



MAX IV Laboratory

Accelerator Reliability Workshop 2024

Pedro F. Tavares
Accelerator Director
MAX IV Laboratory



This is MAX IV

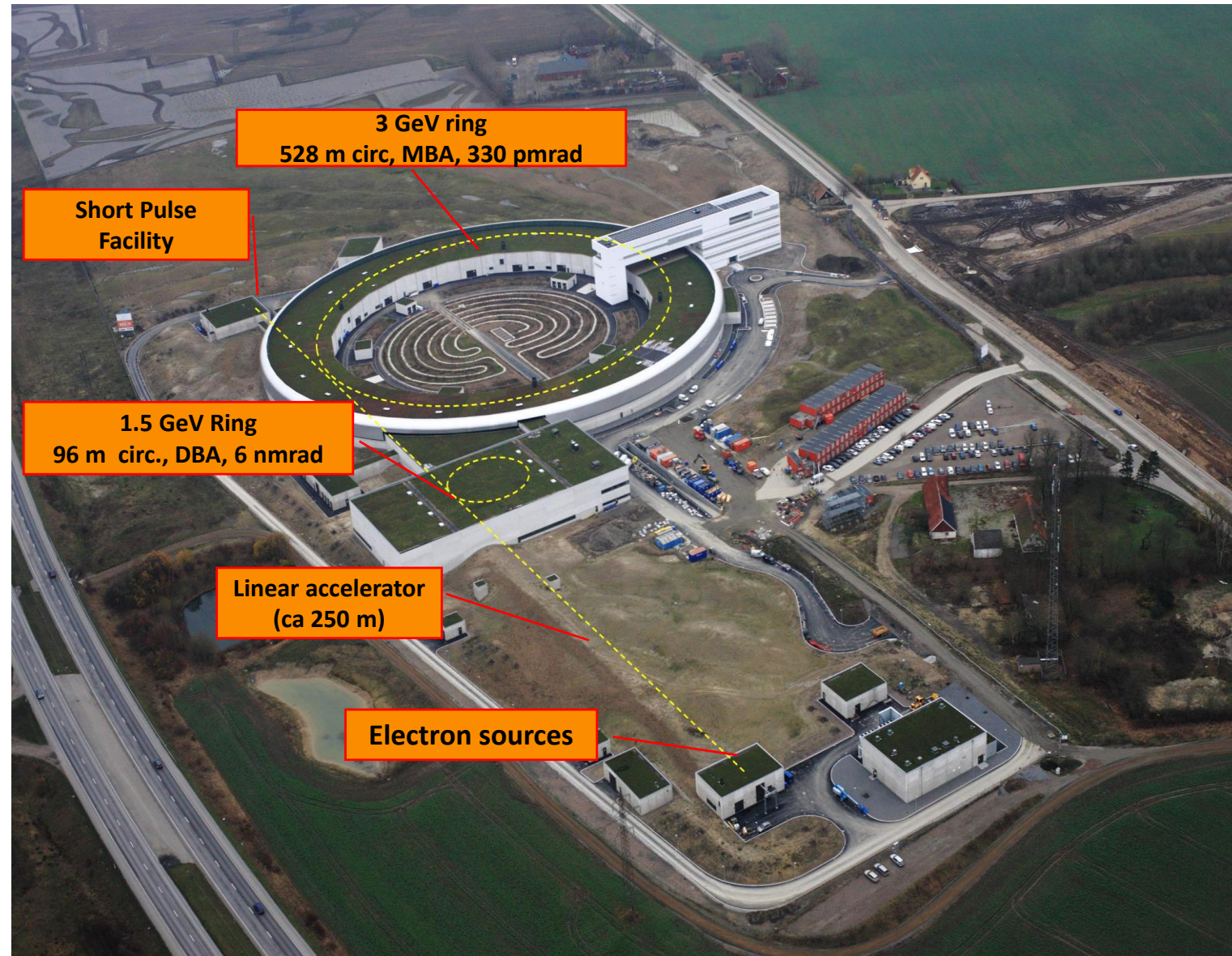
- A Swedish, national laboratory for X-ray research with Lund University as host
- A fourth-generation light source – up to 100 times brighter than the earlier generation and highly coherent
- Available for academic and industrial users worldwide

