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

<table>
<thead>
<tr>
<th>Task 12.2.1</th>
<th>Turnkey Stack</th>
</tr>
</thead>
<tbody>
<tr>
<td>CERN</td>
<td>15.0</td>
</tr>
<tr>
<td>DESY</td>
<td>25.5</td>
</tr>
<tr>
<td>INFN</td>
<td>12.0</td>
</tr>
<tr>
<td>Task 12.2.2</td>
<td>PDDigi</td>
</tr>
<tr>
<td>CERN</td>
<td>13.5</td>
</tr>
<tr>
<td>DESY</td>
<td>20.5</td>
</tr>
<tr>
<td>Task 12.2.3</td>
<td>DDDigi</td>
</tr>
<tr>
<td>CERN</td>
<td>11.0</td>
</tr>
</tbody>
</table>

From Frank’s 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