Data Preservation Activities at DESY.

A retrospective look at the last 4 years - and what's to come

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on behalf of the DESY-DPHEP Group

7th DPHEP Workshop with DASPOS
CERN
22nd March 2013

Contents

- Introduction to the DESY-DPHEP Group and HERA

- 2009: First HERA data preservation activities, initial ideas
- 2010: Defining the projects, resources and goals

} Here I have included original slides from earlier DPHEP workshops, but I will skip over some of the sub-bullet points

- Since 2010/2011: Key areas of activity
  - Data preservation: really preservation of software + environment: the `sp-system` idea
  - Archival storage of the data themselves
  - Documentation: INSPIRE, digital meta-data and non-digital material
  - Governance, future collaboration structures and open access/public data

- 2013: Current status and plans

The DESY-DPHEP group (@ DPHEP 6, November 2012)

- DESY-DPHEP: group of about 15 people, meetings every other week
  - DESY-IT: D.Ozerov
  - DESY-Library / INSPIRE: Z. Akopov
  - H1: V. Dodonov, B. Lobodzinski, J. Olsson, D. South, M. Steder
  - HERMES: E.Avetisyan, G.Schnell
  - ZEUS: A. Ausheva, V.Bokhonov, A.Geiser, J.Malka, K.Wichmann
- Conference presentations in 2012 by DESY-DPHEP (CHEP, ICHEP, IEEE)
- Many people employed on short term, dedicated data preservation contracts, requested in accordance with the DPHEP recommendations
  - Only two names are permanent staff, and are not working exclusively DP

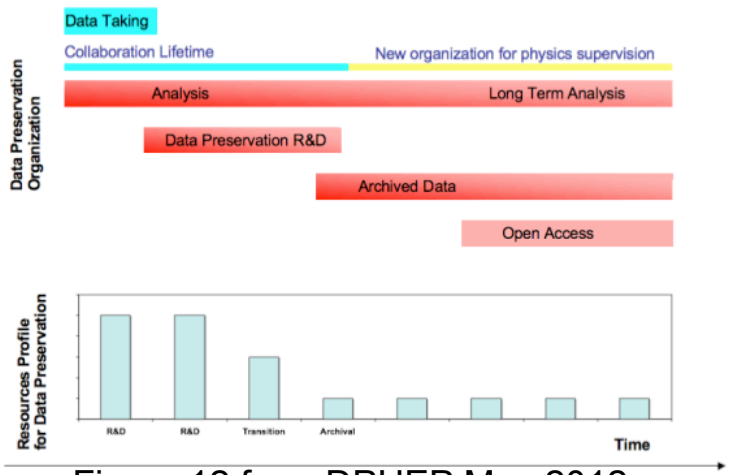

Figure 12 from DPHEP May 2012

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- Many people employed on short term, dedicated data preservation contracts, requested in accordance with the DPHEP recommendations
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  - **HERMES now officially ended, and other non-permanents until 2013 (one until Aug 2014)**

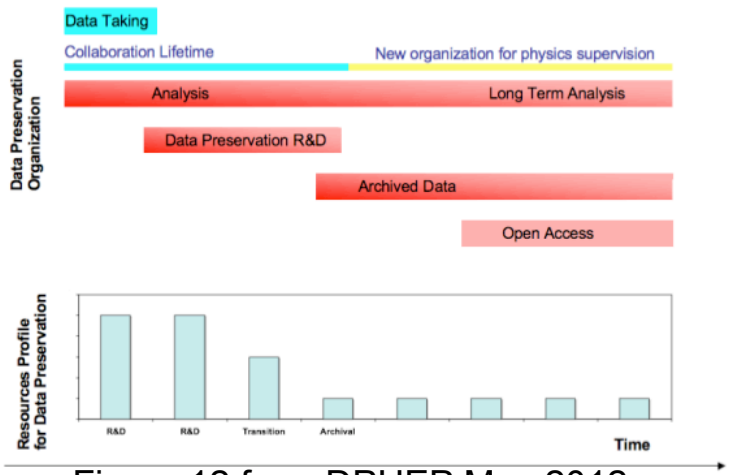
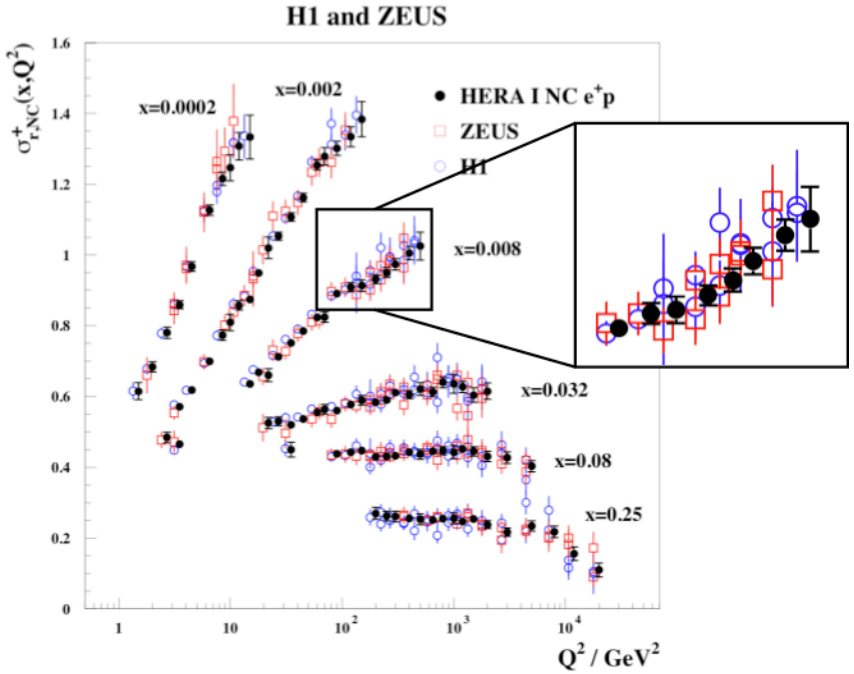
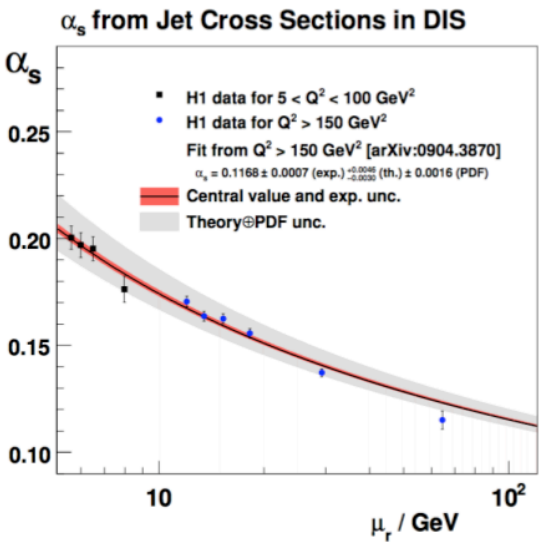


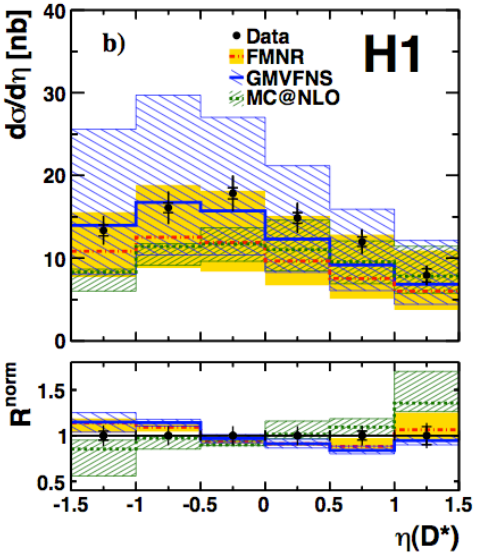
Figure 12 from DPHEP May 2012

The ep collisions from HERA are unique..

- The HERA data are particularly unique, given there are no concrete plans for a new collider for e±p physics on the table
- Many physics cases can be built to support long term analysis
  - Including combinations, better theory available

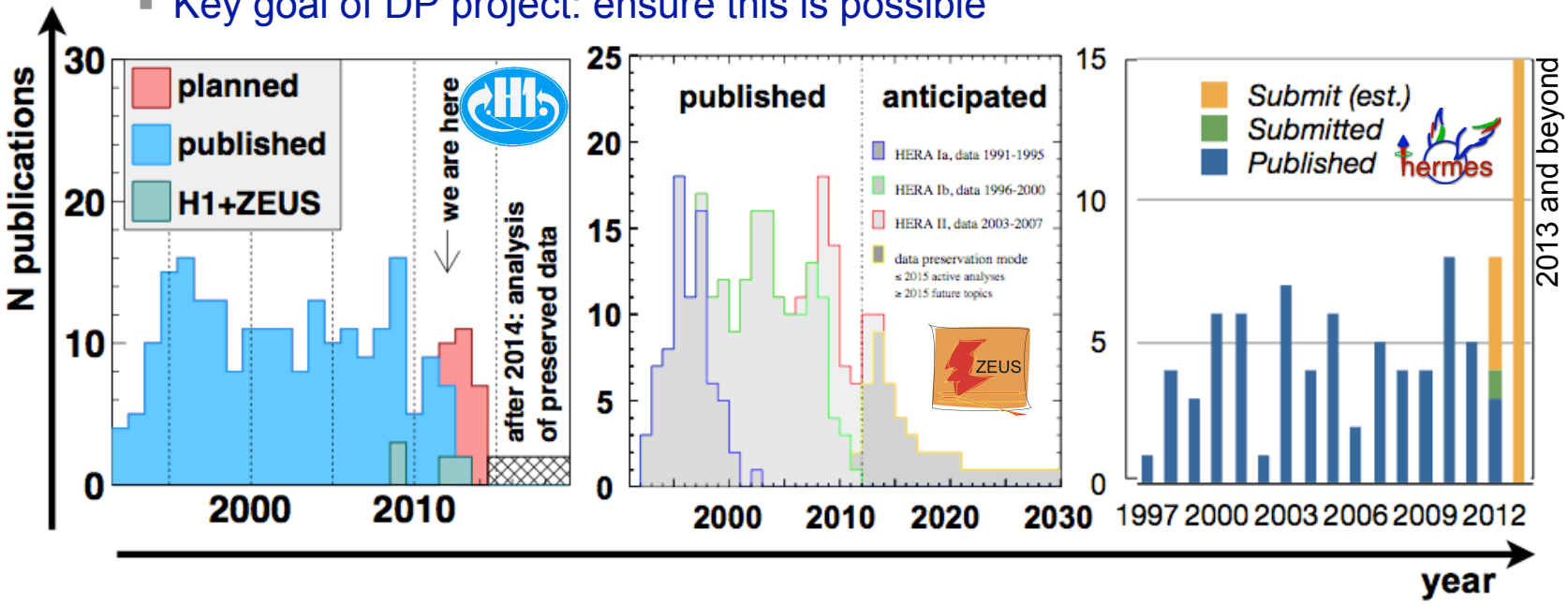






..and we are not done with them yet!

- Collisions stopped in 2007, but the collaborations continue to publish at a significant rate, 5 years after data taking
  - As seen with LEP and predicted by BaBar
- Majority of remaining papers to be published by 2014, but long tail expected
  - Key goal of DP project: ensure this is possible



