<th>#files site</th>
<th>Total size (GB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>EVNT</td>
<td>53</td>
<td>11302</td>
<td>404</td>
<td>28.884</td>
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<tr>
<td>HITS</td>
<td>256</td>
<td>990526</td>
<td>10580</td>
<td>320.073</td>
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<tr>
<td>RDO</td>
<td>270</td>
<td>989770</td>
<td>61794</td>
<td>3333.745</td>
</tr>
<tr>
<td>ESD</td>
<td>29</td>
<td>55206</td>
<td>0</td>
<td>0.000</td>
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<tr>
<td>AOD</td>
<td>590</td>
<td>538084</td>
<td>170688</td>
<td>4116.039</td>
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<tr>
<td>SAN</td>
<td>5</td>
<td>2748</td>
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<td>0.000</td>
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<td>HPTV</td>
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<td>2354</td>
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<td>0.000</td>
</tr>
<tr>
<td>CBNT</td>
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<td>0</td>
<td>0</td>
<td>0.000</td>
</tr>
<tr>
<td>HIST</td>
<td>7</td>
<td>1000</td>
<td>42</td>
<td>0.000</td>
</tr>
<tr>
<td>TAG</td>
<td>5</td>
<td>2328</td>
<td>0</td>
<td>0.000</td>
</tr>
<tr>
<td>TOTAL</td>
<td>1219</td>
<td>2593518</td>
<td>243508</td>
<td>7799.741</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Tier-2</th>
<th>Total data (TB)</th>
<th>AODs (TB)</th>
<th>AOD contribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>IFAE</td>
<td>7.80</td>
<td>4.12</td>
<td>53 %</td>
</tr>
<tr>
<td>IFICDISK</td>
<td>11.16</td>
<td>3.59</td>
<td>32 %</td>
</tr>
<tr>
<td>UAM</td>
<td>21.96</td>
<td>8.76</td>
<td>40 %</td>
</tr>
</tbody>
</table>

More info: [http://ific.uv.es/atlas-t2-es](http://ific.uv.es/atlas-t2-es)
The ATLAS Production System manages the official massive productions of simulated data.

The system consists of:
- a data base (definition of jobs)
- supervisors/executors (they take the jobs from the DB and are managed by the computing resources of ATLAS)

Since January 2008, the ATLAS collaboration has migrated to the unique executor: PANDA

- Management of Distributed Data (the produced data are recorded and stored at different centers)
Production at T2-ES follows the trend of the EGEE Production
Since January 2008, T2-ES sites receiving only jobs from PANDA executor
It seems that simulation jobs are processed with better efficiency, but need more time to accumulate statistics to conclude
• Spanish physicists are doing physics analysis using GANGA on data distributed around the world
  • This tool has been installed in our Tier2 infrastructure
• GANGA is an easy-to-use front-end for job definition, management and submission. Users interaction via:
  • Its own Python shell (command line)
  • A Graphical User Interface (GUI)
• In our case the jobs are sent to the LCG/EGEE Grid flavour. We are doing performance test:
  • LCG Resource Broker (RB)
  • gLite Workload Management System (WMS). New RB from EGEE
The ATLAS analysis is divided into:
- scheduled central production
- user analysis

This analysis will be performed by ATLAS physics groups preferentially on Tier-2 centres.

Users from universities and institutes need some extra computing resources.

A local user analysis facility, called Tier-3, is necessary.
Prototype of a Tier-3

- Tools (i.e. GANGA) and ATLAS software installed at IFIC AFS area

AFS

Desktop/Laptop

- Private User Interface
- Ways to submit our jobs to other grid sites
- Tools to transfer data

RB

CE

dispatcher

WN

WN

WN

... Tier-2

Extra Tier-2

Tier-3

WN

WN

WN

... AOD private production for further analysis

Workers

- PROOF FARM for interactive analysis on DPD
- Work with ATLAS software
- Use of final analysis tools (i.e. Root, PROOF)
- User disk space
• Interaction Scheme Tier-2/Tier-3

Tier-2

Production of Sim Data (Public)

Production of Sim Data (Private)