MAX IV



MAX IV Laboratory in a nutshell

- ❑ Swedish National Synchrotron Radiation Facility
- ❑ First worldwide fourth Generation Storage Ring
- ❑ Inaugurated in June 2016
- ❑ **~5000 hours/year; ~ 98% uptime**
- ❑ 16 Beamlines in user operation
- ❑ 1700 users/year from 34 countries
- ❑ >200 publications/year





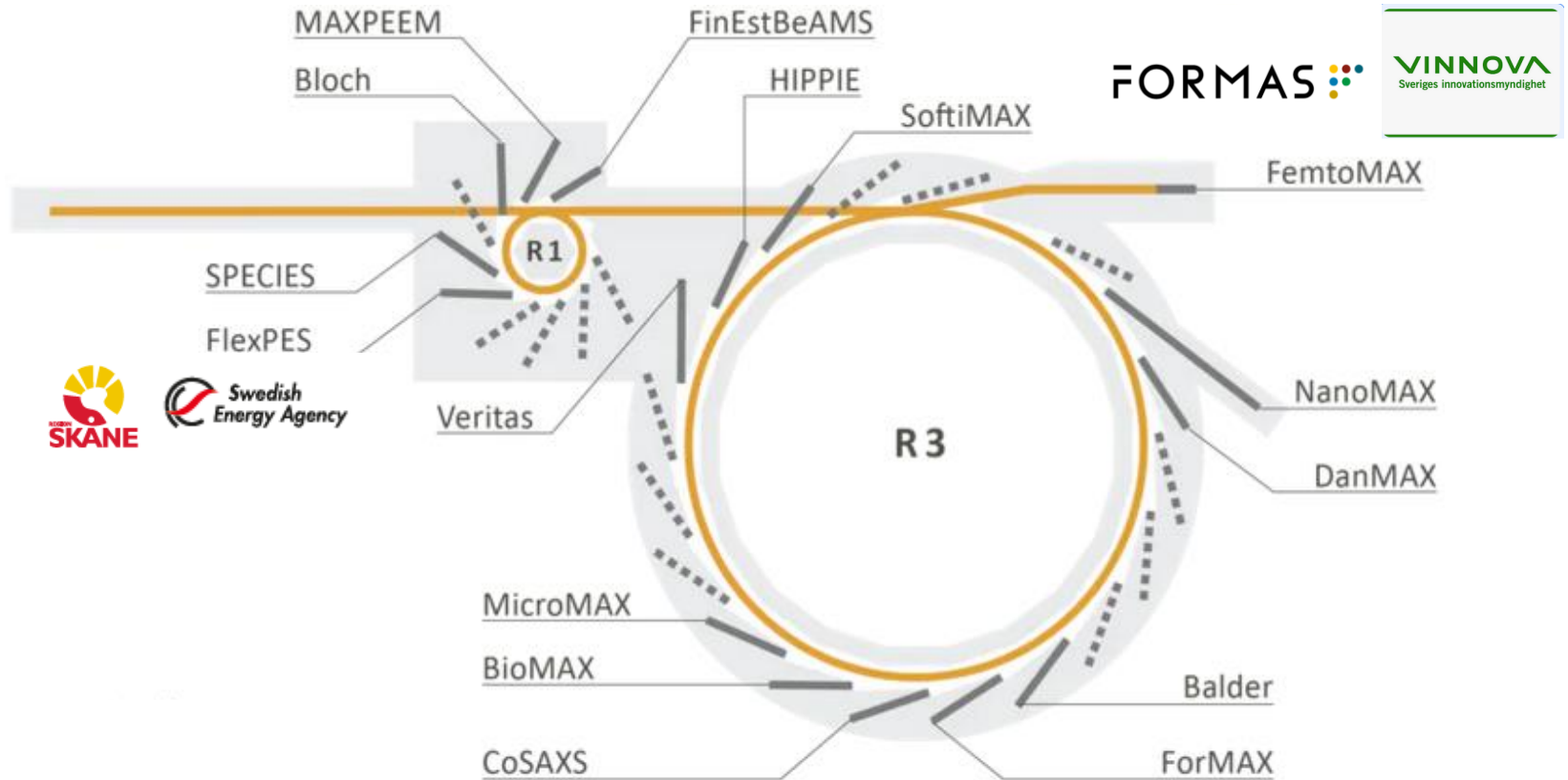
Vetenskapsrådet
Swedish Research Council

