# WP Monitoring & Services

NectarCAM Progress Meeting, 6 & 7 April 2021

# WP Monitoring & Services: Agenda

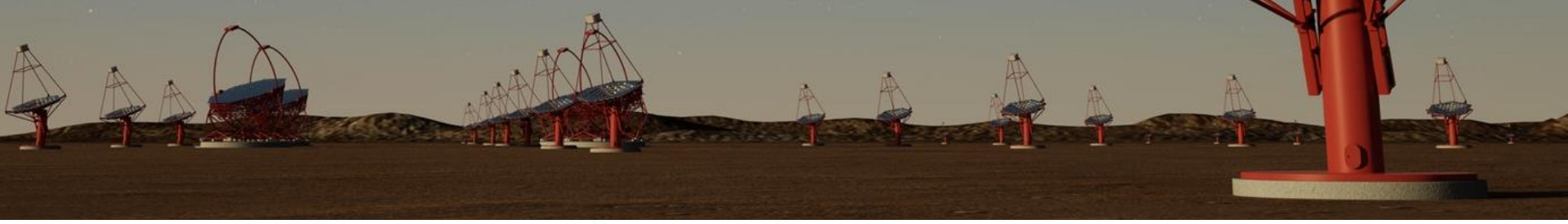
- Power Supply Box (PSB) } Oscar Blanch (IFAE)
- Power Distribution Box (PDB)
- Embedded Camera Controller (ECC) } Julie Prast (LAPP)

- Progress status
- Main CDMR outcomes for our WP
- Draft schedule for the production of the next 4 cameras

# WP Monitoring & Services
# Power Distribution/Supply Box

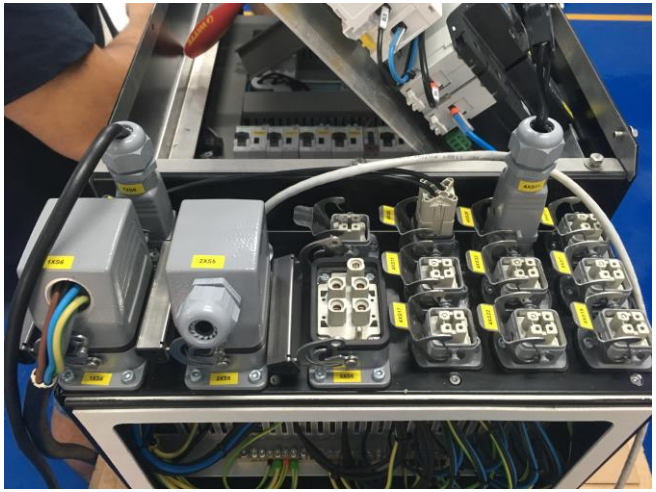
NectarCAM, Remote, 6-7 April 2021

*Oscar Blanch, Laia Cardiel (IFAE), Oscar Ferreira (LLR) + LAPP*



# Power Distribution/Suply Box : Agenda

- Progress Status - Activities
- Main CDMR outcomes
- Draft schedule for the production of the next 4 cameras



# Status Report - Activities

Requested Improvements respect to PDB/PSB at Adlershof

- Power Supply Box:  No changes requested

- Power Distribution Box
  - Remote Control Trigger Crate Power
  - Improve Emergency Stop
  - Improve cold start of the PDB
  - Improve the module that protects for input voltages
  - Improve the communication lost recovery
  - Add an additional 230V output rated for 4A

