THE ELECTRICAL GROUND SUPPORT EQUIPMENT FOR SPECTROMETER/ TELESCOPE FOR IMAGING X-RAYS (STIX)

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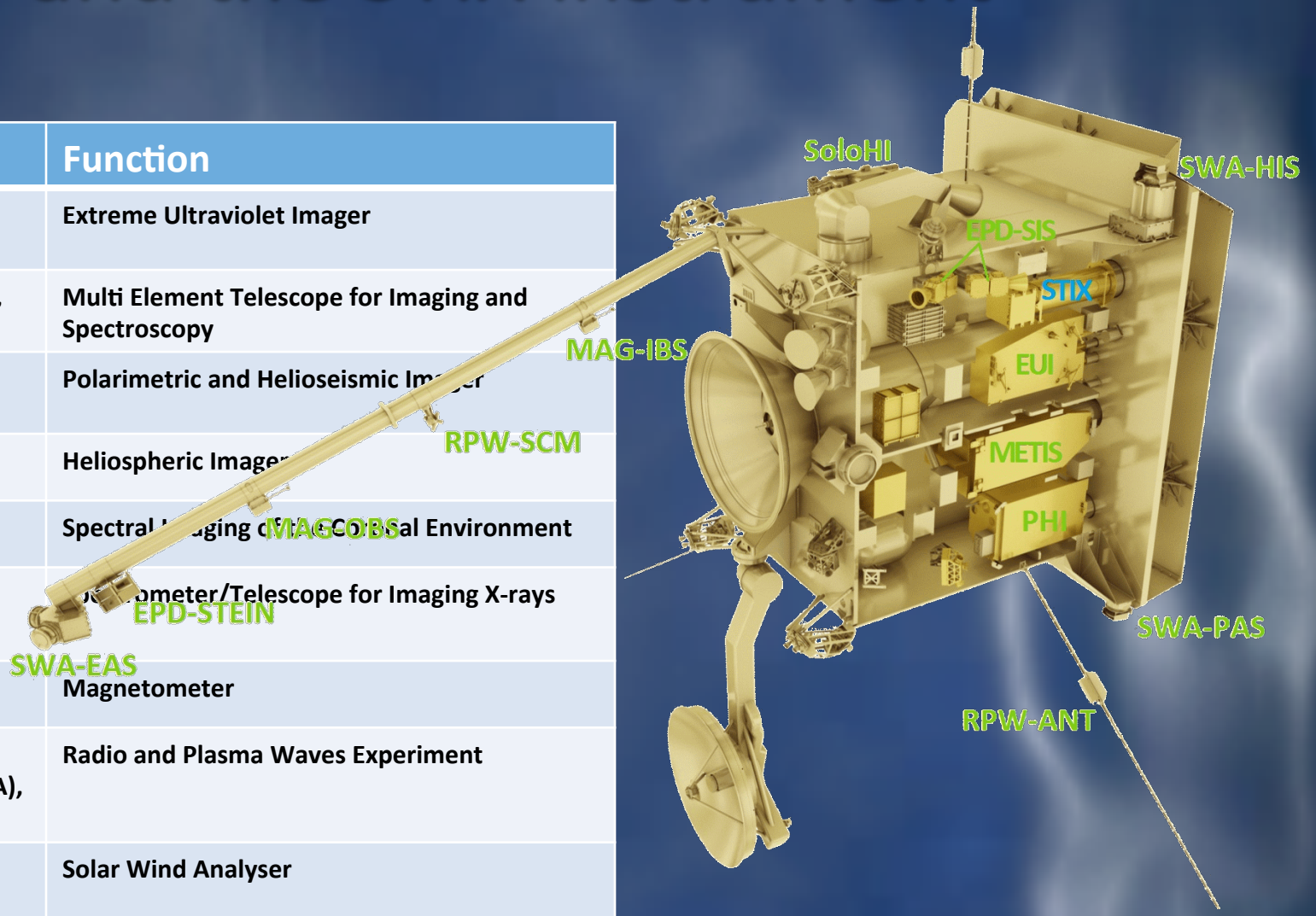
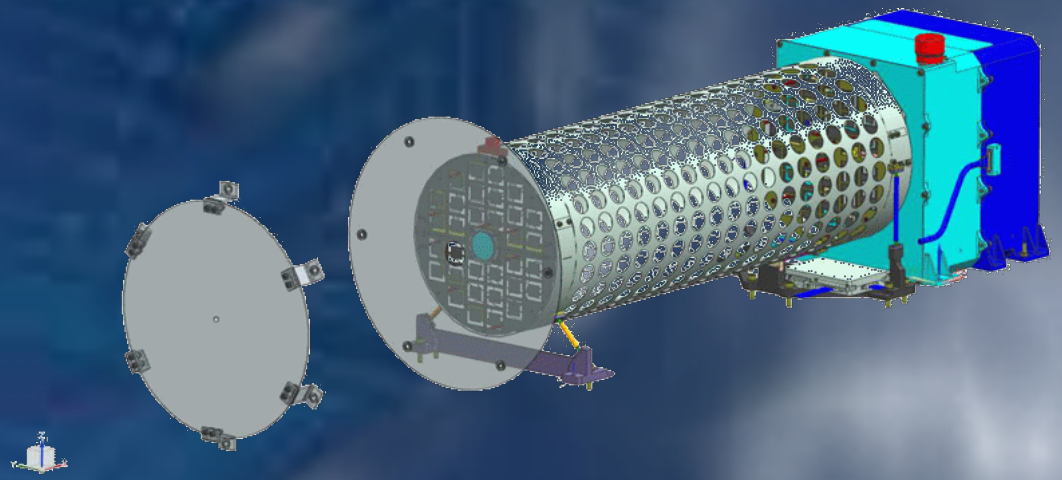
15-я Украинская конференцияпо космическим исследованиям.

