

The LCG based Mass Production Framework of the H1 Experiment

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Contents:

- Introduction
- MC Production Chain
- Experiences
- Summary



bmb-f · Förderschwerpunkt

H1

Großgeräte der physikalischen
Grundlagenforschung

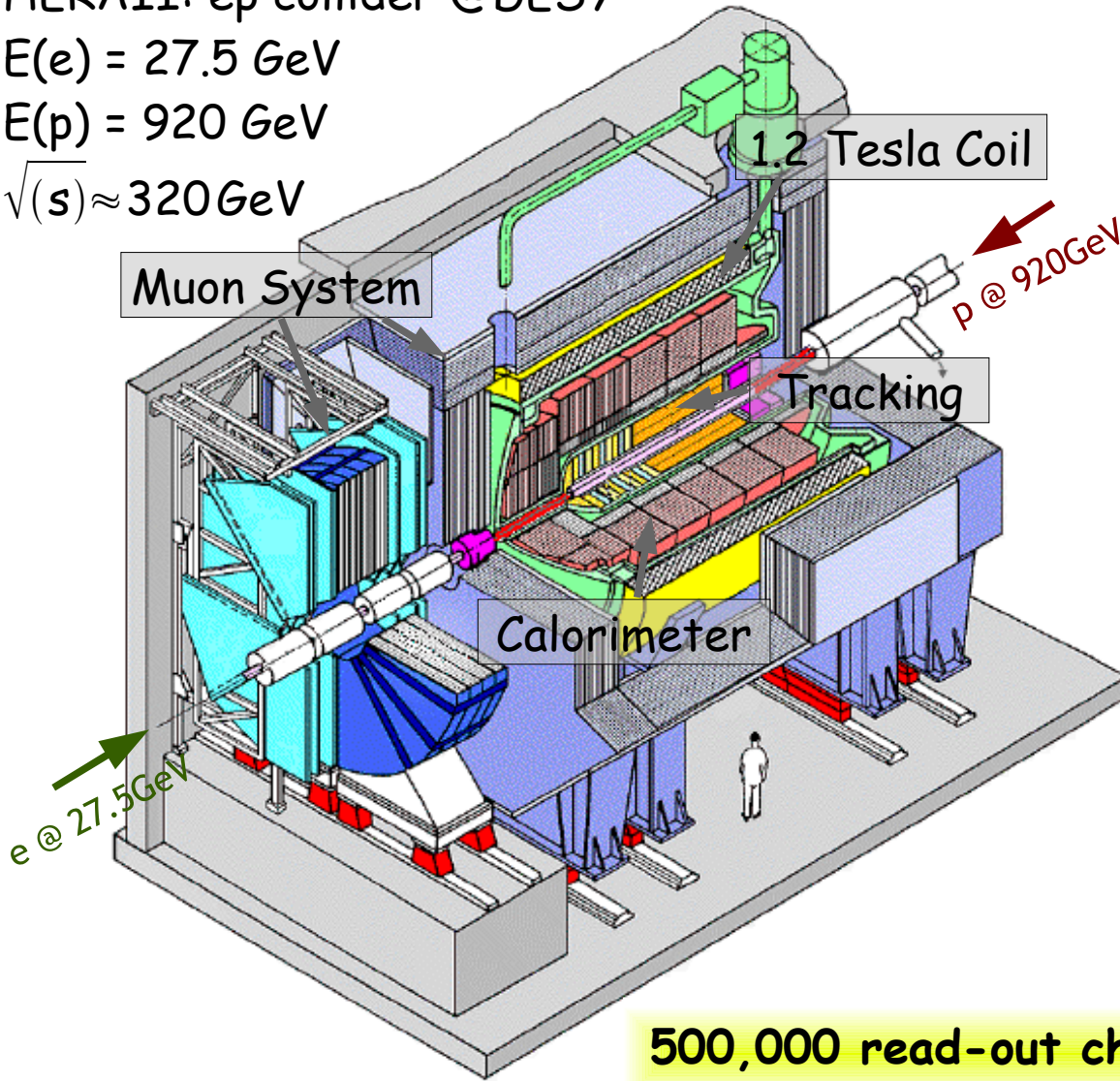
The H1 Detector at HERAII

HERAII: ep collider @DESY

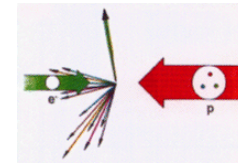
$E(e) = 27.5 \text{ GeV}$

$E(p) = 920 \text{ GeV}$

$\sqrt{s} \approx 320 \text{ GeV}$



500,000 read-out channels



Bunch crossing rate @10 MHz

Physics rate ~ 1 kHz
Background ~ 10 kHz

H1 Trigger System

Logging rate ~ 20 Hz

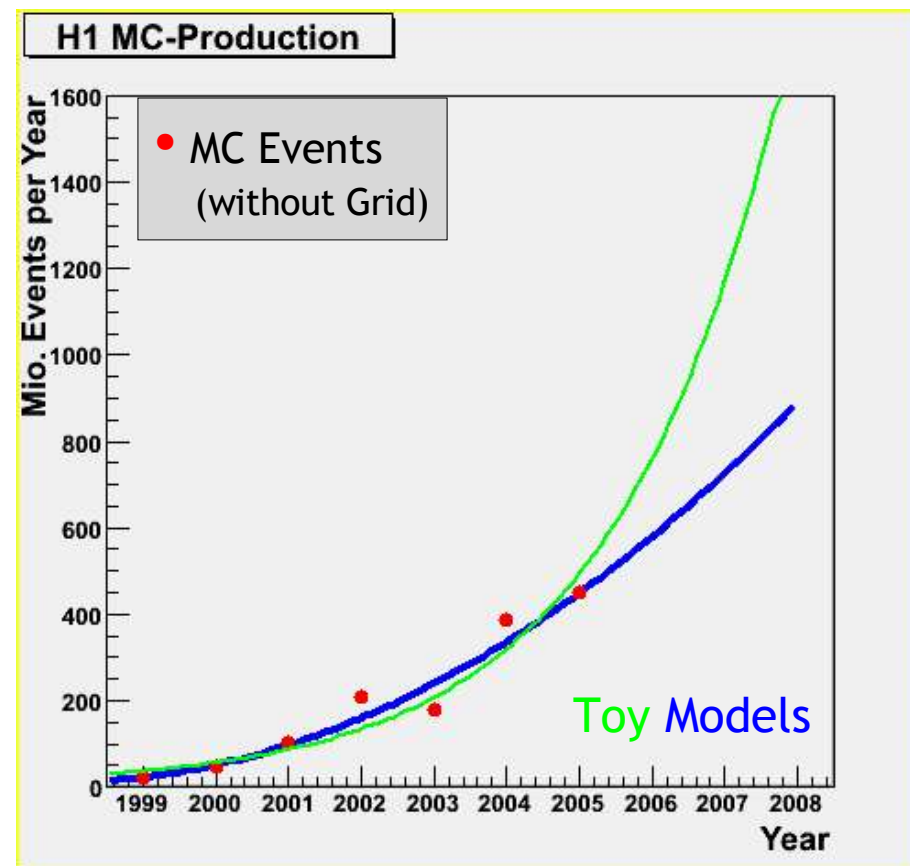
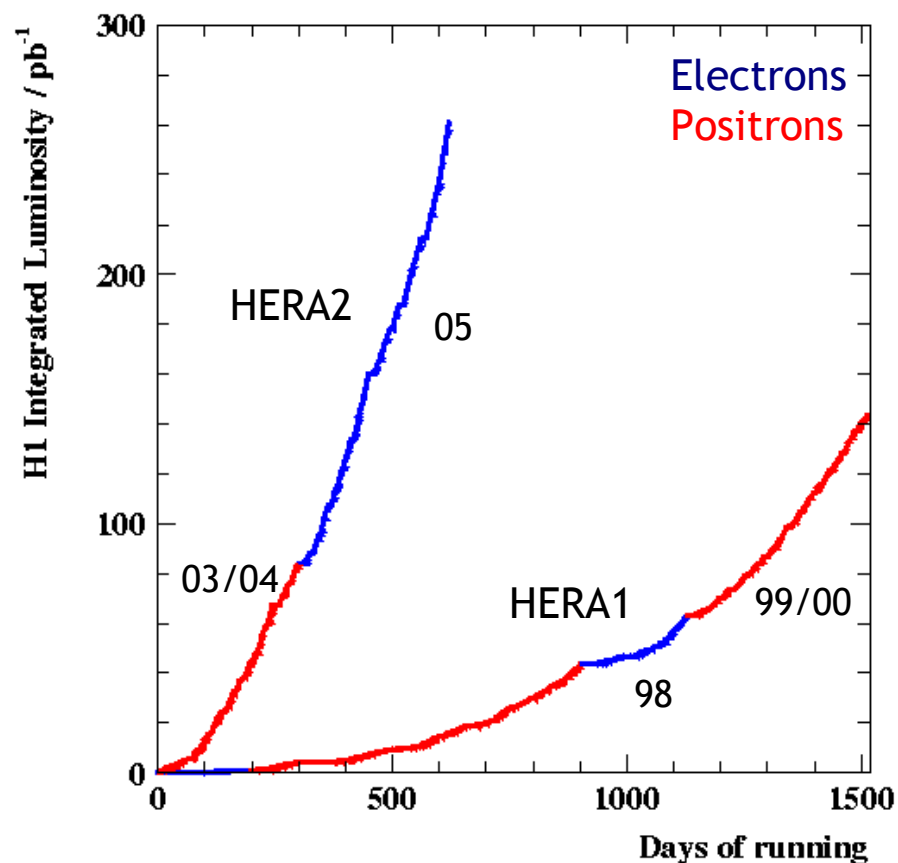
Raw data ~100kB/Event
On Tape



