Report on the theme Development of the SOLCRYS structural research laboratory at the SOLARIS synchrotron

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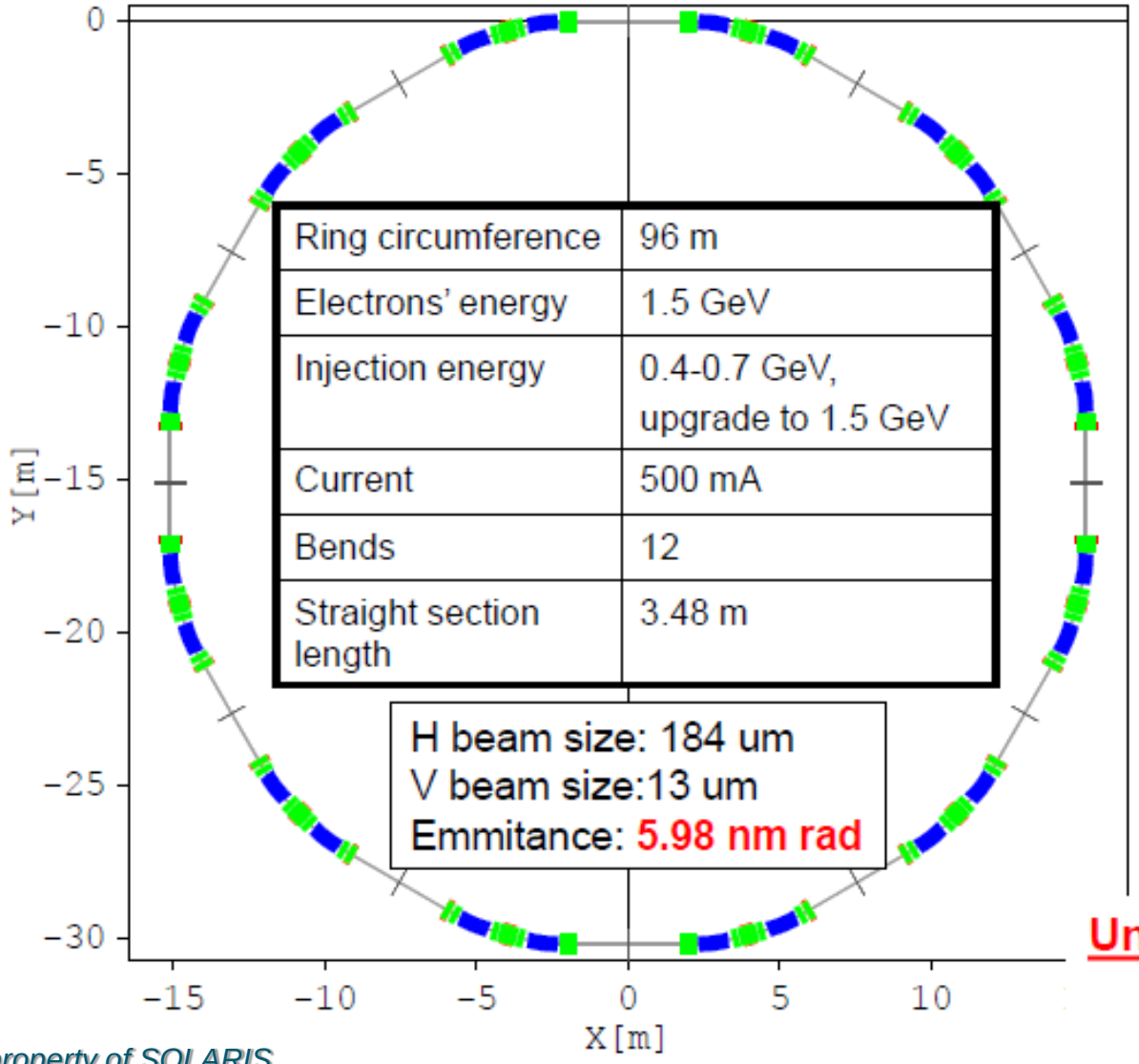
55th (video)meeting of the PAC for CMP at JINR
Dubna: January 20, 2022

Outline

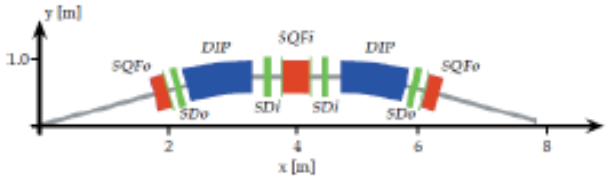
- SOLARIS machine and beamlines
- SOLCRYS laboratory for Condensed Matter Research
- Experimental hall extension
- Synchrotron radiation source
- JINR beamlines
- Endstations and auxiliary equipment

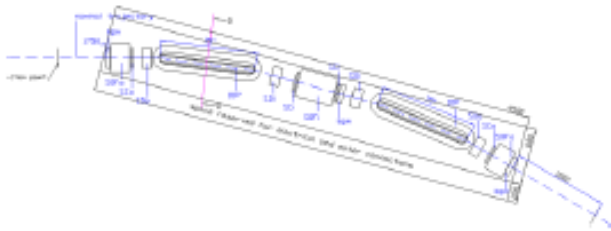
SOLARIS machine (2015)

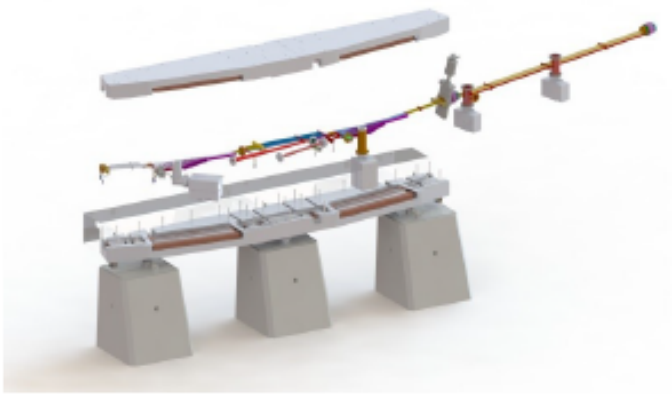


Ring circumference	96 m
Electrons' energy	1.5 GeV
Injection energy	0.4-0.7 GeV, upgrade to 1.5 GeV
Current	500 mA
Bends	12
Straight section length	3.48 m

