Scientific Management: Balancing Innovation and Critical Services

Processes, Workflows, Tools, and KPIs at CERN's EPR Section

TWINRELECT Research Management & Administration Workshop

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Mechatronics

Agenda

- Context: what EPR is and why it was built this way
- Mandate, integration, and the dual mode
- How service and R&D coexist: Culture and Measurements
- KPIs definition
- What KPIs cannot do
- Conclusions

Why This Case?

- Most scientists/engineers will manage a technical team someday
- Nobody teaches you how to run a lab: you learn engineer/physics, then one day you inherit **people, budgets, and deadlines**
- EPR's challenge: **critical services and R&D, with the same people:** reliability on one side, experimentation on the other
- One method: a literature-based approach to KPIs, **tested under real constraints**
- What you take home: **a blueprint you can adapt** to your own lab, facility, or team

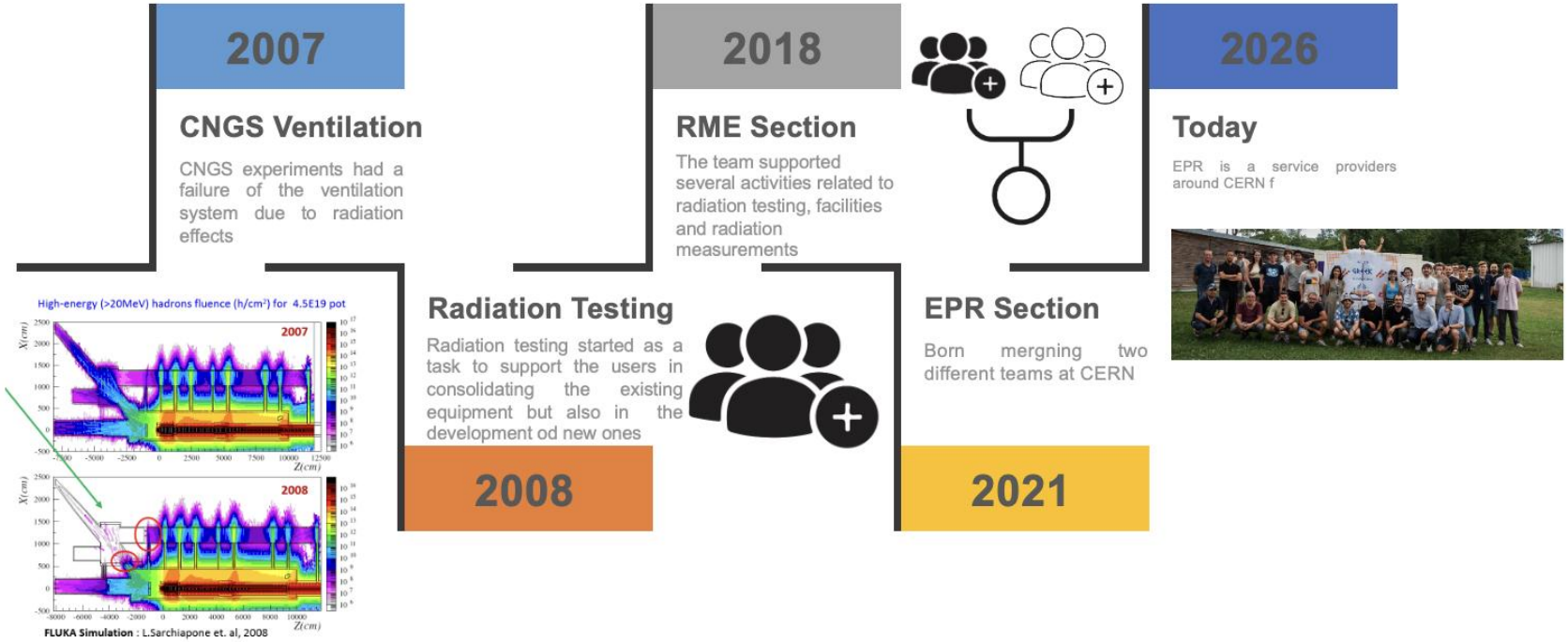
A bit of history

In 2018 a **new section** (organic unit at CERN was created): RME section -> Radiation Tolerant and Measurement Electronics (EN-SMM-RME)

