LASER MEGAJOULE FACILITY OPERATING SOFTWARE OVERVIEW

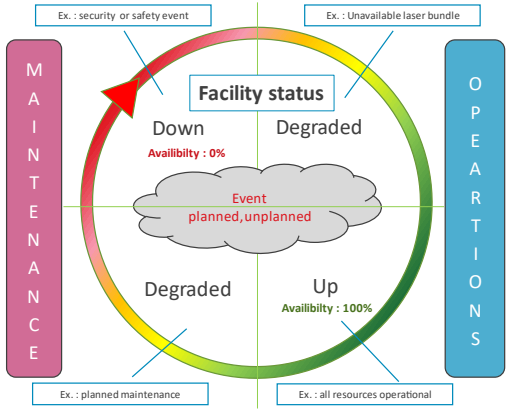
Jean-Philippe AIRIAU, Pascal TORRENT, Hugues DURANDEAU, Nadine LOUSTALET, Pauline FOURTILLAN, Vincent DENIS

CEA - CESTA, F-33116 Le Barp, France

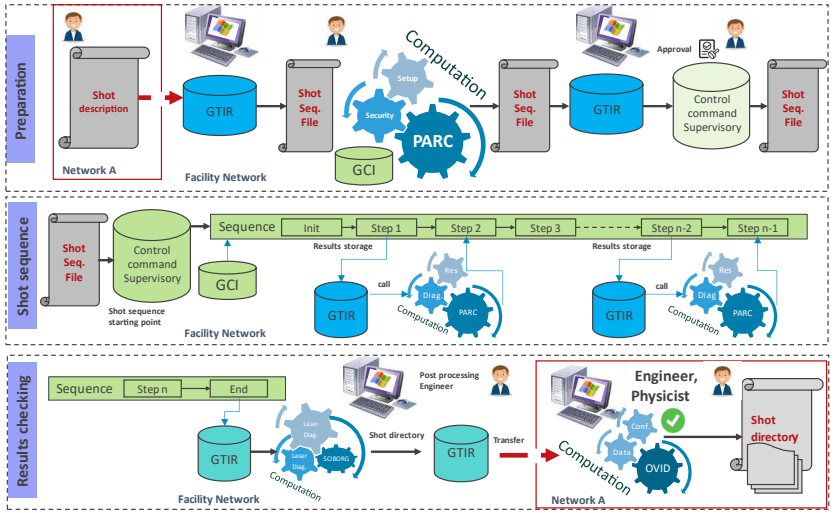
MOPV003

ICALEPCS 2021

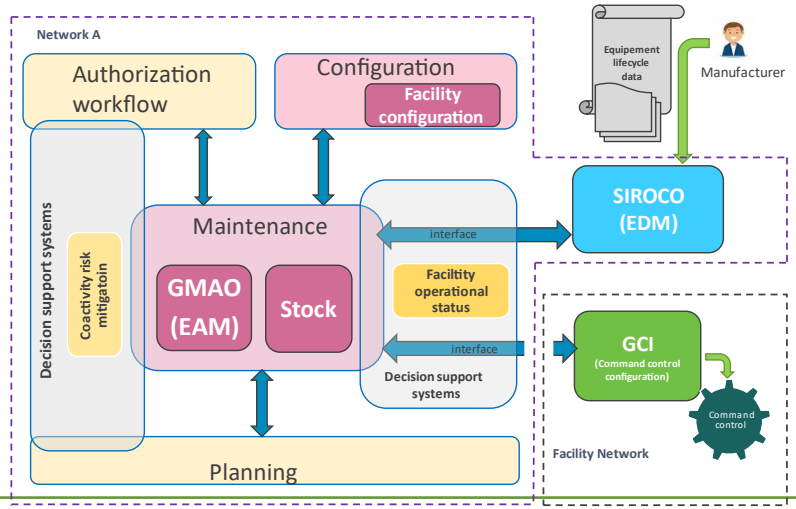
Optimizing facility availability with operating software



