The new ALICE operational logbook for LHC Run 3

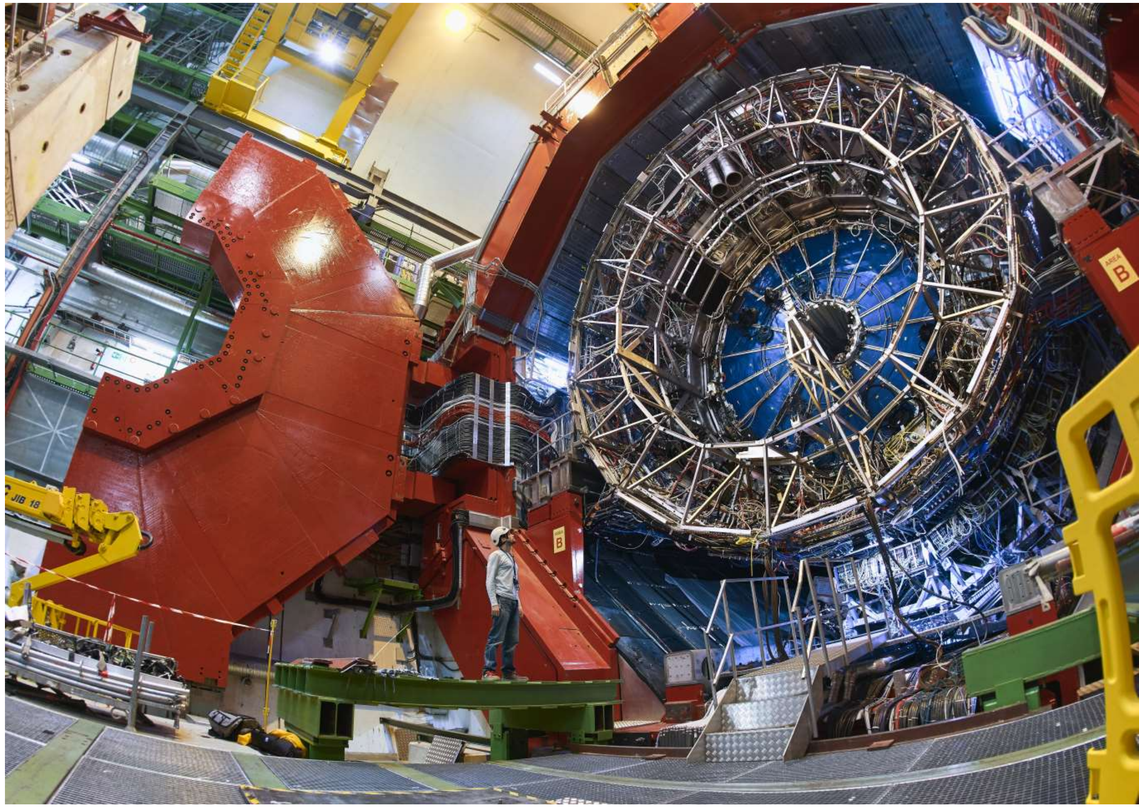
M. Boulais

On behalf of the O^2/FLP project

Context

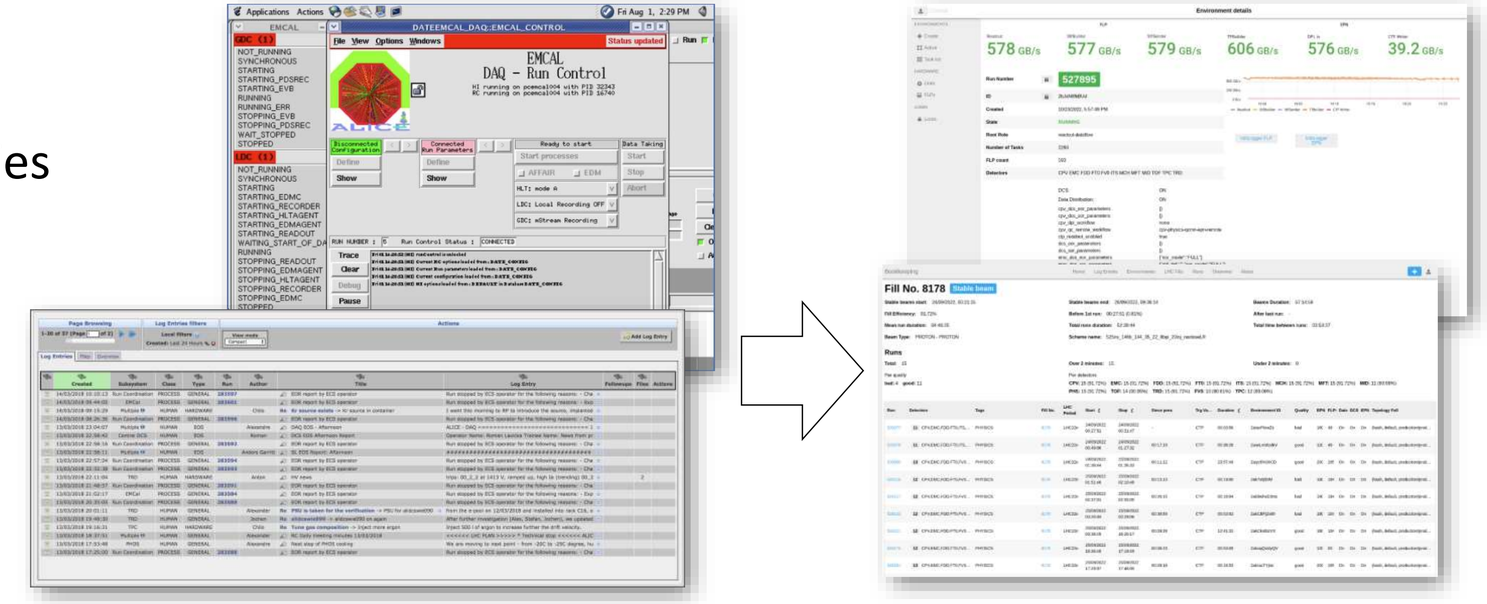
- Context: O^2 Upgrade
- Focus on GUIs

  → Bookkeeping application



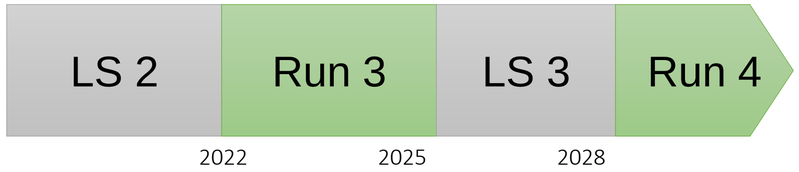
New web GUIs

- Technologies improved considerably, especially web applications
  - Users' expectations increased
    - Fluid navigation
    - Clean user experience
    - Multiple devices & OS
- New set of GUIs based on web technologies
  - Available from everywhere
  - Flexibility
    - Multiple platforms
    - Multiple OS
  - Reduced user input errors
    - Improved UX
    - Automatic workflow
  - Quick and easy access to experiment information