DST 10-20kB/Event
On Disk



Luminosity & MC Events



Amount of 2005 data almost HERA1 data MC production raising

- There are quite some events (data & MC) to come
- HERA demanding in terms of CPU and storage

Monte Carlo

◆ Monte Carlo generator:

- Models the physics processes: Matrix elements, Fragmentation....
- Rather advanced programs BUT
- Can run on a desktop PC or in a single batch job

◆ H1 Detector Simulation

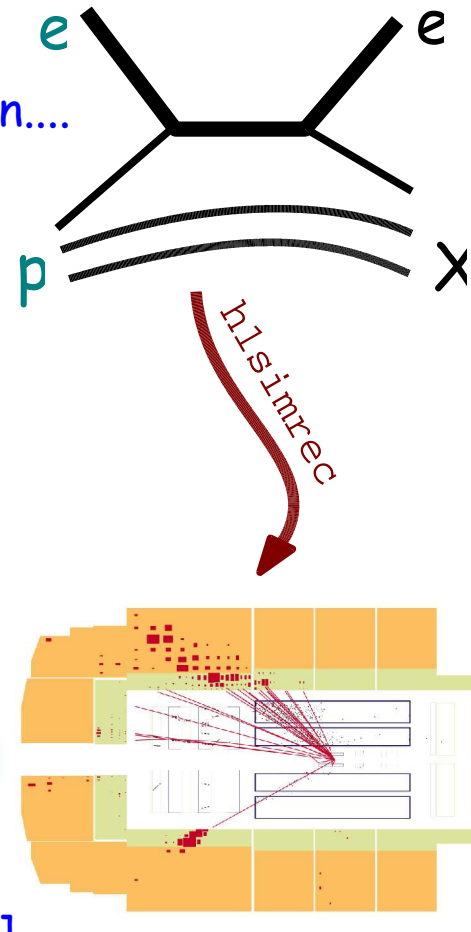
- GEANT3 based FORTRAN code
- Generates RAW data

◆ Typical parameters:

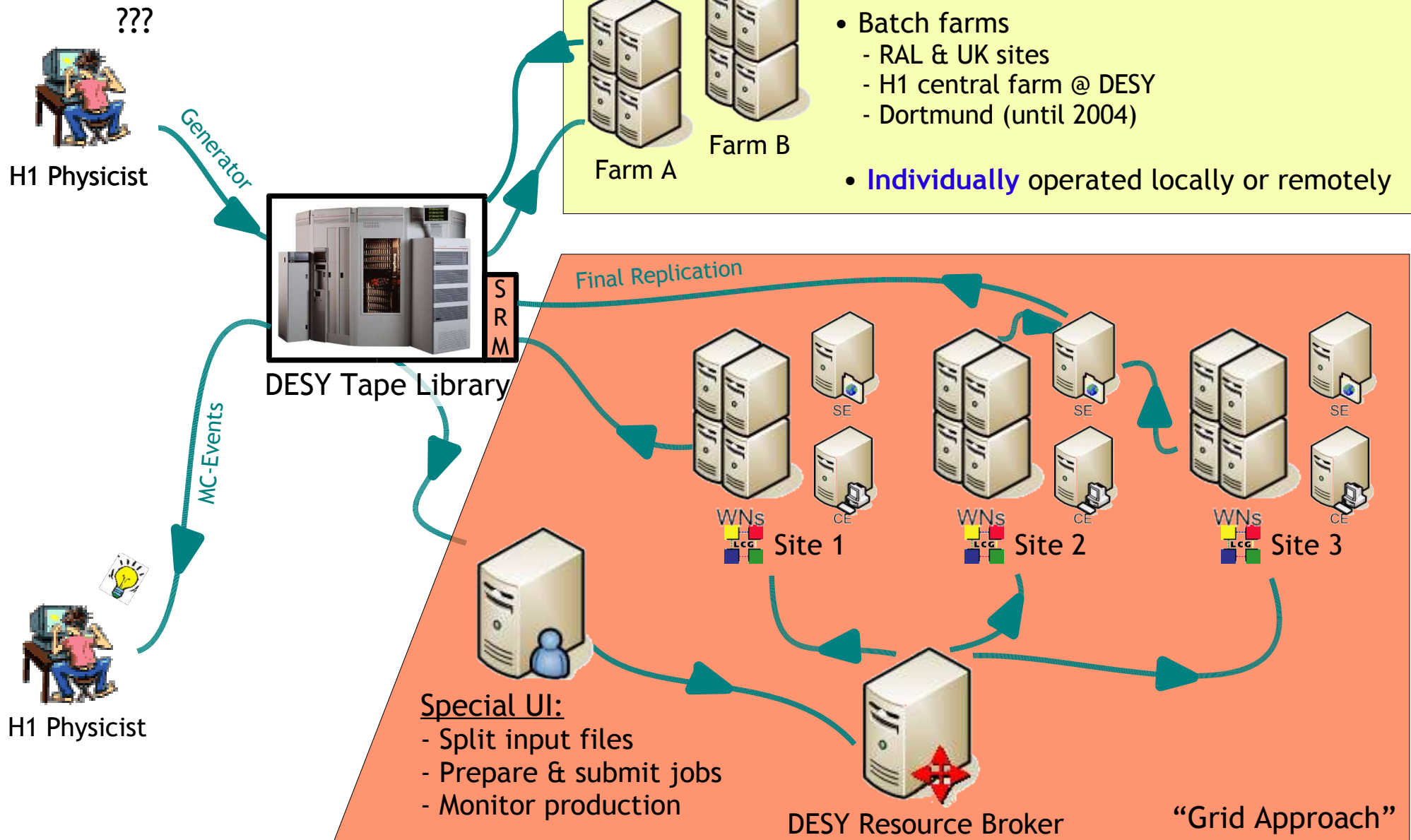
CPU time/event (SIM+REC): 3 - 12 s [depends strongly on process]
Events per request: 0.5 to 20 million [depends on analysis]
CPU time per request: about 1 CPU year