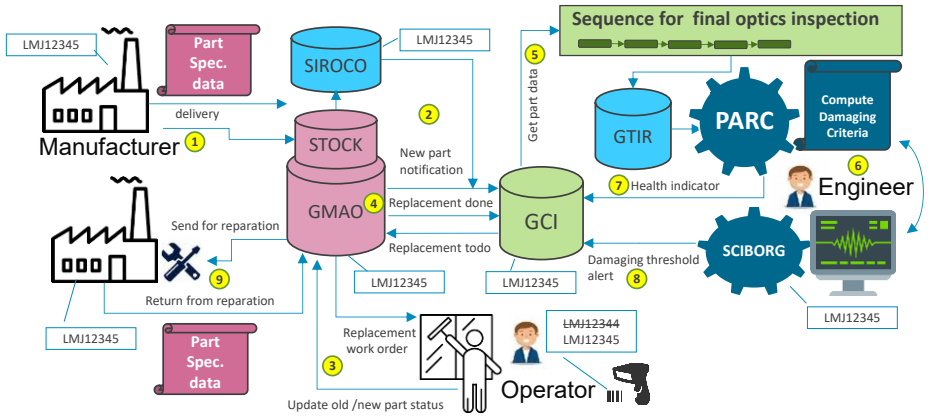
Operating Software for experiment (from the setup to the results)



Operating Software for maintenance (from the supply chain to the asset management)

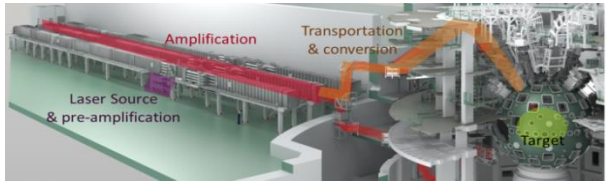


Use Case: Vacuum window lifecycle



The LMJ facility is still in construction. We are currently mixing assembly, operating and maintenance activities at the same time **(see FRAL01 : LMJ status report).**

LMJ Facilicty is composed of thousands of parts.