Constraints for the web GUIs

- Objective : Run 3 and 4
  - Last about 10 years
- Projects must be robust
  - Proven technologies
- Open to new features
  - New needs will appear while being used
- Easiness for developers to integrate their applications

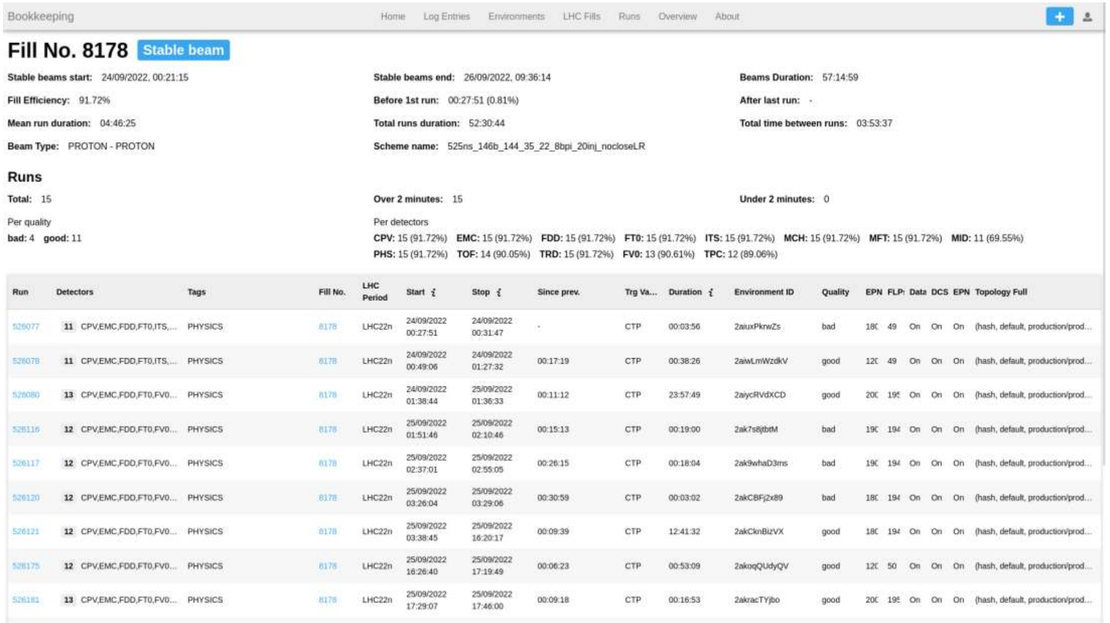


Why a logbook

- Scientific experiment require logbook
  - What was configuration and context at any time during operation
  - Why configuration changed
  - Logging system

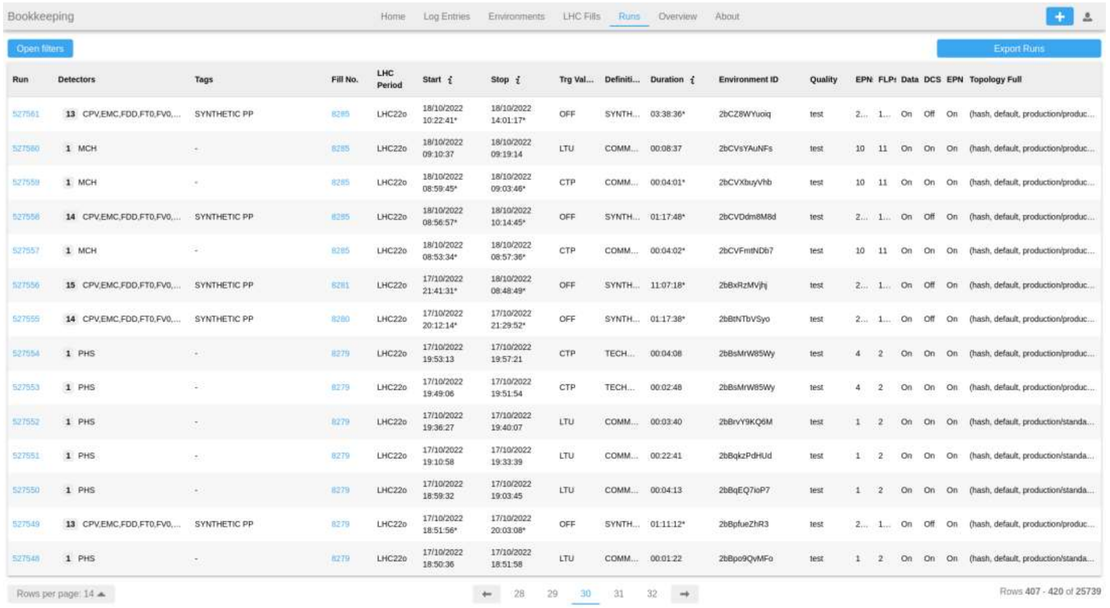
Run-Coordination use-case

- Statistics computed automatically
  - Evaluate the amount of beam time effectively used
  - See why data taking ended
  - See global statistics or per detectors
- Can see:
  - What issues occurred
  - Under which conditions
- Help to improve the overall efficiency



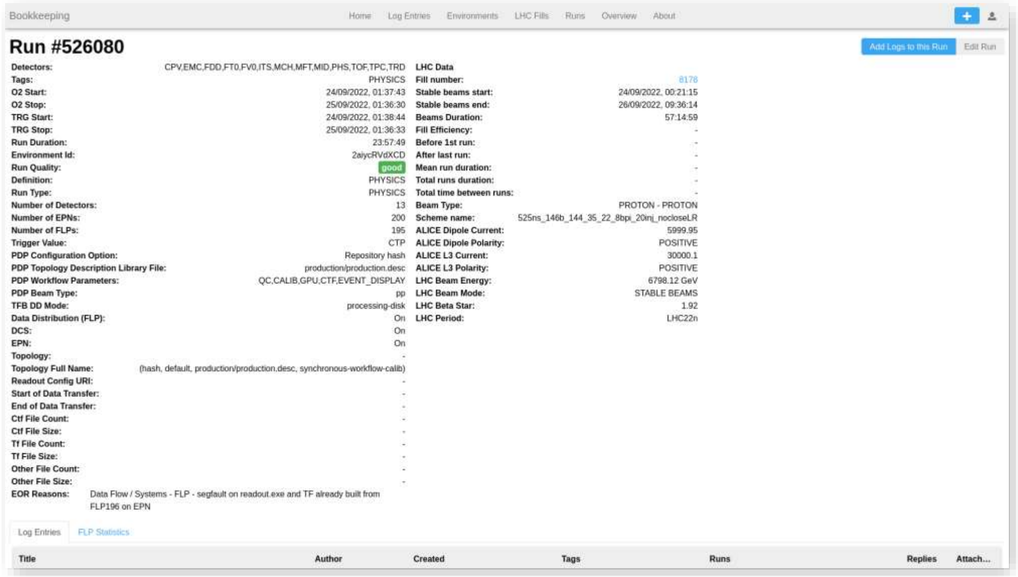
Physicists use-case

- Have an history of data-taking conditions
  - Know which data is good enough to be used
  - See the configuration at any time
  - Know any event that occurred