- The team supported several activities related to radiation testing, facilities and radiation measurements
- The team consisted of ~ 15 people

In 2021 the creation of a new section: **merging two existing sections**

- The new team merged provided a service of Electronic Assemblies and procurement to entire CERN!
- In 2021 we became ~40 people



Mandate Definition

- In 2018 a new sections were born **from scratch**
- What is the first thing to do in this case?
- Mandate definition:
  - In a large organization is important that every team is responsible of specific tasks, projects, services: this is described in the mandate
  - The mandate should not be overlapping with other team activities
  - The tasks should be meaningful for the organization
  - The organization is aware of the mandate and plan resources, activities and budget accordingly

From Mandate to Responsibilities

- A mandate should answer three questions
  - Purpose: the outcome the team is accountable for
  - Scope: the explicit list of services owned
  - Boundary (optional): what is deliberately NOT included, to avoid overlap
- It should be written to be actionable
  - Concrete and testable: not aspirational language
  - Explicit enough that budget and staffing follow directly from it
- It directly drives the team's responsibilities
  - Every mandate line becomes a resourced task area
    - No mandate line, no resourced responsibility
  - *Example : " The EPR section provides: Service of **radiation testing on electronic components and systems** "*

Two Mandates, One Section

- In 2021 EPR was created by **merging two sections** with different mandates
- Not incidental: a deliberate choice that combining cultures **creates more value** than keeping them apart and bring **resource optimization**
- Organizations often merge groups and hope integration happens on its own
- Leaders should treat **integration** as something to actively design and maintain

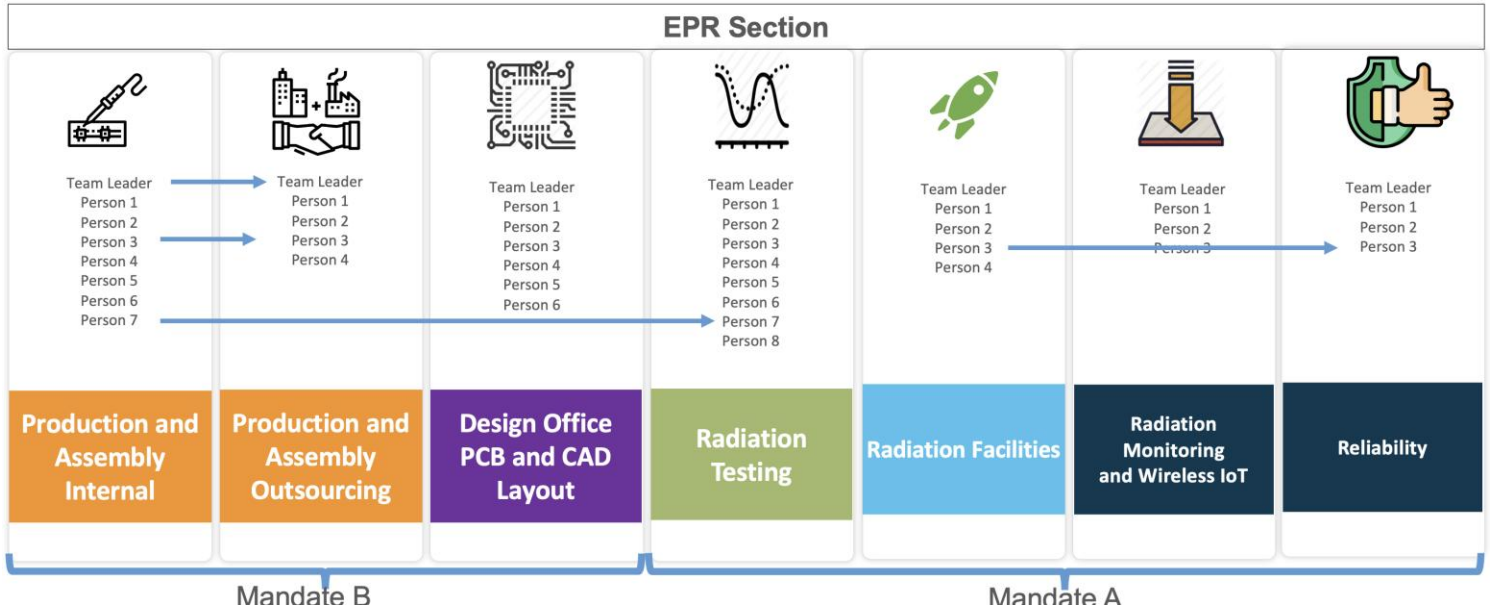
Original Mandate A	Original Mandate B
Radiation test services	Electronics production
Facility operations & external users (CHARM, CC60)	In-house fabrication & prototyping
KPI-driven: test executed, users in facilities,	KPI-driven: throughput, quality pass rate
Culture: electronic engineering, experimental physics, radiation testing, beam scheduling, radiation monitoring	Culture: electronics engineering, highly specialized electronic assembly processes, workshop workflow