Linnéuniversitetet



FORMAS

1. **FemtoMAX**
fs dynamics in solid
2. **NanoMAX**
Nano-imaging & - spectroscopy
3. **BALDER**
Chemical spectroscopy: operando
4. **BioMAX**
Protein crystallography
5. **Veritas**
Electronic & magnetic excitations: solids
6. **Hippie**
Photoemission: near ambient pressure
7. **BLOCH**
Electronic structure: solids
8. **FinEstBeaMS**
Electronic structure: gases, aerosols
9. **SPECIES**
Electronic & magnetic excitations: surfaces
10. **MAXPEEM**
Microscopy: surfaces
11. **FlexPES**
Electronic structure: surfaces & gases
12. **CoSAXS**
Geometric structure & correlation: (bio) liquids
13. **SoftiMAX**
Microscopy & method development



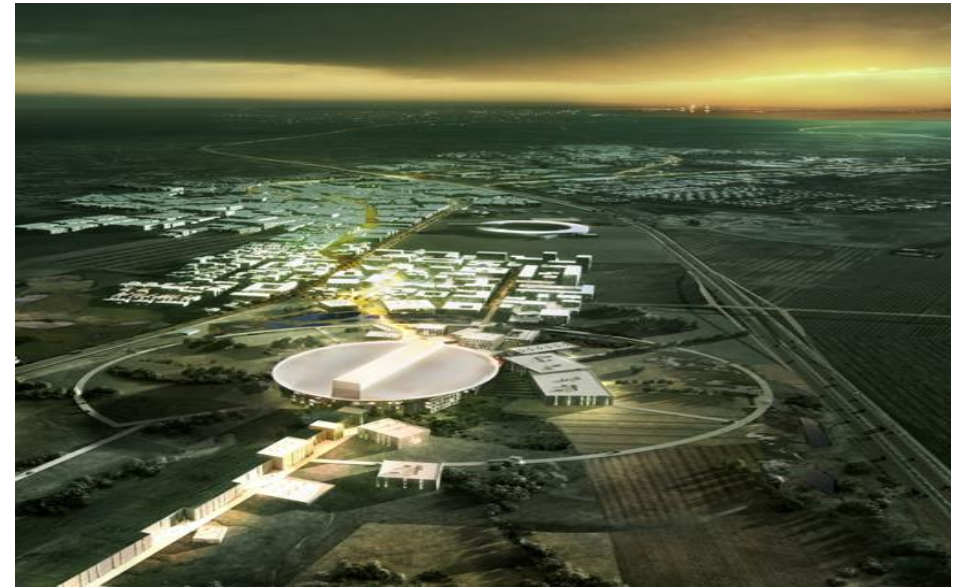
14. **DanMAX**
Powder diffraction & imaging: materials science
15. **ForMAX**
Wood & paper: structure & processing
16. **MicroMAX**
Most relevant (difficult) protein structures



