

ESLS-RF 2019: Welcome

R.P. Walker, Technical Director



Harwell Campus

200 organisations
5000 employees

ISIS –
spallation
neutron source

Central Laser
Facility

Medical Research Council

PHE

Research
Complex

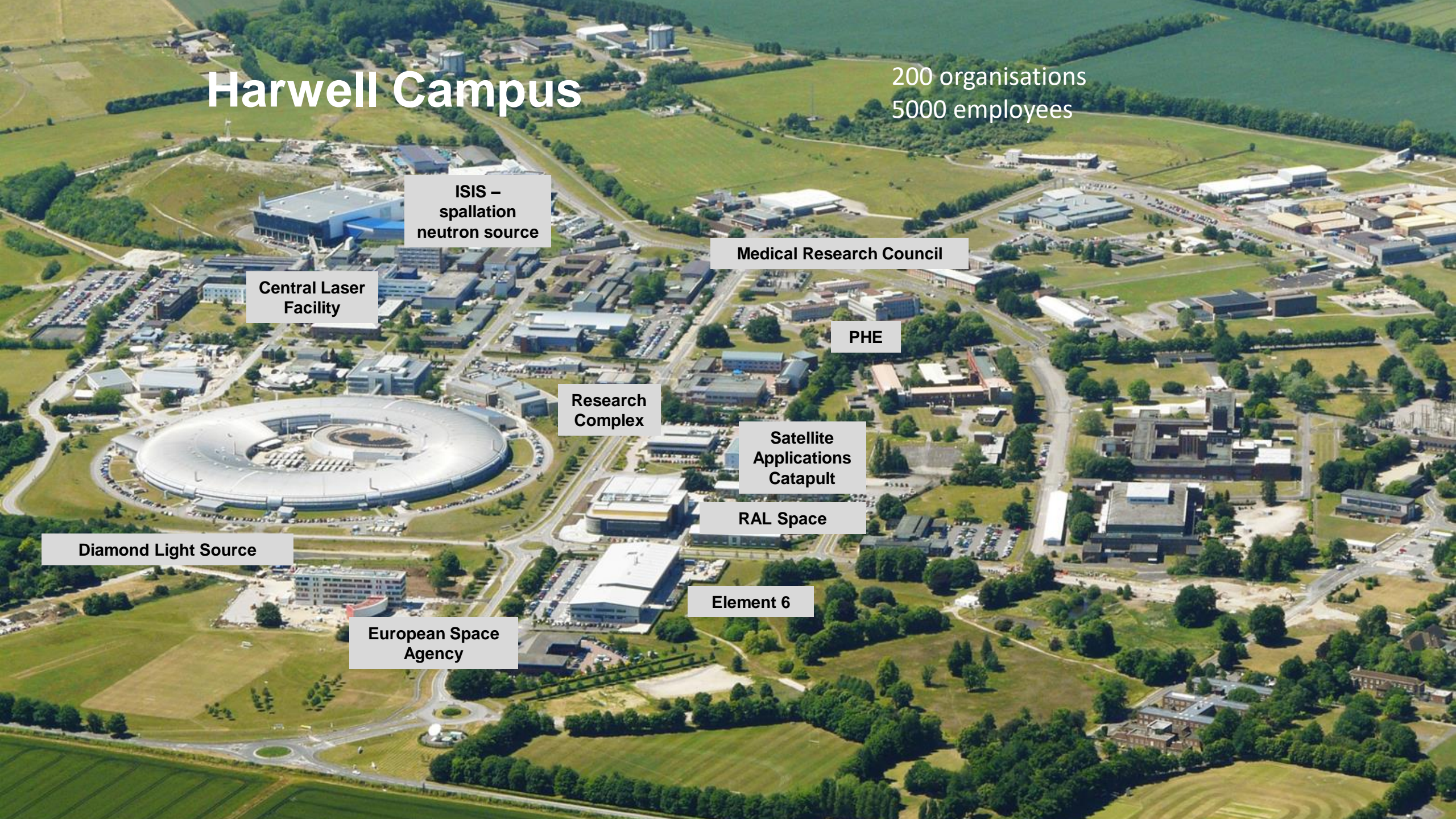
Satellite
Applications
Catapult

RAL Space

Diamond Light Source

Element 6