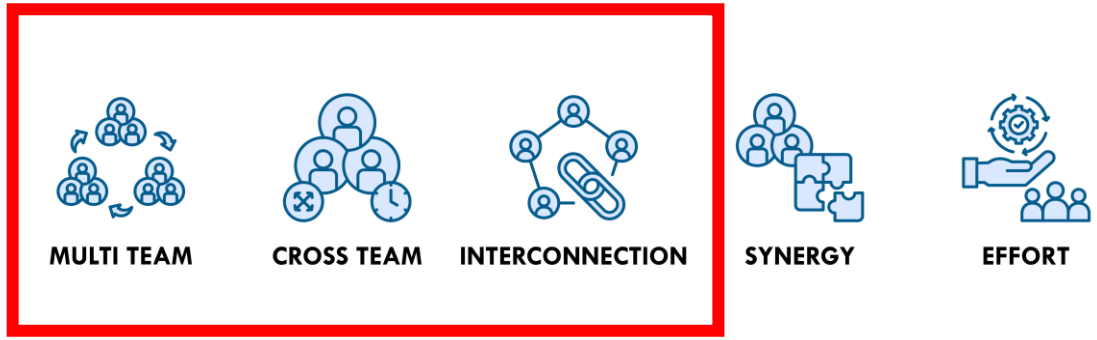
How to organize different activities?

- From the mandate: **which activities** must exist?
- Which tasks and knowledge are the pillars of the activities?
- Can some tasks/knowledge be shared: Synergies?

From Mandate to Teams

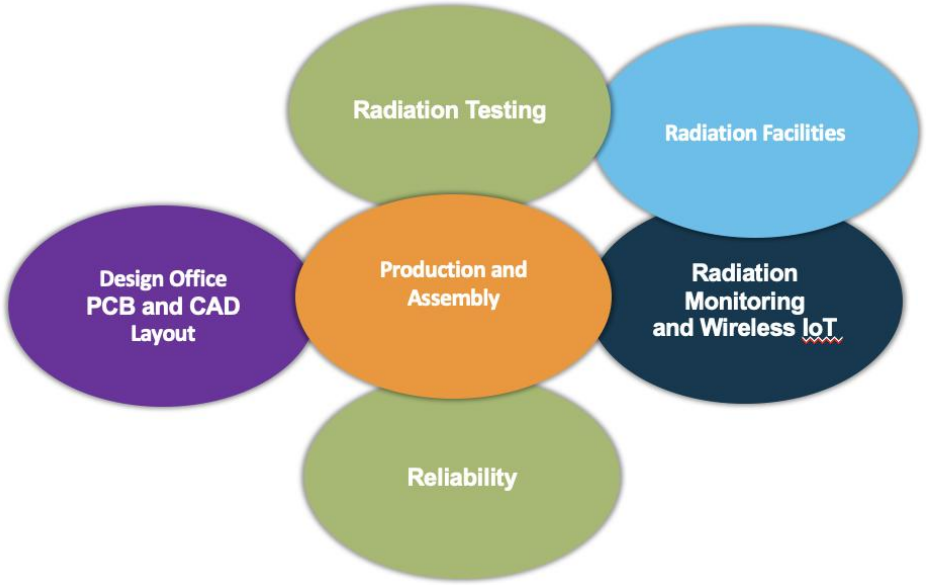
- **One team per pillar:** each mandate activity gets one owner: clear accountability, no orphan services
- **One accountable leader per team:** a single point of contact for the section and for the users
- **Deliberate overlaps:** some people belong to two teams *by design*: cross-team links are staffed, not hoped for

