

Performance monitoring framework for the technical infrastructure

Ugo Gentile on behalf of TIOC

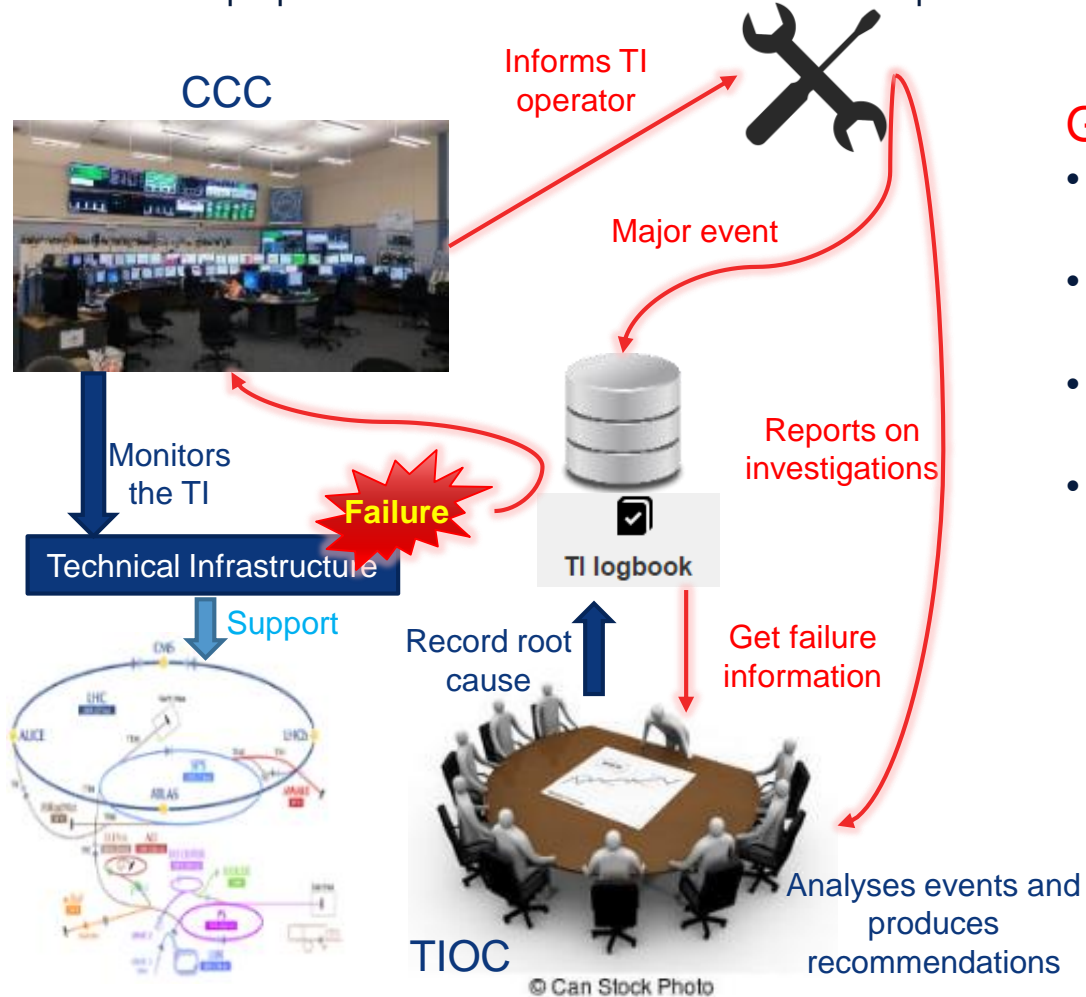


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- Context
- Project goals and work plan
- Activities:
 - SBS
 - Alarm discovery
 - Integration with AFT and Infor EAM DB
- Conclusions

Monitoring and analysis of the technical infrastructure

- Control Center TI operators are in charge of monitoring and record failures
- TIOC meets weekly to perform:
 - post-mortem analysis and coordinate interventions
 - identify root causes
 - propose consolidation actions to minimize impact on the machines complex

