

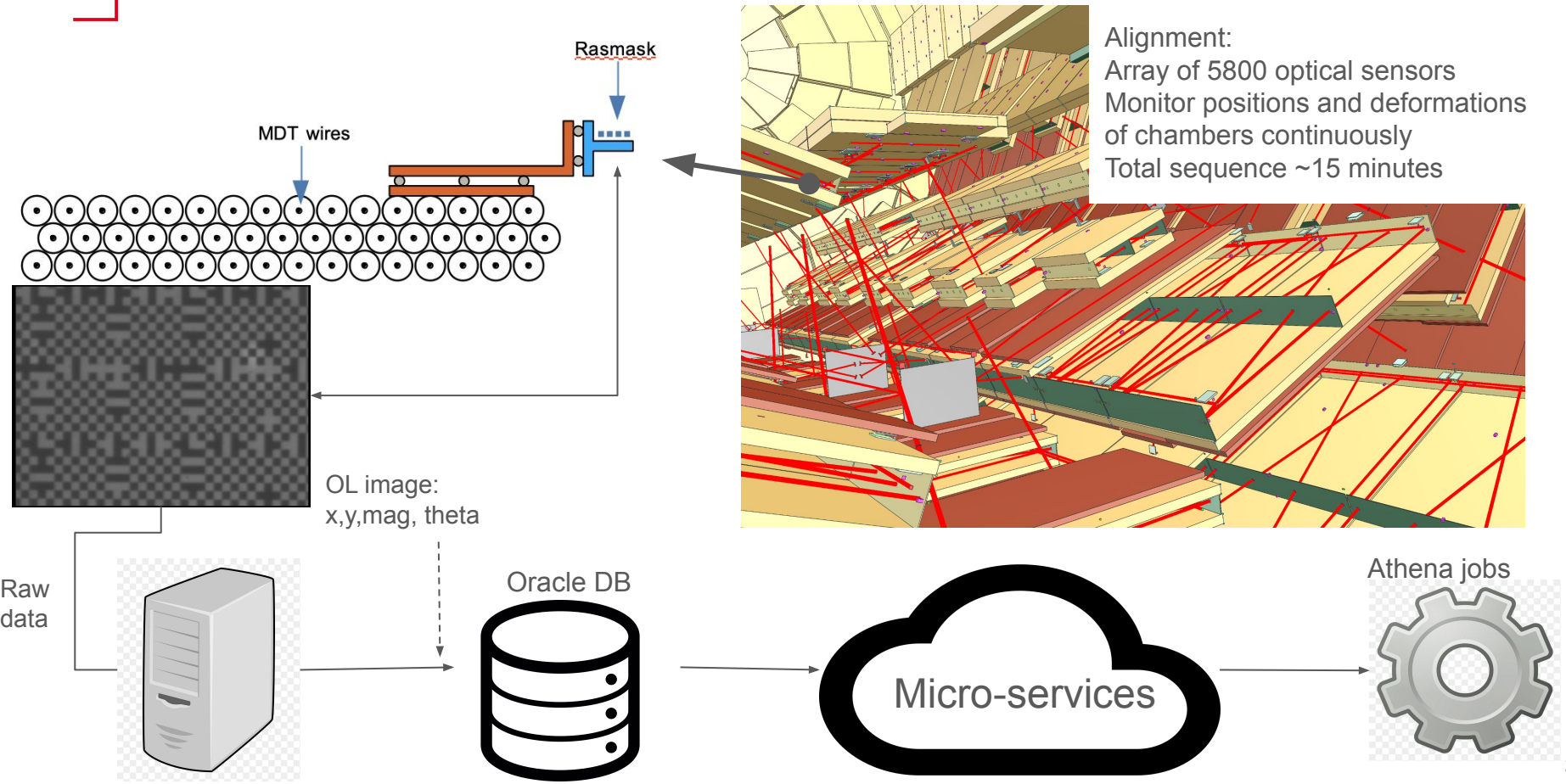
Micro-services architecture for ATLAS Muon Alignment system

