Using Condor for On-line Data Analysis within the LIGO Scientific Collaboration

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Condor-based LIGO Data Analysis

- Stand-alone processing tasks are submitted to compute clusters using Condor.
- Complex analysis pipelines are sequenced using DAGMan.
- Has traditionally been performed "off-line".
- Latencies of several months.

However

- Instrument operators require rapid feed-back on the quality of the data.
- Soon instruments will be running continuously.

We Need "On-line" Data Analysis

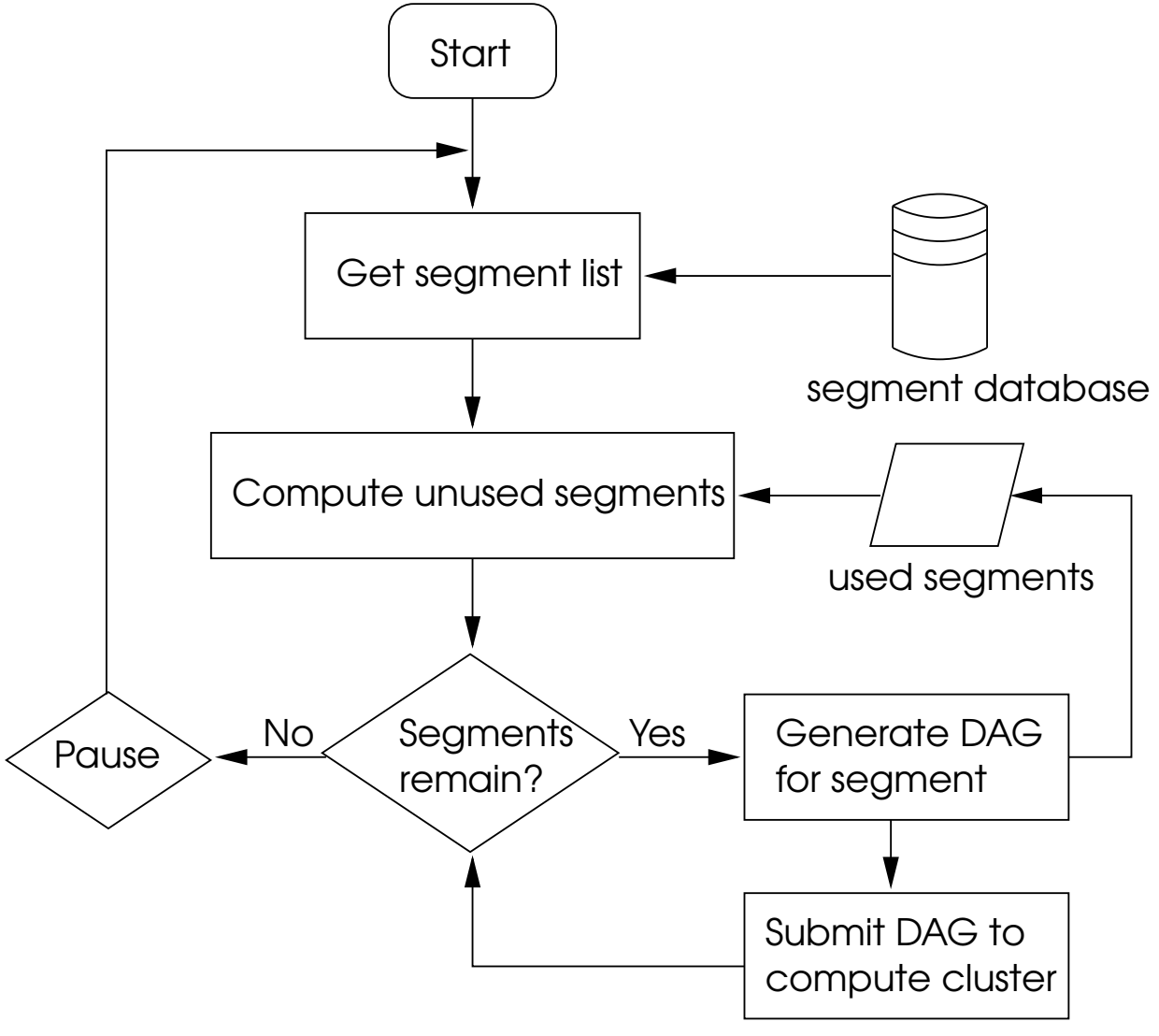
- Low(er) latency, and continuous, analysis.
- Sequencing the same complex work flows seen in off-line analyses.

On-Line Software Goals

- Latencies of hours.
- Minimize the developer cost in converting an off-line analysis to an on-line analysis.
- Be robust against software and hardware failures.
- Provide status reports and error notification.