Bookkeeping structure

- **Run**
- Environment
- Fill
- Log

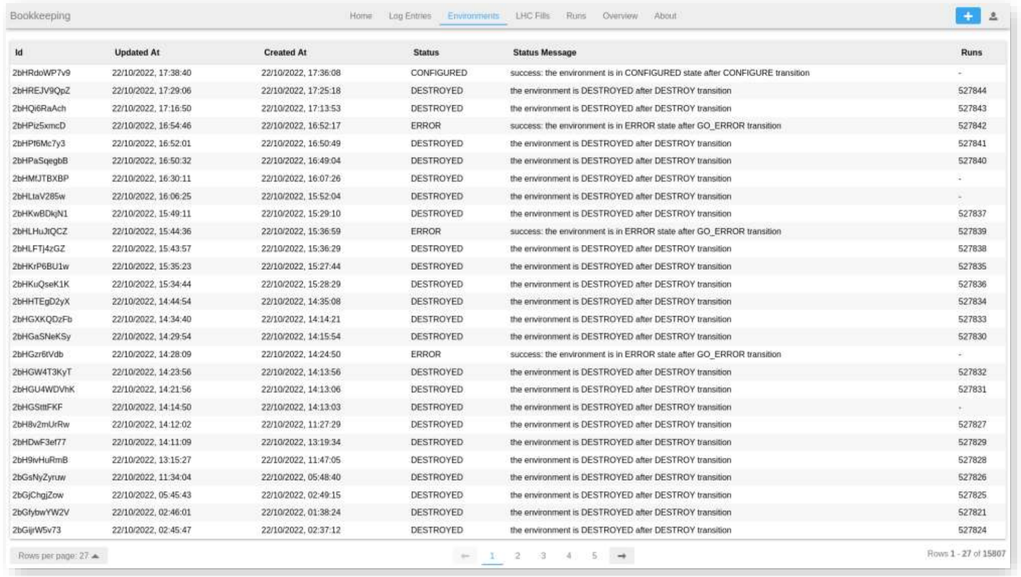


- Metadata for a given data-taking period
  - Run type
    - Actual collisions
    - Cosmic rays
    - Calibration
  - Quality of the data-taking
    - Overall
    - Per detector
  - Tag to ease data mining and automation

Bookkeeping structure

- Run
- **Environment**
- Fill
- Log

- Runs are linked to an environment
- Configuration of the experiment
  - List of detectors
  - Process workflows and target devices
  - Enabled components

