STREAMLINE

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 870313.

STREAMLINE – AN INTRODUCTION

H. Reichert

On behalf of the Streamline Executive Team

ESRF
The European Synchrotron

SusTainable REseArch at Micro and nano X-ray beamLINEs

- **EU Programme Call: H2020 INFRADEV-2018-2019 (RIA)**
- **Topic: Infradev-03: Sustainability of RIs**
- **Funding: 4997.5 M€**
- **Single beneficiary: ESRF**
- **Duration: 4 years with starting date 15th Nov. 2019**

The ESRF - an international collaboration with an intergovernmental convention

ESRF
European Synchrotron

21 PARTNER COUNTRIES

The first 3rd generation synchrotron radiation source

13 Member states:

France	27.5 %
Germany	24.0 %
Italy	13.2 %
United Kingdom	10.5 %
Russia	6.0 %
Benesync	5.8 %
(Belgium, The Netherlands)	
Nordsync	5.0 %
(Denmark, Finland, Norway, Sweden)	
Spain	4.0 %
Switzerland	4.0 %

8 Scientific Associate countries:

Israel	1.5 %
Austria	1.3 %
Centralsync	1.05%
(Czech Republic, Hungary)	
Poland	1.0 %
Portugal	1.0 %
India	0.66 %
South Africa	0.3 %

The first 4th generation high energy synchrotron radiation source!

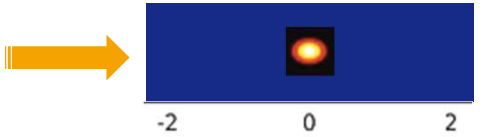
Budget: ~ 100 M€ - 700 staff

X-ray science community's quest for more brilliance

The quest for more brilliance and coherence to the benefit of Science

3rd generation - emittance H/V ~ 1000

4th generation – H/V ~ 1



SERVING THE LARGEST SCIENTIFIC COMMUNITY IN THE WORLD: >50 000 TODAY AND GROWING

The aims of the EBS project:

- To decrease the storage ring horizontal emittance (= a **factor 100** better than the 3rd SR generation)
- To increase the source brilliance (= a **factor 100**)
- To increase the coherence of the beam (= a **factor 30**)
- With the constraints to re-use an existing infrastructure and minimising the impact on the ESRF activity

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New lattice vs. present ESRF lattice: DBA → HMBA

➢ **EBS lattice (cell)**

Hybrid 7 Bend Achromat = (4 dipoles + 3 dipole-quad + 24 quad., sext., oct.)
ID length = 5 m

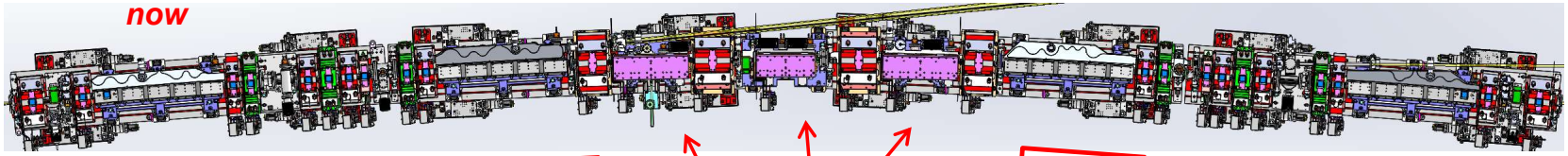
$$\varepsilon \propto \frac{E_e^2}{\left(N_{sect} \cdot N_{dipole}\right)^3}$$

before

31 magnets per cell instead of 17 previously

32 cells (arcs) with 4 girders each

now



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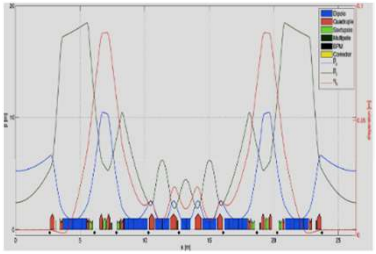
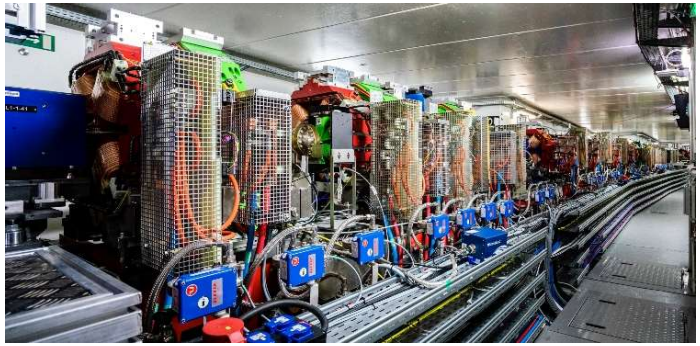
A dream machine becomes a reality