How we do it

- Retain DAGMan as the work flow sequencer.
- User provides a script to generate a DAG that will analyze an interval of data given the start and end time of that data.
- A daemon watches for data, and calls the user's script as each new data segment becomes available.
- A job monitoring process runs alongside each DAG, periodically updating a MySQL database with the DAG's state.
- Scripts query the database, and provide a live view of the status of all analyses via a web interface.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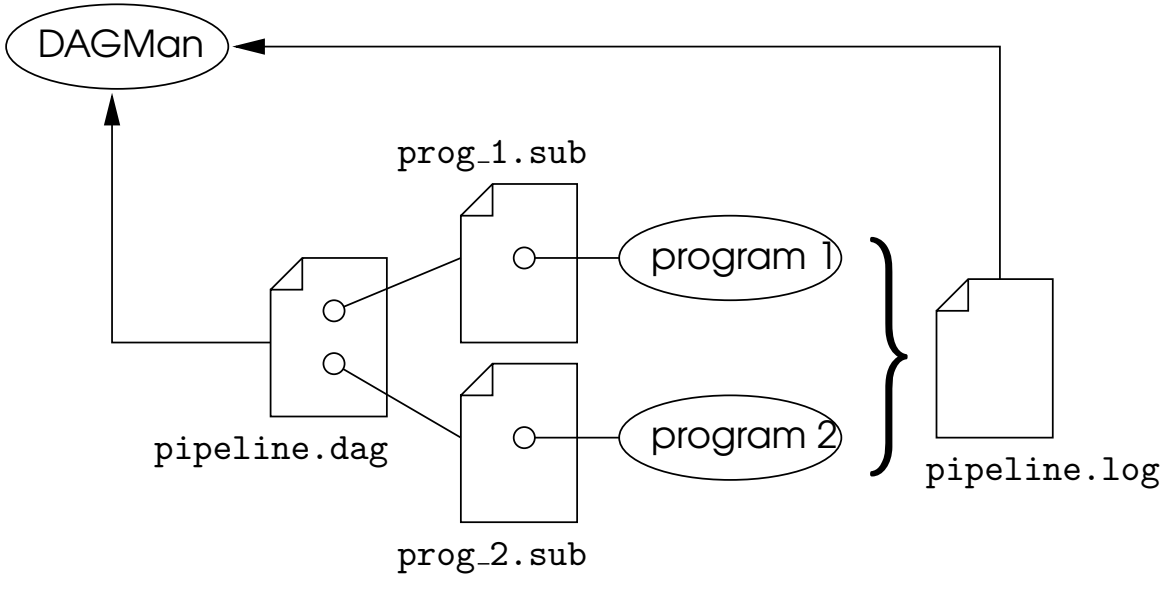