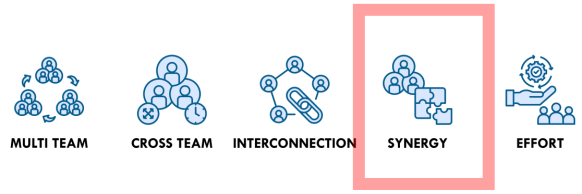




Beyond the Organization Chart

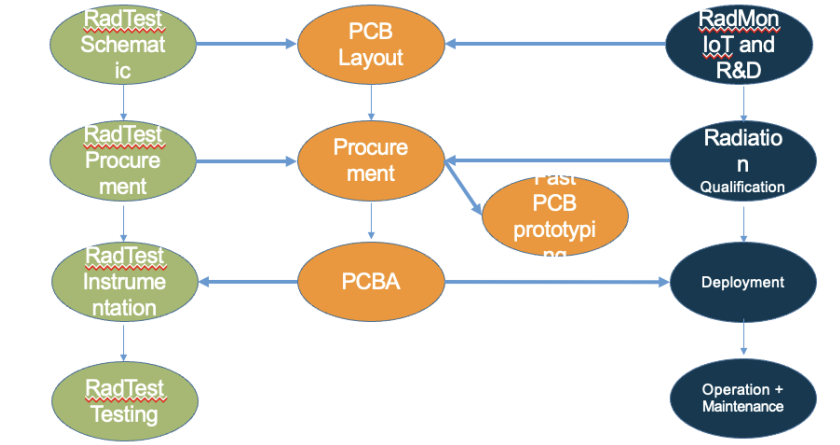
- **Map how knowledge and services flow** between teams
- Let the structure **emerge from the flows**: a central hub, a chain, or a web of overlaps, each has different implications
- Wherever activities **overlap**, there is shared knowledge: that is where synergies live and where they must be maintained

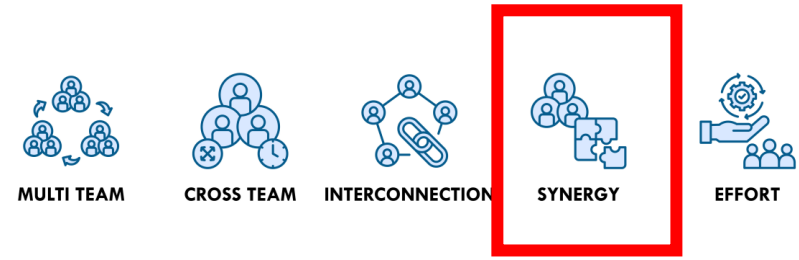




Redesigning Workflows for Integration

- **Map each workflow, stage by stage**
  - For every stage: **the task, the knowledge it requires, who does it today**
  - Not the org chart: the actual sequence of work
- **Look for exploitation opportunities**
  - Goal: find where one workflow can **exploit tasks and knowledge of another**
  - Same task done twice in two chains? Knowledge that exists in one team and is rebuilt in the other?
- **Redesign to optimize**
  - **Tasks** → move each task where the expertise is: the other team may simply be *better* at it — more experience, better equipment
  - **Resources** → the person who did that task "on the side" is now **freed** for their core work
- **The mindset: every person can offer a service:** think of each team member's skills as an internal service available to all workflows, not as private property of one chain





Shared Tools as Tactics

- Tools are not IT choices: they are **integration tactics**
- The rule: **one tool per function, shared by everyone:** two teams using different tools for the same function will drift apart
- Shared tools produce a side effect you will need later: **they generate the data your KPIs run on**

Tool	How It Bridges the Two Mandates
Jira	Ticketing service and tracker for operational tasks and R&D
Confluence	Shared knowledge base
Git + CI/CD	Firmware, software, test scripts for both mandates in one version-controlled ecosystem
Indico	All meetings in one archive — anyone can trace a decision's history across both mandates
EDMS	Single formal document repository, shared across both mandates

Synergy: it compounds and it erodes

- **Virtous Loop**
  - Make the connections visible by all the teams (workflows, tools)
  - As a manager, **watch the workflows**: spot the activities that run well and the ones that don't
  - Be attentive and ready to **praise the good, act on the bad**: *this* becomes the feedback loop