From the idea - 2013 -

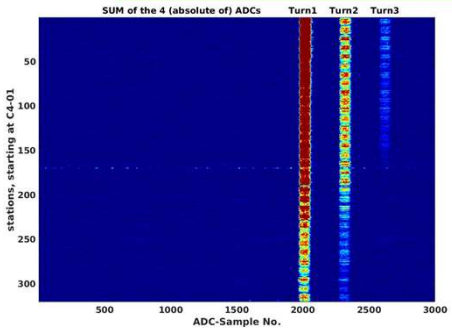


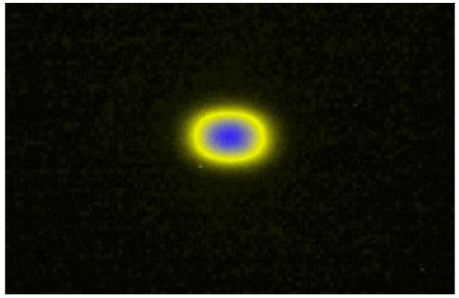
To the design – 2015/16 -

To the machine – 2016/19 -



To the 1st electrons in the EBS storage ring - 28-11-2019





17 DECEMBER 2019
EBS exceeds former SR brightness

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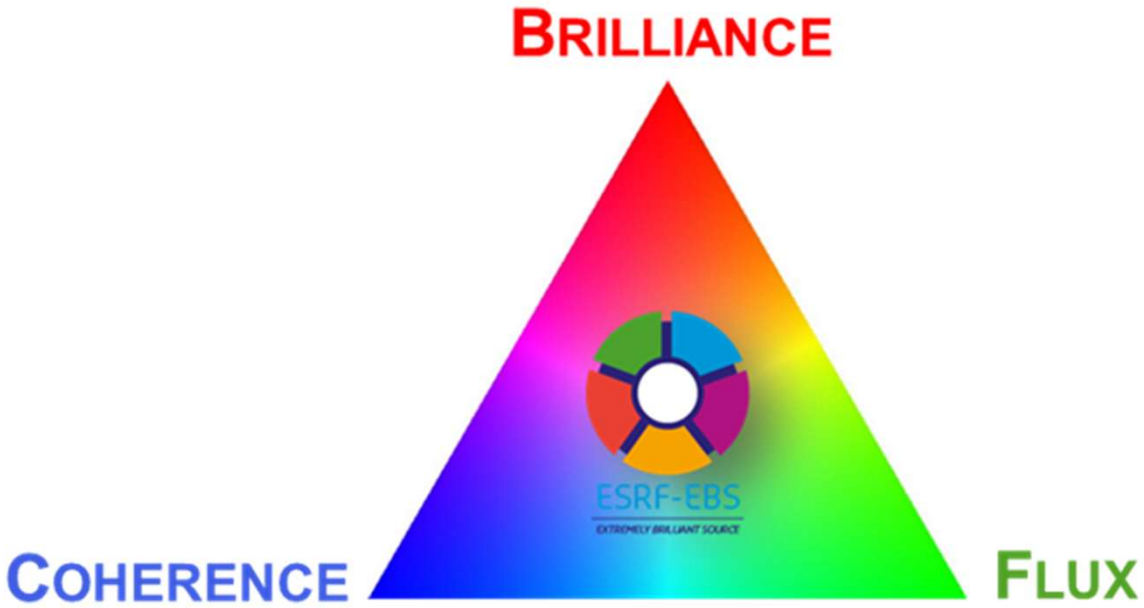
What's new with EBS?

EBS – the first 4th generation high energy SR source:
A big step forward for X-ray science