# Status Report - Activities

## Documentation and preparation of the NectarCAM CDR (PDB)

| Type | Name | Description | Modified | Modified By | Document reference |
|---|---|---|---|---|---|
| | ProgramPDBUpdate | Procedure to exchange PLC program in PDB | 04/02/2021 12:52 | Oscar.Blanch-Bigas | LMST-CAM-PR-0350-IFAE |
| | PDB_Memory_Map | | 04/02/2021 11:46 | Oscar.Blanch-Bigas | LMST-CAM-ICD-0345-IFAE |
| | PowerDistributionBox-v3.6 | Power Distribution Box Description | 04/02/2021 11:42 | Oscar.Blanch-Bigas | |
| | LMST-CAM-LI-0351-IFAE_PDB_BoM | | 04/02/2021 00:09 | Oscar.Blanch-Bigas | LMST-CAM-LI-0351-IFAE |
| | MST-CAM-RP-0525-IFAE_NectarCAM-PDB-02_BoM | | 04/02/2021 00:07 | Oscar.Blanch-Bigas | |
| | MST-CAM-RP-0524-IFAE_NectarCAM-PDB-02_QC | Quality Control for NectarCAM-PDB-02 | 03/02/2021 22:58 | Oscar.Blanch-Bigas | |
| | LMST-CAM-TP-0347-IFAE_PDB_QC | PDB Quality Control | 03/02/2021 22:49 | Oscar.Blanch-Bigas | LMST-CAM-TP-0347-IFAE |
| | ElectricSchematicsPDB_January2021 | Electric scheme of Power Distribution Box for LST2-4 and Nectar Demonstrator | 03/02/2021 22:41 | Oscar.Blanch-Bigas | |
| | LMST-CAM-ED-0514-IFAE_PDB_ElectricalSchemesV2 | NectarCAM PDB Electrical Scheme V2 | 03/12/2020 16:41 | Julie Prast | |
| | MST-CAM-MD-0412-LLR-0502-PDB_Cabinet_Manufacturing_Files | PDB Cabinet Mechanical Drawings | 22/10/2020 06:31 | Julie Prast | |
| | LMST-CAM-JF-0453-IFAE_PDB_PerformanceVerification | PDB Performance Verification | 15/10/2020 21:04 | Oscar.Blanch-Bigas | |
| | LMST-CAM-DF-0352-IFAE_PDB_Configuration-V0.1 | PDB Configuration File | 30/04/2020 17:44 | Oscar.Blanch-Bigas | LMST-CAM-DF-0352-IFAE |
| | PowerDistributionBox-v3.5 | Power Distribution Box Description | 30/04/2020 17:09 | Oscar.Blanch-Bigas | LMST-CAM-TN-0156-IFAE |
| | LMST-CAM-ICD-0346-IFAE_PLC_MODBUS_Interface | PLC MODBUS Interface | 30/04/2020 16:59 | Oscar.Blanch-Bigas | LMST-CAM-ICD-0346-IFAE |
| | LMST-CAM-UM-0348-IFAE_PDB_user_manual | PDB_user_manual | 30/04/2020 16:03 | Oscar.Blanch-Bigas | LMST-CAM-UM-0348-IFAE |
| | IpPDBChange | Procedure to exchange IP of PDB | 30/04/2020 10:01 | Oscar.Blanch-Bigas | LMST-CAM-PR-0349-IFAE |
| | EN-T61-CEA 23-08-2018 | NCAM PDB Schematics | 30/04/2020 07:11 | Oscar.Blanch-Bigas | MAES_EN-T61-CEA |
| | PDB_PLC_MEMORY_MAP | | 29/04/2020 11:14 | Oscar.Blanch-Bigas | |