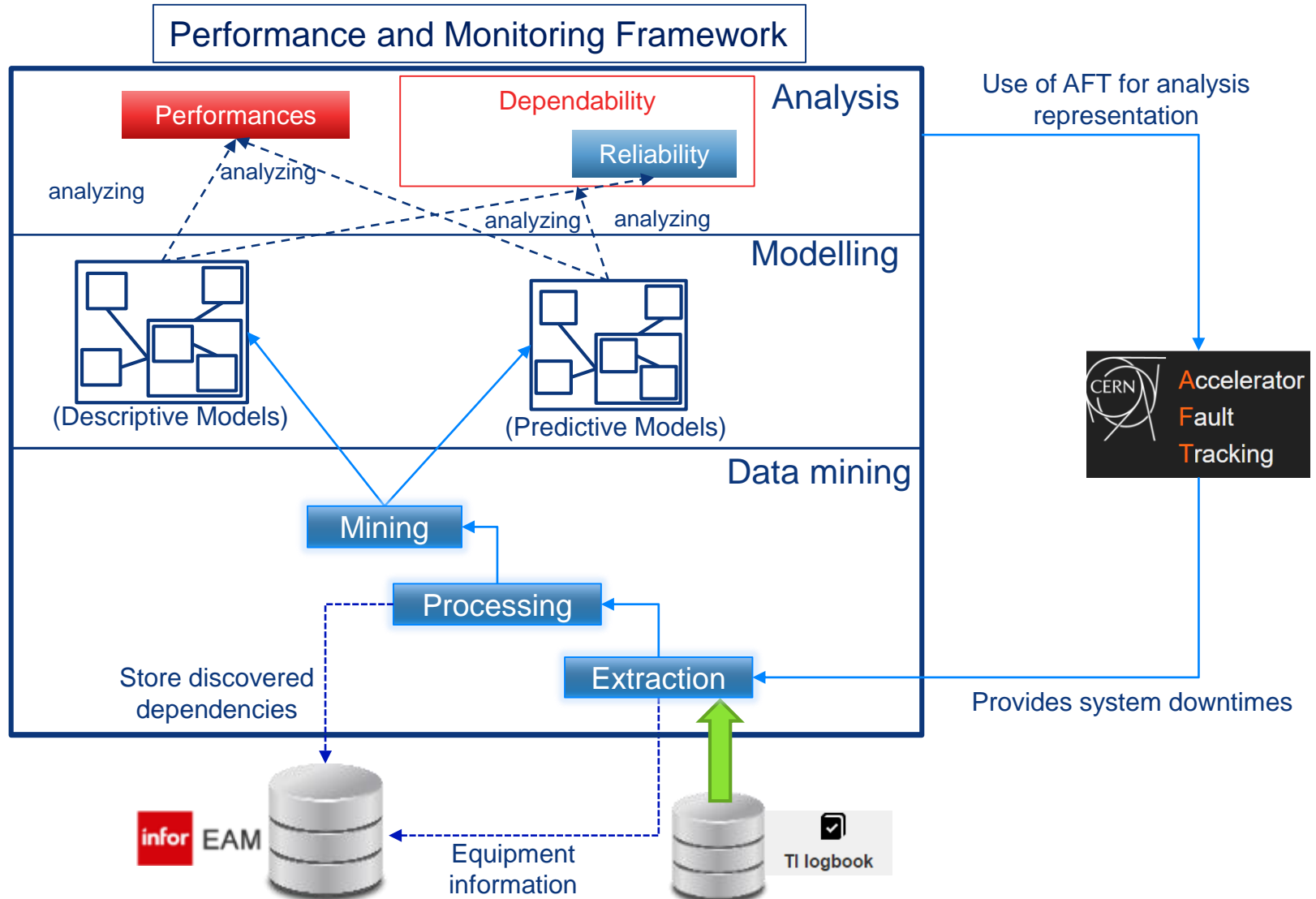


Goals and issues:

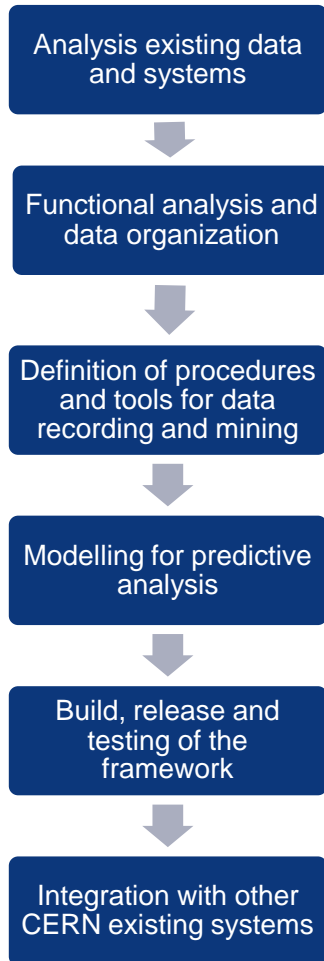
- Clear and representative KPIs
- **Automate** the analysis
- Downtimes calculations (TI logbook)
- Models showing functional dependencies

Project goals

Develop a supporting framework for monitoring and analysis of the TI, guide intervention and troubleshooting



Workplan

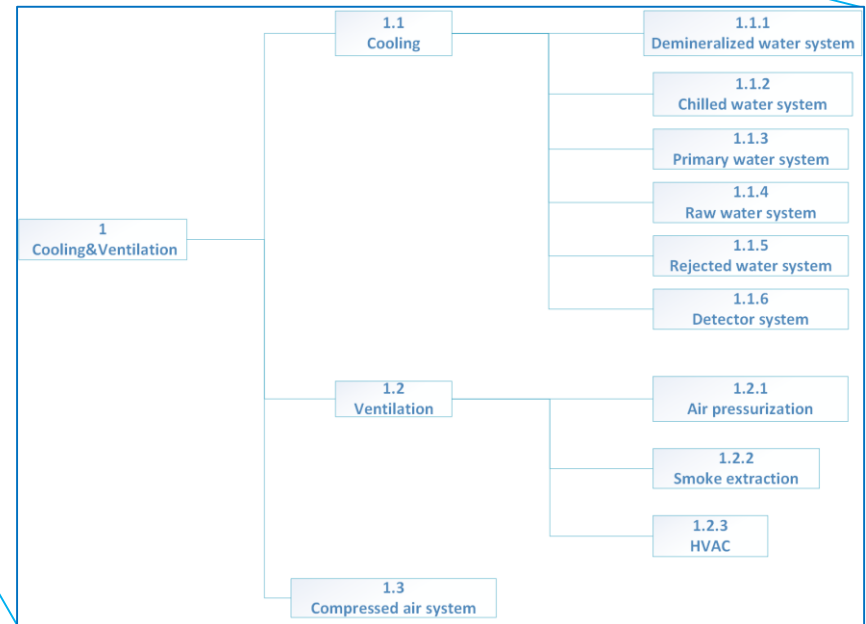


Functional analysis:

Definition of a hierarchical structure to record failures in the logbook: the System Breakdown Structure (SBS) based on systems and data analysis