- *"I know there's a radiation test campaign next week. I'll put my priority there."*
  When you hear this from another team (not the radiation test one), **without you asking: you succeeded.**

- **Synergy erodes without deliberate effort**
  - New hires might fix to their primary domain
  - Nobody's budget line pays for synergy : **so nobody defends it by default**
  - Erosion is silent: you notice it only when it's gone
- Maintenance is a management task: **Meetings** with your team leaders is our single most important mechanism

Highly specialized: still a service

- A service is defined by **how it is delivered:** reliable, repeatable, user-facing, not by how simple it is
- Our services are **industrial in discipline, scientific in content**: top-notch expertise, delivered as routine
- *EPR: detector assembly with extreme soldering processes; radiation testing and facility operation at international state of the art*
- The trap to avoid: **"it's too specialized to be a service":** that mindset kills reliability

Where R&D is born: two doors

- **Door 1 — Challenges from outside (demand-pull)**
  - Scientific challenges → technical challenges → **new solutions required**
  - *EPR: low- and high-temperature soldering, ultra-thin flex-rigid assemblies for new detectors*
- **Door 2 — Challenges from inside (operations-push)**
  - Running the service **at expert level generates scientific questions no one else sees**:
  - *Why did that unexpected event occur? Why do two identical components respond differently? How do you test thousands of components in one run? How do you compare facilities?*
  - Answering them = **research with high scientific content** — publishable, novel, ours
- The service is not the opposite of research : it is its source

The Dual Mode :**one team, two opposite logics**

	Service	**R&D**
Success means	predictability	discovery
Failure is	an incident	expected
Horizon	this week	years
The user (or us) wants	no surprises	the new thing

- Same people, **same day**, both modes
- The management question: *how do you protect each mode from the other?*
- *Culture and Measurements*

How Service and R&D coexist

- **R&D with a declared purpose : "everybody wins"**
  - R&D is never done for its own sake: every activity has a **stated purpose** the whole team knows
  - Either it serves **today, r**educing workload, optimizing a workflow, or it serves a **vision**, a precise future goal
  - When the team understands the *why*, service and R&D stop competing for legitimacy

Two Modes, Two Families of KPIs

- A **Key Performance Indicator**: a measurable value that shows whether an activity is achieving its objective
- It is **connected to an objective**
- It is **measured from data you already have**

	Service KPIs	**R&D KPIs**
What they measure	Throughput & reliability	Learning & progress
Typical examples	Tests executed, PCB lead time, facility uptime, users served	Prototype versions, prototypes tested, milestones / TRL reached, failure reports produced
Green means	Healthy	Progressing
A failure is	An incident to fix	**Data, if documented**
Special ingredient	Trend vs. target	**A kill criterion**

Service and R&D, seen through their KPIs

SERVICE — running radiation testing	**R&D** — connected to the same service
Tests executed per year the volume of the service	**Components tested for R&D** how much we invest in learning
Facility usage which facilities carry the load	**How many failed** failure here is information, not an incident
Average time between tests the rhythm — if it slows, something upstream is wrong	**Observed vs. expected effects** something new? that is where research starts

R&D KPIs come with an end — a kill-or-continue criterion, defined at the start: *services are stopped by decision, research by evidence.*

What KPIs Cannot Do

- KPIs are **vital signs of processes**
  - They measure what you already decided matters
  - If an R&D decision is based solely on KPIs most probably will never fly
    - Investigate on GaN devices -> KPIs you might look : how many requests you had ? How many request you will have -> Time, Uncertainty -> (maybe wrong) Decision
  - **Vision is not in the data**

Conclusions

- **We started from the mandate:** the contract that defines what the section owns, funds and answers for: no mandate line, no responsibility, no KPI
- **We merged two cultures and treated integration as a design task**: one team per pillar, deliberate overlaps, shared workflows and tools, so that activities reinforce each other
- **But synergy erodes silently** maintaining it is management work: watch the workflows, praise the good, act on the bad
- **Our services are scientific and they generate R&D**: challenges arrive from outside, and from operating the service itself, at expert level, every day
- **Service and R&D coexist by design**: every R&D activity has a declared purpose, each mode has its own KPIs, and reliable service buys the credibility to place new bets
- **And one thing no KPI will ever do**: tell you what to build next.
- **KPIs keep the ship running: the captain decides where it sails**

Thank you for your attention!

