DSSC2 Detector Integration

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Outlook

- DSSC detector overview: working principle and geometry
- DSSC2 Integration process:
 - Infrastructure
 - Power system
 - Vacuum system
 - Cooling system and interfacing in vacuum
 - Sensor qualification and installation on a cooling block
 - Detector assembly
 - Commissioning and calibration
 - Tools used



DEPFET Principle

- Non-Linear DEPFET
 - DEPFET Depleted P-channel Field Effect Transistor
 - Detection and amplification of the signal in the same pixel
 - Charges in OR have less effect on FET current
 - Improving CHC of the pixel
 - Capability to cope with both single photon resolution and large DR
 - DSSC: DEPFET Sensor with Signal Compression at sensor level
 - 1 MPx camera with frame rates of up to 4.5 MHz
 - 4 Quadrants, each has four ladders
 - One Quadrant: 2×4 DEPFET sub-sensors (128×256 pixels)
 - 64×64 hexagonal pixels in a sub-sensor are read out by one ASIC
- Applications:
 - Time-resolved X-ray imaging experiment







The DSSC2 Assembly and Integration: Infrastructure

CLEAN ROOM ISO6 (290/m3, >5um particles)

Power system: 4 Full Scale MPOD crates, 80 Cables, 500 Ch.
PLC: Vacuum Pumps, Motors, Chiller, Safety Interlock
Cooling: -20C Operations, piping to clean room.
Timing: C&C and VETO (Trigger based event selection)
Karabo, DAQ and event display: 34 GB/s













Power system acceptance test

- MPODs and Cables have been tested after installation using dedicated test bench
- 2 x HV cables found with malfunction and recovered
- 3 x ISEG HV boards found dead
 - Returned to WIENER for refurbishment









The Vacuum Vessel Acceptance Tests



Scratches on DN450 and DN350 flanges – fixed

Leaks on welding joints of side flanges – rewelding done







Motion stages installation and alignments

- **Diagonal motion stages** installed and precisely aligned
- Encoders installation and alignment
- Limit and collision switches installation and calibration
- Cables vacuum interface
- **RGA** measurement
- Controls (Karabo) implementation
- System commissioning with dummy quadrants



Cooling blocks preparation

- Cleaning
- Deburring
- Tolerances check
- Sniffing leak search













Sensor quality check

- Checks for **impurities**
- Inspect and correct **wire bonds** when applicable
- Detect and document overall sensor quality









Quadrant assembly bench

- Endoscopic cameras for **process monitoring**
- **5-way stage** for precise sensor positioning
- FPMs installation on cooling blocks and inspection
- In-vacuum electronics (RBs, IOB, MIB) installation
- Preliminary functional test
- Quadrant test in ambient conditions: **full power-up**, **FPM**, and **ASIC performance check**

Detector assembly

- Quadrants inserted using dedicated tool
- Vacuum interfaces applied
- Patch Pannels installed
- Cooling and guard vacuum lines installed



Commissioning and Calibration

- System operation and Synchronization studies
- Linear region calibration with Pulsed X-Ray Lab Source (Pulxar)
- Non linear region calibration requires FEL
- ENC<10e, SN ~44









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Phase 2 technical commissioning of sub-systems in DETLAB 10P034-DETOPS-DEPTET					8	1			
Phase 3 Linear gain region calibration measurements in CCTLAD 'DP334 OCTOPS OCPTCT'									
Calibration tests and evaluation "OPIO+ DEFOPS DEPTER*	Owid Lonidze					-			_
Phase 4 Photon Rus measurements in SQS hutch w/o 00PFET-0PI34-00T0PS-00PFET*						-	300		_
Phase 5 Calibration of DCFTET ladder in 505 hatch "DPD34 DCTOPS DCFTET"		_	_	_	_	_	-	_	_

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Contents:

1. Revisions

· 2 Abstract

3. Vacuum and cooling

= 3.2. Cooling down the detector

4.1, DSSC setup for data taking

5. DAQ configuration and data taking

6.1. The DSSC Motion Mechanics.

9 5.1. Taking dark data rums

= 6.2. Operation Instruction

6. DSSC Motion System

4.3. Configuring the detector ASICs

Welcome to DSSC's documentation!

4. Powering ON the DSSC detector and sending data to DAQ.

= 4.2. Switching ON the in-vacuum electronics up to ASICs

= 3.1. Checking if the detector is in vacuum and at room temperature

= 4.4. Powering up the source voltages and the high voltage channels

6.1.1. Understanding Opening and Closing the aperture

6.2.1. Powering and restartting encoders and motors
 6.2.2. Opening motion system log file

0	Karabe deployments "DP034 DETOPS DEPTET"	Andrea Parenti	ļ
0	Order technical communication (initial remote viewing webcam if needed) "DPDH DC10PS DCPFC1"	Vasili Batherev	1
0	Beckholf PLC I/w loop generation and texting "DPD/4 DE10PS DEPTER"	Leandro Zanellatto	Į
0	Timing and CBC technical commissioning "DPD34 DCTOPS DCPFC1"	Patrick Gesaler	Į
0	Commissioning nexts of PastSDD s/w and h/w 10P034 DE10PS DEPFET ¹	Cyrit Danilavski	
0	Karabo DEPTET control device development and technical commissioning (support DET = DPS) "DPD14 DETOPS DDI	Andrey Samartsev	
0	Karabo GenericPower device, configuration and technical commissioning. '04934 DETOPS DEPTER'	Astrid Muesnich	
0	Deckholf PLC technical commissioning DEPFET (same as DSSC) (/w loop *0P034 DETOPS DEPFET*	Leandro Zanellatto	
0	0AQ technical commissioning "DPQ34 DETOPS DEPYET"	Djellout Doukhelef	

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Abstract

Vocuum and cooling

Powering ON the DSSC detector and ending data to DAQ

1. DAQ configuration and data taking

DSSC Motion System
 Powering OFF the DSSC detector

Troubleshooting

DSSC configuration files for SCS intrament

10. DSSC configuration files for the

QS instrument

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2. SCS Expert Sketup

Tools used in Implementation Process

- Two PMO projects
- Regular meetings (Internal, Consortium, DAC)
- Redmine system: Project planning and ticketing
 - Tasks breakdown and critical paths identification
 - Progress monitoring
- Documentation: E-logs, Alfresco, XIM, Alfresco.

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194	27 Jan 2025, 18:06	ligor Antovski	Routine	Other	OSSC2 Copper block Q2/Q4 SEC00995853 packed and moved from 80.102 test stand to the share to the share to the share to the share to the	COBCJ Opper Next SJCG (2009)0000000 was tak tak 55 MD pressurely Adabbat Terri segan construction Apaliti packed				
193	24 Jan 2025, 17:45	Ampad Natir	Installation	Detector cabling	Cable Amangement In the Clean Room for	Notation from				

Thanks for you attention!

