
ESRF
The European Synchrotron

ESRF UPGRADE PROGRAMME

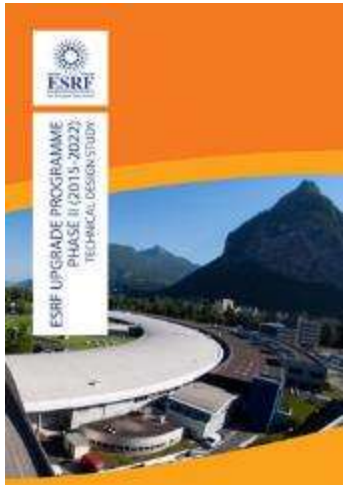
Phase I

19 upgraded or deeply refurbished BLs
Accelerator and source upgrades
Construction Programme

2009 — 2015

Purple Book
2008

Orange Book
January 2015



2015 — 2022

Phase II – EBS

New storage ring
4 new BLs
Technology Programme
Data Analysis as a Service

NEW LATTICE VS. PRESENT ESRF LATTICE

- **Present ESRF lattice (cell)**

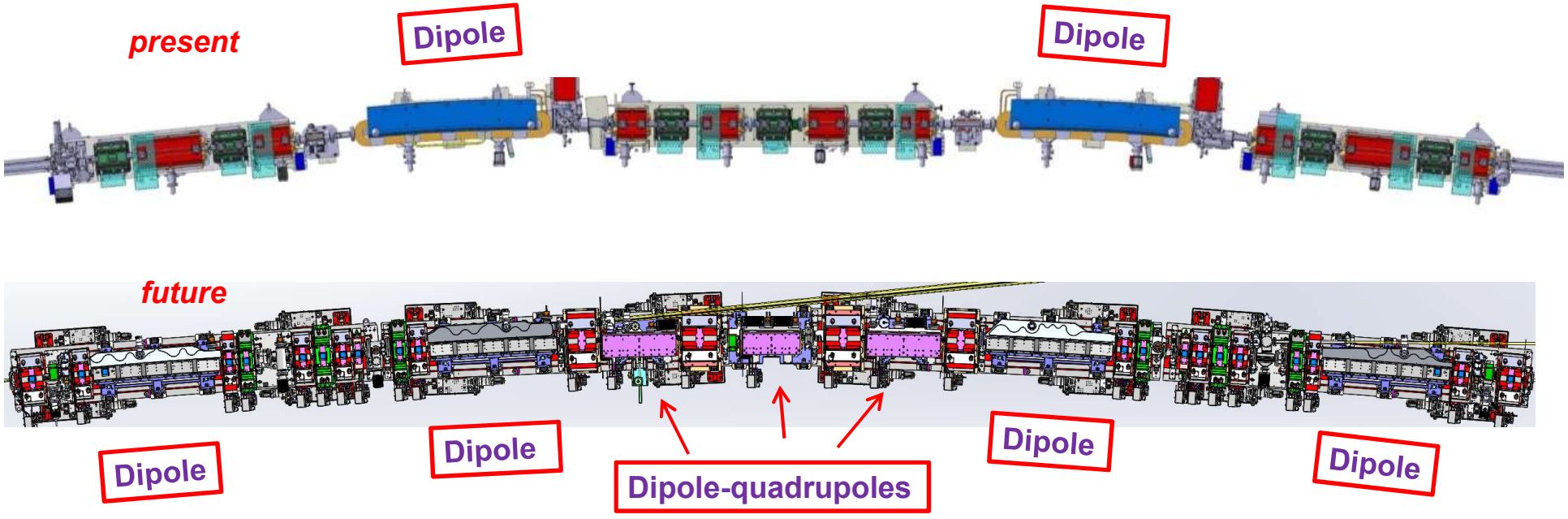
  Double Bend Achromat = (2 dipoles + 15 quad. sext.) per cell