# Status Report - Activities

## Documentation and preparation of the NectarCAM CDR (PSB)

| Type | Name | Description | Modified | Modified By | Document reference |
|---|---|---|---|---|---|
| | MST-CAM-DF-344-IFAE_PSB_Configuration | | 18/03/2021 23:53 | Oscar.Blanch-Bigas | MST-CAM-DF-344-IFAE |
| | LMST-CAM-TP-0343-IFAE_Test_Procedure_for_PSB | Test Procedure for PSB | 18/03/2021 23:33 | Oscar.Blanch-Bigas | LMST-CAM-TP-0343-IFA |
| | MST-CAM-MD-0428-LLR-0501-PSB_Cabinet_Manufacturing_Files | PSB Cabinet Mechanical Drawings | 22/10/2020 06:32 | Julie Prast | |
| | LMST-CAM-JF-0452-IFAE_PSB_PerformanceVerification | PSB Performance Verification | 15/10/2020 20:58 | Oscar.Blanch-Bigas | |
| | LMST-CAM-TN-0209-IFAE | Power Supply Box Description | 05/10/2020 15:34 | Oscar.Blanch-Bigas | |
| | PDB_Memory_Map | PDB Memory Map | 29/04/2020 11:14 | Oscar.Blanch-Bigas | |
| | psb_v0r4 | Power Supply Box Description | 29/04/2020 08:39 | Oscar.Blanch-Bigas | LMST-CAM-TN-209-IFAE |
| | LMST-CAM-TN-0342-IFAE_PSB_Assembly_Guide | PSB Assembly Guide | 29/04/2020 08:23 | Oscar.Blanch-Bigas | |
| | LMST-CAM-UM-0338-IFAE_PSB_user_manual.docx | PSB User Manual | 28/04/2020 23:55 | Oscar.Blanch-Bigas | LMST-CAM-UM-0338-IFAE |
| | 20180621_PSB Bill of Materials | PSB BOM | 28/04/2020 23:30 | Oscar.Blanch-Bigas | |
| | LMST-CAM-LI-0341-IFAE_PSB_BoM | PSB Bill of Materials | 28/04/2020 23:29 | Oscar.Blanch-Bigas | |
| | LMST-CAM-ED-0336-IFAE_PSB_Schematic_v4r3 | PSB Schematic | 28/04/2020 09:56 | Oscar.Blanch-Bigas | LMST-CAM-ED-0336-IFAE |

# Status Report - Activities

Hardware Production - PDB

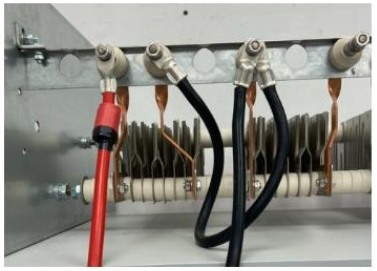
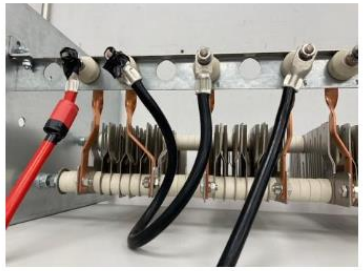
- Produced by MAES
- Cabinets provided by LLLR
- All Changes implemented
- QC done at MAES workshop by IFAE
- Interface with ECC validated at LAPP
- Delivered to AIV team

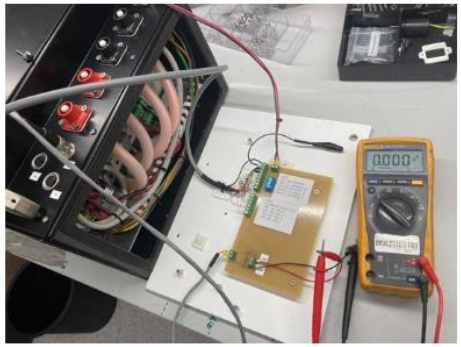
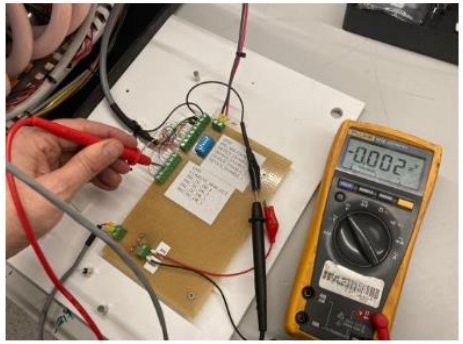
ADP and REACh documentation missing

# Status Report - Activities

Hardware Production - PSB

- 2 more PSB assembled at IFAE
- Components bought by LAPP
  - Also for next PSBs (stored at IFAE)
- Cabinets provided by LLR
- QC done at IFAE
- Interface with ECC validated at LAPP
  - Non-Conformity tracked to not well defined interface, already solved
- Delivered to AIV team