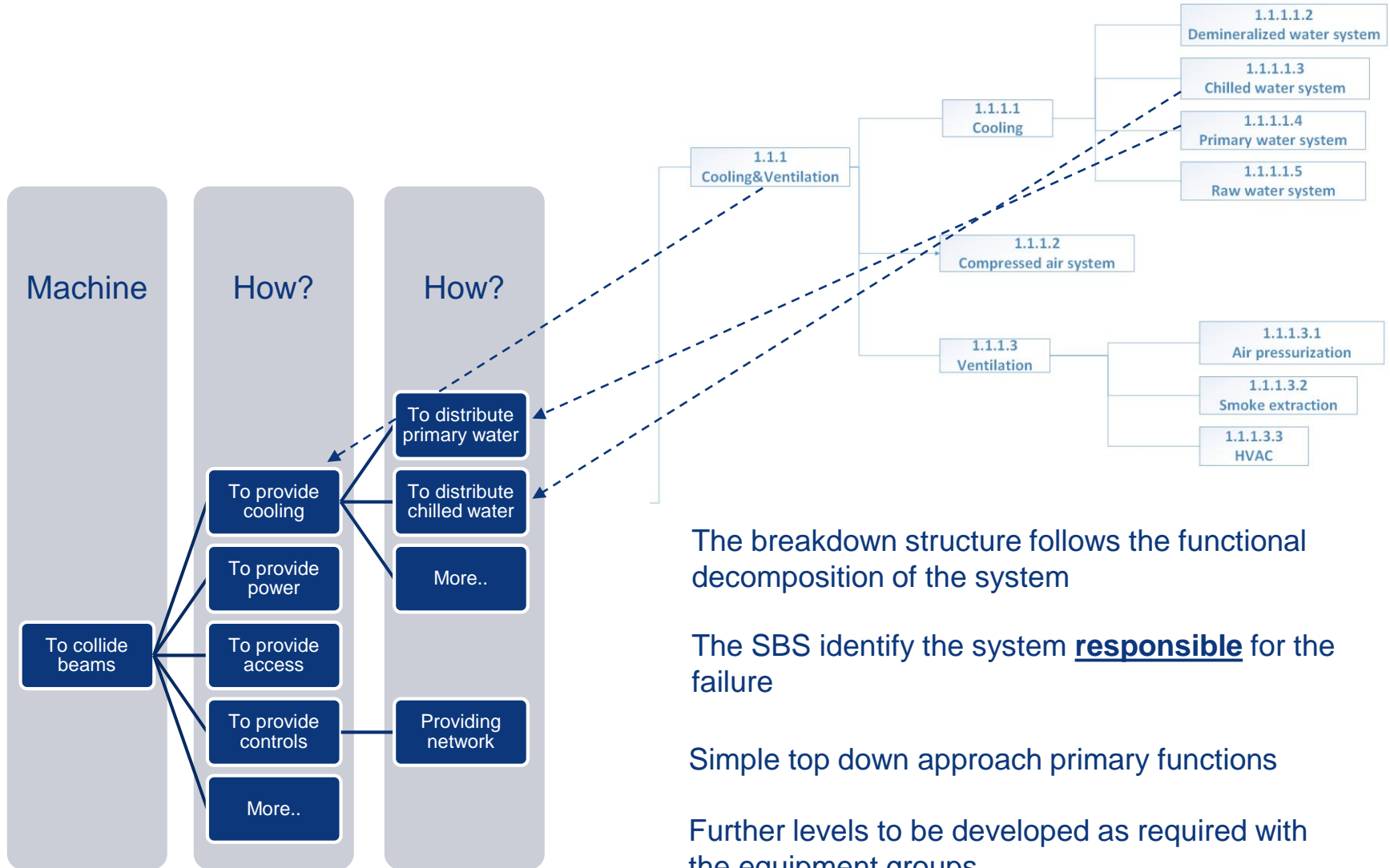
The SBS is necessary since:

- ✓ Allows to understand system functionalities and dependencies
- ✓ Allows to organize failure data for the **modelling phase**
- ✓ Provides a common interface to integrate the TI Logbook with other existing systems (e.g. the AFT)



SBS definition process

Top-down approach, following the functional structure of the system



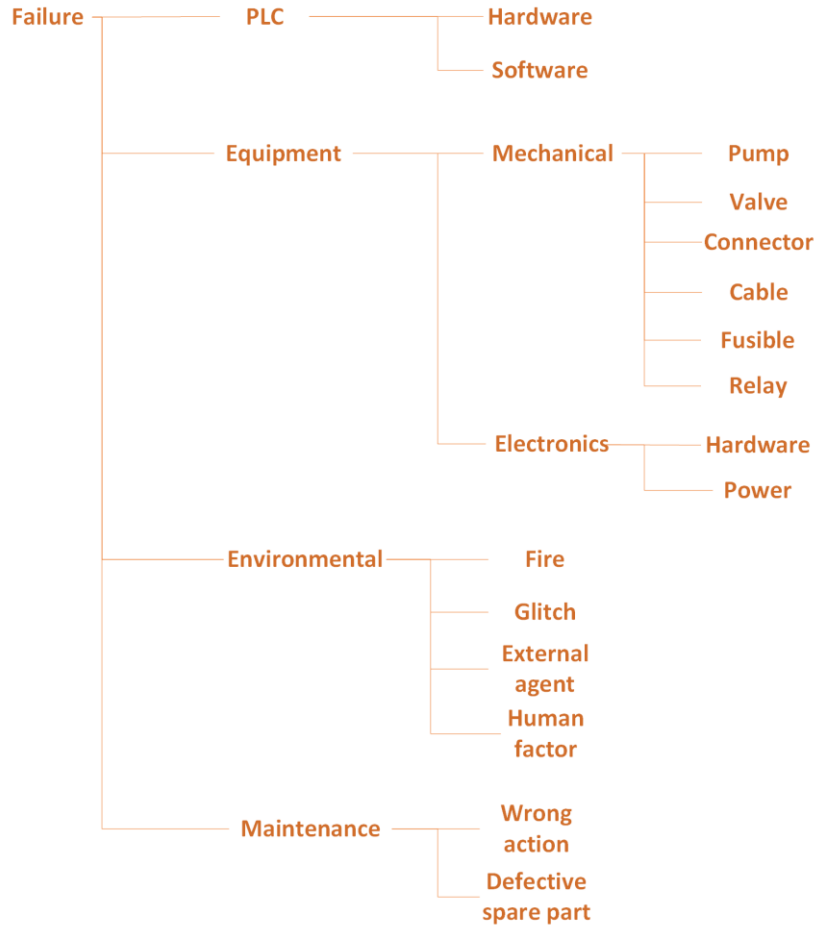
The breakdown structure follows the functional decomposition of the system