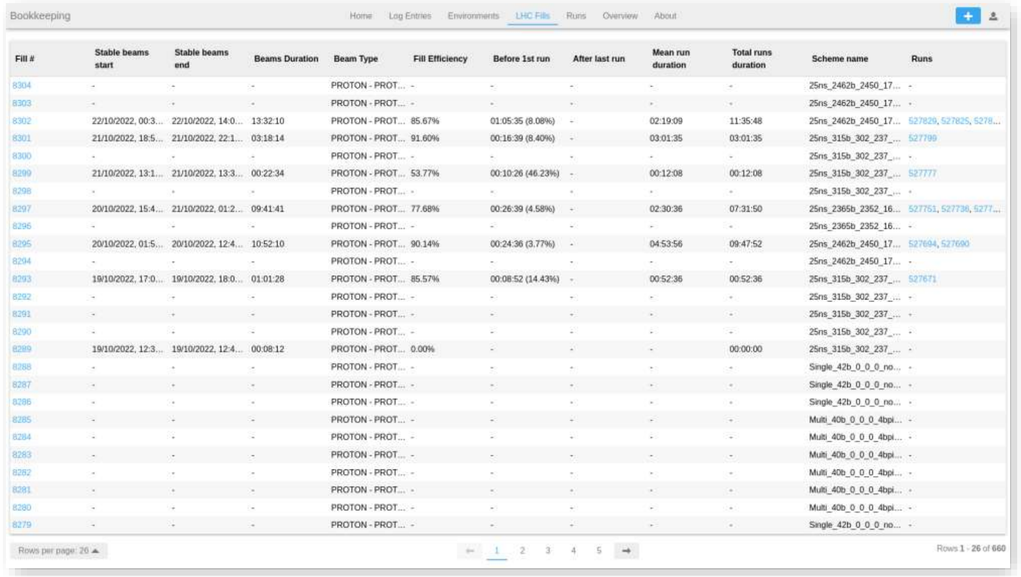


Id	Updated At	Created At	Status	Status Message	Runs
2bHRdoWP7v9	22/10/2022, 17:38:40	22/10/2022, 17:36:08	CONFIGURED	success: the environment is in CONFIGURED state after CONFIGURE transition	-
2bHREJV9QpZ	22/10/2022, 17:29:06	22/10/2022, 17:25:18	DESTROYED	the environment is DESTROYED after DESTROY transition	527844
2bHQi6RaAch	22/10/2022, 17:16:50	22/10/2022, 17:13:53	DESTROYED	the environment is DESTROYED after DESTROY transition	527843
2bHPiz5xmcD	22/10/2022, 16:54:46	22/10/2022, 16:52:17	ERROR	success: the environment is in ERROR state after GO_ERROR transition	527842
2bHPf6Mc7y3	22/10/2022, 16:52:01	22/10/2022, 16:50:49	DESTROYED	the environment is DESTROYED after DESTROY transition	527841
2bHPaSqegbB	22/10/2022, 16:50:32	22/10/2022, 16:49:04	DESTROYED	the environment is DESTROYED after DESTROY transition	527840
2bHMtJTBXBP	22/10/2022, 16:30:11	22/10/2022, 16:07:26	DESTROYED	the environment is DESTROYED after DESTROY transition	-
2bHLtaV285w	22/10/2022, 16:06:25	22/10/2022, 15:52:04	DESTROYED	the environment is DESTROYED after DESTROY transition	-
2bHKwBDkjN1	22/10/2022, 15:49:11	22/10/2022, 15:29:10	DESTROYED	the environment is DESTROYED after DESTROY transition	527837
2bHLHuJtQCZ	22/10/2022, 15:44:36	22/10/2022, 15:36:59	ERROR	success: the environment is in ERROR state after GO_ERROR transition	527839
2bHLFTj4zGZ	22/10/2022, 15:43:57	22/10/2022, 15:36:29	DESTROYED	the environment is DESTROYED after DESTROY transition	527838
2bHKrP6BU1w	22/10/2022, 15:35:23	22/10/2022, 15:27:44	DESTROYED	the environment is DESTROYED after DESTROY transition	527835
2bHKuQseK1K	22/10/2022, 15:34:44	22/10/2022, 15:28:29	DESTROYED	the environment is DESTROYED after DESTROY transition	527836
2bHHTEgD2yX	22/10/2022, 14:44:54	22/10/2022, 14:35:08	DESTROYED	the environment is DESTROYED after DESTROY transition	527834
2bHGXKQDzFb	22/10/2022, 14:34:40	22/10/2022, 14:14:21	DESTROYED	the environment is DESTROYED after DESTROY transition	527833
2bHGaSNeKSy	22/10/2022, 14:29:54	22/10/2022, 14:15:54	DESTROYED	the environment is DESTROYED after DESTROY transition	527830
2bHGzr6tVdb	22/10/2022, 14:28:09	22/10/2022, 14:24:50	ERROR	success: the environment is in ERROR state after GO_ERROR transition	-
2bHGW4T3KyT	22/10/2022, 14:23:56	22/10/2022, 14:13:56	DESTROYED	the environment is DESTROYED after DESTROY transition	527832
2bHGU4WDVhK	22/10/2022, 14:21:56	22/10/2022, 14:13:06	DESTROYED	the environment is DESTROYED after DESTROY transition	527831
2bHGStttFKF	22/10/2022, 14:14:50	22/10/2022, 14:13:03	DESTROYED	the environment is DESTROYED after DESTROY transition	-
2bH8v2mUrRw	22/10/2022, 14:12:02	22/10/2022, 11:27:29	DESTROYED	the environment is DESTROYED after DESTROY transition	527827
2bHDwF3ef77	22/10/2022, 14:11:09	22/10/2022, 13:19:34	DESTROYED	the environment is DESTROYED after DESTROY transition	527829
2bH9lvHuRmB	22/10/2022, 13:15:27	22/10/2022, 11:47:05	DESTROYED	the environment is DESTROYED after DESTROY transition	527828
2bGsNyZyruw	22/10/2022, 11:34:04	22/10/2022, 05:48:40	DESTROYED	the environment is DESTROYED after DESTROY transition	527826
2bGjChgjZow	22/10/2022, 05:45:43	22/10/2022, 02:49:15	DESTROYED	the environment is DESTROYED after DESTROY transition	527825
2bGfybwYW2V	22/10/2022, 02:46:01	22/10/2022, 01:38:24	DESTROYED	the environment is DESTROYED after DESTROY transition	527821
2bGijrW5v73	22/10/2022, 02:45:47	22/10/2022, 02:37:12	DESTROYED	the environment is DESTROYED after DESTROY transition	527824

Bookkeeping structure

- Run
- Environment
- **Fill**
- Log

- Two colliding beams of particles in the accelerator
  - LHC Fill
- Extract statistics



Fill #	Stable beams start	Stable beams end	Beams Duration	Beam Type	Fill Efficiency	Before 1st run	After last run	Mean run duration	Total runs duration	Scheme name	Runs
8304	-	-	-	PROTON - PROT...	-	-	-	-	-	25ns_2462b_2450_17...	-
8303	-	-	-	PROTON - PROT...	-	-	-	-	-	25ns_2462b_2450_17...	-
8302	22/10/2022, 00:3...	22/10/2022, 14:0...	13:32:10	PROTON - PROT...	85.67%	01:05:35 (8.08%)	-	02:19:09	11:35:48	25ns_2462b_2450_17...	527829, 527825, 5278...
8301	21/10/2022, 18:5...	21/10/2022, 22:1...	03:18:14	PROTON - PROT...	91.60%	00:16:39 (8.40%)	-	03:01:35	03:01:35	25ns_315b_302_237_...	527799
8300	-	-	-	PROTON - PROT...	-	-	-	-	-	25ns_315b_302_237_...	-
8299	21/10/2022, 13:1...	21/10/2022, 13:3...	00:22:34	PROTON - PROT...	53.77%	00:10:26 (46.23%)	-	00:12:08	00:12:08	25ns_315b_302_237_...	527777
8298	-	-	-	PROTON - PROT...	-	-	-	-	-	25ns_315b_302_237_...	-
8297	20/10/2022, 15:4...	21/10/2022, 01:2...	09:41:41	PROTON - PROT...	77.68%	00:26:39 (4.58%)	-	02:30:36	07:31:50	25ns_2365b_2352_16...	527751, 527736, 5277...
8296	-	-	-	PROTON - PROT...	-	-	-	-	-	25ns_2365b_2352_16...	-
8295	20/10/2022, 01:5...	20/10/2022, 12:4...	10:52:10	PROTON - PROT...	90.14%	00:24:36 (3.77%)	-	04:53:56	09:47:52	25ns_2462b_2450_17...	527694, 527690
8294	-	-	-	PROTON - PROT...	-	-	-	-	-	25ns_2462b_2450_17...	-
8293	19/10/2022, 17:0...	19/10/2022, 18:0...	01:01:28	PROTON - PROT...	85.57%	00:08:52 (14.43%)	-	00:52:36	00:52:36	25ns_315b_302_237_...	527671
8292	-	-	-	PROTON - PROT...	-	-	-	-	-	25ns_315b_302_237_...	-
8291	-	-	-	PROTON - PROT...	-	-	-	-	-	25ns_315b_302_237_...	-
8290	-	-	-	PROTON - PROT...	-	-	-	-	-	25ns_315b_302_237_...	-
8289	19/10/2022, 12:3...	19/10/2022, 12:4...	00:08:12	PROTON - PROT...	0.00%	-	-	-	00:00:00	25ns_315b_302_237_...	-
8288	-	-	-	PROTON - PROT...	-	-	-	-	-	Single_42b_0_0_no...	-
8287	-	-	-	PROTON - PROT...	-	-	-	-	-	Single_42b_0_0_no...	-
8286	-	-	-	PROTON - PROT...	-	-	-	-	-	Single_42b_0_0_no...	-
8285	-	-	-	PROTON - PROT...	-	-	-	-	-	Multi_40b_0_0_0_4bpi...	-
8284	-	-	-	PROTON - PROT...	-	-	-	-	-	Multi_40b_0_0_0_4bpi...	-
8283	-	-	-	PROTON - PROT...	-	-	-	-	-	Multi_40b_0_0_0_4bpi...	-
8282	-	-	-	PROTON - PROT...	-	-	-	-	-	Multi_40b_0_0_0_4bpi...	-
8281	-	-	-	PROTON - PROT...	-	-	-	-	-	Multi_40b_0_0_0_4bpi...	-
8280	-	-	-	PROTON - PROT...	-	-	-	-	-	Multi_40b_0_0_0_4bpi...	-
8279	-	-	-	PROTON - PROT...	-	-	-	-	-	Single_42b_0_0_no...	-