ADP and REACh documentation missing

# Main CDMR outcomes for PDB & PSB

| # | Priority | Subject | Assigned To | Comp | Action |
|---|---|---|---|---|---|
| 42329 | High | Missing camera safety system | GALDEMARD Philippe | ECC, PDB | Complete the work needed to demonstrate conformance with applicable EU Directives with the support of the CTAO Product Safety engineer |
| 41808 | Normal | DD164_MST-CAM-DF-344-IFAE_PSB_Configuration: missing document version numbers; missing files | Oscar Blanch | PSB | Check & finalise PSB CIDL |
| 41809 | Normal | DD176_LMST-CAM-DF-0352-IFAE_PDB_Configuration-V0.1: | Oscar Blanch | PDB | Check & finalise PSB CIDL |
| 42365 | Normal | DD153 - PSB Performance Verification | Oscar Blanch | PSB | Modify document |
| 42400 | Normal | DD168 - PLC Modbus Interface | Oscar Blanch | PDB | Complete ICD |
| 42508 | Normal | DD174 Procedure to ex-change IP of PDB | Prast Julie | PDB | Modify document |
| 42509 | Normal | DD175 Procedure to exchange PLC program in PDB | Prast Julie | PDB | Modify document |
| 42844 | Normal | DD133 MST Requirements Verification matrix for WP Monitoring & Services | Prast Julie | WP | Review wording of requirements |
| 42851 | Normal | DD153 PSB Performance Verification | Oscar Blanch | PSB | Address the verification of each requirement separately |
| 42852 | Normal | DD166 PDB Performance Verification | Oscar Blanch | PDB | Address the verification of each requirement separately |

- 10 non closed RIX related to PDB/PSB
- Basically all related to (small) documentation modifications
- 1+1 on performance verification
- 1 related to safety standards which mis be discussed with CTAO Safety Engineer

# Draft schedule for the production of next 4 cameras

| When | PSB | PDB |
|---|---|---|
| **ASAP** | 1 PSB (remaining cabinet) | |
| **Q1 2022** | NCAM spare PSB (1 right + left) | 1 PDB |
| **April 2022** | NCAM2 PSB (1 right + 1 left) | 1 PDB |
| **August 2022** | NCAM3 PSB (1 right + 1 left) | 1 PDB |
| **October 2022** | NCAM4 PSB (1 right + 1 left) | 1 PDB |
| **December 2022** | NCAM5 PSB (1 right + 1 left) | 1 PDB |

But no funding available (neither man power) for the moment

- Many possibilities investigated: none successful, many already discarded

# Conclusions

- PDB and PSB for the First camera delivered to the AIV site
- PDB improved after feedback from Adlershof
- Major effort on documentation for the CDR, ADP and REACh documentation missing
- Some documentation to be updated according to CDMR RIXs, but nothing directly related to production
- For the next cameras, clear schedule but not resources available

