Task 12.2 - Turnkey Software

WP12 General Meeting

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Task 12.2. Turnkey Software

Objectives and partners

- Integrated Turnkey Software Stack, for physics and performance studies
- Simplified data model toolkit for modern hardware platforms
- Digitisation extensions for geometry toolkit
- R&D study on frameworks to manage heterogeneous resources

DESY (lead), CERN,
INFN-PI, (INFN-PD, INFN-BA, INFN-BO - unfunded)
IHEP, SDU - associated

Share of PPMs in T12.2

Task 12.2.1	Turnkey Stack
CERN	15.0
DESY	25.5
INFN	12.0
Task 12.2.2	**PODIO**
CERN	13.5
DESY	20.5
Task 12.2.3	**DDDigi**
CERN	11.0

From Franks slides at Kick-Off meeting

Turnkey Software Stack

Latest developments in Key4hep

`k4SimDelphes`

- First version of Gaudi algorithm to run converter in framework
  - Easier to include in more complex workflows
- Some changes necessary for newest Delphes release (3.5.0)

`k4MarlinWrapper`

- Configurable **on-the-fly conversion between LCIO and EDM4hep**
  - Including round-trip unit tests
  - Can now use Marlin processors in combination with Gaudi algorithms
- Started to discover some smaller “conversion issues”/incompatibilities between EDM4hep and LCIO
  - CellIDEncoding parameters
  - MCParticle endpoint treatment is more involved in LCIO than in EDM4hep
- Using a map/dict to configure wrapped Marlin processors now
- Start to evaluate for ILC with summerstudents at DESY

Turnkey Software Stack

Migration status

FCCSW

- Currently ongoing and making good progress
- Migration of core packages from FCCSW
  - `k4Gen` - generic generator interface
  - `k4SimGeant4` - Geant4 simulation interface using DD4hep geometries
  - `FCCAnalyses` - RDataFrame based analysis framework using EDM4hep
  - Will be moved to Key4hep project once migration is done

CEPCSW

- Validation of EDM4hep in CEPCSW
- Porting Pandora to Key4hep

MuColl

- Interest in porting from the iLCSoft stack towards Key4hep

Turnkey Software Stack

Deployment & Validation

spack installation

- Key4hep stack can be built completely with `spack`
- Automated deployment via CERN GitLab runners
- Started to use `spack` based CI workflows on top of nightly builds that are done via `spack`

Validation of Key4hep components for CEPC

- Dedicated CI runner deployed at IHEP
- Configurable Python test profiler was developed
  - Supporting configurable log parser, performance profiling and physics validation
- Github API based CI dashboard under development
- Plan to improve profiler and integrate with DIRAC for data production and physics validation

Simplified Data Model Toolkit

Latest developments in podio & EDM4hep

`podio`

- Start to work on schema evolution
  - Currently most important missing feature
  - Starting to be an issue also for other developments
- A lot of other possible features that would be nice to have
- Many smaller fixes / improvements
  - Handling of fixed width integers, const-correctness fixes, ...

`EDM4hep`

- Ongoing discussion on how to best handle “generic user data”
  - Non-trivial problem with many considerations
  - Evaluating different ideas
  - This and missing schema evolution are major open points to be addressed before v1.0

Digitisation extension of geometry toolkit

DDDigi

- Work has already started some time ago
- Technical implementation could be very challenging
  - Very memory intensive, large systems not possible
  - Generic enumeration of sensitive cells in sub-detectors not yet solved
- Other developments ongoing in DD4hep in parallel
- Having a “customer” (i.e. a testing ground) would help

R&D on heterogeneous resource usage in frameworks

INFN Pisa

- Started to look into CMSSW to try and isolate the heterogeneous parts to understand dependencies
- First steps in Key4hep

IHEP

- Plan to develop fast simulation software for simulating drift and avalanche process of electrons in drift chamber
  - Replace Garfield++
  - GPU version necessary for achieving required performance
  - Investigate if EDM4hep can be used with heterogeneous resources

Person power situation

INFN Pisa

- Still waiting for the assignment of the 20k€ (+5K€ OH)
  - Plan to open a position for 1 year in September
  - More activity once position is filled

DESY

- Plan to combine funding for all WP12 tasks into one PostDoc position (2-3 years)
- Work started with “matching personal”

IHEP

- Simon Blyth planned to join for heterogeneous resources work
  - Already at IHEP, working on simulation with NVIDIA OptiX on GPUs