H beam size: 184 um
V beam size:13 um
Emmitance: 5.98 nm rad

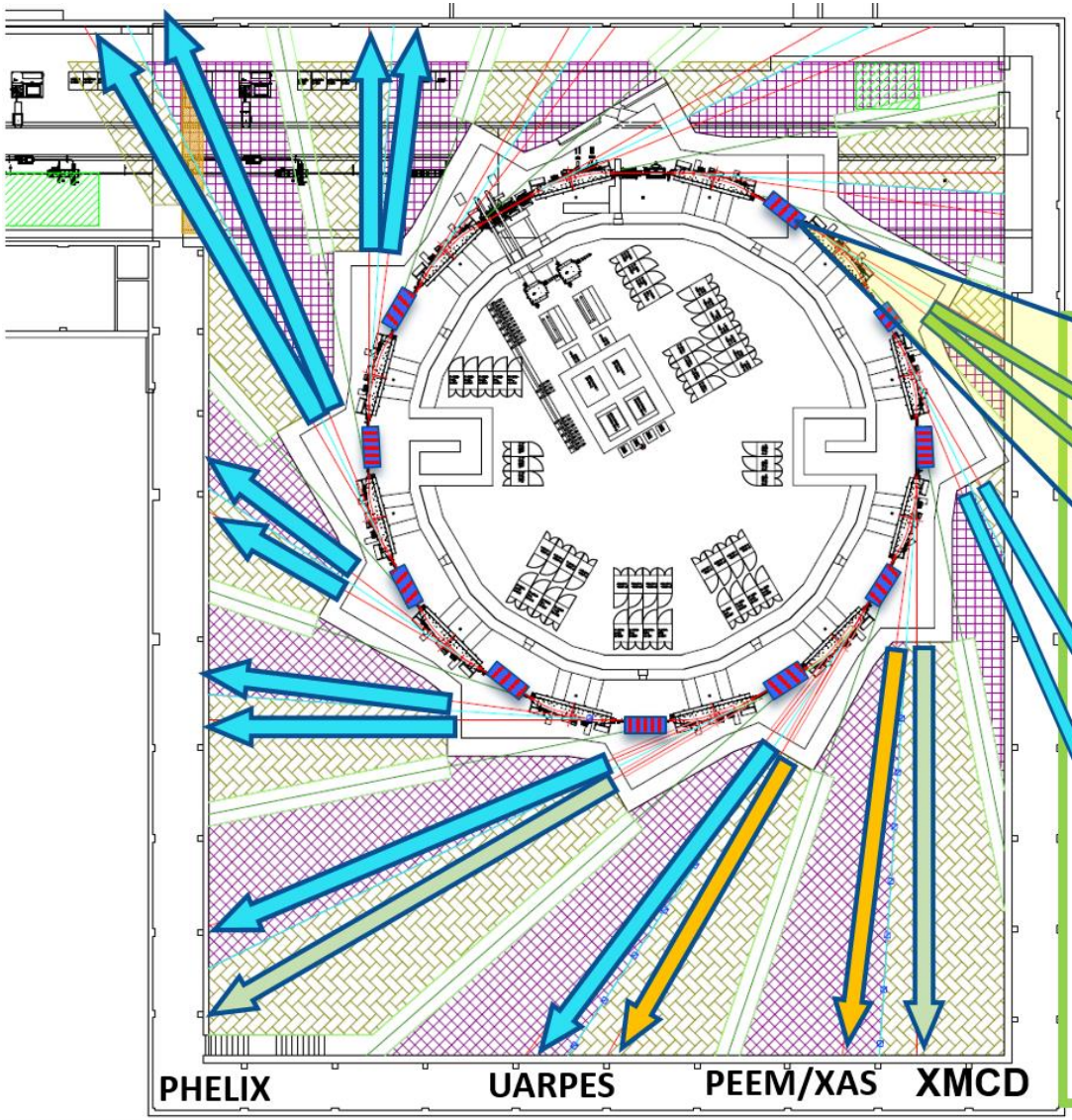






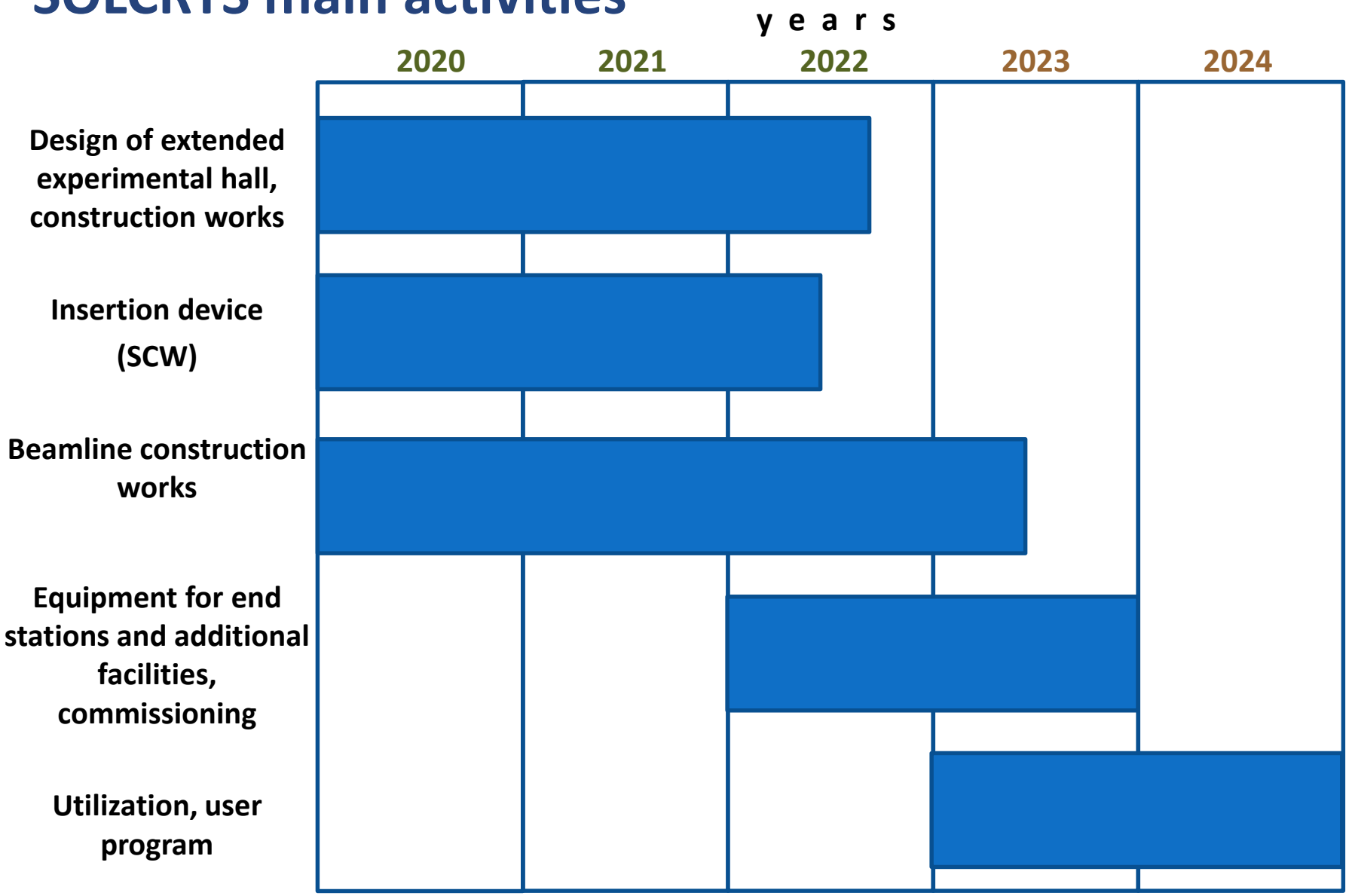
Unique, state of the art solution
Integrated magnets

SOLARIS beamlines