European Space
Agency



The Diamond Machine

100 MeV Linac

3 GeV Booster

3 GeV Storage Ring

circumference 561.6 m

lattice 24 cell DBA

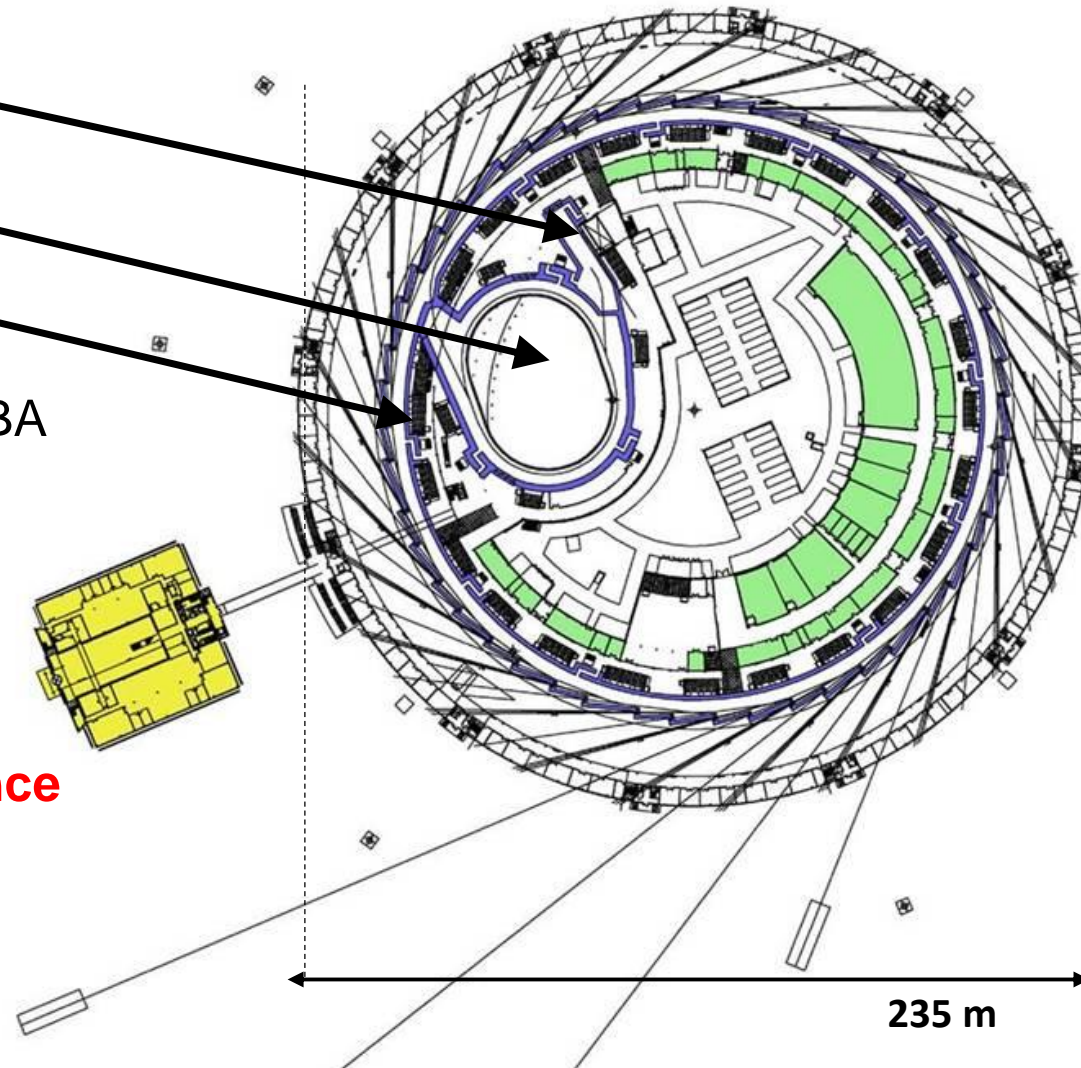
current 300 mA

emittance, H 2.7 nm

emittance, V 8 pm

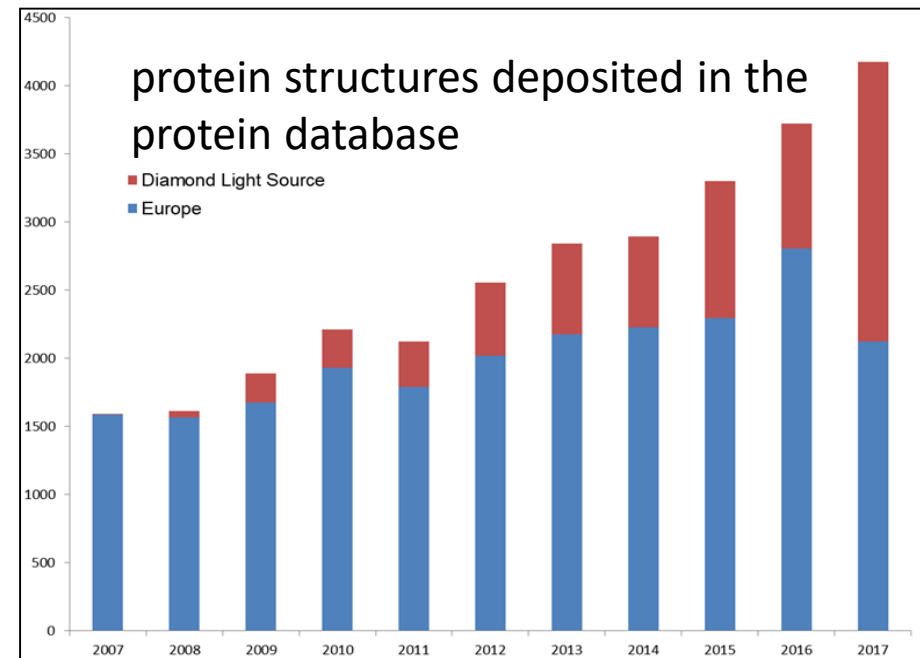
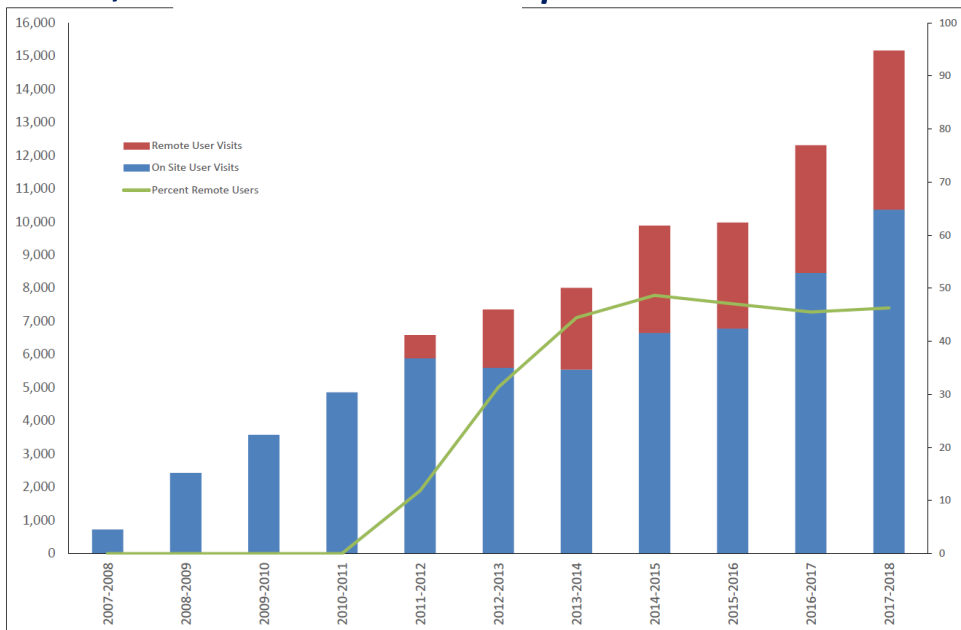
min. ID gap 5 mm

