ESRF | The European Synchrotron

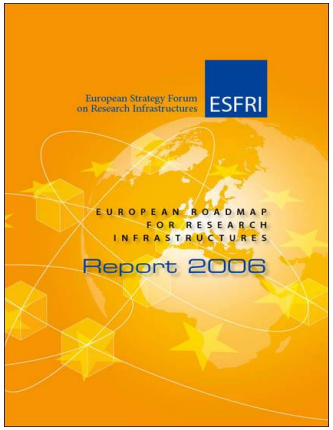
The ESRF UPGRADE PROGRAMME
Challenges – Implications

Special thanks to J.L. Revol (ESRF)

SOME MILESTONES

- **2013** - South Africa joins as associate member
- **2008** - ESRF Upgrade Programme 2009 - 2018 launched.
- **1998** - Construction period ends. 40 beamlines are made available to users.
- **1994** - The ESRF opens its doors to users, offering 15 operational beamlines.
- **1992** - First electron beam in the ring and first X-ray beam in a beamline.
- **1989** - The ESRF company as a *société civile de droit français*.
- **1988** - Start of the construction with 12 countries supporting the project.
- **1987** - Foundation phase report.
- **1985** - Grenoble chosen as the future location of the ESRF.
- **1975** - first meeting - European Science Foundation.

THE ESRF UPGRADE PHASES



ESRF UPGRADE PROGRAMME
PHASE II (2015-2019)
WHITE PAPER

Technical Design Study

2007 2009 2013 2015 2023

ESRFUP

Phase I
Definition - Preparation

Phase I
Implementation

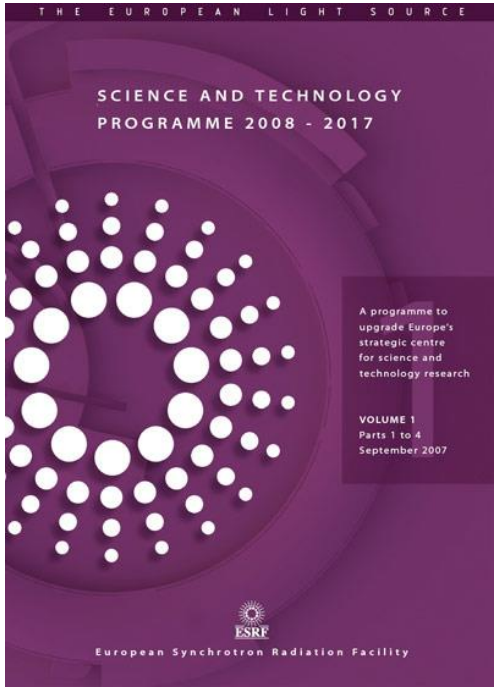
Phase II
Definition

Phase II
Implementation

5 M€ | **170 M€** | **149 M€**

The European Synchrotron | ESRF

THE ESRF UPGRADE PROGRAMME (PHASE I: 2009-2015)