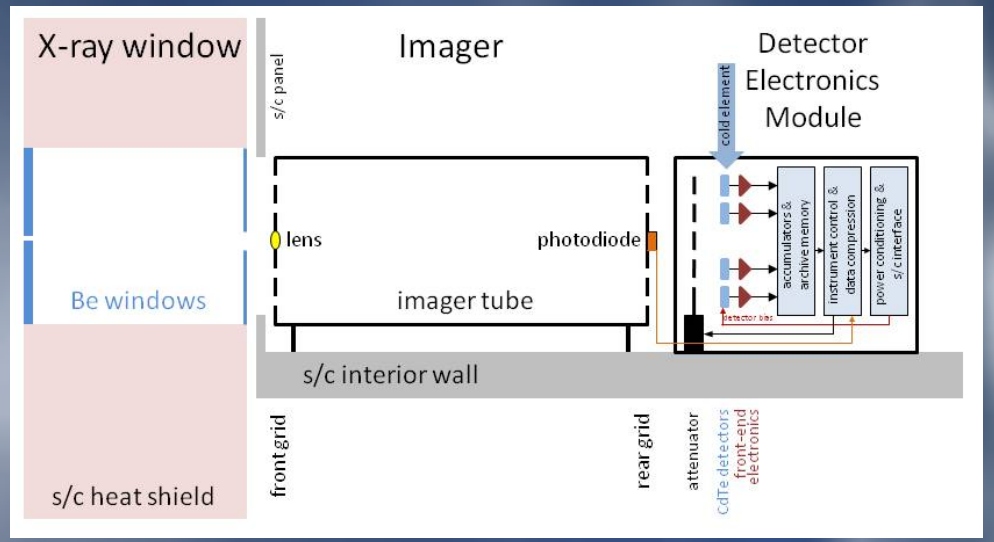
Solar Orbiter and the STIX instrument

Instrument	PI institute	Function
EUI	Centre Spatial de Ličge (CSL), Belgium	Extreme Ultraviolet Imager
METIS	Astrophysical Observatory of Turin (INAF), Italy	Multi Element Telescope for Imaging and Spectroscopy
PHI	Max Planck Institute for Solar System Research (MPS), Germany	Polarimetric and Helioseismic Im[illegible]
SoloHI	Naval Research Lab (NRL), USA	Heliospheric Image[illegible]
SPICE	ESA funded	Spectral [illegible]aging [illegible]al Environment
STIX	University of Applied Sciences North Western Switzerland (FHNW)	[illegible]ometer/Telescope for Imaging X-rays
MAG	Imperial College London, UK	Magnetometer
RPW	Laboratoire d'études spatiales et d'instrumentation en astrophysique (LESIA), France	Radio and Plasma Waves Experiment
SWA	Mullard Space Science Lab (MSSL),UK	Solar Wind Analyser



THE SPECTROMETER/?????????
TELESCOPE FOR IMAGING X-RAYS (STIX)