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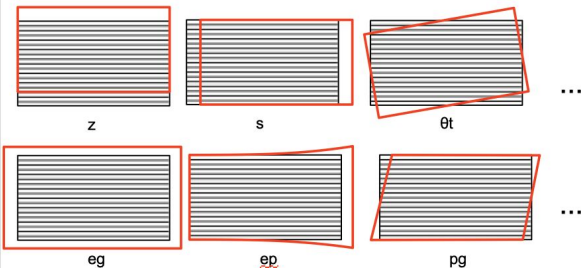
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- ATLAS Muon Alignment system
 - Overview of the “challenge”
- Monitoring architecture
 - Software components (micro-services)
 - Architecture and deployment

Overview of the hardware and software chain



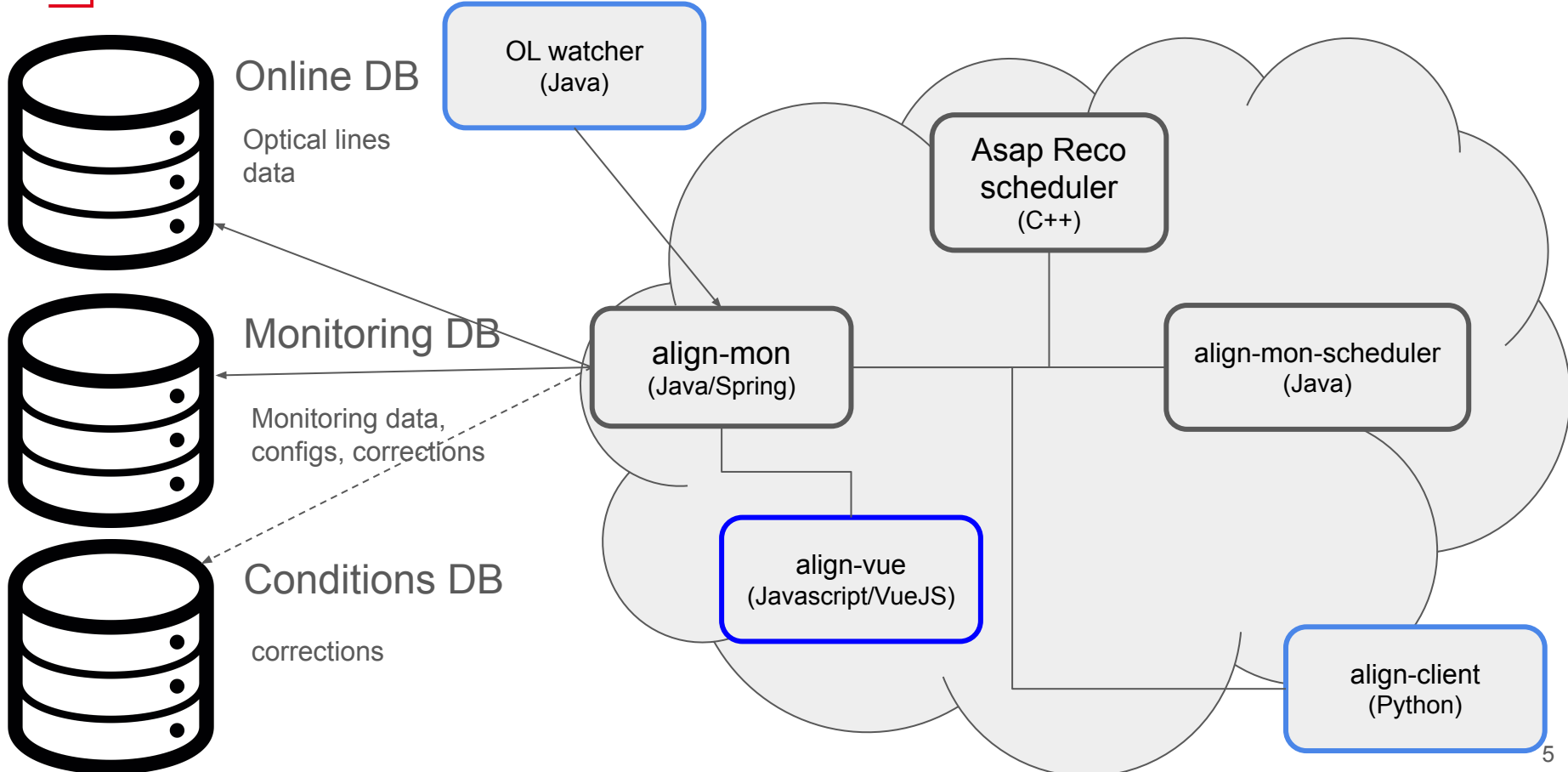
irfu Muon Alignment Reconstruction



Muon chamber alignment corrections:
... 6 position parameters
11 deformation parameters