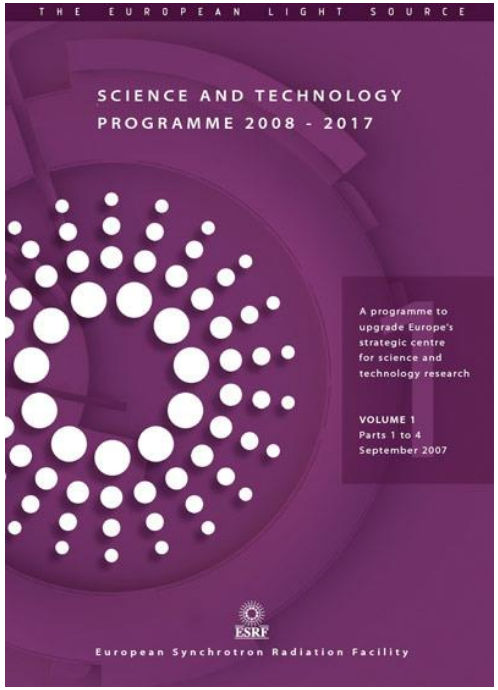


Vision for 2009 to 2018 mapped out in Purple Book

5 science drivers

http://www.esrf.eu/AboutUs/Upgrade

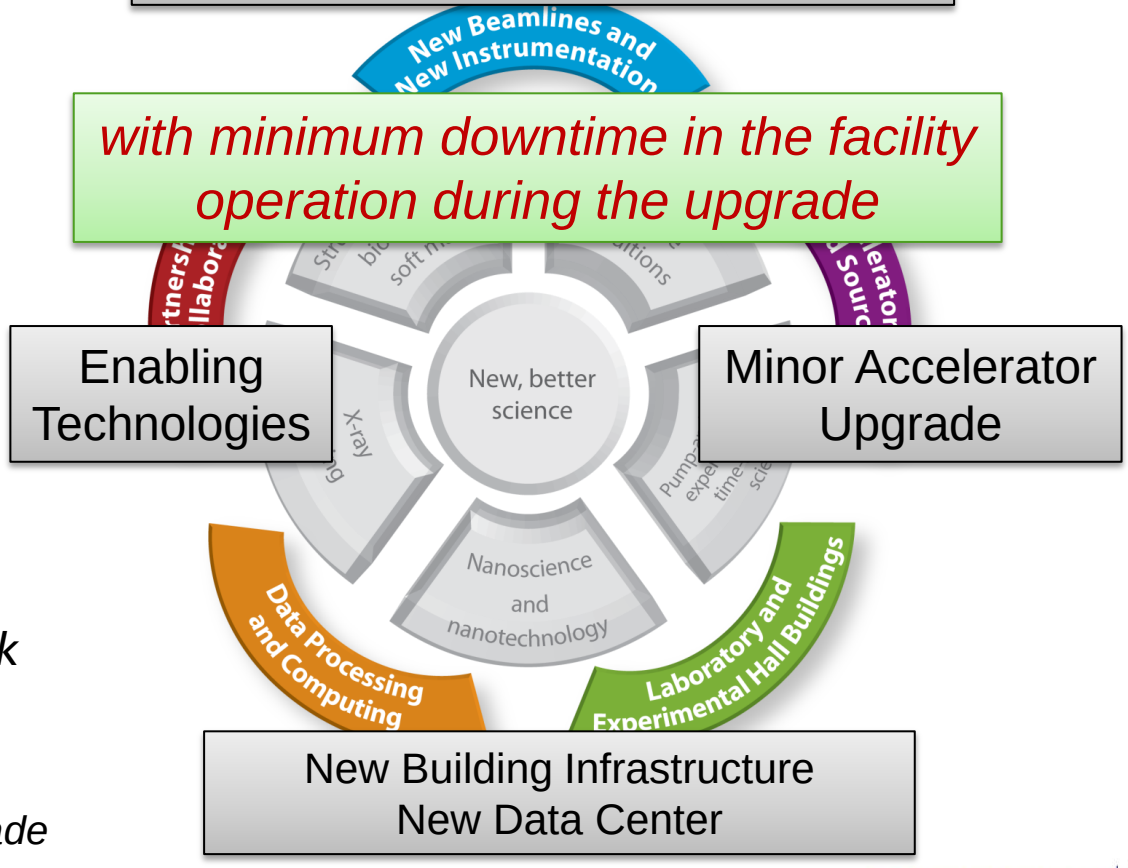
THE ESRF UPGRADE PROGRAMME (PHASE I: 2009-2015)



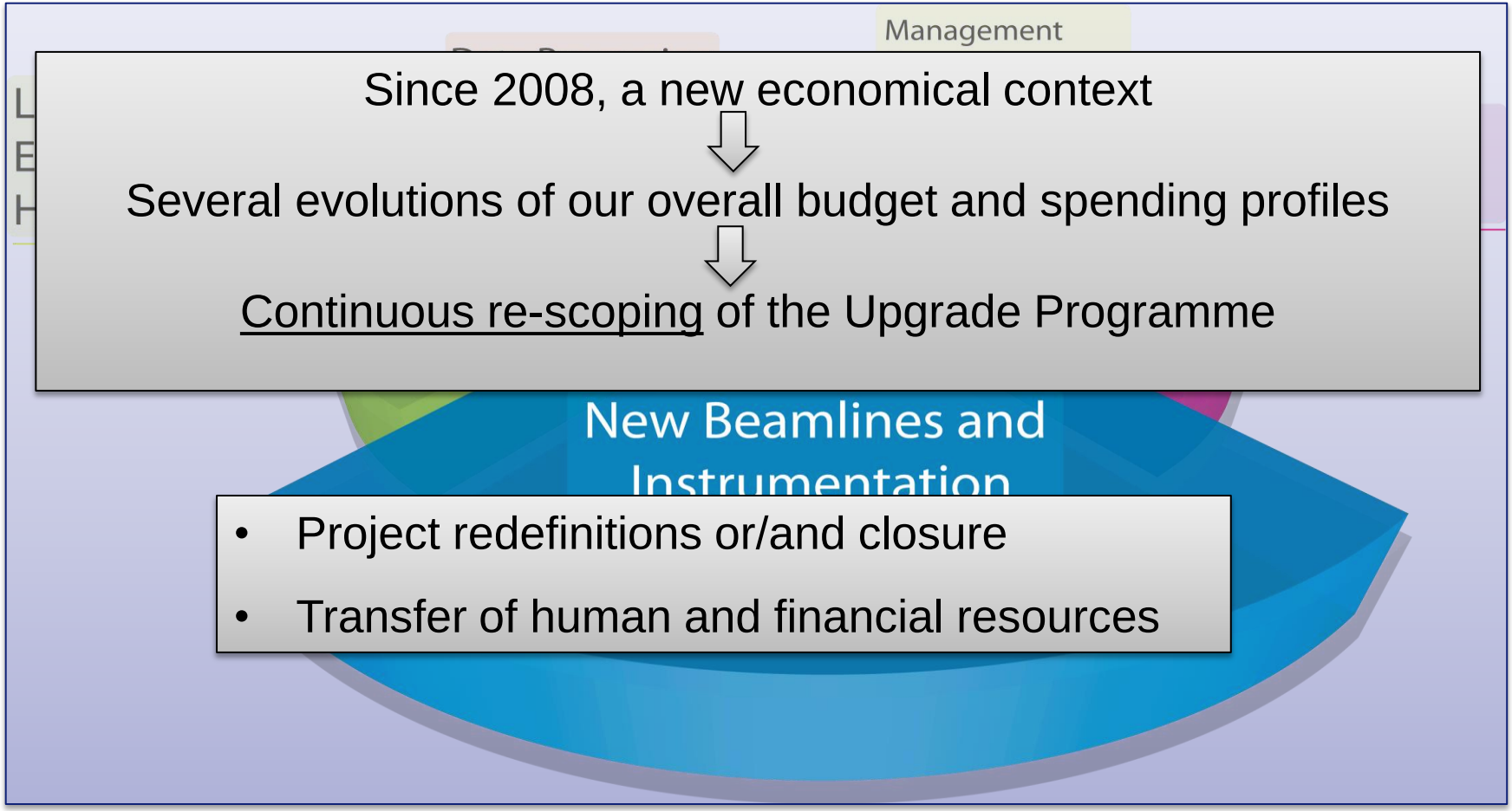
Vision for 2009 to 2018 mapped out in Purple Book

http://www.esrf.eu/AboutUs/Upgrade

Major Renewal of Beamline Portfolio
(11 new beamlines + 2 moving beamlines)