- **SOLARIS-JINR agreement 2018-2024**

SOLCRYS main activities



Outline

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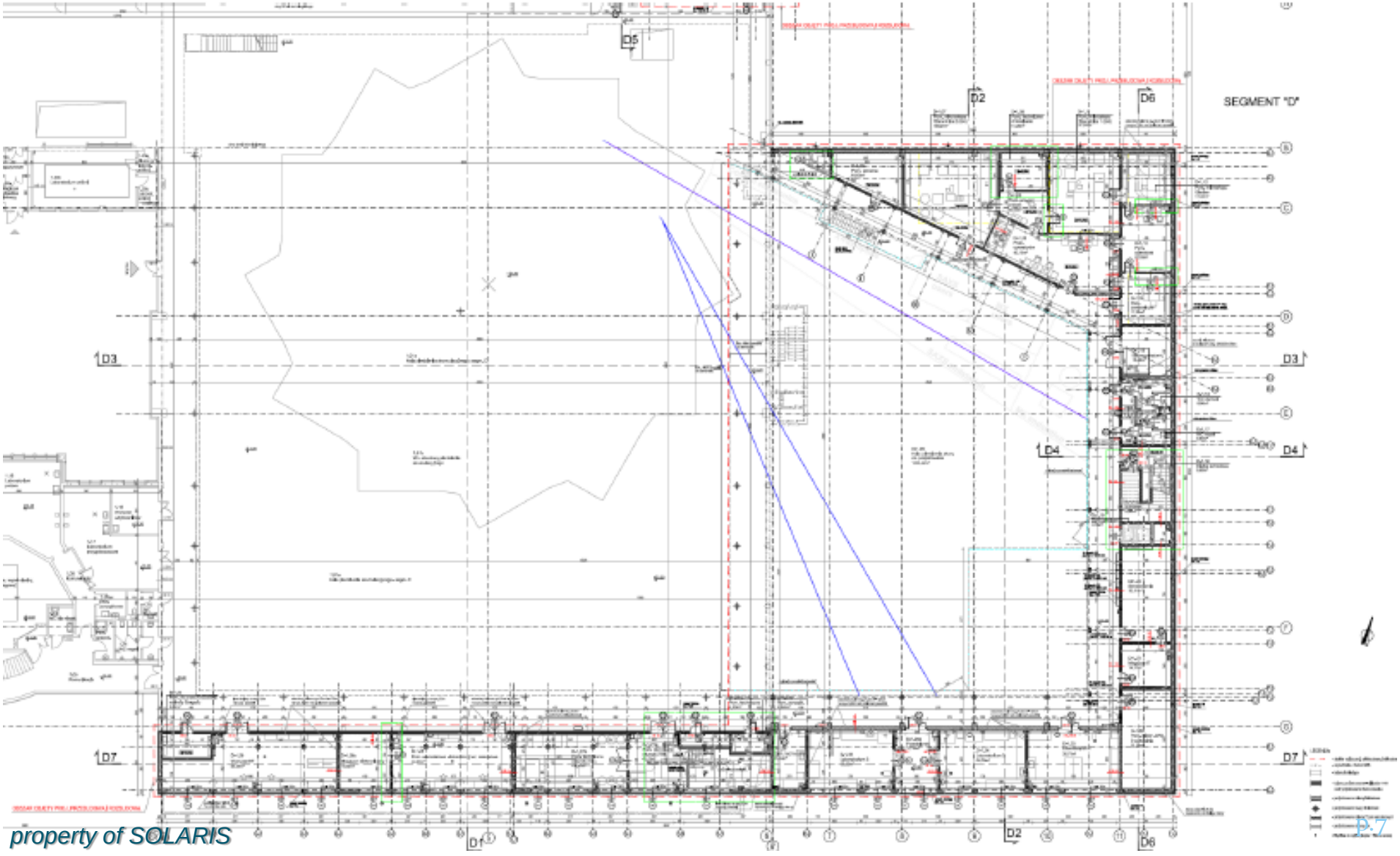
Experimental hall extension design