  ID length = 5 m (standard) / 6m / 7m

- **Future EBS lattice (cell)**

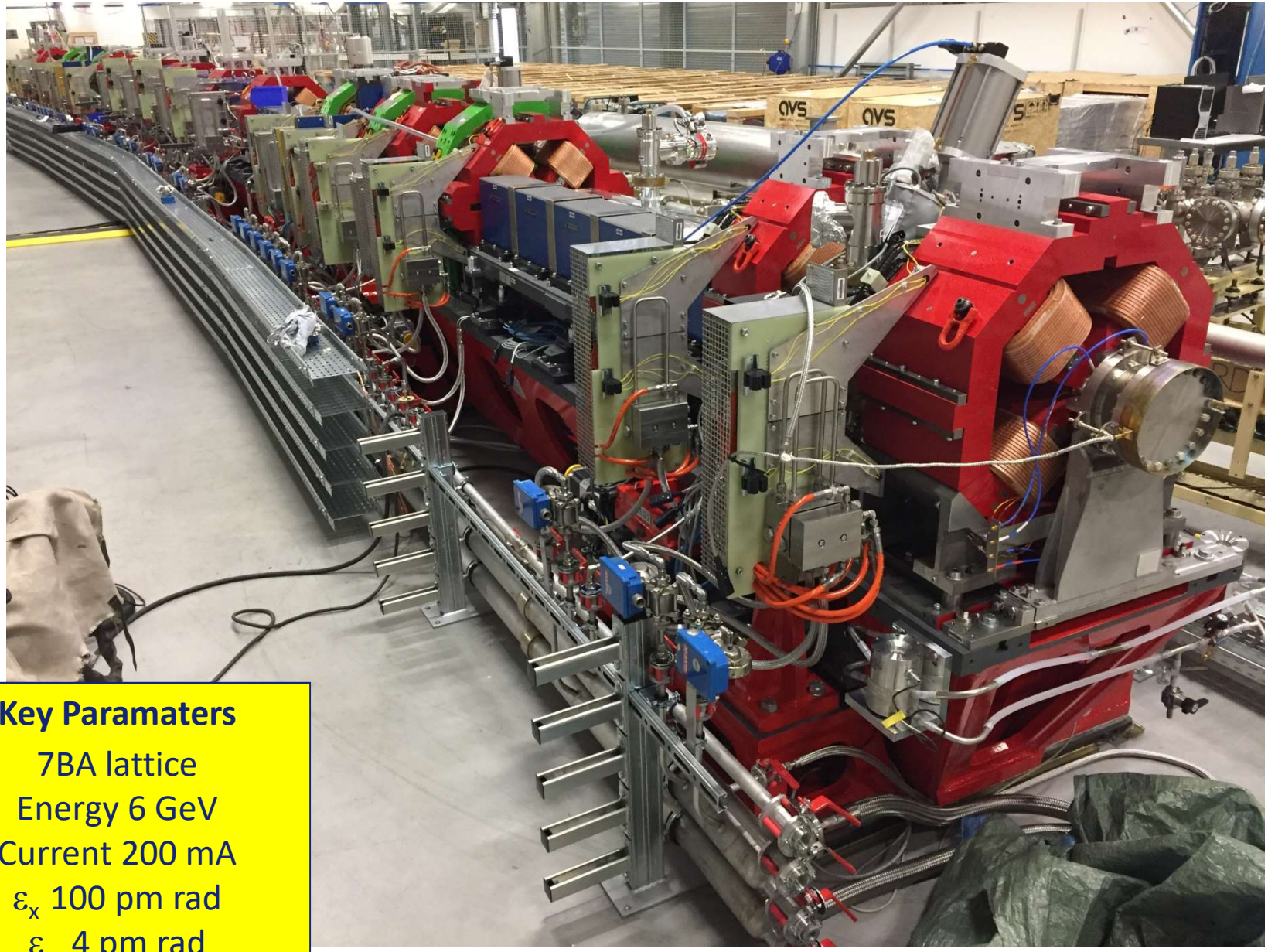
  Hybrid 7 Bend Achromat = (4 dipoles + 3 dipole-quad + 24 quad., sext., oct.)

  ID length = 5 m



31 magnets per cell instead of currently 17!