THE ESRF UPGRADE PROGRAMME (175 M€* BUDGET)



Since 2008, a new economical context

⇩

Several evolutions of our overall budget and spending profiles

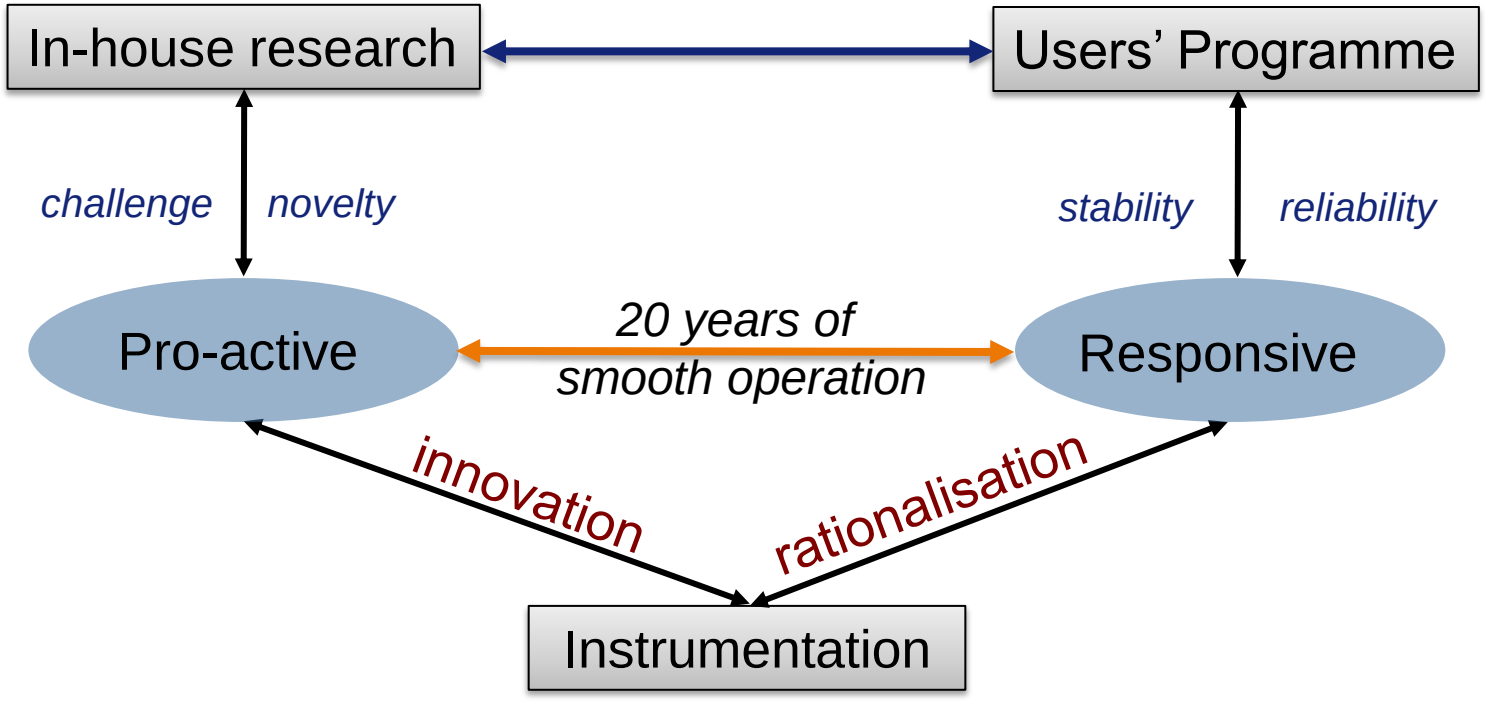
⇩

<u>Continuous re-scoping</u> of the Upgrade Programme

- Project redefinitions or/and closure
- Transfer of human and financial resources

* 2009 reference

THE PARADIGM OF A USERS' FACILITY



This equilibrium was broken by the Upgrade Programme

A MANDATORY EVOLUTION DRIVEN BY THE UPGRADE PROGRAMME

✓ In-house culture tailored by 20 years of user operation

✓ Decentralisation of resources over a large number of instruments

- ESRF upgrade and refurbished BLs require cutting edge instrumentation
- Need for a fully integrated multi-disciplinary approach
- Need for transverse project structure
- Complement and maximise potential of existing instrumentation groups