Six DPHEP workshops

DESY January 2009

SLAC May 2009

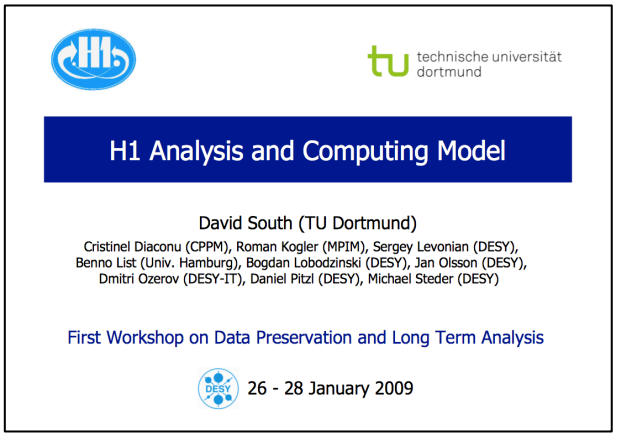
CERN December 2009

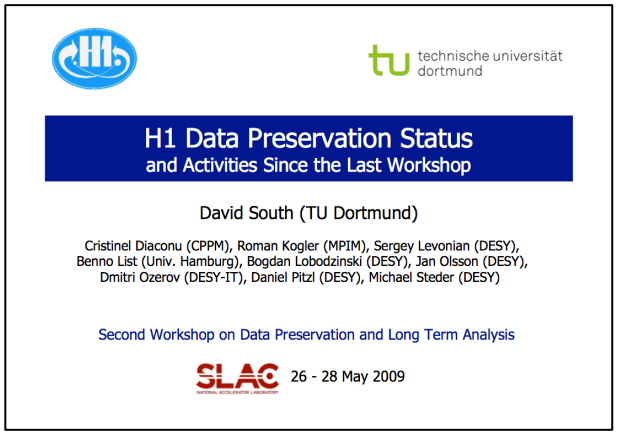
KEK July 2010

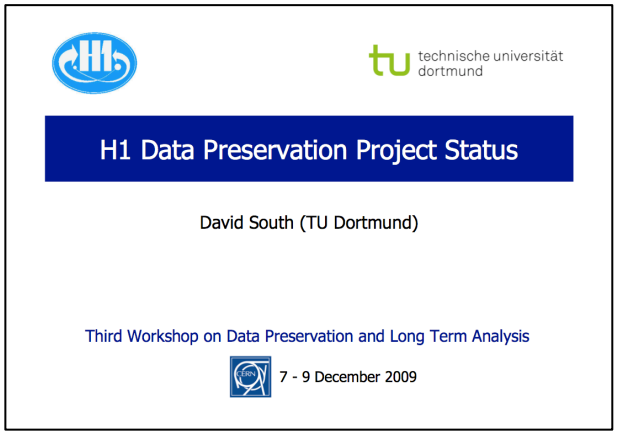
Fermilab May 2011

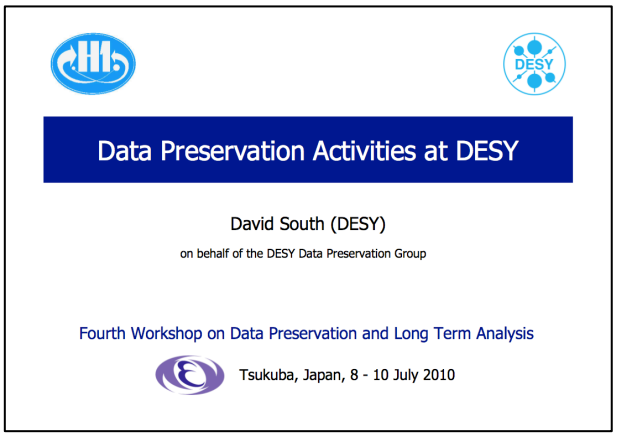
CPPM November 2012

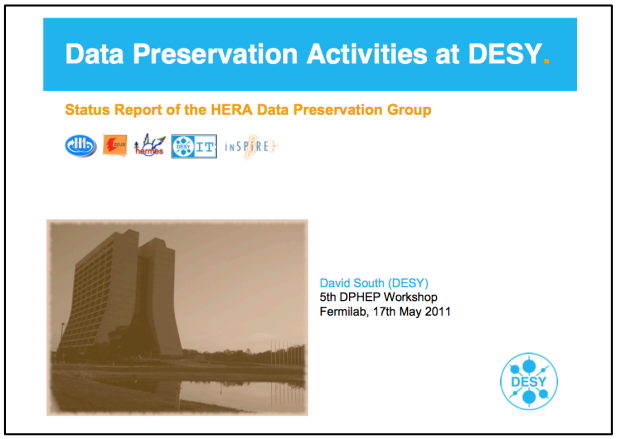
DESY at DPHEP 1-6



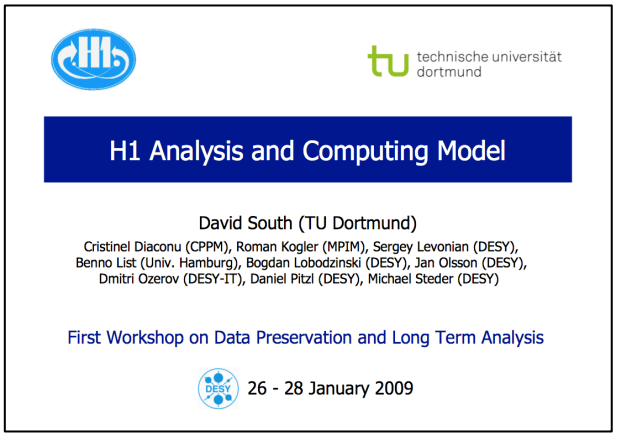


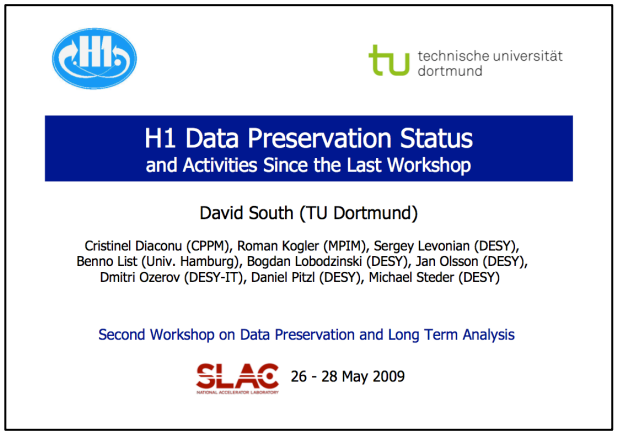


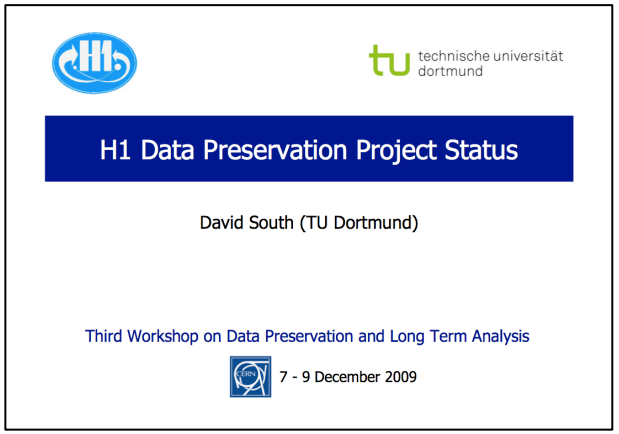


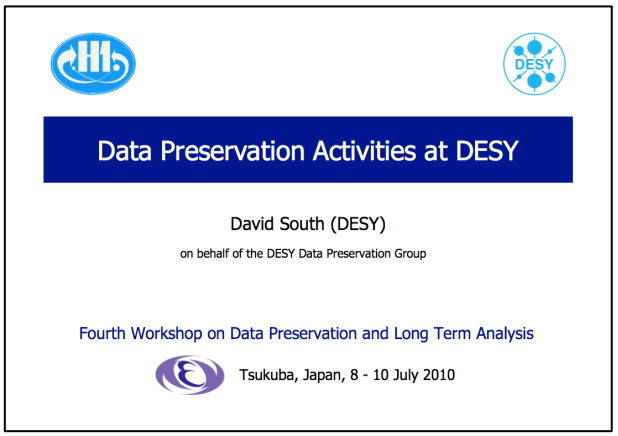


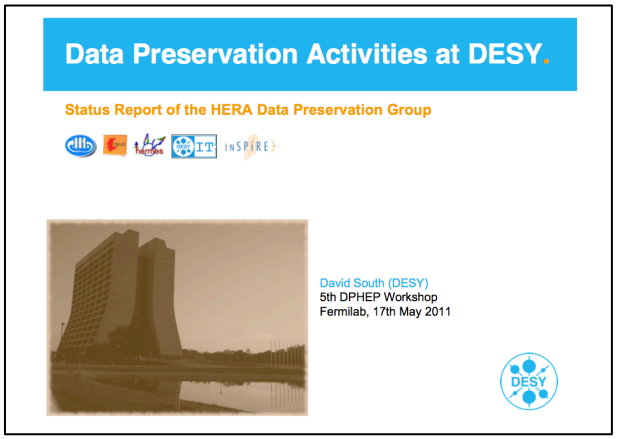
DESY at DPHEP 1-6







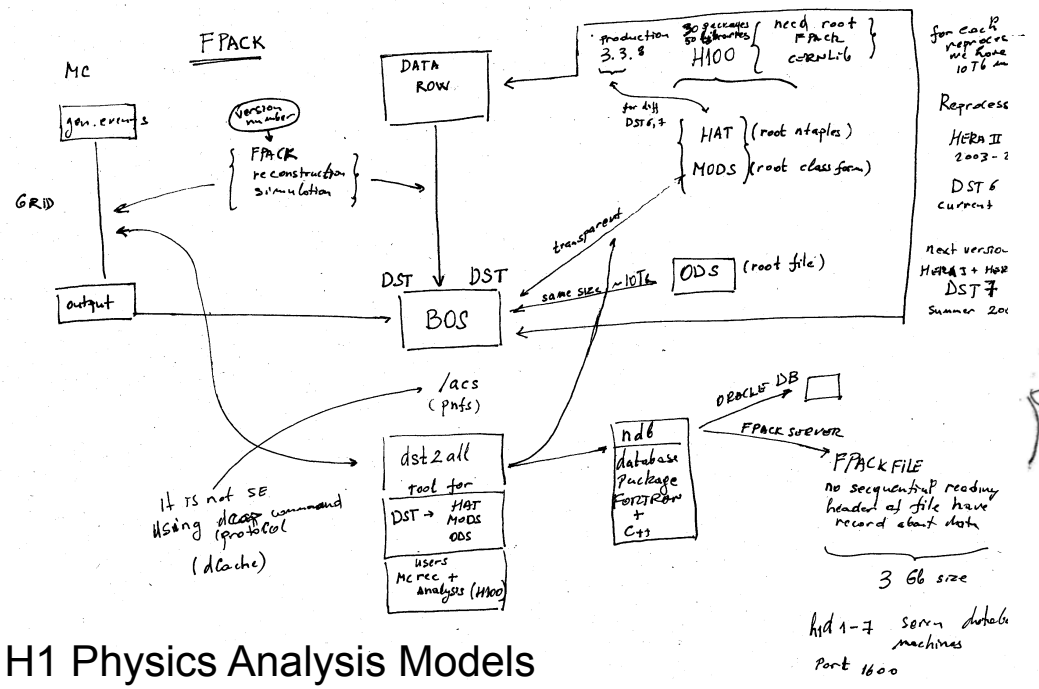




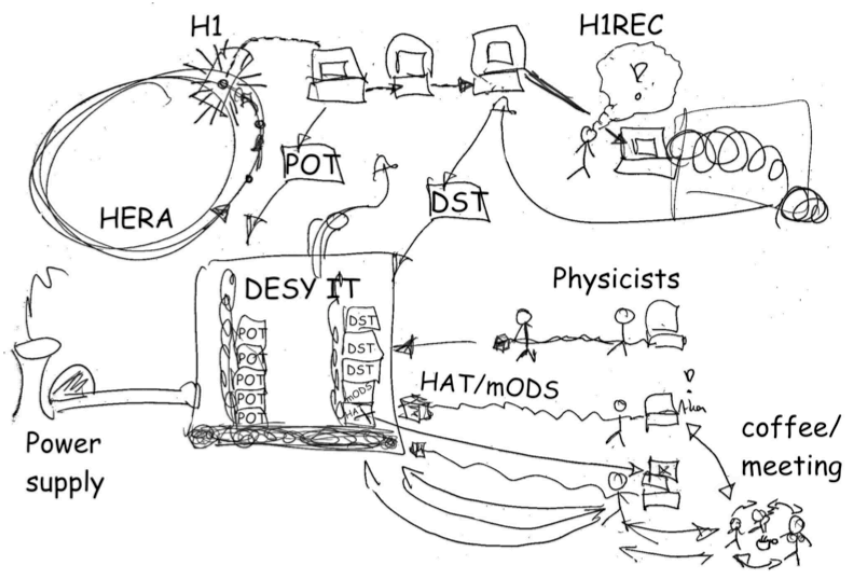
- First half I will mainly use H1 examples (apologies to ZEUS, HERMES)
- The description of current projects which follows applies to the DESY-DPHEP group as a whole

DPHEP 1 — Initial ideas

- A real meet and greet for many recently finished experiments or those finishing soon, current analysis models presented and initial data preservation ideas discussed
- Different working groups established:
  - Physics Case, Preservation Models, Technologies, Governance



H1 Physics Analysis Models



DPHEP 1 The H1 data analysis model

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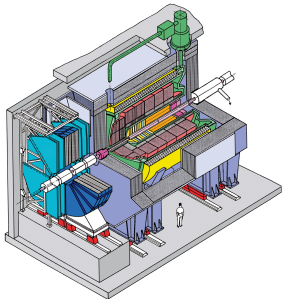


HERA delivered e±p collisions 1992-2007 and the H1 Collaboration collected 0.5 fb^{-1} of data, ~ 10^9 events

119.977679	129.534731	124.739135	176.316414
130.46875	135.839924	130.84732	168.289658
135.895502	149.510531	140.795689	120.686833
134.127052	140.495868	132.823819	206.138393
129.851598	137.880438	124.888856	189.675642
123.797241	131.84633	126.146789	202.496855
118.435374	130.691651	112.877008	140.366234
112.401212	121.561443	114.237637	125.298579
112.388488	128.496503	113.302591	192.223669
129.011813	138.880759	128.517198	108.701884
127.077465	139.289941	129.528986	127.406576
124.9785	135.363241	127.454638	129.669126
124.294035	133.242253	124.704841	244.567067
125.663717	135.159011	125.476984	169.271991
123.704853	127.612613	124.25382	170.401964
118.926697	122.818967	115.379664	134.970308
116.588208	121.798711	116.018173	323.148148
119.458869	124.788744	119.103839	204.736734
120.081967	124.847434	120.425321	289.50681
123.462329	127.367029	123.298233	287.632974
124.442179	128.115374	125.592252	362.764329
125.490169	128.448761	124.411031	382.978361
124.446597	128.898705	126.602473	358.369956

The raw data output from the detector is written to tape

DST

Raw data transformed into DST format using Fortran based software, regular re-processing

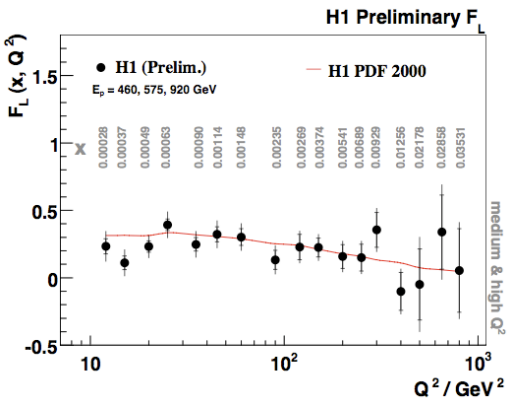
H100

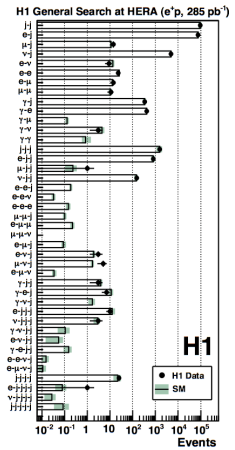
ODS

H1 event

Analysis level data format and software written in C++ and based on ROOT

Regular common data and MC production, calibrations and analysis performed using central computing resources





H1 publishes physics results

The grand survey (1)

- How to move from a working physics analysis model to something more suitable for preservation? Some (mainly H1) statements made at the time:

- Consider which data formats to be preserved?
  - RAW data; latest full set of DST data; latest common analysis level files, other data such as calibration and cosmic runs, in addition to well prepared and defined MC sets (basic data format FPACK/BOS designed as machine independent)

- Future migration of OS?
  - IBM to UNIX conversion already done in 1996, Since then a few Linux conversions, SL4-5 transition at DESY now
  - Efforts now on going to investigate the impact of (64 bit) SL5, including possible use of virtualisation techniques and adaptation of existing (SL4) executable

- Do not expect to be limited by CPU or disk space in the future?
  - Preserved data/MC to be copied to new media at regular intervals, say every 2 years
  - Expect cost of migration to be double current costs: 1 + 1/2 + 1/4 + 1/8 + .. = 2

The grand survey (2)

- What about reconstruction / simulation software?
  - Development essentially completed. Which languages involved? Mostly Fortran, some C, some C++ with some parts already frozen since a good few years. Could database access via Oracle be fazed out?
- What about the physics analysis software?
  - Started in 2000, written entirely in C++ language, unlike reconstruction software, further development is planned for the coming years, with DST 7 as the input
  - Model heavily reliant on ROOT framework, in particular I/O, TTree
  - Could try to remove as much ROOT but most classes inherit from TObject, not a good solution: try to incorporate ROOT updates
- After development, could foresee “a rolling preservation model” for the analysis software, with regular recompilation of analysis software and file production, say every 3 months
  - These considerations led to the first ideas about preservation levels

DPHEP 2 First sketch of data preservation levels

Minimum Level of Preservation	
0	RAW data
1	Reconstruction Simulation Database considerations? Commercial software?
2	DST
3	Ntuple / analysis level data (and MC?) ***production***
4	Existing ntuple / analysis level
5	Combined analysis with a (for example) H1+ZEUS "ep ntuple"
6	Outreach : very simple format

The basic level to conserve

Essentially frozen, but ensure reconstruction software still compiles, so changes still possible. A new simulation: can it use old reconstruction (issue of F vs C++)?

Essentially frozen, DST 7 the "final" reconstruction software version

Rolling model, fluid preservation from here up: gives regular verification of full chain

Fixed ntuple, "all" analysis level info

Common format ntuple (repository?)

Not enough for full analysis(?), but rather for open access / outreach

Use of Virtualisation / Emulation techniques ?

DPHEP 2 First sketch of data preservation levels

- Found this was best split in terms levels of complexity of the levels

Increasing complexity (inclusive)

  - Nothing at all
  - Additional documentation for existing results
  - Data only *(incl. Simplified Common Data Format)*
  - Data + "community code" (ROOT, ..)
  - Data + experiment specific software (SIM+REC)

- Include a description of each of these cases, including:
  - Effort needed (two stages: preparation, maintenance)
  - Estimated costs in FTE years
  - Benefits of preservation

May be different depending on which stage the experiment is at

DPHEP 3 A rolling preservation model

- In the longer term, for the analysis level plan a rolling model of preservation, *with a timescale of say 3 months interval*
  - Regular recompilation of analysis level software
  - Full data production of analysis level files, probably MC too

- Defining a strategy for a rolling preservation model
  - Always use newest versions or freeze external software?
  - Continue using the database / have a snapshot of it?
  - Aim to incorporate ROOT updates, other migrations
  - A changes in OS, compiler..