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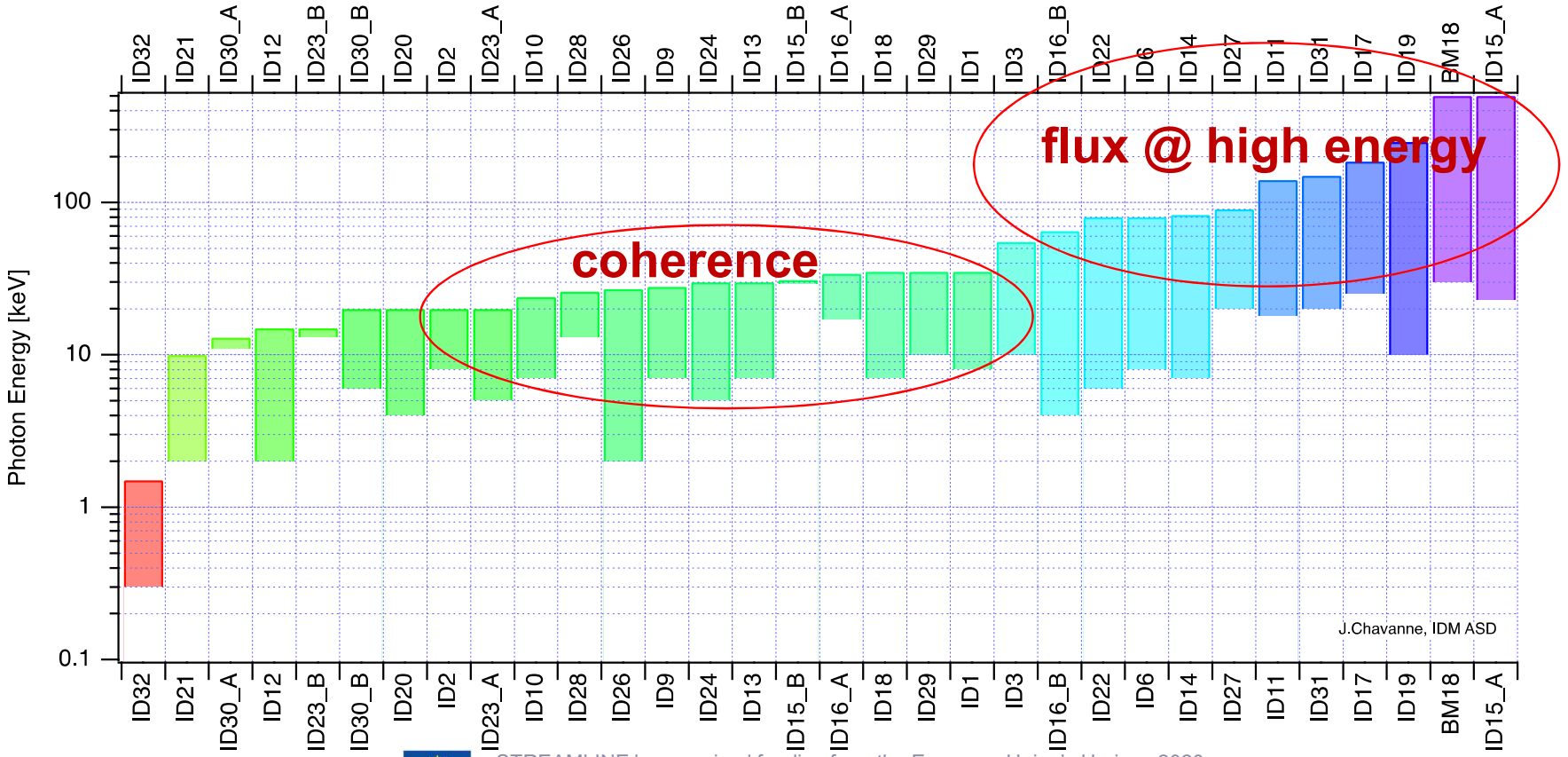

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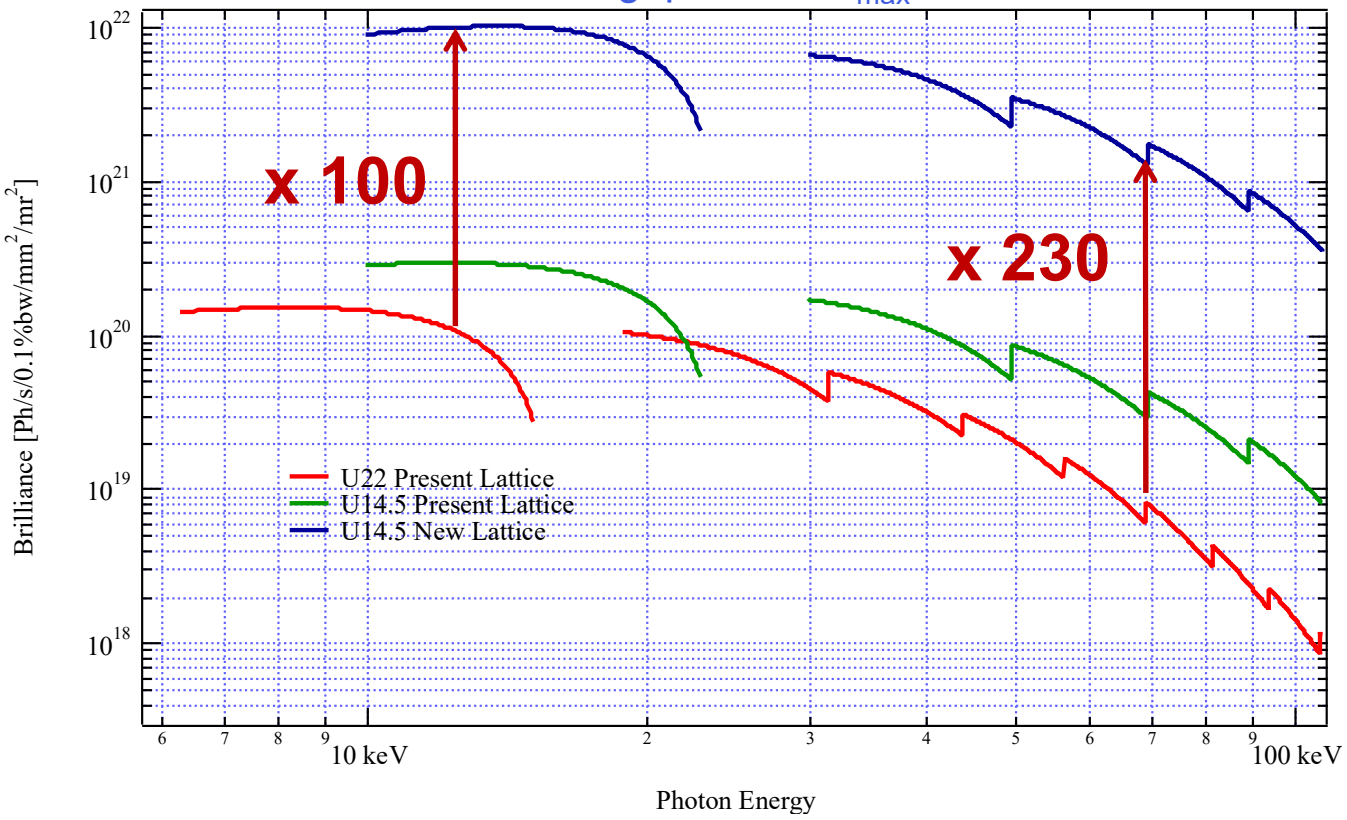
EBS – the extremely brilliant source