◆ H1 Reconstruction

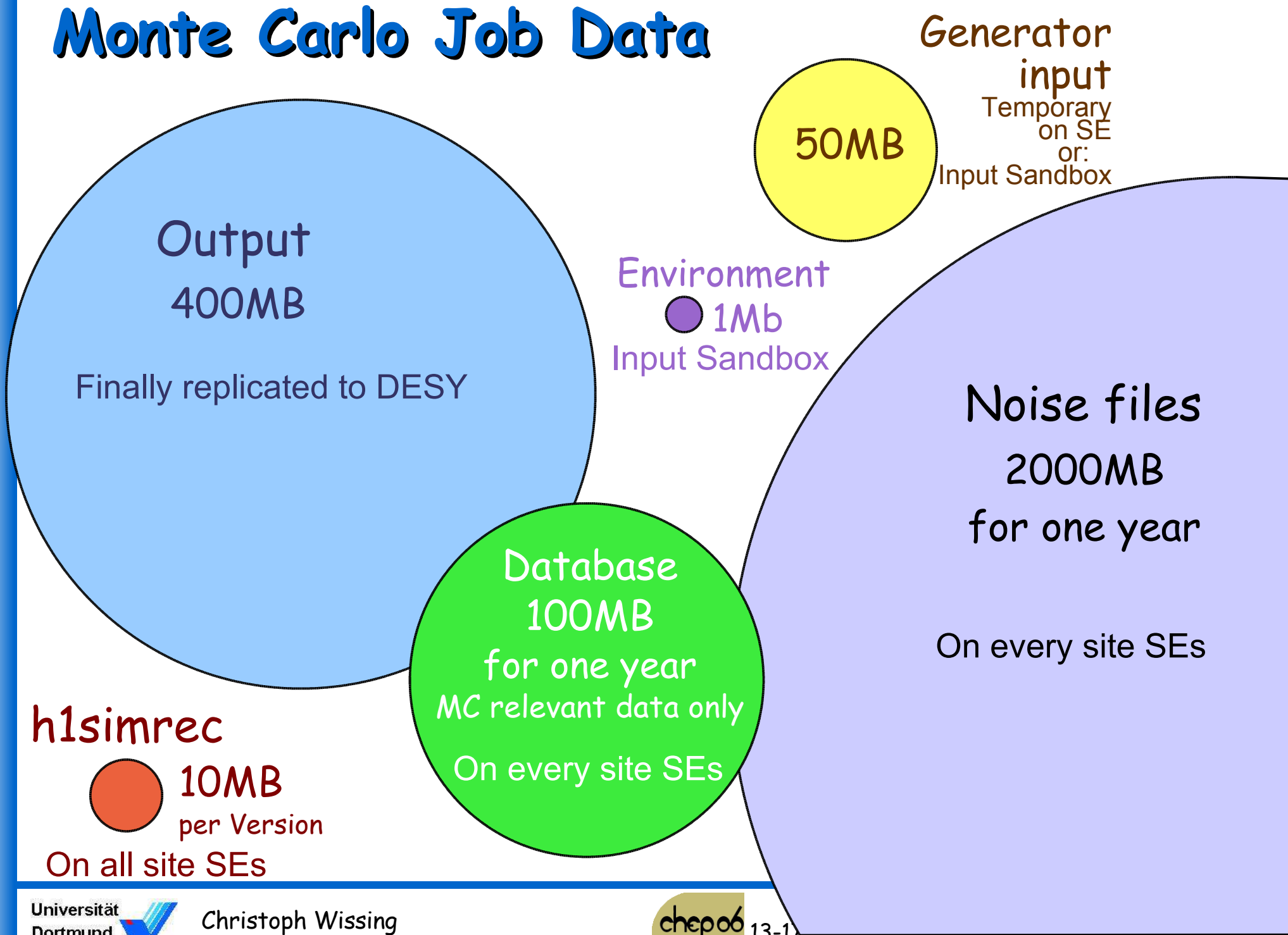
- 80% FORTRAN
20% C/C++
- Delivers tracks, clusters, jets ...