Get segment list
segment database
Compute unused segments
used segments
Segments remain?
No
Pause
Yes
Generate DAG for segment
Submit DAG to compute cluster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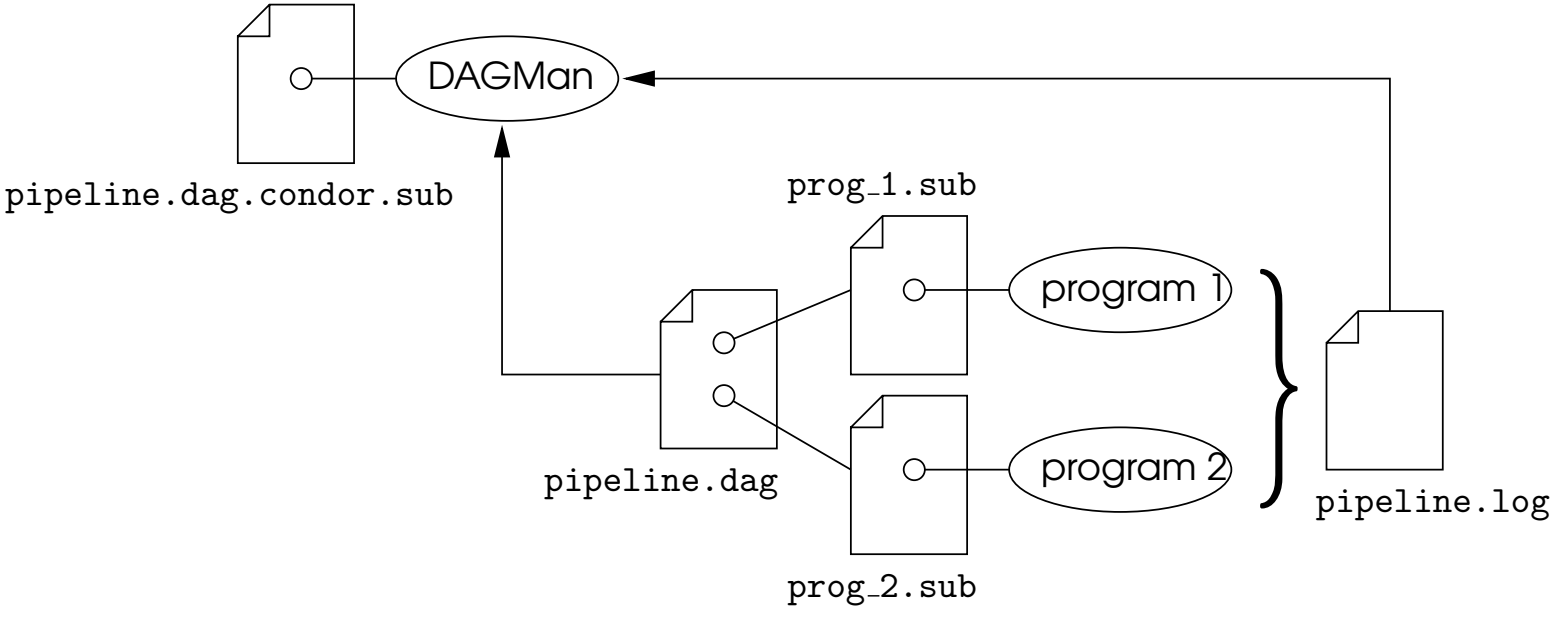
program 1
pipeline.dag
program 2
pipeline.log
prog_2.sub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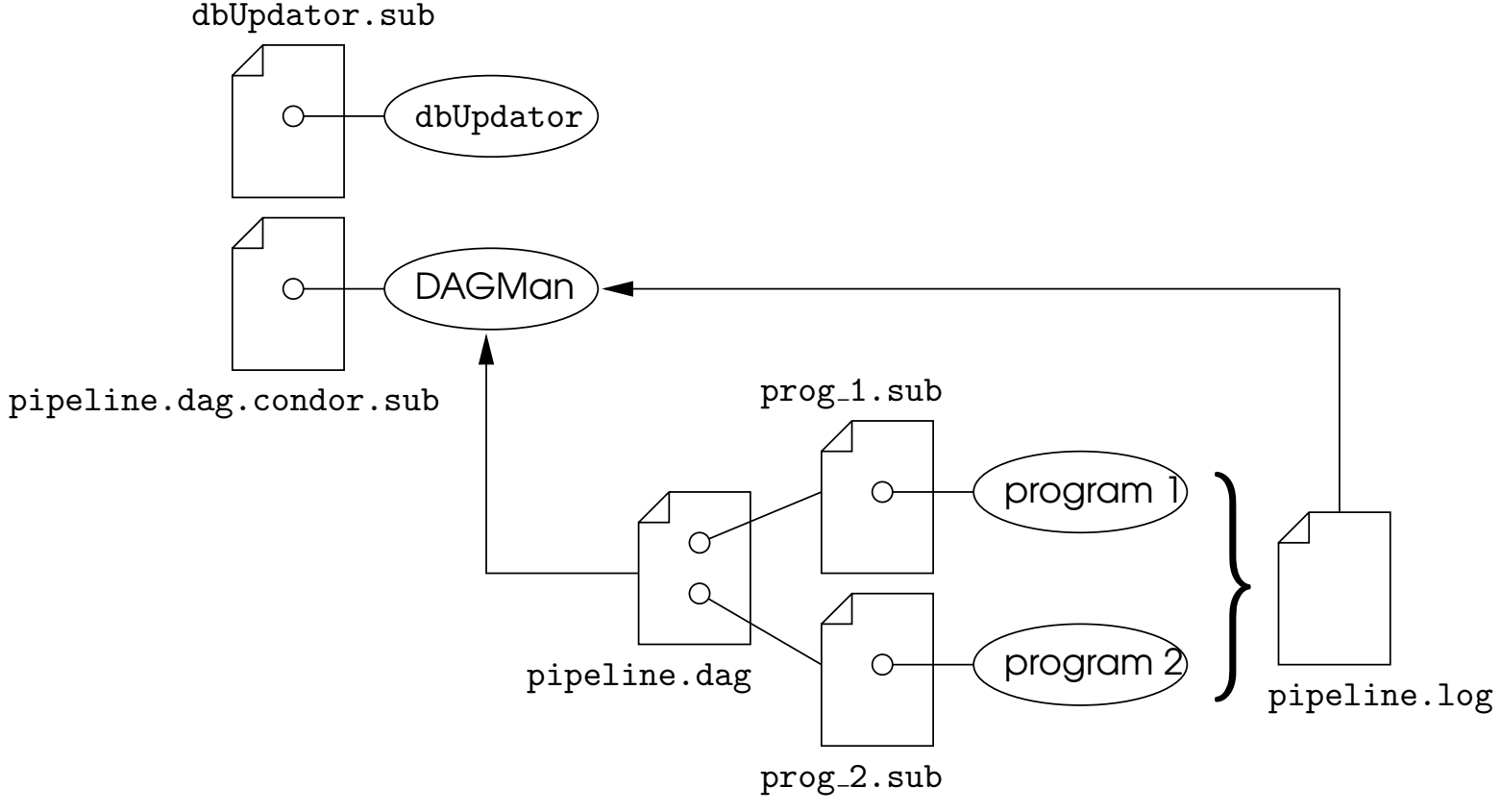
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pipeline.dag