Rows per page: 26 ▲

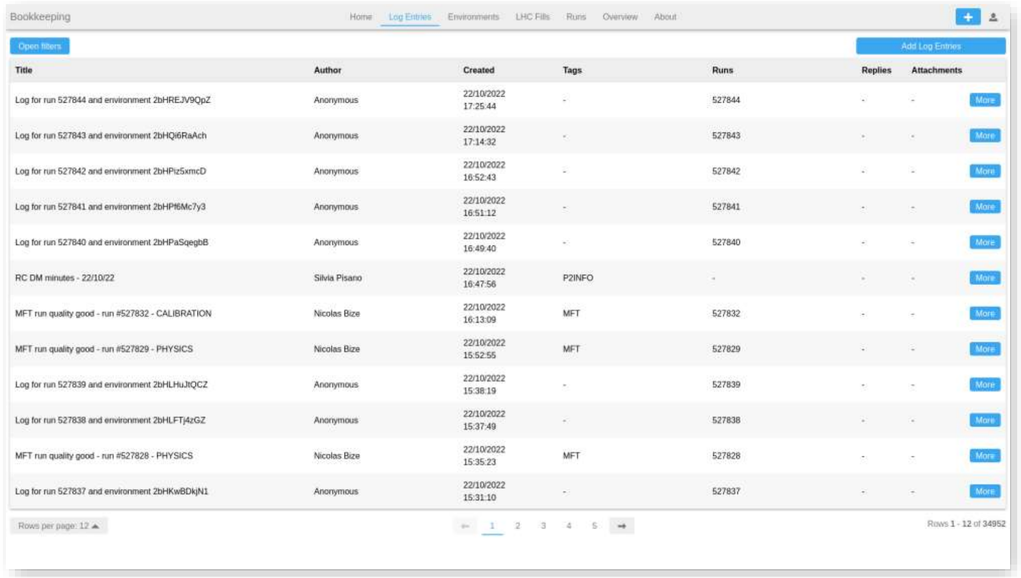
1 2 3 4 5

Rows 1 - 26 of 660

Bookkeeping structure

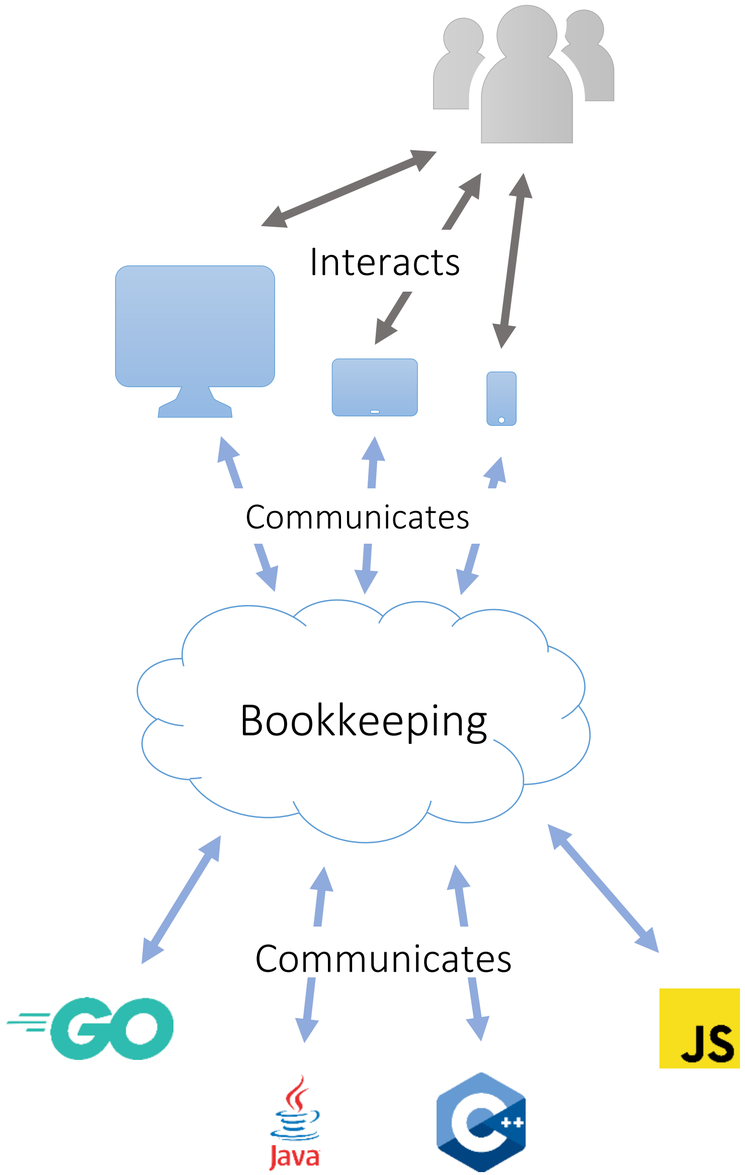
- Run
- Environment
- Fill
- **Log**

- Free textual information with optional attachments
- Can be created manually through bookkeeping or automatically when events occur
- Tag to ease data mining and automation



