



Stacks

Plan of Work 2025

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- Look back on 2024
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Section 1:



- 1 SPI: Software Process and Infrastructure
 - SPI Deliverables
 - Look Back on 2024
 - Plans for 2025

Providing compilers and consistent software stacks: 800+ packages

- For a large set of architectures, operating systems, compilers
 - ▶ $\text{len}((x86, ARM) \wedge (EL8, 9, mac13, \dots) \wedge (gcc11, \dots, clang16, \dots) \wedge (opt, dbg) \wedge (dev3, \dots)) \approx 50$
- ROOT, Geant4, MC Generators, ML packages, ...
- Every night (except Sundays) to CVMFS
- LCG releases and experiment specific stacks (“layers”) are provided on CVMFS and as RPMs
- Librarian and Integrators Meeting (“LIM”) every 2 weeks to discuss and decide on the content of nightlies and release dates
- Information/Documentation: <https://spi.web.cern.ch/>, <https://lcginfo.cern.ch>,
<https://lcgdocs.web.cern.ch>

Plans for 2024

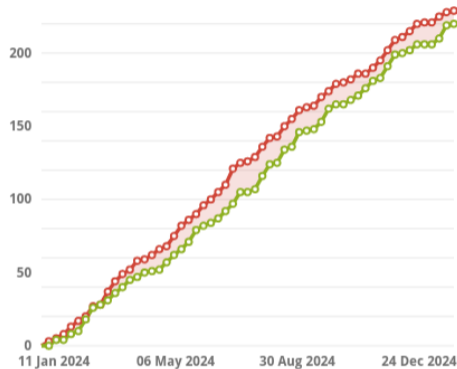


- Continue to provide compilers and consistent software stacks for our stakeholders
 - Integrate new packages and updates, provide user support ✓
- Maintain build infrastructure: Build machines, Puppet recipes, storage ✓
 - CentOS7 EoL in June 2024; migration of some workflows, e.g., rpmbuild ✓
- JIRA migration ✓
- Adapt CVMFS-gateways for parallel publications ✓
- Decide whether or with what to replace LCGCMake ✓

General Issues of 2024



- Continued to provide compilers and consistent software stacks for our stakeholders
- Integrated new packages and updates
 - ▶ **Proactively update some packages**, e.g., Analysis (zfit, coffea), ML (jax, torch, tensorflow), dev-tools related (mypy, ruff)
 - ▶ Simplified trivial updates to a single jenkins job
- Maintained infrastructure: build machines, puppet recipes, storage, DBs
 - ▶ CentOS7 EoL, inclusion of **Ubuntu 24**, new **MacOS version(s)** in particular for **Geant4** externals



Issues in the last 387 days (grouped weekly) [View In Issue Navigator](#)

○ Created Issues (229)

○ Resolved issues (220)



- LCG_104d, LCG_105a[, _cuda, _swan], LCG_105b, LCG_105c, LCG_106[, _cuda, _swan], LCG_106a[, _cuda, _swan], LCG_106b[, _cuda, _swan]
 - ▶ **Between 104d and 106b**: Updated to Python 3.11, integrated gcc 13 and 14, added 92 packages, dropped 15.
 - ▶ LCG_106b released for: 14 platforms
- LCG_104c_ATLAS_[5,6], LCG_104d_ATLAS_[1-22], LCG_106_ATLAS_[1-14], LCG_106a_ATLAS_[1-8], LCG_106b_ATLAS_[1,2]
- LCG_102b_LHCB_8, LCG_105_LHCB_[Core, 7], LCG_105a_LHCB_[Core, 7], LCG_105b_LHCB_[Core, 7], LCG_105c_LHCB_[Core, 7, 8]

Other Major Items in 2024



- Adapted CVMFS-gateways for parallel publications
 - significant improvements for nightly build publication times
- Decided *not* to replace LCGCmake with spack
- Included **ROOT**'s test in nightly builds
 - Also DD4hep and testing for other packages
- Added a **devship** nightly
- Updated **NXCals** (accelerator logging) configurations

General Tasks for 2025



- Updating and adding packages
 - ▶ Aim for increased automation for updates
- LCG releases aligning with ROOT releases
- Layers for ATLAS, LHCb, SHiP, Key4hep, NXCals, Swan
- Add tests to prevent regressions
- Keep infrastructure (build machines, puppet recipes, storage, DBs, CDash, CVMFS repositories) up-to-date and running
- User support