Time now for :

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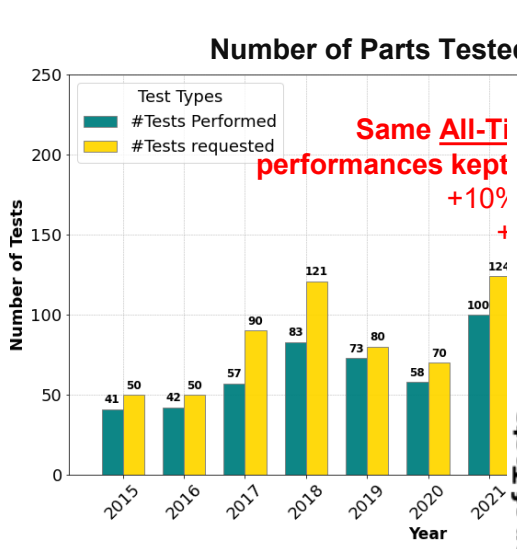
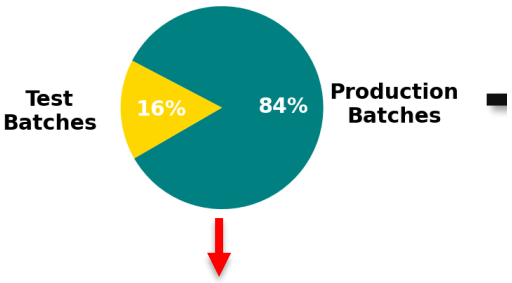
Statistics about the service

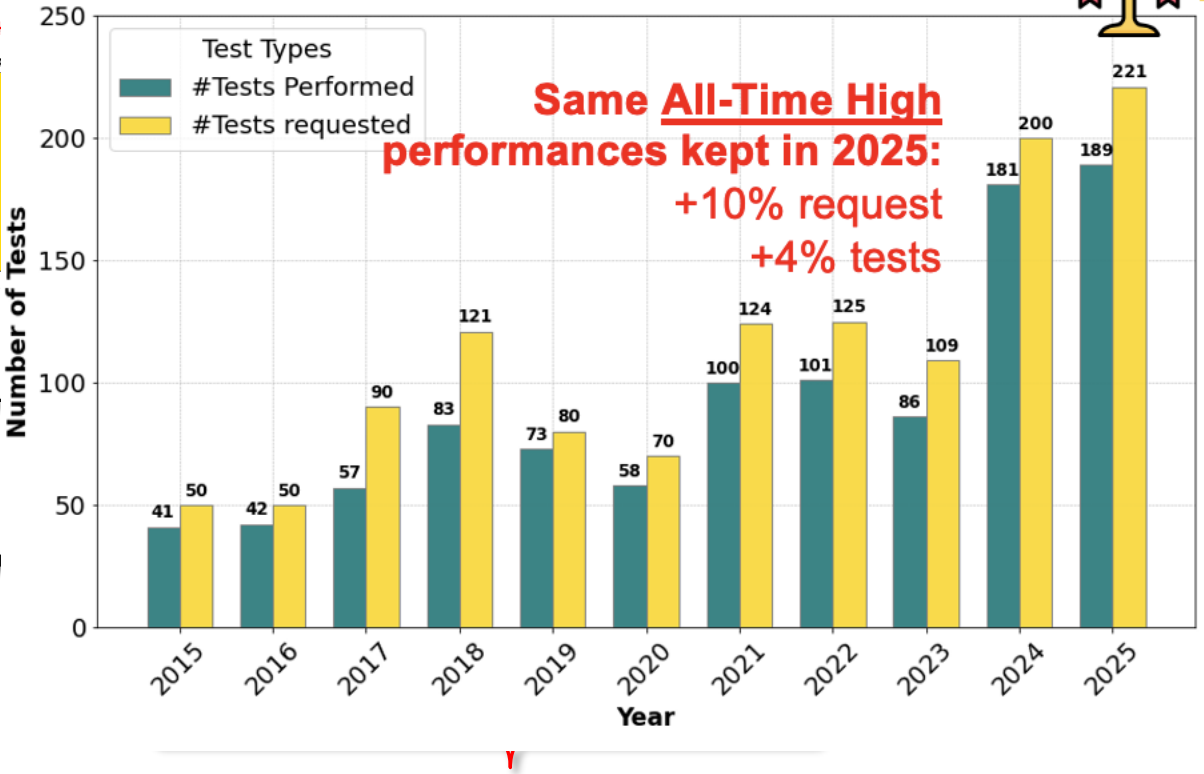


All-time record!