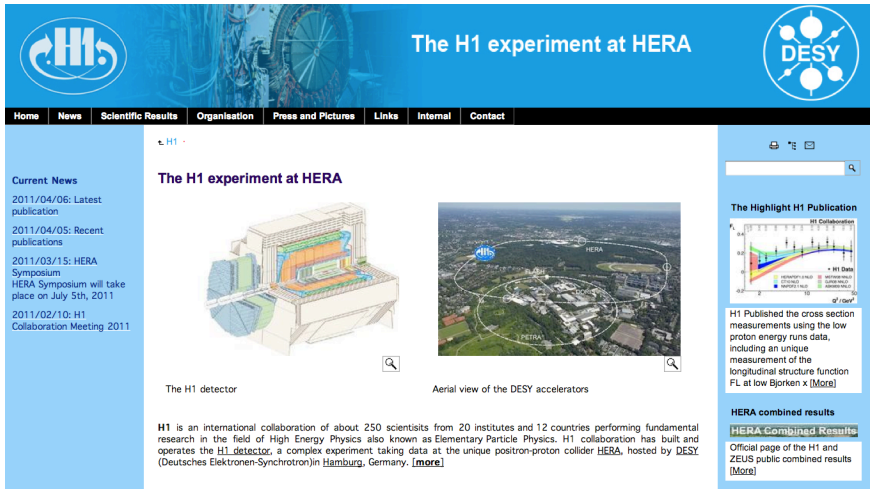
- Surveys of performed of current hardware used by the collaborations and the future needs, given that this will disappear at some stage
  - Must assume that we have no dedicated hardware from 2015

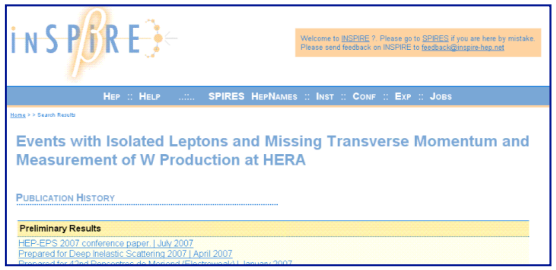
DPHEP 3 Future archival storage of data

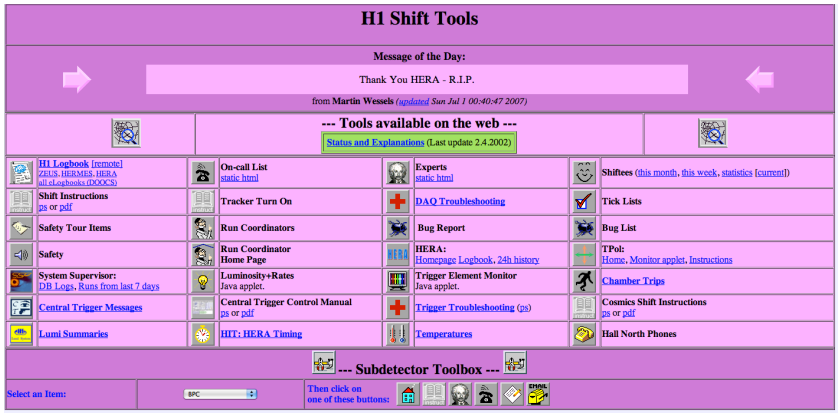
- Present storage system at DESY-IT “as is” not suitable for archive
  - Discovery of problems with file integrity depends on user activity (files are only checked once they have been read..)
  - There is too much manual work involved (tape migrations, database consistency)
  - Weak connection between the user-end system and the storage back-end

- Develop a system needed for long term preservation at DESY
  - End-to-end data integrity checks, periodic inventory of archive with file fingerprint
  - Verification of file content; file recovery in a reasonable amount of time
  - Possibility to store and retrieve large amounts of data
  - Ease the migration to newer storage technology

Documentation: digital







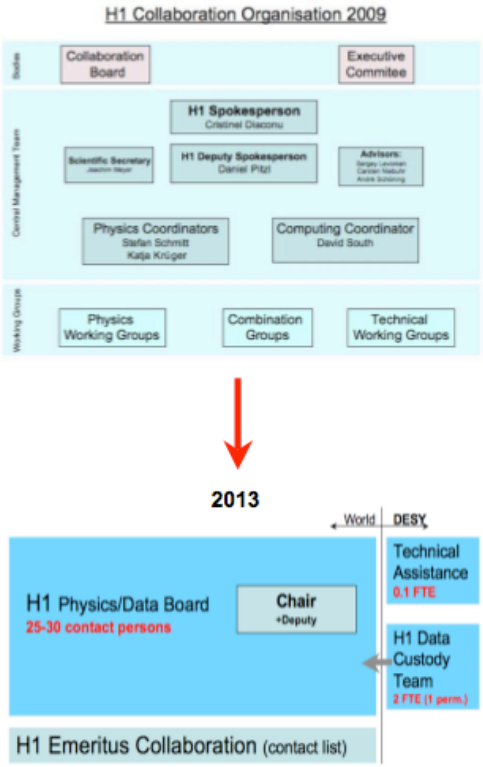
- Many different sources of digital documentation are around
  - Old online shift tools: may be particularly vulnerable to losses
  - Electronic logbooks, trigger, components, detailed run information
  - Calibration files on old hardware, was it all rescued?
  - Back-end of web pages currently spread over many volumes and irregular structures
  - Who will take care of this after the “end” of the collaboration?

Documentation: non-digital

- Current location: Where is everything now?
  - Physics and technical talks from pre-web days
  - Detector schematics, blueprints..
  - Experimental hall *again*: artefacts: logbooks..?
- Is digitisation a viable solution?
  - Can we digitise paper documents?
  - Or pay someone to do it?
  - Which items, do we need it, how much?
- Future location: Where can we put everything?
  - Old documentation rooms due to be reassigned (renovation at DESY)
  - Need to catalogue the existing contents and consolidate non-digital documentation in one place from other areas at DESY
  - Can the library provide physical space?

Future collaboration structure

1. **Define the end of the H1 Collaboration in the present form**
   - 06/2013 defined by the common funding
2. **Adopt long term organization scheme:**
   - H1 Physics Committee overview the operations: nominations and appointment by September 2010
   - Infrastructure: DESY responsibilities to be defined
   - H1 Emeritus Collaboration is linked to the usage of data
3. **Data access should remain possible in the next period**
   - Consolidate the analysis environment and hardware in the present configuration
   - One more technological step (SL6+new h/w) near end 2012
   - A technical proposal is in progress (target 2013-2023, to be defined)
4. **H1 plays a major role in DPHEP**
   - Extra resources for the extension of the data access to be identified outside the internal computing effort
   - Close connection with DESY/IT, ZEUS, HERMES



- Discussion on the various models of the organisation of ZEUS after 2013 has started in Collaboration Meeting in Kiev in October 2009
  - Due to change of management of the ZEUS collaboration postponed until the coming collaboration meeting in autumn 2010

Areas of interest

- Try to package the project into manpower requirements
  - This is just an initial collection of different areas we've examined into groups
  - The formal proposal may differ, and will certainly go into more detail

Documentation Master (0.5 FTE) *1 year*
Non-digital documentation
Web pages and other digital
Includes some database dependencies

Virtualisation / Validation Projects (1.0 FTE) *1-2 years*
Project with DESY-IT for validation suite
Stand alone effort with CERN VM
SLD5(6) migrations
External dependencies
Web server migrations and virtual environments

Outreach ***(parallel project..)***
Would be nice, but needs some thought about how to proceed

Project with INSPIRE ***(parallel project..)***
Highly attractive, and important even, promising ideas

H1 Hardware Supervision (1.0-2.0 FTE) *2-3 years*
GRID infrastructure and interfaces
Batch farm maintenance
H1 desktops, h1wgs (user level)
Digital preservation, hardware archaeology

H1 Software Supervision
H1OO maintenance + validation
Fortran (more validation)
GRID, MC production
Data and MC sets for preservation

DPHEP 5 First person-power estimates

- Which then turned into person-power requirements
- Similar requests from the different experiments
- Follows typical manpower profile contained in the first DPHEP publication

		2011	2012	2013	Translates into Position	2014++
DESY-IT	Validation	1.0		0.5	3 year FTE 2011 – 2013	(0.5)
	Storage		1.0	0.5		
H1	Validation	0.5	1.0	0.5	2 year extention for 2011 – 2013	(0.5)
	Documentation	0.5	0.5		1 year extention for 2012	
ZEUS	Validation	0.5	1.0	0.5	(Initial) 2 year FTE 2011 – 2013	(0.5)
	Documentation	0.5	0.5		1 year FTE 2011 – 2012	
HERMES	Validation			0.5	0.5 year extention for 2013	(0.5)
	Documentation	0.5	0.5		1 year FTE 2011 – 2012	

Description data preservation projects at DESY

- **Documentation**: INSPIRE, digital meta-data and non-digital material

- Data preservation: this really means preservation of the software and working environment: **A validation system** (`sp-system`) idea

- **Archival storage** of the data

- Governance, **future collaboration structures**, open access/outreach

DESY-DPHEP projects with INSPIRE

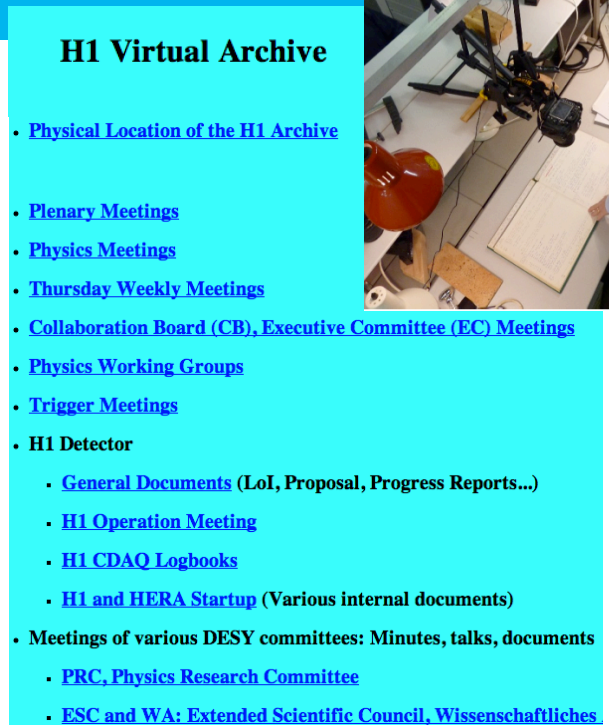
- Successful collaboration with INSPIRE and the DESY Library
- ALL HERA collaboration internal notes now on INSPIRE
  - In the case of ZEUS, this is over 1800 new records!
  - Also completed for HERMES and H1
- Work on going in further projects
  - List of theses available now
  - Upload of additional theses
  - ZEUS explore putting their preliminary results on INSPIRE too
- Collaboration curator accounts now installed for all experiments
  - Self management of material

Collaboration web pages

- All HERA collaborations have now moved their web pages to a new host in the DESY-IT virtual environment
  - Removing the need for dedicated hardware in the future
- ZEUS are migrating their pages to a more future-proof, simplified version with a flat html structure
  - Thorough survey of all content, consolidation different material from different sources
  - Removal of databases, php and other specialities, importing from /afs directories
  - New management system considered for meetings, likely indico
- Improvements taking place in other areas such as storage of theses, conference talks and proceedings
  - In many cases, these are additional candidates for storage on INSPIRE

Non digital documentation

- Much material exists from pre-web days
- Requires quite some management, cataloguing and new archives
- Non-digital documentation safely stored in a dedicated library archive
- Some parts of non-digital documentation digitised, including theses, talks, minutes, log books, internal notes,..



H1 Virtual Archive

- Physical Location of the H1 Archive
- Plenary Meetings
- Physics Meetings
- Thursday Weekly Meetings
- Collaboration Board (CB), Executive Committee (EC) Meetings
- Physics Working Groups
- Trigger Meetings
- H1 Detector
  - General Documents (LoI, Proposal, Progress Reports...)
  - H1 Operation Meeting
  - H1 CDAQ Logbooks
  - H1 and HERA Startup (Various internal documents)
- Meetings of various DESY committees: Minutes, talks, documents
  - PRC, Physics Research Committee
  - ESC and WA: Extended Scientific Council, Wissenschaftliches

Status DPHEP-5: May 2011

Status DPHEP-6: November 2012

H1: now an additional third row added

- **1984**
  - **H1 Collaboration Meeting 5-6 Nov. 1984**

Letter from Spokesman G.Weber, 16.11.1984

Copies of transparencies of Reports of the Regional Groups

a) DO Tests	D.Brick	(Brown Univ.)
b) SLD Tests	R.K.Yamamoto	(MIT)
c) Dipole vs. Solenoid fields	J.Feltesse	(Saclay)
d) Small vs. Large Coil including report of UK group on coil size	A.B.Clegg	
e) Track detection in the presence of high background	J.Heintze	(contained in WG 2 report)
f) Detector design problems	F.Brasse	

List of the 8 Working Groups

Date and Main Subjects of future H1 Collaboration Plenary Meetings

Reports of the Working Groups

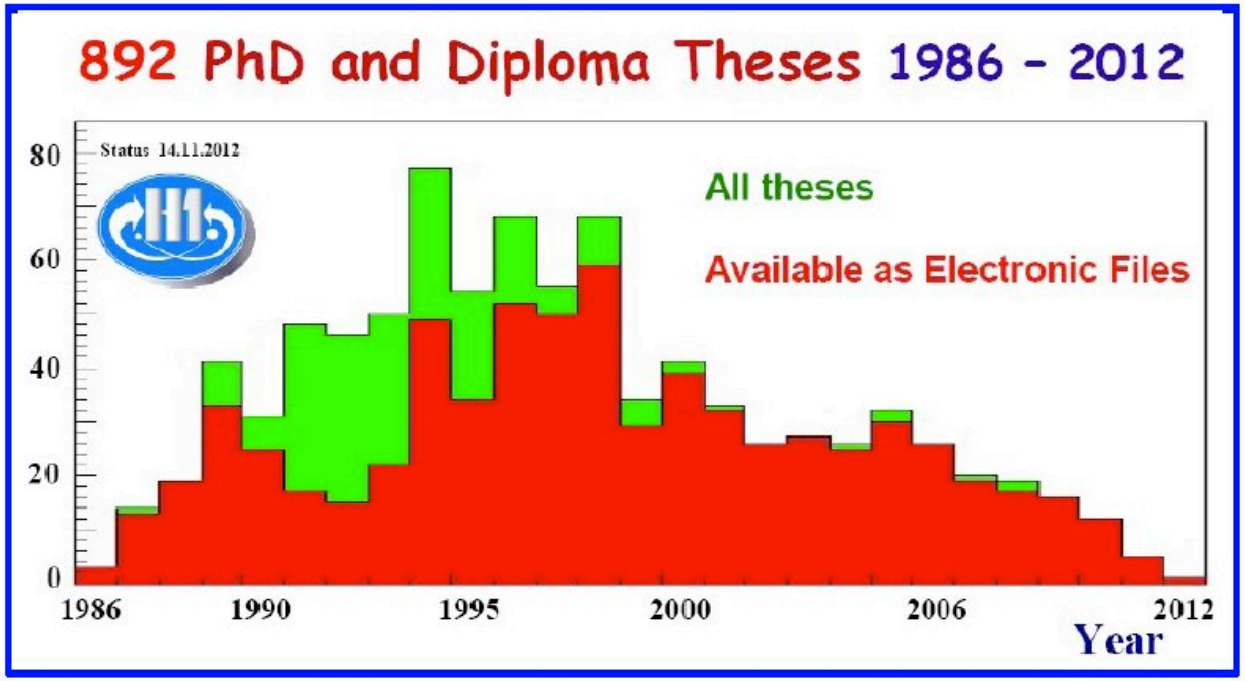
WG 1	Interaction Region	W.Bartel
WG 2	Tracking Devices + TRD: Agenda and Participants list	
	Design for FWD Tracking	R.Marshall
	A Thin Jet-chamber as Forward Detector for a HERA-Experiment ("Radial Wire Jet-chamber")	P.Steffen
	Proposition for a Transition Radiation Detector at HERA	W.Struczinski
	A small, high precision Tracking Device Some preliminary Thoughts!	H.McCann
	High Rate, High Precision Chamber	A.H.Walenta
	CELLO 'Stereo Wire Chamber' for HERA?	L.Criegee
	Track Detector	J.Heintze
WG 3	Detector Simulation	H.-U.Martyn
	Calorimeter Studies	G.Lindstroem
	WG3 List of participants	
WG 4-7	Remark "no transparencies"	
WG 8	Physics and Event Simulation	B.Stella

List of Participating Institutes (as of 12.11.1984)

Document "Design Principles for HERA-detectors" F.Eisele and D.Wegener (18.01.1984)

H1 Theses

- Since October 2010, **106** H1 theses discovered not previously known to the collaboration; **18** since this summer, latest ones only last week
- Scanning and linking these to the official H1 pages is given high priority



- Currently, of the 892 known H1 theses 197 are not available in electronic form: ~ 22% not available to the H1 community!