Distributed Analysis

Data Management

User Support

Infrastructure Maintenance

Tier-3

Local Batch Facility

Interactive Analysis

End Users

• Interaction Scheme Tier-2/Tier-3
• Analysis Use Cases

• #1: AANT ntuple generation from a given dataset to analize events with semileptonic channels to study Top Polarization
  – Challenge: to process 595,550 evts
  – Distributed Analysis is needed
  – GANNA and TopView are used
  – Several sites in the game: IFIC (mainly), Lyon, FZK, CYF
  – Good performance of IFIC
• **Analysis Use Cases**

• **#2: Analysis of AOD for the process $Z_H \rightarrow t\bar{t}aar$ (Little Higgs)**
  - 4 ROOT files x 5000 of event generation in local
  - 30 files AOD x 250 reconstruction events in GRID (20000 evts)
  - Whole process takes 5 days/AOD file
  - **Strategy:**
    - To test with a small number of events
    - Once problems are fixed, jobs are sent to Tier-2 of 12 countries
  - We save time: 400 days running in local / 14 days using GR

<table>
<thead>
<tr>
<th>Proceso</th>
<th>Lugar</th>
<th>Ficheros</th>
<th>Eventos</th>
<th>Tiempo (horas)</th>
<th>N° veces</th>
<th>enviar x fallos</th>
<th>Tiempo por fallos</th>
</tr>
</thead>
<tbody>
<tr>
<td>Generación</td>
<td>Local</td>
<td>4</td>
<td>5000</td>
<td>5</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Simulación+Digitalización</td>
<td>Grid</td>
<td>400</td>
<td>50</td>
<td>96</td>
<td>2</td>
<td>144</td>
<td></td>
</tr>
<tr>
<td>Reconstrucción</td>
<td>Grid</td>
<td>80</td>
<td>250</td>
<td>18</td>
<td>2</td>
<td>72</td>
<td></td>
</tr>
<tr>
<td><strong>Total:</strong></td>
<td></td>
<td></td>
<td></td>
<td>119</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Todo tiempo:</strong></td>
<td></td>
<td></td>
<td></td>
<td>335</td>
<td>2</td>
<td>216</td>
<td></td>
</tr>
<tr>
<td><strong>Todo tiempo (dias):</strong></td>
<td></td>
<td></td>
<td></td>
<td>13.96</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
5.- Experience and Perspectives

- Cosmic Runs (M4,M5,M6) & CCRC’08

- ATLAS Software Validation

-Andreu Pacheco is the responsible for the production of the physics data samples for the validations of the new releases of the ATLAS software since March 2007. ATLAS software updates are released every 2 weeks and from 50.000 to 10.000 grid jobs are released for every cycle and data replicated to TIER-1. Old samples are deleted.

https://twiki.cern.ch/twiki/bin/view/Atlas/PhysicsValidation
Tier-1 re-processing

• L. March has accepted to be the liaison between the ATLAS offline software commissioning and the Tier-1s for re-processing cosmic rays data.

• Started during last ATLAS Software Week (15-29 Feb. 2008).

• Work and responsibilities are under study.

More info:
https://twiki.cern.ch/twiki/bin/view/Atlas/T1Reprocessing
https://twiki.cern.ch/twiki/bin/view/Atlas/AtlasOfflineCommissioning
https://twiki.cern.ch/twiki/bin/view/Atlas/CosmicCommissioningReconstructionStatus
ADC operations Shifts

- There are 3 people from the Spanish Tier-2 (out of 25) contributing to the ATLAS Distributed Computing operations Shifts:
  - L. March (IFIC), J. Nadal (IFAE) and M. Campos (IFAE)
- Shifts involve different activities:
  - MC production, DDM services, Distributed Analysis and Tier-0

- These coordinated shifts started at the end of January 2008, around one month ago. They are official shifts for the ATLAS computing since then.
ADC operations Shifts

- 2 shifters/day: one from USA and another from Europe. Each shift covers 15 hours/day with USA/Canada & Europe time zone.
- Shifts in Europe: from 9 am to 5 pm
- It will be increased to 24 hours/day with Asia and far East shifters.