➢ Adaptation of the internal organisation

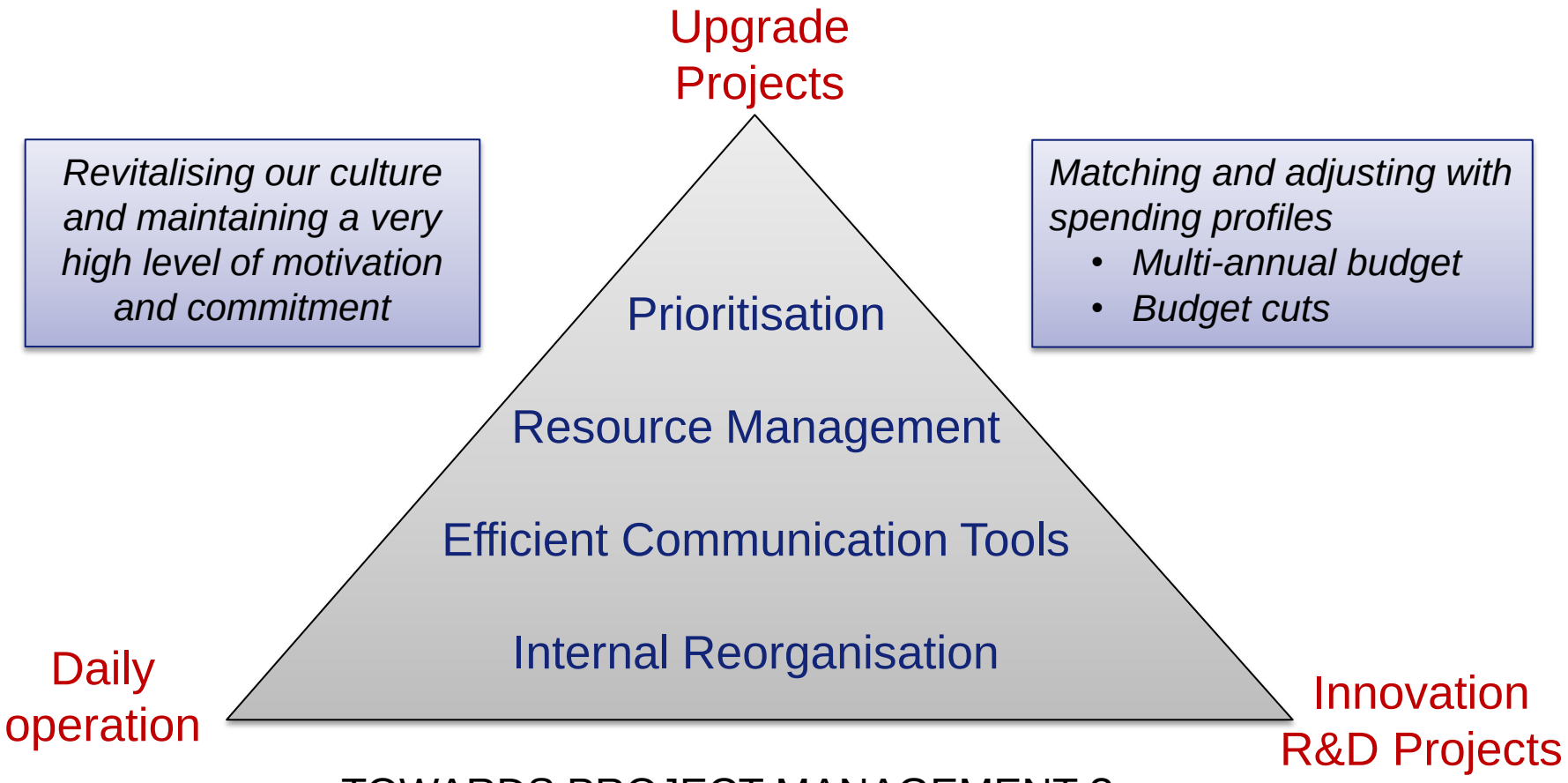
➢ Implementation of new practices

RE-ORGANISATION → CREATION OF THE INSTRUMENTATION DIVISION

Mandate (ESRF Council Nov 2008)

- To bring together the expertise(s) required for the most critical technical developments that ASD and ExpD will need for the future of the ESRF
- To minimise the duplication of capabilities that existed in our former structure
- To facilitate the integration of the optics, sample environment, electronics, software, detectors on future beamlines
- To work effectively within a project structure and a cross-disciplinary management

THE UPGRADE PROGRAMME CHALLENGES



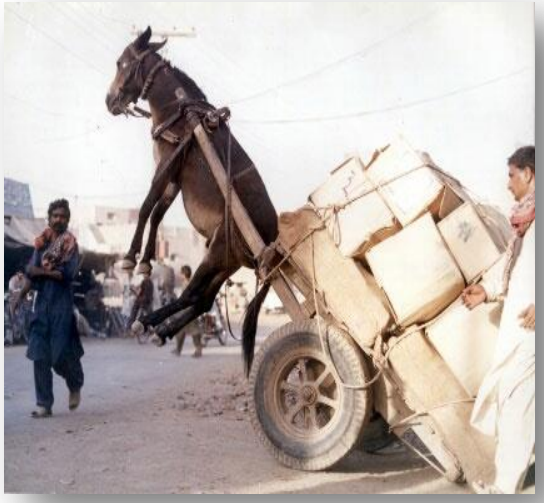
TOWARDS PROJECT MANAGEMENT ?

TOWARDS PROJECT MANAGEMENT?