Production Chain



Monte Carlo Job Data

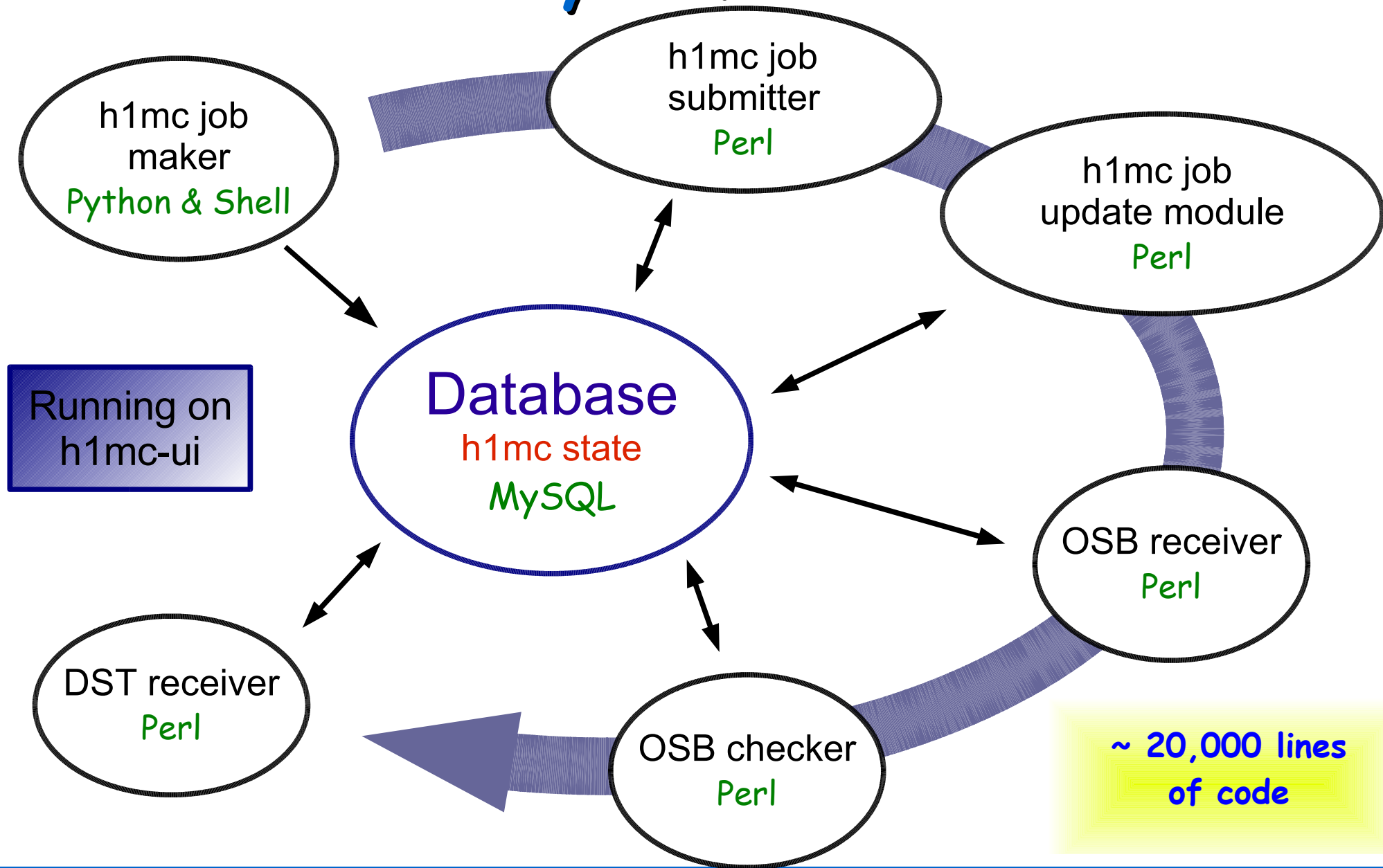


h1simrec

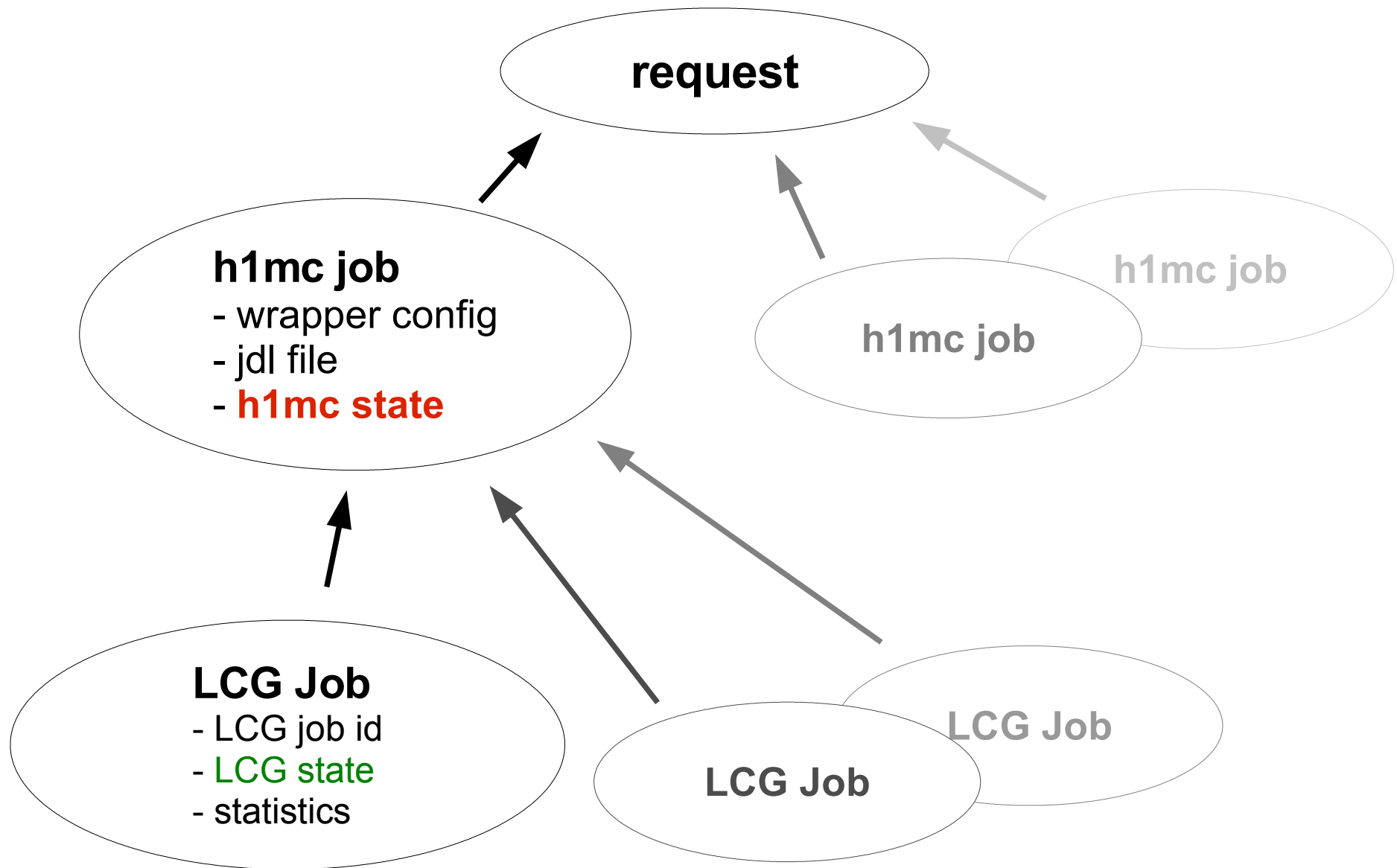
● 10MB
per Version

On all site SEs

H1 Grid Batch System



Objects in the H1MC Database



Job Script on the Worker Node

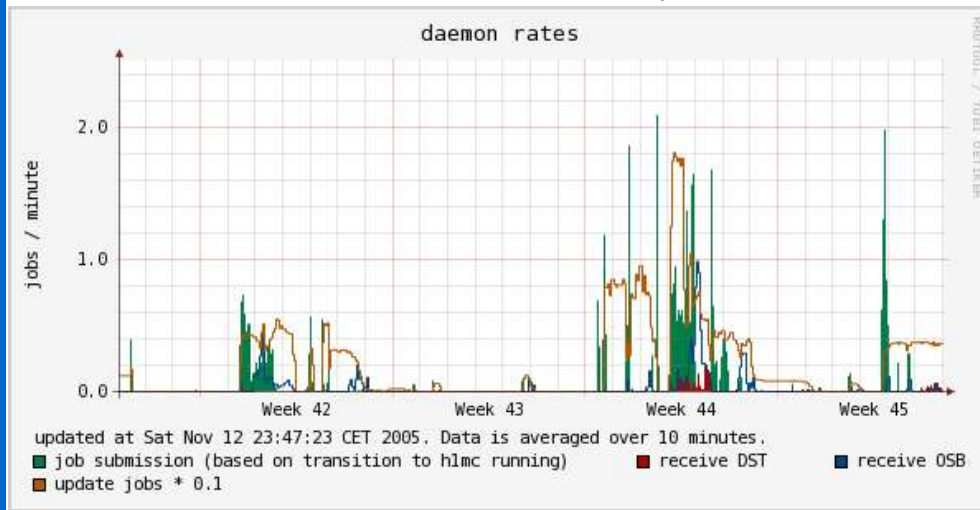
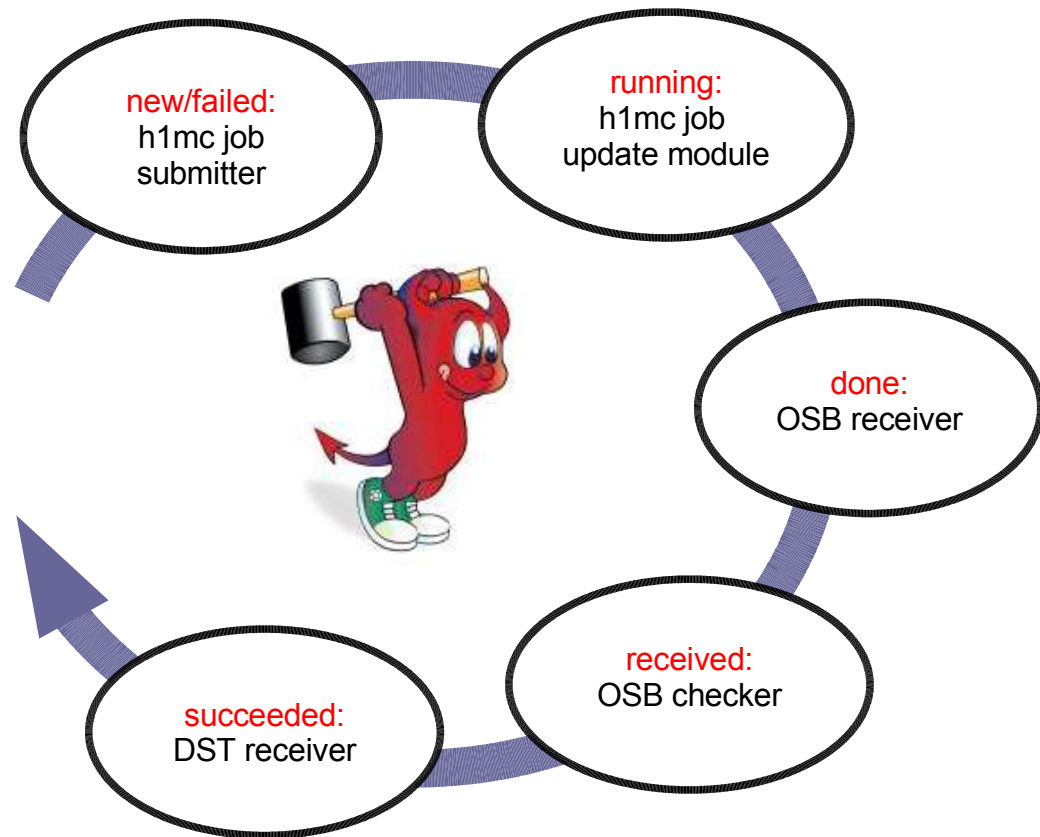
Run autonomously on the Worker Node:

- You cannot login!
- Recover from
 - Bad file transfers
 - Crash of the application
 - Crazy application (endless loops...)
- Restart parts of tasks
- Put things together at the end
- Logging and statistics



A Daemon for Automated Running

- ◆ Daemon calls each module
 - Module acts on jobs in particular state
 - Delay between calls steerable
- ◆ Handles several requests
- ◆ Command line interface



User Friendly Web Interface

H1 MonteCarlo Production - Konqueror

Adresse: <http://h1mc-ui/h1mc-cgi/printRequestCGI.pl?id=15>

H1 MonteCarlo Production

Tue Jun 14 16:30:10 CEST 2005

view requests <- request

Request 2001

Number of Jobs in each h1mc state

h1mc state	Number of Jobs
mute	~5
failed	~5
finished	~70
queue	~5

actions

- update
- forced update
- submit
- receive Output Sandboxes
- check Output Sandboxes
- replicate DST output to srm-dcache.desy.de
- cancel
- delete