MOCK-UP: TUNNEL CORRIDOR VIEW



Key Paramaters

7BA lattice

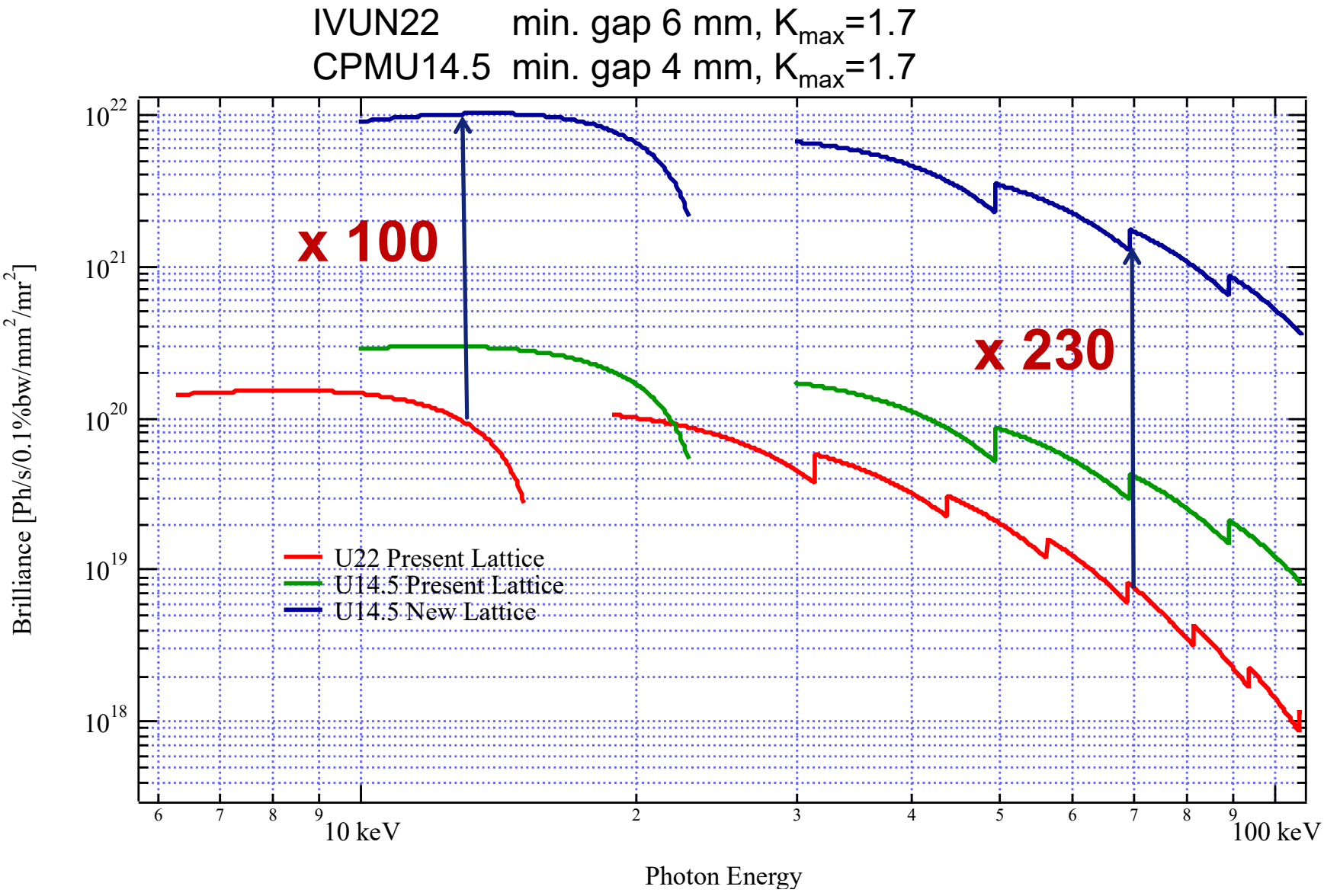
Energy 6 GeV

Current 200 mA

ε_x 100 pm rad

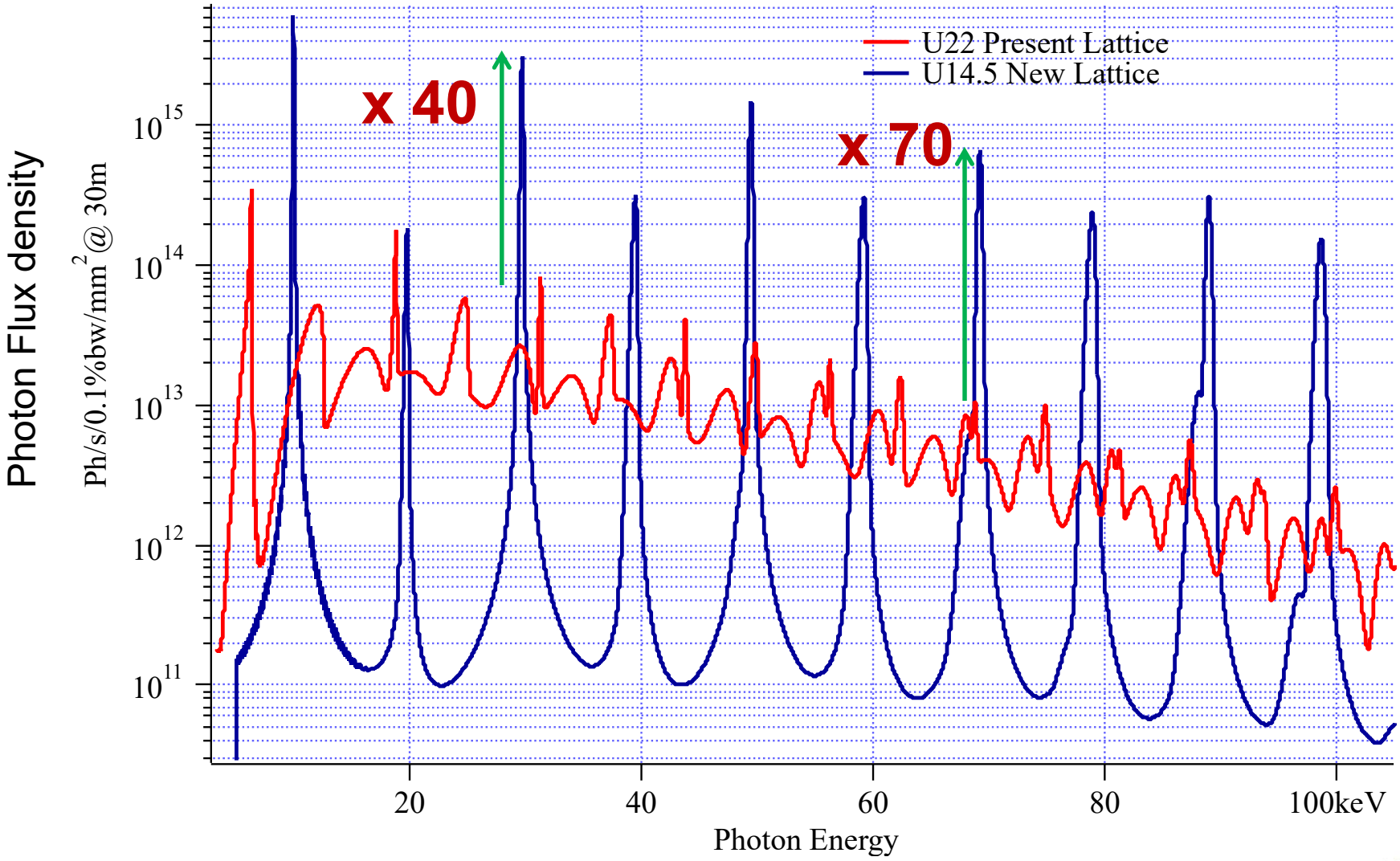
ε_z 4 pm rad

INCREASED BRILLIANCE & COHERENCE



2 M IVUS & CPMUS

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

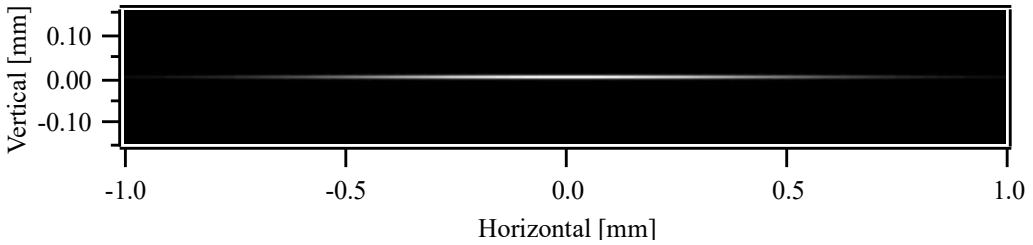