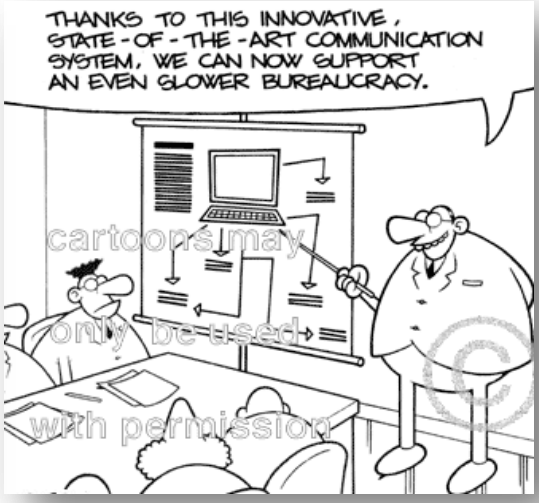
CULTURE INERTIA & RESISTANCE TO CHANGE

Unnecessary bureaucracy

Work overload

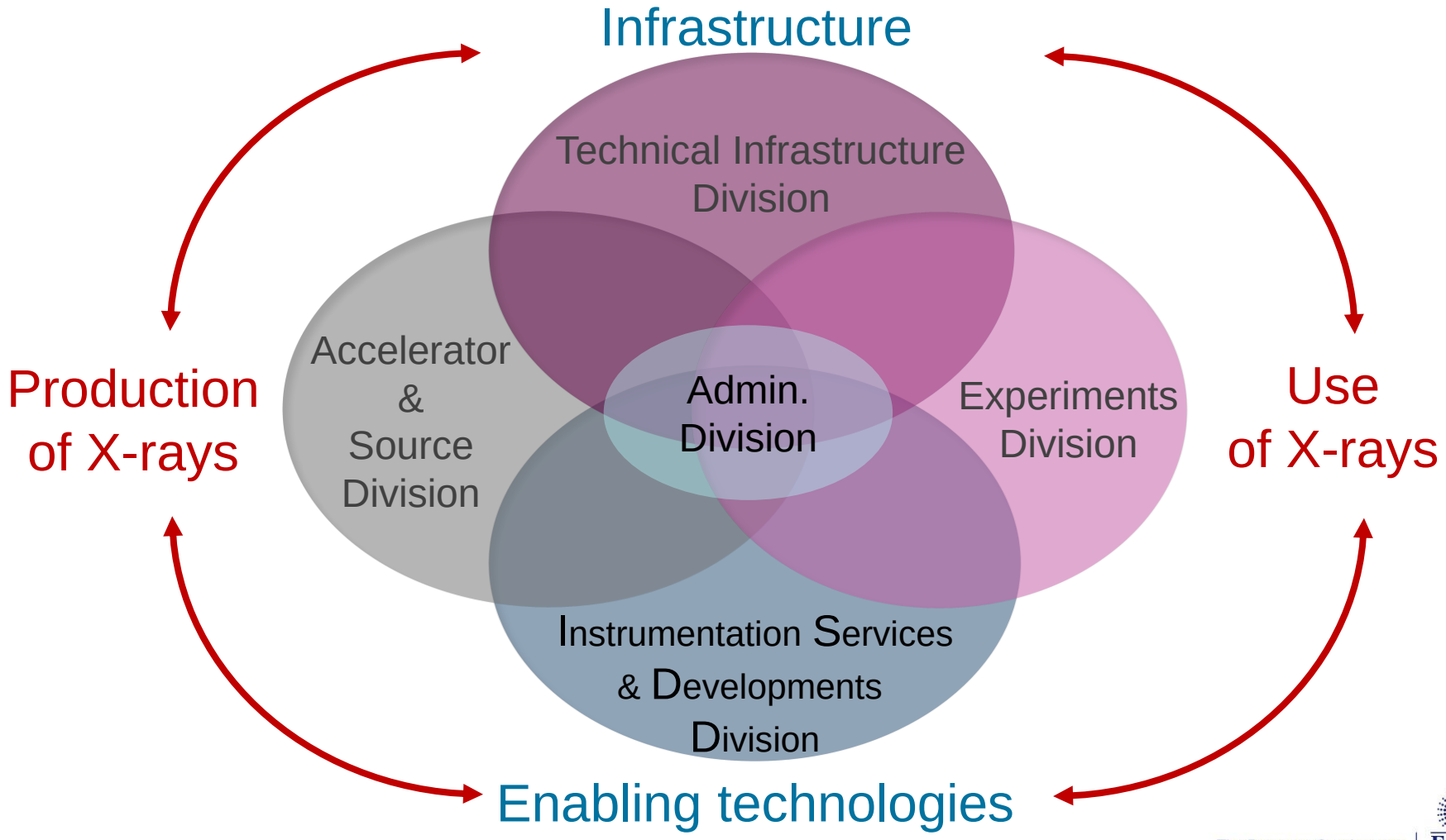


Inadequate tools



It took 5 years (P. Duru's talk)… and still a lot to do …

A NEW ORGANISATION FOR THE ESRF (2008)



THE ESRF UPGRADE PHASE II

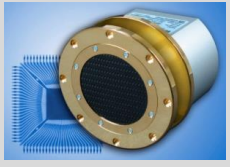
A new accelerator

100M€

ESRF UPGRADE PROGRAMME
PHASE II (2015-2019)
WHITE PAPER

Phase II
2015-2023

Enabling Technologies

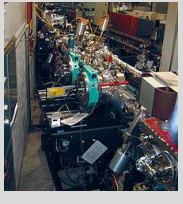


16M€

Computing Infrastructure

4M€

4 new beamlines



20M€

Source→ Detectors → Data Analysis

THE FIGURE OF MERIT OF THE SOURCE: BRILLIANCE

Brilliance or *Brightness (flux density in phase space) is an invariant quantity in statistical mechanics, so that no optical technique can improve it.*