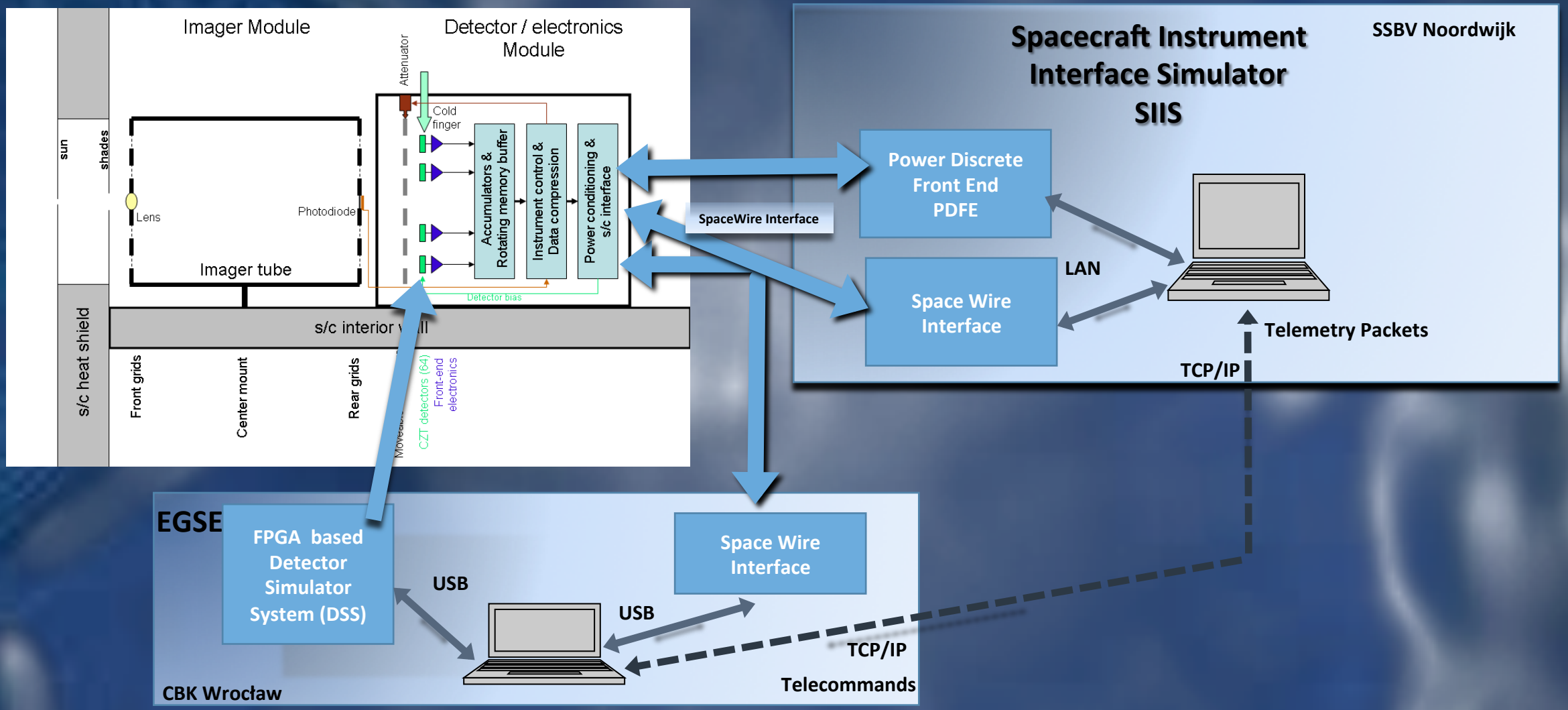




Collaboration
spectrometer
Features
Polish activities in SRC include Instrument Data Processing Unit, Instrument EGSE and Instrument Thermal Modelling.

Energy Range	**4 – 150 keV**
Energy Resolution (FWHM)	**1-15 keV (energy dependent)**
Effective area	**6 cm^2**
Finest angular resolution	**7 arcsec**
Field of view	**2°**
Image placement accuracy	**~4 arcsec**
Time resolution (statistics limited)	**≥ 0.1 s**