Request was last updated successfully on
2005-06-08 15:41:00

associated jobs

h1mc job Nr	h1mc state	grid state of current job	grid queue	nr of LCG jobs
1	finished	Cleared	grid-ce.desy.de:2119/jobmanager-lcgpbs-hone	1
2	finished	Cleared	grid-ce.desy.de:2119/jobmanager-lcgpbs-hone	1
3	finished	Cleared	grid-ce.desy.de:2119/jobmanager-lcgpbs-hone	1
4	finished	Cleared	grid-ce.desy.de:2119/jobmanager-lcgpbs-hone	1
5	finished	Cleared	grid-ce.desy.de:2119/jobmanager-lcgpbs-hone	1
6	finished	Cleared	grid-ce.desy.de:2119/jobmanaqer-lcgpbs-hone	1

H1 MonteCarlo Production - Konqueror

Adresse: <http://h1mc-ui/h1mc-cgi/printJobsCGI.pl?id=831>

H1 MonteCarlo Production

Tue Jun 14 16:35:12 CEST 2005

view requests <- request <- h1mc job

H1mc Job 66 of request 2001

Job was last updated successfully on
2005-05-22 23:50:33

Status

H1mc State	Wrapper Exit State of current LCG job
finished	ERRORS_OCCURRED

associated lcg jobs

DB Id	LCG Job Id	grid state
274	https://grid-rb.desy.de:9000/bYR51Zpwjr7mMHd7FDFR5g	Aborted
345	https://grid-rb.desy.de:9000/Ne8Hb0StunJpGCSB_KujSg	Cleared

associated files

id	type	name	lfn
816	jdl	/afs/desy.de/user/m/...creq2001/jobs/0066/h1mcjob.jdl	
831	DST	output	lfn:h1mc/output/2001...2.P920.Z0066.sim31003.rec9 srm://srm-dcache.des...2.P920.Z0066.sim31003.rec5

