

Accelerator Fault Tracker/Performance Tracker

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04/07/12 Higgs Boson Announcement



28/04/16 18kV Transformer, 1 week downtime



Large Hadron Collider: Weasel causes shutdown <https://www.bbc.com/news/world-europe-36173247>

Accelerator Fault Tracker: What is it?



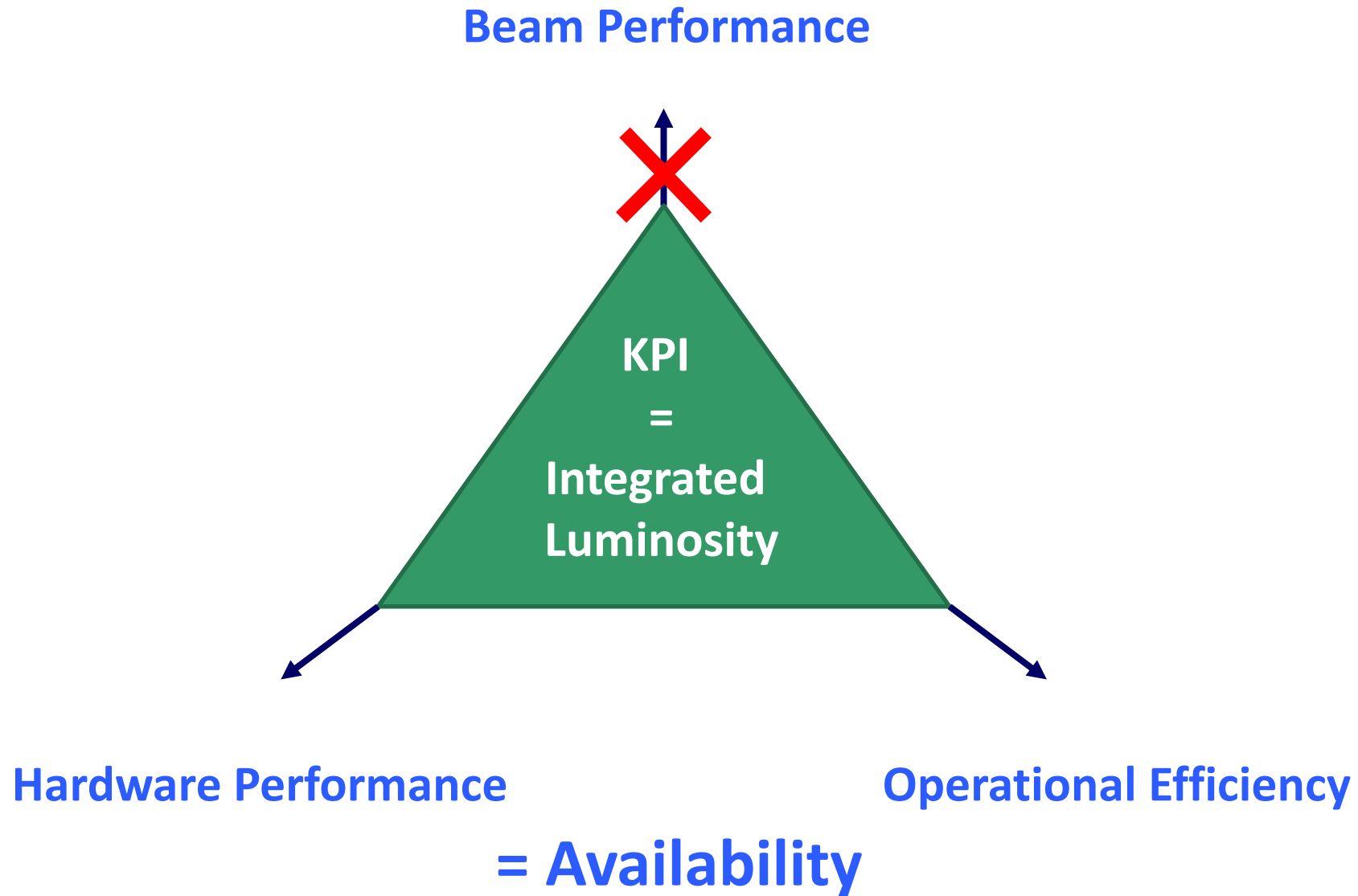
Operators register faults – providing a very **broad overview** of accelerator behavior, but **lacking details** for targeting improvements