Experimental hall extension

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Extension of experimental hall - tender

UNIWERSYTET JAGIELLOŃSKI W KRAKOWIE

POSTĘPOWANIA BIEŻĄCE | POSTĘPOWANIA ZAKOŃCZONE | AKTY PRAWNE | DLA ZALOGOWANYCH | KONTAKT

OGŁOSZENIA O POSTEPOWANIACH

ZAPROSZENIA DO SKŁADANIA OFERT Z DZIEDZINY NAUKI

WSTĘPNE OGŁOSZENIA INFORMACYJNE

Ogłoszenie z dnia 27.08.2021 r.

announcement of the tender

Opis: o przetargu nieograniczonym na wykonanie prac budowlanych związanych z przebudową i rozbudową budynku Narodowego Centrum Promieniowania Synchrotronowego SOLARIS, ul. Czerwone Maki 98 w Krakowie
Nr sprawy: 80.272.191.2021
Termin składania ofert: 28.09.2021 , godzina 10:00
~~Przedłużenie terminu do dnia: 12.10.2021 , godzina 10:00~~
Przedłużenie terminu do dnia: 22.10.2021 , godzina 10:00
Kontakt: Artur Wyrwa - tel.: +48 12 663-39-41; e-mail.: artur.wyrwa@uj.edu.pl
Status: ogłoszone

Ogłoszenie z dnia 27.08.2021 r. o zamówieniu, opublikowane w DU UE
Specyfikacja Warunków Zamówienia - WERSJA PDF
Specyfikacja Warunków Zamówienia - WERSJA EDYTOWALNA

Experimental hall extension

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Extension of experimental hall – selection of the best offer

Selection procedure

1st company selected: PPHU Wemo-group Mariusz Maligłówka
40 879 105,35 PLN **~10.5 M$**

- Request to supplement documents (deadline 8/12/2021)
- Extension of the deadline (21/12/2021)
- Documents submitted, **formal errors in documents provided by bidder after second request**, offer should be excluded.

2nd company selected: HOCHTIEF Polska S.A.
40 913 281,23 PLN

- Request to supplement documents (deadline 11/01/2022)
- Documents submitted (analysis in progress).

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Super-Conducting Wiggler for energy 5-20 keV