LMJ Facility Operations LifeTime (LMJ-OLT) : 30 years or more

Parts have different Mean Time To Failure (MTTF) :

- Parts with MTTF > LMJ-OLT : no maintenance expected (ex. metal bracket)
- Parts with MTTF< LMJ-OLT :
  - recurrent maintenance (ex . : pump)
  - operation dependent maintenance (ex. : optics)

Operations and maintenance are two different lines of work , but serve the same goal : facility availability.

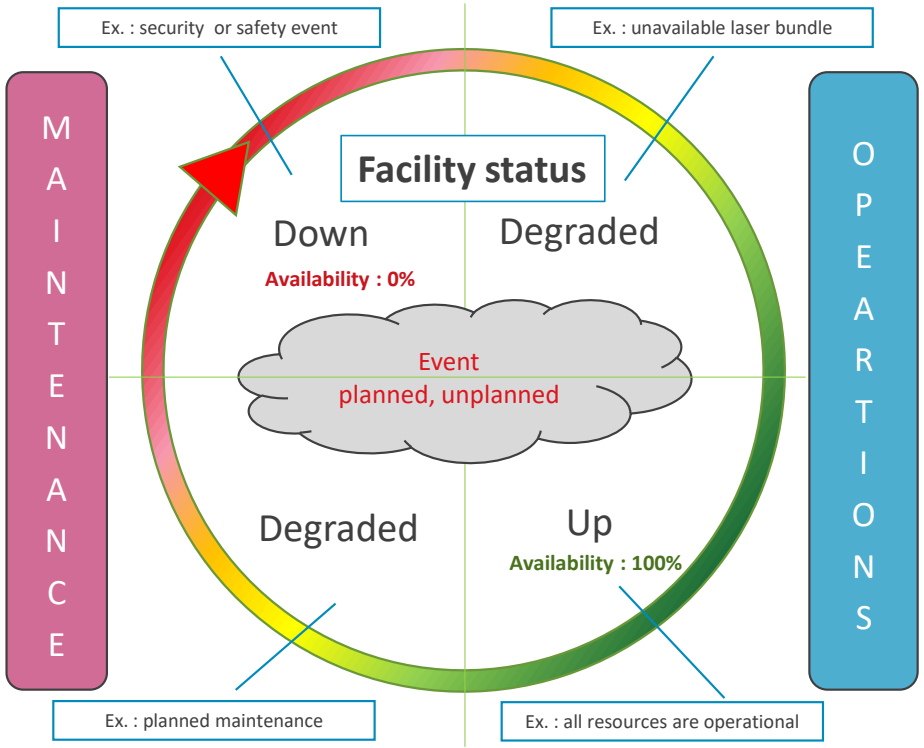
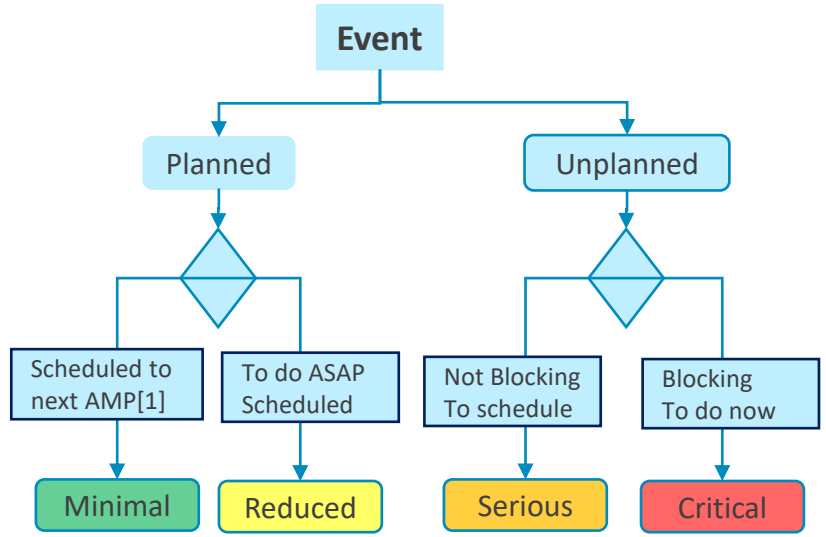