Shifts covers 15 hours/day

More info: [https://twiki.cern.ch/twiki/bin/view/Atlas/ADCoS](https://twiki.cern.ch/twiki/bin/view/Atlas/ADCoS)
FDR & CCRC’08

2.1 GB/s out of CERN
Service Level Agreement

- To ensure the service availability of our TIER-2:
  - 12 hours/day; 5 days/week
- To ensure a delay time in responding to operational problems
- Contribution to the M&O A and B (in 1 or 2 people)

Breakdown of the requested/obtained Manpower

<table>
<thead>
<tr>
<th></th>
<th>IFAE</th>
<th>UAM</th>
<th>IFIC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contracts Phys/Eng.</td>
<td>2/1.5</td>
<td>2/1.5</td>
<td>4/1.5</td>
</tr>
<tr>
<td>Fellowships</td>
<td>0/0</td>
<td>0/0</td>
<td>2/0</td>
</tr>
<tr>
<td>Technicians (TTP)</td>
<td>1/0</td>
<td>1/0</td>
<td>2/2</td>
</tr>
</tbody>
</table>

Maximum delay in responding to operational problems:
- Prime Time: 2 hours
- Other periods: 72 hours

Averaged availability measured on annual basis:
- 95%
Main objective: to achieve a more federative structure
Organization & management of the project is responsibility of the subproject leaders
  – SL constitute the Project Management Board
    • A. Pacheco (IFAE), J. del Peso (UAM) and J. Salt (IFIC)
  – PMB chairman is the Coordinator of the Project
    • J. Salt (Tier-2 Coordinator)

PMB meeting every 4-5 weeks
Tier-2 Operation Meetings: Virtual, biweekly

Presential Tier-2 meetings: every 6 months
  – February’06: Valencia
  – October’06: Madrid
  – May’07: Barcelona
  – November’07: Valencia
    • with a previous T1-T2 Coordination meeting
  – May’08: foreseen in Madrid
• The Spanish ATLAS Tier-2 is running very well
• Network needs to be improved
• Several updates in the CC logistics are being deployed to be stable in the following 4-5 years
• The fundamental Tier-2 Activities are well covered
  - Contribution to the Monte Carlo Production at the forseen level
  - Distributed analysis is used by the analysis physicists
• Increasing the participation in the central ATLAS Computing tasks
• Main objective: to get a satisfactory T-2 sustainability
• Local Analysis Facilities (‘Tier-3’) must be put in place to cover the demands of users

• Co-funding is being obtained from another sources (GV, CSIC, UVEG,...) permitting to complete the full operational status of infrastructures (i.e. the upgrade of the IFIC Computer Center)
BACKUP SLIDES
# Justification of the budget

<table>
<thead>
<tr>
<th>Project’s reference</th>
<th>Obtained</th>
<th>Technicians MEC</th>
<th>Spent</th>
<th>End of the project</th>
</tr>
</thead>
</table>
| FPA2005-07688-C03 (2 years) | Direct cost: 876.000’- Eur  
Total cost: 1.042.440’- Eur | 2 | 766.422’- (87.5%) | Dec’07 – May’08 |
| FPA2007-66708-C03 (3 years) | Direct cost: 1.945.900’- Eur  
Total cost: 2.354.539’- Eur | 2 | 7.800’- | Oct’10 |
Cost Summary of the Project

<table>
<thead>
<tr>
<th>Concept</th>
<th>Requested Funding (in euros)</th>
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<tbody>
<tr>
<td></td>
<td>IFAE</td>
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<td>Personnel Cost</td>
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<td>Salary Complement</td>
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<td>Total Personnel</td>
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<td>Execution Cost</td>
<td>Equipment</td>
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<td>Consumables</td>
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<td>Travels</td>
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<td>Others</td>
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<td>Total Execution</td>
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<td>Cost</td>
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<td>Total Direct Cost</td>
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<td>Indirect Cost</td>
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<tr>
<td>Total Cost</td>
<td></td>
</tr>
</tbody>
</table>

Total Cost: **4.044.583’51 Eur**

Effect of the delay of the LHC Startup: to substract to the cost of project (FPA2007-66708) the remanent of present project (FPA2005-07688): 135.530’- Eur (87 KSI2k + 54 TB)
Data Management

Cosmic run: M5 (22/10 - 05/11)

- New MSS backend at PIC, tested for this exercise.
  - Worked smoothly.
- Data replication went fine.
- Shares and D/T balance was respected.
  - Some T1s asked for the full set.

More info:
http://gridui02.usatlas.bnl.gov:25880/server/pandamon/query?mode=listM5_Tier1