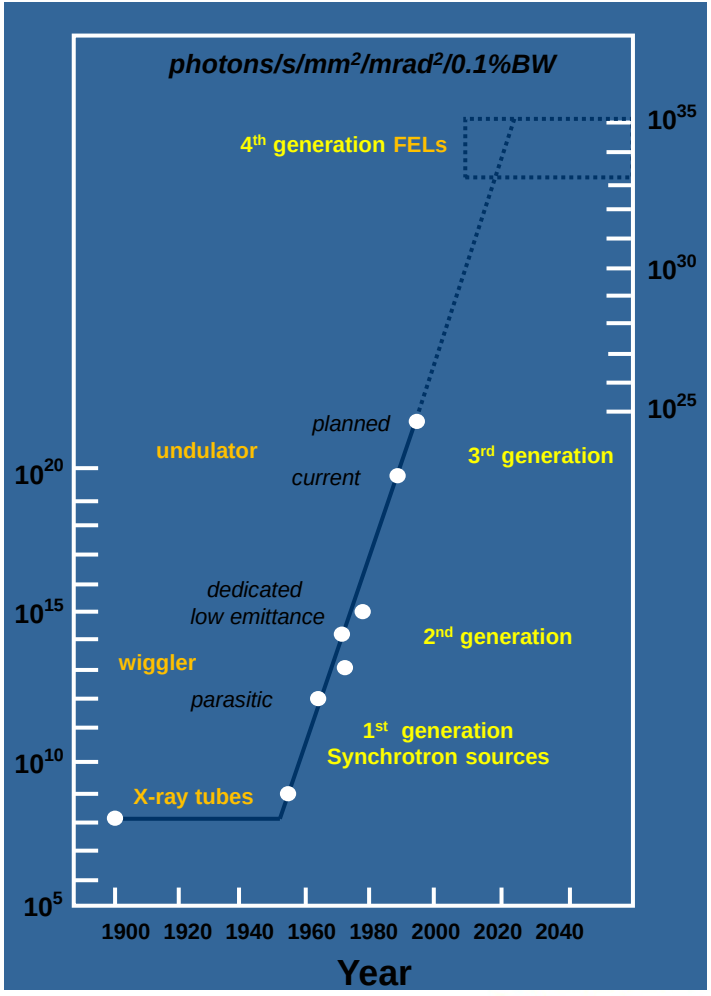
$$\text{Brightness} = \frac{\text{photon flux}}{(\Delta A)\,(\Delta\Omega)}$$

$$\text{Spectral Brightness} = \frac{\text{photon flux}}{(\Delta A)\,(\Delta\Omega)\,(\Delta\lambda/\lambda)}$$

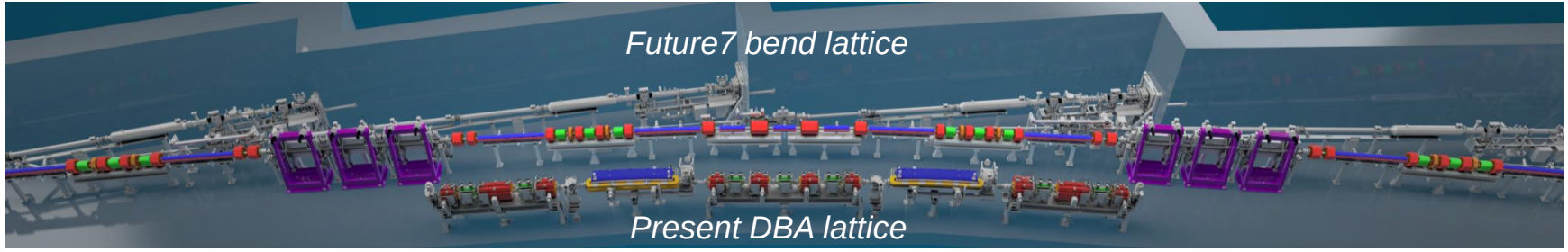
$$\frac{[\text{Photons/sec}]}{[\text{mm}]^2\,[\text{mrad}]^2\,[0.1\%\ \text{bandwidth}]}$$

