

Eleventh International Workshop on Semiconductor Pixel Detectors for Particles and Imaging



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ATLAS ITk Production Database use and tools for ITk Pixels community

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The ATLAS experiment will undergo major upgrades for operation at the high luminosity LHC. The high pile-up interaction environment (up to 200 interactions per 40MHz bunch crossing) requires a new radiation-hard tracking detector with a fast readout.

The Inner Tracker (ITk) upgrade is an international effort to meet this challenge.

The scale of the upgraded tracker is much larger than the current ATLAS tracker. The tracker consists of ~4000 modules while ITk is designed to have ~9,500 pixel modules (and ~18,000 strip modules). The manufacture of the different detector components follows a complex production flow involving institutes around the globe. To maintain the tight production schedule, a continuous monitoring of production rates is essential.

The ITk Production Database (PDB) is a custom database developed to track the location of ITk components, monitor production progress, and retain component information to support data-taking performance during 10 years of running. Results from QC/QA tests carried out over multiple production steps must be uploaded, production rates and yields extracted, and component shipments and inventories monitored to ensure no institute lacks material. In addition, the PDB is a resource for CERN's dual export license oversight used for some items such as frontend chips, where all materials must be returned to CERN even if they are faulty.

In the case of ITk pixel production the database currently hosts data for more than 200 component types, including sensors, front-end chips, flexes, assembled modules and larger structures and cables. Each component has associated data on component tests and tracks production stages. Roughly 60 production sites and more than 300 users are registered for pixels production including vendors, research laboratories and universities.

User interaction with the PDB such as component registration and test data uploads is done either via a dedicated PDB web GUI (shared with all ITk projects) or through an API. APIs are a common tool to mediate user interactions with databases and provide flexibility in custom GUI development. Interface development is provided by a community of PDB experts who have pursued several options to meet collaboration needs: a pythonic API wrapper, data-acquisition GUIs with integrated scripts, commandline scripts. Tools have been distributed via git repositories, containerised applications, and CERN hosted platforms such as Openshift.

A complimentary effort is made to report data from the PDB to monitor production evolution. Reports are prepared for specific user audiences to meet specific tasks, including management oversight and collaboration reviews. This information helps to quickly identify and remedy any production issues.

Examples will be provided of ITk Pixel community tools for PDB population and reporting.

Though the examples are ATLAS ITk Pixels specific, the general themes of large-scale data management and multi-user global accessibility are now standard to LHC-scale detector production. These concepts are relevant to modern high-energy particle physics and large experiments beyond HEP. The goal of this presentation is to promote information exchange and collaboration of tools which can support production.

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