# s² innovation
## Software solutions

# FOFB @ NSRC
# SOLARIS

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Piotr Goryl,

on behalf of Wojtek Kitka, Grzegorz Kowalski and other colleagues from S2I and SOLARIS

# Who are we?

- S2Innovation was founded in December 2017 by:

  - **Piotr Goryl**, former Head of IT and Controls at SOLARIS,

  - **Wojciech Soroka**, former Procurement officer at SOLARIS

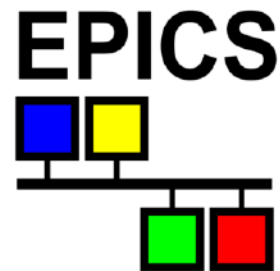- Since 2019 S2Innovation is a Polish-Slovenian Joint Venture (Investment of **Cosylab d.d.**).



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Software solutions

# 19+ (not-only) engineers with experise on

- ▶ Control systems engineering:
  - ▶ Open-soruce SCADA frameworks,
  - ▶ PLC
- ▶ Software development:
  - ▶ Python, C++, Java, .Net, HTML/JavaScript/CSS/REACT, Matlab
  - ▶ **Tango Controls**, EPICS
- ▶ Documentation,
- ▶ DevOps,

# The Fast Orbit Feedback

▶ The Fast Orbit Feedback system at SOLARIS is designed to complement the software-based Slow Orbit Feedback and provide orbit **correction** in the **frequency** range of up to **10 kHz.**

▶ This is accomplished using **Libera Brilliance+'s GDX** module FPGA and fast **LiberaGrouping optical links** between them. The **FPGA** image performing **calculations** is delivered by I-tech.

▶ The **Fast Corrector magnets** are directly controlled by Liberas via **RS485 serial link**. The magnets are specifically designed to allow switching frequencies of tens of kHz.
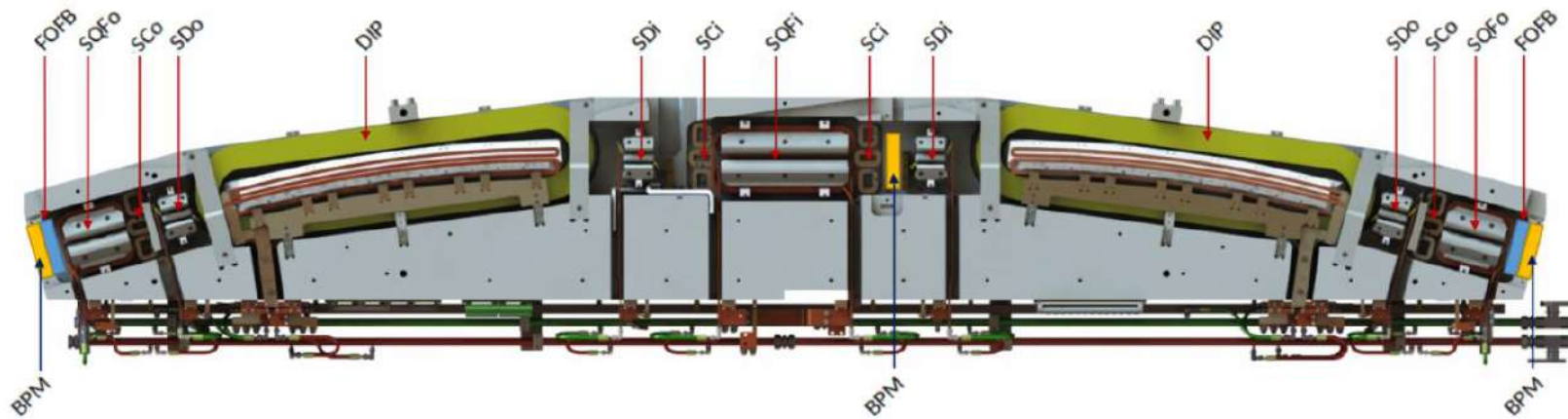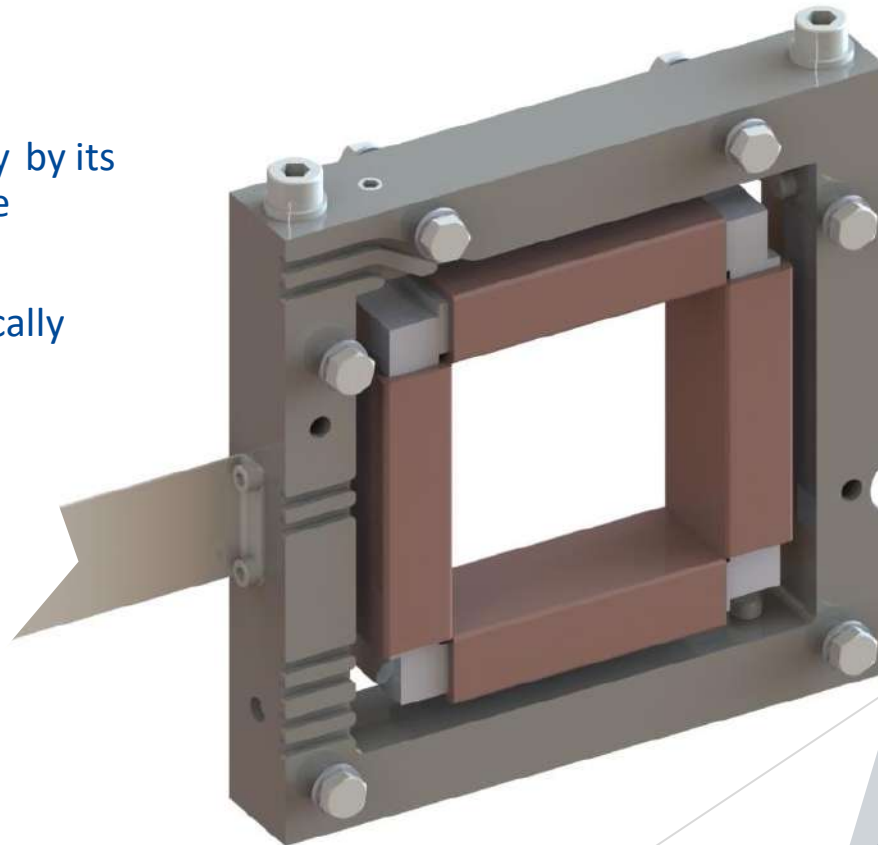
# The Fast Orbit Feedback