**Operational for users since
Jan. 2007**

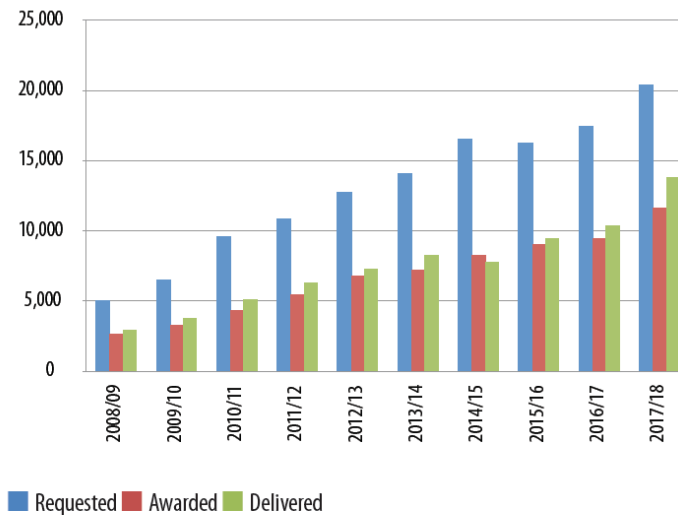


Increasing Use

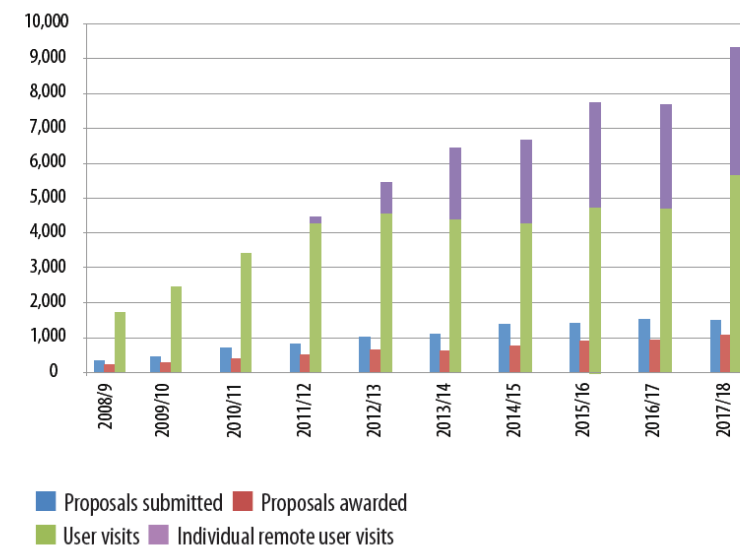
~ 15,000 user 'visits' *per annum* - 45% remote



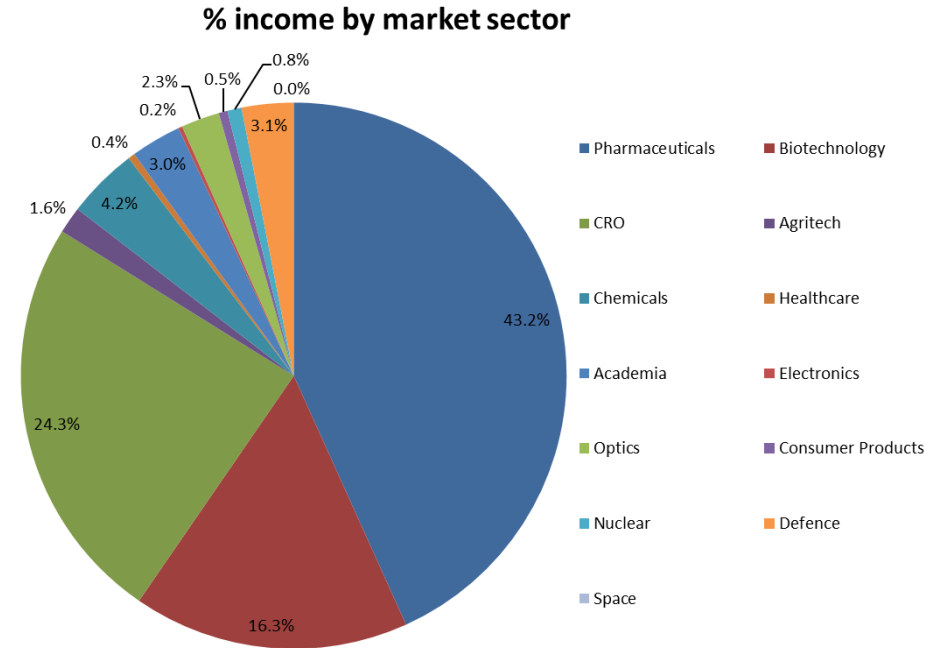
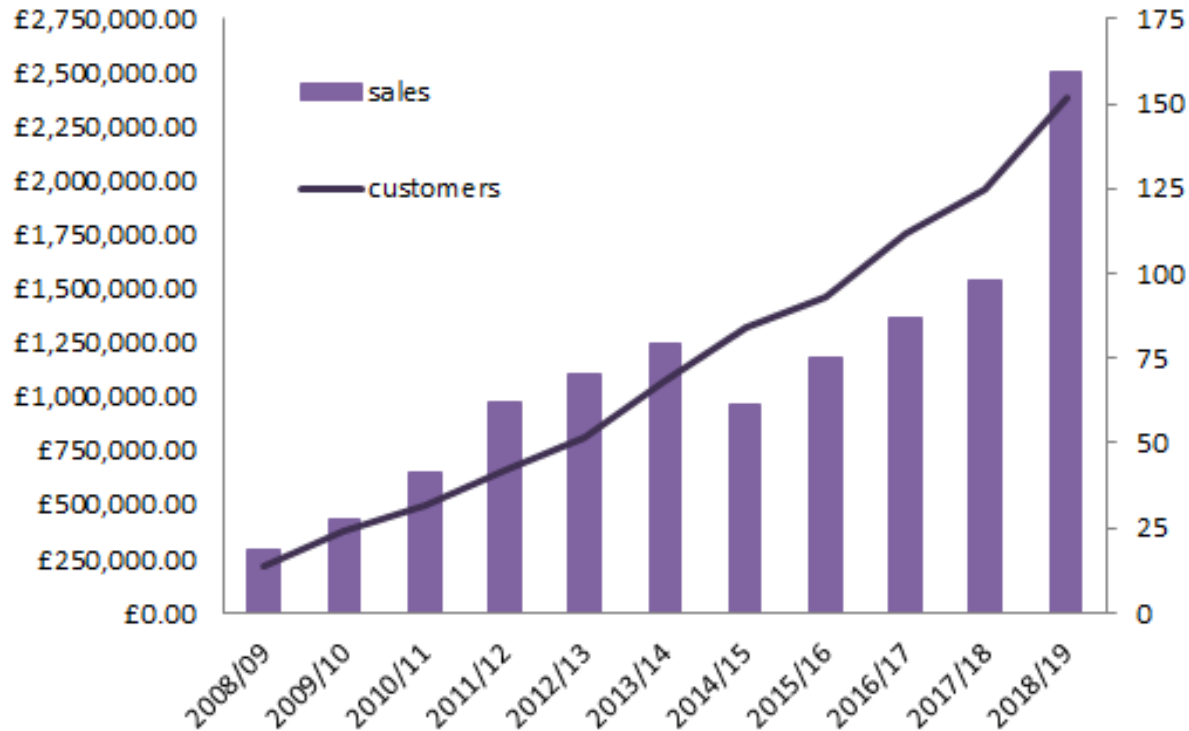
Total user shifts requested, awarded and delivered



