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SOLARIS NATIONAL SYNCHROTRON RADIATION CENTRE

National Synchrotron Radiation Centre SOLARIS

Marek Stankiewicz
- on behalf of SOLARIS Team

FAIR

Meeting with FAIR Gmbh management 26.10.2021

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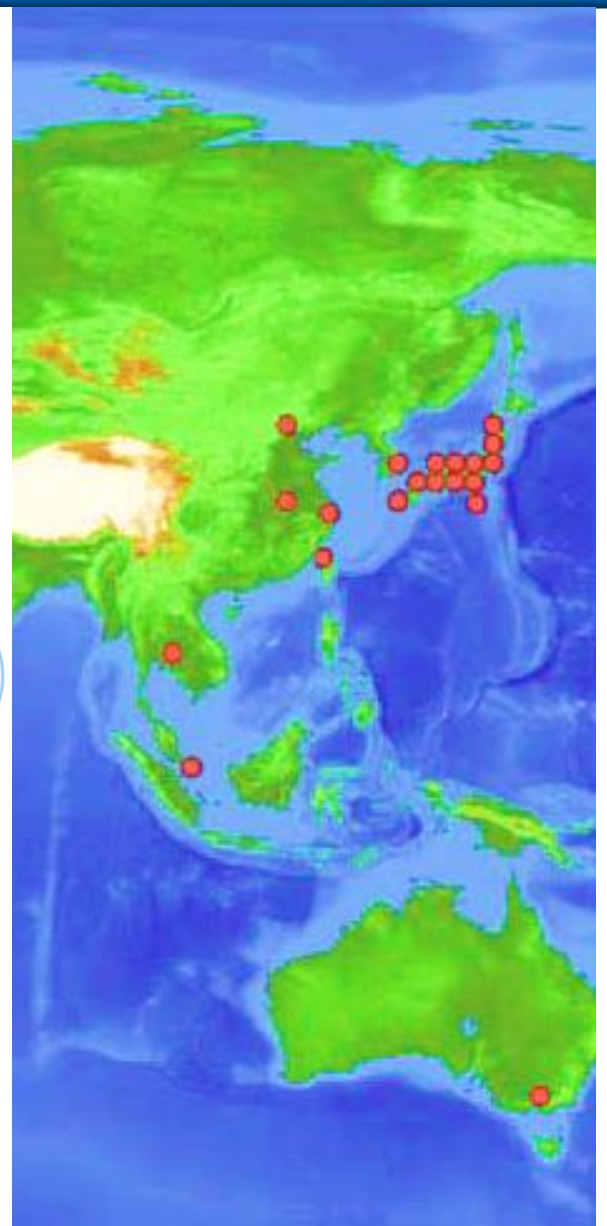
Synchrotrons of the world



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SHORT HISTORY OF SOLARIS

- Community of SR users in PL - since the advent of synchrotron sources
- Polish Synchrotron Radiation Users Society (PTPS) **since 1991** (now 180 members)
- Polish Synchrotron Consortium – 36 members

  ==➔ Long lasting initiative to built a SR source in PL – user driven initiative
- Jagiellonian University management support
- 2009 money allocated (40 MEUR) **==➔**

INNOVATIVE ECONOMY
NATIONAL COHESION STRATEGY

EUROPEAN UNION
EUROPEAN REGIONAL DEVELOPMENT FUND

- <u>Feasibilty</u>
  - ✓ brain storms
  - ✓ correlation with MAX-IV project and decision by Max-II lab management
- Decision taken by JU => SOLARIS as JU unit – but available for all researchers at no cost