IVUN22 min. gap 6 mm, K_{max}=1.7
CPMU14.5 min. gap 4 mm, K_{max}=1.7



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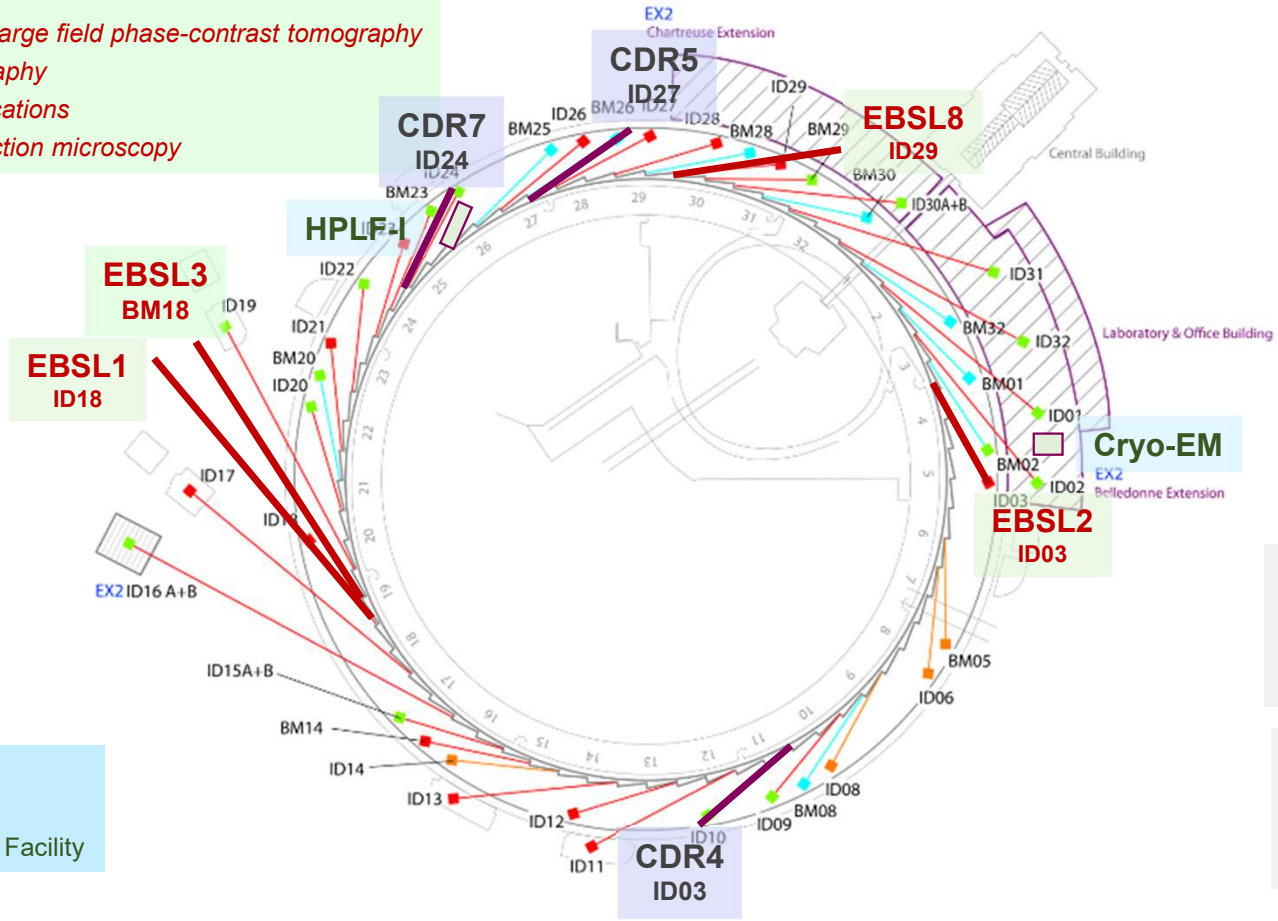
EBS – Experimental programme: overview