# Backup

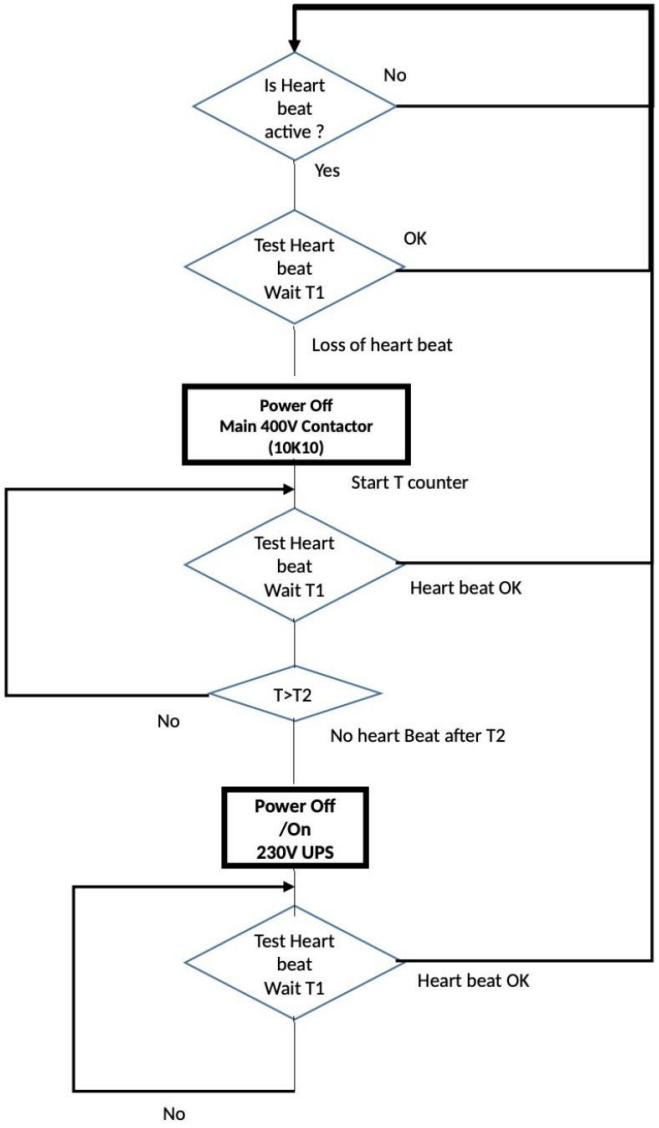
# Change Requests for Power Distribution Box

## Introduction

From the experience of the Power Distribution Box (PDB) mounted in the partially instrumented NectarCam and tested in Alderhof, some modifications are suggested for the PDB to be used in the NectarCam demonstrator. The list of suggested modifications are:

- Add remote control for the trigger crate power
- Improve the emergency stop system
- Improve the cold start of the PDB
- Improve the module that protects for abnormal input voltages
- Improve the communication lost recovery
- Add and additional 230V output rated for 4A if possible

# Status Report - Activities



# WP Monitoring & Services

NectarCAM Progress Meeting, 6 & 7 April 2021

Julie Prast for the LAPP team

# ECC Summary & Agenda

- Common component between NectarCAM and LSTCAM.
- Last 12 months focused on:
  - Preparation of the NectarCAM CDMR
  - Development of a production hardware and software
    - Optimized for manufacturing efficiency, reliability & maintainability,
    - Based on feedback from LST1 commissioning and Adlershöf Campaign

- Team: Sami Caroff, Armand Fiasson, Nadia Fouque, Isabelle Mievre, Jean-Luc Panazol, Julie Prast (LAPP)

**Talk Agenda (ECC part)**

- Progress status
  - Software
  - Hardware
  - Production
- Main CDMR outcomes
- Draft schedule for the production of the next 4 cameras