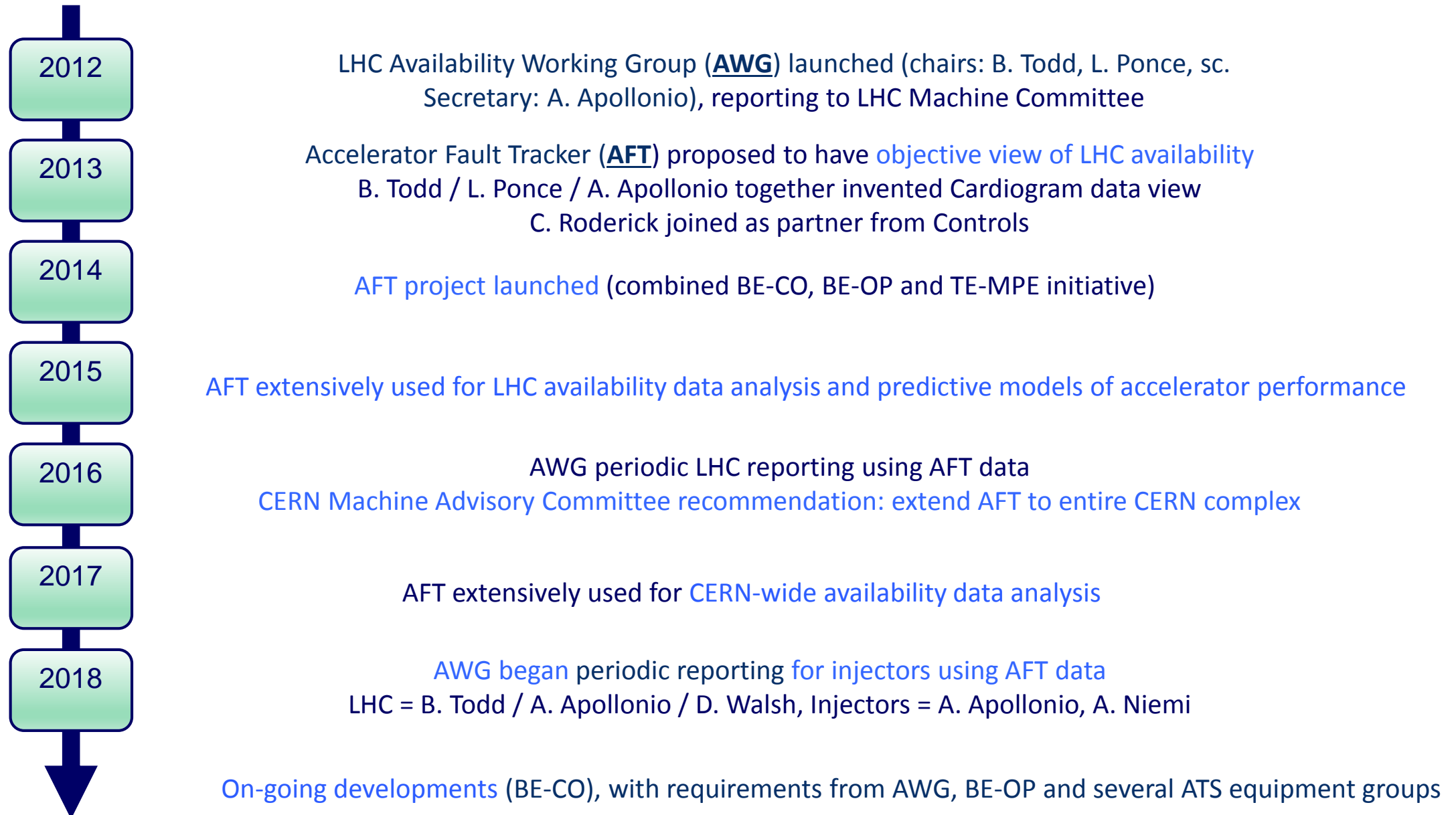
AFT is a software application to:
Ensure consistent and objective fault tracking for the CERN accelerator complex

System experts register faults via dedicated tools (Jira, AMMSs, Excel, etc.) that are not easily shared – resulting in a **very detailed system specific view**, but **lacking information on overall accelerator impact**



AFT: Why was it invented?