EBS Beamlines

- **EBSL3**: *High throughput large field phase-contrast tomography*
- **EBSL8**: *Serial crystallography*
- **EBSL1**: *Coherence applications*
- **EBSL2**: *Hard X-ray diffraction microscopy*



Refurbishment Programme

- **CDR4**: *Surface science*
- **CDR5**: *Extreme conditions*
- **CDR7**: *High brilliance XAS*

- **ID21, ID18**
- **ID17, ID23-2, ID26**

Data Analysis as a Service

- Data Policy
- Data storage and archiving
- Scientific programming

Instrumentation Programme

- Detectors
- Monochromators
- BL control system

User Platforms

- Cryo-EM Facility
- High Power Laser Facility

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Revisiting the ESRF Science Programme

THE ESRF X-RAY SCIENCE PROGRAMME AIMS TO PROVIDE AS SOON AS POSSIBLE A BRAND-NEW GENERATION OF HIGH-ENERGY SYNCHROTRON TO TACKLE GLOBAL CHALLENGES

1. **Health, Health Innovation**, and overcoming cancer and neuro-degenerative diseases
2. **Material for tomorrow** and innovative and sustainable industry
3. **Clean Energy transition**, sustainable energy storage and clean hydrogen technologies
4. **Planetary** (terrestrial and extra-terrestrial) **research**
5. **Environmental and climatic challenges**, water supplies and earth atmosphere
6. **Bio-based economy and food security**
7. **Humanity and world cultural heritage**

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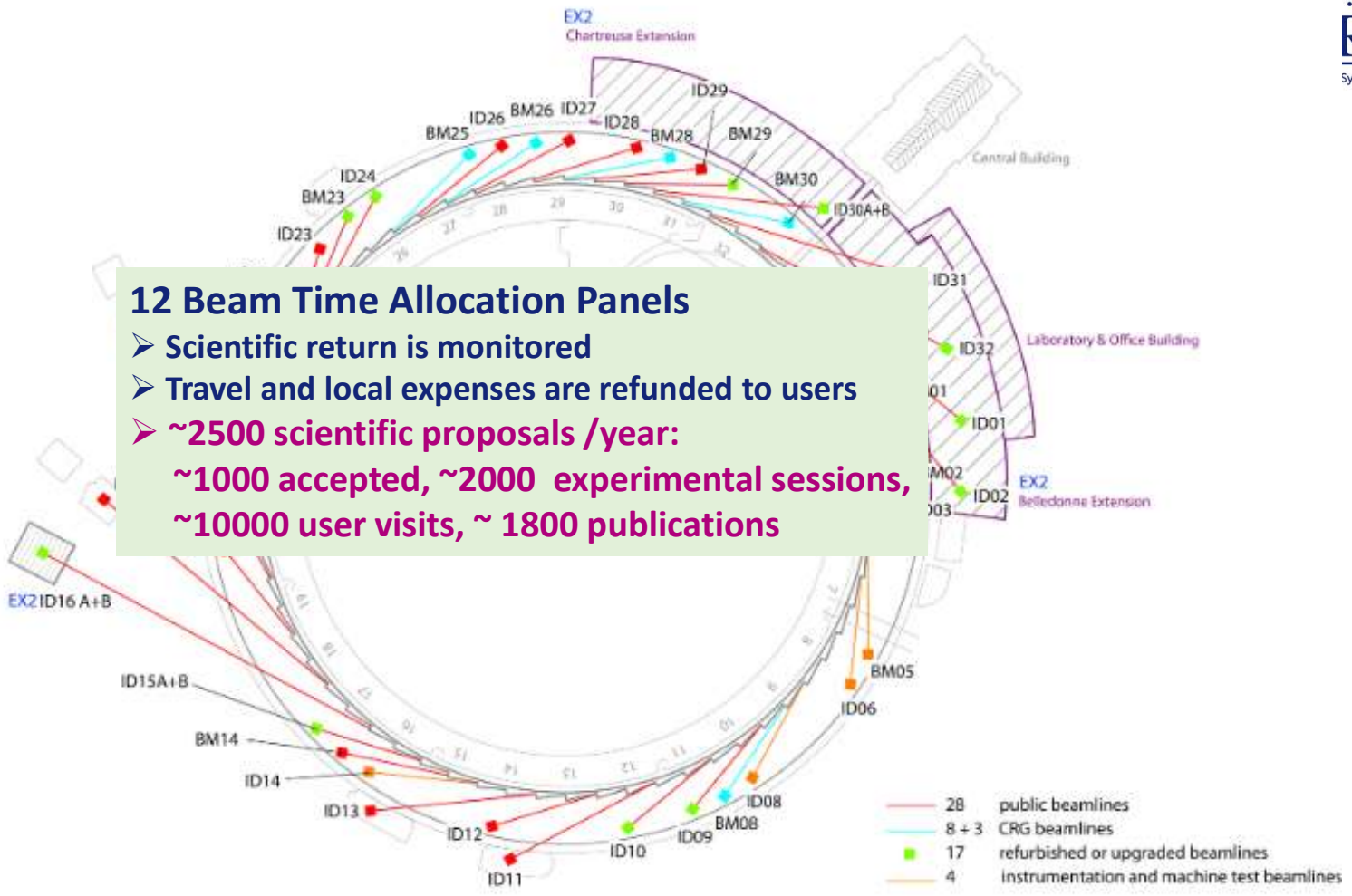
ESRF today - the experimental programme