The SBS identify the system **responsible** for the failure

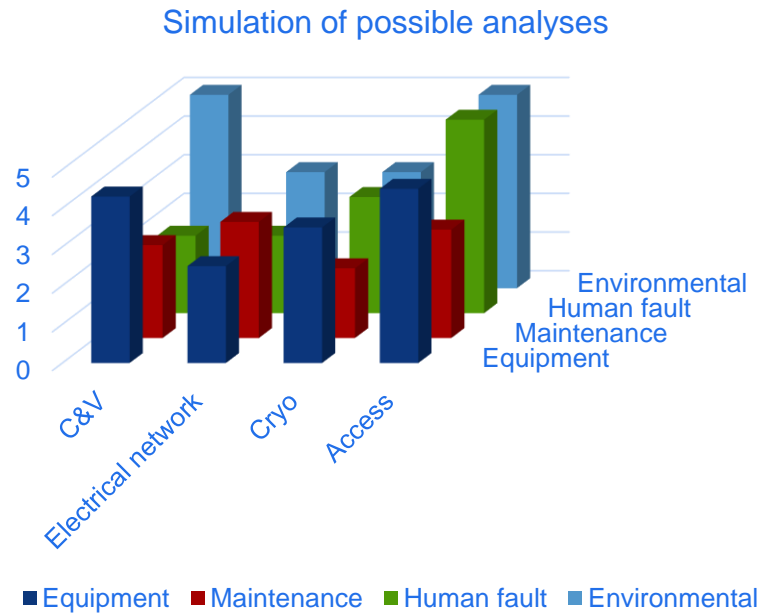
Simple top down approach primary functions

Further levels to be developed as required with the equipment groups

Root cause field definition



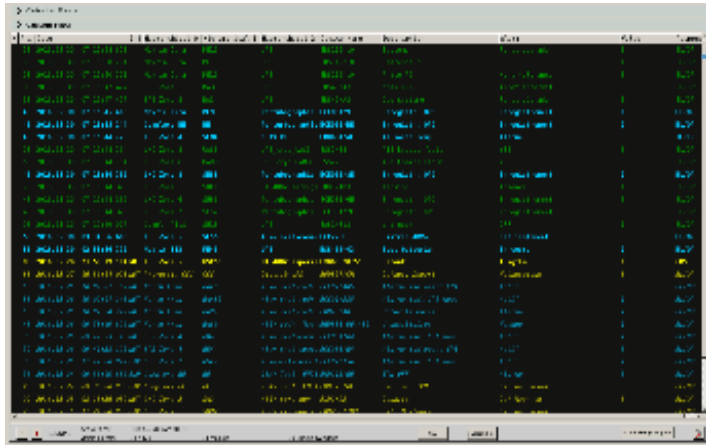
- Failure category should be specified for analysis purpose
- Used has an attribute of the failure
- A hierarchical organization to simplify the analysis at different level