- MacOS Virtualisation ([SPI-2721](#))
 - ▶ Currently about one node for MacOS version, causing bottle necks for queued builds
 - ▶ Effort to maintain wide range of OS versions
 - ▶ Implement a virtualisation layer to unify host OS and make different MacOS versions available
- Investigate integration with “AliBuild”-derivative ([SPI-2729](#))

New Versions of Operating Systems, Compilers, Python



Ordered by priority or time

- Python 3.12 (work in progress) ([SPI-2493](#))
- Integrate GCC 15 (May(?) 2025) ([SPI-2722](#))
- MacOS 16 (September 2025) ([SPI-2723](#))
- Integrate Clang 20 or 21 or both ([SPI-2724](#))
- Python 3.13 (Released October 2024) ([SPI-2725](#))
- RHEL (i.e., Alma Linux) 10 (Release December 2025) ([SPI-2726](#))

Participation in the LHC Generators WG



Potentially provide

- Static analysis for MC Generators: coverity etc. ([SPI-2727](#))
- A stack for MCPlots ([SPI-2728](#))

Stretch Goals for 2025



- Micro architecture level update

- ▶ It has been on the menu for a long time, but insufficient demand so far to push up the priority

Plan Of Work Overview



[Overview in Jira](#) (click on *Show in Detail View*)

Issue	Status	Resolution	Created	Updated	Due Date	...
Σ Summed Values						
SPI-2729 Investigate use of ali-build derivative	OPEN	UNRESOLVED	22/Jan/25	22/Jan/25		...
SPI-2728 Provide a stack for MCPlots	OPEN	UNRESOLVED	22/Jan/25	22/Jan/25		...
SPI-2727 Make static analysis available for MC...	OPEN	UNRESOLVED	22/Jan/25	22/Jan/25		...
SPI-2726 Prepare stack for RHEL10	OPEN	UNRESOLVED	22/Jan/25	22/Jan/25		...
SPI-2725 Create Python 3.13 based stack	OPEN	UNRESOLVED	22/Jan/25	22/Jan/25		...
SPI-2724 Integrate Clang 20 or 21	OPEN	UNRESOLVED	22/Jan/25	22/Jan/25		...
SPI-2723 Create MacOS16 stack	OPEN	UNRESOLVED	22/Jan/25	22/Jan/25		...
SPI-2722 Integrate gcc15	OPEN	UNRESOLVED	22/Jan/25	22/Jan/25		...
SPI-2721 MacOS Virtualisation	OPEN	UNRESOLVED	22/Jan/25	22/Jan/25		...
SPI-2493 Add dev3python311 dev3python312	OPEN	UNRESOLVED	23/Jan/24	22/Jan/25		...

Section 2:



- 2 Key4hep
 - Look back on 2024
 - Plans for 2025

Plans for 2024 from Last Year's Presentation



Key4hep

- Bring the validation system into production 🚧
- ACTS track fitting 🚧
- DDGaudiPandora interface 🚧
- EDM4hep native Overlay background processing ✓
- Validate detector models for use in physics studies 🚧

Heterogeneous Frameworks

- Extract representative workflows of Gaudi-based applications. Construction of data flow and control flow graphs complemented with timing and memory size information. ✓
- Prepare a single-node mock-up application of a realistic workload ✓
- Evaluate computation offloading mechanisms and prototype a single-node Gaudi scheduler for heterogeneous resources 🚧

Major Developments



- Functional algorithms and easier use of multi-threading
- podio version 1.0, EDM4hep version 0.99
- Validation system used for IDEA and ALLEGRO detector models in addition to CLD
- EDM4hep Overlay processor implemented
- PandoraPFA seeing more interest and use

See also [Juan's presentation at the FCC Physics Workshop](#)

Plans for 2025



- podio and EDM4hep
 - EDM4hep version 1.0
 - ★ Begin of guaranteed backward compatibility
 - Improve compatibility with C++ standard algorithms, views, and ranges
 - Prepare an algorithm for producing analysis flat n-tuple from EDM4hep
- Complete integration of ACTS and PandoraPFA
- Support validation of detector models for use in physics studies
- Improve Documentation
- EPPSU input document
- Investigate possibility of a Key4hep consortium
- Investigate Key4hep (development) releases with LCGCmake instead of spack
- Write a PhD Thesis



Julia:

- Investigate static compilation of Julia packages to C++ compatible libraries on the example of JetReconstruction.jl
- Implement a showcase of FCC analysis in Julia

Heterogeneous scheduling:

- Study and improve throughput of Julia based event-processing framework demonstrator
- Investigate task-scheduling with C++ standard execution



Thank you for your attention!