- **ASAP (Atlas Spectrometer Alignment Program)**
 - C++ program which is performing the reconstruction of the alignment corrections that can be used by the athena muon reconstruction
- **Alignment monitoring system**
 - Monitor and visualize the raw data and keep track of hardware failures
 - Perform the ASAP reconstruction
 - Validate the alignment corrections
 - Debug and correct problems in case of bad fits
 - Export the alignment corrections to Condition DB for later access from Athena

irfu Muon Alignment Monitoring System



irfu Micro-services in Muon alignment monitoring

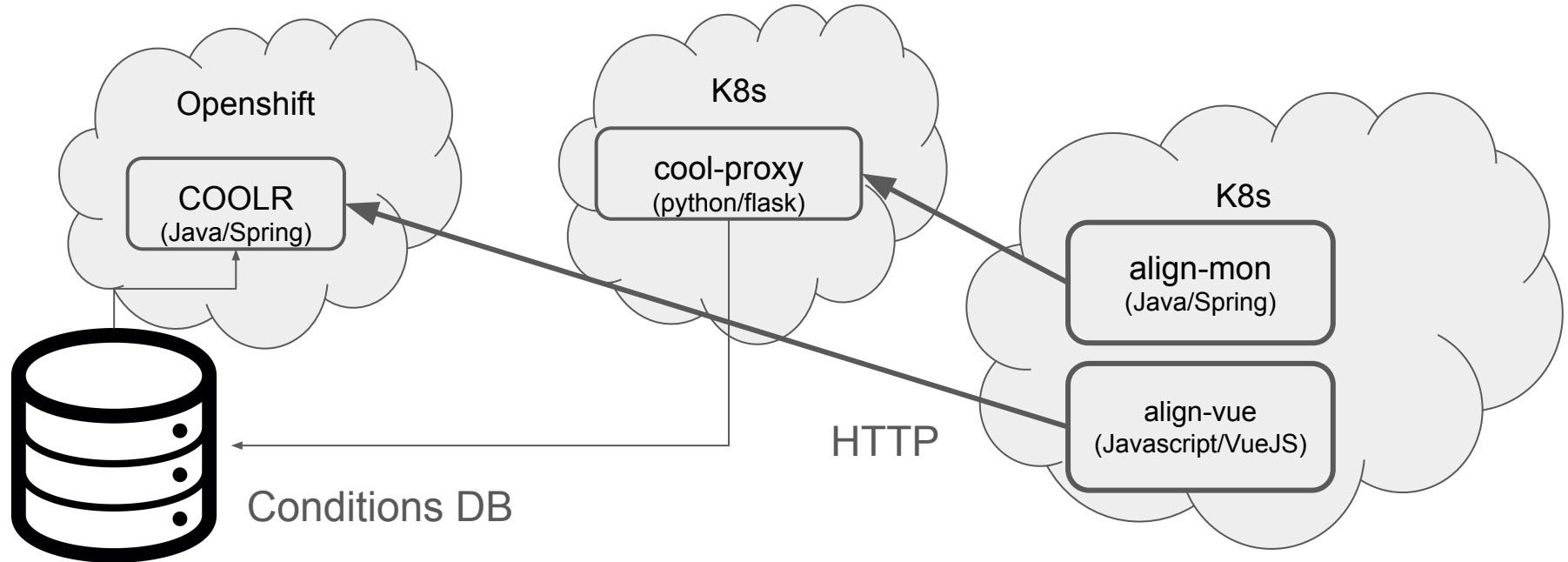
- ***align-mon service*** expose an [API](#) defined using [OpenApi](#) specifications, allowing to generate server stubs and client in several languages and frameworks
 - [openapi generator](#) : we used the available ones for java, javascript and python, while ad hoc generator for C++ using nlohmann / CPR libraries was developed
- Micro-services are stateless: state is completely contained in DB
 - **Asap Reco scheduler** : verify if there are available intervals to run the reconstruction, if so it reads OL data / stores corrections to the DB via align-mon
 - **align-mon-scheduler** : triggers several actions via align-mon service: check for uploads to conditions DB, checks for stability of the reconstructed intervals, ...
 - **align-ui** : browse DB content via ***align-mon*** API: update configuration, remove and relaunch fits are possible for admin users (usage of OAuth2 authentication/authorization features via CERN SSO system)