[show full paths]

actions

- update
- forced update
- (re)submit
- receive Output Sandbox
- check Output Sandbox
- replicate DST output to srm-dcache.desy.de
- cancel

User Friendly Web Interface

H1 MonteCarlo Grid Production - Mozilla

http://h1mc-uh1mc-cgi/printLogJobsCGI.pl?id=21831

H1 MonteCarlo Grid Production

Fri, Feb 10 15:02:01 CET 2006
logged in as wissing (logout)

[view requests](#) <- [request 71311](#) <- [h1 mc job 15](#) <- [log job 21831](#)

Log Job 21831

Log Job was last updated successfully on
2006-02-06 14:12:21

Status

Grid State	Wrapper Exit State
Cleared (user retrieved output sandbox)	SUCCESS

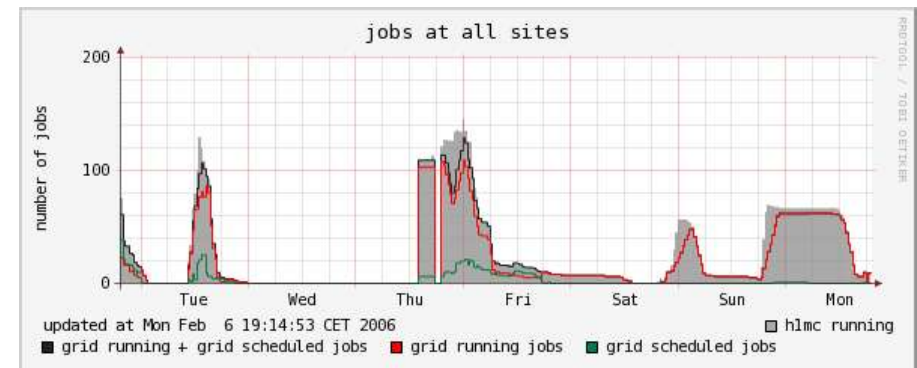
actions

- [update](#)
- [submit](#)
- [receive Output Sandbox](#)
- [cancel](#)
- replicate DST output to srm-dcache.desy.de (use command line tools)
- delete from database (use command line tools)

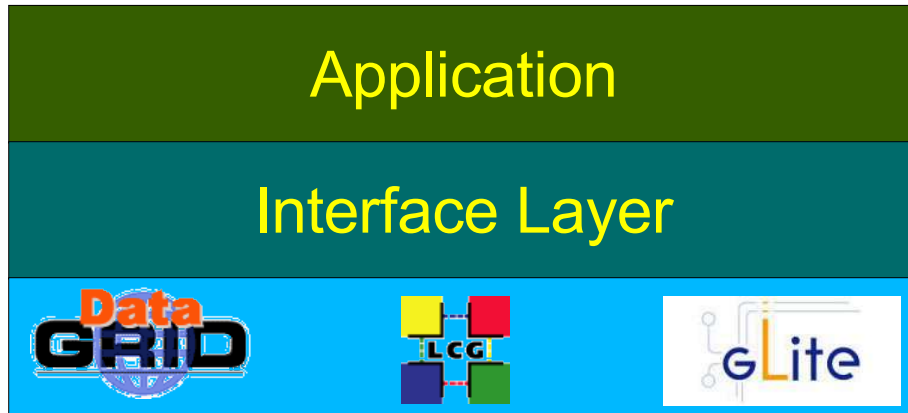
Content of Output Sandbox

04_05_ele.simrec.run.striped.run1	2.1 kb
cmds.log	55.0 kb
files.guid	42 byte
files.lfn	80 byte
h1mc.log.run1	50.1 kb
h1simrec.out.run1	2.6 Mb
statistics.log	1.2 kb
std.err	12.5 kb
std.out	41.5 kb
watchdog.log.run1	209.7 kb

- ◆ Call modules interactively
 - Debugging
 - Tracing of single jobs
 - Look at output sandboxes
- ◆ Monitoring & Statistics



Programming Concept



Avoid changes not related to application

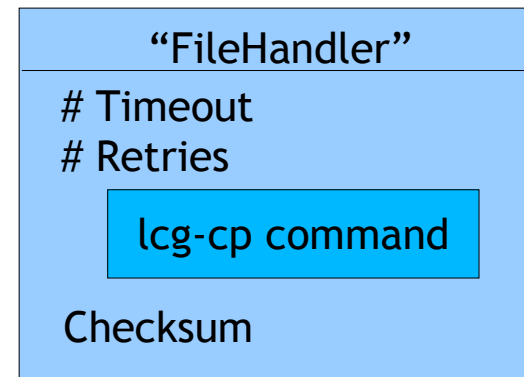
Adapt to changes in middleware

"Always changing":

LCG_2_X → gLite EDG- / LCG-catalogue

◆ Object oriented PERL:

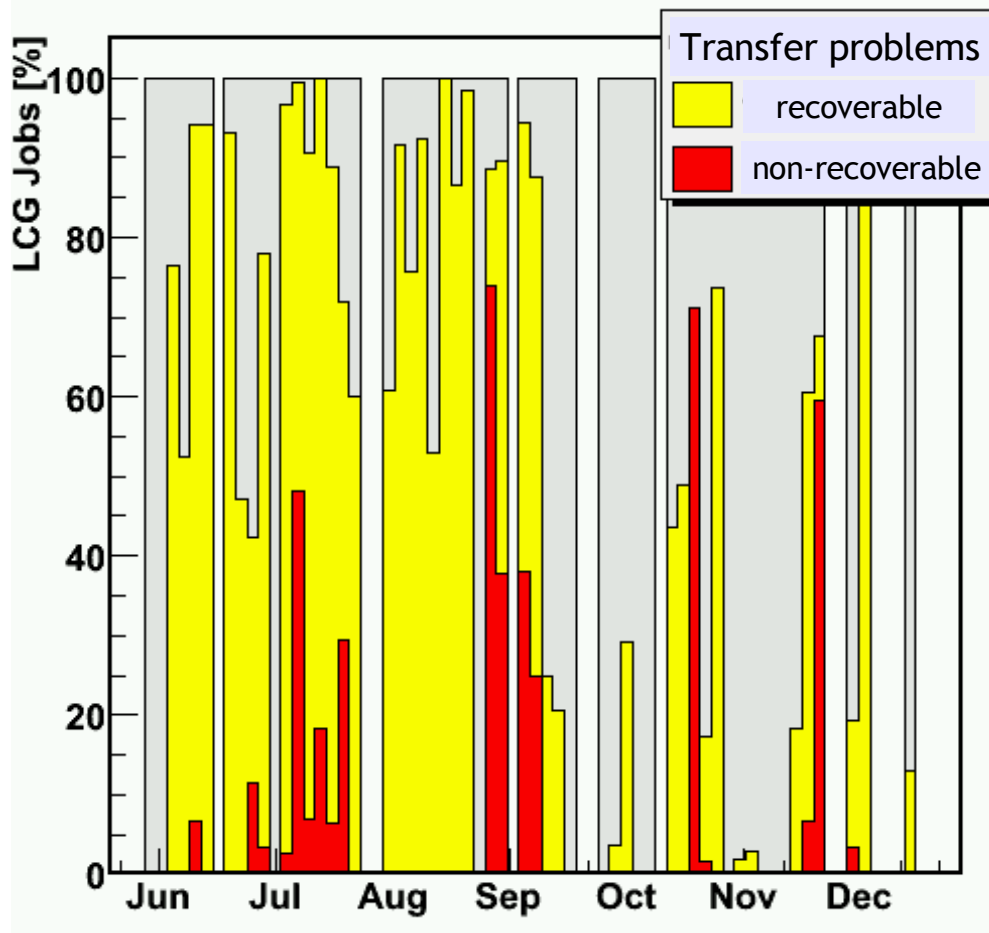
- Wrapper around edg-/lcg-commands
- Enforced timeouts
- Automatic retries
- Additional checks