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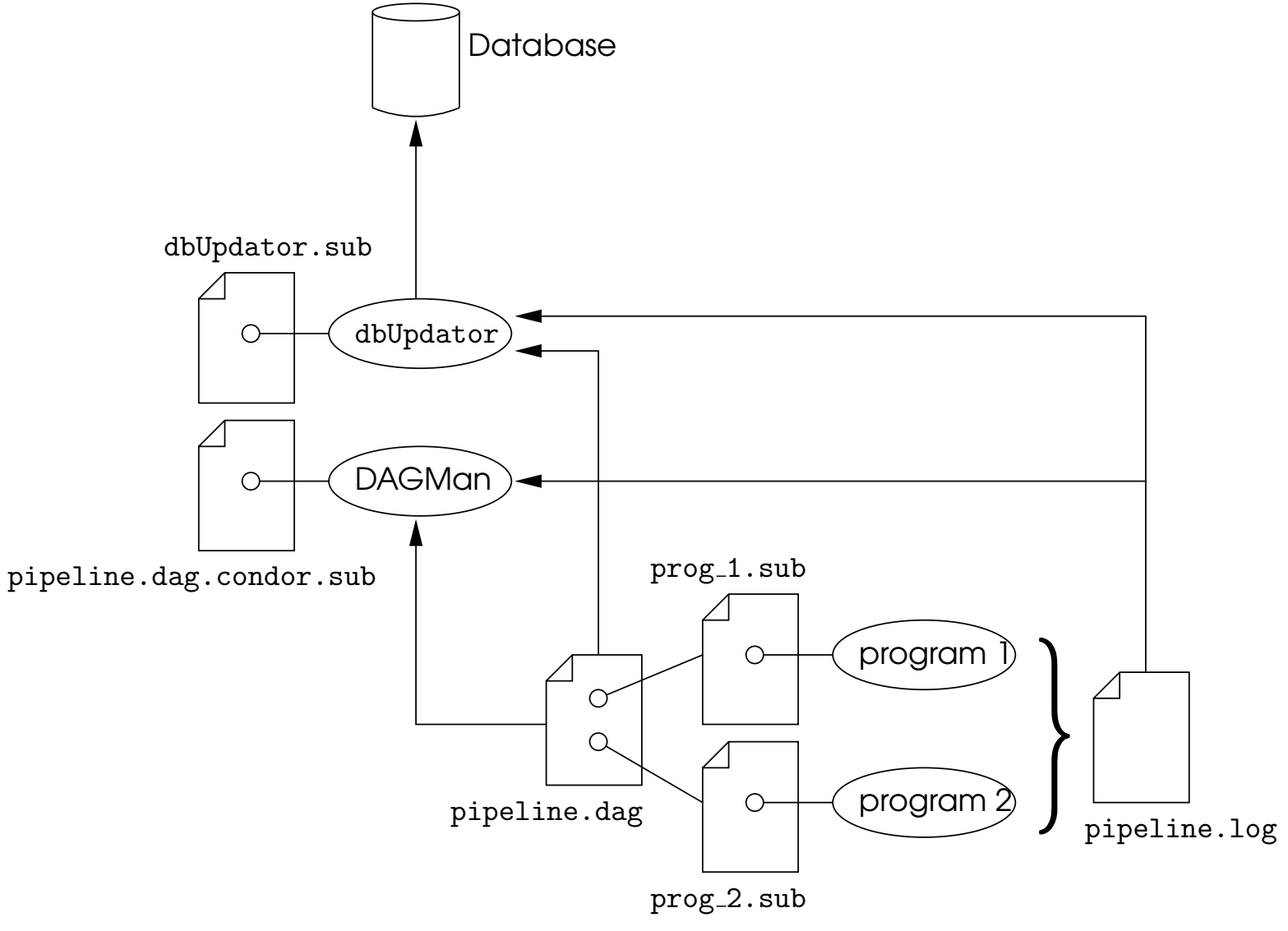
pipeline.log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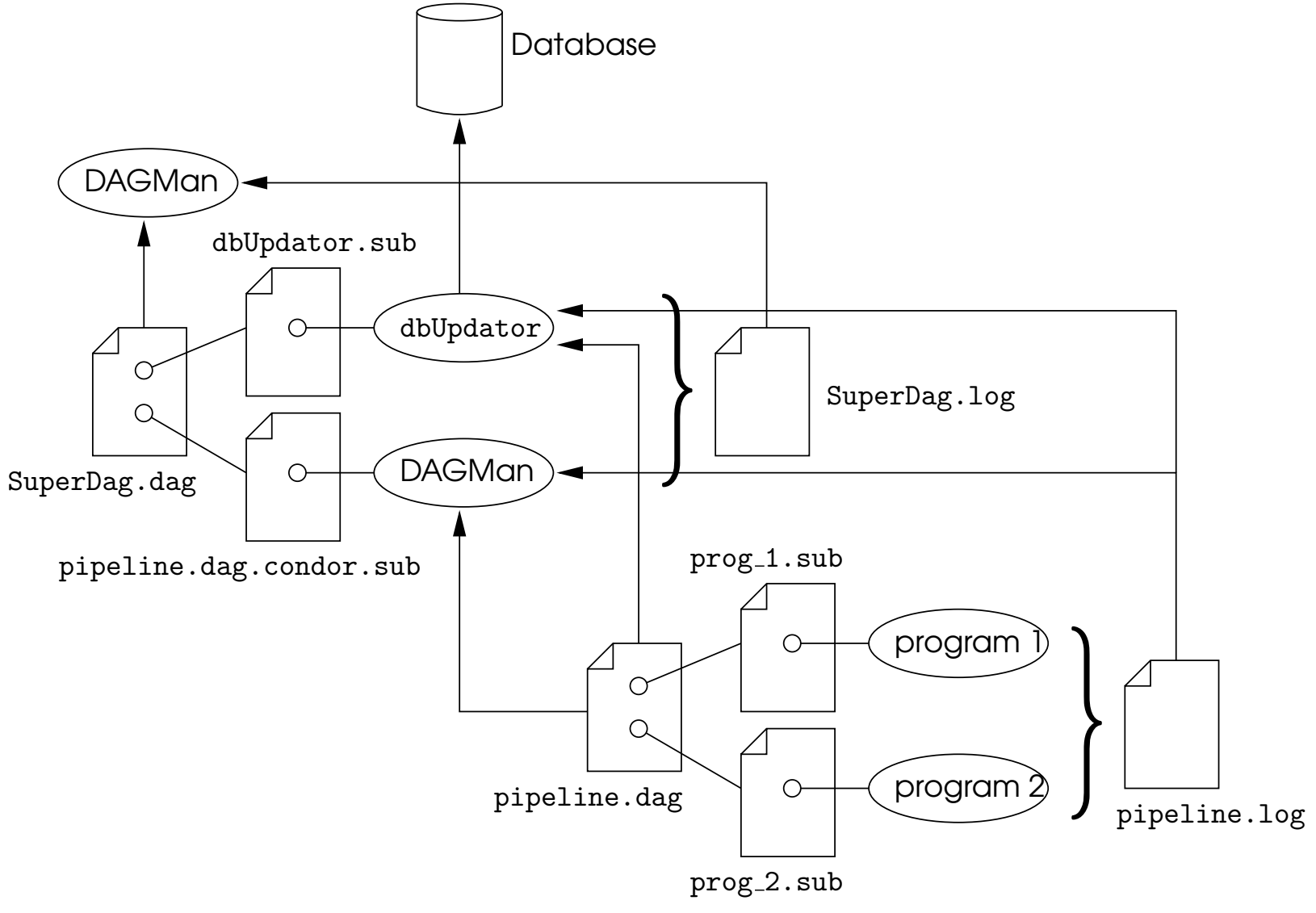
program 1
program 2
pipeline.dag
pipeline.log
prog_2.sub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dbUpdator
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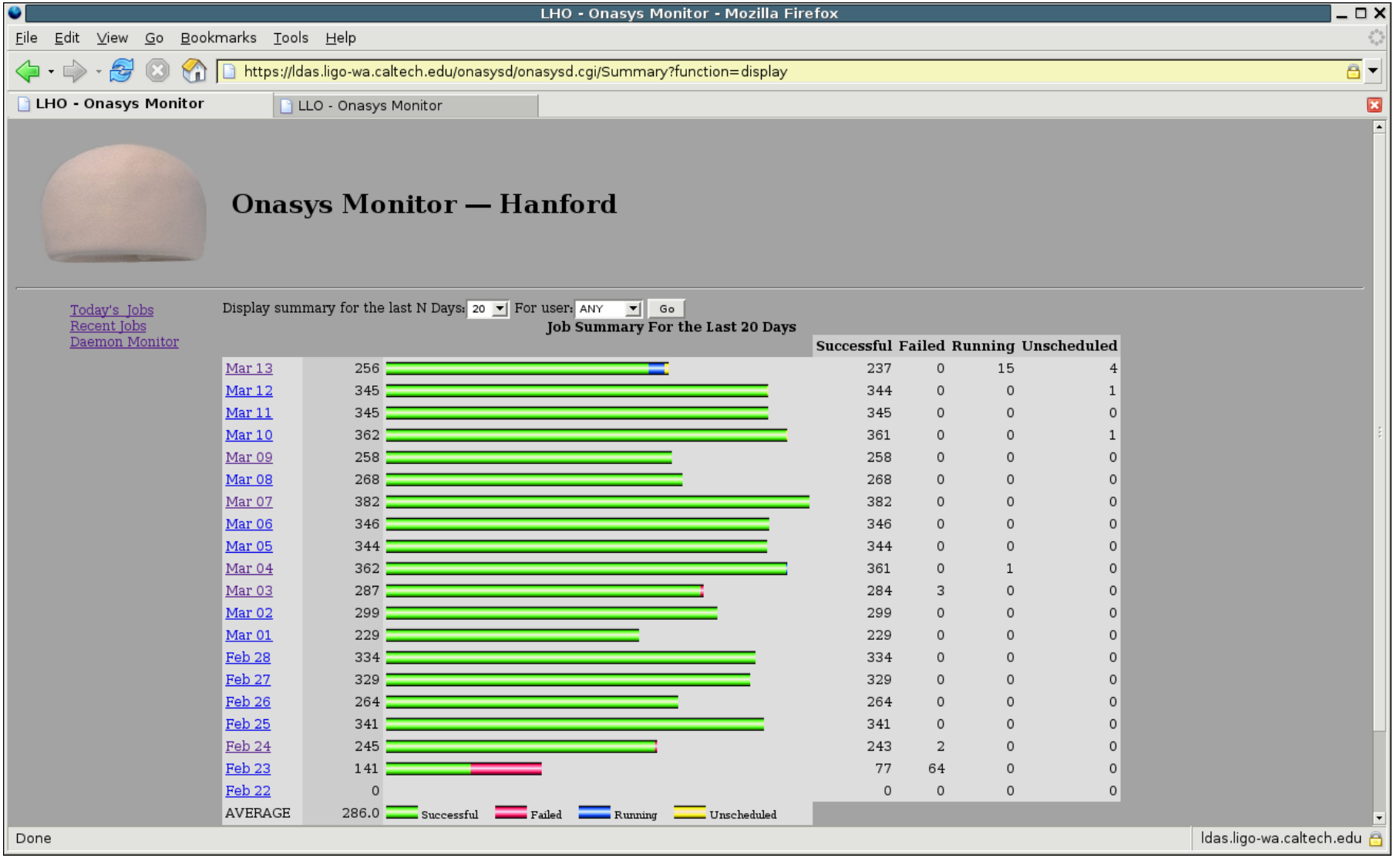
SuperDag.dag
DAGMan
pipeline.dag.condor.sub
prog_1.sub
program 1
pipeline.dag
program 2
pipeline.log
prog_2.sub