# Finalization of Production Software

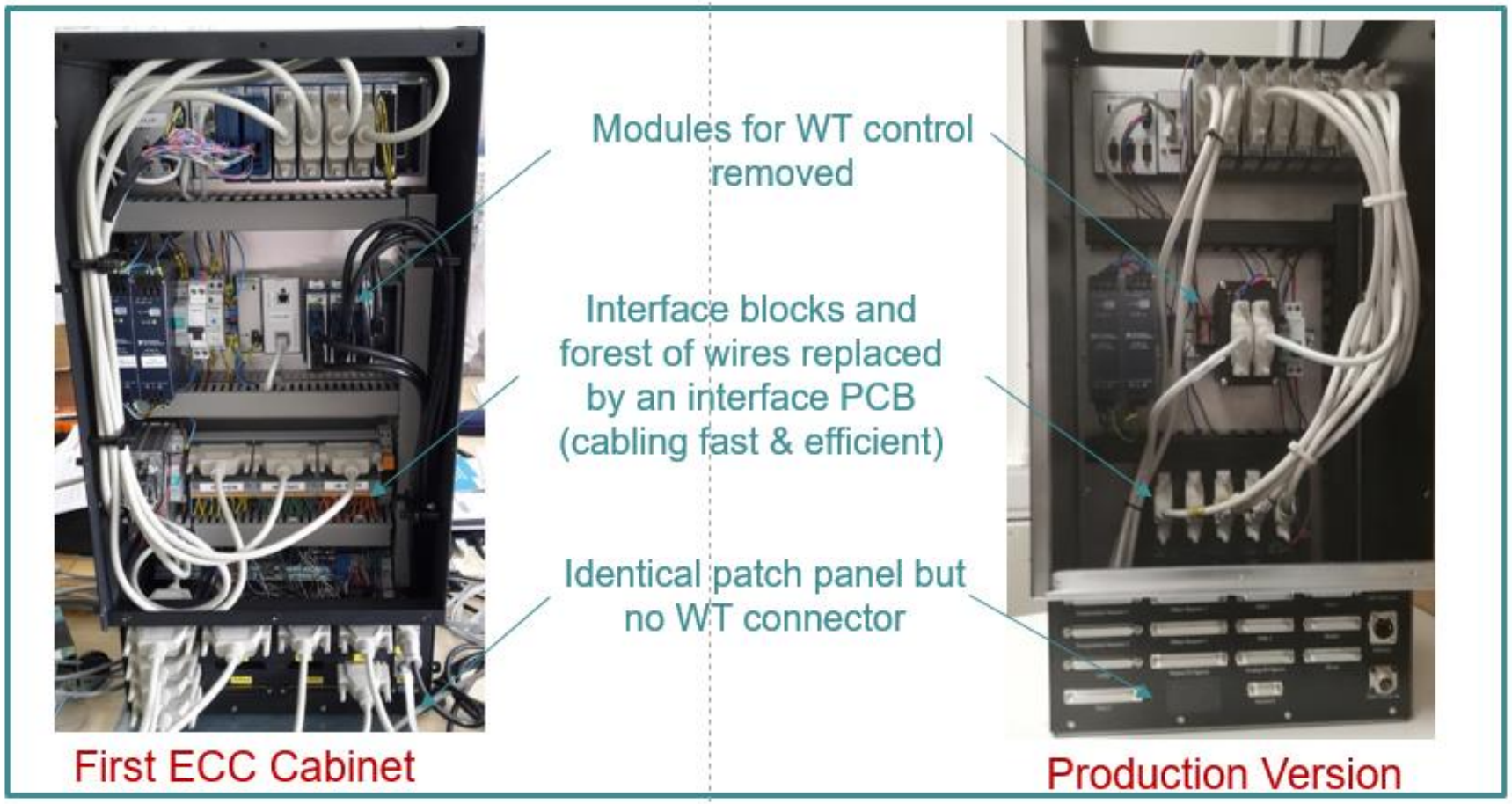
- Completely new version of code
  - Based on current validated ECC features
  - New architecture, more compact and better structured
  - Integrates most of the various review recommendations (CTA, LST, NectarCAM, IN2P3, …)
  - Based on LabVIEW 2018

- Additional features:
  - State machine transitions improved
  - Alarm handling & identification improved
  - Additional monitoring info (ongoing methods, CPU load, ECC versions, debug…)
  - Additional parameters accessible in the configuration file
  - Updated chiller & shutter interfaces
  - Additional sensor & actuator interfaces

- Feb 2020: First release installed at IRFU
- **Feb 2021 : release of ECC Software V5.0**
  - Integrates all functionalities discussed
  - Delivered inside production cabinets
  - Common code between LST & NectarCAM with dedicated configuration
  - Extensively tested @ LAPP

# Production Hardware

- Optimization of the ECC cabinet for manufacturing
- Development of an Interface Board to replace most of the internal cables
- White Target (WT) control removed



# ECC Production

- Production of Electronics Boards
  - 25 Interface boards
  - 20 additional LED controllers (for a total of 25)