Data preservation strategies of the HERA experiments

Increasing cost, complexity and benefits

	Preservation Model	Use Case	
1	Provide additional documentation	Publication related info search	**Documentation**
2	Preserve the data in a simplified format	Outreach, simple training analyses, information transfer theory/expt.	**Outreach**
3	Preserve the analysis level software and data format	Full scientific analysis, based on the existing reconstruction	**Technical Preservation Projects**
4	Preserve the reconstruction and simulation software as well as the basic level data	Retain the full potential of the experimental data	

Preservation level 4

- Keep full chain from compilation of simulation, reconstruction and analysis code
- Retain the full flexibility in the future for data and MC production

Preservation level 3-4 (no compilation)

- Data and MC preserved in the form of ROOT-based Common Ntuples
- Maintain the ability to simulate small samples of new MC with existing executables

Preservation level 4

- ADAMO-based micro-DST files for data and MC
- Compilation of full analysis chain, production

HERA data for preservation

Final data reprocessing to mDST completed in 2009

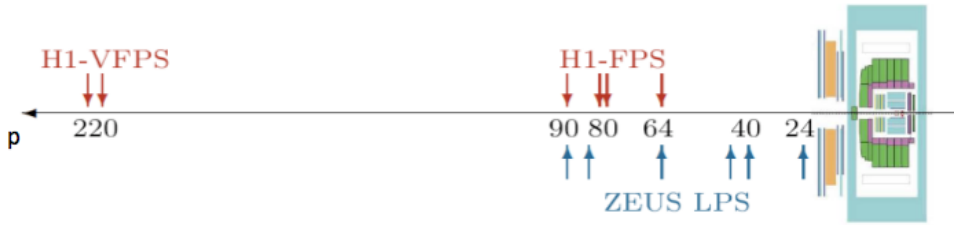
- Basic preserved data format: ROOT based “Common Ntuples”
- Ultimately RAW, MDST data and MC removed from robots, keep only cNuptles
- Final production of data/MC cNuptles started, to be completed early 2013

Final reprocessing (DST-7) of HERA II data in 2009, HERA I done in 2012

- Final version of *common analysis software environment* + *files*, H1OO also done
- Preserve RAW data, as well as DST-7 and H1OO 4.0 versions
- Large MC production of up 2.10^9 events / year, preserved MC sets to be decided

Final data and MC production completed in 2012

- Main format for analysis is the mDST, this is the one to be preserved
- Importantly for HERMES, all data/MC productions now moved to dCache



Dialogue with DESY machine group concerning their HERA data

HERA data for preservation

Final data reprocessing to mDST completed in 2009

- Basic preserved data format: ROOT based "Common
- Ultimately RAW, MDST data and MC removed fr uptles
- Final production of data/MC cNuptles starte 2013

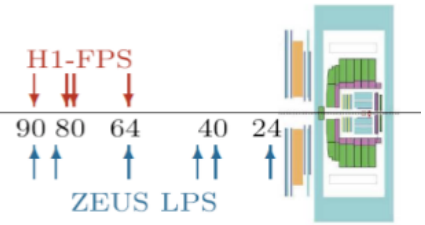
Final reprocessing (DST-7) of HERA done in 2012

- Final version of common anal nt + files, H1OO also done
- Preserve RAW data, as O 4.0 versions
- Large MC productio ear, preserved MC sets to be decided

Final data and ted in 2012

- Main f mDST, this is the one to be preserved
- In , all data/MC productions now moved to dCache

Total for HERA experiments: ~ 1 PB
Data preservation is not about the data!



Dialogue with DESY machine group concerning their HERA data

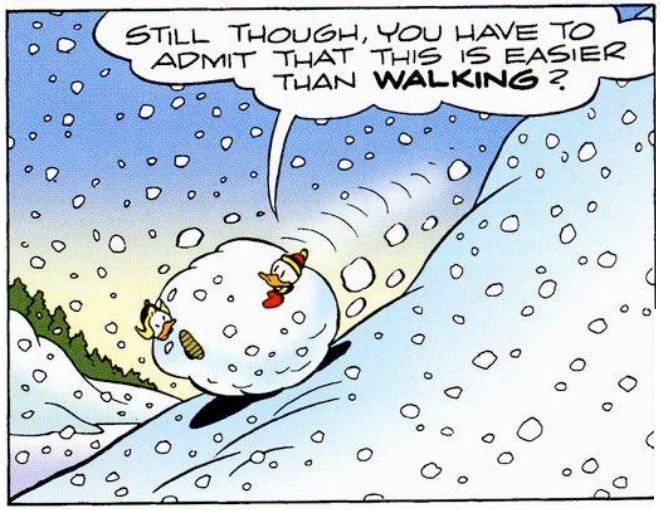
Isn't it obvious, virtualisation will solve everything?

My first and very naïve ansatz

- OK, why don't we just put everything an a virtual machine?
  - Data archival is done elsewhere, just need "to plug that into the VM"
  - Your VM contains everything you need to develop and run code and analysis
- The problem would then be reduced to maintain virtual images, and maintain their ability to run. In the Cloud era, seems like a trivial task
- Problems: Everything in IT is a moving target:
  - Will your network always be the same?
  - Will your access protocol always be the same?
  - Are you sure you do not need new software (e.g. MC generators) that require a new OS?
  - Are you sure your i386/SL4 VM will produce the same results when emulated on a quantum computer in NN years?
  - What about service you need, like CondDB,…
- Naïve virtualization will not work… but still, virtualization can help

Freezing vs rolling

- **Pro Freezing**
  - One-time effort, very small maintenance outside of analysis phase
  - Also allows software w/o code (but might fail with DRM / licensing issues)
- **Cons Freezing**
  - Rely on certain standards and protocols that may evolve
  - Potential performance problems



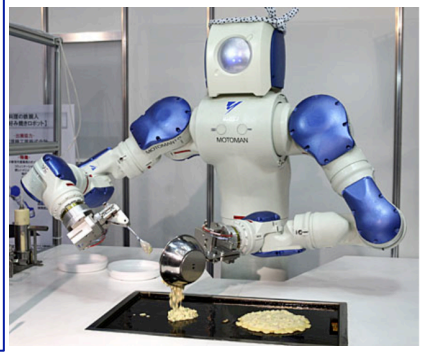
- **Pro Test-driven migration**
  - Usability and correctness of code is guaranteed at every moment
  - Data accessibility and integrity can be checked as well
  - Fast reaction to standard/protocol changes
  - General code quality can improve, as designed for portability and migration
- **Cons Test-driven migration**
  - Needs long-time intervention, more man-power and resources needed
  - Some knowledge of the frameworks must be passed to maintainers

Yves Kemp (DESY-IT)

Pizza Preservation

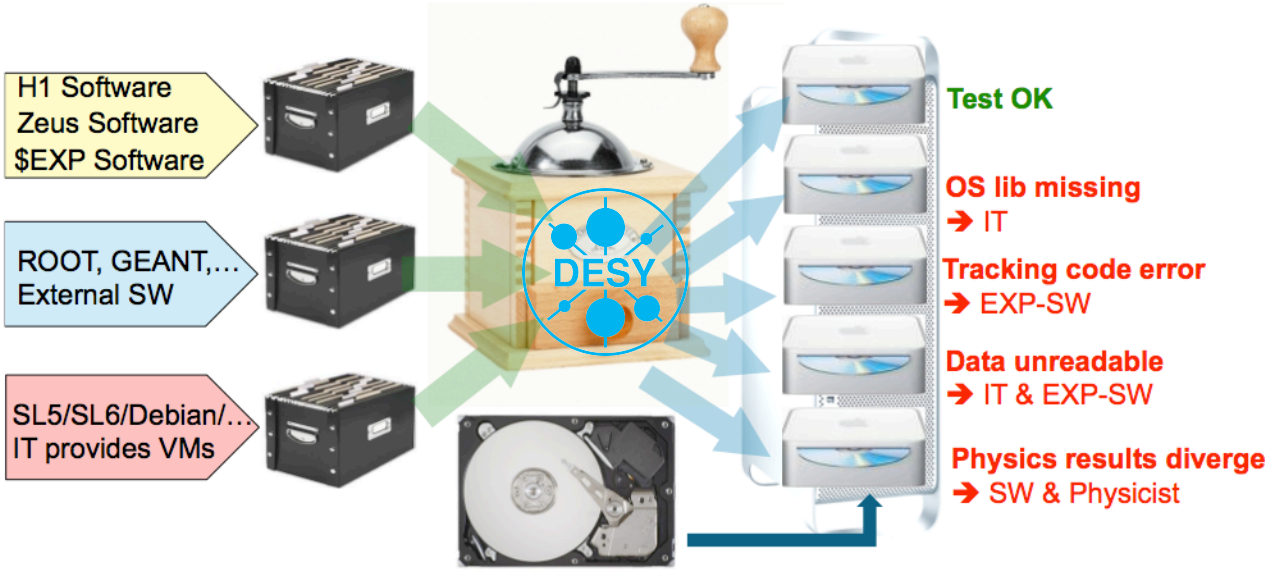
- Couple of days
  - Fridge
- Couple of month
  - Deep freezer
- Couple of years???
  - Preserve the recipe
  - Practice it often: You will not forget the recipe and you can detect variations in external dependencies

Y. Kemp, D. Ozerov, CHEP 2012



- Whilst freezing the software and environment is easy to do, long term use and correctness of the results not guaranteed
  - Naïve assumption virtualisation solves everything breaks down at the first security hole
- Freezing software is *OK* if the timeline and scope are reduced, but if changes are needed this is more difficult the longer software is frozen
- Better to cook the same recipe again and again (and maybe even allow it to be improved), validating the output *automatically*
  - Virtualisation can help!

The Software Preservation System @ DESY



- Automated validation system to facilitate future software and OS transitions
  - Uses virtualisation techniques to repeatedly run well defined tests
  - Perform checks of different and evolving environments (OS, s/ware configuration)
  - Stand alone system: No hidden dependencies or /afs access etc: rigorous testing
  - Automatically check these results against predefined, default values
  - Notify when test results differ from these values
  - Separate responsibilities of IT and the experiments

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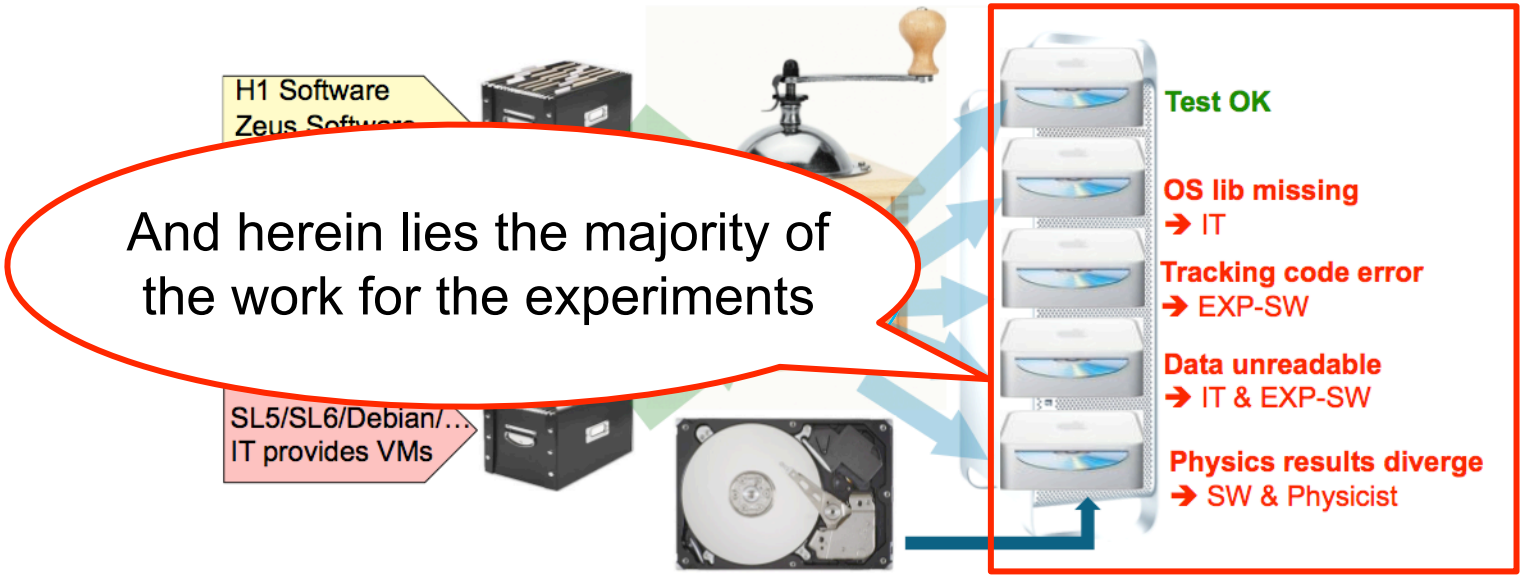

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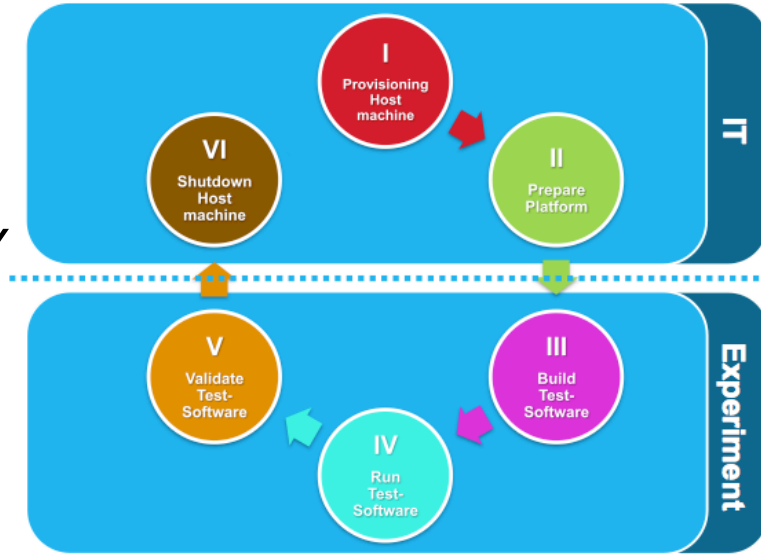
First test runs in pilot project at CHEP 2010

	SL4	SL5	Fedora 13	
ROOT V5.26	-no F77 compiler gfortran found -libX11 MUST be installed	Estimated ROOTMARKS: 1534.29	Estimated ROOTMARKS: 1512.76	Compilation
H1Data analysis	Processed 47243 events with J/Psi candidates Histogram written to jpsi_mods.root	Processed 47243 events with J/Psi candidates Histogram written to jpsi_mods.root	Processed 47243 events with J/Psi candidates Histogram written to jpsi_mods.root	Run pre-compiled tgz using compat libs
ZEUS MC prod	> ls -lh ZEUSMC.HFSZ627.E8954.GRAPE.Z01 4.2 MByte	> ls -lh ZEUSMC.HFSZ627.E8954.GRAPE.Z01 4.2 MByte	> ls -lh ZEUSMC.HFSZ627.E8954.GRAPE.Z01 4.2 MByte	Run pre-compiled tgz using compat libs
HERA-B	Compilation OK DB connect fails	Compilation OK DB connect fails	Compilation failed – needs code change	Compilation