BEAM SIZE AT SOURCE

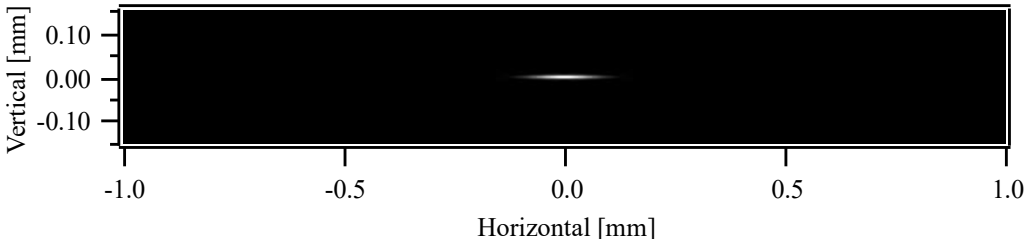
Middle of ID straight

Past ESRF

High Beta ~ parallel beam and large source size

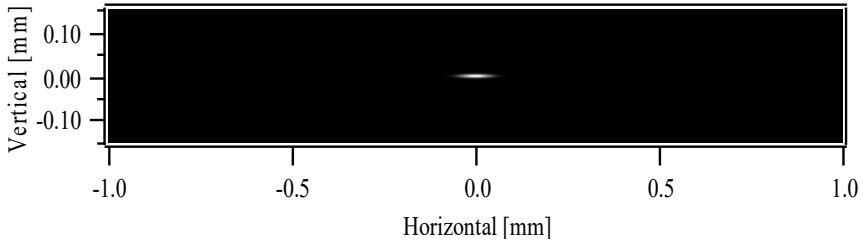


Low Beta : large horizontal divergence and small source size



ESRF-EBS

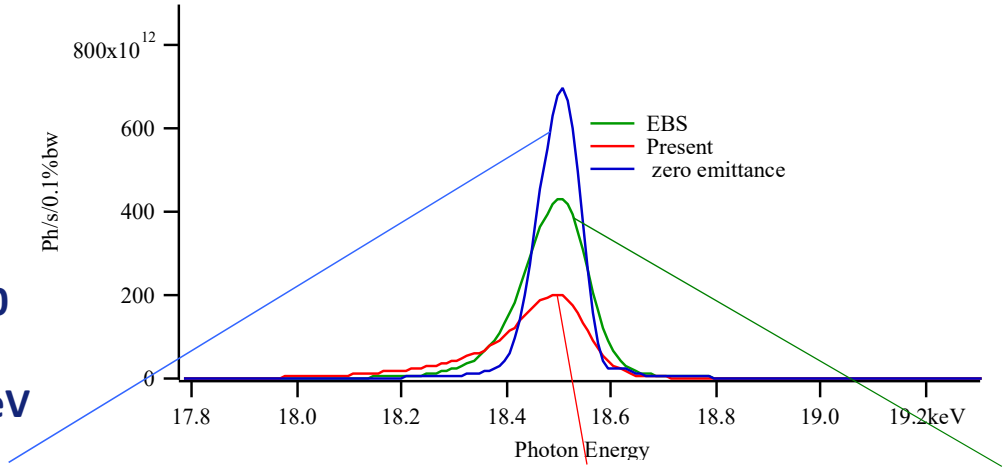
ESRF EBS ~ an even more parallel beam and smaller source size