Advantages

- No direct input from the on-line tools to the data analysis pipeline, only monitoring.
- Little interaction between on-line tools and data analysis pipelines means very few restrictions — user can run nearly any off-line DAG virtually as-is.
- Uses Condor and DAGMan to provide execution reliability for the various components.

Potential Problems

- "A DAG every ten minutes" might bury us under log files — reliable machine-assisted job monitoring and diagnostics are a must.
- Long-term scalability. Existing setup will survive current science run without problems. The next, six month long, science run can almost certainly be accommodated as well. Will need to develop automated house-keeping tool(s) for continuous running.


LHO - Onasys Monitor - Mozilla Firefox
File Edit View Go Bookmarks Tools Help
https://ldas.ligo-wa.caltech.edu/onasysd/onasysd.cgi/Summary?function=display
LHO - Onasys Monitor
LLO - Onasys Monitor
Onasys Monitor — Hanford
Today's Jobs
Recent Jobs
Daemon Monitor
Display summary for the last N Days: 20 For user: ANY Go
Job Summary For the Last 20 Days
Successful Failed Running Unscheduled
Mar 13 256 237 0 15 4
Mar 12 345 344 0 0 1
Mar 11 345 345 0 0 0
Mar 10 362 361 0 0 1
Mar 09 258 258 0 0 0
Mar 08 268 268 0 0 0
Mar 07 382 382 0 0 0
Mar 06 346 346 0 0 0
Mar 05 344 344 0 0 0
Mar 04 362 361 0 1 0
Mar 03 287 284 3 0 0
Mar 02 299 299 0 0 0
Mar 01 229 229 0 0 0
Feb 28 334 334 0 0 0
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Feb 26 264 264 0 0 0
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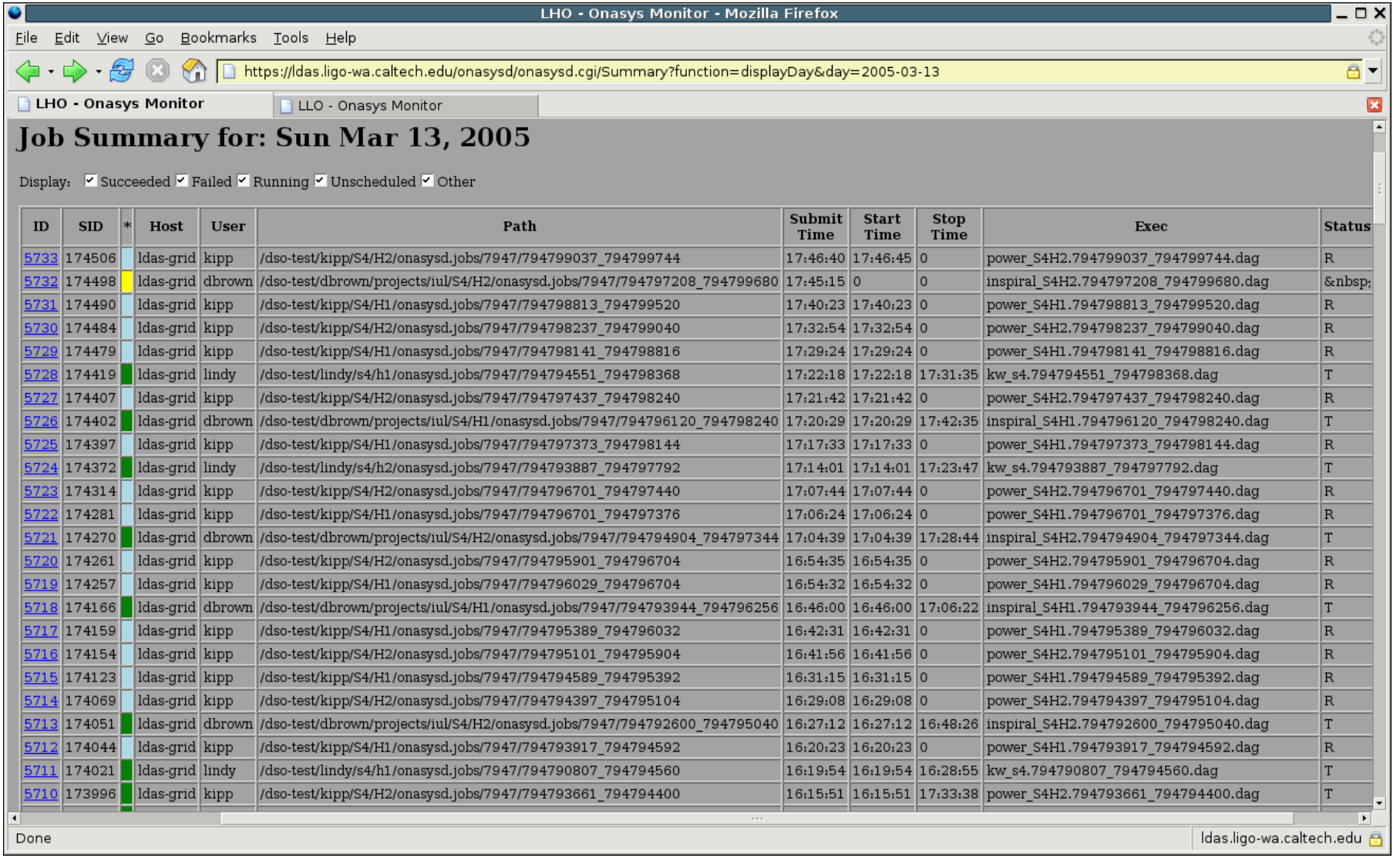