32.5 ESRF Beamlines
13 CRG Beamlines

(Teams from Member States)



12 Beam Time Allocation Panels
- **Scientific return is monitored**
- **Travel and local expenses are refunded to users**
- **~2500 scientific proposals /year:**
  ~1000 accepted, ~2000 experimental sessions,
  ~10000 user visits, ~ 1800 publications

Imaging
Diffraction
Scattering
Spectroscopy

nm – μm – mm – cm
beam size

research and innovation programme under grant agreement No. 870313

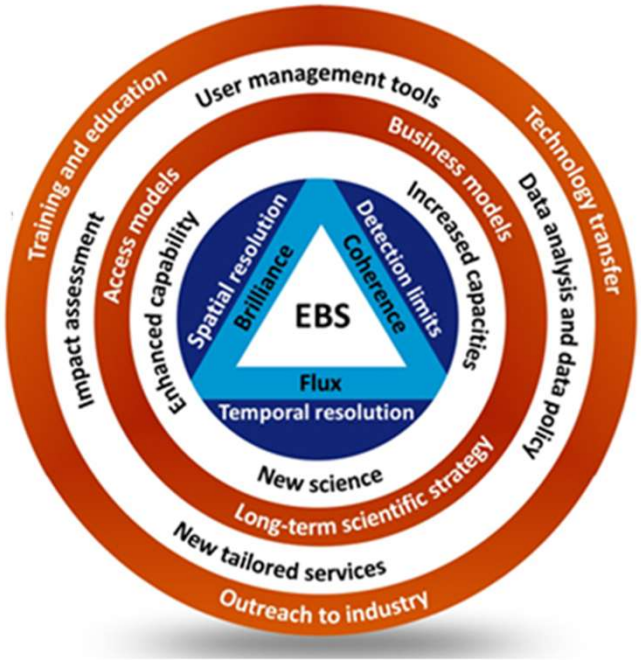
How do Photon and Neutron facilities work?

1. **User**: has an idea / need to study a sample
2. **Proposal**: User writes a proposal for one of the PaN facilities
3. **Review committee**: Reviews proposal and rates scientific quality
4. **Beamline scientist**: Review proposal and checks feasibility
5. **Beamtime allocated**: User travels to facility / sends sample
6. **Experiment**: Sample(s) are exposed to beam + data collected
7. **Analysis**: Data is reduced, analysed + curated (DOI)
8. **Publication**: User publishes results (DOI) in peer review journal

Sustainable scientific exploitation of the ESRF-EBS

ESRF-EBS
Extremely Brilliant Source

- New source
- Brighter X-ray beams
- New beamlines
- New infrastructure



STREAMLINE

- New services (access, data)
- Enhanced capacity
- Modernization of tools
- Outreach to new communities