The `sp-system`: Towards the full implementation

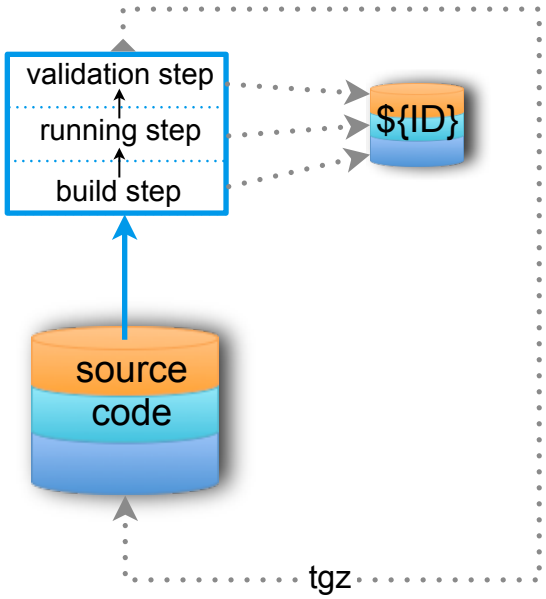
- Pilot project in 2010
  - Single configuration, simple tests
- Full implementation now installed at DESY
- Common baseline of SLD5 / 32-bit achieved in 2011 by all experiments
  - Sound starting point for validation



- Following OS configurations now available in `sp-system`:
  - **sl5.6/64**(gcc4.4), **sl5.7/32**(gcc4.4), **sl5.7/64**(gcc4.1), **sl5.7/32**(gcc4.1), **sl6.2/64**(gcc4.4)
- In addition, to multiple ROOT versions
  - **5.26**.00d, **5.28**.00c, **5.30**.05, **5.32**.00, **5.34**.01
- 64-bit systems a major step toward migrations to future OS and hardware
  - SL6 will only be supported in 64 bit variant at DESY
  - NFS4.1 technology, to be used in dCache, native only in SL6.2/64 or higher

Running jobs in the `sp-system`

- Initial step
  - Compilation of analysis (level 3) and sim/rec (level 4) software
  - ***Or:*** use tar-balls with pre-compiled software
  - Provide access to software
    - Copy tar-balls to persistent storage
  - All output kept in directory with unique name



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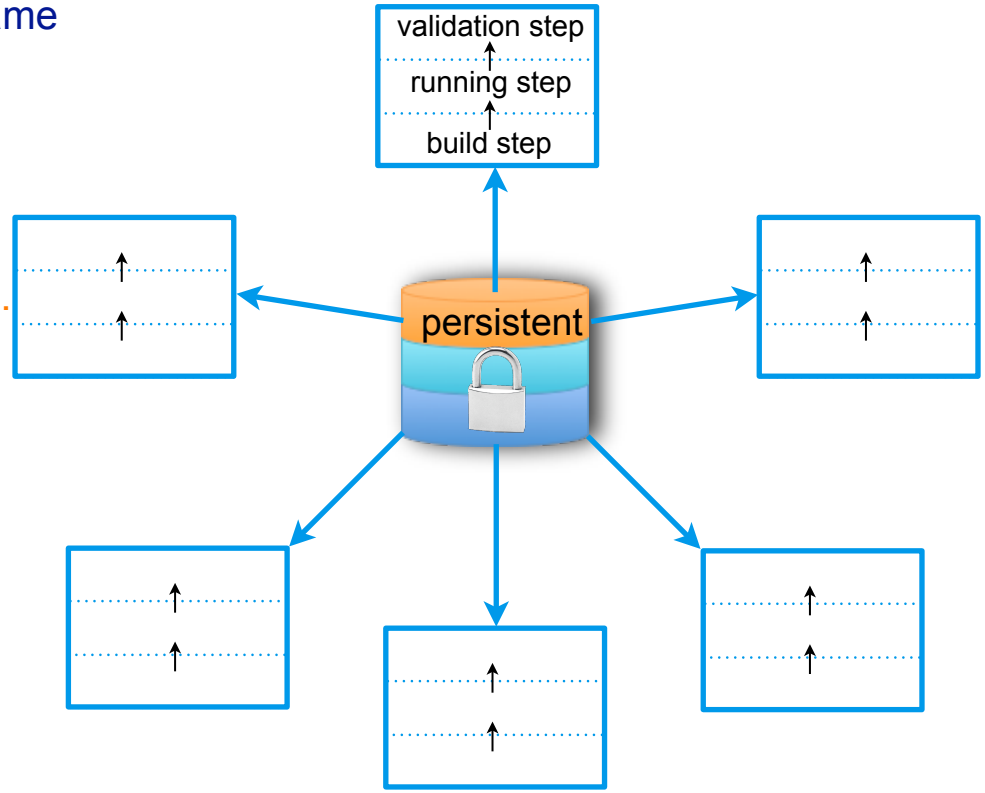
  - Set up software environment
  - Validate binaries with persistent input
    - e.g. event display, database access, ..



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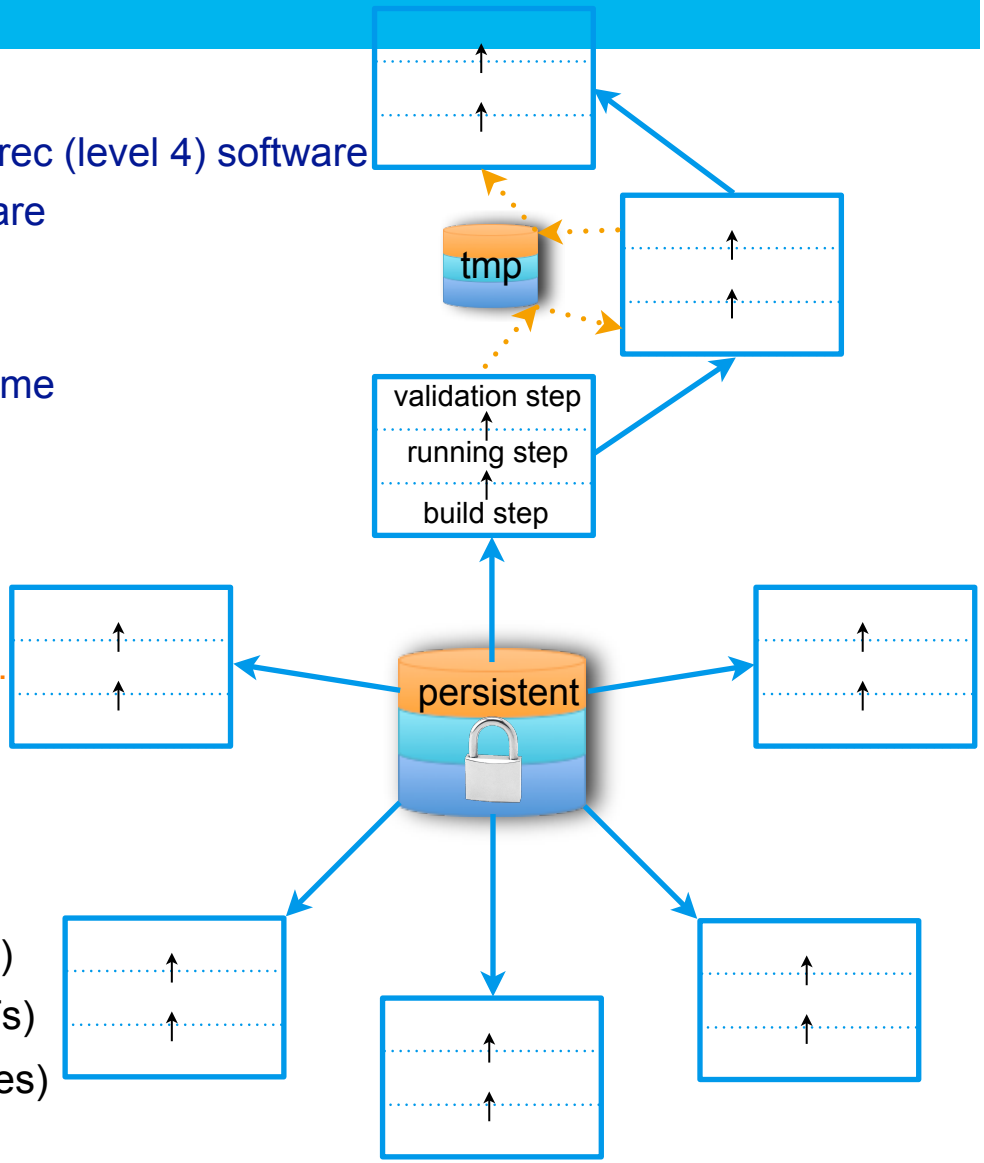
- Run sequential tests
  - Set up software environment
  - Validate file production
    1. MC generation (produce gen files)
    2. Reconstruction (gen. files → DSTs)
    3. Analysis level (DSTs → ROOT files)
  - Tests use output of previous test as input
- Results remain accessible or can be reproduced with identical results



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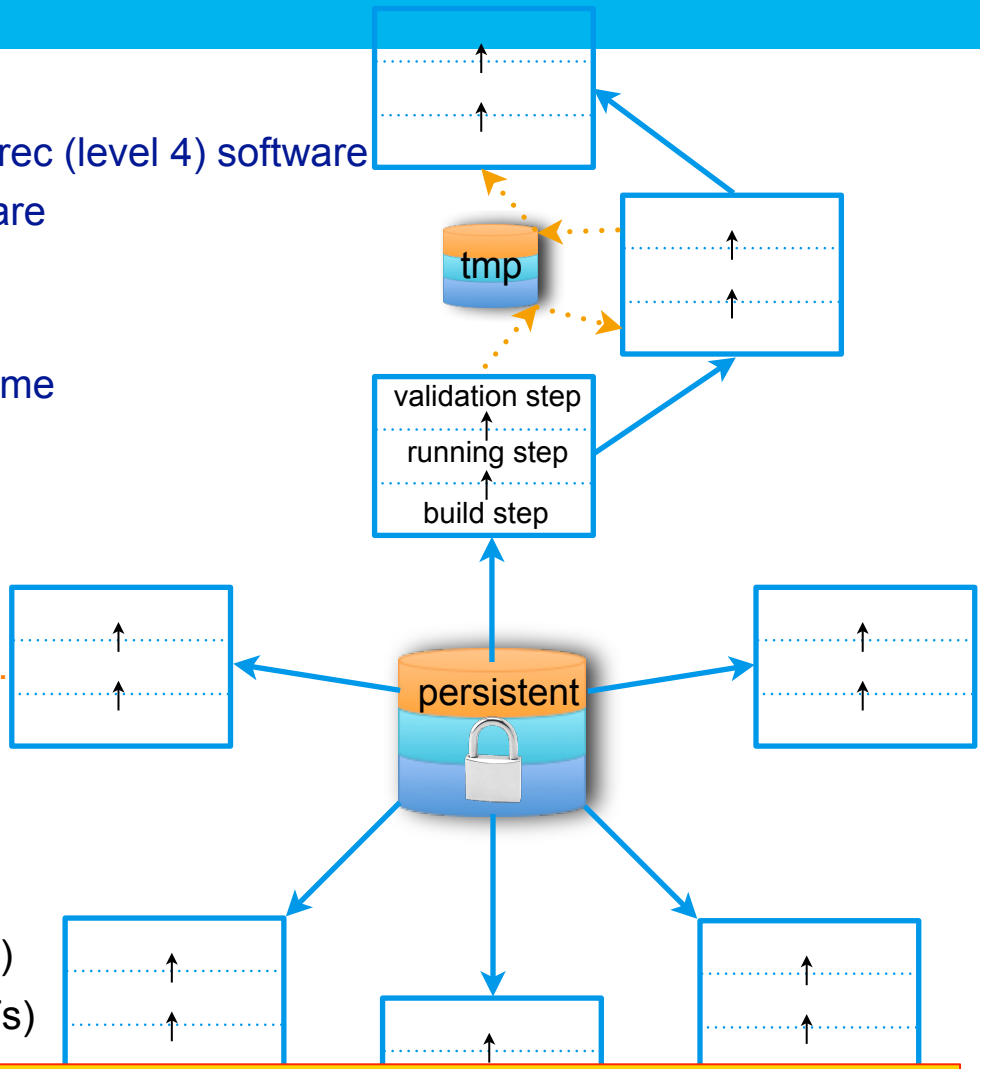


➔ It is essential to have robust definition of complete set of experimental tests

The nature and number dependent on desired preservation level

First sketch of H1 tests

++++++++++++++
++++++++++++++
++h1 executables
++++++++++++++
++++++++++++++
antlr
batch_kinit
cartl
chk_tree
dlg
fpack
fplist
fpmerge
fpsubset
h1fttemu
h1geaonly
h1ieeefp.o / h1ieeefp.cpp
h1rec
h1sim
h1simcheck
h1simrec
hostn
l45his
l4his
l4m
l4s
look
ltab
ndbint
nqs2pbs
pbs_tclsh
pbs_wish
pbsdsh
pbsnodes
printjob
printtracking
qalter
qdel
qdisable
qenable
qhold
qmgr
qmove
qmsg
qorder
qrerun
qrls
qrun
qselect
qsig
qstart
qstat
qstop
qsub
qterm
refresh
refresh_init
tracejob
xpbs
xpbsmon

++++++++++
++++++++++
++h1 libraries
++++++++++
++++++++++
#cernlib-gcc44
libLHAPDF.so
libariadne412.a
libbases.a
libbos.a
libcascade2.a
libdatman.a
libdiffvm.a
libfpack.a
libfpack.so
libgksdummy.a
libh1bstrec.a
libh1eclass.a
libh1fttemu.a
libh1geang.a
libh1geanh.a
libh1geant.a
libh1l4.a
libh1look.a
libh1mcutil.a
libh1ndb.a
libh1phan.a
libh1qt.a
libh1rec.a
libh1sim.a
libh1trig.a
libh1util.a
libheracles*.a
libheracles*.so
libhztool.a
libjetset74.a
liblook.a
libpythia62.a
libpythia64.a
librapgap31.a
libshift.a

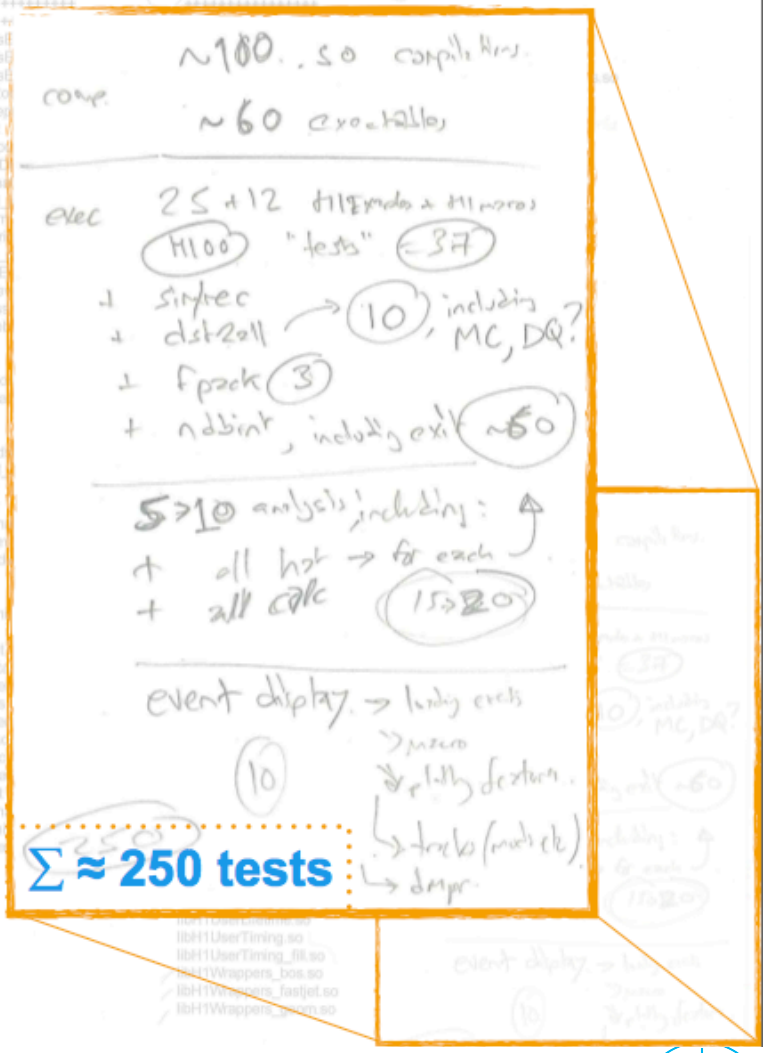
++++++++++++++
++++++++++++++
++h1oo packages
++++++++++++++
++++++++++++++
H1Analysis
H1AnalysisExample
H1Arrays
H1Banks
H1Benchmarks
H1Binning
H1Bos2oop
H1CalcPointers
H1CalcWeights
H1Calculator
H1CalibTrigger
H1CaloTrigger
H1Clusters
H1Cuts
H1ElecCalibration
H1Examples
H1Filler
H1Finder
H1Geom
H1HadronicCalibration
H1Hat
H1HatFiller
H1HfsFinder
H1JetFinder
H1Macros
H1Mods
H1MuonFinder
H1NonepBgFinder
H1OOBanks
H1Ods
H1PartEmFinder
H1PhysUtils
H1Pointers
H1QCDFunc
H1Red
H1SVFit
H1Selection
H1Skeleton
H1SoftLeptonId
H1Steering
H1SubDetInfo
H1Tools
H1Tracks
H1TrkFinder
H1UserCim
H1UserDstar
H1UserFtt
H1UserLifetime
H1Wrappers
oo_tools
#share

