



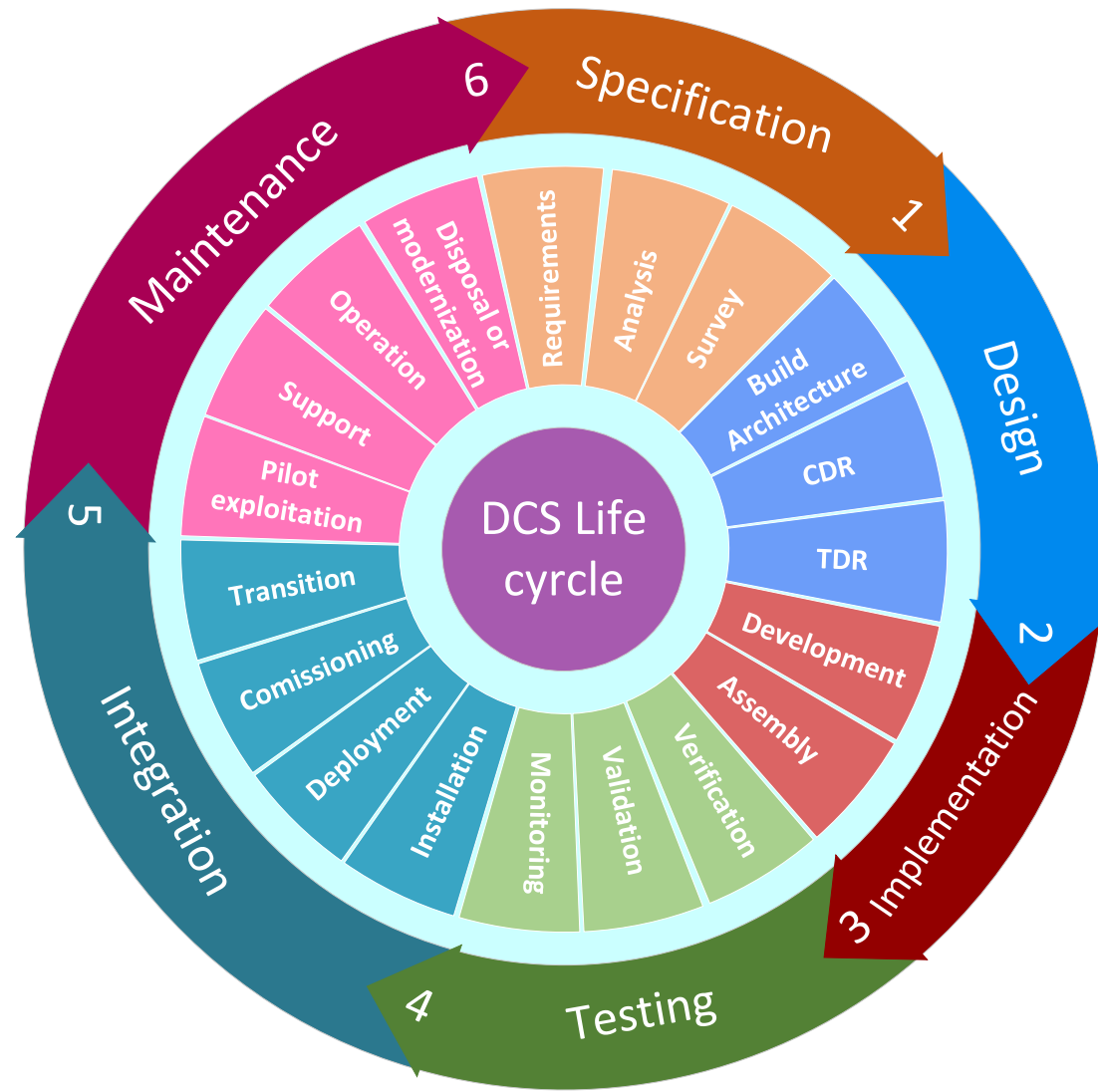
JOINT INSTITUTE
FOR NUCLEAR RESEARCH



**Design issue
of
Automation systems
in
Experimental facilities**

— Baldin Nikita,
Dubna, March 2024