Job Summary for: Sun Mar 13, 2005

Display: ☑ Succeeded ☑ Failed ☑ Running ☑ Unscheduled ☑ Other

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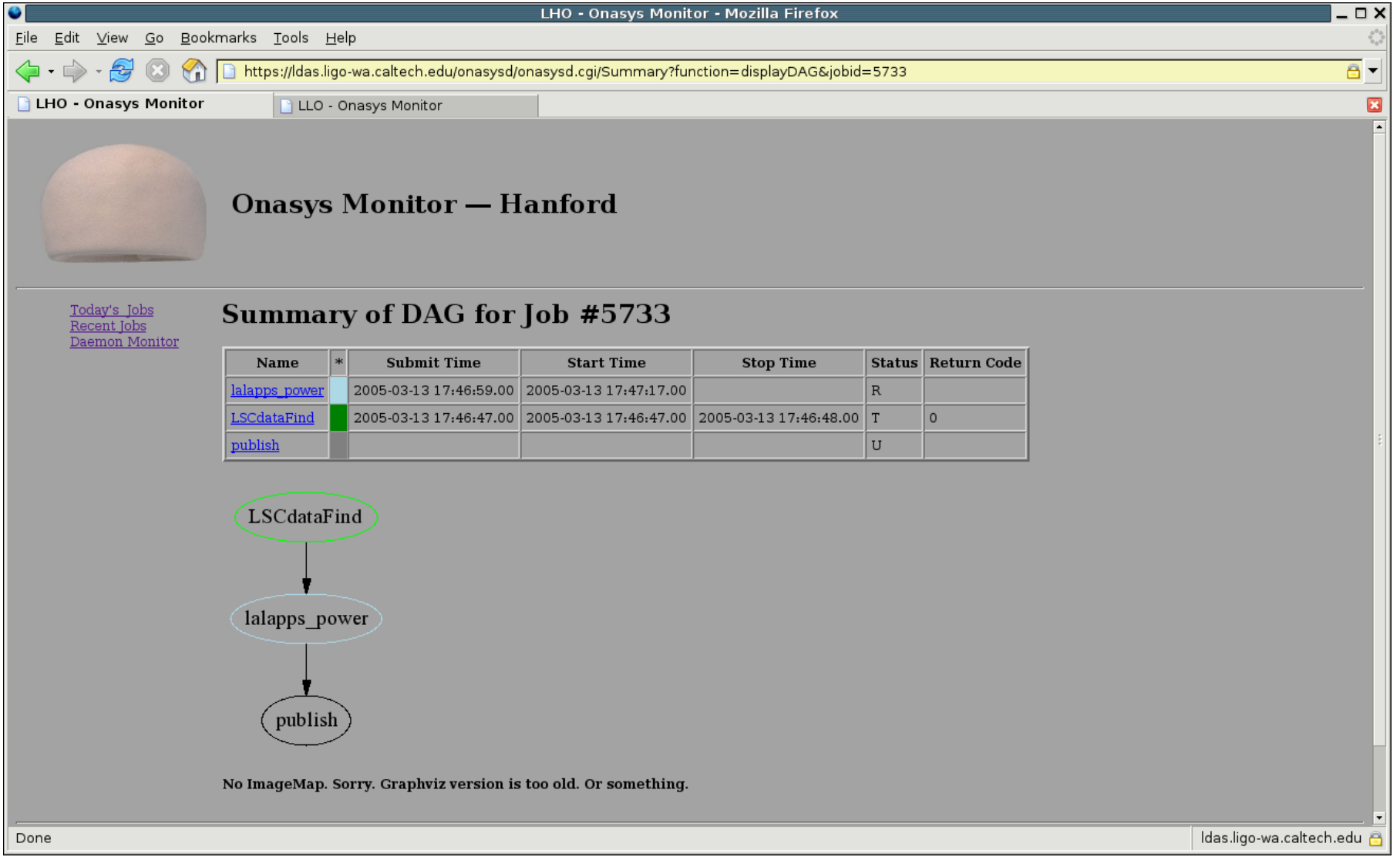
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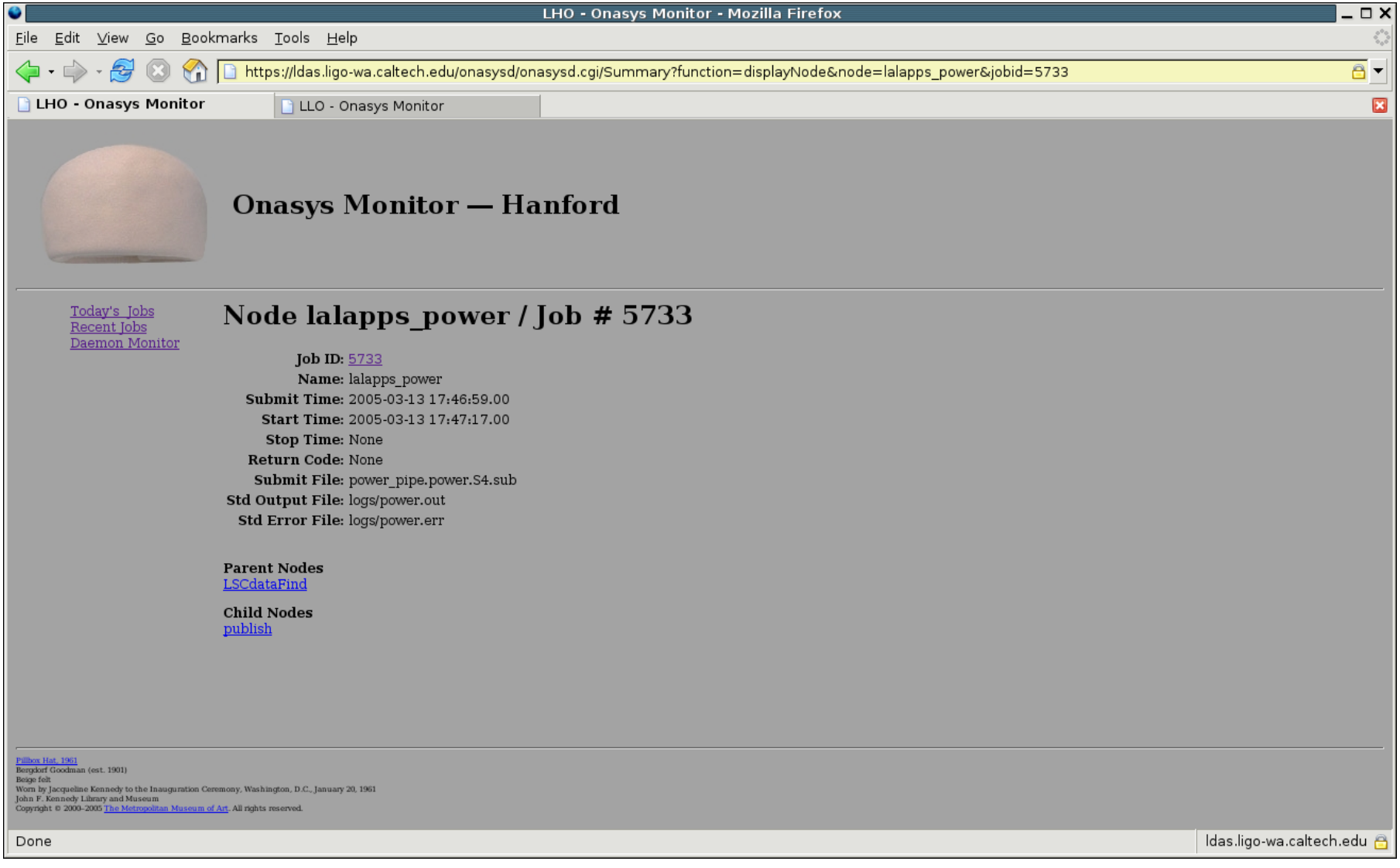
Onasys Monitor — Hanford
Today's Jobs
Recent Jobs
Daemon Monitor
Summary of DAG for Job #5733
Name | * | Submit Time | Start Time | Stop Time | Status | Return Code
lalapps_power | 2005-03-13 17:46:59.00 | 2005-03-13 17:47:17.00 | | R |
LSCdataFind | 2005-03-13 17:46:47.00 | 2005-03-13 17:46:47.00 | 2005-03-13 17:46:48.00 | T | 0
publish | | | | U |
LSCdataFind
lalapps_power
publish
No ImageMap. Sorry. Graphviz version is too old. Or something.
Done
ldas.ligo-wa.caltech.edu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File Edit View Go Bookmarks Tools Help