==➔ 2010 contract signed – green field project started

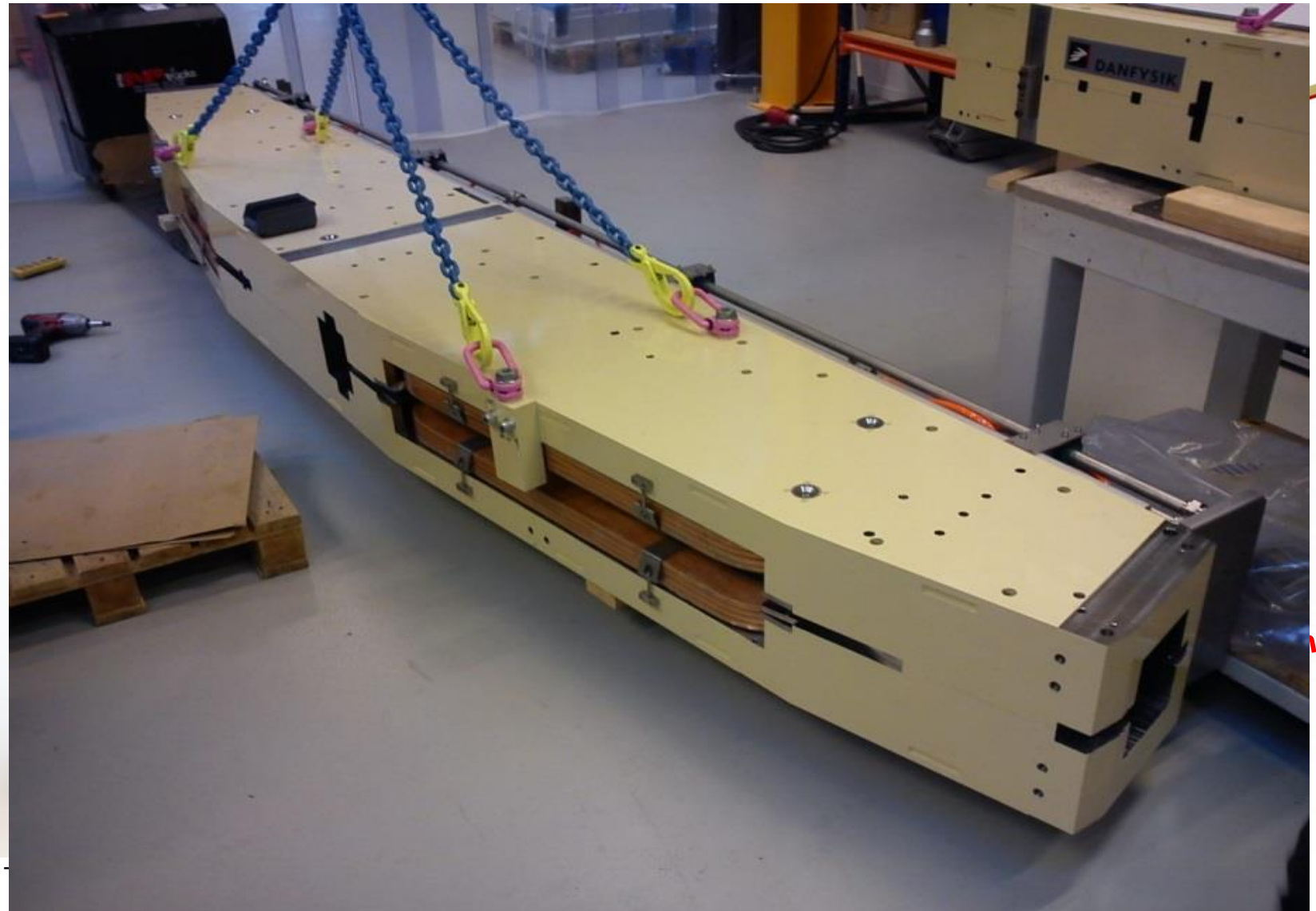
==➔ 2015 project completed

GREEN FIELD PROJECT

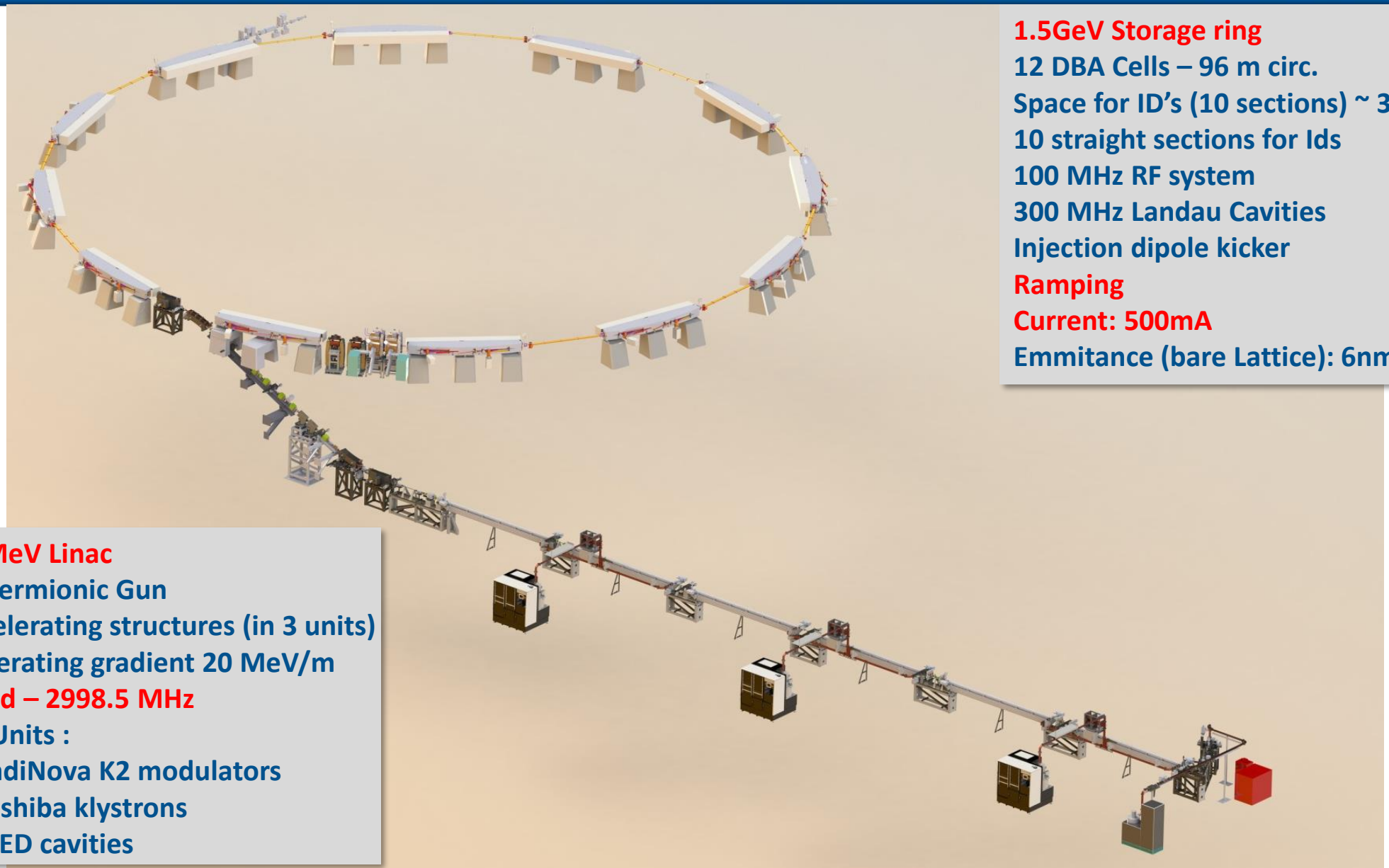
DELIVERABLES:

- Building
- Linac
- Storage ring
- Two beamlines
- **TEAM**

SOLARIS 1.5 GeV ring design - MAX-lab accelerator team - Mikael Eriksson



SOLARIS accelerators



1.5GeV Storage ring
12 DBA Cells – 96 m circ.
Space for ID's (10 sections) ~ 3.5 m
10 straight sections for Ids
100 MHz RF system
300 MHz Landau Cavities
Injection dipole kicker
Ramping
Current: 500mA
Emmitance (bare Lattice): 6nmrad

600 MeV Linac
RF Thermionic Gun
6 accelerating structures (in 3 units)
Accelerating gradient 20 MeV/m
S-band – 2998.5 MHz
3 RF Units :
- ScandiNova K2 modulators
- Toshiba klystrons
- SLED cavities