SCW contract

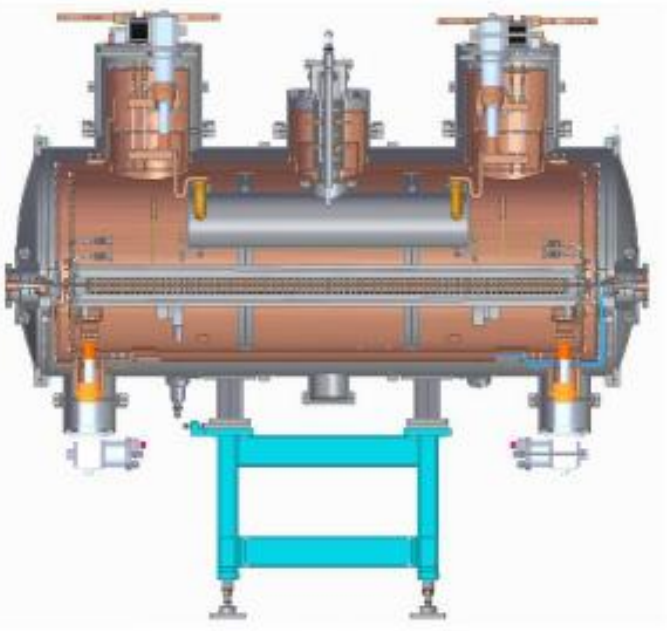


Figure 71. Longitudinal section of SCW cryogenic system

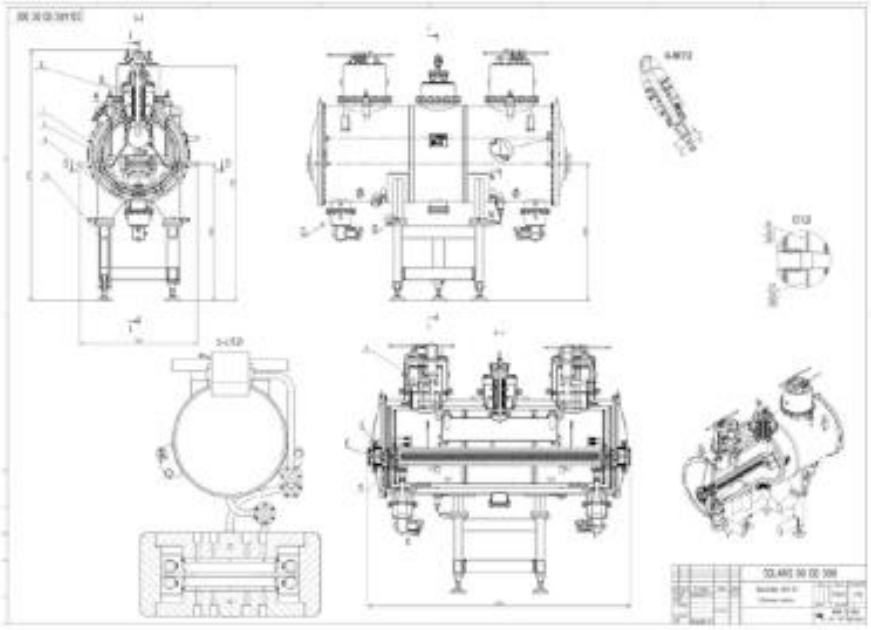
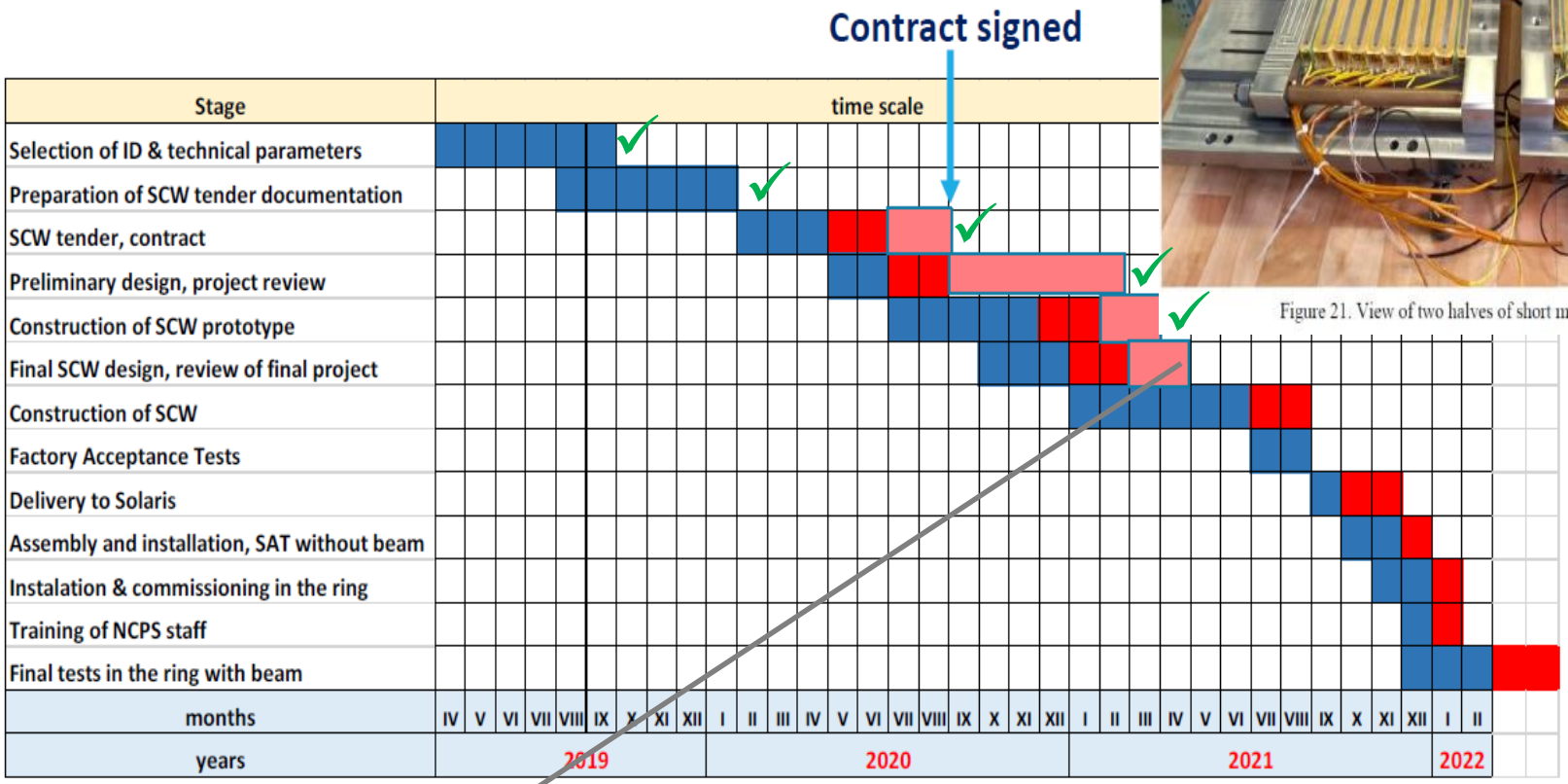


Figure 74. Design of SC MPW for SOLARIS

Source activities schedule

Figure 21. View of two halves of short magnet prototype.



04/04/2021 Final Design Report was provided

SCW - parameters of the radiation power exceeded border values described in tender documents

Super conducting wiggler

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Initial FDR – SCW parameters

- Period **48 mm**
- Nominal magnetic field 4.0 T, maximum peak on-axis field 4.2 T, K <19
- Full vertical aperture of the vacuum chamber 8 mm
- Magnetic gap 10 mm
- Full horizontal aperture of the vacuum chamber ~60 mm
- **Magnetic length ~1880 mm**
- **Period number 37**
- **Main pole number 74**
- **Total number of poles 78**
- ¾ pole number 2
- ¼ pole number 2
- Maximum length flange-to-flange 2500 mm
- Beam axis height from the floor 1300 mm
- Liquid helium consumption (at normal operation) 0 l/h
- Period for LHe refill with beam >6 month
- **Radiation power, (100mA, 4.0T) ~3.65 kW --> 18,25 kW (500 mA, 4.0 T - limit 13 kW)**