irfu Deployment

- **Production Site**: Kubernetes cluster created from resources delivered via an openstack project. All services are deployed inside this cluster visible only from GPN network.
- **Openshift** : only align-mon and align-vue services, to deliver browsing capabilities even outside CERN (authentication required)
- **Continuous integration** : images are generated via gitlab-ci, and stored in the CERN registry (Harbor)

irfu Connecting micro-services

- Some features are delegated to external services
 - Uploads to conditions DB (cool-proxy)
 - Check of conditions DB content (COOLR)
(**verify** which intervals have been already updated or **browse** the conditions DB content)



irfu UI functionalities : check OLS

A sample of OLS images are stored daily from P1

Bookkeeping of actions to performed during pit access

The screenshot shows a web browser window displaying the 'Optical hardware status' page. The page has a blue header with navigation links: Home, Hardware, Reconstruction, Cool, Configuration. The main content area is titled 'Optical hardware status' and includes a search bar with 'Query', a filter box containing '08', and a 'Clear' button. The 'Per page' dropdown is set to '50'. Below the search bar, a message states: 'Queried for optical lines with identified problem, ignoring chambers not in position. Filtered 7 optical lines.'

OI Name	PC	Date	Image	Err Incidents
axi_BOS3A08_BOS2A08_RO	2	00:10:13 UTC+1 17 novembre 2022		4 PIT TODO L5. Rasmusx teste, LED peut-etre deconnectee
ccc_BIS7A08_BIL6A09	2	00:10:41 UTC+1 17 novembre 2022		4
inp_BIS2A08_1	2	00:10:30 UTC+1 15 decembre 2017		0 PIT TODO Permanent ERR3: check cabling (see email from Karol 2020-12-04). Removed temporarily from main sequence.
inp_BMS3C08_1	7	00:09:00 UTC+1 17 novembre 2022	(No image)	2
inp_BMS3C08_3	7	00:09:01 UTC+1 17 novembre 2022	(No image)	2
pra_BISSA08_BIS4A08_HV	2	00:15:23 UTC+1 17 novembre 2022		0 PIT TODO Catastrophic shift of all optical lines connected to BISSA08_PAP_CHV (praxial and axial), occurred on 2020-11-02. Should check if the praxial platform is loose
pra_BMS2C08_BMS1C08_HV	7	00:18:11 UTC+2 5 avril 2022	(No image)	2 PIT TODO Channel taken out of main sequence permanently (see e-mail from Karol 2022-04-05) PIT TODO On the CCD cable, we observe several lines are shorted to the ground. Attempted to make a new CCD plug, but no success. Should try to revisit.