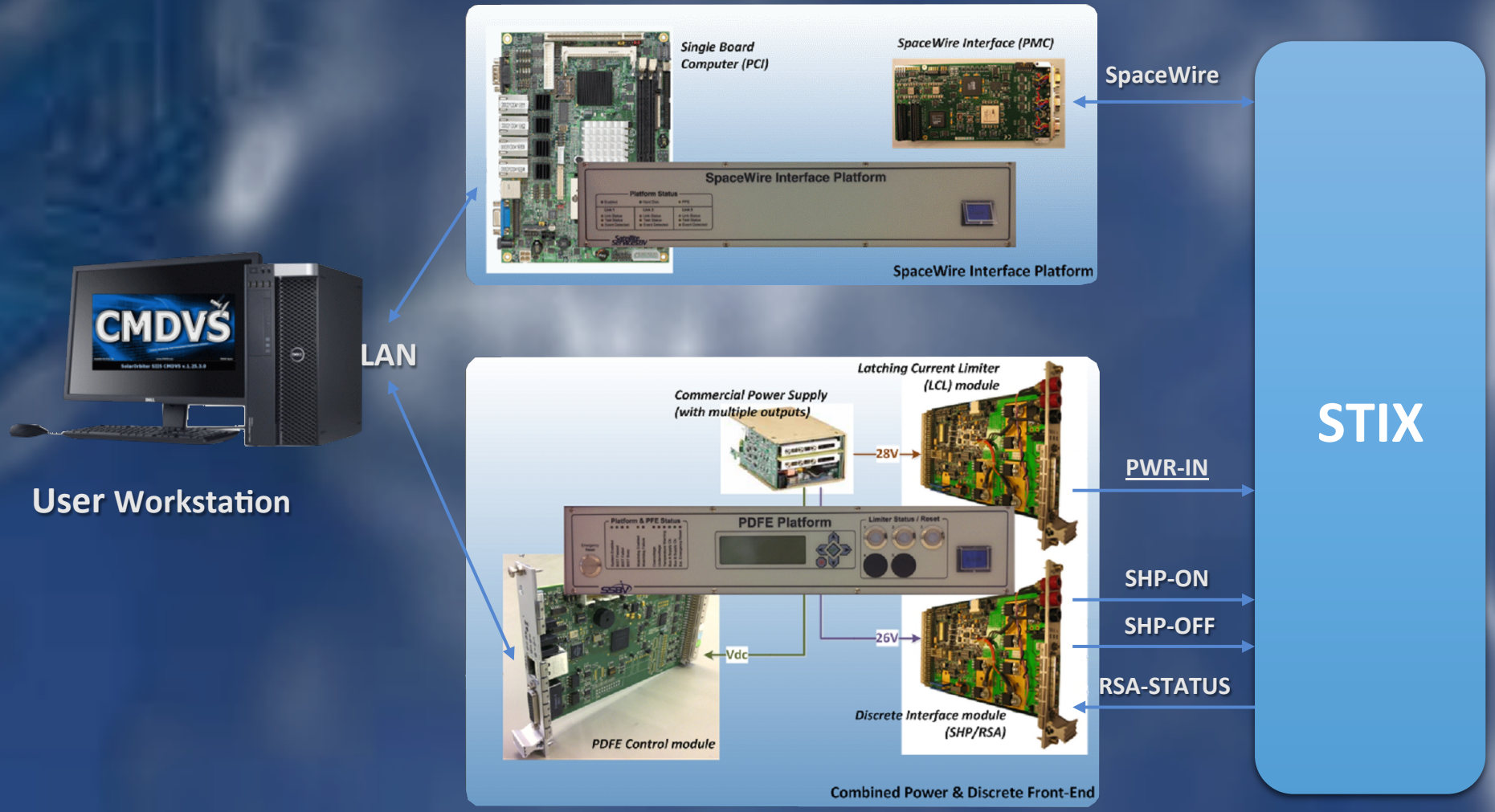
THE STIX EGSE Block Scheme



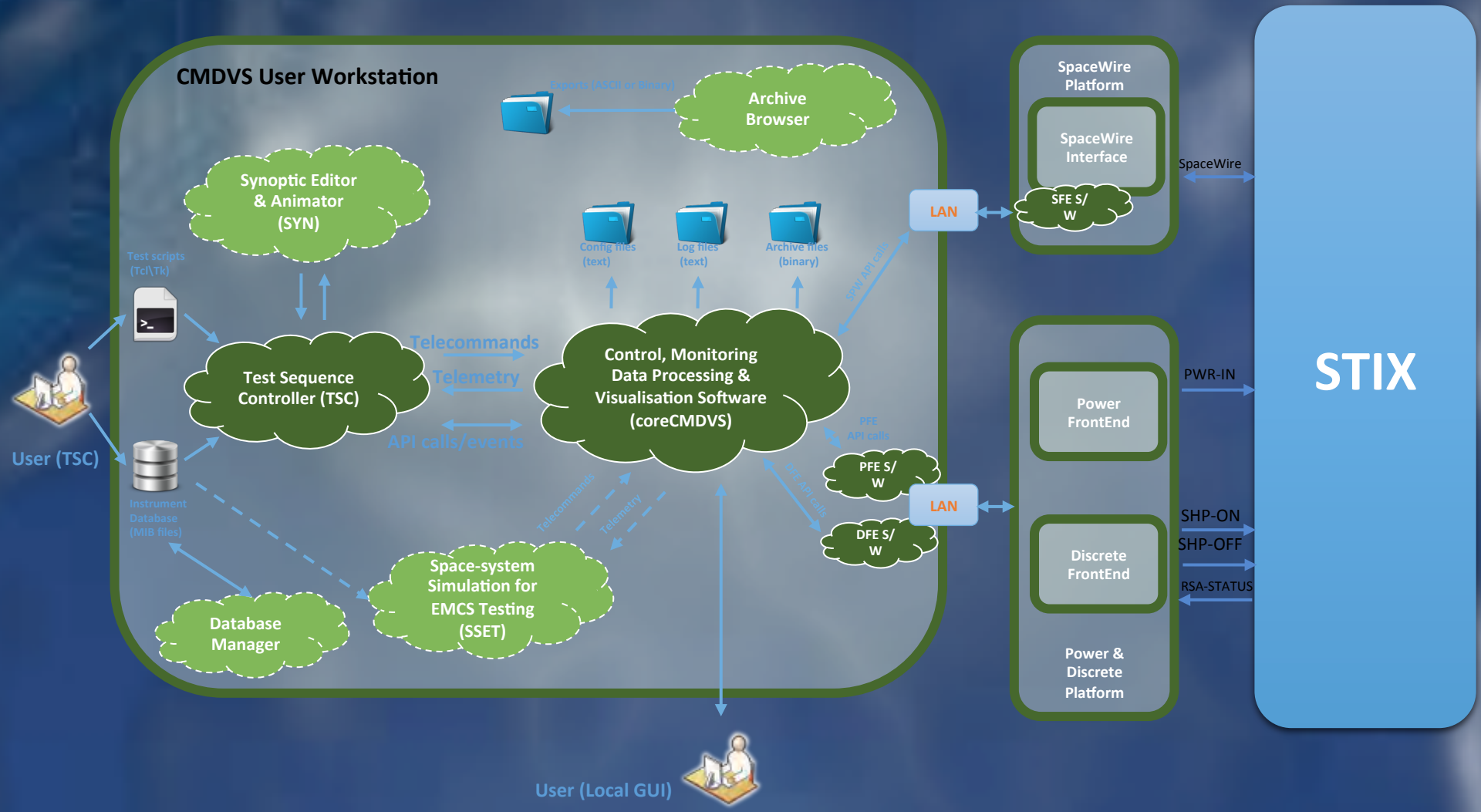
Spacecraft Instrument Interface Simulator (SIIS) overview

- hard- and software elements which provide the tool for instrument power interface and TM/TC electrical and data protocol validation,
- specified for delivery phases of instrument models to integration,
- designed and manufactured by SSBV (NL), previously deployed and in-field proven (e.g. BepiColombo, EarthCARE)