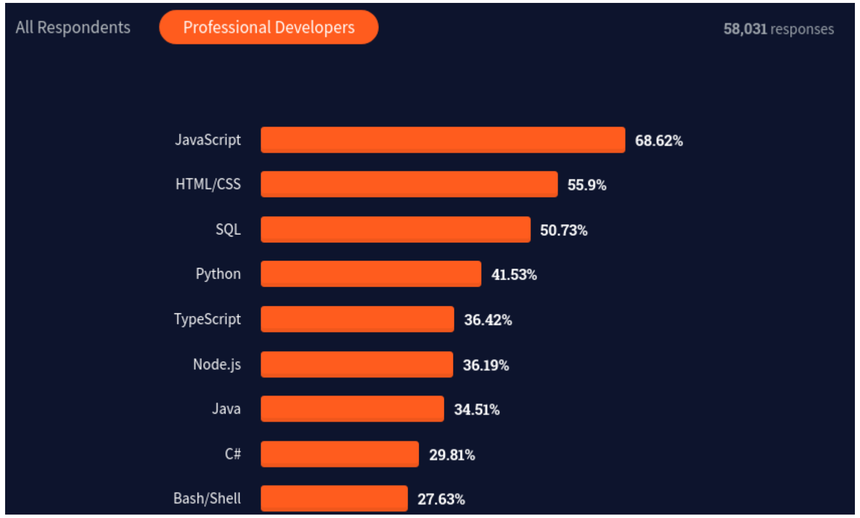
Technical stack – Usage

- Two clients
  - Users
    - Manual interaction, through GUI
  - Interfaces to other applications implemented in various technologies and languages
    - Go (Control System)
    - C++ (readout and data quality monitoring)
    - Web application (Run condition table)
    - Java (interface to the LHC information service)

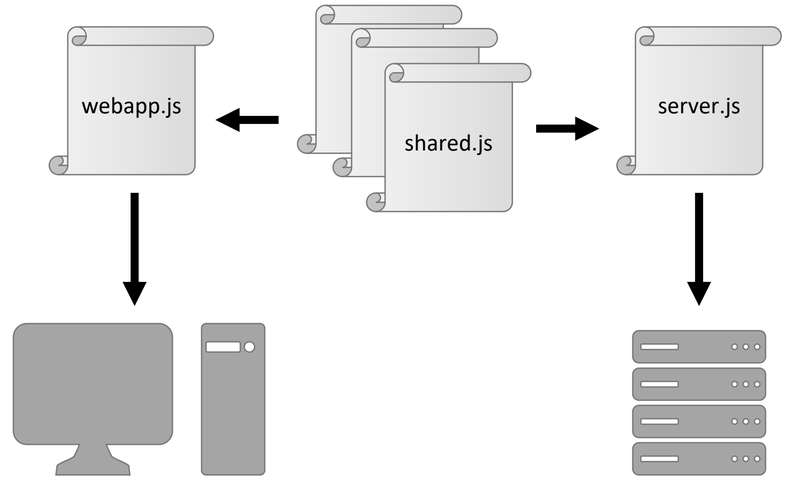


Technical stack – Main stack : User GUI

- NodeJs backend
  - Non-blocking: handle huge number of requests without hanging
- Javascript
  - Reference in web development
  - Low learning curve yet powerful
    - Useful if team grows
- Customized mithril frontend
  - Lightweight
  - Component oriented
- One technology for back and main front
  - Shared code
  - Developers efficient on both sides

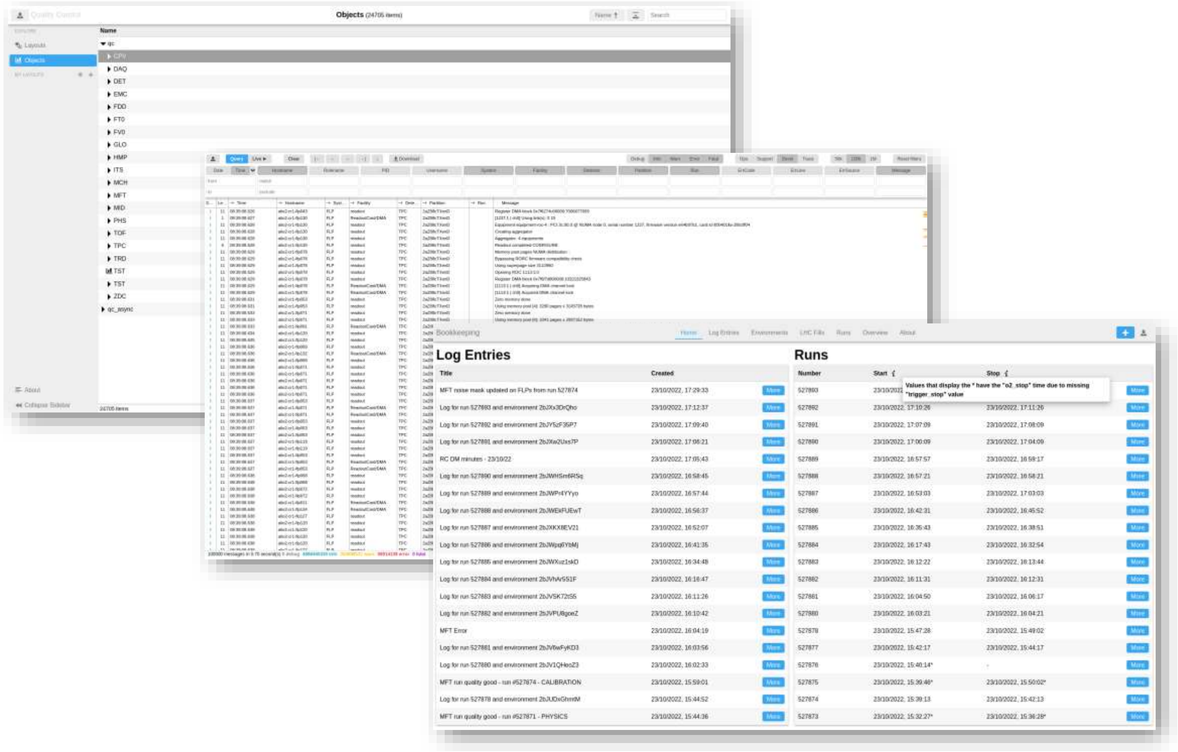


Stack overflow survey 2021



Technical stack – User GUI

- Use of a common framework across all GUIs
  - Used by 4 other tools
  - Factorizes development
    - Mutualizes common code patterns
  - Similar look and feel
    - Easy switch between applications



Technical stack – APIs

- REST API
  - HTTP client
    - Available in many languages
    - Scripting using cURL
  - First client: Bookkeeping SPA
- gRPC API
  - Widely used at CERN
  - Fast and secured
  - Interface-based (robustness)