- Light (X-rays)
- Swedish

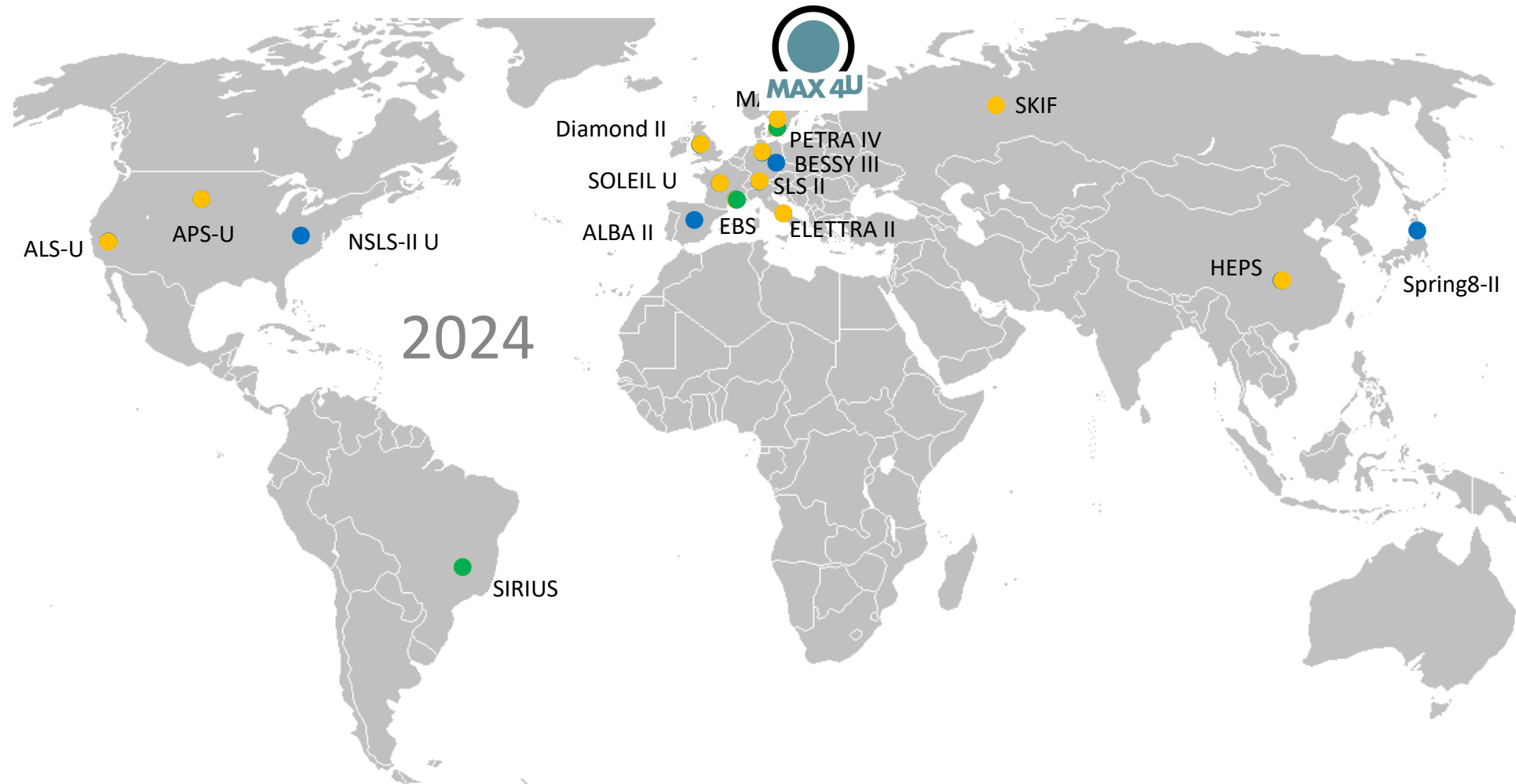


- Neutrons
- 13 European Countries



Accelerator Reliability is critical to both facilities

Landscape of Fourth Generation Storage Rings



- Proposed
- Under Design/Construction
- In operation

Small Emittance – More opportunities for research

- ❑ **Not “more” photons but better photons**

- ❑ More photon per eV
- ❑ More access to micron and submicron size beams
- ❑ More Coherence

- ❑ **Better resolution**
 - ❑ Better spatial resolution
 - ❑ Better time resolution
 - ❑ New opportunity to study dynamics, kinetics
 - ❑ Operando and in-situ studies

Slide by Aymeric Robert



MAX 4^U : Upgrade of the MAX I 3 GeV Ring

- Hard boundary conditions:
 - Emittance \lesssim **100 pmrad**.
 - Keep shielding wall/existing light source positions
 - Limited dark period
 - Cost-effective
 - Realizable until the early part of the next decade

- Likely assumptions
 - Keep the ring periodicity
 - Keep all light source positions
 - Keep the injector: accumulation (no swap-out)
 - Keep the RF system