Figure 1 : Operations and maintenance duality

Operating software are use on both side. They are used to automate, secure and optimize the operations on the LMJ facility. They contribute to the smooth running of the experiment process (from the setup to the results). They are integrated in the maintenance process (from the supply chain to the asset management)

Optimizing facility availability



Availability impact :

[1] AMP : Annual Maintenance Period

Figure 2 : impact of planned and unplanned events on facility availability

Operating Software for experiment (from the setup to the results)

MOPV003

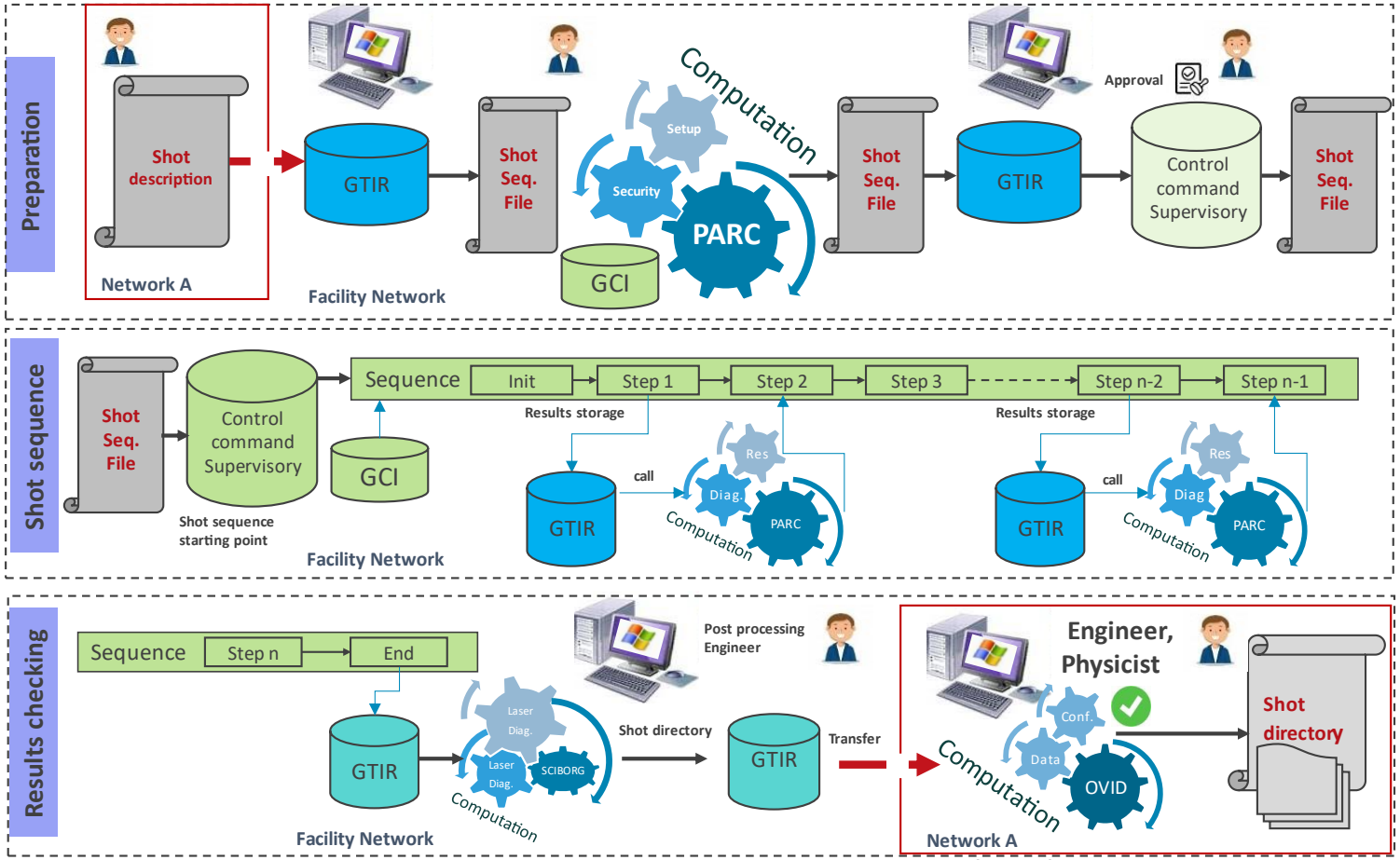


Figure 3 : Operations software for experiment

GTIR : shot management software
GCI : command control configuration tool (setup,characteristics, lifecycle attributes)
PARC : prediction and results computation[1]
SCIBORG : health indicators monitoring and analysis [2]
OVID : target diagnostic results validation

[1] PARC: A COMPUTATIONAL SYSTEM IN SUPPORT OF LASER MEGAJOULE FACILTY OPERATIONS", ICALEPCS 2017, Barcelona , Spain
[2] SCIBORG: Analyzing And Monitoring LMJ Facility Health And Performance Indicators", ICALEPCS 2019, New York, USA

Usage and benefits

Operating software are involved in the experiment process from the setup to the results.
They are used to automate and optimize each step of the process. Human validation is required at each critical transition.

Lessons learned

Health indicators return the health status of equipment (ex. : working time and RPM rate of a pump). They are used to detect degraded operating mode and anticipate maintenance before breakdown.

Lesson 1 : Identify the missing health indicators and the way to implement them.

Lesson 2 : Deploy a global monitoring system on the facility (LMJ Dr.) :

- manage multipurpose monitoring
- use stored data to detect health indicator decrease and/or predict equipment failure

Operating Software for maintenance (from the supply chain to the asset management)