SCW FDR (version April 2021) by BINP

Super conducting wiggler

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21/04/2021	NCPS Solaris comments to FDR	
22/04/2021	BINP answers and clarification of problems mentioned by NCPS Solaris	BINP confirmed that border parameters of the radiation power are exceeded
23/04/2021	**Zoom meeting, discussion on SCW design**	
30/04/2021	Clarification report (NCPS)	
09/07/2021	Discussion/information on the other company which will take care about the extraction the photon beam down to the frontend area.	
15/07/2021	Meeting with FMB Berlin	
25/08/2021	**The new design of 52-poles SCW from BINP**	
27/08/2021	Information to BINP on collaboration with FMB-B, comments to straight section	
09-10/2021	FMB-B - feasibility studies of the straight section	

Super conducting wiggler

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5/10/2021	Straight section meeting (NCPS)	
13/10/2021	**Drawing update from BINP**	Correction of drawings
08-11/2021	Work with FMB, some clarifications etc.	
30/11/2021	Information from BINP	design of the vacuum chambers is still incomplete
03/12/2021	**Preliminary report from FMB-B**	
9/12/2021	design of straight section vacuum chamber from BINP	
10/12/2021	**New schedule proposed by BINP, stp files of vacuum chamber design from BINP**	
21/12/2021	**Report (final) from FMB-B**	
23/12/2021	**New schedule + annex no1**	

Source activities schedule

Figure 21. View of two halves of short magnet prototype.

04/04/2021 Final Design Report was provided

SCW - parameters of the radiation power exceeded border values described in tender documents

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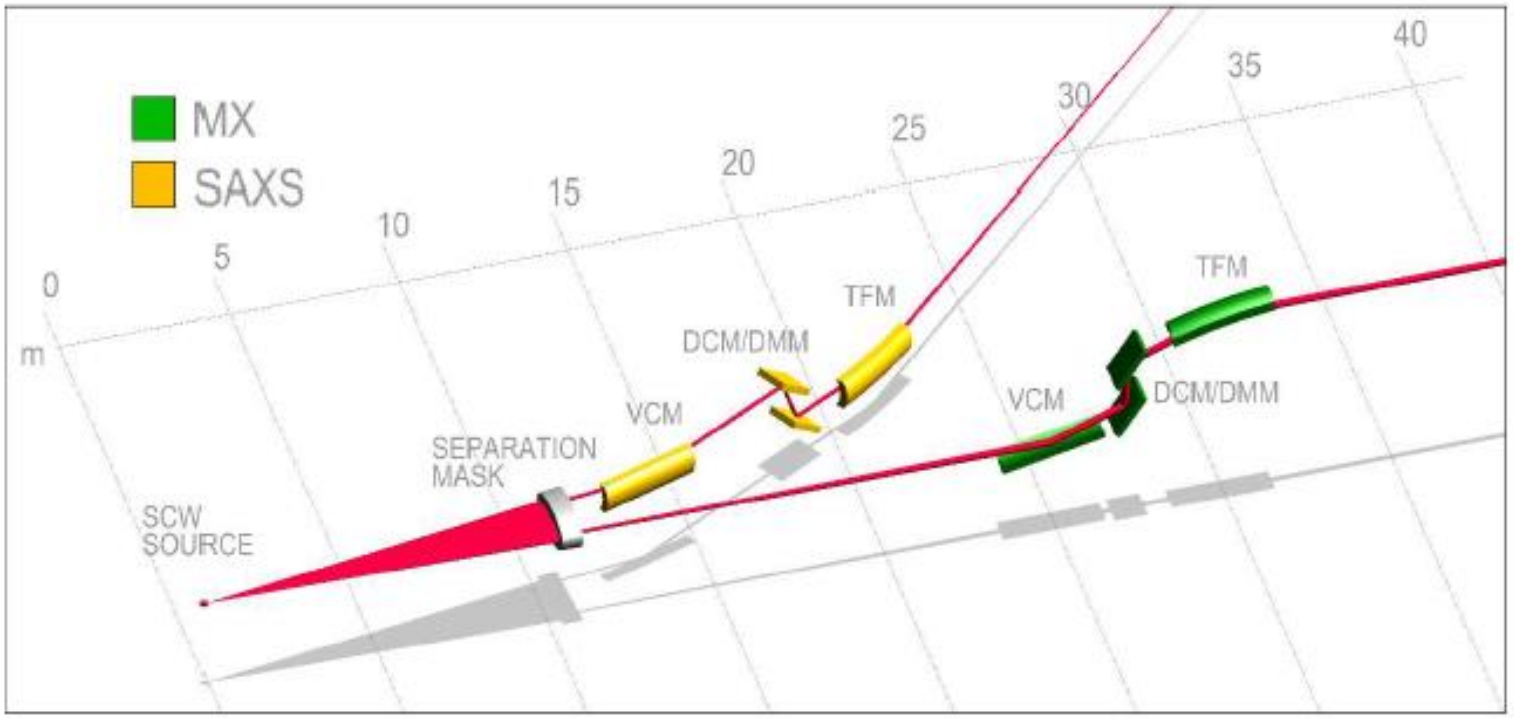
Beamlines conceptual design

- **Beamline splitting by a fixed aperture**



Beamlines main activities

- **Technical dialogue with FMB Oxford Ltd. (UK), IRELEC (FR), AXILON (DE)**
- **Evaluation of technical documentation by external experts M. Weiss (BESSY), A. Petukov (Utrecht U), A. Wegner (DLS)**
- **Preliminary proposals of the X-ray photon delivery systems from FMB Oxford, Cinel (Italy)**

Beamlines schedule

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- The tenders, final design and construction of optical part of SOLCRYS BL and FE are limited by final SCW FDR.
- Modification of straight section – **9 months**
- Front end – **13-14** months for construction.
- X-ray optics – **18-20** months after signing the contract.