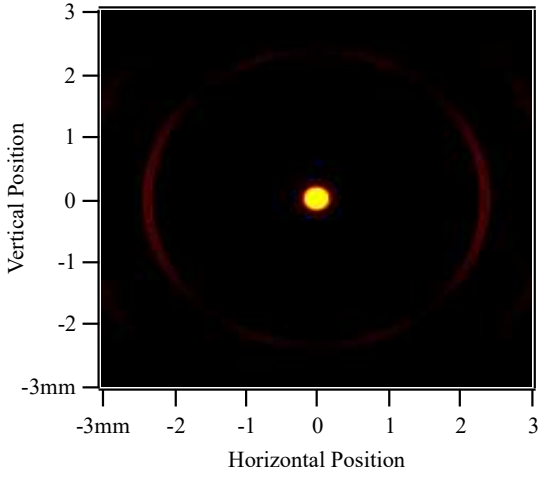
BEAM SIZE AT BEAMLINE

Photon beam size @ 30 m from source

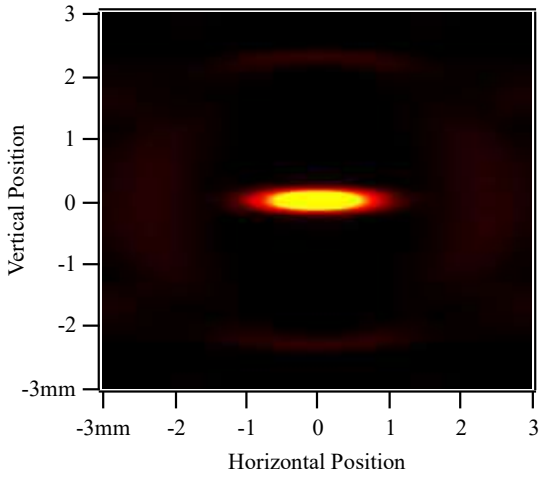
Undulator:
Period λ_0= 22 mm
Number of periods N=90
K=1.79
Harmonic n=3 @ 18.3 keV



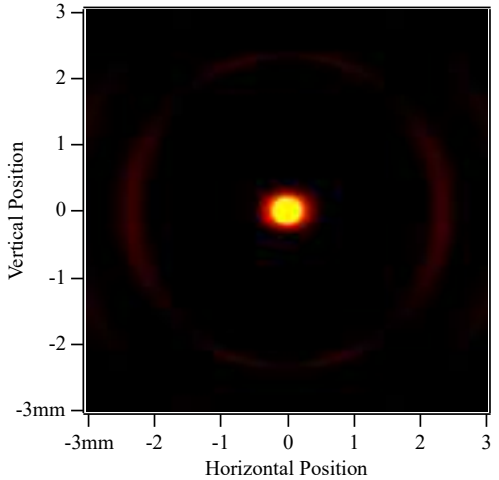
ESRF –EBS: Revolution in Synchrotron Science



ideal electron beam
(zero emittance)