AFT: What does it do?

Fast, powerful and objective reporting on accelerator performance

Enabling to:

Prioritize consolidation activities according to impact on availability

Maximize return of investment given allocated budget constraints

Provide input for modelling of accelerator projects

Cardiogram of LHC Operation



History of changes

Customisable Event Details

The image displays two side-by-side screenshots of the LHC Equipment interface, showing fault details for different equipment types. Red circles highlight the equipment names 'LHC Equipment' and 'PSB Equipment' at the top. Red lines connect these circles to red boxes highlighting the 'Attributes' section at the bottom of each page. The 'Attributes' section includes fields for Impact, RP Needed, Precycle Needed, Prevents Injection, R2E Status, and System-specific Properties.

Left Screenshot (LHC Equipment):

- System:** Electrical Network » Distribution
- Effective Duration:** 05h 40min 21s
- Description:** Large electrical glitch
- Display Label:** [?]
- Access Needed:** No
- Labels:** TIOC, [x], [+]
- Impact:** RP Needed [No], Precycle Needed [Yes]
- Prevents Injection:** [No]
- R2E Status:** NOT_R2E_RELATED
- System-specific Properties:** TI Fault Type [none], TI Major Event Id [none]

Right Screenshot (PSB Equipment):

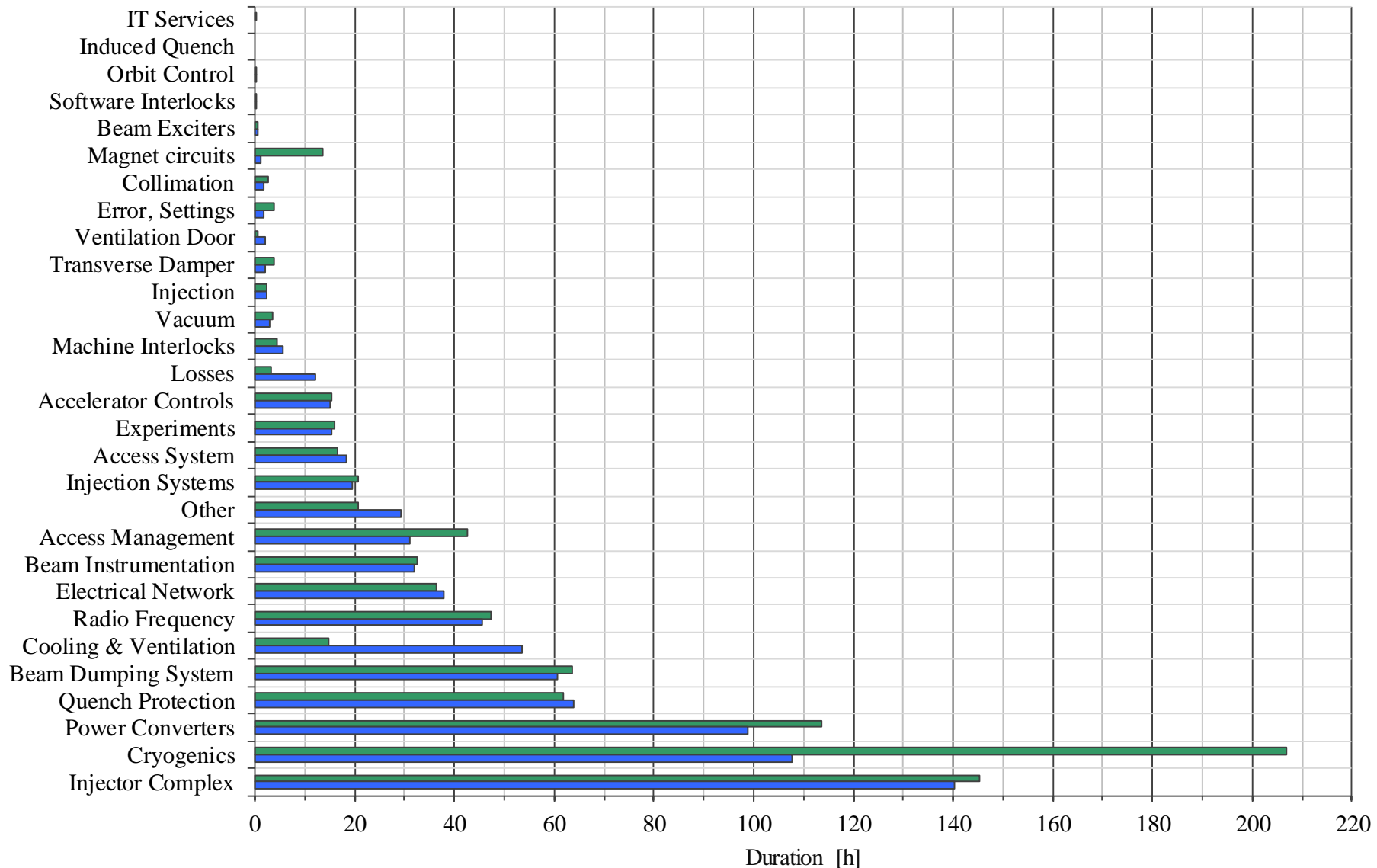
- System:** Electrical Network » Distribution
- Effective Duration:** 0s
- Description:** Electrical Glitch
- Display Label:** [?]
- Access Needed:** No
- Labels:** TIOC, [x], [+]
- Impacted Destinations:** PS
- Affected Rings:** Ring 1, Ring 2, Ring 3, Ring 4
- Timing User:** ZERO, Destination: BDUMP
- Mapped Cycle:** ---ZERO---
- System-specific Properties:** TI Fault Type [Glitch], TI Major Event Id [57706]