++++++++++++++
++++++++++++++
++h1oo binaries
++++++++++++++
++++++++++++++
AnalysisExample
AnalysisExampleExtraction
AnalysisExamplePlots
H1Bos2oop
H1Makeptr
Lt2Root
MakeInputTable
TestQCDFunc
batchAnalysis
boosted_jets
checkcim
cintsteering
clusters_ods
copyMyEvents
create_eventlist
dbaccess
deleteJobs
dst2all
dst2ods
dstar_mods
empz_hat
h1red
h1root
jpsi_mods
kaonfind_ods
l1te_hat
lumicalc
mergeAnalysis
mymkcim
ods2modshat
oolist
oolumi
oomclumi
oomove
oosubset
read_dstartree
read_eventlist
read_ods
read_usertree
rerun_finder
rerun_rec
resubChains
snapshot
steermanager
test_binning
write_eventlist

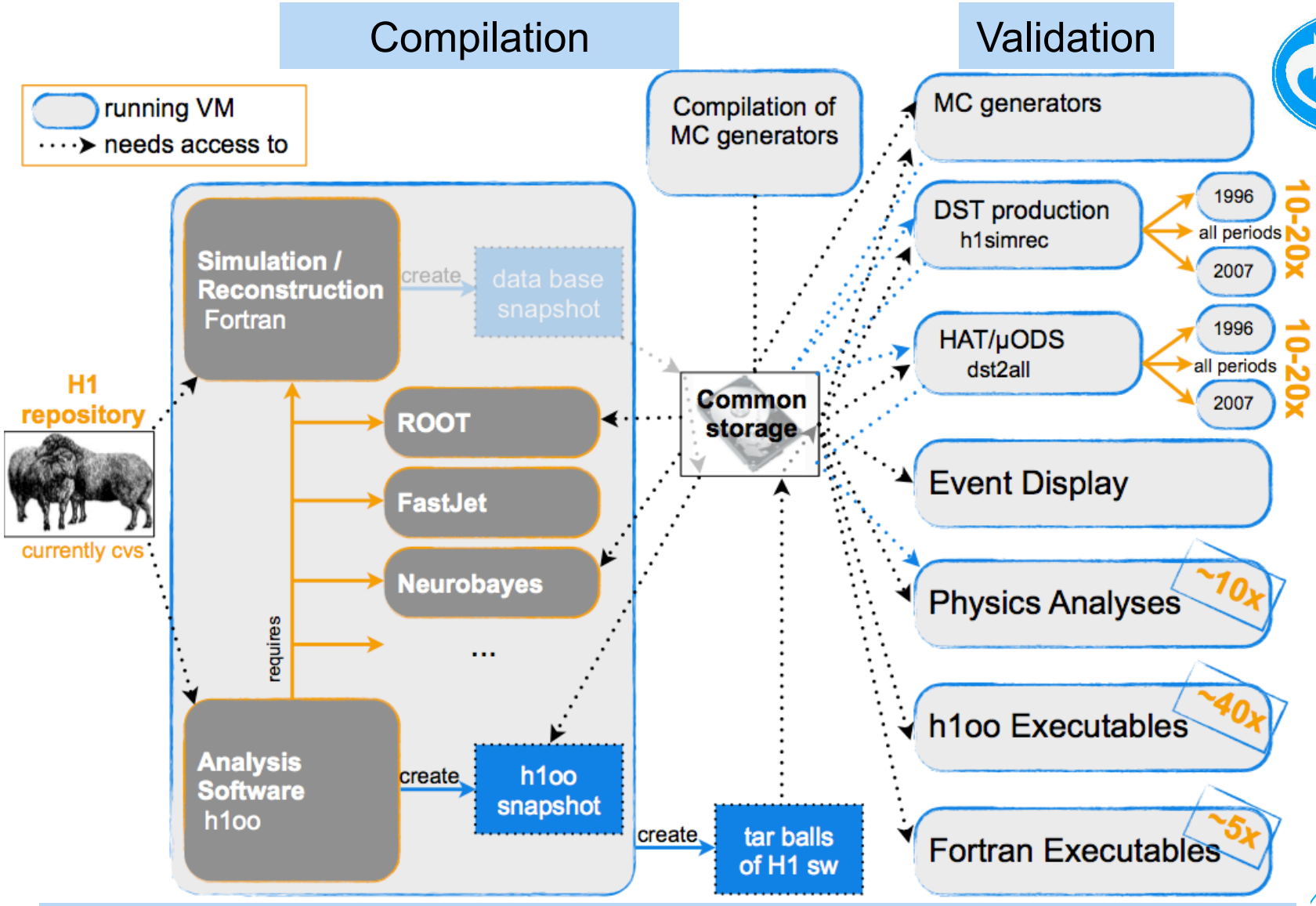
++++++++++++++
++++++++++++++
++h1oo libraries
++++++++++++++
++++++++++++++
libH1Analysis.so
libH1AnalysisExample.so
libH1Arrays.so
libH1Benchmarks.so
libH1Binning.so
libH1CalcPointers.so
libH1CalcWeights.so
libH1Calculator.so
libH1CaloTrigger.so
libH1Clusters.so
libH1Cuts.so
libH1ElecCalibration.so
libH1Filler.so
libH1Filler_odsonly.so
libH1Finder.so
libH1Geom.so
libH1HadronicCalibration.so
libH1Hat.so
libH1HatFiller.so
libH1HfsFinder.so
libH1JetFinder.so
libH1MagfieldOO.so
libH1Mods.so
libH1MuonFinder.so
libH1NonepBgFinder.so
libH1OOBanks.so
libH1Ods.so
libH1PartEmFinder.so
libH1PhysUtils.so
libH1Pointers.so
libH1QCDFunc.so
libH1Red.so
libH1RedLook.so
libH1Red_bos.so
libH1SVFit.so
libH1Selection.so
libH1Skeleton.so
libH1SoftLeptonId.so
libH1SoftLeptonId_impl...so
libH1Steering.so
libH1SubDetInfo.so
libH1Tools.so
libH1Tracks.so
libH1TrkFinder.so
libH1UserCim.so
libH1UserDstar.so
libH1UserDstar_fill.so
libH1UserFtt.so
libH1UserFtt_Filler.so
libH1UserLifetime.so
libH1UserTiming.so
libH1UserTiming_fill.so
libH1Wrappers_bos.so
libH1Wrappers_fastjet.so
libH1Wrappers_geom.so
libH1Wrappers_lumi.so
libH1Wrappers_ndb.so
libH1Wrappers_neurobayes.so
libSISConePluginOO.so
libUser.so
libbosutil.so
libcernlibOO.so
libfastjetOO.so
libfortran.so
libfortranpatchOO.so
libfortranshared.so
libfortranstat.a
libfpackOO.so
libh1ndbOO.so
libh1recOO.so
libmdbdummy.so
libneurobayesOO.so
libsisconeOO.so
libutildummy.so

First sketch of H1 tests

- Validate compilation of
  - ~100 (shared) library objects
  - ~60 executables
    - MC generators not yet included
    - most important:
      - simrec - reconstruction / dst production
      - dst2all - h1oo file production
- Validate correct running of
  - 37 x h1oo
  - 4 x fpack, ndb
  - ≥10 x h1simrec → dst2all → analysis
    - One test for every run period + MC / (DQHat)
  - … Let's say about 60 executables
- Run and validate physics analyses
  - (At least) one test for every run period
    - Inclusive & all HAT/H1Calculator variables
  - 5-10 'real' physics analyses
- Check event display



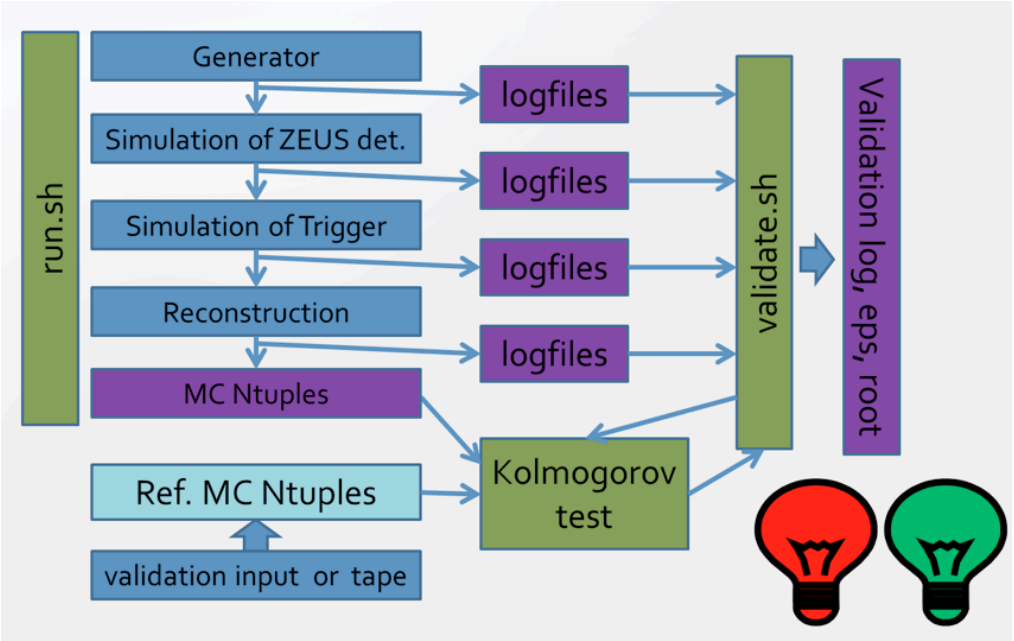
Example structure of experimental tests: H1 (Level 4)



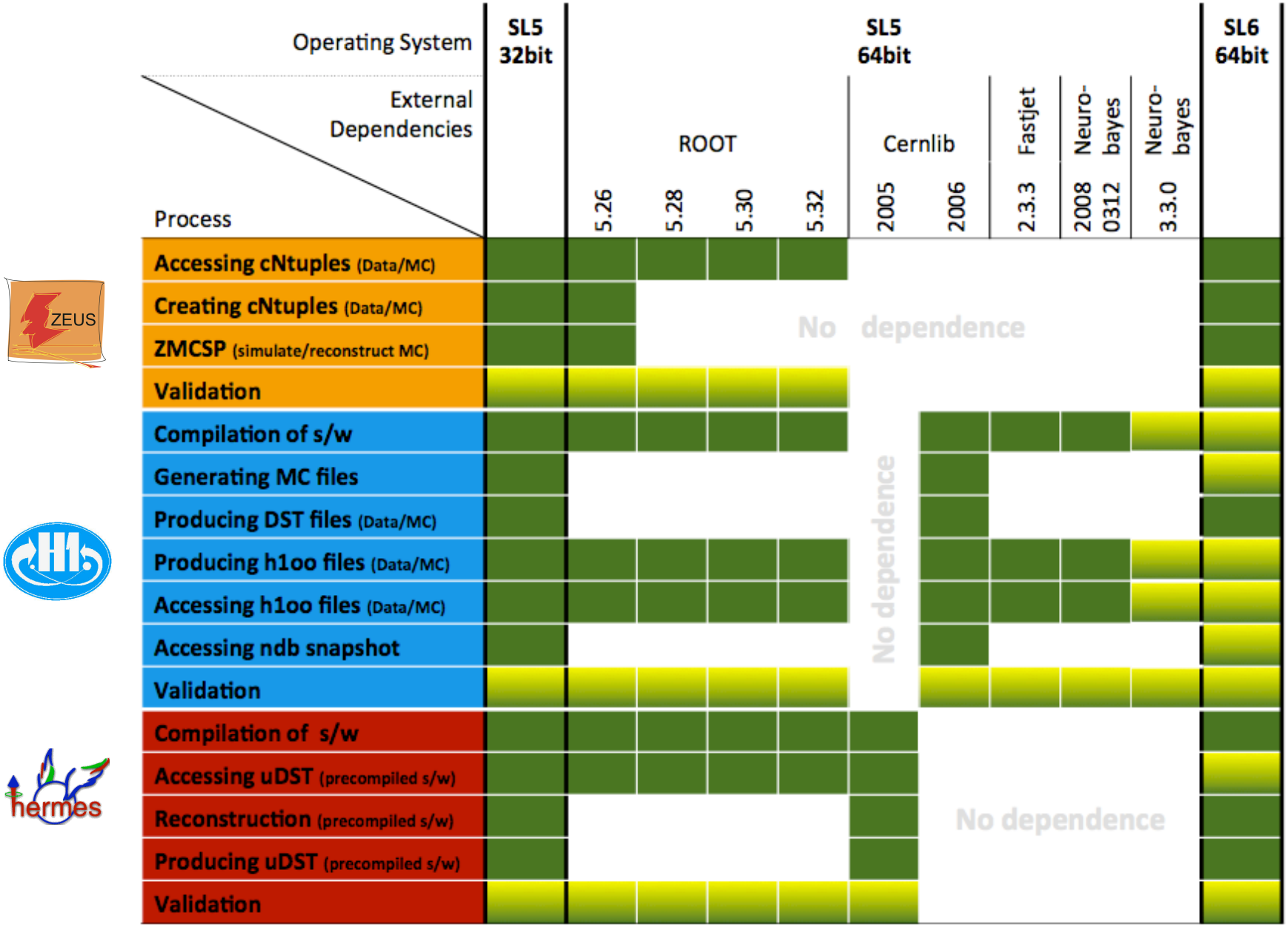
Including compilation of individual packages: about 250 tests planned by H1

Example structure of experiment tests: ZEUS (Level 3 + MC chain)