MOPV003

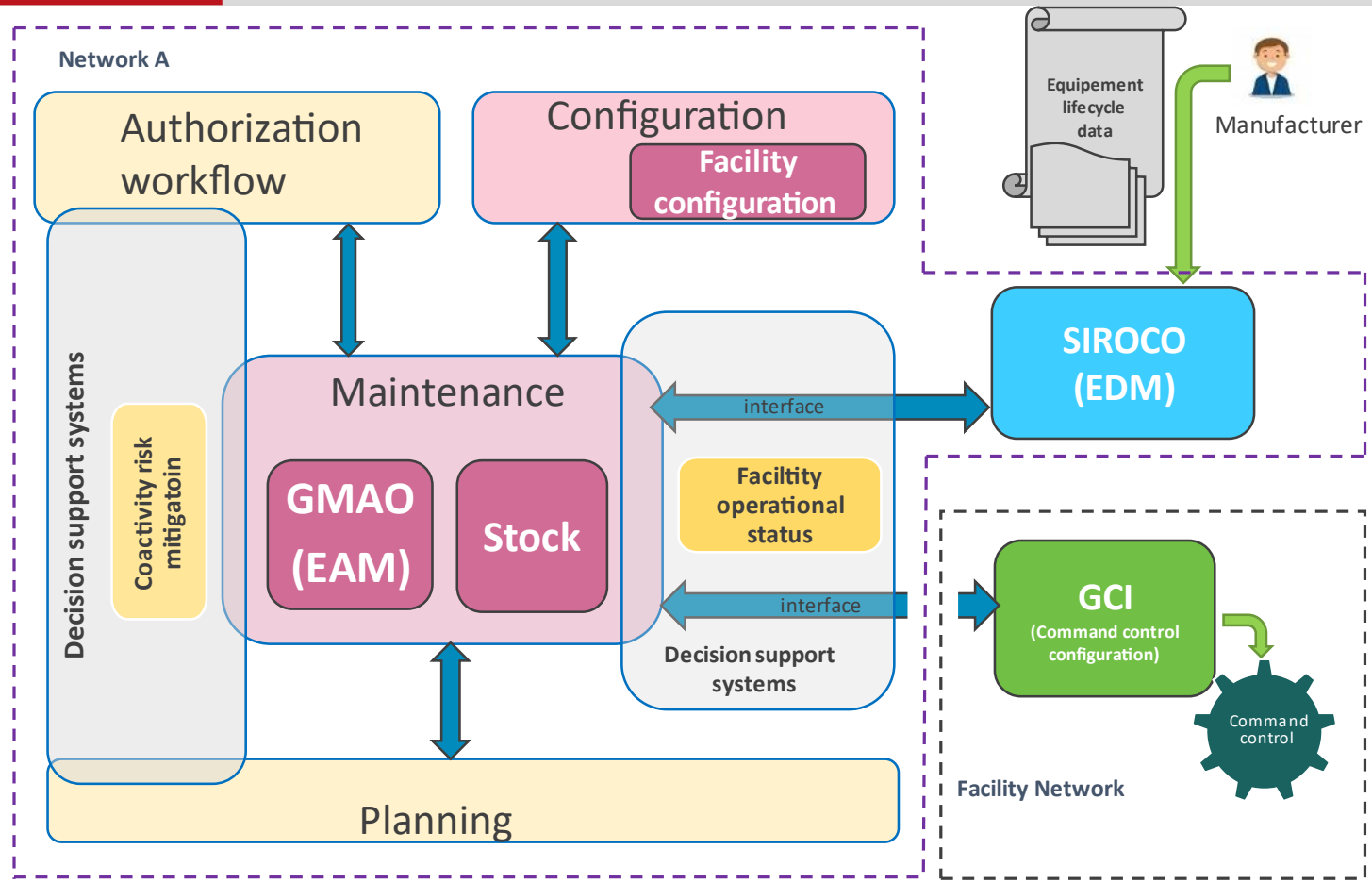


Figure 4 : Operations software for maintenance

GMAO (Infor EAM) : facility asset and stock management and facility configuration board
SIROCO (Dassault Systems – ENOVIA) : Electronic Document manager and project lifecycle management
GCI : command control configuration tool (setup, characteristics, lifecycle attributes)
Other operating software not detailed in this poster :
Authorization workflow : manages work permit (authorization, location, resources, etc.)
Planning : manages short, mid and long term planning for operations and maintenance on the facility
Decision support systems : coactivity risk mitigation, operational status, etc.

Usage and benefits

Operating software are involved in the maintenance process from the supply chain to the asset management. They are linked to the experiment operating software by GCI.

Lessons learned

Lesson 1 : A direct software link is crucial between maintenance and experiment operating software.
Cybersecurity constraints of network A block the direct link to the facility network. The operating tools of this network need to move on an another network free of these constraints.

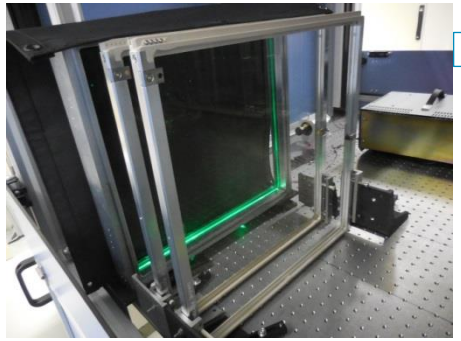
Lesson 2 : The former consistency rule between asset from GMAO and controlled equipment from GCI is deprecated. A new simple rule has been established to ensure consistency in each case.

Lesson 3 : Identifying parts on the facility is not easy.
Local WIFI network, mobile devices and optical barcode scanner must be deployed on the facility. It will be easier for an operator to find, check, and validate part's mounting point.

Lesson 4 : The spare parts inventory is about to be completed. For each part, it is important to evaluate the stock size, the maintenance frequency and the maintenance procedure (resources, tools and time expected).

Operating software are used to automate, secure and optimize each step of the part 's lifecycle