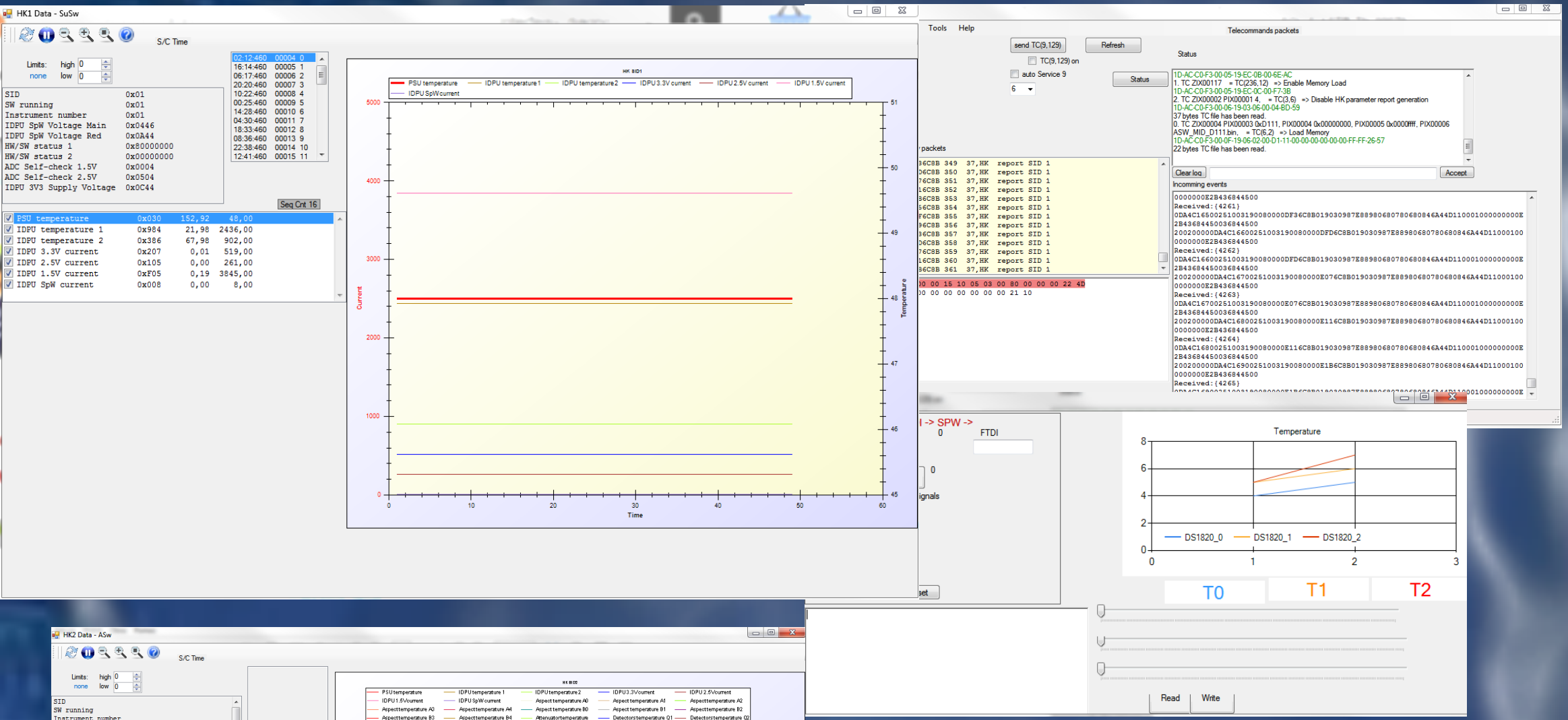
Spacecraft Instrument Interface Simulator (SIIS) - hardware



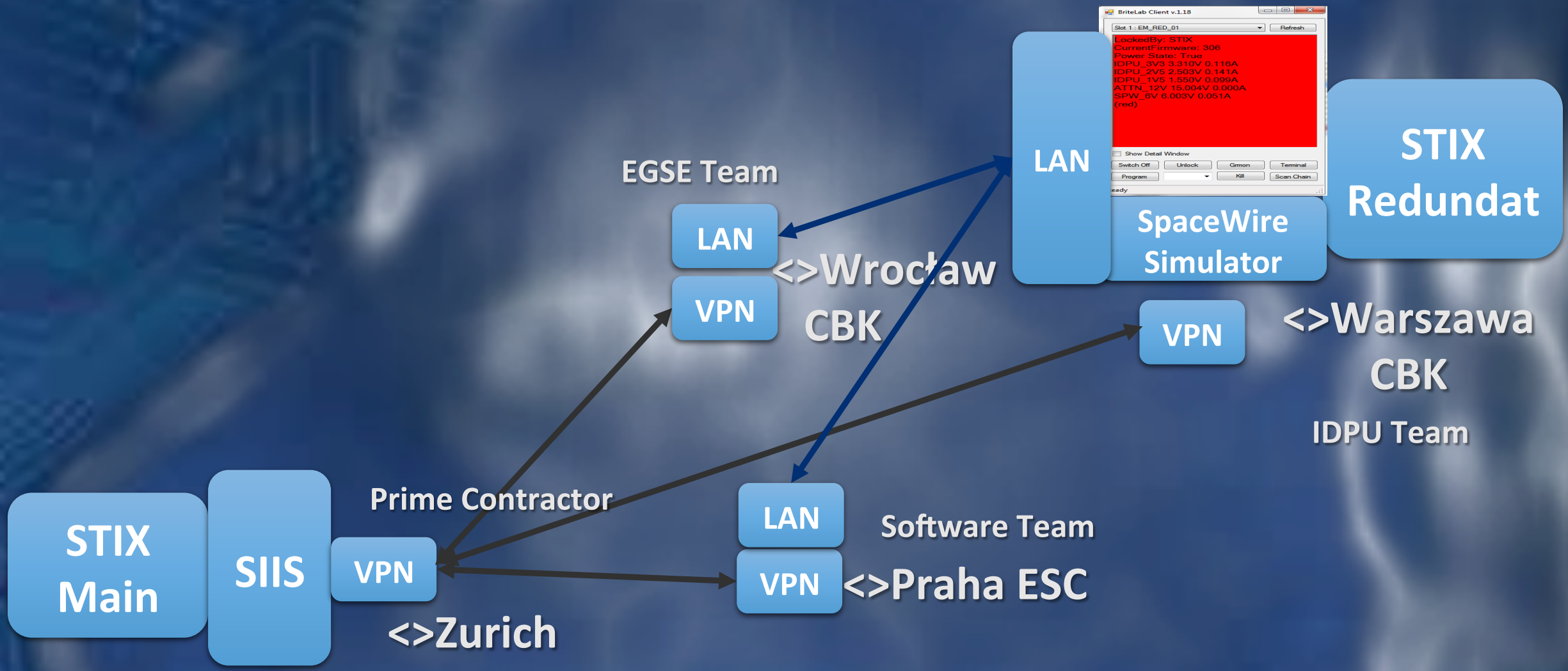
Spacecraft Instrument Interface Simulator (SIIS) - software