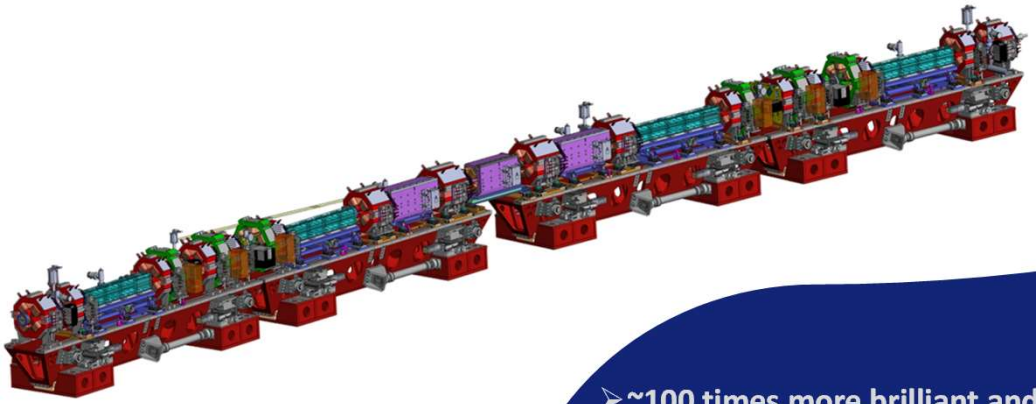
finite emittance,
present high-β



EBS beam

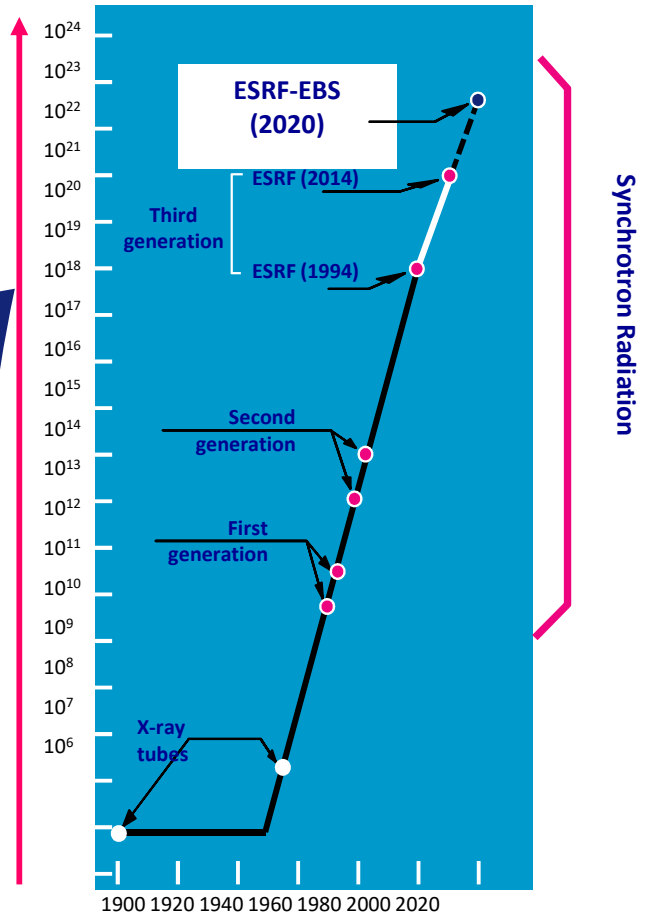
ESRF EBS: A NEW STANDARD FOR SYNCHROTRON STORAGE RINGS

ESRF Extremely Brilliant Source
ESRF-EBS – 150 M€ (2015-2022)



Pantaleo Raimondi winner of the 2017 Gersh Budker prize for the Hybrid Multi Bend Achromat (HMBA) lattice, “which has become the design basis of most future 4th generation synchrotron sources”

- ~100 times more brilliant and coherent X-rays
- Programme to exploit the qualities of this new and unique extremely brilliant X-ray source:
  - Creation of new beamlines
  - Innovative detector programme
  - « Data as a Service » strategy



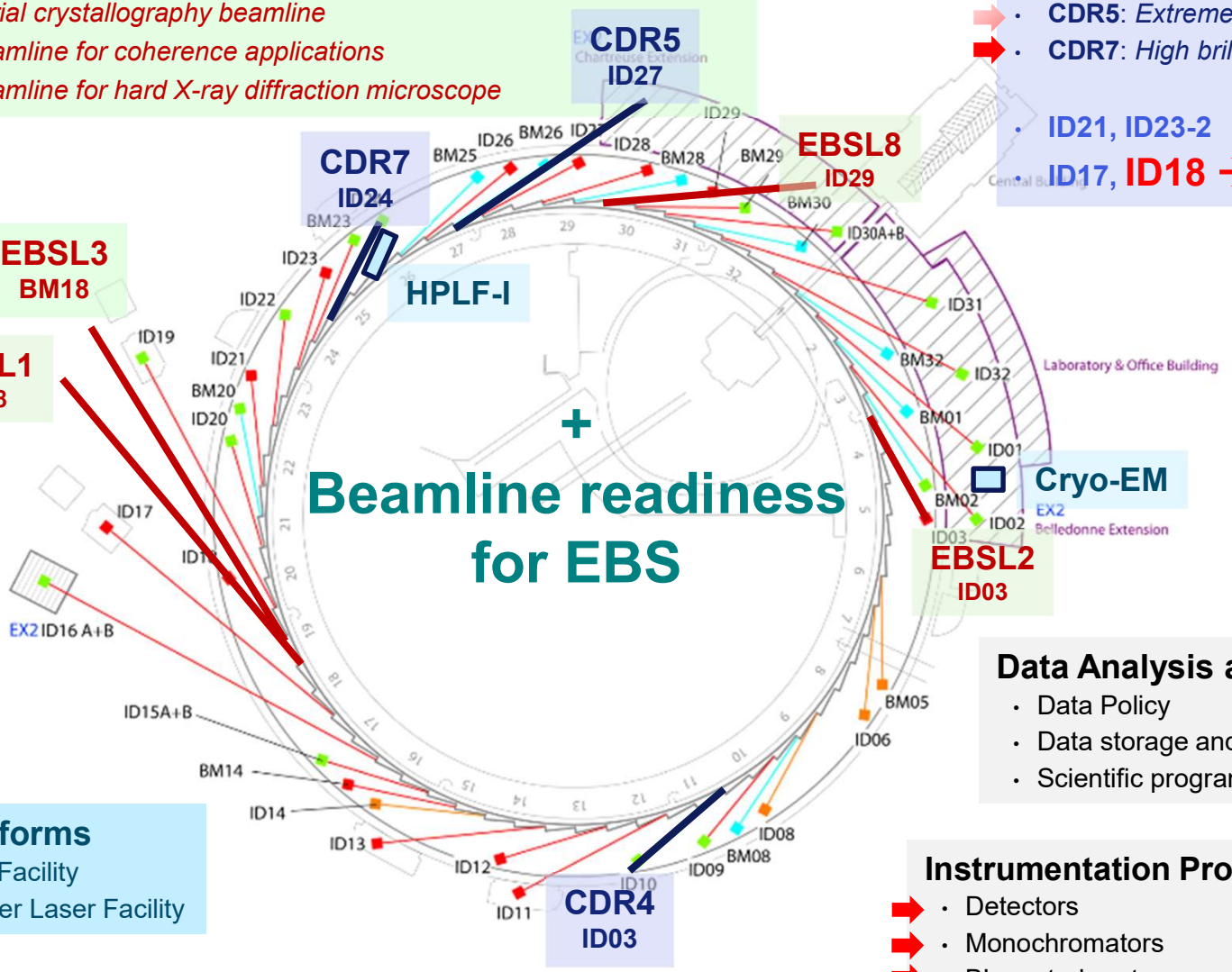
EBS: EXPERIMENTAL PROGRAMME OVERVIEW

EBS Beamlines

- **EBSL3**: *High throughput large field phase-contrast tomography beamline*
- **EBSL8**: *Serial crystallography beamline*
- **EBSL1**: *Beamline for coherence applications*
- **EBSL2**: *Beamline for hard X-ray diffraction microscope*