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SOLARIS machine status

SOLARIS NATIONAL SYNCHROTRON RADIATION CENTRE

SOLARIS Machine Status Portal

Friday, September 24th 2021, 4:29 pm

Current	Energy
269.15 mA	1.50 GeV

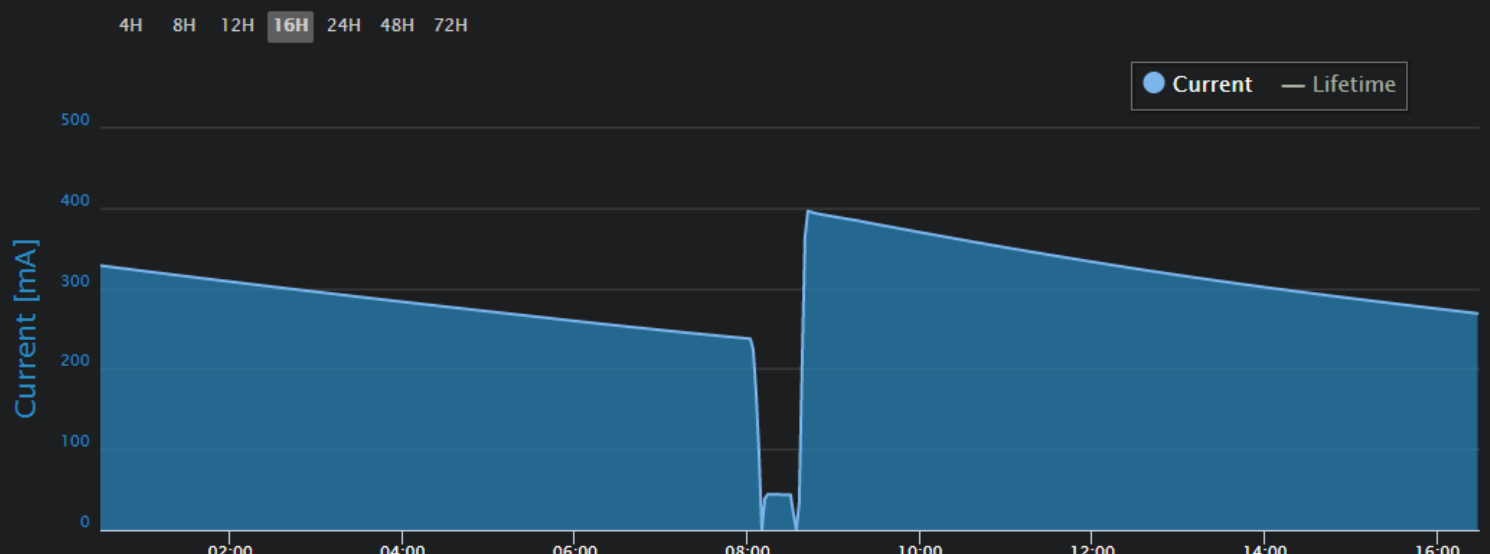
Lifetime	I·τ product
21.26 h	5.72 Ah

ID Beamlines

Name	Gap	State
PHELIX	28.29 mm	CLOSED
UARPES	48.86 mm	OPEN
DEMETER	28.00 mm	OPEN
SOLCRYS	N/A	under construction

BM Beamlines

Name	State
XAS	OPEN
SOLABS	under construction
SOLAIR	under construction
POLYX	under construction



Storage Ring Status: Beam Delivered

Operation Mode: User Operation

Next injections:

8:00 am and 8:00 pm during User Operation mode

OPERATOR MESSAGE

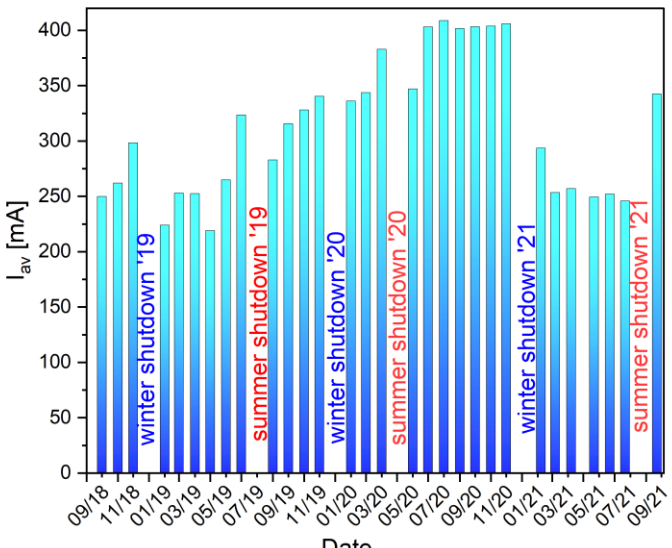
21-09

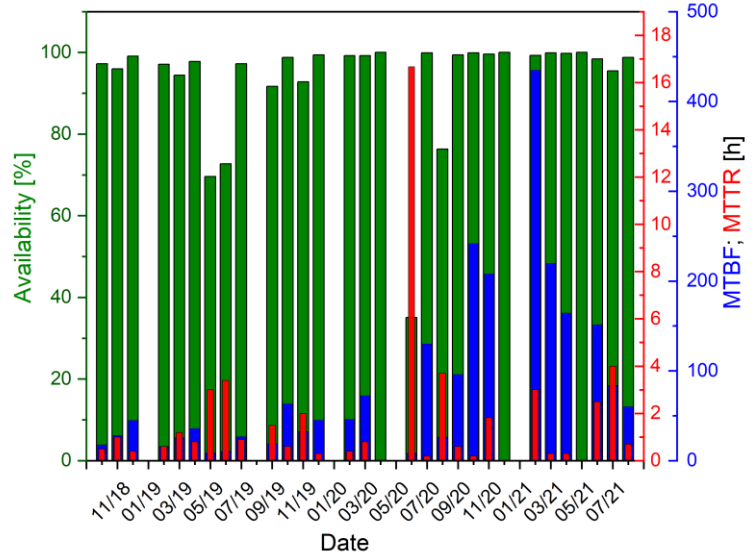
http://status.synchrotron.pl/

SOLARIS - MACHINE STATS

As seen, in most months the beam availability was above 90%, and in only four months during these 2 years it was significantly lower due to serious failures of the synchrotron subsystems that required a longer repair time. From the beginning of 2021 the operation is done with reduced current (260A instead of 400 mA) due to RF system failure. **Since September 2021 we are again delivering 400 mA!**

Year	Total Beamtime	Availability	MTBF	MTTR	Average current
2018	1704 h	90.4 %	16.3 h	1.5 h	270 mA
2019	2530 h	91.9 %	22.8 h	1.7 h	284 mA
2020	3868 h	93.0 %	76.0 h	3.6 h	385 mA
2021	4654 h	99.2 %	218.4 h	2.3 h	270 mA





SOLARIS continuous development

Due to the very limted budget serious compromizes had to be made

To utilize the full potential of the infrastructure further investment is needed

- **New beamlines (portfolio of initiatives)**
- **New sources (wigglers + undulators)**
- **Linac extension - full energy injection (1.5 GeV)=> 24 hrs operation**

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SOLARIS – dziś i jutro

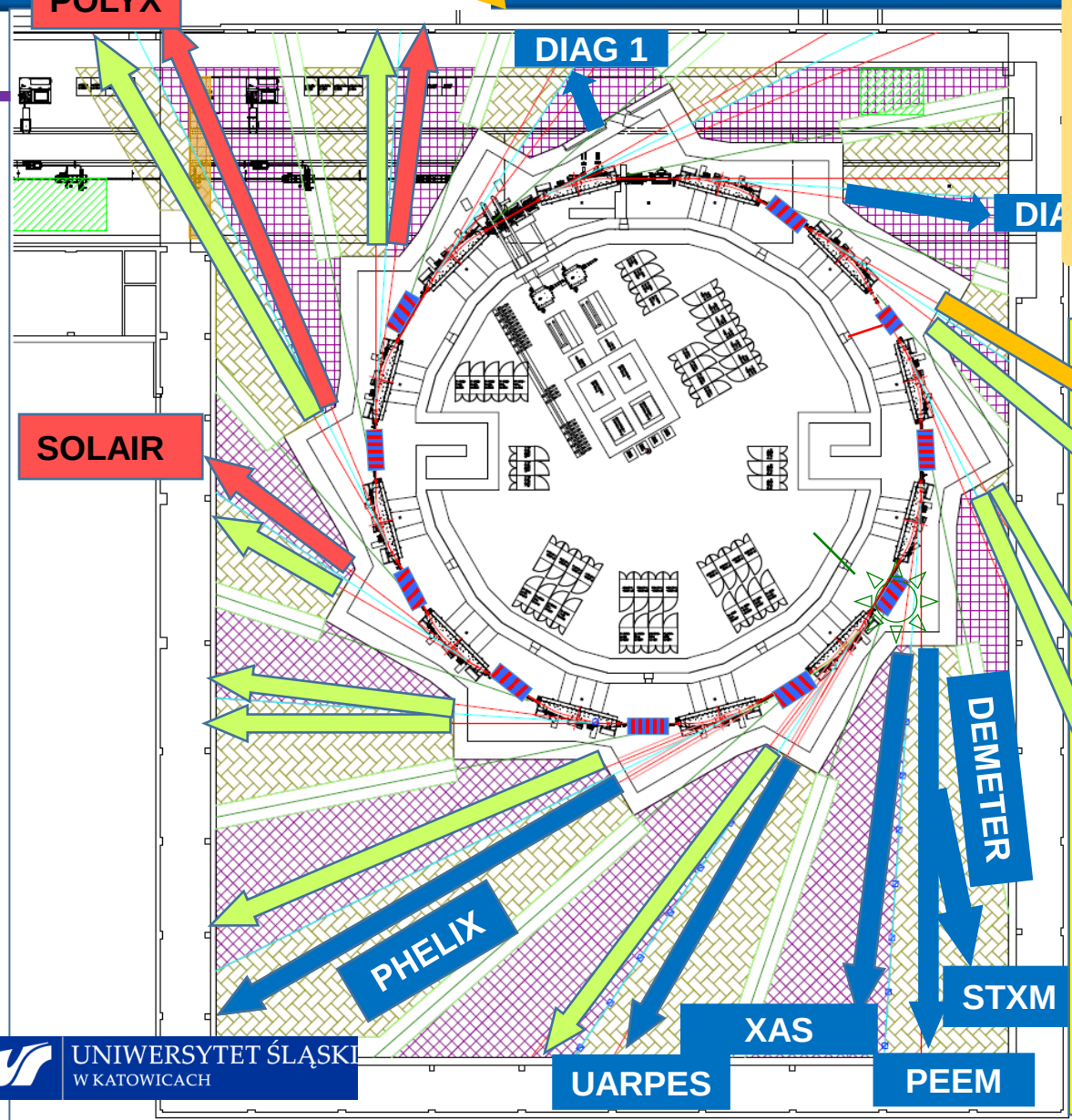
Hochschule Niederrhein
University of Applied Sciences