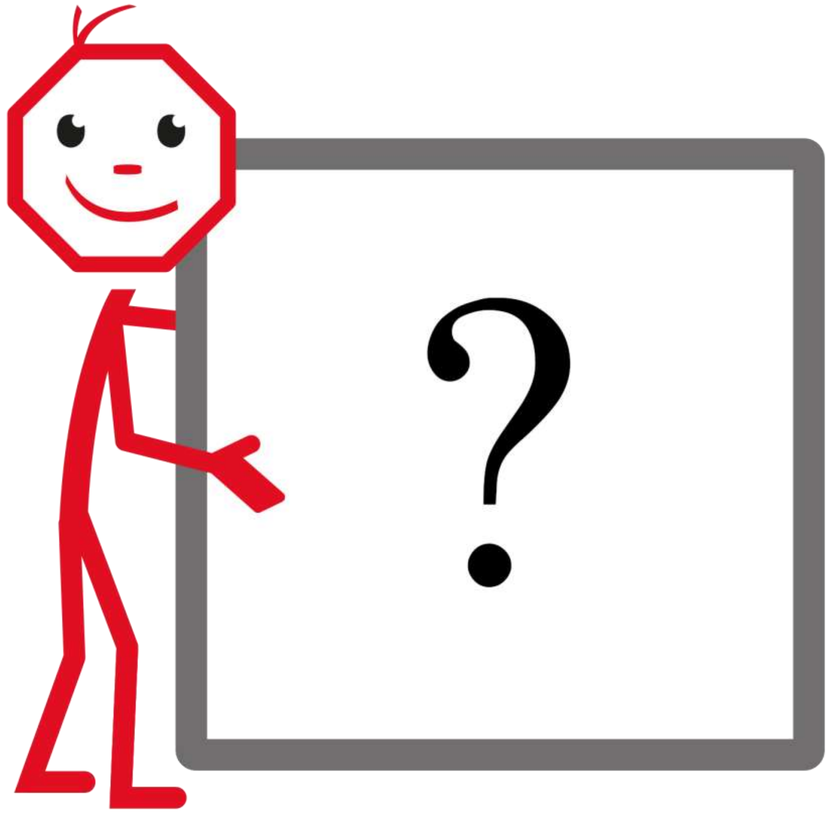
```
syntax = 'proto3';

package o2.bookkeeping;

import 'common.proto';

// Services

service RunService {
  rpc Create(RunCreationRequest) returns (Run);
  rpc Update(RunUpdateRequest) returns (Run);
}

// High level messages

message RunCreationRequest {
  string environmentId = 1;
  int32 nDetectors = 2;
  int32 nEpns = 3;
  int32 nFlps = 4;
  int32 runNumber = 5;
  RunType runType = 6;
  bool dd_flp = 7;
  bool dcs = 8;
  bool epn = 9;
  string epnTopology = 10;
  string odcTopologyFullName = 11;
  repeated Detector detectors = 12;
}
```

Future works

- Improve automation
- Add user customization
- Improve statistics

Thank you

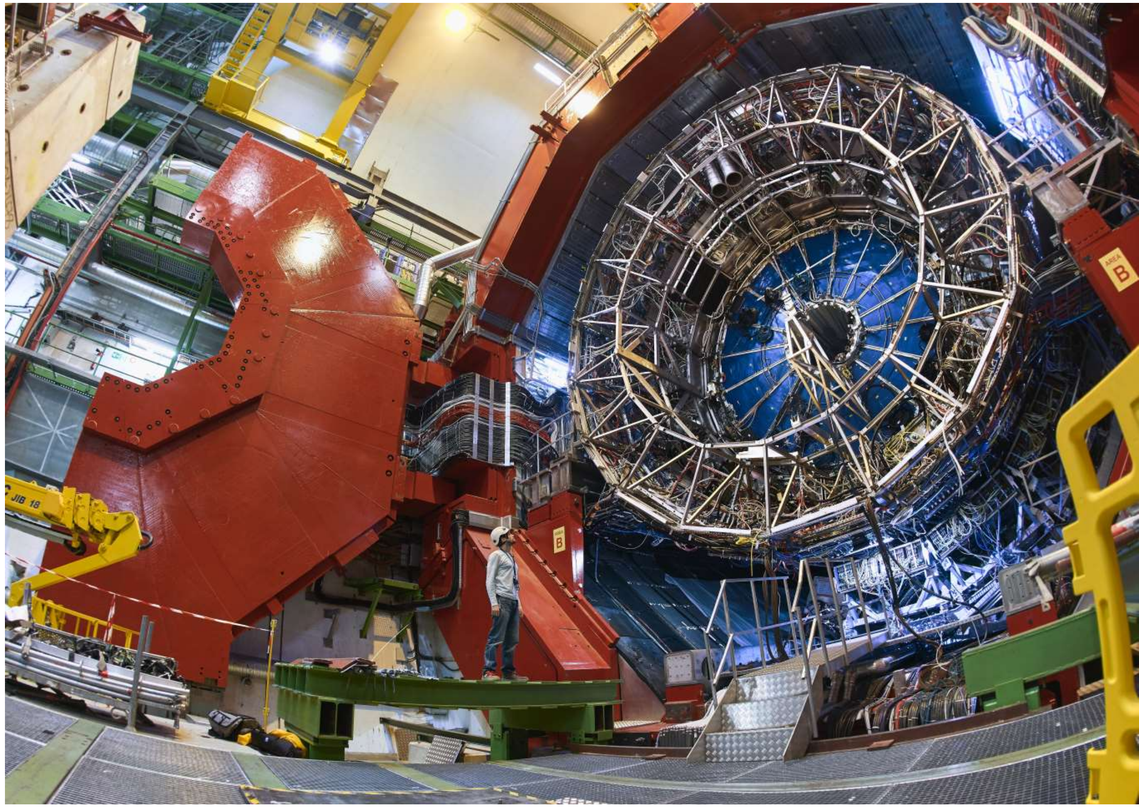
Any question?



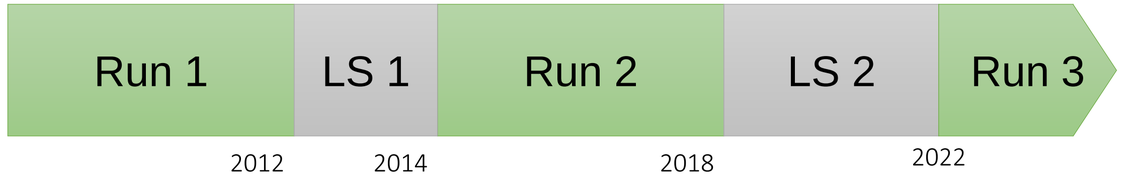
ALICE presentation

- 1 of the 4 main experiments at LHC
- 173 institutes over 40 countries
- Main goal: Collision of heavy ions at high energy

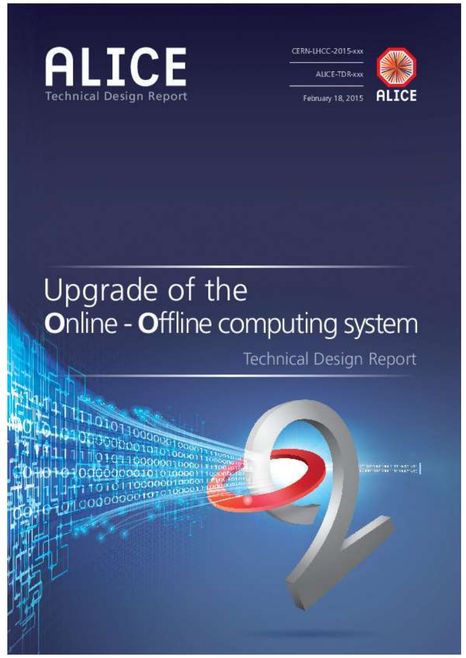
  ➔ Objective: study quark gluon plasma
- Huge installation:
  - 52 meters underground
  - 16m wide and high, 26m depth
  - Weight as much as Eifel tower