Refurbishment Programme

- **CDR4**: *Surface science*
- **CDR5**: *Extreme conditions*
- **CDR7**: *High brilliance XAS*
- ID21, ID23-2
- ID17, ID18 → ID14



Data Analysis as a Service

- Data Policy
- Data storage and archiving
- Scientific programming

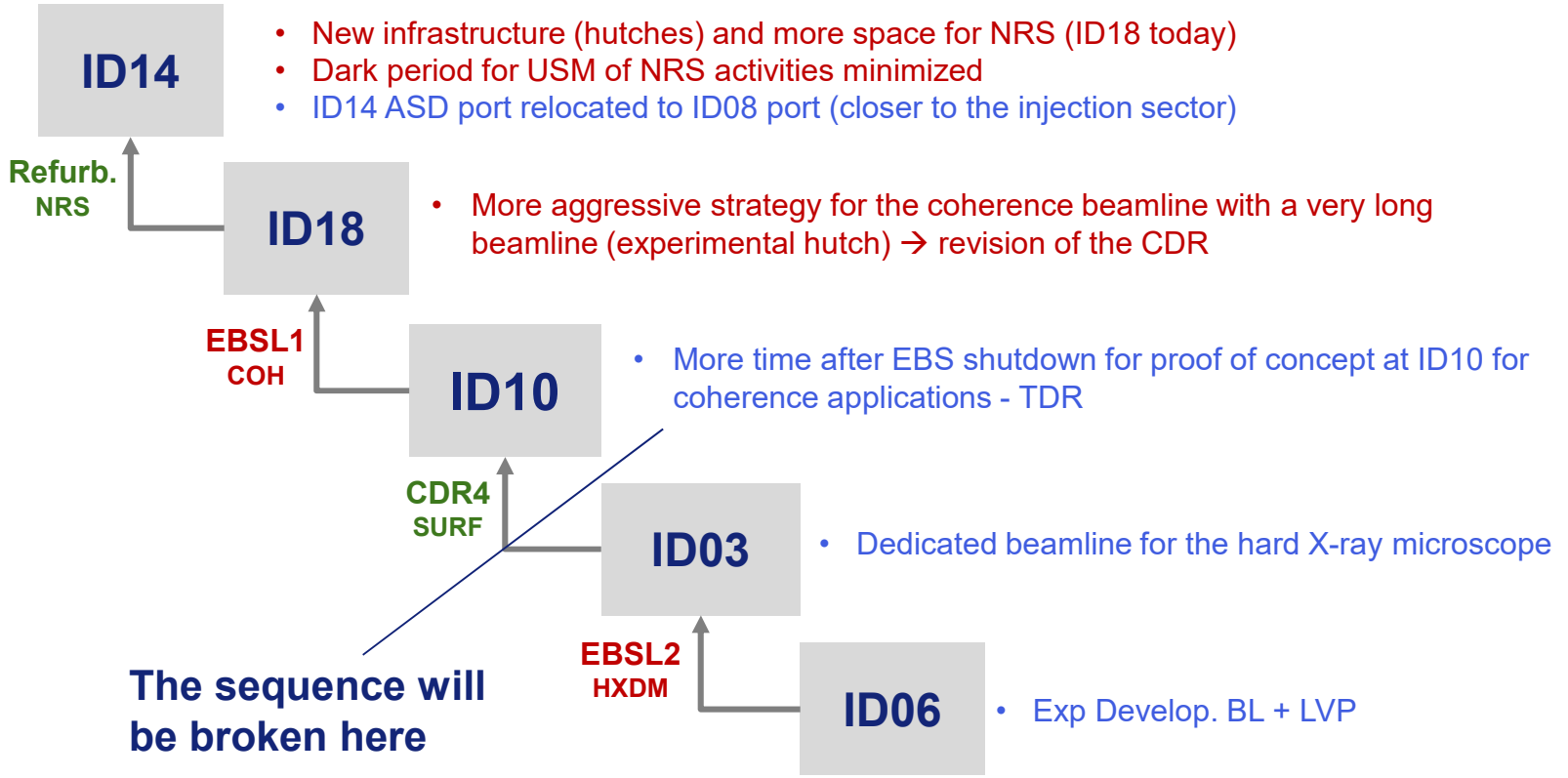
User Platforms

- Cryo-EM Facility
- High Power Laser Facility

Instrumentation Programme

- Detectors
- Monochromators
- BL control system

SEQUENCE


ID14
• New infrastructure (hutches) and more space for NRS (ID18 today)
• Dark period for USM of NRS activities minimized
• ID14 ASD port relocated to ID08 port (closer to the injection sector)
Refurb.
NRS
ID18
• More aggressive strategy for the coherence beamline with a very long beamline (experimental hutch) → revision of the CDR
EBSL1
COH
ID10
• More time after EBS shutdown for proof of concept at ID10 for coherence applications - TDR
CDR4
SURF
ID03
• Dedicated beamline for the hard X-ray microscope
EBSL2
HXDM
ID06
• Exp Develop. BL + LVP
The sequence will be broken here