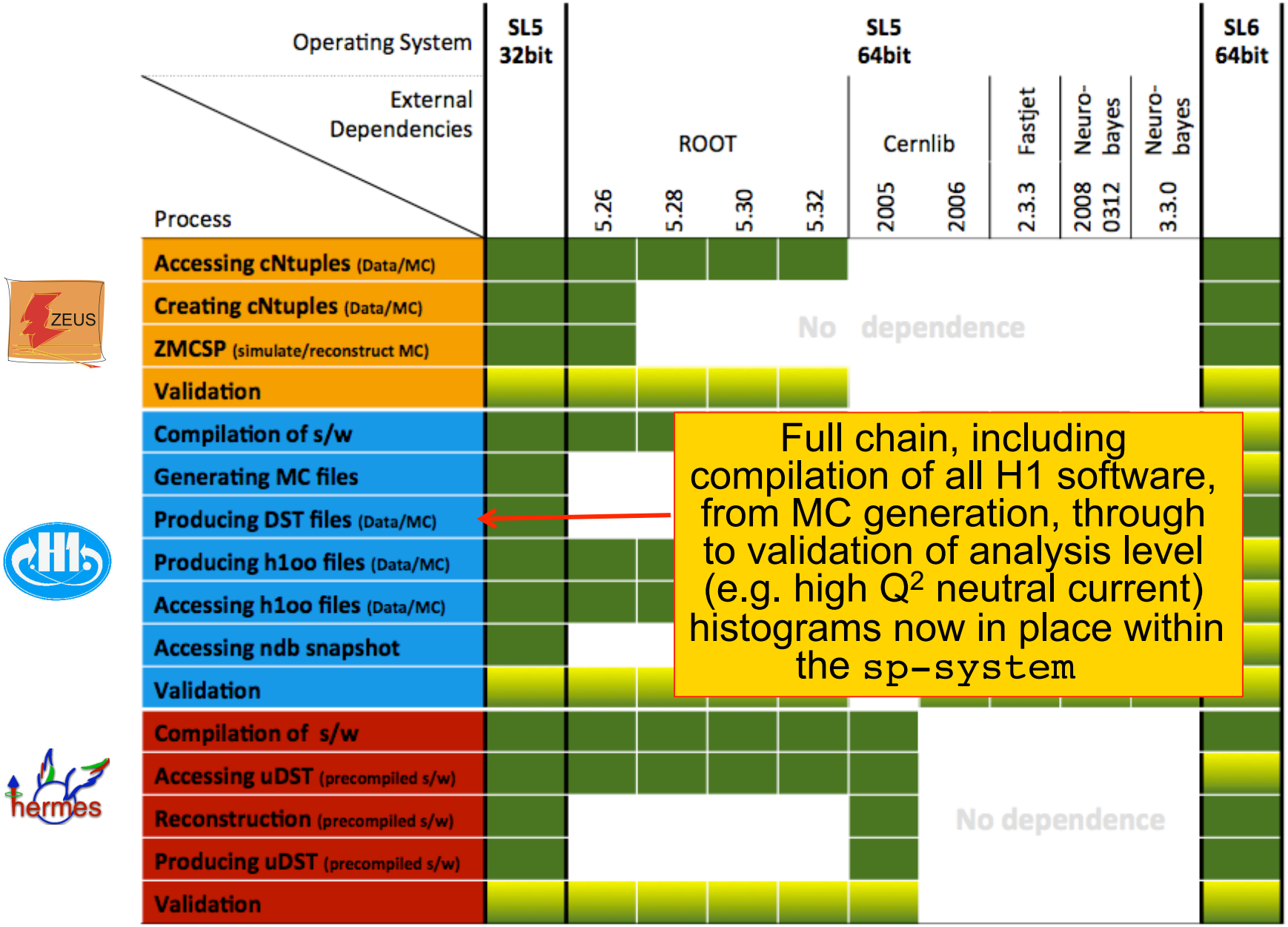
- ZEUS strategy: use ROOT based analysis level Common Ntuples as data format for preservation – DPHEP level 3
- Only external dependence is ROOT
  - Validation of new ROOT versions included as analysis level tests in the `sp-system`
- However, the MC production chain pre-compiled executables will also be preserved as a standalone package
  - Remaining ZEUS SL3 executables continue to work on the SL6/64 OS
- In addition, an interface for new generators is developed, which is also included in the validation system



Putting it all together

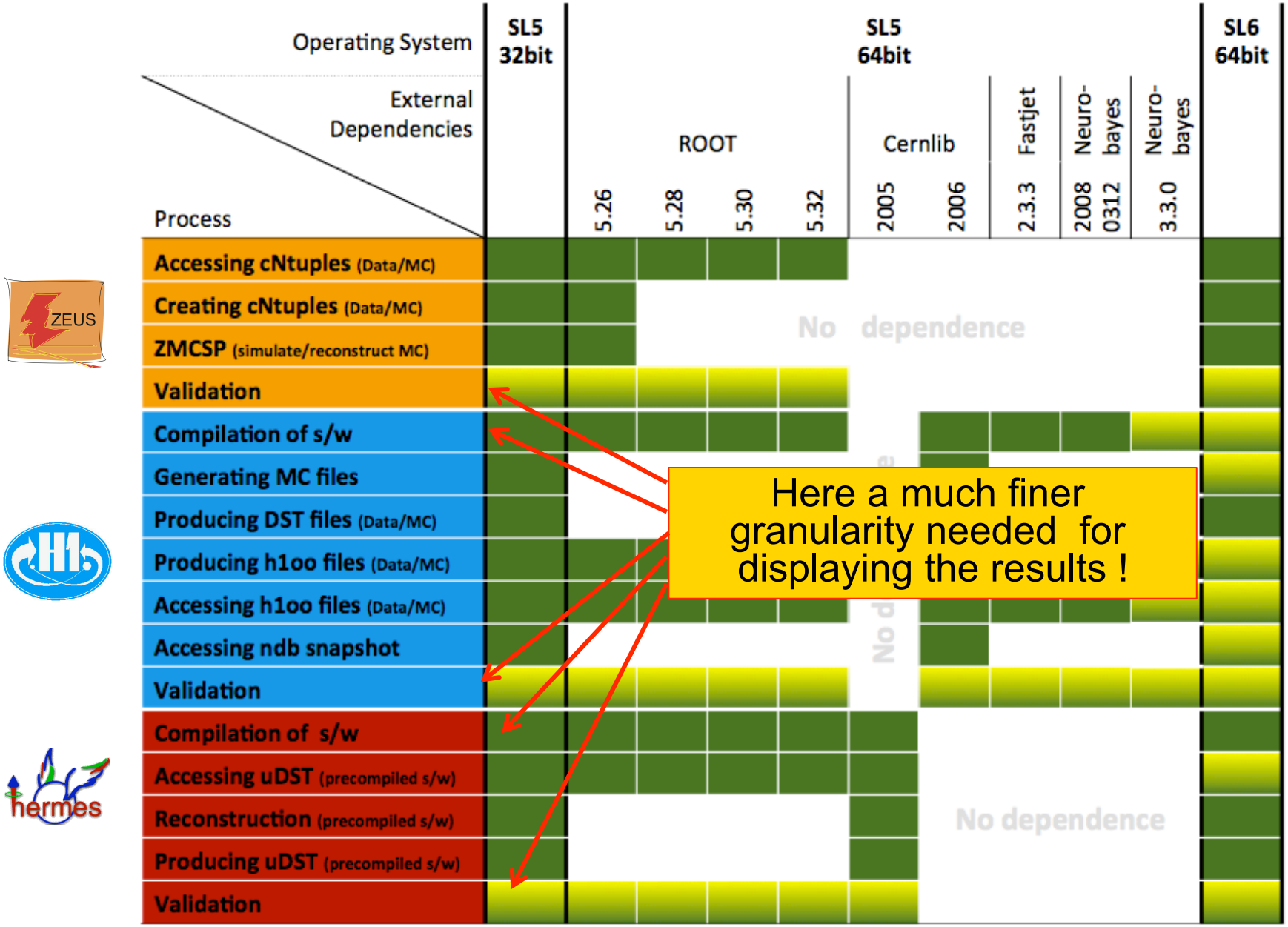


Putting it all together



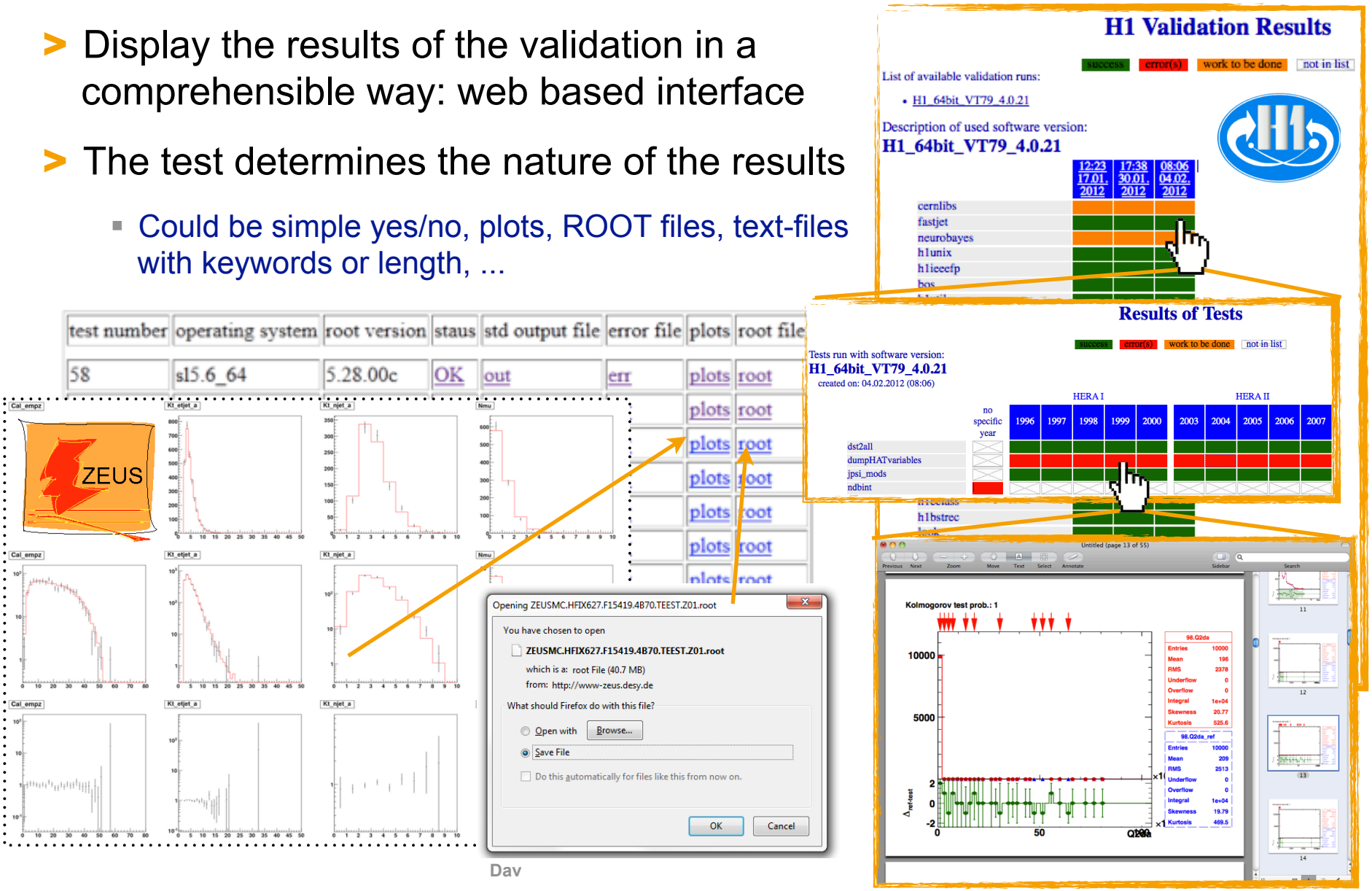
Full chain, including compilation of all H1 software, from MC generation, through to validation of analysis level (e.g. high Q^2 neutral current) histograms now in place within the `sp-system`

Putting it all together



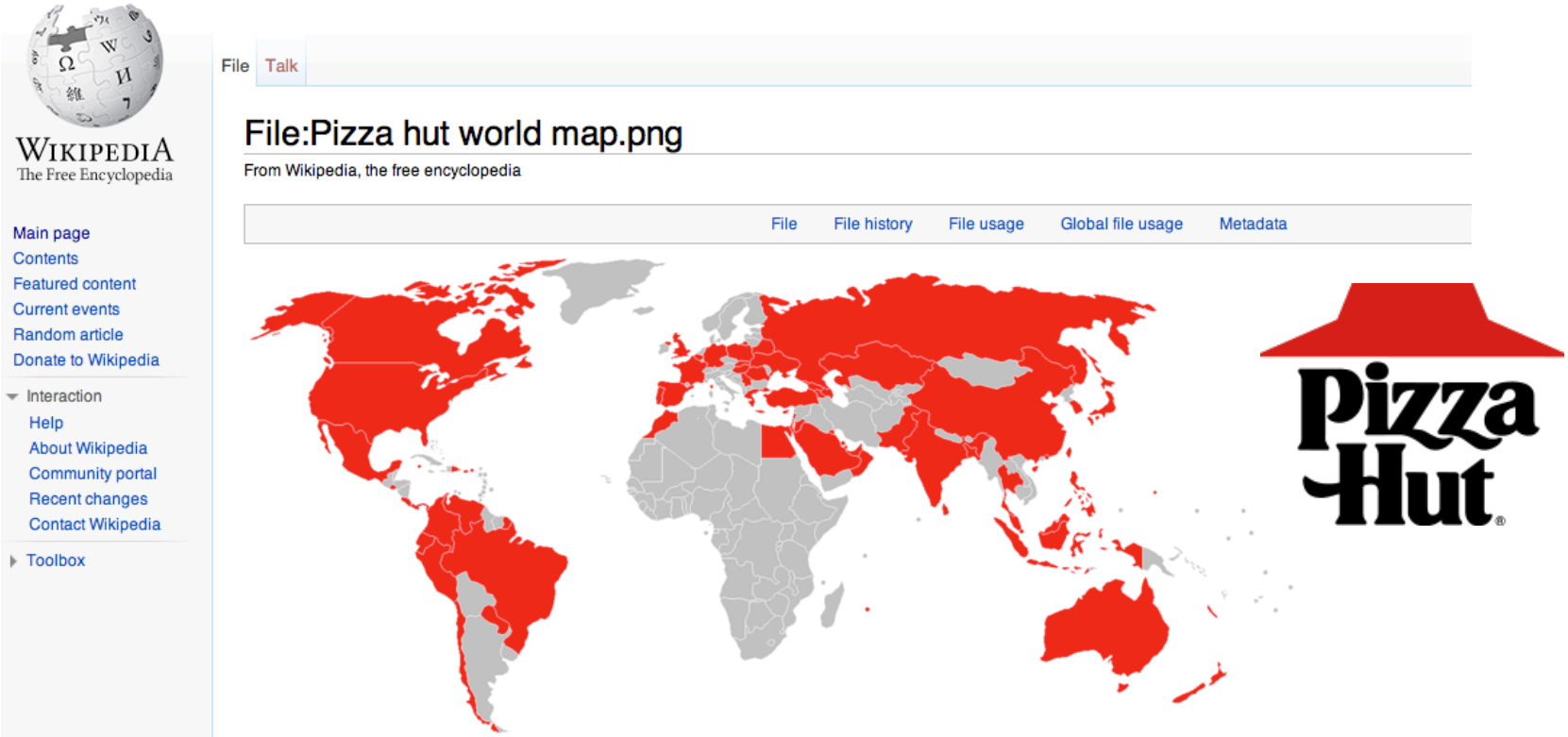
Digesting the validation results

- Display the results of the validation in a comprehensible way: web based interface
- The test determines the nature of the results
  - Could be simple yes/no, plots, ROOT files, text-files with keywords or length, ...