Figure 6 : Vacuum window



Barcode LMJ12345

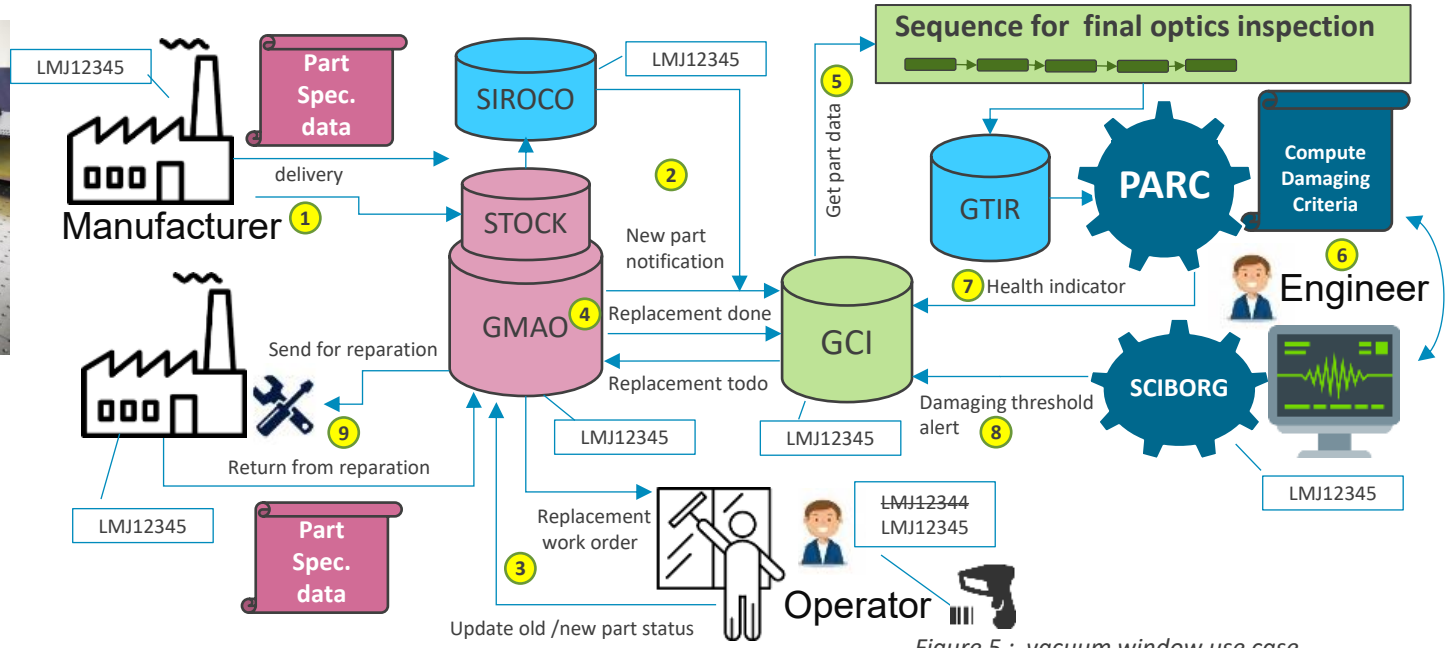


Figure 5 : vacuum window use case

Operating software interactions

1) The new part specification data are inserted in SIROCO and the part is registered in the stock of GMAO
2) The part and its characteristics are imported in the GCI (to be known by the control command)
3) Part replacement is scheduled and work order is done, GMAO parts status are updated (old = repair, new =active)
4) Replacement done , GCI is updated with the new characteristics, old part lifecycle attributes are send back to SIROCO
5) Control command get new part data from GCI
6) Characteristics are used in computation of health and security indicators (PARC), indicators are stored and analyzed (SCIBORG)
7) Indicators are sent to GCI
8) Damaging threshold alert (energy loss / window's integrity) is send to GCI and is propagated to GMAO to plan the replacement
9) Parts with repair status are transferred to the reparation site (with lifecycle attributes)

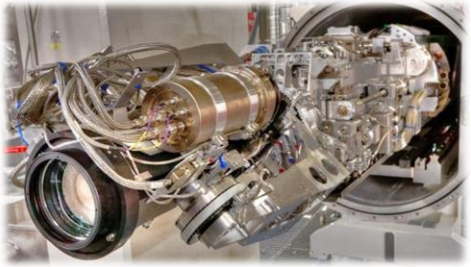


Figure 7 : Target chamber diagnostic module (See WEPV036)

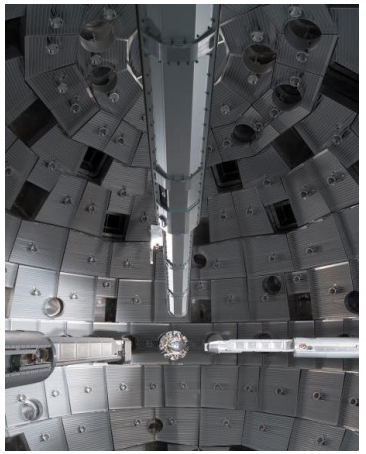


Figure 8 : LMJ target chamber