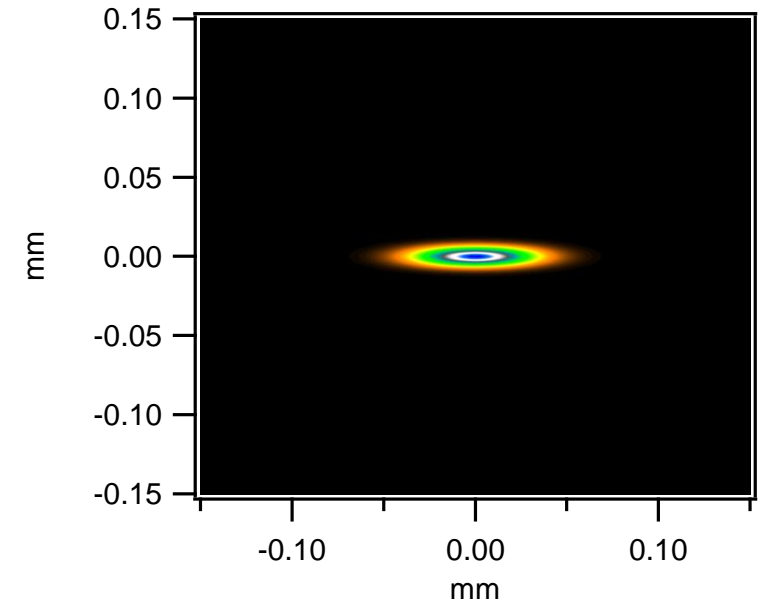
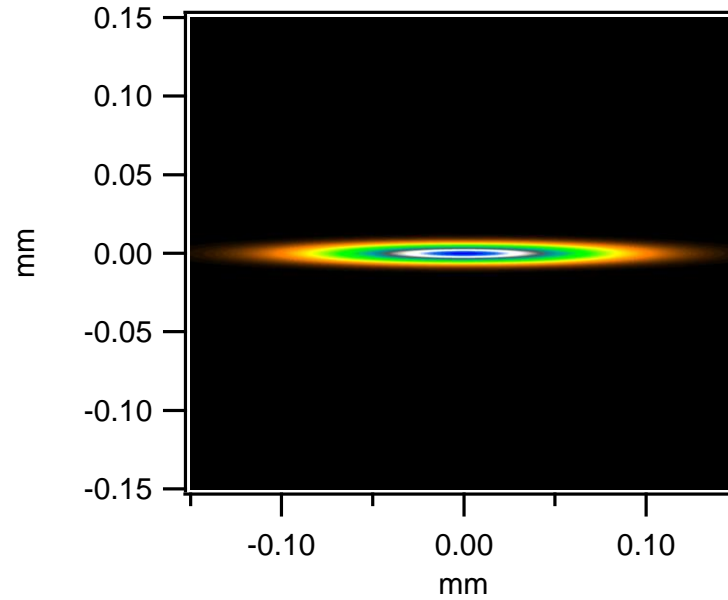
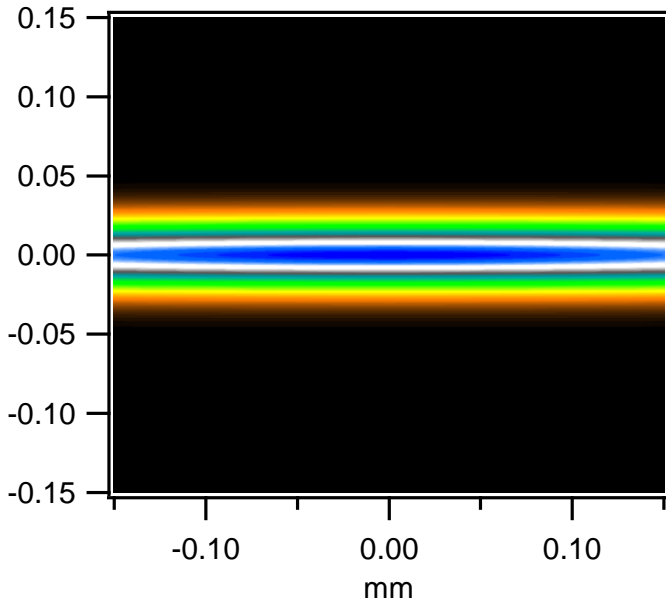


MAX 4^U: Towards the next generation

MAX II (1996 – 2015)

MAX 4 (2016 – 2030)

MAX 4^U (2030 –)



Higher Brightness and Coherence