Dav

Deployment



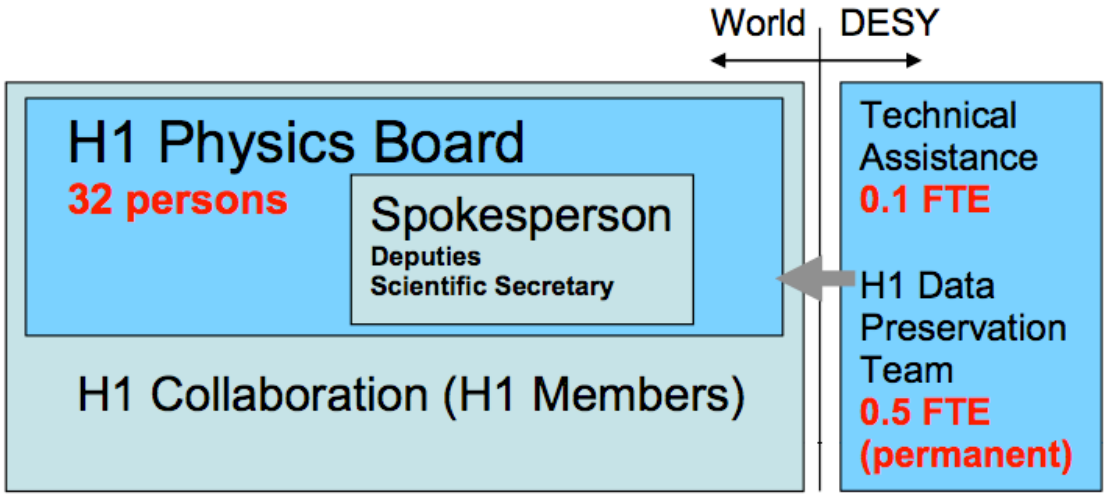
- The whole point of the `sp-system` is ***not*** to provide a future resource for the experiments, but rather to provide a recipe which can be deployed
  - At DESY, this means for example exploring alternative resources such as the local BIRD cluster, the National Analysis Facility (dedicated to LHC, unlikely) or the Grid

Long term archival storage for the HERA data

- Dedicated system too costly in both hardware and person-power
- All collaborations now using dCache for mass storage, and this system will continue at DESY-IT for the LHC, photon-physics, others..
  - By using dCache this is completely transparent for user, relying on IT admin work
  - Active check for the data consistency on disk level, tape copy only for the case if disk copy is corrupted; corresponding checks also on the tape (checksum)
  - For data which have no copy on disk: two copies on tapes (different technology old vs new, but both still readable), regular migration to new media
  - Data which should be archived, but not online all the time – re-pack into larger files
- System properties also defined by which data needed “always online”
  - Initial estimates: ~ 1 PB in total
  - Different strategies visible

	Online	Not online	Total
H1	~ 250 TB	~ 100 TB	~ 350 TB
ZEUS	~ 250 TB		~ 250 TB
HERMES	~ 40 TB	~ 350 TB	~ 390 TB
Total	~ 540 TB	~ 450 TB	~ 990 TB

Changing face of the HERA collaborations



- H1 moved to a new collaboration management model in July 2012
  - Formation of ***H1 Physics Board***, to replace Collaboration Board (institute based)
  - Future author list policies also set down in new constitution approved by collaboration
- ZEUS (and HERMES) management teams retain same model as before, but similarly to H1 the collaborating institute layer is now removed
  - Remaining physics ZEUS working groups are now consolidated to a single physics group

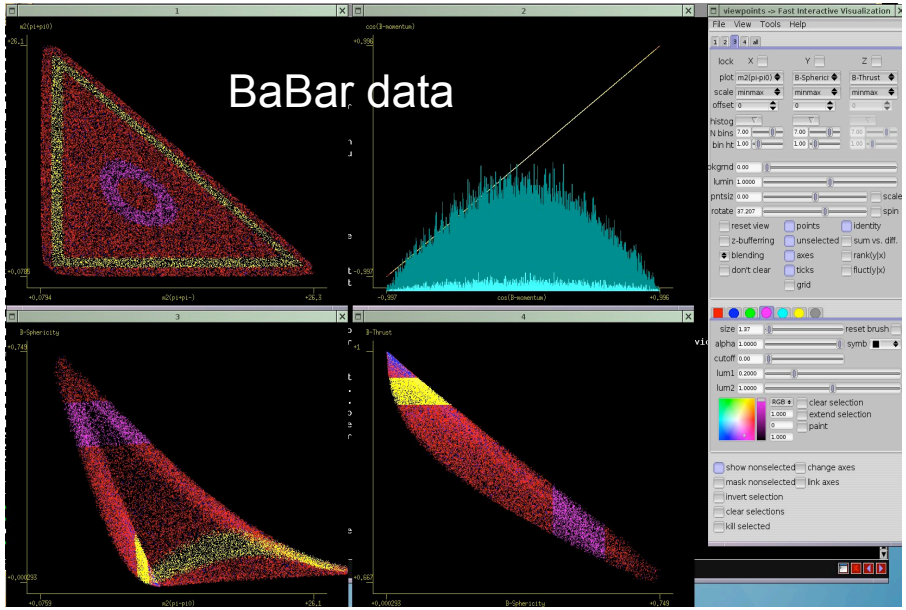
A word on HERMES

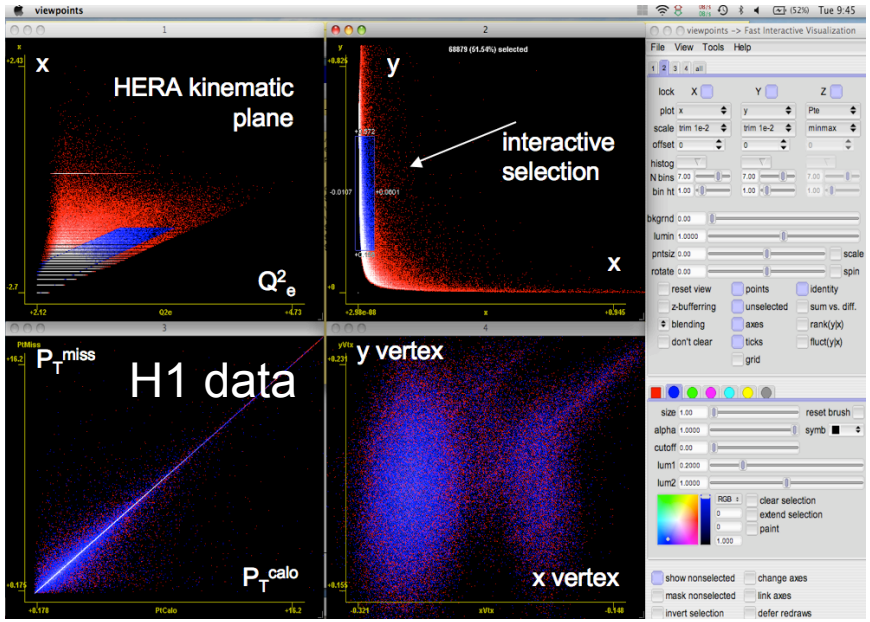
- HERMES financial support officially ended December 31st, 2012
- Last year was a busy time to try to finish off as much as possible, in terms of physics and data preservation
- Still a wealth of interesting physics in their data!

- Validation project not really implemented
- Hardware turn-off and transfer to DESY-IT central services completed

- Current situation has no dedicated manpower for any HERMES activities, including data preservation
- The same will apply to ZEUS and H1 at the end of 2014

I did not really cover outreach...





- ..because we didn't really do it. We always had something in mind, but without attributing dedicated manpower it was difficult
- One nice collaboration was between BaBar and H1, using the NASA Viewpoints application
- Common format: simple text

# Q2e	y	x	PtCalo	PtMiss	Ex	Ptx	Phix	Thx	Ee	Pte	Phie	The	Empz	xVtx	yVtx	zVtx
377.673	0.174	0.021	2.769	2.769	109.685	15.153	-11.780	8.231	26.226	17.665	164.138	137.656	50.542	-0.237	0.207	2.582
185.111	0.399	0.005	2.133	2.133	41.933	12.652	87.669	36.327	18.252	10.544	-93.948	144.713	57.878	-0.248	0.192	-12.829
187.320	0.211	0.009	2.584	2.584	51.742	9.773	78.869	13.682	23.482	12.160	-106.349		148.813	55.164	-0.266	0.208	2.968
264.266	0.508	0.005	0.238	0.360	35.343	11.738	-138.270		64.975	15.984	11.407	41.034	134.465	57.043	-0.225	0.210	5.925
229.056	0.043	0.052	4.204	5.067	65.601	19.196	72.870	17.842	28.485	14.805	-98.351	148.685	58.941	-0.237	0.199	-7.082
275.596	0.121	0.022	4.277	4.282	78.331	18.413	51.596	14.380	26.750	15.562	-139.235		144.425	55.018	-0.234	0.200	-5.038
240.102	0.183	0.013	3.513	3.434	67.134	17.402	85.049	17.201	24.719	14.004	-92.840	145.491	56.060	-0.266	0.202	-1.606
451.996	0.209	0.021	1.723	1.723	49.126	17.196	66.018	24.927	25.936	18.913	-114.452		133.180	55.810	-0.259	0.190	-13.705
524.251	0.572	0.009	2.170	2.170	43.738	17.555	171.073	61.182	16.573	14.987	-11.341	115.274	58.543	-0.249	0.208	4.410
391.944	0.000	0.000	2.107	2.107	183.513	21.270	75.875	6.693	31.602	19.959	-108.713		140.834	58.375	-0.245	0.203	-0.630
201.600	0.212	0.009	4.441	4.441	44.890	17.098	-92.989	27.261	23.578	12.605	86.968	147.683	55.361	-0.243	0.212	7.653
335.881	0.052	0.064	16.769	16.769	29.256	1.142	-90.021	2.250	29.219	17.848	83.461	142.349	52.723	-0.242	0.214	10.137
286.039	0.009	0.315	2.514	2.514	194.560	18.922	-83.365	5.616	29.944	16.837	92.126	145.787	56.826	-0.254	0.193	-11.169
207.703	0.137	0.015	8.095	8.095	84.993	21.487	82.549	15.129	25.701	13.389	-95.886	148.605	53.237	-0.258	0.205	0.895
387.371	0.358	0.011	1.272	1.272	70.266	15.460	-91.456	17.173	21.232	15.772	93.071	132.027	55.684	-0.236	0.198	-5.242
855.333	0.509	0.017	2.588	2.588	88.511	23.066	70.622	21.191	21.306	20.499	-110.759		105.828	56.196	-0.237	0.178	-24.198
154.527	0.667	0.002	3.509	3.509	72.273	8.810	174.450	101.604	10.598	7.176	-28.067	137.379	92.478	-0.240	0.207	4.578
304.756	0.025	0.121	1.622	1.622	120.020	17.765	-145.756		8.522	29.678	17.240	39.272	144.486	55.298	-0.228	0.193	-5.659
278.950	0.627	0.004	3.813	0.726	37.163	9.588	124.342	60.056	12.831	10.205	-53.435	127.311	52.247	-0.243	0.190	-10.069

Current status at DESY

- The documentation effort is coming to a close
  - Many documents now on INSPIRE, including internal notes, preliminary results, theses; may (easily!) be opened up for public access at a later date
  - Webservers and much electronic documentation moved into DESY-IT resources
  - Large and necessary amount of work to consolidate non-digital documentation
- Final versions of HERA data, which are different between the experiments are essentially complete (ZEUS to finish soon)
  - Archival storage to be based on current model, with adaptations
- Collaborations are rapidly shrinking and available expertise leaving
  - Officially no more HERA resources or support after 2014
  - Future analysis model: integrate now into central DESY-IT infrastructure

Current status at DESY

- Most involved and ambitious project is the validation system
  - Successful running of validation jobs in an isolated, independent system, in multiple VM versions and software set-ups
  - Much progress in migrations to 64bit OS, SLD6/64bit is the next step
  - Still much work to do on the validation tests, especially from the (level-4) H1 side
  - But has already shown it's worth in debugging experiment's software

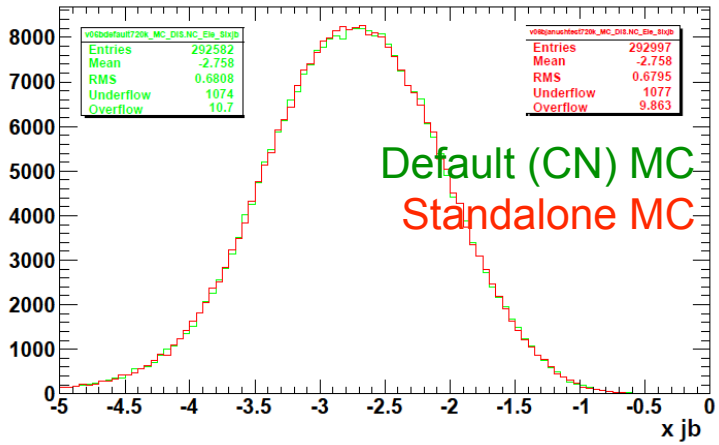
- Concept is portable, generic idea but the majority of the work is on the experiments side
  - Developing a complete set of validation tests and a version of the software that can be run in an environment as isolated as possible
  - Future deployment (outside of DESY) of `sp-system` is an attractive proposition
  - The proliferation of the `sp-system` may also benefit the HERA data in the long run
  - Unlikely that DESY can continue in central role and offer to host additional data sets

Extras slides

HEP MC interface and standalone MC production

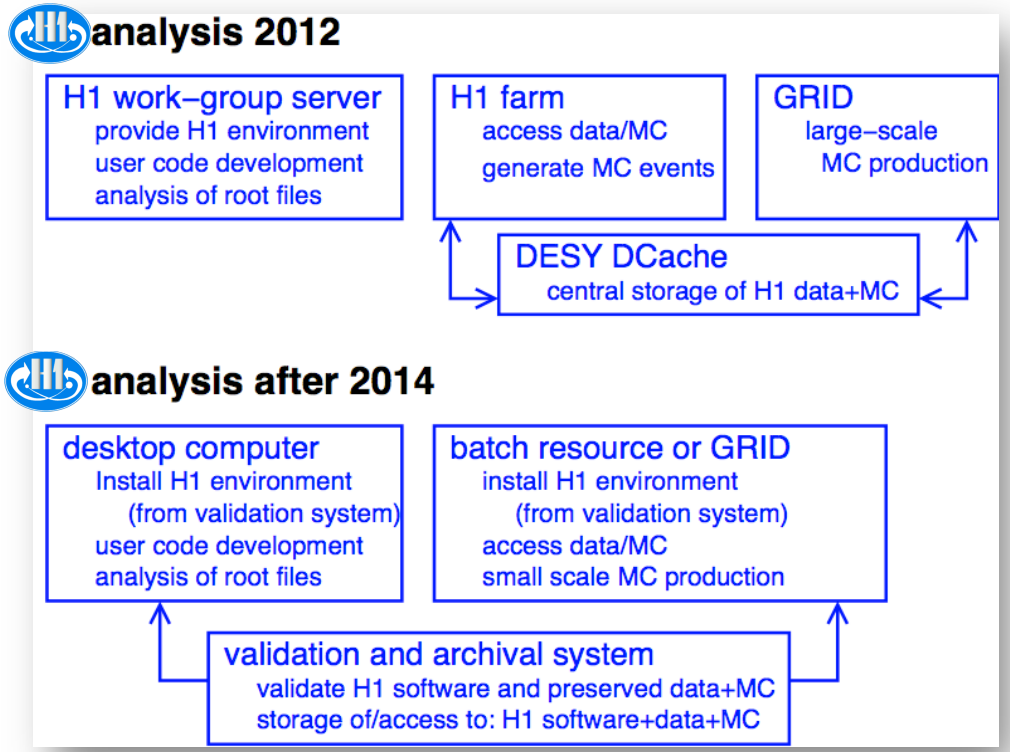
- Work on interface between HepMC and ZEUS ADAMO on going, very preliminary version is ready
  - The HepMC format C++ classes and Fortran formoza compile to one executable
  - Event record from HepMC ASCII file is converted to HEPEVENT common block and passed to formoza to fill the ZEUS ADAMO
  - Still need testing: events record flow, different version of HepMC format, different OS,..

- Several options where to run the standalone MC production
  - **Powerful work group server:** no significant differences observed with respect to standard Common Ntuples
  - **Stand alone work group sever:** Output looks reasonable, some checks still needed
  - Use of distributed computing for future MC production not planned (only small samples are foreseen, where small ~ 1M events)



Future analysis model

- H1 model illustrated on the left for post-2014 period
  - Existing infrastructure replaced by alternative future resources
  - SL5/64 `sp-system` recipe already successfully deployed on bare wgs



- HERMES situation more urgent, current infrastructure now very old and unsupported
  - Already mentioned the move of their data to the central dCache within DESY-IT
  - Many user jobs running on BIRD cluster, allowing retirement of much-maligned hardware

- ZEUS standalone MC production likely to run on single machine
  - Analysis resources to be used where available (preserved data only needs ROOT)