◆ Very much inspired by the ZEUS Grid-Toolkit

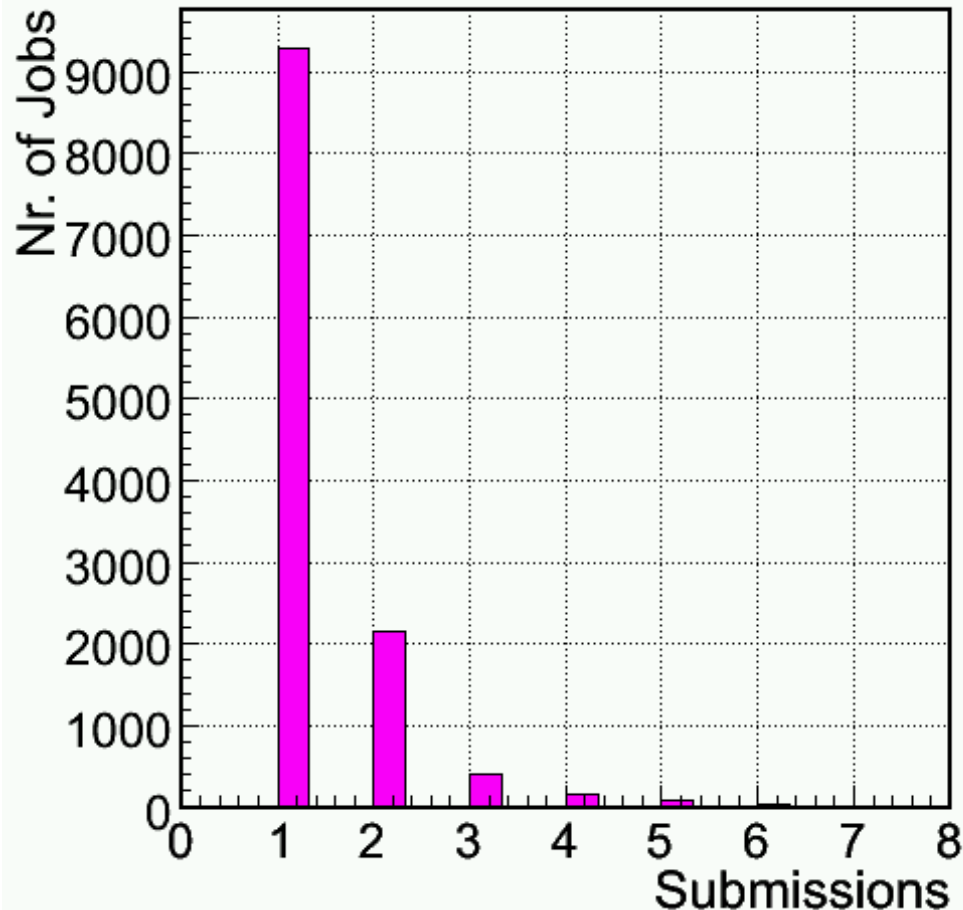
See poster by K.Wrona - 324

Production Experiences: Data Transfer



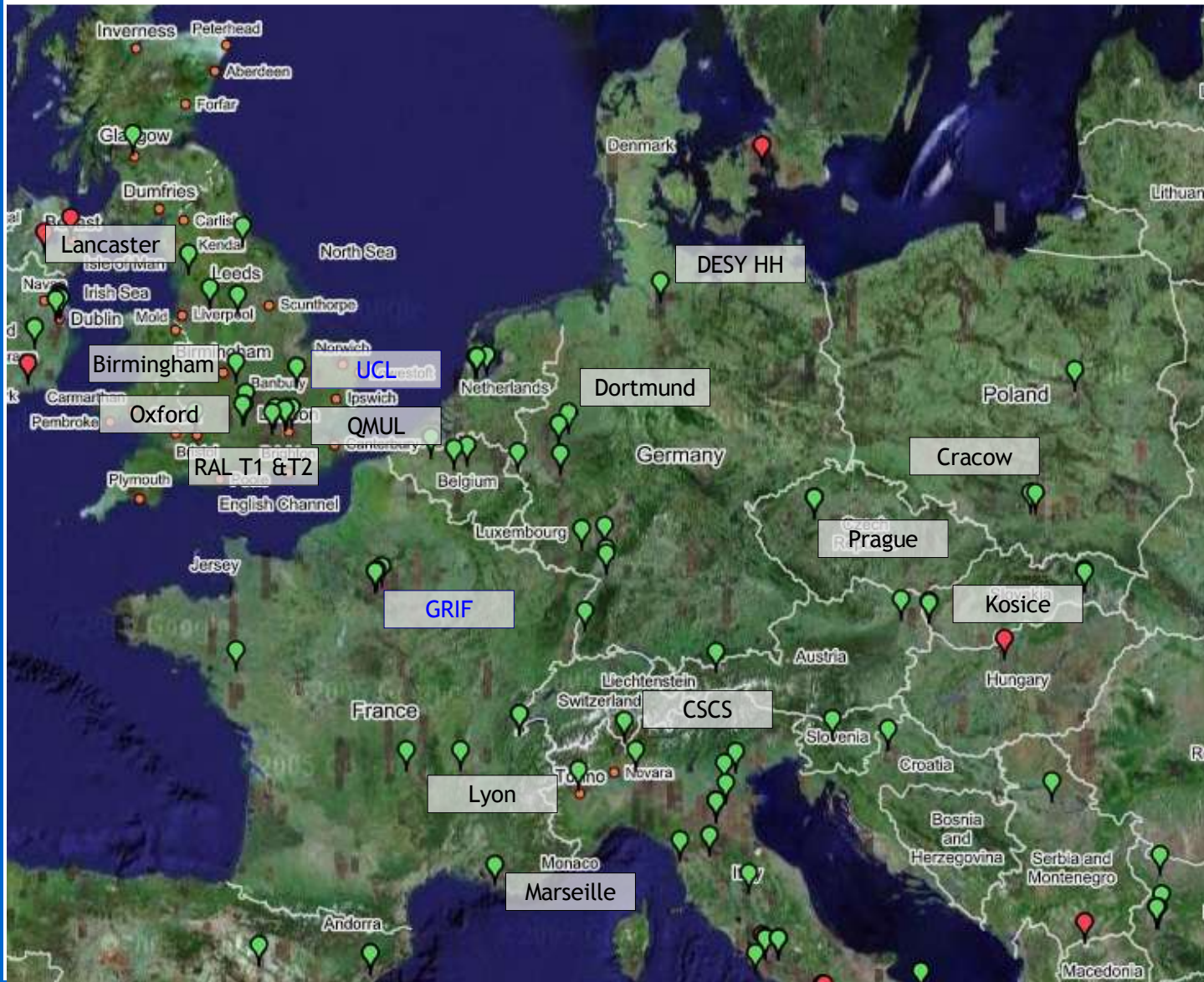
- ◆ Pure lcg-tools often not reliable
 - Failure rate often 80%
 - Recovered by retries
- ◆ Performance increased
 - LCG_2_6 tools better
 - Sites improving infrastructure
 - Big files now at every SE
- ◆ Sometimes complete failures
 - Problems with central components (e.g. catalog)