A race towards Diffraction Limited SR Source

- Brightness
- Coherence



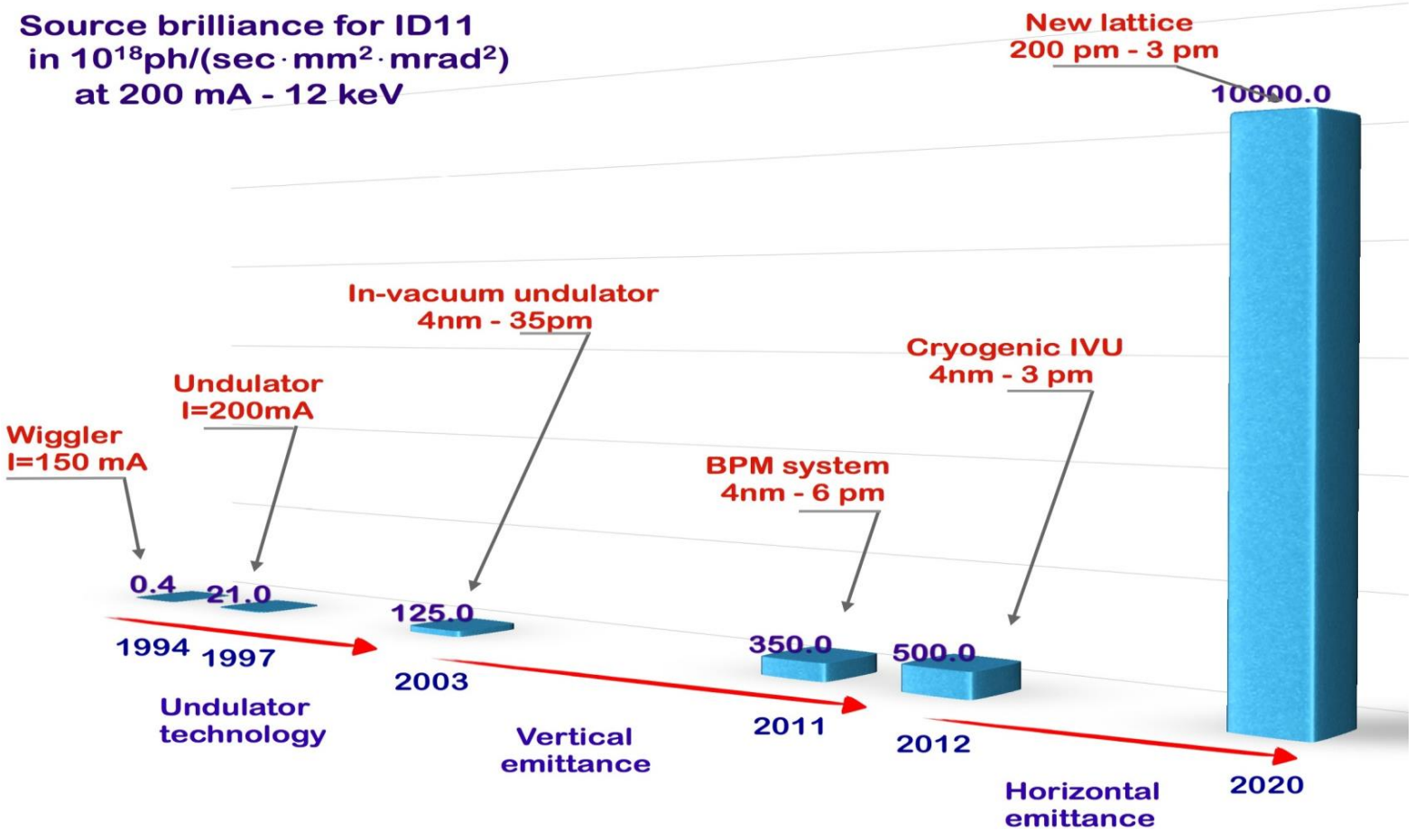
ACCELERATOR PROJECT WITHIN THE ESRF UPGRADE PHASE II



A new accelerator for an ultra low emittance synchrotron source within the following boundary conditions:

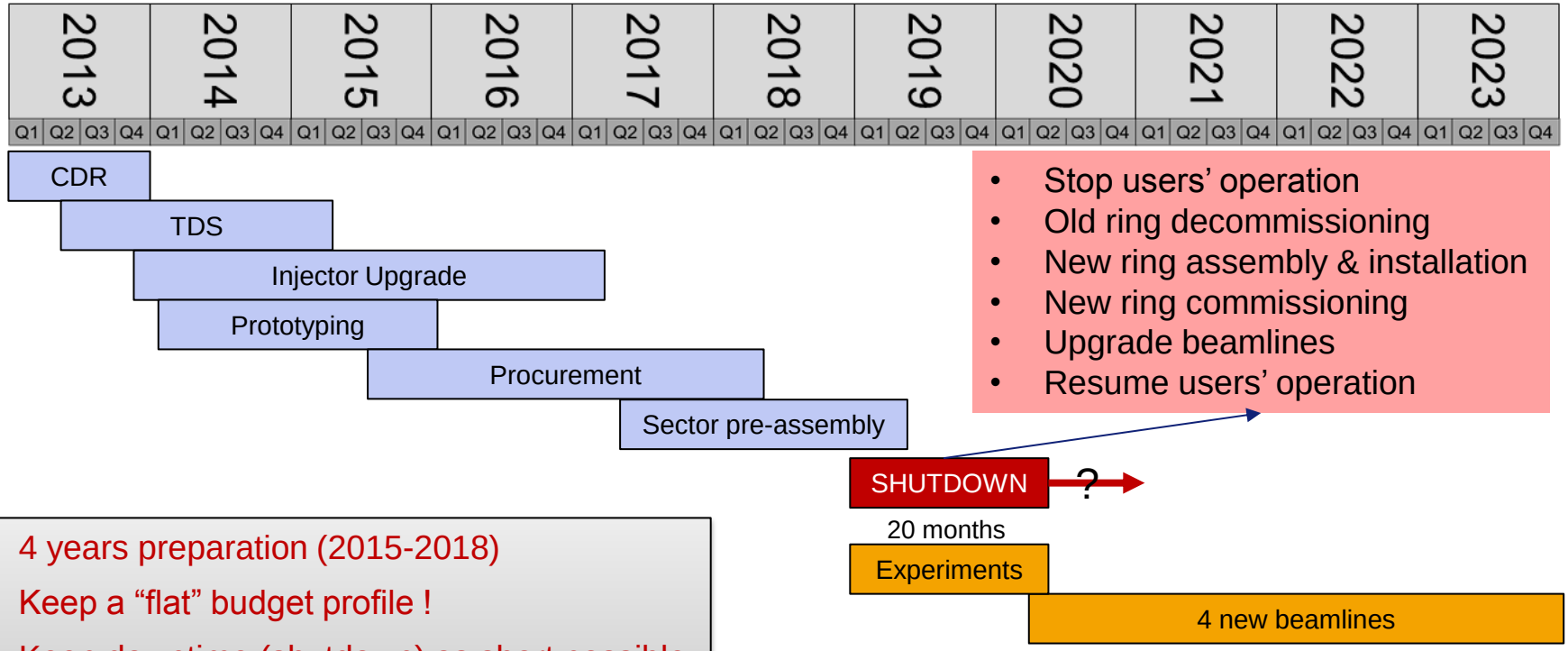
- Budget: 100MEuros (< 10% contingency)
- Reuse the same tunnel and infrastructure
- Maintain the existing insertion device and bending magnets beamlines
- Preserve the time structure operation and a multibunch current of 200 mA
- Keep the present injector complex
- Reuse, as much as possible, existing hardware (pumps, electronics…)
- Minimize the impact on User Operations due to the downtime for installation and commissioning