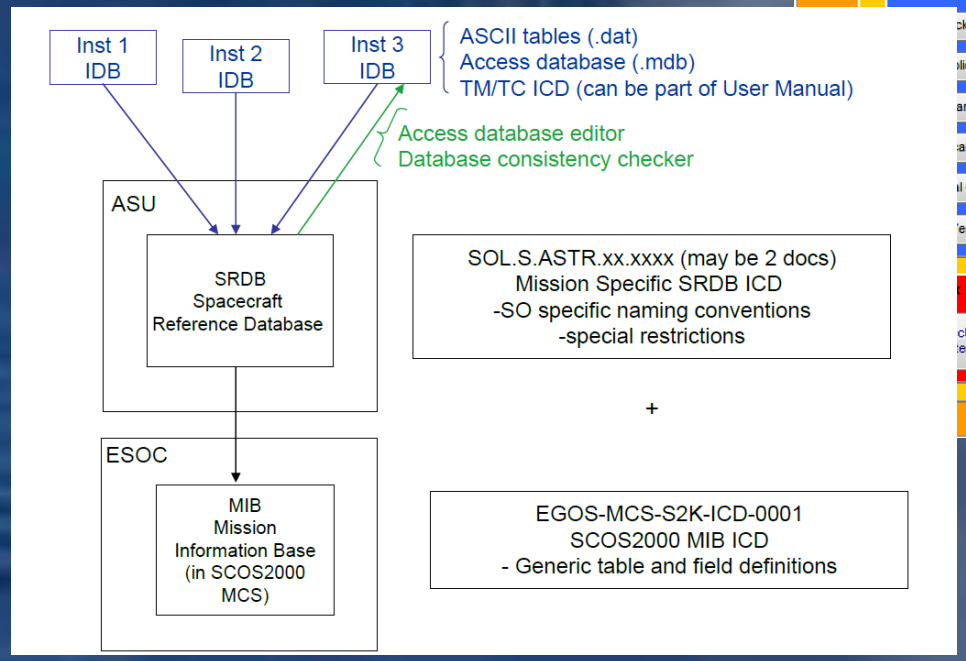
Space Wire Simulator software

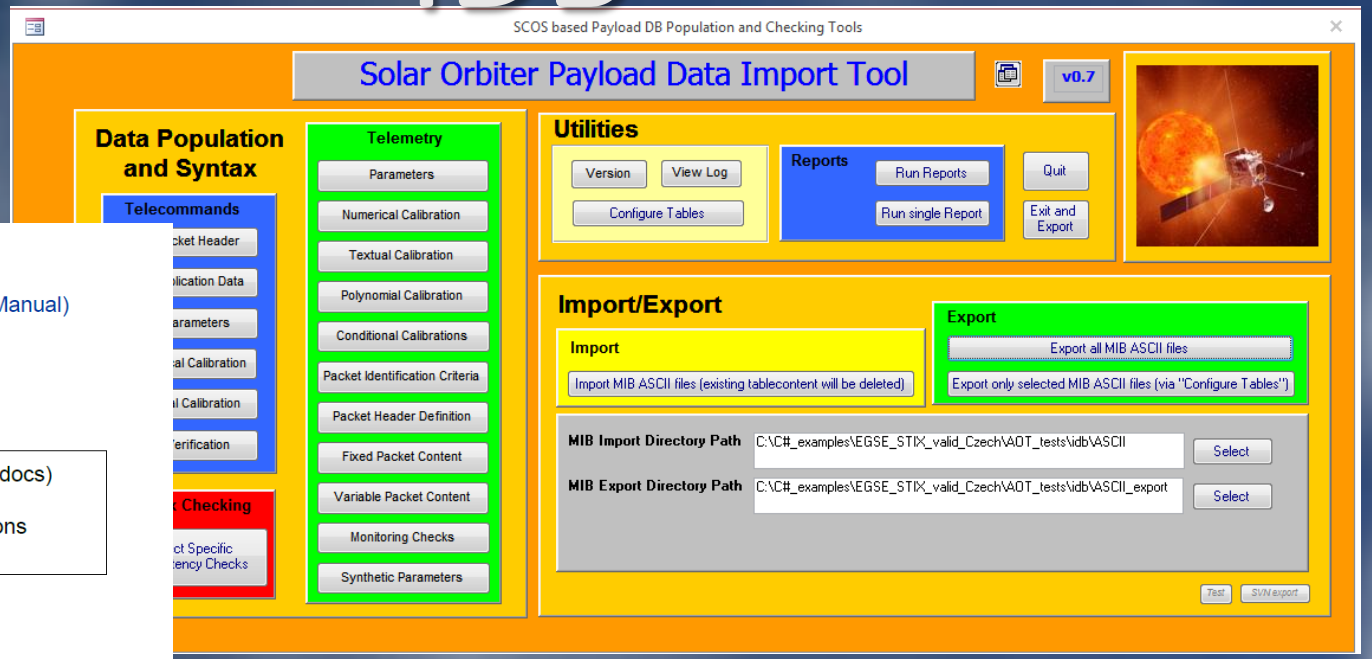


EGSE connecting people



IDB


Inst 1 IDB
Inst 2 IDB
Inst 3 IDB
ASCII tables (.dat)
Access database (.mdb)
TM/TC ICD (can be part of User Manual)
Access database editor
Database consistency checker
ASU
SRDB
Spacecraft
Reference Database
SOL.S.ASTR.xx.xxxx (may be 2 docs)
Mission Specific SRDB ICD
-SO specific naming conventions
-special restrictions
+
ESOC
MIB
Mission
Information Base
(in SCOS2000
MCS)
EGOS-MCS-S2K-ICD-0001
SCOS2000 MIB ICD
- Generic table and field definitions