The technical specification is ready, initial documents for FE tender are submitted to DZP UJ (Public Procurement Department). **FDR for SCW and clarification of straight section modifications from BINP are crucial for next stages of SOLCRYS construction.**

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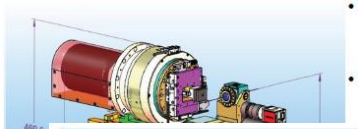
Beamline endstations

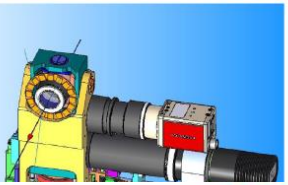
Diffractometer for MX endstation



- High-precision Roadrunner crystallography goniometer for **conventional and serial crystallography experiments.**
- Chi-arc segment for optimal data collection (low symmetry space groups and for phasing

Diffractometer for MX endstation

Roadrunner on-axis sample viewing microscope
• 20x microscope objective, NA = 0.25, working distance: 25 mm
• dual view system providing 2 different field of views: 1000 x 800 µm² (high-magnification) and 500 x 400 µm² (low magnification).



suna precision

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Technical dialogue - meeting with Suna Precission (Germany)

suna precision

suna-precision GmbH
Geschäftsführer: Dr. Alke Meents
Sitz der Gesellschaft:
Notkestraße 85
c/o Deutsches Elektronen Synchrotron
22607 Hamburg

Amtsgericht Hamburg HRB 132708
USt-Ident/VAT-Nr.: DE 296 400 776

20/12/2021

Time to delivery
13 months after receipt of order and 50% payment.

- collimator mounted on a positioning unit, mounted on a x,y positioning
- **photo-diode positioning unit**, carries photodiode for X-ray beam intensity measurements, mounted on a x,z positioning unit, stepper motor operated,
- **capillary beamstop for ultra-low background applications**, consisting of a telescopic arrangement of different diameter tantalum capillaries as described in Meents et al, pink beam serial crystallography, Nature Comm. 2019,

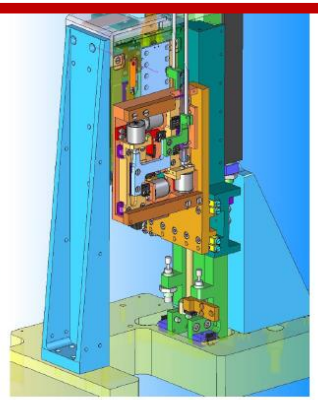

Figure 3: Beam conditioning unit of the Roadrunner crystallography goniometer in measurement position. The actual design might slightly differ from the version shown here.

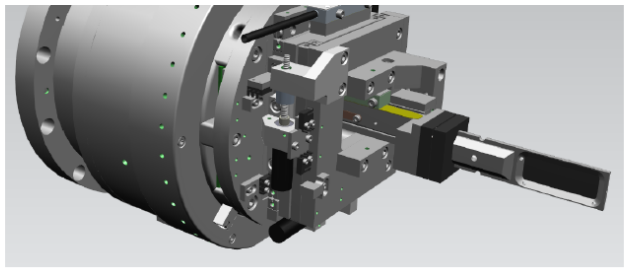

Figure 4: Roadrunner III goniometer axis for high-speed scanning applications: It consists of a servo motor operated high-precision rotation stage with is equipped with a x,z centering stage to position the sample in the rotation axis. The center of the x,z stage is further equipped with fast linear stage oriented along the rotation axis, which allows for high-speed scanning of the samples with speeds of up to 100 mm/sec. The actual design might slightly differ from the version shown here. X,y,z positioning system is not shown here.