Activity Log (Right Screenshot):

- 31-05-2018 14:43:33 by becodev: Fault registered by psbop.
- 31-05-2018 14:43:33 by copera: Fault state [Blocking OP] added starting at 31-05-2018 14:27:55.
- 31-05-2018 14:54:04 by copera: Fault state [OP Ended] added starting at 31-05-2018 14:43:00.
- 31-05-2018 15:13:00 by bettina1: Fault marked as [AWG Reviewed]
- 12-06-2018 16:30:01 by rledru: Description changed from "Electrical Glitch" to "Emergency stop".
- 12-06-2018 16:30:21 by rledru:

Objective view of 2017 LHC System Downtime

Clustered Pareto - Fault Duration and Root Cause Duration vs System



System Viewpoint =
Integrated fault time logged

Operations Viewpoint =
Corrects for dependencies
parent / child / shadow

Fast, powerful and objective reporting on ~~accelerator~~ industry specific performance

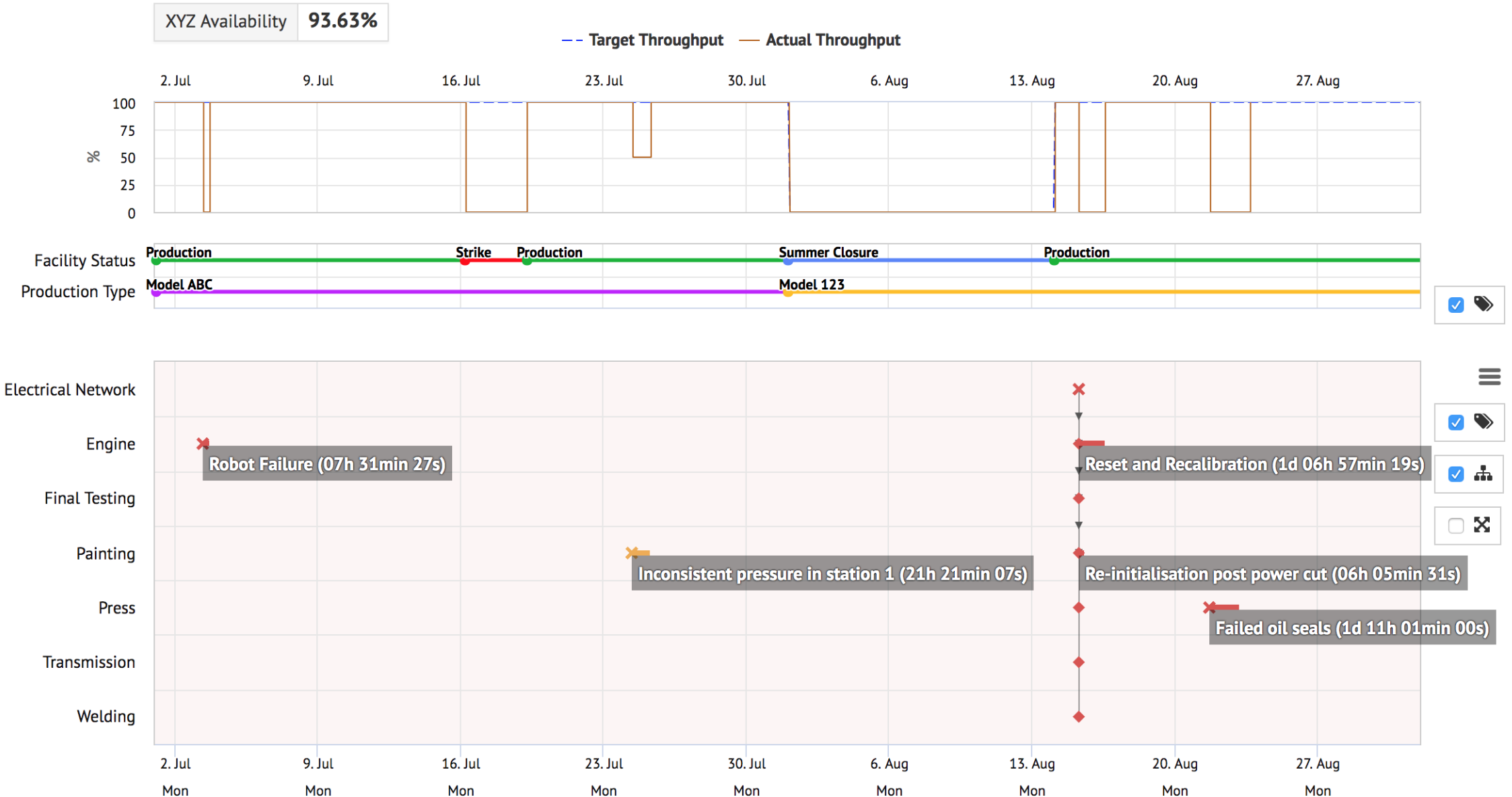
Enabling to:

Prioritize consolidation activities according to impact on availability

Maximize return of investment given allocated budget constraints

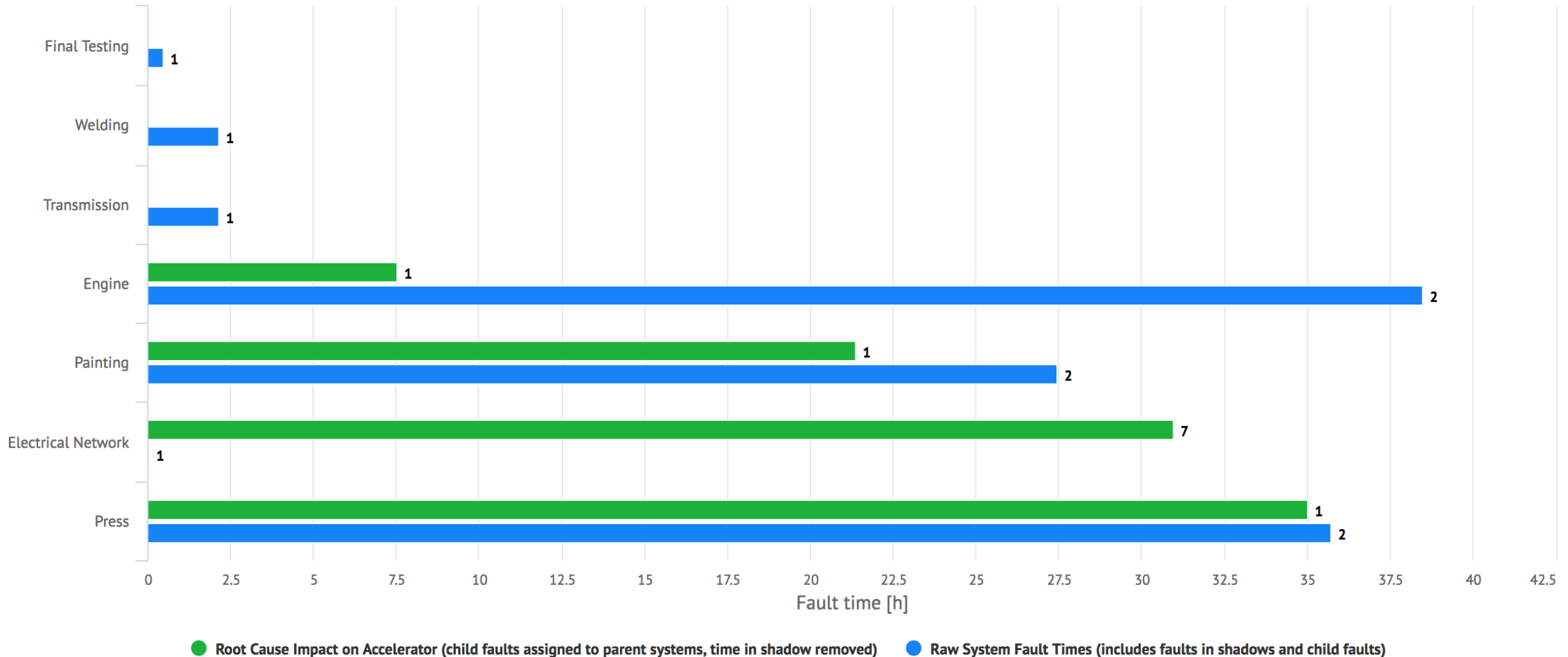
Provide input for modelling of ~~accelerator~~ industry specific projects

Example Cardiogram for Industry



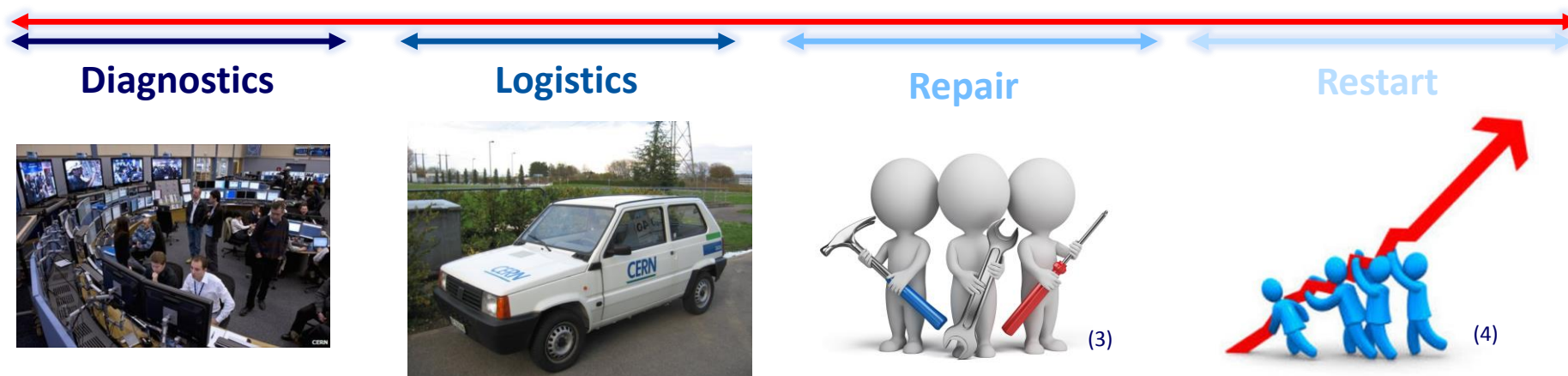
Objective view of Industry Facility Downtime