Total numbers of proposals and users per year



Industrial Use



Examples of industrial use

Engineering



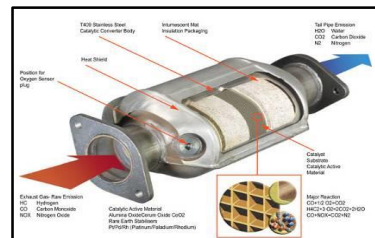
Rolls-Royce
Strain scanning in
aerospace
components

Consumer products



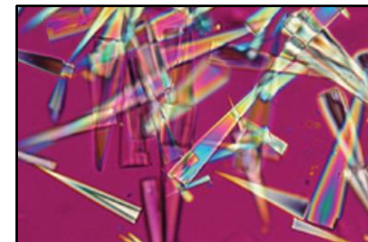
Unilever
Microstructure in
a new hair care
product

Catalysis



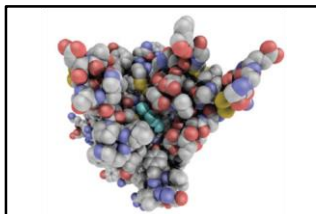
Johnson Matthey
Platinum
speciation in three
way catalysts

Fuel additives



Infineum
Crystallisation
processes in biofuels

Drug design



Heptares
Designing drugs
for Parkinson's
disease treatment

Drug manufacture



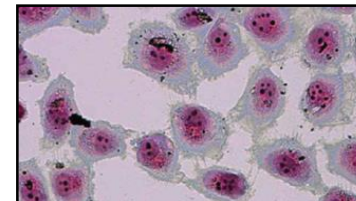
GlaxoSmithKline
Controlling a
manufacturing
process

Medical devices



NHS
Understanding
failure in MOM hip
replacements

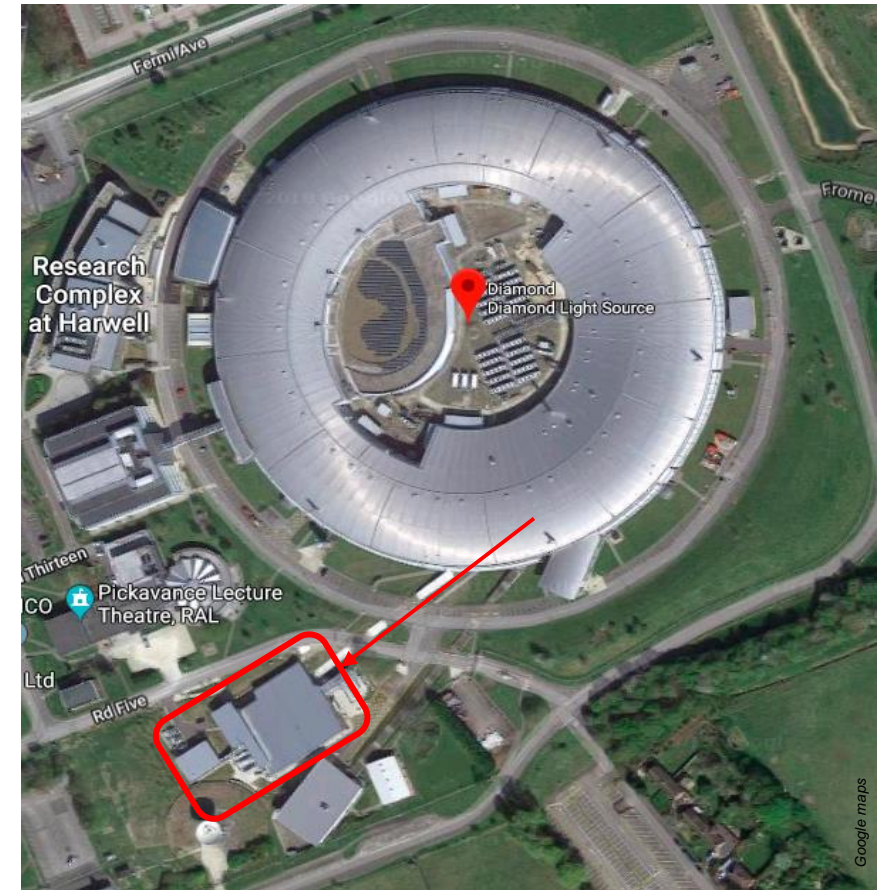
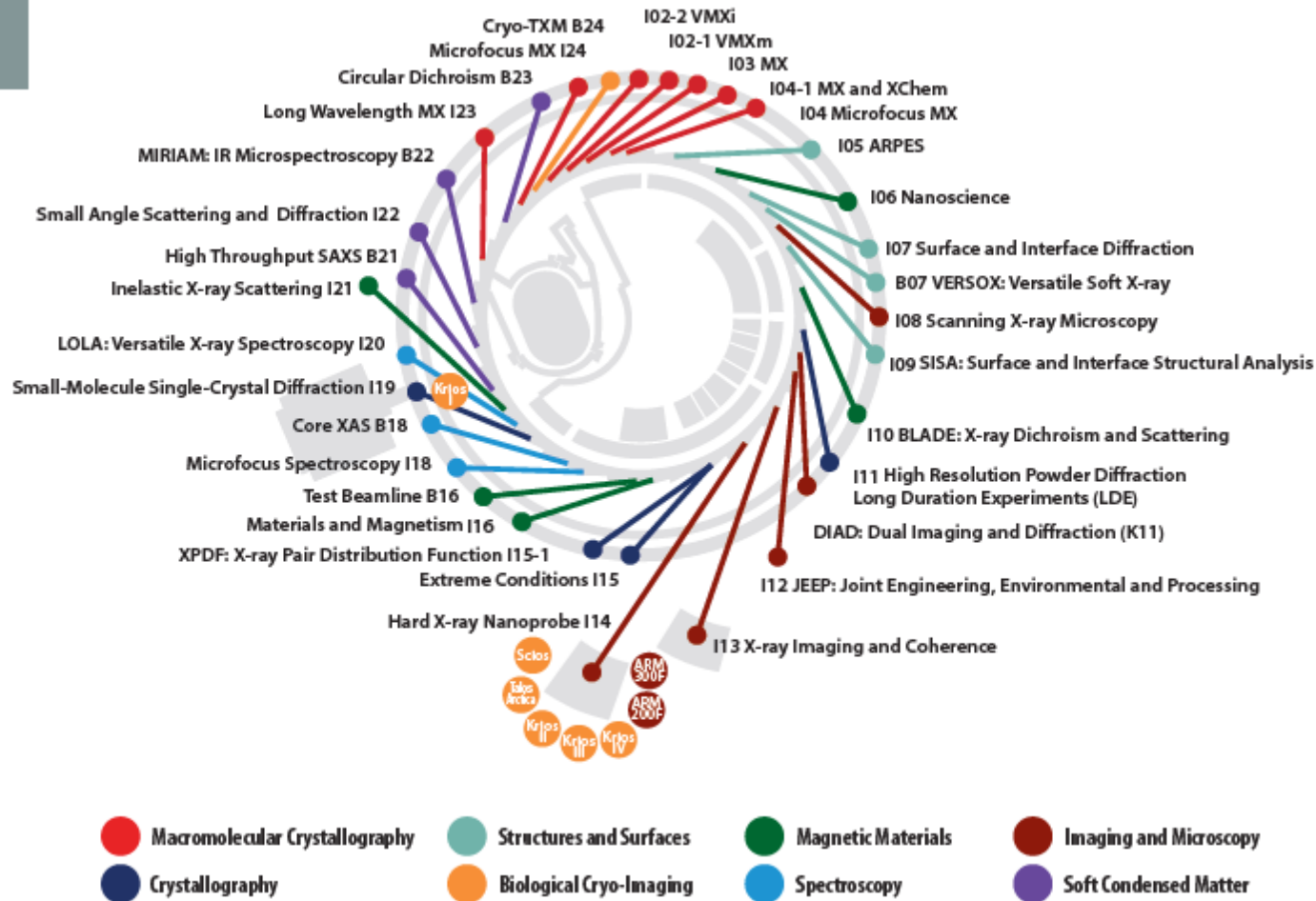
Diagnosing disease



