ATLAS ITk Production Database usage

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ATLAS ITk Upgrade

The ATLAS experiment will undergo major upgrades for 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 the challenge

ATLAS Simulation Preliminary — ITk Layout: 23-00-03

	$\int L$	<μ>	|η|	#modules	A	#channels
ID	400fb^{-1}	38	2.5	4000	63m^2	100M
ITk	4000fb^{-1}	200	4	9500+18000	180m^2	5000M

Closest to beam pipe:
- 2×10^{16} n$_{eq}$ cm^{-2} fluence
- 10MGy TID
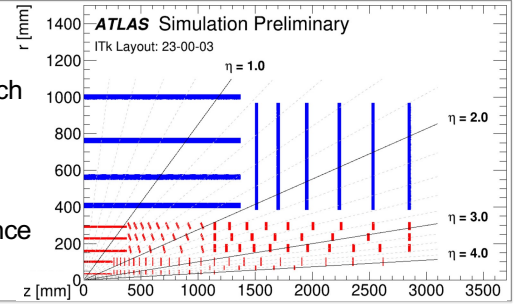
Production Monitoring

The manufacture of the different detector components follows a global production flow

To maintain the tight production schedule, continuous oversight of collaboration activities is essential
- Location of parts
- Monitoring production quality and yields
- Monitoring production rates

+4U For this purpose, a custom database was developed by a dedicated database team
- Cloud based mongoDB backend

Database Specification

The ITk Production Database (PDB) stores information on:
- Each detector part (component)
- Part locations and production states
- Part Quality Assurance & Control tests
- Project evolution: production and yield rates
- Dual export license materials that must be returned to CERN

This is a **common resource** for ITk sub-projects: Pixels, Strips, Common Electronics, Common Mechanics
Maintained until end of ITk operation: >10 years

Database Content

The PDB is required to store production history per component including mechanical, thermal & electrical tests.
Component information:
- Essential: e.g. type, manufacturer, creation date & origin
- Contingent: e.g. location, stage, defects
- Related objects: parents, children, tests

Test information:
- Essential: e.g. pass/fail, date, location, user
- Contingent: e.g. test parameters, analysis versions
- Related objects: components

Shipment information:
- E.g. sender, recipient, contents, courier

A hierarchical component structure reflects complex assembly

Current content for Strips & Pixels sub-projects:

	component (types)	test types	institutes	users
Strips	~100k (~200)	~320	~60	>300
Pixels	~900k (~200)	~120	~60	>450

PDB Interactions

Interactions with the PDB is done via a centralised web-based application or API (provided & maintained by Unicorn University, Czech Republic).
Common interactions:
- Registration: component, test, batch, cluster, user, institution
- Additional: attachments & updates
- Search requests: including filtering

The PDB API is documented and supports development of custom scripts for specialised PDB interactions.

The ITk community develops modern interface tools for GUIs, webapps, notebooks and command-line scripts.
Tools are distributed via CERN's IT platforms & licences

PDB Uploads

PDB uploads: prescribed data + attachments
- Prescribed: json format sent to PDB
- Small / large attachments: binary sent to PDB / CERN EOS

Various frontend formats are used for collaboration needs, making uses of the PDB API:

2024, YTD, # of requests to ITkPD API, >10k, total=15707213

- Python package API wrapper (itkdb)
- Data-acquisition GUIs with integrated PDB scripts
- Interface scripts distributed via git repositories
- GUIs in docker containers
- CERN hosted OpenShift containers
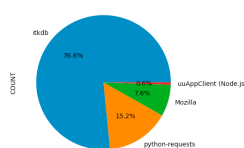
PDB Reports

Reports are prepared for specific audiences and tasks
- Data integrity checks of PDB data
- Production quality monitoring of parts
- Yield calculations and Cost Reporting (CORE)
- Input to simulation of production flow
- Automated reports and alerts are also deployed

Effort is made to centrally host reports for collaborative review.
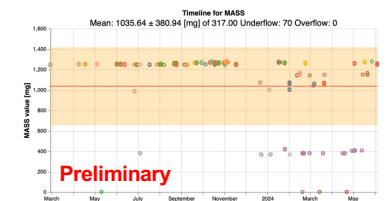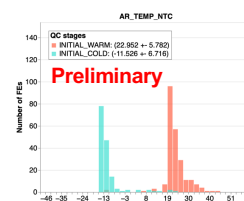
A duplicate of the PDB is being set-up for reporting tasks.