System Downtime Vs Facility Impact

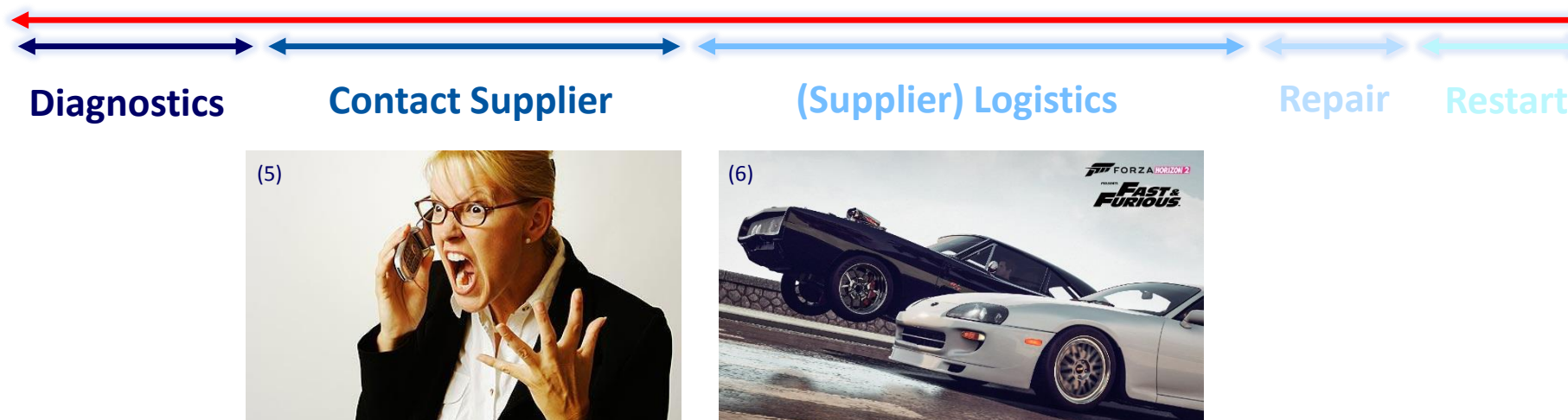


Unavailability

Any particle
accelerator
/
Any production
facility



Production
facilities



AFT could allow having an **accepted interface** with service and part suppliers

What are the next steps needed to take it further

Remove dependency on Oracle database → move to something Open Source.

(also an opportunity to get practical experience in ATS with an Oracle alternative)

Software development / re-factoring to:

- **generalise concepts** such as “Accelerators” and possibly “Faults”
- **re-package** into a core with extensions (to satisfy domain specific code / concepts e.g. LHC fills)
- Provide **alternative authentication / authorization mechanisms** (e.g. not only CERN SSO)
- Extend with **configuration tools** to avoid the need for custom configuration scripts

Investigate different scenarios on **how to distribute** AFT and then put something in place, learning from similar CERN endeavours like Indico.

AFT is used at CERN during ~4 years

It satisfies use cases which are surely applicable to many other fields

To the best of our knowledge, there are no similar products in the market place

The main technical actions required to take this further are known, but require more detailed investigations

aft.cern.ch

Reference 1: <http://go.web.cern.ch/go/vLx7>

Reference 2: <http://archive.is/pkNQB>

Reference 3: <https://www.bitmart.co.za/product/antminer-repairs-returns/>

Reference 4: <https://www.forconstructionpros.com/rental/article/11565139/its-time-to-increase-rental-rates>

Reference 5: <https://imgflip.com/memetemplate/53718762/Angry-phone-call>

Reference 6: <https://www.teamvvv.com/reviews/forza-horizon-2-presents-fast-furious-review/>