Same All-Ti
performances kept
+10%
+



LS3 Production dominating the use of the service in 2025 !



All-time record!

The UCS and DQQDL production qualification from TE-MPE are the most critical qualification of this year (and next year!)

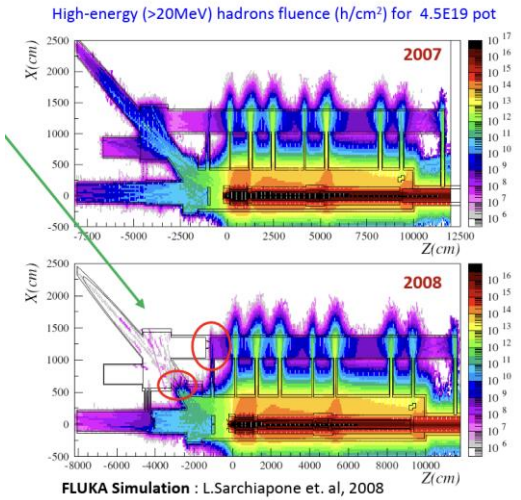
New CHARM MONTRAC Position!

amples tested at once per week
y low cross section assessment !

2007

CNGS Ventilation

CNGS experiments had a failure of the ventilation system due to radiation effects



FLUKA Simulation : L.Sarchiapone et. al, 2008

2008

Radiation Testing

Radiation testing started as a task to support the users in consolidating the existing equipment but also in the development od new ones

2018

RME Section

The team supported several activities related to radiation testing, facilities and radiation measurements

2021

EPR Section

Born mergning two different teams at CERN

2026

Today

EPR is a service providers around CERN f

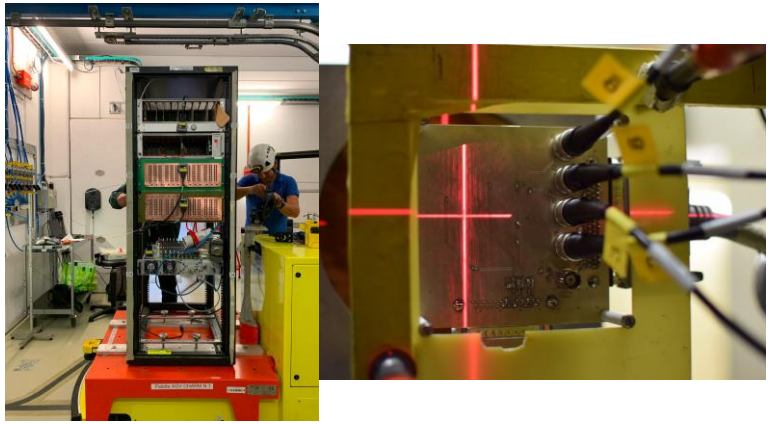
BE-CEM-EPR Section at CERN

EPR : Electronics Production and Radiation Tolerance

Provide CERN-wide support in the domain of Printed Circuits Boards (PCB), electronic systems assembly, radiation testing, radiation monitoring for the electronics and radiation test facilities for radiation tolerance assessment.

The ERP section provides:

- Service of PCB Layout design for electronic boards and crates
- Service for electronic cards assembly and cabling, internally or by subcontracting including components procurement.
- Procurement of bare PCB, manufactured internally at CERN or by subcontracting
- Manufacture and Assembly for prototypes in fast track production lines
- Service of **radiation testing on electronic components and systems**
- Coordination and the operation of **the CC60 gamma and CHARM** radiation test facilities at CERN.
- Design, installation, operation and maintenance of the RADMON and BatMon monitoring system



CHARM