The SOLARIS storage ring consists of 12 DBA

# Magnets and power supplies

- Dual ferrite core/copper coil quadrupoles manufactured by Scanditronix.

- One magnet consists of vertical and horizontal quadrupole

- Each part of the magnet is powered independently by its own power supply. The rated current range for the magnets is ±2 A.

- The power supplies used are Itest BE5495, specifically designed for FOFB applications..

# LIBERA Brilliance+

The instruments consist of several modules each:

• ICB - main system module which provides control system connection.

• BPM - beam position monitor board, digitizes analog BPM data, performs basic calculations and provides several data paths.

• EvRx - event receiver board that receives, filters, and distributes timing information to other modules. Equipped with MRF timing decoder.

• GDX - data exchange module, provides connections for Libera Grouping and Global data outputs. This module's FPGA performs FOFB calculations.

• SER - serial data output module used to directly control fast corrector power supplies.

# LIBERA Brilliance+ - libera-ds

The libera-ds is a standard Tango device server for all Libera instruments. It offers direct access to all MCI tree elements and provides a great deal of customization and configuration possibilities.

While the configuration file format is not exactly user friendly, it allows great flexibility in tailoring the Tango interface to specific installation needs.

At SOLARIS, the TANGO devices of the libera-ds are separated into three different groups EVR, GDX, RAF

# LIBERA Brilliance+ - firmware update

Firmware update can be divided into 3 steps:

- Update of the Debian packages related to the Libera and TANGO.

- Update of the FPGA images.

- Reconfiguration of the Liberas.