LIFE CYCLES OF AUTOMATED SYSTEMS

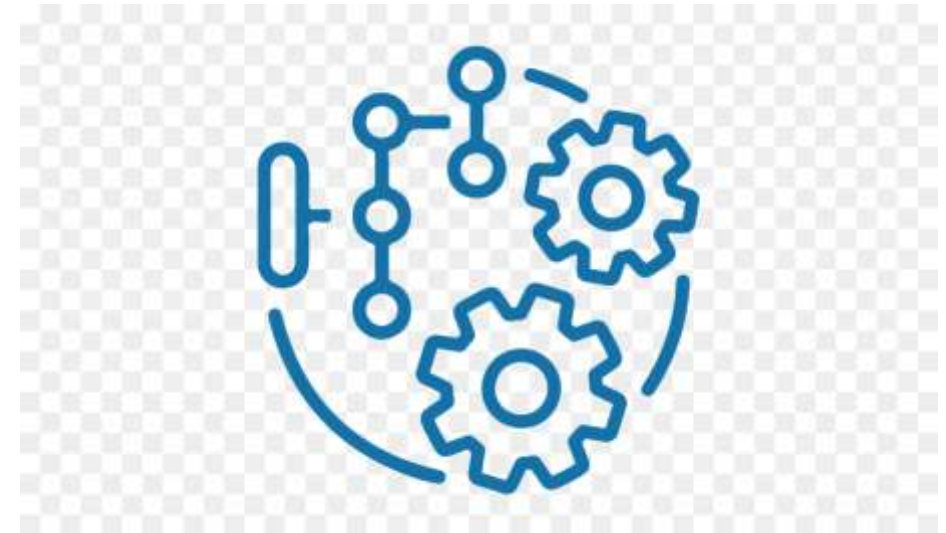


1.

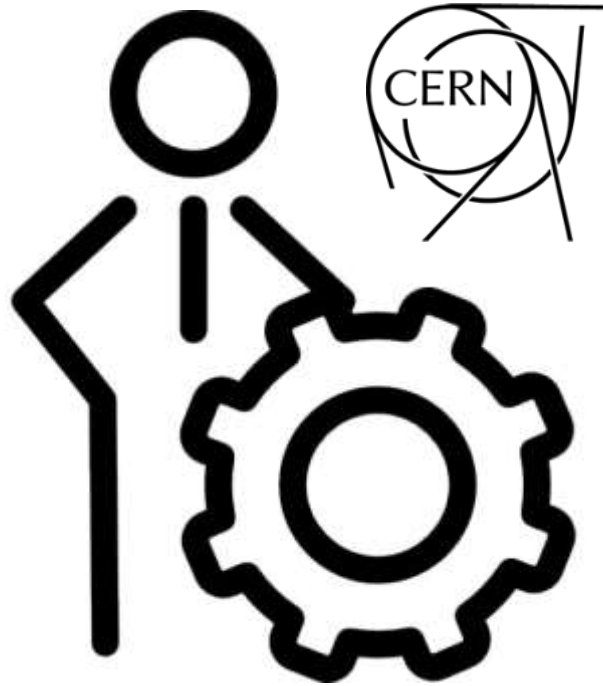


Equipment

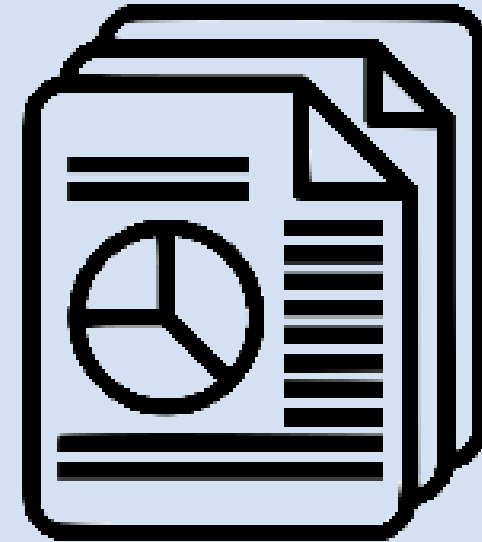
2.