ESRF UP PHASE II – A QUANTUM LEAP FOR NEW SCIENCE



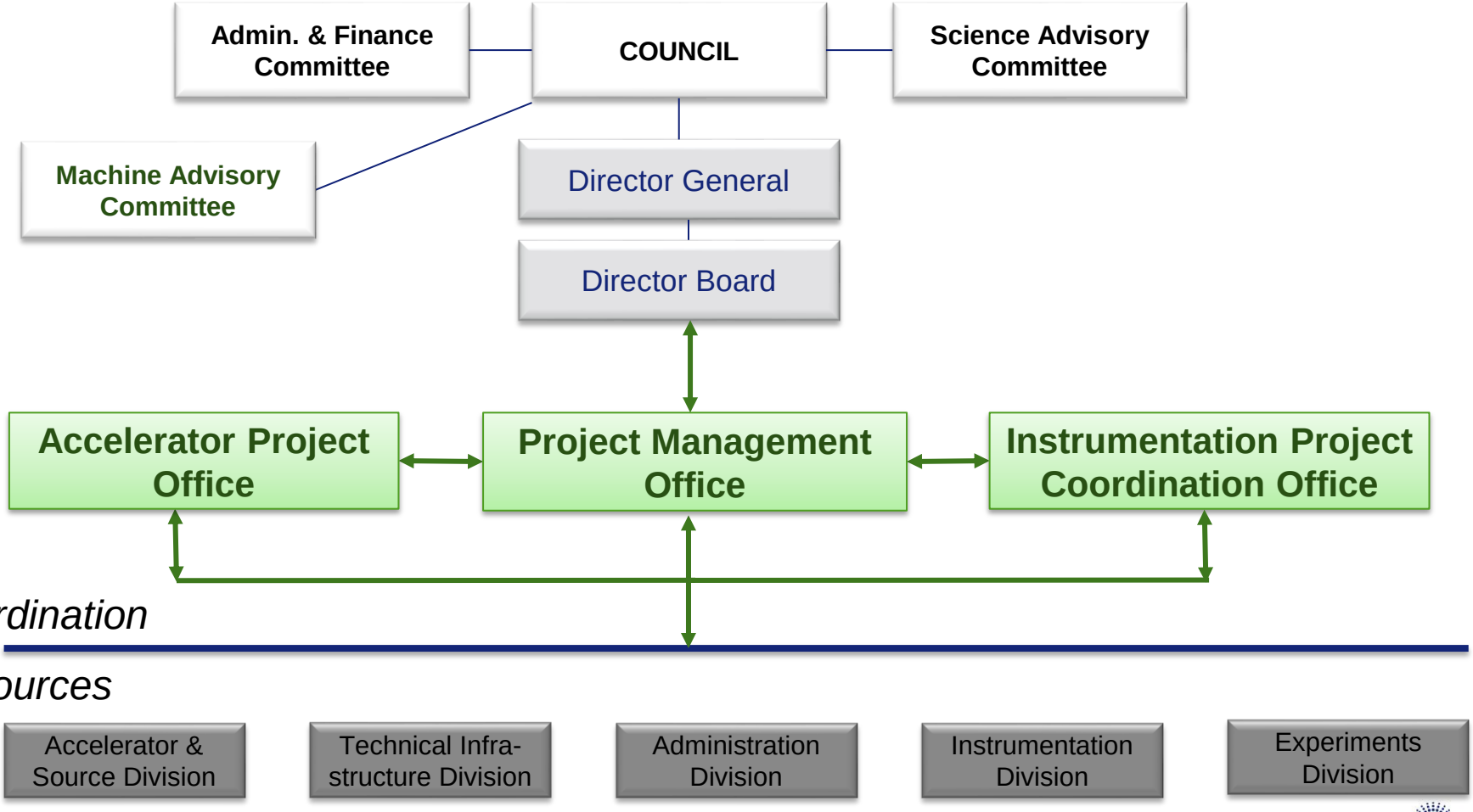
The European Synchrotron | ESRF

THE PHASE II TIMELINE AND RELATED ISSUES



- 4 years preparation (2015-2018)
- Keep a "flat" budget profile !
- Keep downtime (shutdown) as short possible
- Manage resource during and after shutdown

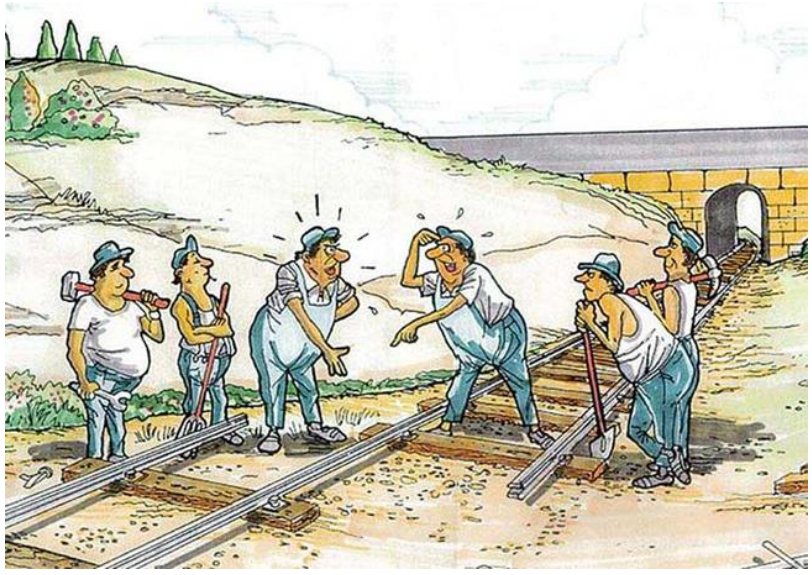
PROJECT COORDINATION: ACCELERATOR VS. EXPERIMENTS



CONCLUSION

A major Upgrade Programme concomitant to continuous operation is challenging and requires a high level of commitment at all levels.

ESRF UPGRADE PROGRAMME



Beyond technical upgrades, major deliverables of this programme are

- *Structural changes*
- *Cultural evolution*

Phase I

- Overall delivered within budget (+/- 2%) and schedule
- Minimum impact on the users' programme (6000hrs → < -10% at worst)

Phase II is more challenging

- Improved coordination between divisions
- Budgets are interlaced
- Shutdown: logistic and resource conflicts, staff profile and skills
- Hiring strategy (scientists/post docs vs. technicians/engineers)


THANK YOU!