Production Experiences: Job Efficiency



- ◆ Job efficiency ~75%
- ◆ Resubmission against
 - Arrival on bad site
 - Processing on bad nodes
 - ▲ Disk space
 - ▲ Environment
 - Temporary problems
 - ▲ On sites
 - ▲ Global failures
- ◆ Manual interference
 - After many resubmissions
 - Less than 1% !!!

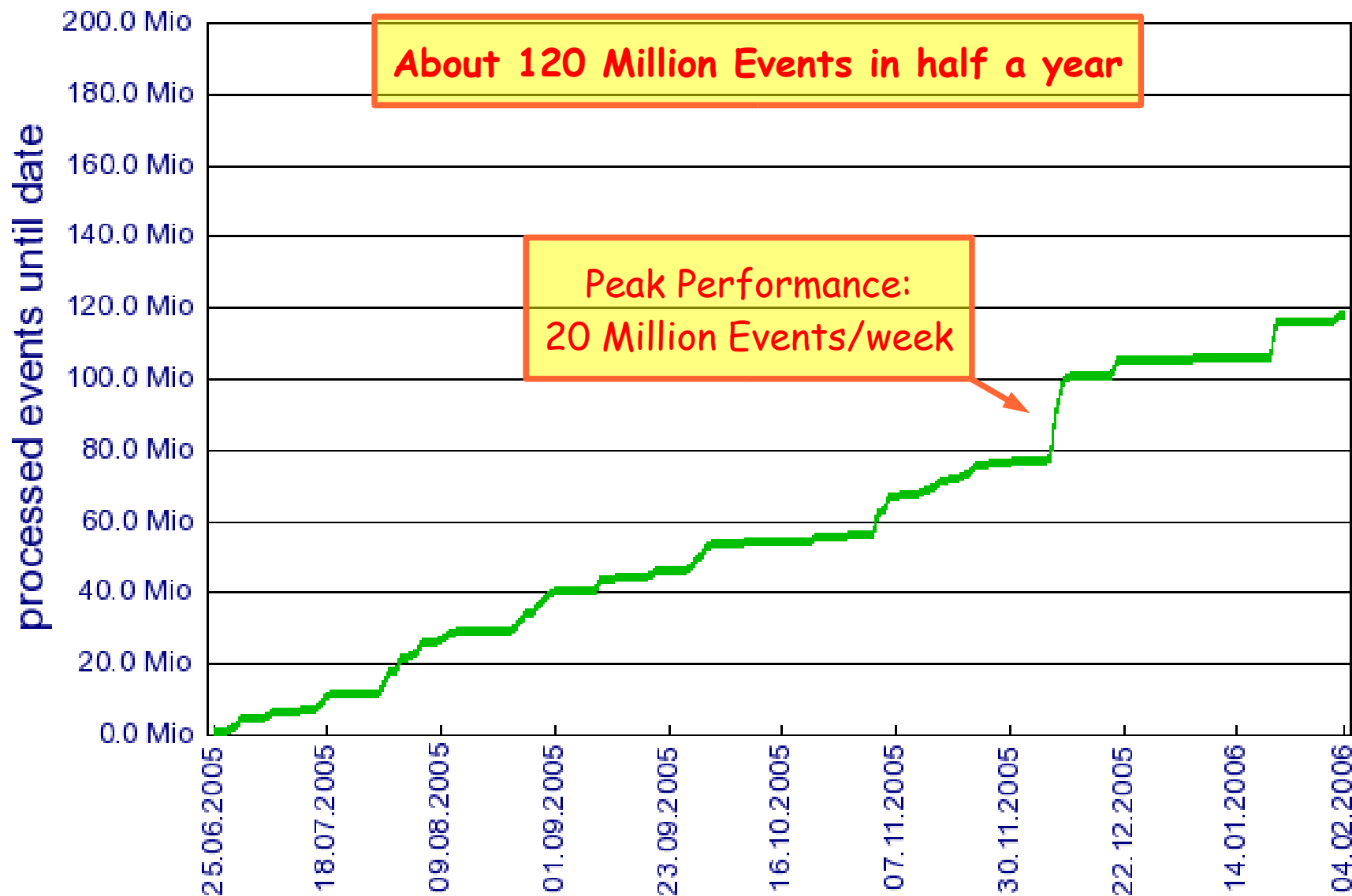
H1 LCG Sites & Resources



H1 sites	CPUs	Storage
Birmingham	26+106	1.6 TB
CSCS	37	5.5 TB
Cracow	85	1.8 TB
DESY HH	80+166	10 TB
Dortmund	60	0.5 TB
Kosice	14	0.8 TB
Lancaster	350	10.0 TB
Lyon	1300	11.6 TB
Marseille	28	0.9 TB
Oxford	74	2.2 TB
Prague	200	4.8 TB
QMUL	554	14 TB
RAL Tier 1	875	45 TB
RAL Tier 2	80	5.5 TB
GRIF*	60	1.0 TB
UCL*	140	0.9 TB

* work in progress

Production Since June 2005



Beyond MC Production

- ◆ Production framework independent of application
- ◆ Characteristics of MC production:
 - Very CPU demanding
 - Medium size of data throughput
- ◆ Another suitable application: **Analysis Tree Production**
 - Conversion of reconstructed data (DST) to ROOT trees
 - Done twice a year for all data and selected MCs
 - High data throughput
 - Requires full installation of H1 software on sites
FORTRAN & C++ environment
 - Tests are on going



Grid adequate



Grid adequate

Summary

- ◆ Computing at HERA II will be a demanding task
 - Increased event rates in data
 - Much more MC events needed for analysis
 - New resources available via GRID - about 3,000 CPUs
- ◆ A new frame work for MC production is ready
 - Production rates of ~20 million events per week achieved
 - Robust and (almost) unattended production
 - Web interface for monitoring
 - Extension to other applications (Analysis tree production) under study
- ◆ H1 has arrived in the Grid - the Grid has arrived in H1

H1mc States