# The *fofbresponsemtx* application

The fofbresponsemtx application is used to **measure and apply fast corrector response matrix**. It handles the measurement process and implements calculations and matrix reformatting necessary for Liberas to make use of the measured data.
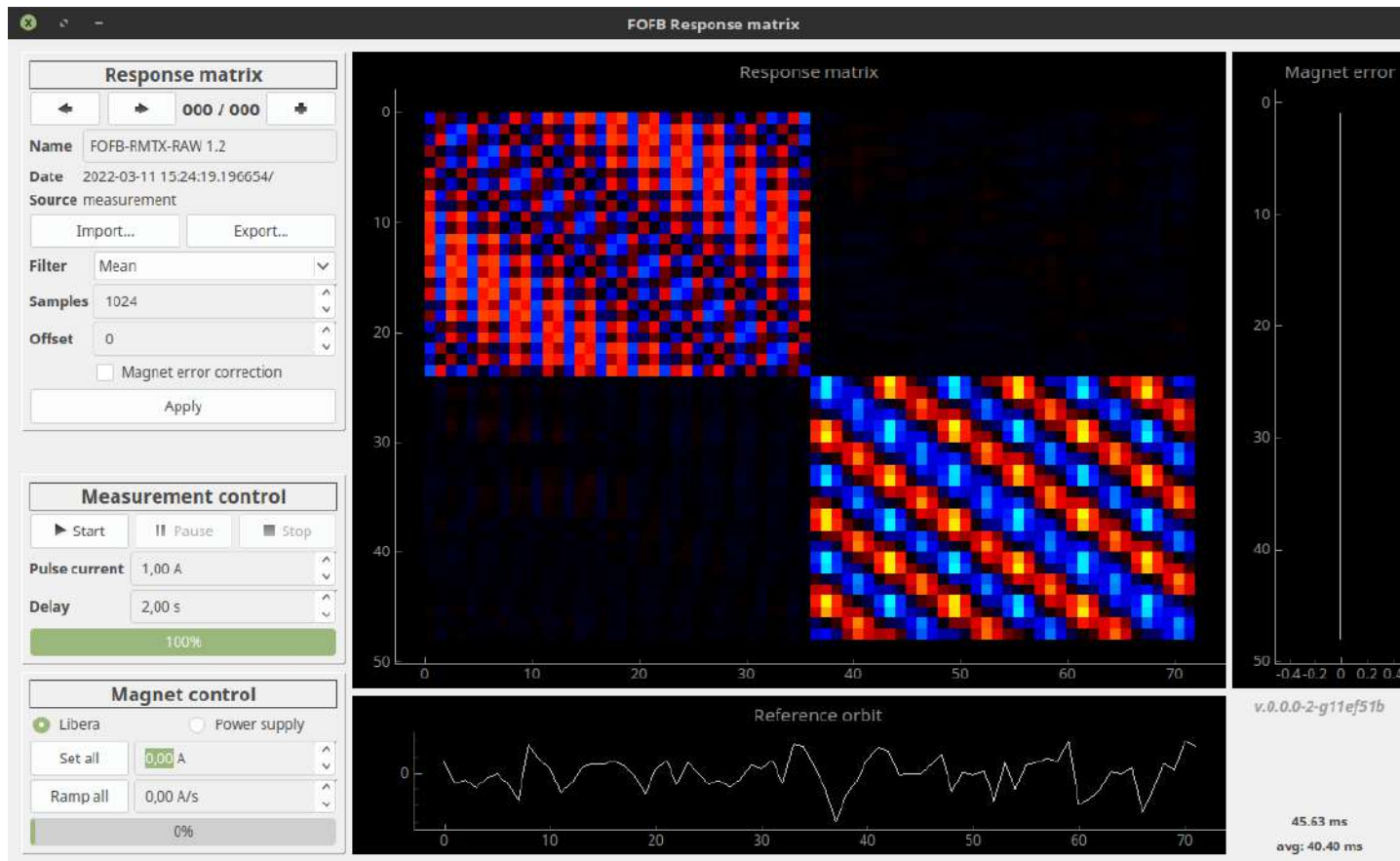
# The *fofbcontrol* application