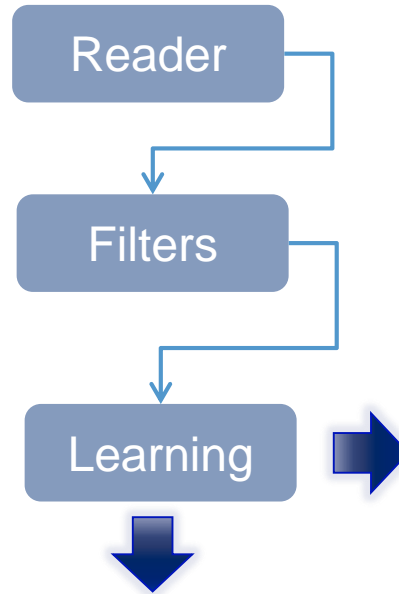
The failure attribute specify why the responsible system has failed

Alarm data mining

Based on alarm systems used by the CCC Operator (LASER, PSEN..)



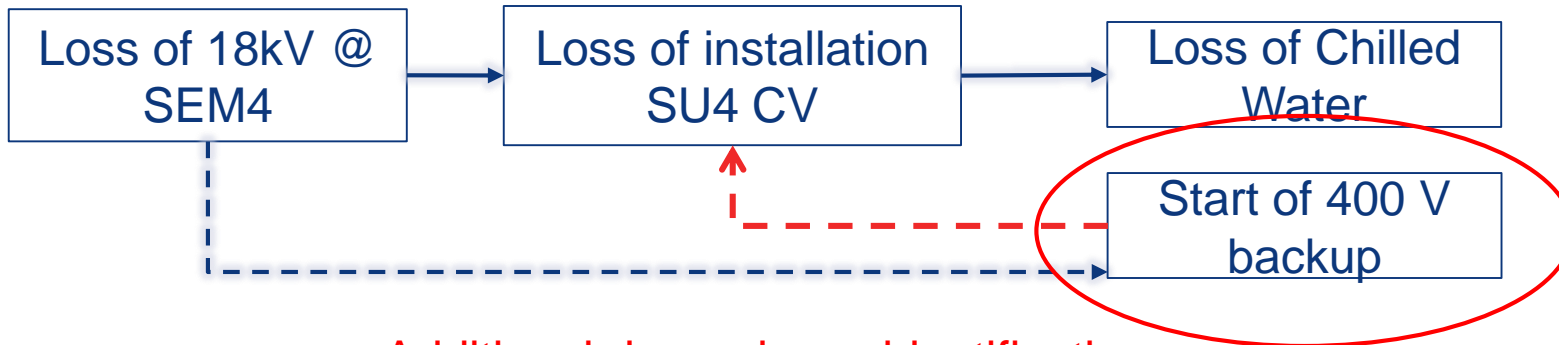
PSEN, LASER..



To help CCC operators to identify failure causes



To discover dependency



Additional dependency identification between Air compressed (SU4) and 400V

Integration with the AFT (1/2)

The integration allows to have a common and unique tool for assessment of availability and reliability for the whole accelerator complex

Open Issue: Need for a synchronization mechanism between the two systems!

AFT Event n. 26140

Assigned to System	Technical Services » Electrical Network
Current State	OP Ended
Started	07-04-2016 03:34:19 OP
Ended	07-04-2016 03:56:24 OP
Duration	22m 05s
Faulty Element	RCO/RCD.A56B2
Description	: tripped during the ramp, problem on a DC cable

- Initially assigned to TI

- Then rejected and assigned to Power Convertor

🔧 25-04-2016 10:12:35 by jespem on fault
Not TI fault, no perturbations at this date