Beamline auxiliary equipment

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DAC system for XRD

- DAC – Poznań

60% of Almax Easylab pice

Summary

- SOLARIS machine and beamlines
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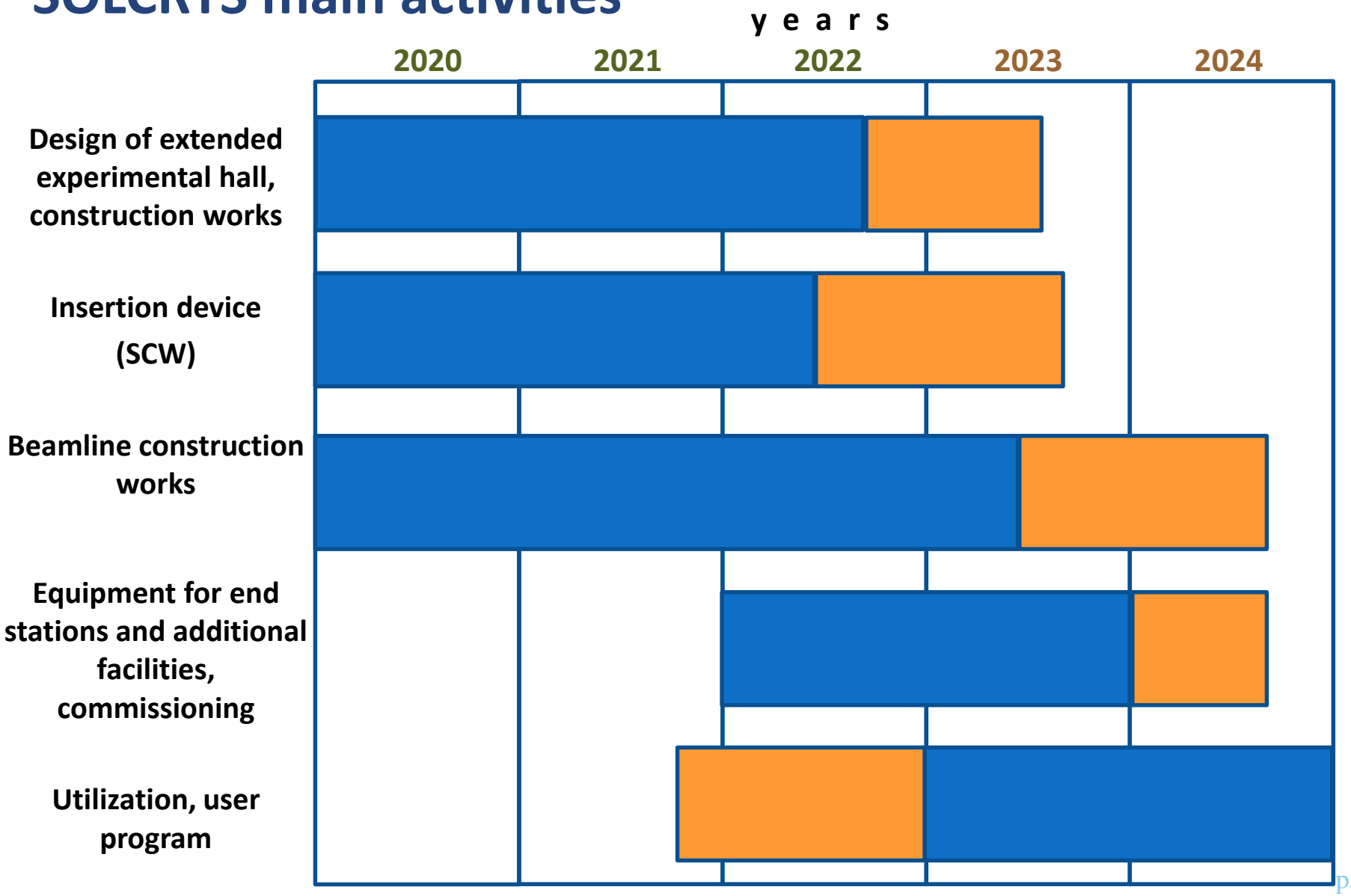
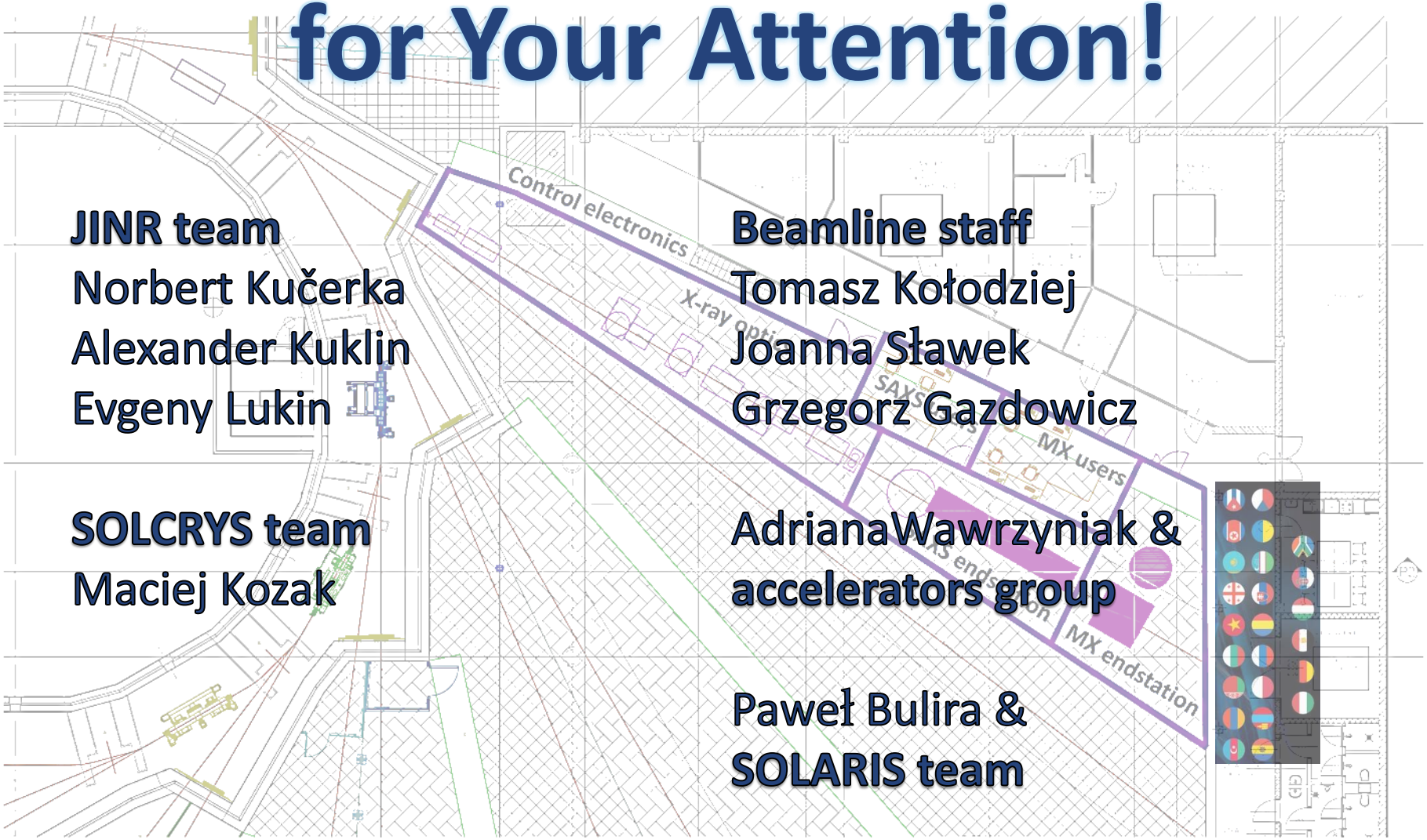
- Utilization and user program

SOLCRYS main activities



User community

Thank You for Your Attention!



JINR team
Norbert Kučerka
Alexander Kuklin
Evgeny Lukin

SOLCRYS team
Maciej Kozak

Beamline staff
Tomasz Kołodziej
Joanna Sławek
Grzegorz Gazdowicz

AdrianaWawrzyniak &
accelerators group

Paweł Bulira &
SOLARIS team