ATLAS muon alignment

irfu UI functionalities : check Intervals

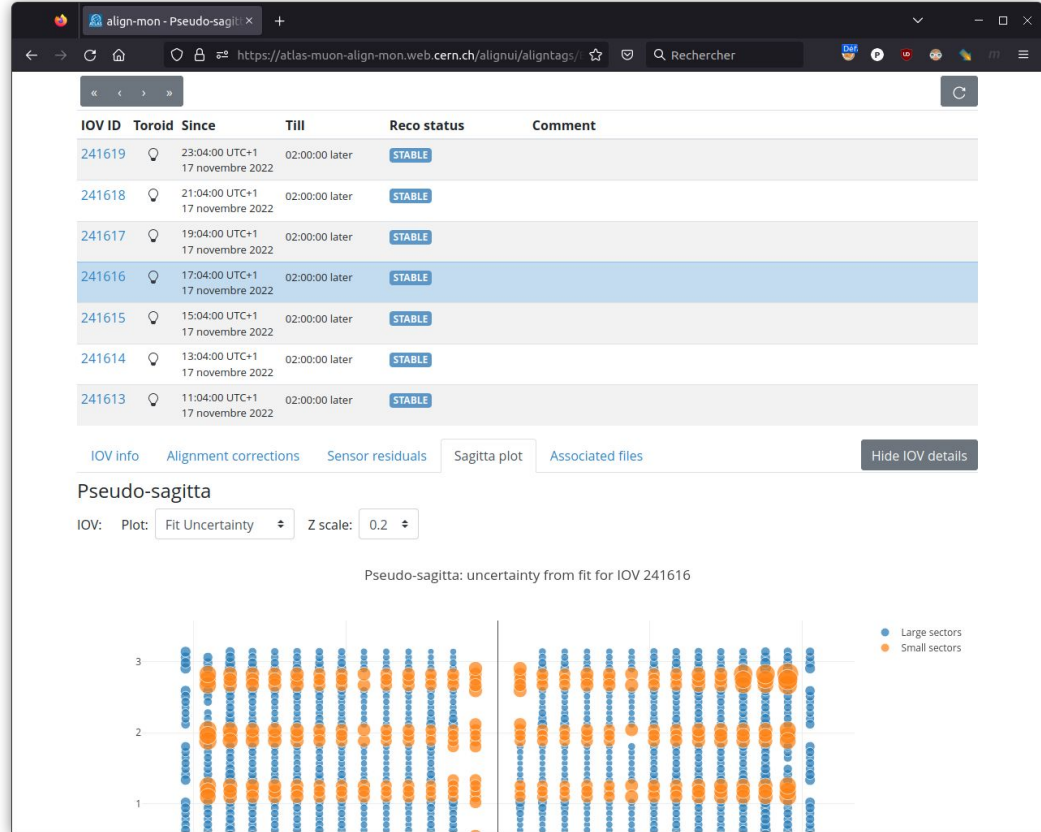
Control the corrections stability for each interval reconstructed

Flag the intervals where the corrections are “moving” and need to be propagated to conditions DB

241542	💡	21:04:00 UTC+1 14 novembre 2022	02:00:00 later	STABLE
241541	💡	19:04:00 UTC+1 14 novembre 2022	02:00:00 later	STABLE
241540	💡	17:04:00 UTC+1 14 novembre 2022	02:00:00 later	STABLE
241539	💡	15:04:00 UTC+1 14 novembre 2022	02:00:00 later	RELEASED_FOR_CONDDB
241538	💡	13:04:00 UTC+1 14 novembre 2022	02:00:00 later	STABLE
241537	💡	11:04:00 UTC+1 14 novembre 2022	02:00:00 later	STABLE
241536	💡	09:04:00 UTC+1 14 novembre 2022	02:00:00 later	STABLE
241535	💡	07:04:00 UTC+1 14 novembre 2022	02:00:00 later	STABLE
241534	💡	05:04:00 UTC+1 14 novembre 2022	02:00:00 later	RELEASED_FOR_CONDDB
241533	💡	03:04:00 UTC+1 14 novembre 2022	02:00:00 later	STABLE
241532	💡	01:04:00 UTC+1 14 novembre 2022	02:00:00 later	STABLE
241531	💡	23:04:00 UTC+1 13 novembre 2022	02:00:00 later	STABLE
241530	💡	21:04:00 UTC+1 13 novembre 2022	02:00:00 later	STABLE

irfu UI functionalities : check corrections stability

Verify the stability of the corrections among intervals



irfu Summary

- CERN openstack/kubernetes infrastructure is well adapted for deployment of useful micro-services and suitable for key production services
- Authentication/Authorization using OAuth2 allows to protect endpoints in an efficient way (in connection with e-groups)
- Micro-services : in REST architectures the definition of the API is essential. OpenApi usage allows for fast client generation, and defines a clear contract between services.