STRUCTURAL BIOLOGY CORE FACILITY

NATIONAL CRYO-EM FACILITY at SOLARIS

Krios

Glacios



SOLCRYS DUBNA

Joint Institute for Nuclear Research

SCIENCE BRINGING NATIONS TOGETHER

Operating

Under construction - available 2022/2023

Under construction - available 2024/2025

8-9 slots unoccupied
- SOLARIS is open to domestic/international initiatives resulting in building new beamlines and end stations.

UNIWERSYTET ŚLĄSKI W KATOWICACH

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Since 2018 SOLARIS is open to external users

XAS/PEEM Beamline

COLLABORATION WITH

AKADEMICKIE CENTRUM MATERIAŁÓW i NANOTECHNOLOGII AGH

AGH WYDZIAŁ FIZYKI I INFORMATYKI STOSOWANEJ

PAN Instytut Katalizy i Fizykochemii Powierzchni PAN

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SOLARIS NATIONAL SYNCHROTRON RADIATION CENTRE

Since 2018 SOLARIS is open to external users

UARPES Beamline

COLLABORATION WITH

INSTYTUT FIZYKI UJ

UNIWERSYTET JAGIELLOŃSKI W KRAKOWIE

JAGIELLONIAN UNIVERSITY IN KRAKOW

SOLARIS NATIONAL SYNCHROTRON RADIATION CENTRE

Since 2018 SOLARIS is open to external users

PHELIX Beamline

COLLABORATION WITH

Wydział Nauk Ścisłych i Technicznych

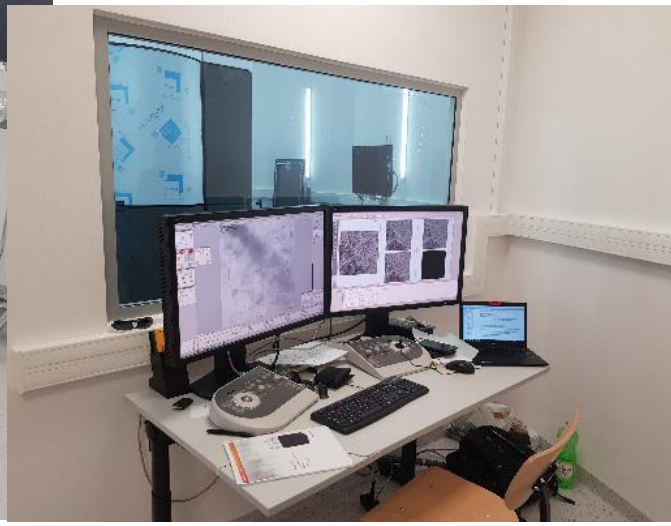
UNIWERSYTET ŚLĄSKI W KATOWICACH

Cryo-TEM 300 kV – Titan Krios G3i

1 March 2019

NATIONAL CRYO-EM FACILITY

at SOLARIS NATIONAL SYNCHROTRON RADIATION CENTRE



Detectors:

- Thermo Scientific™ Falcon™ 3EC Direct Electron Detector
- Gatan K3 Bioqantum
- Ceta 16M camera 300kV

COLLABORATION WITH

MAŁOPOLSKIE CENTRUM BIOTECHNOLOGII

STRUCTURAL BIOLOGY CORE FACILITY

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ACCESS to SOLARIS

- ✓ SOLARIS accepts external domestic and international applications – keeping the balance between those groups
- ✓ Regular calls, every 6 months - International Evaluation Committee
- ✓ Applications via Digital User Office

- ✓ Since 1 September call open for PEEM, XAS, UARPES & PHELIX
- ✓ STXM – next call

https://duo.synchrotron.pl/#/login

- ✓ From March 2019 we are all facing COVID 19
- ✓ However, SOLARIS is operating and open for users.
- ✓ Of course we all need to monitor the situation and observe relevant rules and restrictions

SOLARIS – synergy with international research landscape

Talk

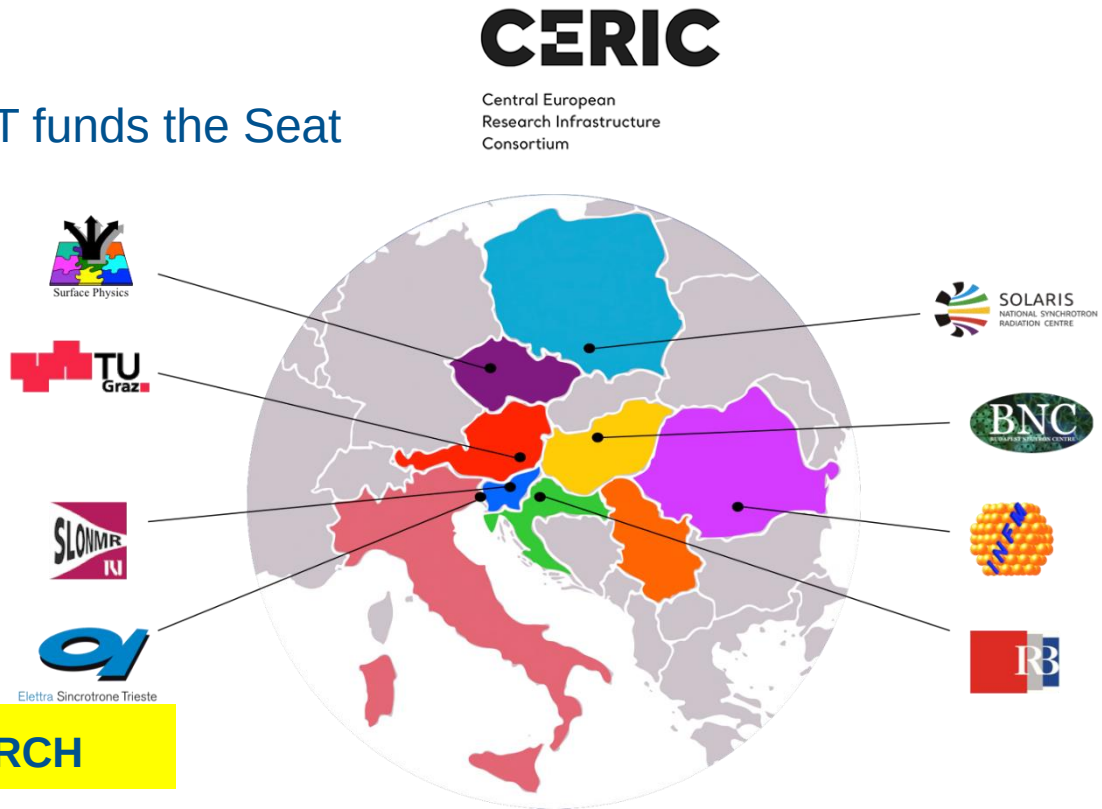
SOLARIS – part of Central European Research Infrastructure Concortium CERIC-ERIC