New science

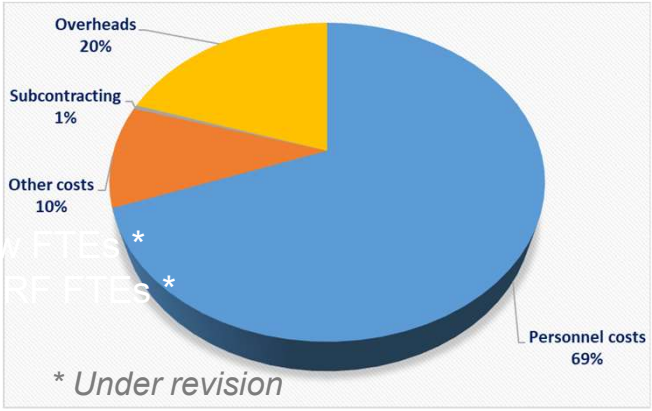
Increase socio-economic impact
with a reduced environmental footprint

Increased sustainability

Overall organization

STREAMLINE

Openness	*Attractiveness*	*Competitivity*	*Efficiency*	*Innovation*	*Influence*
WP1: Project management, communication, dissemination and exploitation	**WP2: Business plan and facility access policies**	**WP3: Update user tools and administrative procedures**		**WP4: Build capacity**	**WP5: User engagement, training and outreach**
T1.1: Implementation of project management	T2.1: New scientific opportunities	T3.1: Update user administrative procedures		T4.1: Codesign of new services	T5.1: Creation of scientific training tools
T1.2: Project monitoring and reporting	T2.2: Sustainable access models	T3.2: Enabling new access models		T4.2: Sample environment for high throughput	T5.2: Outreach and training programme
T1.3: Internal communication	T2.3: Enhanced reporting and socio-economic impact	T3.3: Commercial access offer and charging models		T4.3: LIMS for new mail-in services	T5.3: Nurturing new communities
T1.4: External communication and dissemination	T2.4: Collaboration with industry	T3.4: Pilot run of new procedures and services		T4.4: Data collection and data analysis	
T1.5: Publications and conference presentations	T2.5: Consolidated business and sustainability plan	T3.5: Enhanced reporting		T4.5: Finalise and launch new customised service	
T1.6: Workshops to disseminate results					
T1.7: Knowledge IPR and innovation management					



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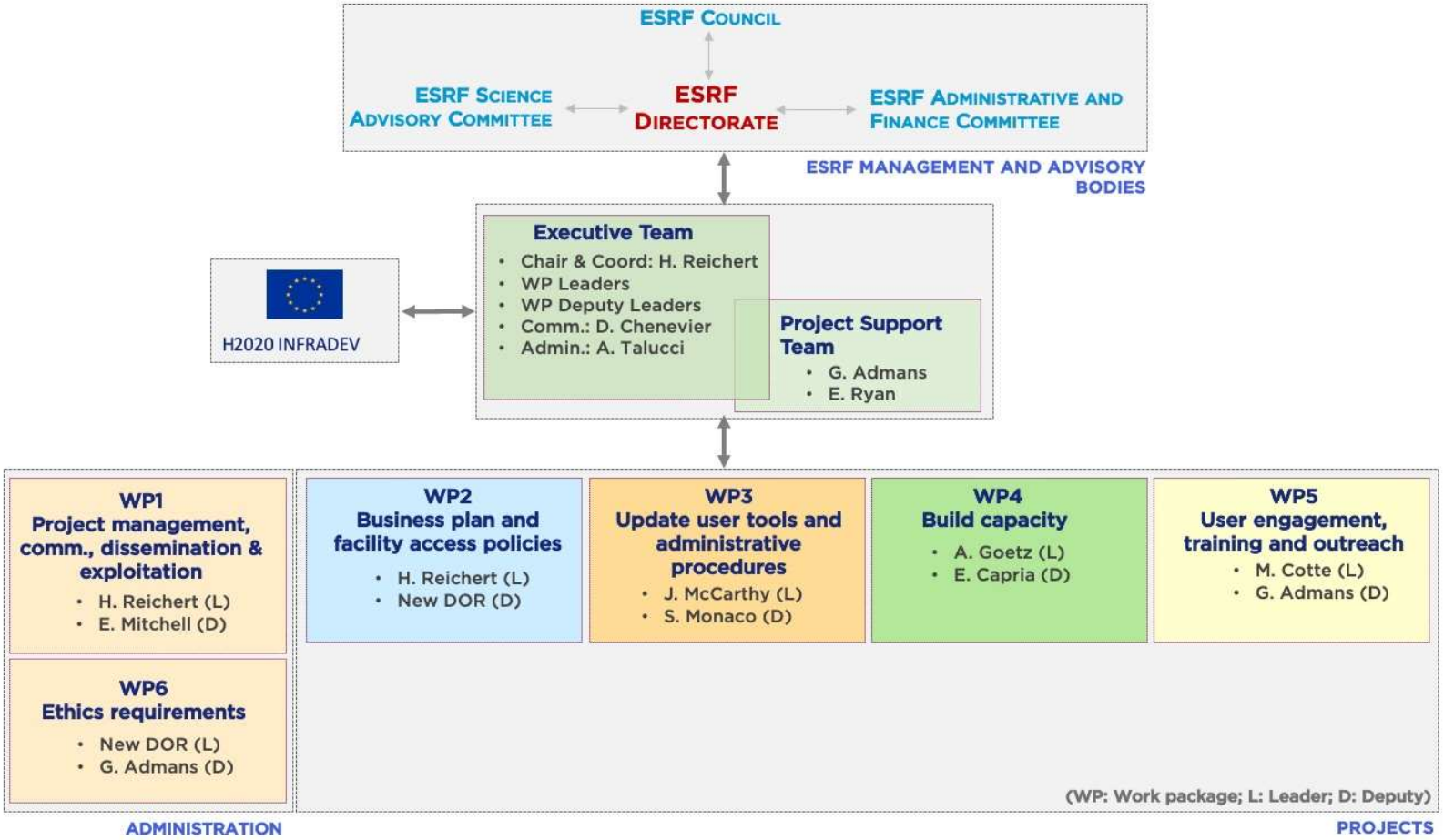
Project management and organisation