ALICE upgrade



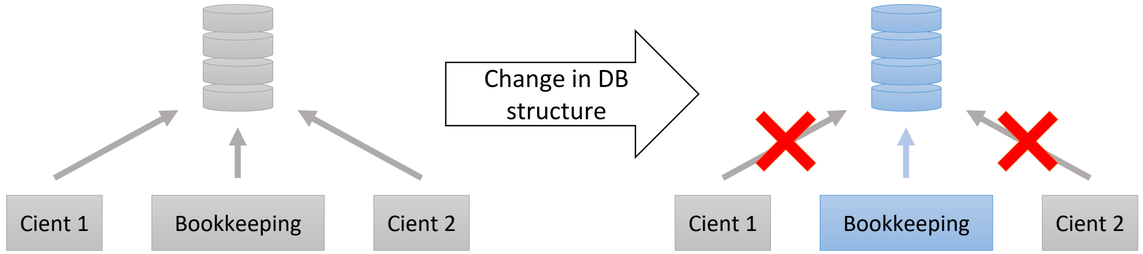
- Long shutdown 2
  - 2018 -2022
- Change multiple detectors
- After upgrade: data rate up to 3.5 TB/s
- New computing system: Online-Offline
  - Online reconstruction of events → reduce from 3.5TB/s to 90GB/s
  - Raw data is discarded, no room for errors
  - Offline processing of events
- Complete rewrite of all the components, including the logbook



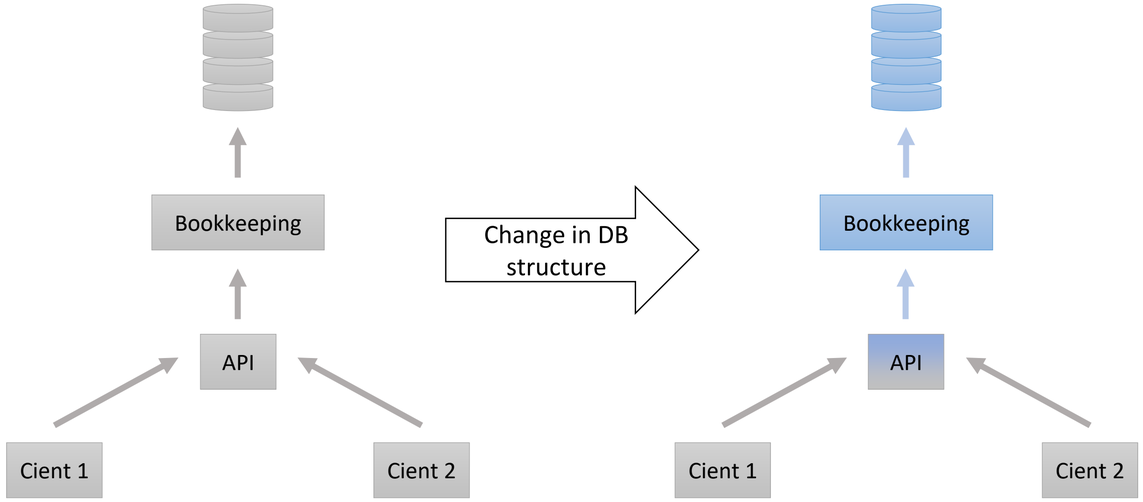
Technical stack – APIs

- Applications need to
  - Provide data
  - Read data
- Naive solution: open access to database
- Problem
  - Clients depend on database structure
    - Limits evolution possibilities of the application
- API
  - Encapsulates database schema
  - Improves security

Direct access to the DB

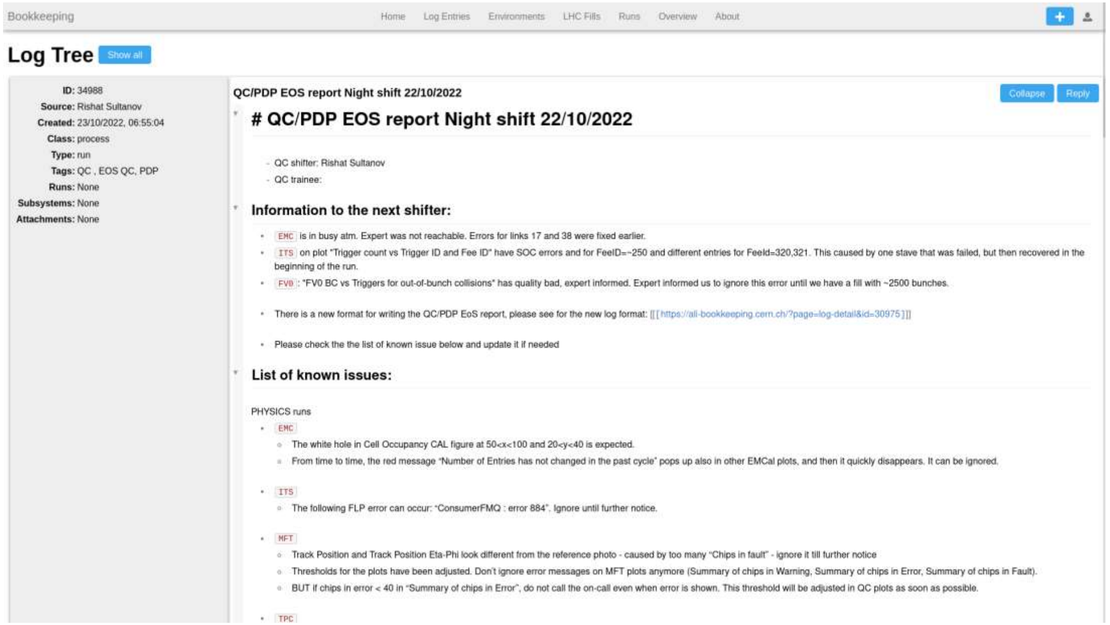


API interfacing DB



Shifters use-case

- End of shift report
  - Quick overview of the situation when starting a shift: previous runs, eventual issues
  - Written by shifters at the end of their shift
- Fill the end of run reason



On-call (experts) use-case

- Get environment list
- Used to identify what has gone wrong