Automatable functions



**CERN materials
Analysis & Current MPD
CDR TDR analysis**



**Worldwide standards and
methodology analysis**

CONTROL ROOM LIKE FINAL RESULT



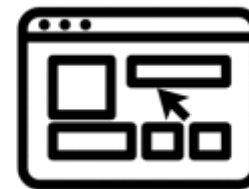
**Defined
shifter number**



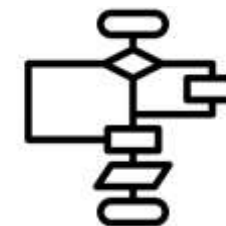
**Defined
ARM**



**Defined
functionality**



**Defined
HMI**



**Defined
algorithms**

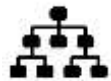


**Defined
architecture**

top-down design



overall concept



defined structure and architecture

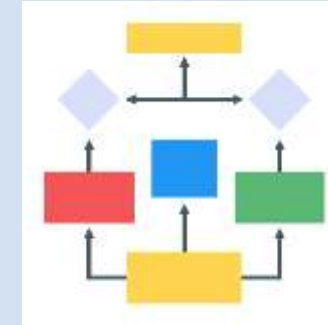


Improved planning and understanding requirements

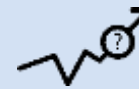


Easy maintenance

bottom-up design



detailed design of low-level components



gradual increase

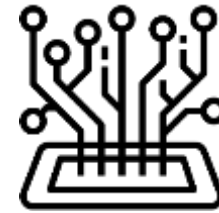
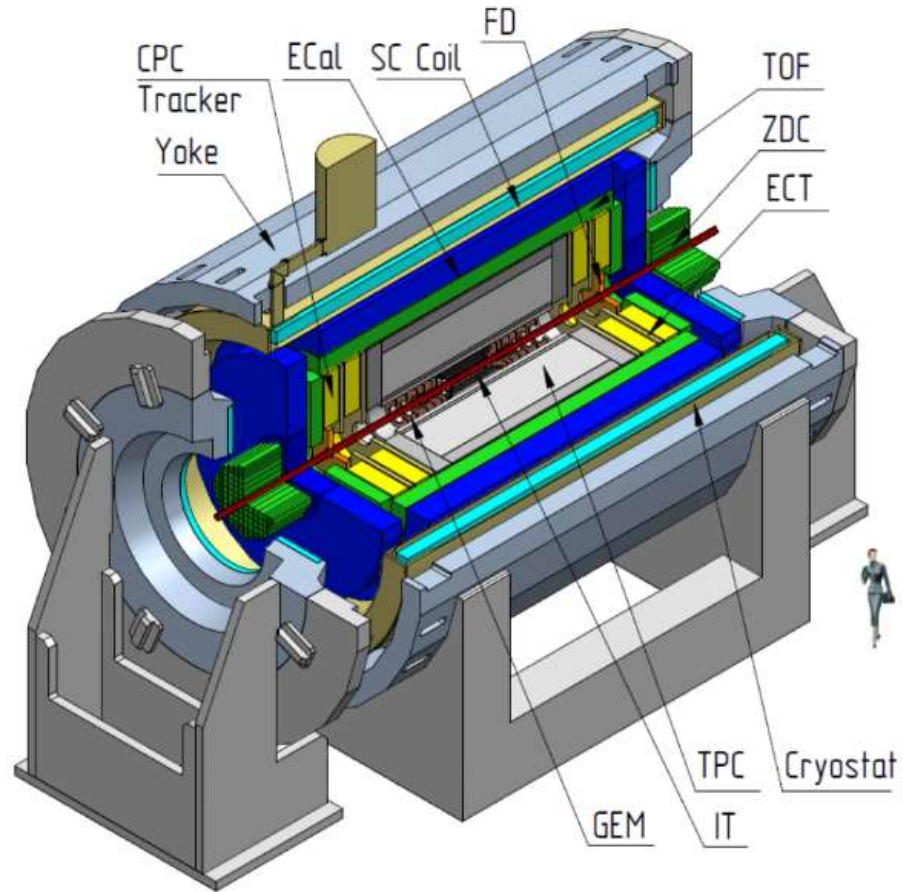


risk of component integration problems and architecture revision



Difficulties in managing complexity, harder maintenance & rising costs

Multi-Purpose Detector



First stage Subdetectors:

- TPC, TOF, Ecal, FFD, FHCAL

Second stage Subdetectors:

- ITS, GEM, CPC



Infrastructure subsystems:

- Magnets, B-field, radiation, access control, ventilation, etc.