https://ldas.ligo-wa.caltech.edu/onasysd/onasysd.cgi/Summary?function=displayNode&node=lalapps_power&jobid=5733
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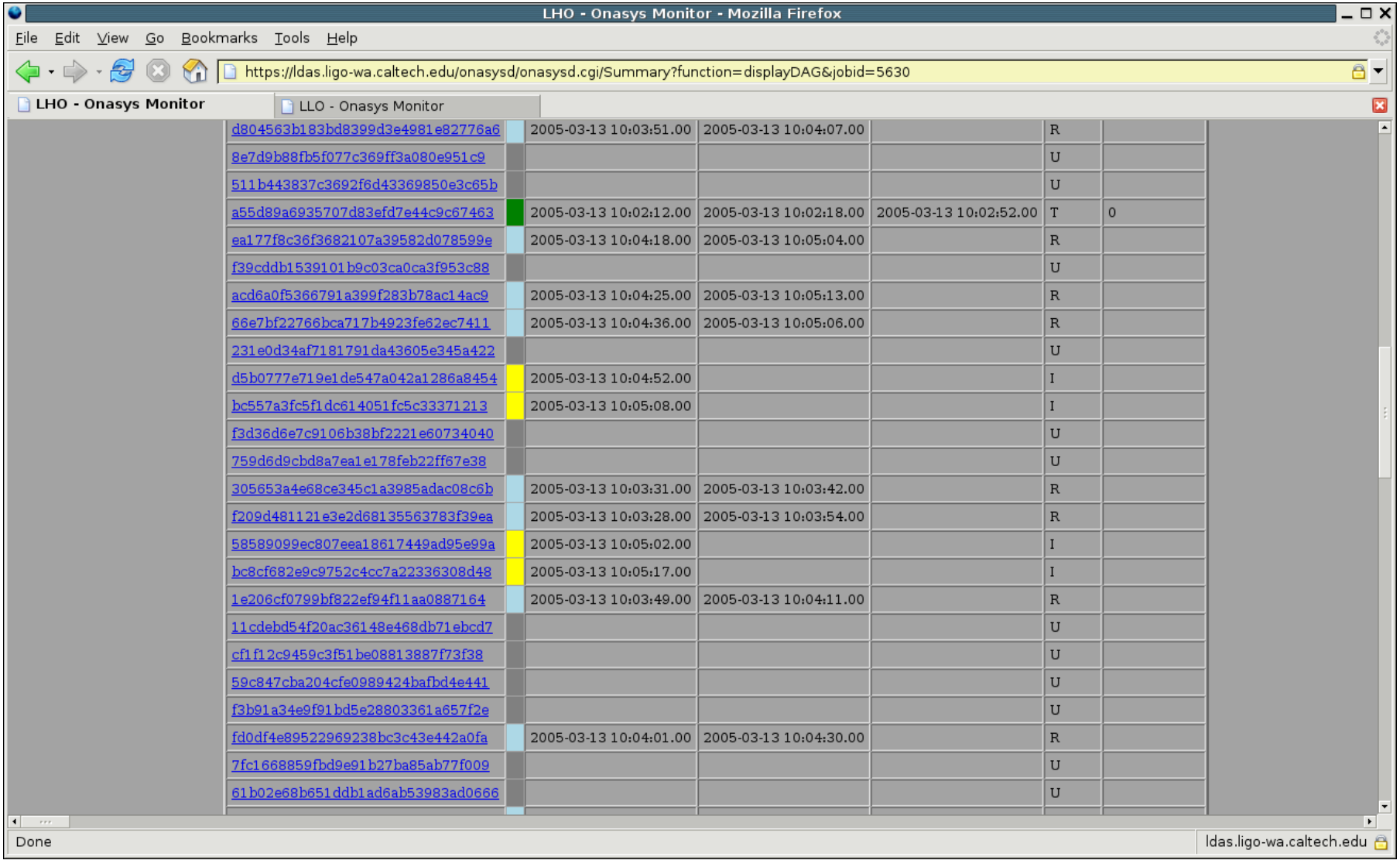
LLO - Onasys Monitor
Onasys Monitor — Hanford
Today's Jobs
Recent Jobs
Daemon Monitor
Node lalapps_power / Job # 5733
Job ID: 5733
Name: lalapps_power
Submit Time: 2005-03-13 17:46:59.00
Start Time: 2005-03-13 17:47:17.00
Stop Time: None
Return Code: None
Submit File: power_pipe.power.S4.sub
Std Output File: logs/power.out
Std Error File: logs/power.err
Parent Nodes
LSCdataFind
Child Nodes
publish
Pillbox Hat, 1961
Bergdorf Goodman (est. 1901)
Beige felt
Worn by Jacqueline Kennedy to the Inauguration Ceremony, Washington, D.C., January 20, 1961
John F. Kennedy Library and Museum
Copyright © 2000-2005 The Metropolitan Museum of Art. All rights reserved.
Done
ldas.ligo-wa.caltech.edu