NHS
Speeding up
cancer diagnosis
using IR

Complementary Facilities

Electron Bio-imaging Centre (eBIC) and Electron Physical Science Imaging Centre (ePSIC)
Electron Microscopes operated 24/7 like beamlines for external users.



electron Bio-Imaging Centre (eBIC)

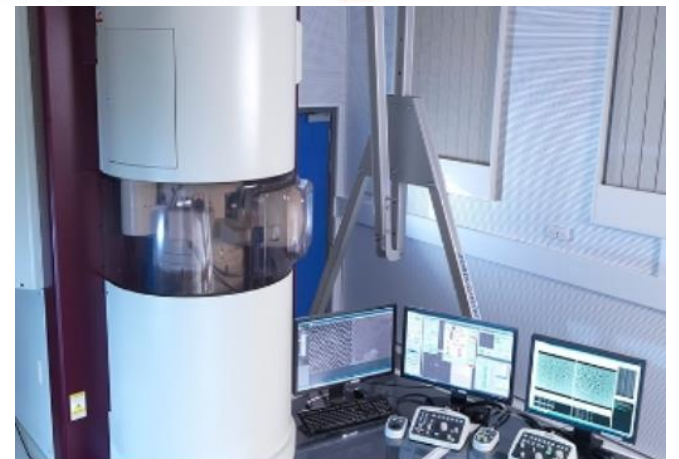
-collaboration between Diamond, Birkbeck College and Univ. of Oxford , funded by Wellcome Trust, MRC and BBSRC



Microscope	Main Capabilities	Accelerating Voltages	Operational Status
Titan Krios I	Cryo-EM, cryo-ET	80, 120, 200, 300 kV	Operational since 2015
Titan Krios II	Cryo-EM, cryo-ET	80, 120, 200, 300 kV	Operational since 2016
Titan Krios III	Cryo-EM, cryo-ET	80, 120, 200, 300 kV	Operational since 2017
Titan Krios IV	Cryo-EM, cryo-ET	80, 120, 200, 300 kV	Operational since 2017
Talos	Cryo-EM, cryo-ET	200 kV	Operational since 2016
Scios	Cryo-SEM, Cryo-FIB	3 to 30 kV	Operational since 2017
JEOL ARM200F	EDX, EELS, atomic scale STEM imaging, electron diffraction	80, 200 kV	Operational since 2017
JEOL ARM300F	EDX, atomic scale TEM and STEM imaging, electron diffraction	30, 60, 80, 160, 200, 300 kV	Operational since 2017