SCOS based Payload DB Population and Checking Tools
Solar Orbiter Payload Data Import Tool
v0.7
Data Population and Syntax
Telecommands
Checking
Telemetry
Parameters
Numerical Calibration
Textual Calibration
Polynomial Calibration
Conditional Calibrations
Packet Identification Criteria
Packet Header Definition
Fixed Packet Content
Variable Packet Content
Monitoring Checks
Synthetic Parameters
Utilities
Version
View Log
Configure Tables
Reports
Run Reports
Run single Report
Quit
Exit and Export
Import/Export
Import
Import MIB ASCII files (existing tablecontent will be deleted)
Export
Export all MIB ASCII files
Export only selected MIB ASCII files (via "Configure Tables")
MIB Import Directory Path
C:\C#_examples\EGSE_STIX_valid_Czech\AOT_tests\idb\ASCII
Select
MIB Export Directory Path
C:\C#_examples\EGSE_STIX_valid_Czech\AOT_tests\idb\ASCII_export
Select
Test
SVN export

TM/TC

CCSDS Secondary header flag = 0	PUS Version = 1	Ack	Service Type	Service Subtype	Source ID
Boolean	Enumerated	Enumerated	Enumerated	Enumerated	Enumerated
1 bit	3 bits	4 bits	8 bits	8 bits	8 bits

PACKET HEADER (48 bits)							PACKET DATA FIELD
PACKET ID					PACKET SEQUENCE CONTROL		PACKET LENGTH	DATA FIELD HEADER
Version Number = 0	Packet Type =1	Data Field Header Flag	APID		Sequence Flags = 11_{bin}	Sequence Count		
			Process ID	Packet Category				
3	1	1	7	4	2	14		
16					16		16	

<---------- 248 octets max ----------

SOURCE PACKET HEADER (48 bits)							PACKET DATA FIELD (VARIABLE)	
Packet ID				Packet Sequence Control		Packet Length	Data Field Header	Source Data
Version Number =0	Packet Type = 0	Data Field Header Flag	Application Process ID	Segmentation/ Grouping Flags	Source Sequence Count			
3	1	1	11	2	14			
16				16		16	80	Variable

Spare	PUS Version = 1	Spare = 0	Service Type	Service Subtype	Destination ID	S/C Time
1 bit	3 bits	4 bits	8 bits	8 bits	8 bits	48 bits
Fixed bit string	Enumerated	Fixed bit string	Enumerated	Enumerated	Enumerated	Enumerated CUC

Set of TM/TC

SFT - Short functional tests
FFT - Full functional tests

FFT - Full functional tests

- test procedures designed and implemented by STIX team,
- demonstrates the functionallity of the instrument and all of its operational modes,
- performed before the delivery of the instrument to generate reference test data,
- maximal duration is 8 hours,
- planned to run twice after integration to the spacecraft: once before and once after environmental tests campaign