CERIC-ERIC: a unique distributed research facility in 8 countries

Number of infrastructures (Partner Facilities), one from each member countries made available to member countries for free

- ***no transfer of money***, but transfer and share of values, IT funds the Seat
- ***single entry point***, offering over 40 available techniques;
- ***peer evaluation system*** to select the best proposals;
- ***free and open access*** by quality selection only;

STRUCTURE:
Participating Country (member)
Representing Entity
Partner Facilities



PROVIDING ENVIRONMENT FOR MULTITECHNIQUE RESEARCH

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LEAPS - European synergy

League of Accelerator Based Photon Sources

est. November 2017 - www.leaps-initiative.eu

LEAPS - the League of European Accelerator-based Photon Sources - is a strategic consortium initiated by the Directors of the Synchrotron Radiation and Free Electron Laser (FEL) user facilities in Europe. Its primary goal is to actively and constructively ensure and promote the quality and impact of the fundamental, applied and industrial research carried out at their respective facility to the greater benefit of European science and society.

LEAPS members will produce a road map for the development of the next-generation light sources and instrument technologies, advocate for its funding and together address the big data challenge.

LEAPS will also:

- Play to the strengths of individual facilities through smart specialisation, recognising strengths in a more coordinated way to better serve the future needs of the user community
- Strengthen and expand services to industry to trigger innovation more widely and efffectively
- Standardise and improve access modes for users, capture and map socio-economic impact, enhance training and outreach programmes
- Strengthen scientific integration, both across Europe and globally

Polish companies involved

- Buliding
  - **Probadex** – design
  - **Łęgprzem**(Alpine) - construction
- Cooling water system – HVAC - **PYCIAK**
- Mechanical auxiliary infrastructures
  - **ZIBET** – hybrid/concrete/composite stands & supports
  - **Dudmet** – matal stands and supports
  - Beamline hutches **Zup DELTA** (Zamość)
- Accelerator assamblying and integration – **National Centre for Nuclear Research**
- End stations, beamlines, UHV infrastructures & equipment- **PREVAC**
- Electricity supply infrastructure – PREK, integration ZSK
- Systemy PLC – **ABIS - Kraków**
- Magnet power supplies **SEMIINSTRUMENTS** (Zabrze)
- Research infrastructure installation **LABSOFT**
- BMS systems **- ELSTER**
- Controlling software, Digital User Office, synoptic panels, IT integration – **in house**

Acknowlegements

- **Project success relied on exceptional transnational collaborations**
- **FOREMOST - The freely given design of the MAX IV 1.5 GeV ring and its injector technology by MAX-lab**
- **MAX IV – Solaris Collaboration:**

  Training and exchange of personnel

  Exchange of ideas and requirements

  Collaboration in procurements and contract specifications: Procurements for Solaris were as options in MAX IV tenders

  Provision of state-of-the-art components: Gun System, Landau cavities, modifications to vacuum chambers and magnets

  Technical support with industrial follow-up and FATs

  Maximised return for cash by allowing industry to plan for double purchase orders

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Acknowlegements

Elettra-Sincrotrone Trieste - Expert advice, contracts for PSS, design of transfer line, vacuum chamber components, beamline and front-end, EPU insertion device

Swiss Light Source - Expert advice, trainingBake-out oven and control

Diamond - Expert advice

Soleil - Expert advice, commissioning software

ALBA - Expert advice, commissioing software, training

ESRF - Expert Advice, IcePAP motion controllers

Machine Advisory Committee – Expert advice of 5 world class experts from Diamond, Soleil, PSI

National Centre for Nuclear Research, Świerk - Vacuum system installation inclusive of linac, storage ring and RF cavities.

Polish Synchrotron Consortium (36 universities and institutes)

Polish Synchrotron Radiation Society

Polish Physical Society

PL-Grid

Institute of Catalysis and Surface Chemistry PAS – PEEM End Station

Cracow University of Technology

MAX IV LABORATORY

PTPS

ESRF PAUL SCHERRER INSTITUT PSI

ALBA Synchrotron Light Facility

SOLEIL SYNCHROTRON

PL-GRID

diamond

Elettra Sincrotrone Trieste

PK

POLSKIE TOWARZYSTWO FIZYCZNE

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Thank you for your attention!

http://www.synchrotron.uj.edu.pl/