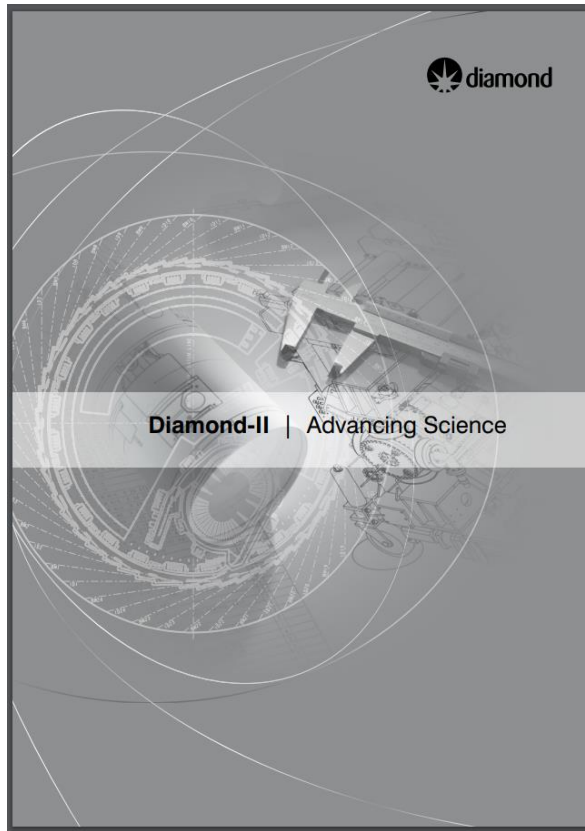
electron Physical Science Imaging Centre (ePSIC):

- collaboration between Diamond, Johnson Matthey and Univ. Oxford



Diamond-II

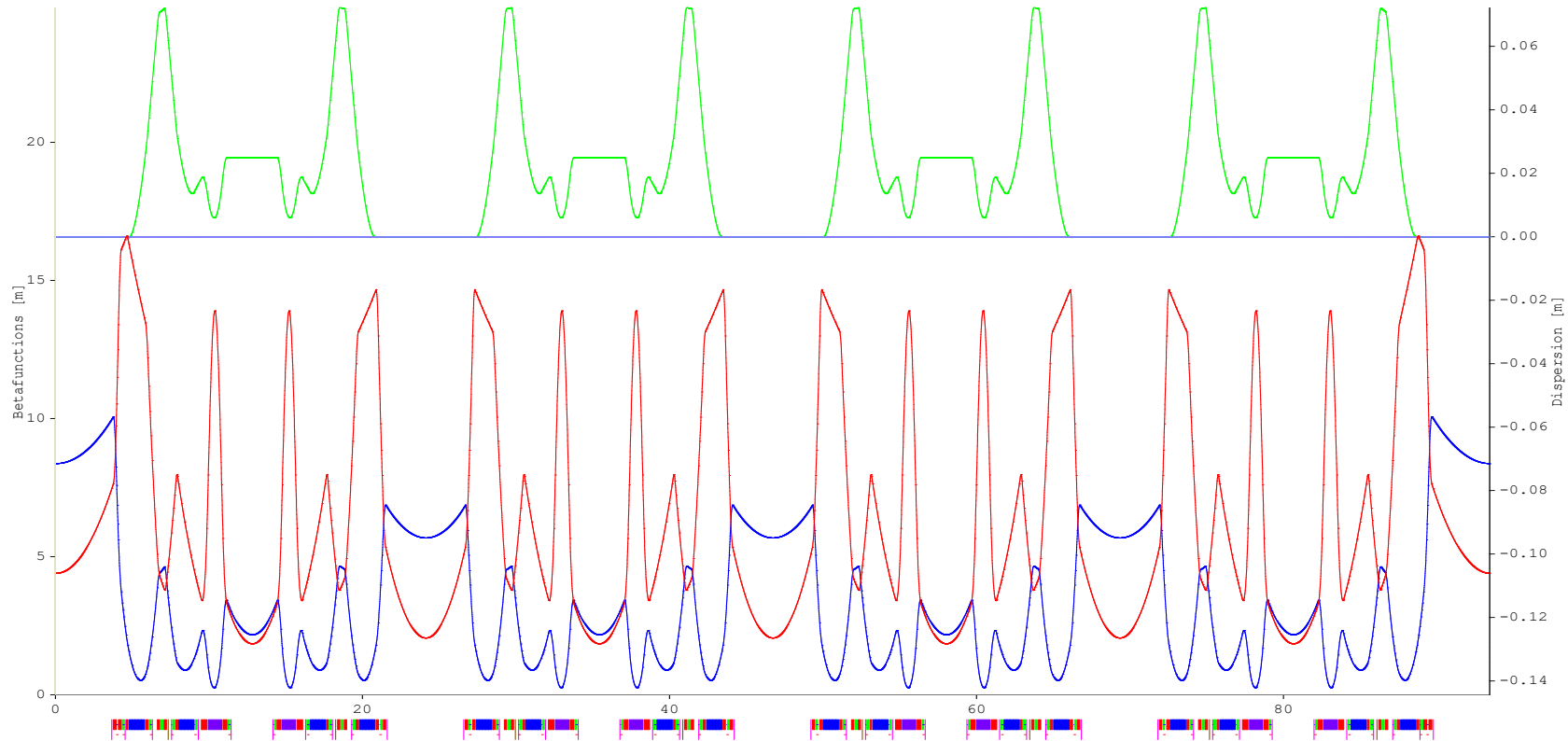
- Science case endorsed by Science Advisory Committee, November 2018
- Conceptual Design Report endorsed by external expert review, April 2019
- DLS Board approved proceeding to the Technical Design Report phase, June 2019
- Now developing business case for funding (UKRI-STFC and Wellcome Trust), first half of 2020