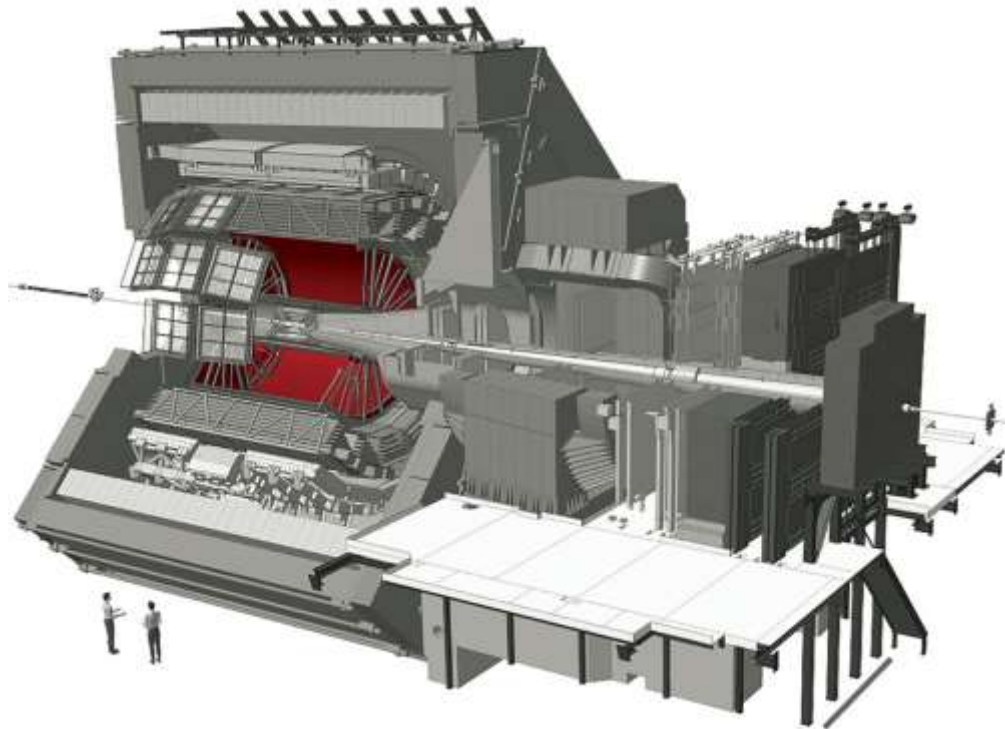


External services:

- Electricity, cryogenic, cooling, gas etc.



at



Quantitative indicators:



1 control room



100 servers (WinCC OA)

*12 TPC servers



270 crates

*more 60 cabinets



1.200 network-attached devices



3.000.000 parameters

*ATLAS 12.000.000

Qualitative indicators:



Monitoring all subsystems
All in one application



Alarm table & tips
All in one application



Automations algorithms

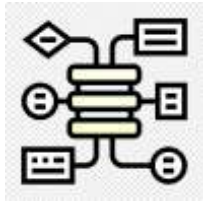


Control function



Archive & logging





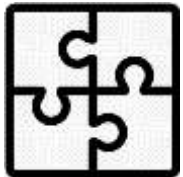
Automation of an experimental facility - a massive task

- over 1000 hardware units
- over 100.000 lines of software code
- linking software tools, configuring protocols



At the moment there are no design solutions worked out

- no CDR
- no TDR
- no any diagrams, etc.



Types of automated systems and their components

- Goals and objectives: experimental data, operability, safety, quality, optimality
- Systems types: DCS, DSS, DAQ, ECS
- Components: hardware, software, algorithmic, informational, organizational



A step-by-step approach to creating automation systems

- Conduct a survey of the automation object
- Define the requirements for the automation system
- Develop design solutions (CDR, TDR)



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