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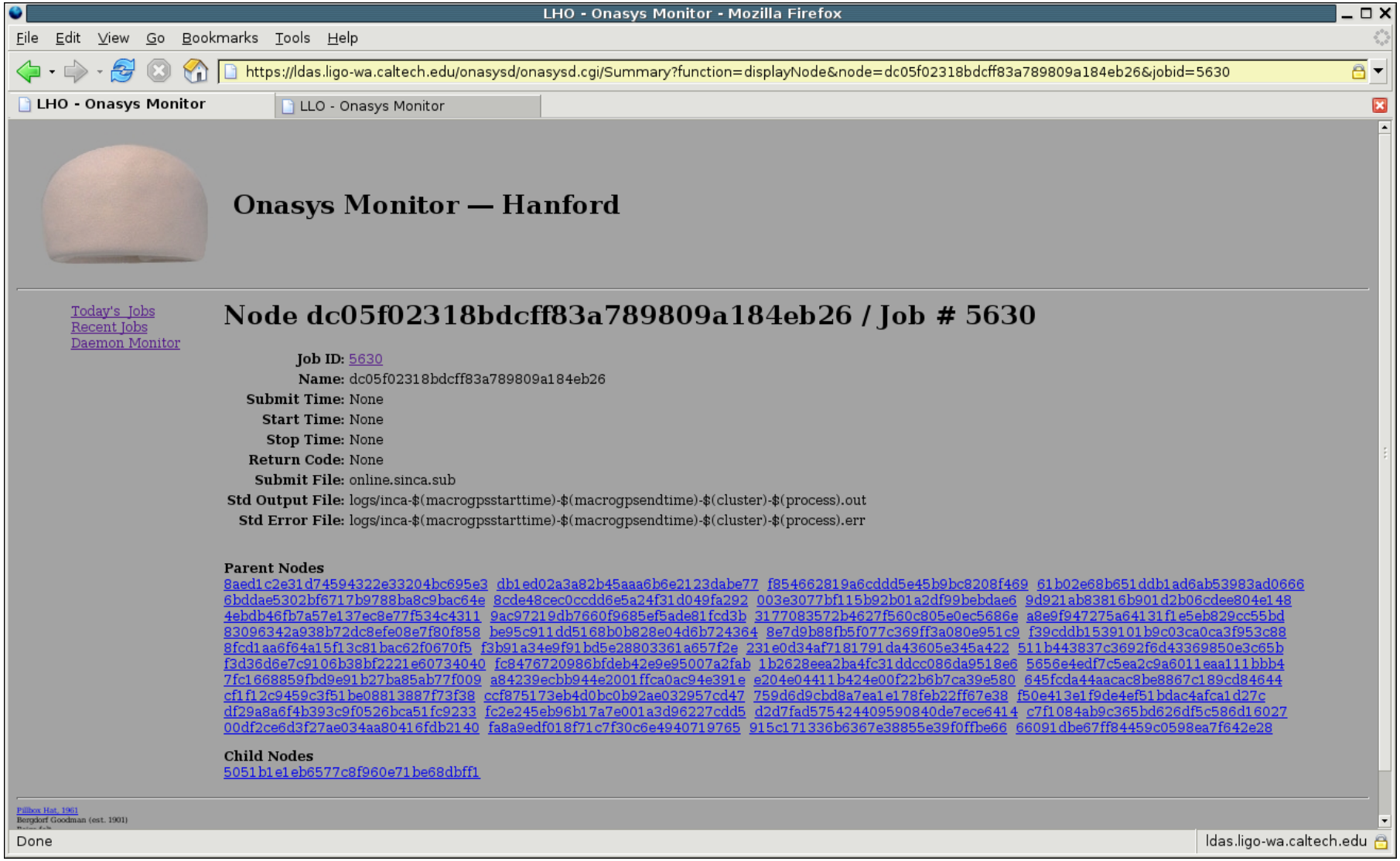
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LLO - Onasys Monitor
Onasys Monitor — Hanford
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Recent Jobs
Daemon Monitor
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Stop Time: None
Return Code: None
Submit File: online.sinca.sub
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Std Error File: logs/inca-$(macrogpsstarttime)-$(macrogpsendtime)-$(cluster)-$(process).err
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Child Nodes
5051b1e1eb6577c8f960e71be68dbff1
Pillbox Hat, 1961
Bergdorf Goodman (est. 1901)
Done
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Summary

- As far as we can tell, any DAG at all can be run using these tools, and monitored via the web interface.
- For three weeks, the system has delivered latencies of 10s of minutes for all three searches being run using it.
- System has proven itself to be fault tolerant, surviving a power failure at one observatory with minimal user intervention.
- The machine-assisted monitoring and fault analysis has proven itself to be highly effective at quickly identifying failures, and directing the user to the specific problem that has occurred.

Acknowledgements

- Stuart Anderson, Duncan Brown, Ben Johnson, Scott Koranda, Greg Mendell, Brian Moe