available from

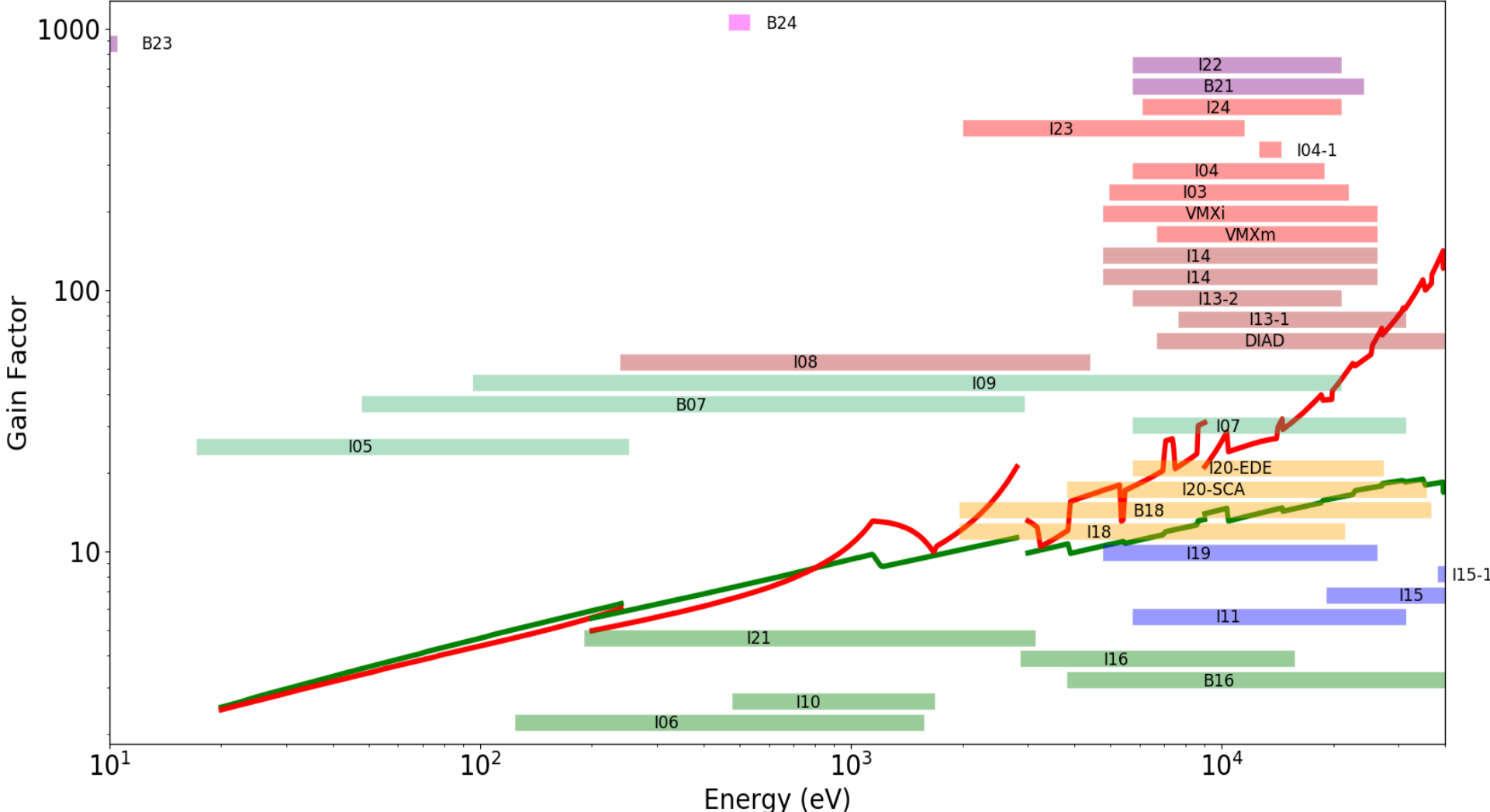
<https://www.diamond.ac.uk/Home/About/Vision/Diamond-II.html>