The fofbcontrol is a main control application for FOFB. Its main tasks are configuring the system, displaying status of all elements and sending the control signals in form of timing events
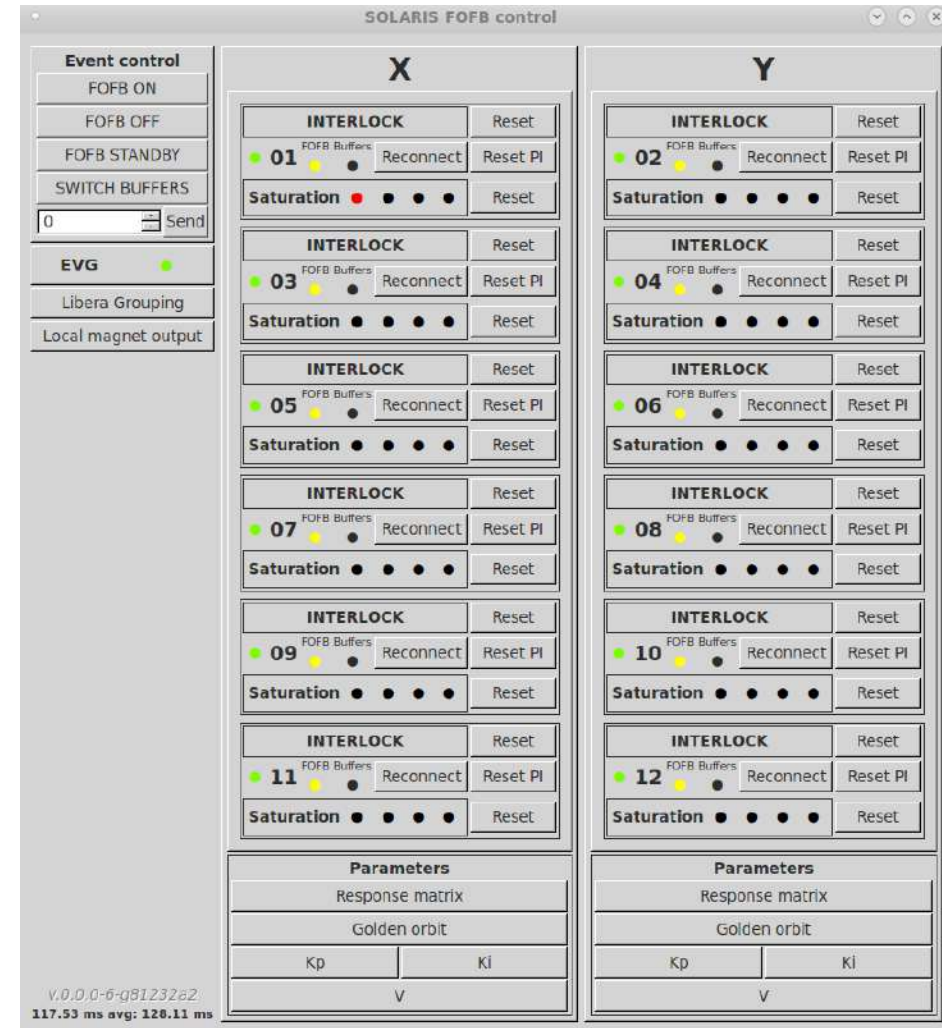
# The *fofbcontrol* application: local magnet output

The local magnet output window shows status of all SER outputs and provides direct control over magnets in manual mode.
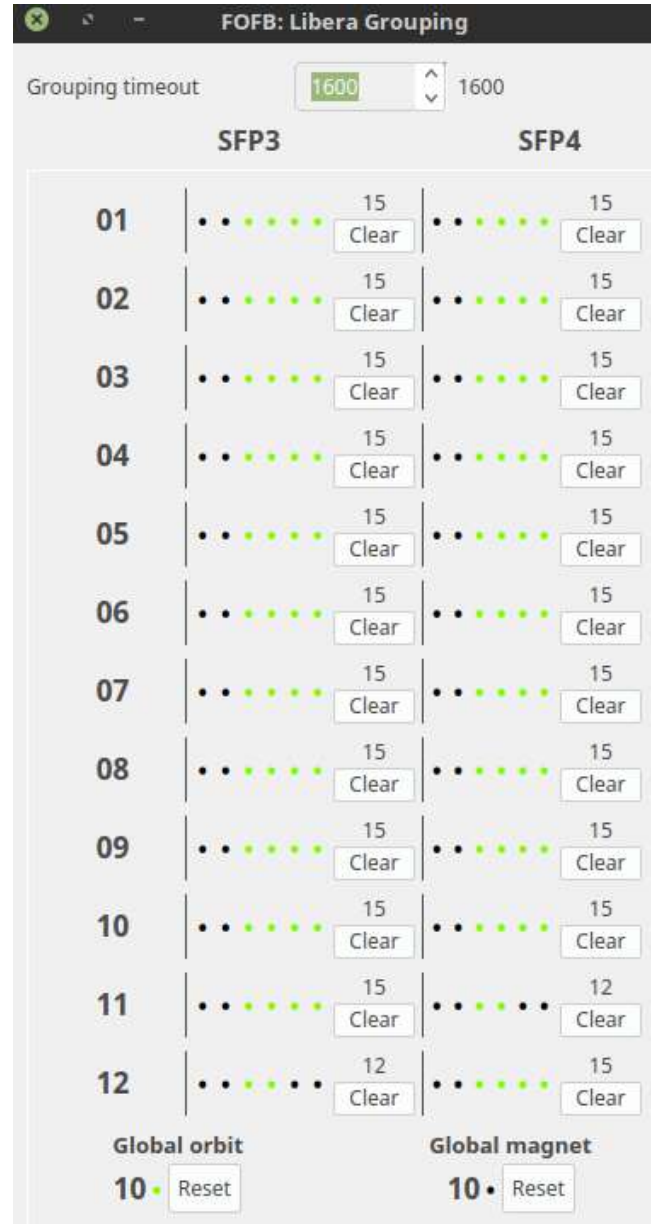
Red - output is off