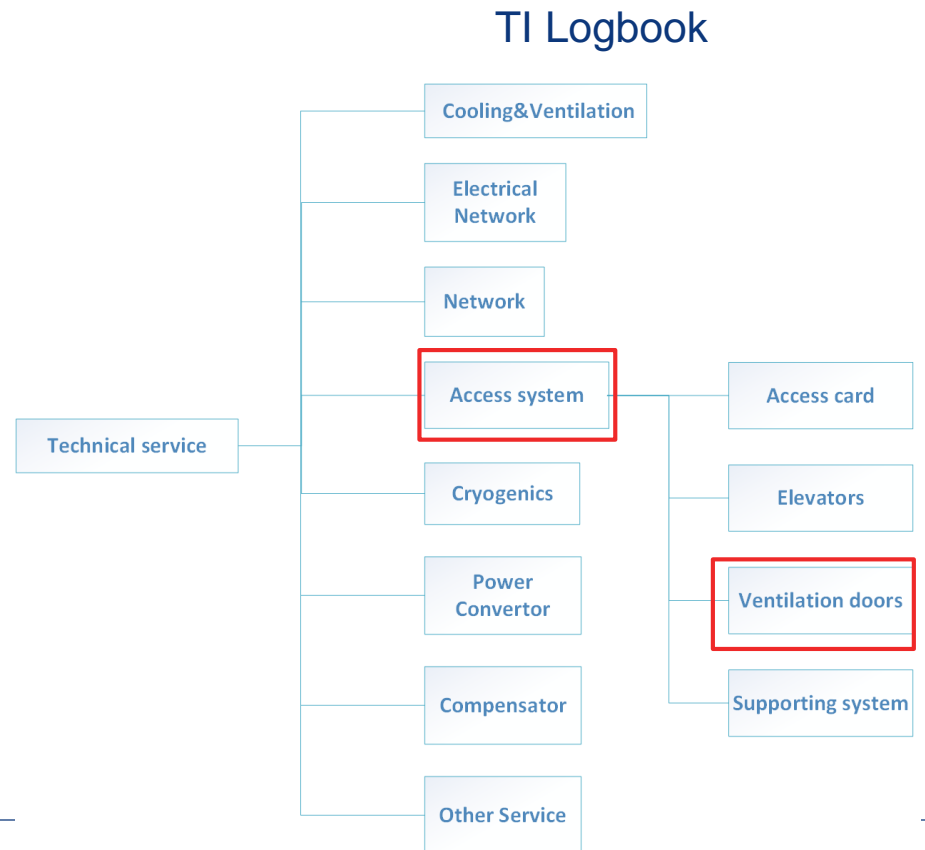
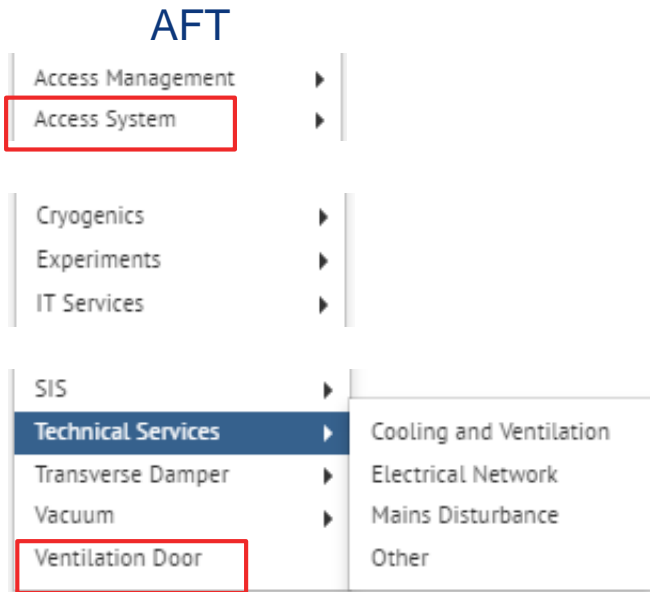
- Then assigned again to TI

🗨️ 12-05-2016 11:22:19 by vmontabo on fault
This fault is not related to the Power Converter.
The problem was on the DC Cables ;