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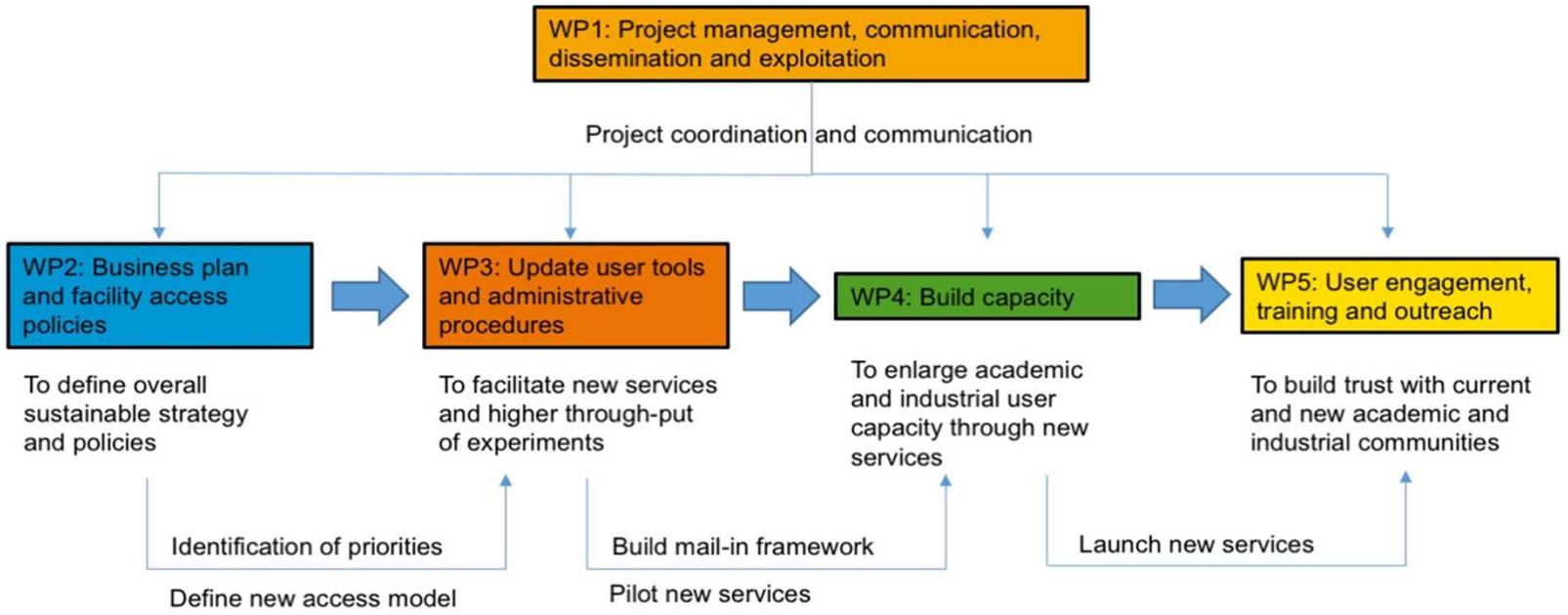
Execution sequence: from definition to implementation



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Conclusion

STREAMLINE is a 4-year project which aims to capitalize on the possibilities offered by ESRF-EBS for new experiments, new access modes and new services

STREAMLINE is key to expand the ESRF's role towards an active facilitator in areas of the highest societal relevance

The STREAMLINE scope and objectives are fully embedded in the core activities and mission of the ESRF. The implementation of this programme naturally involves all divisions and many aspects of ESRF operation

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Thank you for your attention!

streamline.esrf.eu

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