BM18
EBSL3
TOMO
ID27
CDR5
EXTR
ID29
EBSL8
SSX
ID24
CDR7
XAS

EBS WORKSHOP SERIES IN 2019 (LONG SHUTDOWN)

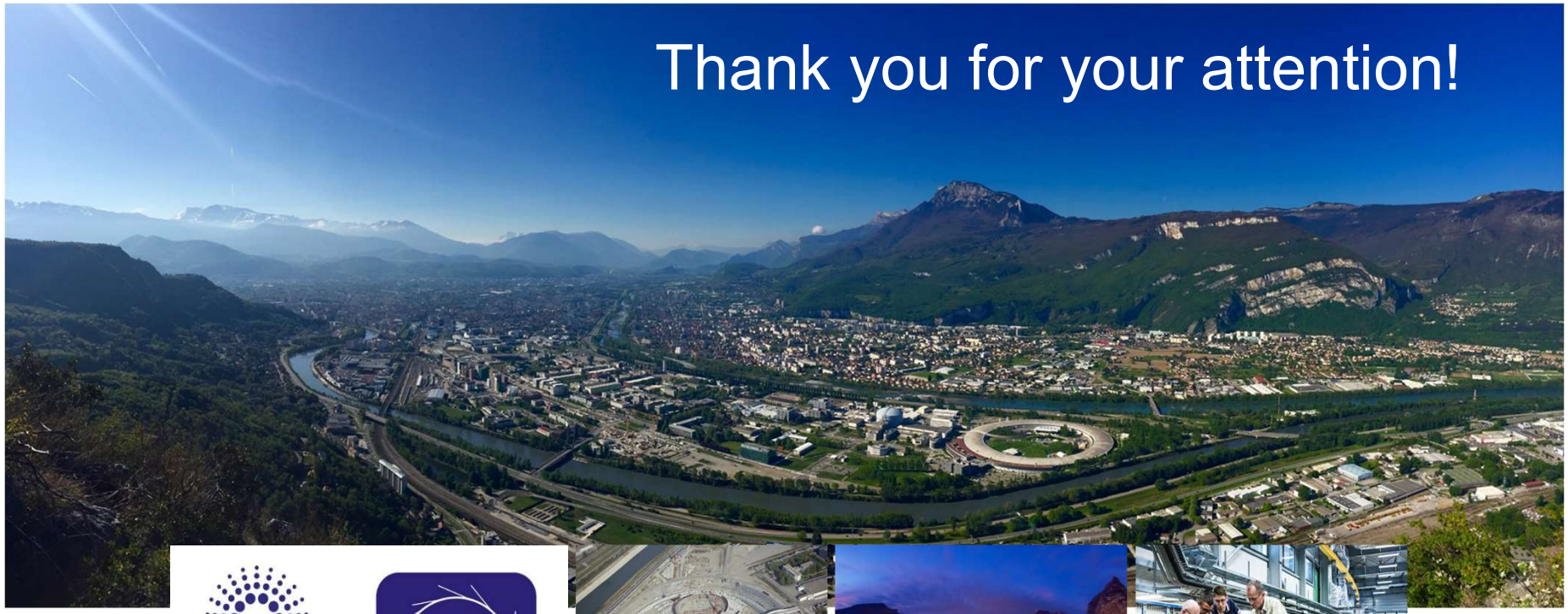
1. Time-resolved science at ID09 and its synergy with EuXFEL programme	4-5 March
2. **Nuclear resonance scattering at the Extremely Brilliant Source**	**11-12 March**
3. Probing low Z elements using hard X-ray Raman scattering spectroscopy	1-5 Apr.
4. Hands on! High Pressure Techniques at the ESRF-EBS	17-21 June
5. Opportunities and challenges for dynamical and structural studies with coherent X- rays at EBSL1	9-13 Sept.
6. A coherent future with coherent X-rays at ESRF-EBS	9-13 Sept
7. Emerging synchrotron techniques for characterization of energy materials and devices	24-25 Sept.
8. X-ray spectroscopy of magnetic materials	6-10 Oct.
9. Short-pulse experiments with the Extremely Brilliant Source	28-31 Oct.
10. Local electronic structure and coordination probed by X-ray emission spectroscopy	2-6 Dec.
11. Undesired effects of high photon densities on the sample – analysis and strategies for mitigation	10-12 Dec.
12. Surface science at the ESRF-EBS	Dates TBC

SCHEDULE

SCHEDULE:

2017-2018	Delivery of the components, testing, and pre-Assembly
10th Dec 2018	End of USM and start of the shutdown
Jan – ~~March~~ Feb 2019	Dismantling of the storage ring
March ~~April~~ – Nov 2019	New storage ring installation
Dec 2019 – March 2020	Accelerator commissioning
March – Aug 2020	Beamline restart and commissioning
25th August 2020	Back to full User Operation

Thank you for your attention!



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30 years of science