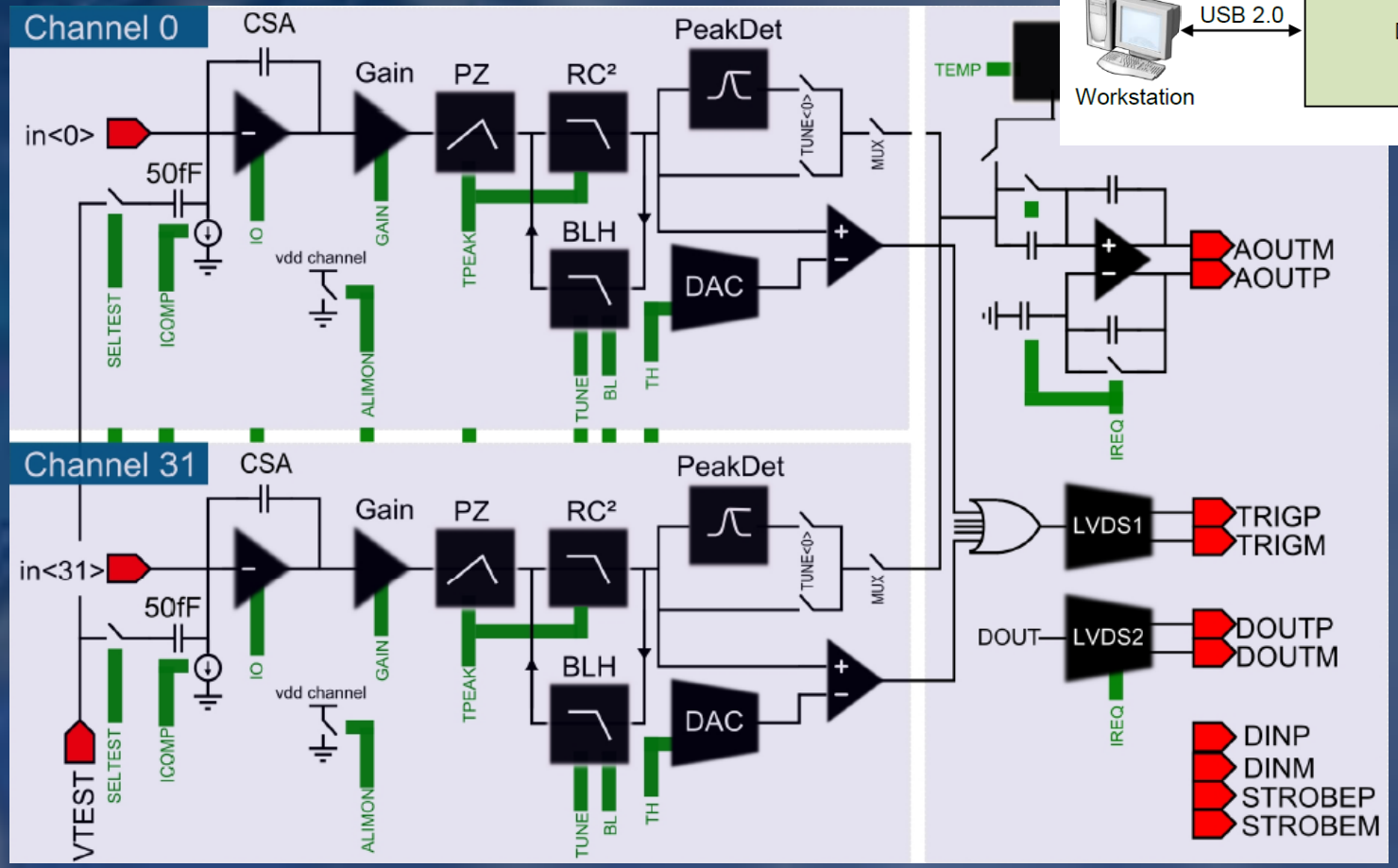
SFT - Full functional tests

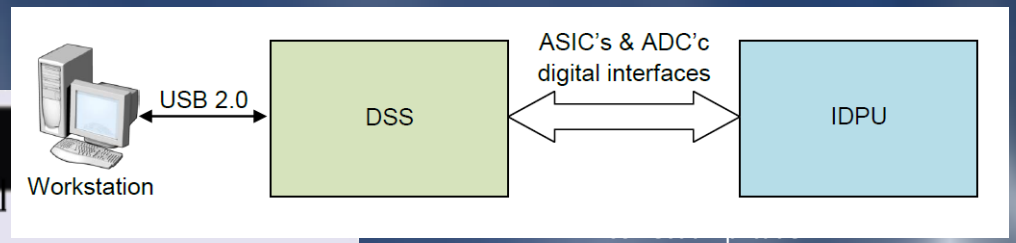
```
// HK telemetry packet -  TM(3,25) SID = 1 (look Table 1)
TM,NIX00004,EQUAL,1
TM,NIX00005,LIMIT,0,1
TM,NIX00006,LIMIT,0,7
TM,NIX00007,LIMIT,0,4
TM,NIX00008,LIMIT,0x018,0x028
TM,NIX00009,LIMIT,0x019,0x029
TM,NIX00010,LIMIT,0x019,0x029
TM,NIX00017,LIMIT,0x059,0x129
TM,NIX000XX,LIMIT,0x059,0x069
TM,NIX00018,LIMIT,0x059,0x079
TM,NIX000XX,LIMIT,0x00000059,0x00000089
TM,NIX000XX,LIMIT,0x00000059,0x00000089
```

```
// SID
// SW running
// Instrument number ??   3 bits
// Instrument mode
// PSU temperature
// IDPU temperature 1
// IDPU temperature 2
// 3.3V current
// 2.5V current        This parameter is absent in IDB.
// 1.5V current
// HW/SW status 1  This parameter is absent in IDB.
// HW/SW status 2  This parameter is absent in IDB.
```

- simplified procedures derived from I-FFT and implemented by STIX team,
- demonstrates the integrity, functionality of the instrument and verifies the command and telemetry paths,
- performed before the delivery of the instrument to generate reference test data,
- maximal duration is 1 hour,
- planned to be performed a number of times at set points as the monitor of health during environmental tests campaign

DSS





correct amplitude
2
Arrival of a second photon in the coinci-dence window
pile-up
one count missed, incorrect amplitude
one count missed, only the greatest amplitude
3
Arrival of a second photon during the readout phase
dead time
missed count
missed count
4
Arrival of a second photon at the end of the readout sequence
partial event
incorrect amplitude
missed count
Table 3-2 The cases of particle detection

IDeF-X HD front–end ASIC architecture. The 32 analog channels with level discrimination stages are connected to a

versity of Alcala, Spain
USA, ESA
ution functions of suprathermal and energetic particles. Scientific topics to be addressed include the sources, acceleration mechanisms, and transport processes of these particles.

United Kingdom

s of the heliospheric magnetic field with high precision. This will facilitate detailed studies into the way the Sun's magnetic field links into space and evolves over the solar cycle; how particles are accelerated the Earth; how the corona and solar wind are heated and accelerated.

ervatoire de Paris, France
Czech Republic, Austria
biter instruments in that it makes both *in situ* and remote-sensing measurements. RPW will measure magnetic and electric fields at high time resolution using a number of sensors/antennas, to determine the waves in the solar wind.

ace Science Laboratory, United Kingdom
Italy, France, USA
uite of sensors that will measure the ion and electron bulk properties (including, density, velocity, and temperature) of the solar wind, thereby characterising the solar wind between 0.28 and 1.4 AU from the f the wind, SWA will provide measurements of solar wind ion composition for key elements (e.g. the C, N, O group and Fe, Si or Mg).

e Liège, Belgium
Kingdom, France, Germany, Switzerland
pheric layers above the photosphere, thereby providing an indispensable link between the solar surface and outer corona that ultimately shapes the characteristics of the interplanetary medium. EUI will also out-of-ecliptic viewpoint (up to 34° of solar latitude during the extended mission phase).

mical Observatory of Turin, Italy
Czech Republic
et and extreme ultraviolet emission of the solar corona and diagnose, with unprecedented temporal coverage and spatial resolution, the structure and dynamics of the full corona in the range from 1.4 to 3.0 num (maximum) perihelion during the nominal mission. This is a region that is crucial in linking the solar atmospheric phenomena to their evolution in the inner heliosphere.

tut für Sonnensystemforschung, Germany
France
rovide high-resolution and full-disc measurements of the photospheric vector magnetic field and line-of-sight (LOS) velocity as well as the continuum intensity in the visible wavelength range. The LOS velocity