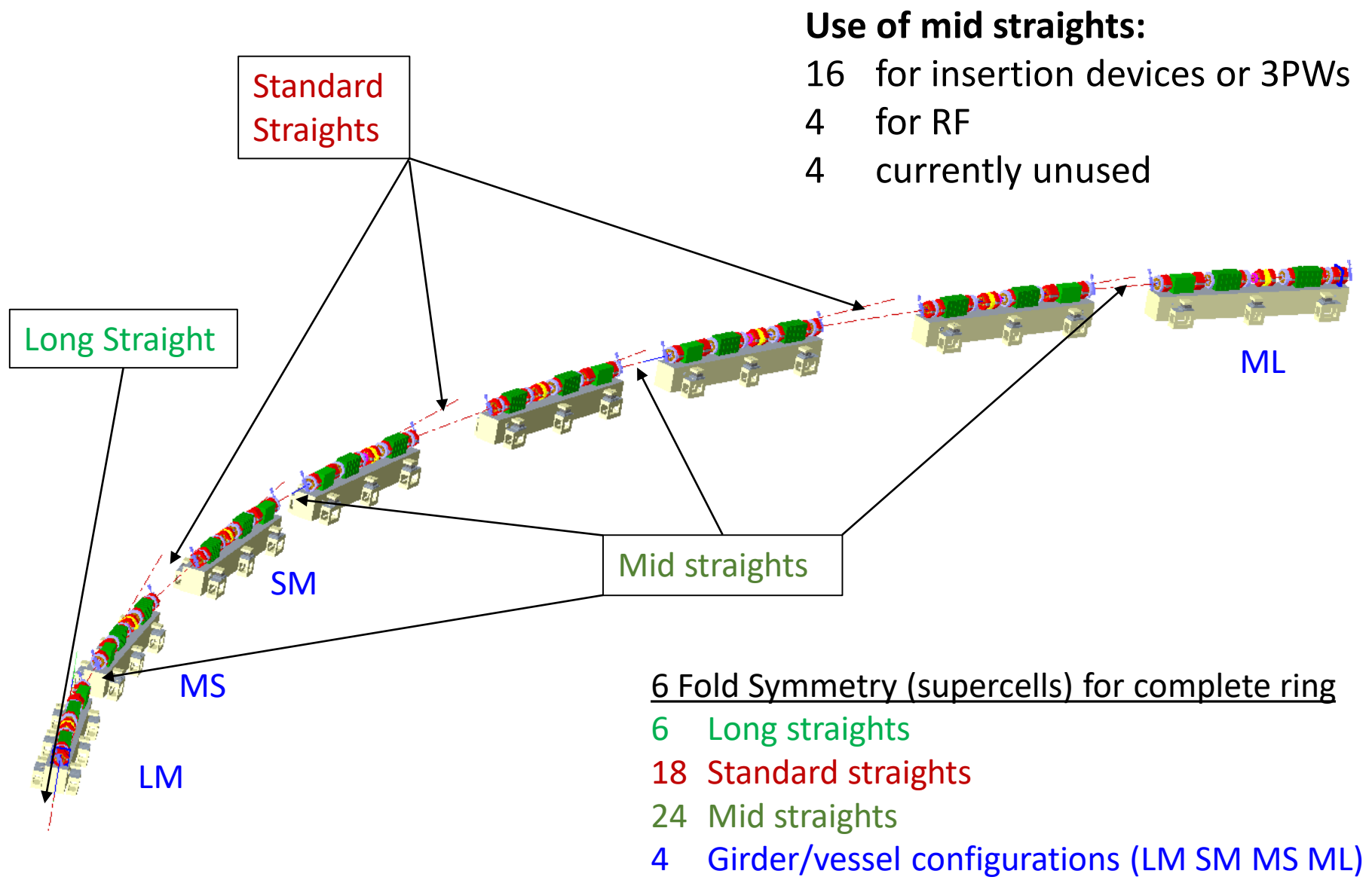
Baseline lattice (CDR): M-H6BA-15-1-1



Parameters	
Energy [GeV]	3.5
Circumference [m]	560.574
Nat. emittance [$\mu\text{m rad}$]	160
Nat. energy spread	$7.8 \text{ e-}4$
Tune (H/V)	57.16/20.25
Nat. chromaticity (H/V)	-75.7/-89.6
Mom. com. factor	$1.17 \text{ e-}04$
Length of LSS/SSS/MSS	7.54/5.19/2.92

Why 3.5 GeV ?



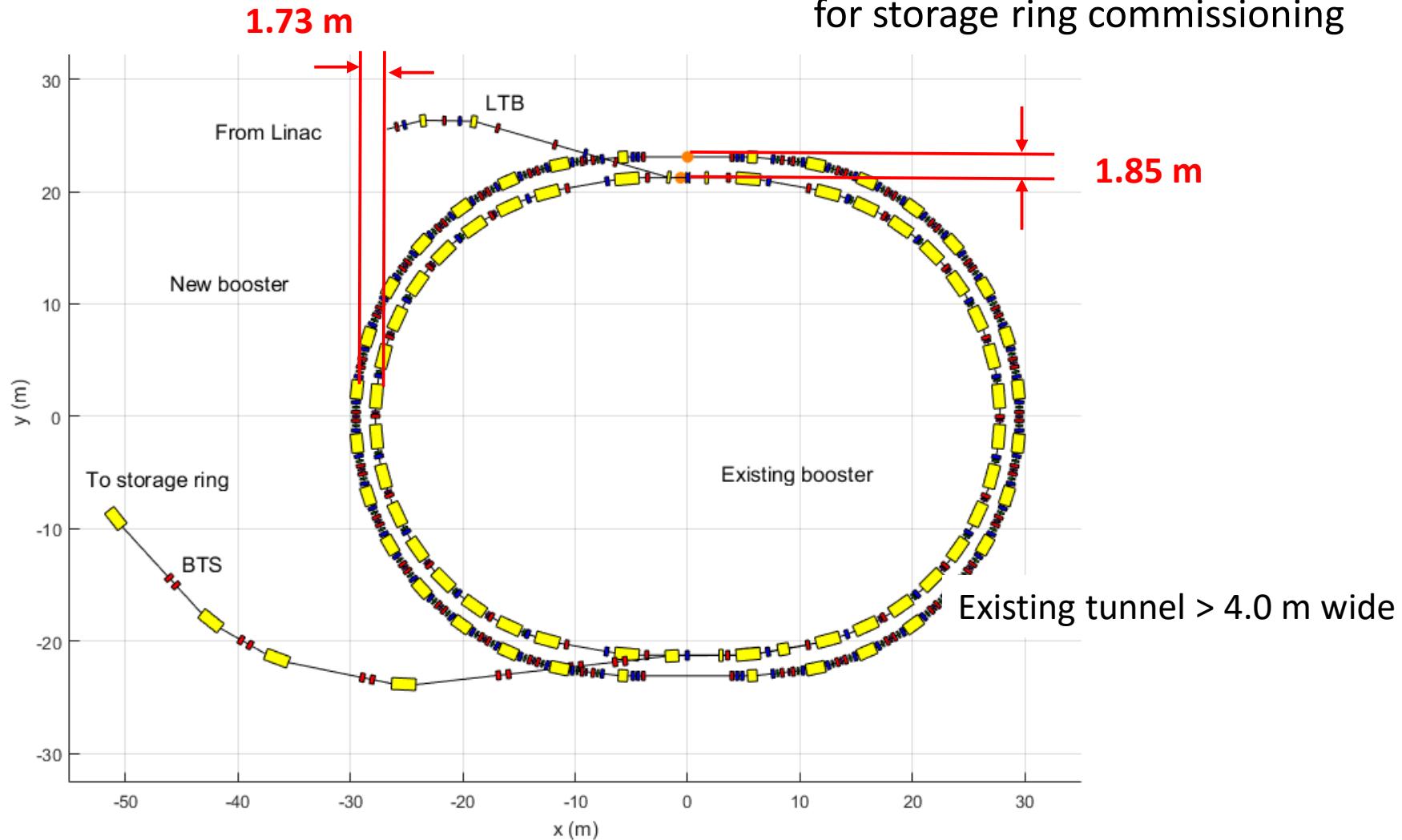


New Booster

- need lower emittance (< 30 nm)
- need shorter bunch length (< 40 ps)
- need 3.5 GeV

Plan:

- install 80% of new booster in the 2 years prior to the dark period
- complete booster and commission during the dark period in advance of when needed for storage ring commissioning



Possible (minimum) timescales

Event	Date
Outline case approved by SAC & Board	✓✓ Apr./Jun. 2016
Board approves working on CDR and the science case	✓✓ Oct. 2016
New Science Group Leaders appointed	✓✓ Feb. 2018
Outline science case by Groups	✓✓ May 2018
Science Workshops with the User Community	✓✓ Sep./Oct. 2018
Full science case presented to SAC	✓✓ Nov. 2018
CDR ready	✓✓ Mar. 2019
Review of CDR (SAC, MAC, DISCo etc.)	✓✓ Apr./May 2019
Board approves CDR, gives go-ahead for TDR	✓✓ Jun. '19
Draft TDR reviewed by MAC and SAC	Apr./May 2021
Board approves seeking formal approval	Jun. 2021
Final TDR published	Sep. 2021
Diamond-II project approval	Dec. 2021
Start calls for tender	Jan. 2022
Start of funding and procurement	Apr. 2022
Start of shutdown	Apr. 2025
Start operation with friendly users	Jul. 2026
Resume full User Mode	Oct. 2026

ESLS-RF 2019: Have a Good Workshop !

R.P. Walker, Technical Director