Orange – output in manual mode

Green – output uses FOFB calculated values

# The *fofbcontrol* application: Libera grouping

The status of Libera Grouping is shown in the Libera grouping window, allowing for clearing errors and resetting global orbit and magnet data outputs.

# Plans

- As of now, the fofbresponsemtx application doesn't support the bit cutting during the response matrix calculations. We are currently working on implementing this feature.

- In parallel we're going to test MAX IV's solution: the SOFB and the FOFB TANGO device classes (currently it is done by scripts)
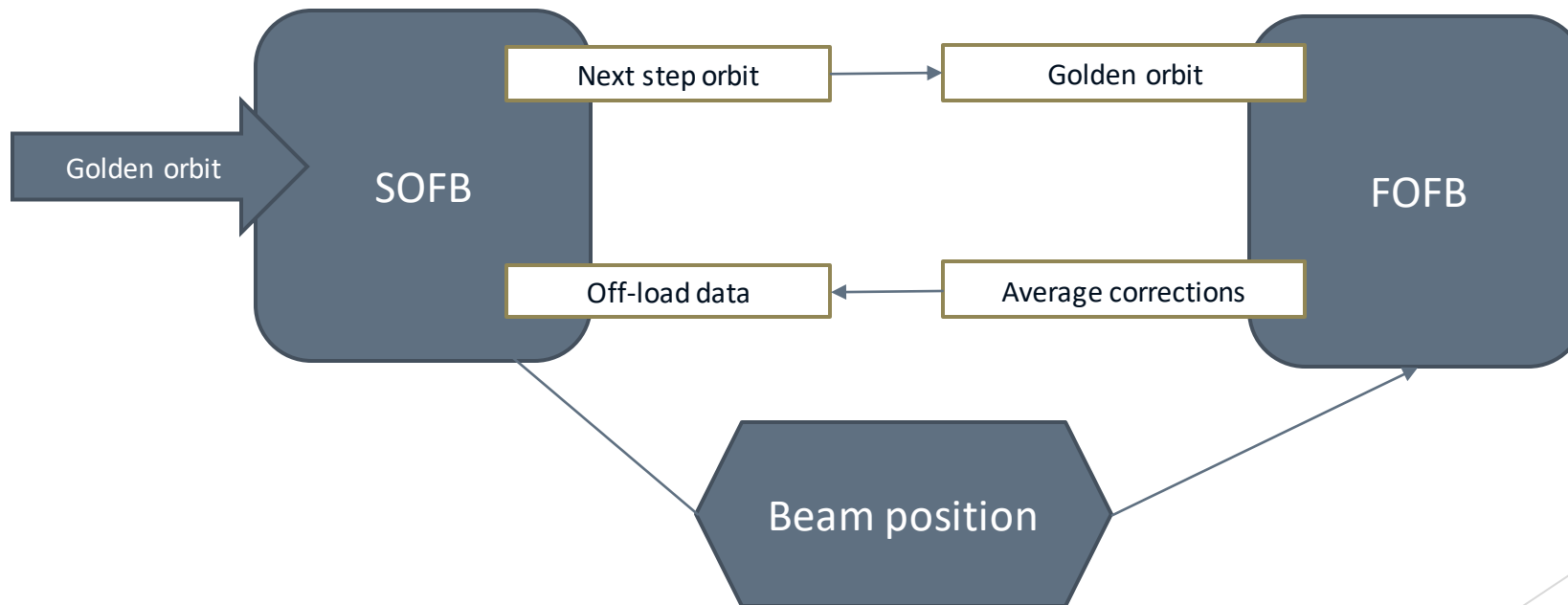
# Thank you!

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