- But there isn't a major event in the TI Logbook

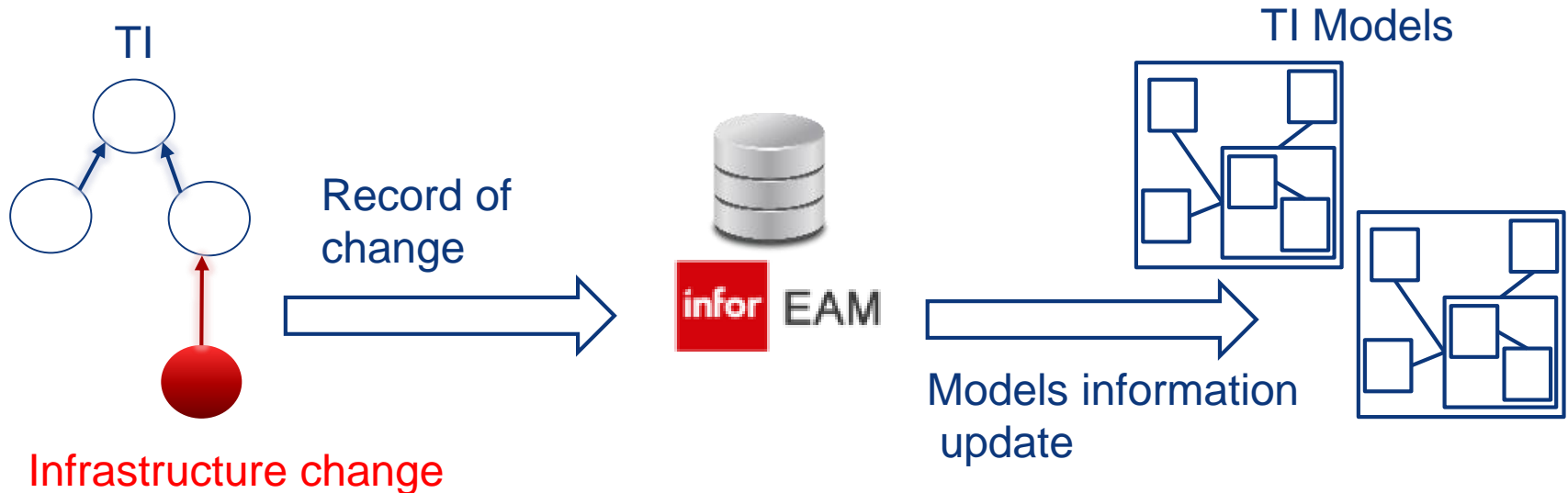
Integration with the AFT (2/2)

- ❑ Different breakdown structures in AFT and TI logbook increase the discrepancies.
- ❑ Data synchronization only in a manual – and error prone – way
- ❑ Functional incoherencies:
Example: Ventilation Doors and Access system at the same functional level than the whole Technical service



Integration with the InforEAM DB

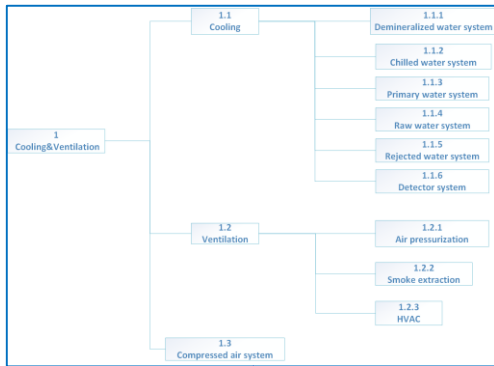
- The System breakdown structure provide a high-level view
- InforDB allow to implement and structure the detailed dependency of all assets of the TI
- The **InforEAM DB functional positions** provide:
 - the storage of the functional dependencies information
 - the maintenance and consistency of models and the equipment



This integration is currently being defined with the InforEAM DB group

Work plan schedule

System Breakdown Structure



End 2017

2nd semester 2016

System analysis

2nd semester 2016

Data structuring

1st semester 2017

Development of procedures and tools for data mining;
Definition of interfaces for the integration with the AFT

2018 -2019

Modelling for predictions

Build, release of the framework;
Framework and integration testing

Machine learning

- ✓ to self-adapt models to the changes of the TI
- ✓ to guide operation and interventions in order to reduce MTTR and recovery

First release of the framework

Conclusion

- Monitoring and analysis of TI will be supported by a computer-based framework to:
 - Provide representative performance indicators
 - Provide tools for the analysis and monitoring
 - Reduce analysis time
 - Reduce manual – and error prone! – activities
 - Streamline operation and intervention activities
 - Maintain consistency with infrastructure evolution (by relying on data)
- Integration with existing CERN tools is a key activity in order to provide coherent analysis and interpretation of data



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