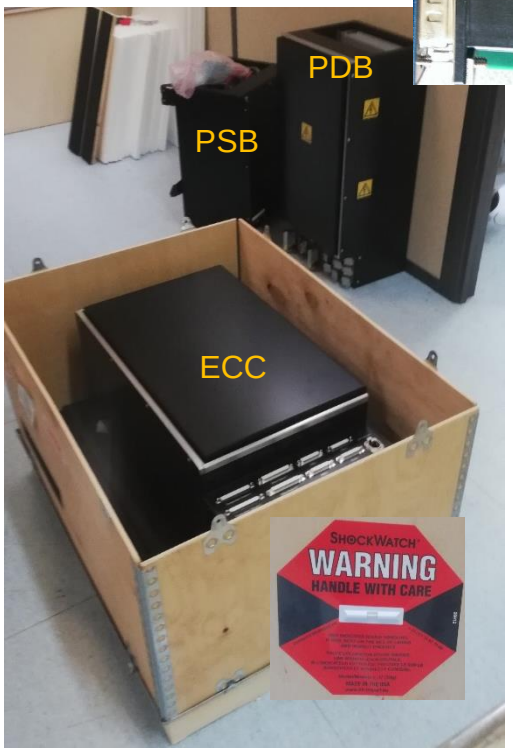
=> Should cover NectarCAM & LST needs

Interface Board


LED Controller

- Production of NectarCAM1 ECC cabinet.
  - Tested with the NectarCAM1 two-PSBs and PDB to validate interfaces
  - Delivery of the 4 cabinets to the AIV team in March 2021
  - Delivered with associated Acceptance Delivery Package (ADP).

- Production for LST running in parallel
  - LST2-3 ECC delivered end of February
  - LST4 ECC assembled, under test
  - LST spare cabinet + LST engineering model in preparation




Ready for departure

# Main CDMR outcomes for ECC

| # | Priority | Subject | Assigned To | Comp | Action |
|---|---|---|---|---|---|
| 42329 | High | Missing camera safety system | GALDEMARD Philippe | ECC, PDB | Complete the work needed to demonstrate conformance with applicable EU Directives with the support of the CTAO Product Safety engineer |
| 42438 | Normal | DD147 - ECC test plan - General Issues | Nadia Fouque | ECC | Complete manual |
| 42439 | Normal | DD147 ECC test plan - Specific Issues | Nadia Fouque | ECC | Complete manual |
| 42440 | Normal | DD148 - ECC OPCUA Method Test Results | Nadia Fouque | ECC | Modify document |
| 42441 | Normal | DD149 - ECC Test Results | Nadia Fouque | ECC | Modify document |
| 42458 | Normal | Comments on DD130_MST-CAM-TN-0050-Slow_control_LST-Nectar_Cameras-V2.6.pdf | Prast Julie | ECC | Modify document |
| 42459 | Normal | Comments on DD131_LMST-CAM-0383_ECC_V4.0_SW_Documentation_V2.1.pdf | JL Panazol | ECC | Modify document |
| 42460 | Normal | Comments on DD150_LMST-CAM-TN-0248-LAPP_UserDocumentECC-V2.2.pdf | Prast Julie | ECC | Tell CTAO that Doc replaced by n°383 (DD131). |
| 42520 | Normal | Maximum altitude | Nadia Fouque | ECC | Search new reference for 2 components specified until 2000m |
| 42583 | Normal | Terms in French | Pruteanu George | ECC | Terms in French in electrical schemes |
| 42844 | Normal | DD133 MST Requirements Verification matrix for WP Monitoring & Services | Prast Julie | WP | Review wording of requirements |
| 42846 | Normal | DD134 ECC Performance Verification | Prast Julie | ECC | Address the verification of each requirement separately |
| 42849 | Normal | DD147 ECC Test Plan | Nadia Fouque | ECC | Modify document |

- 22 non closed RIX assigned to the WP (12 related to ECC)
- Most related to documentation modification requests
- 1 concerns components specified until 2000m
- 1 related to safety certification (High priority) which must be discussed with the CTAO Safety Engineer

# Draft schedule for the production of the next 4 cameras

- ECC Cabinets delivered up to now were cabled internally
- Plan for further production is the tendering process
- First discussion started with administrative staff
- LAPP perimeter redefined within NectarCAM:
  - Full production of the ECC cabinet (with all the internal parts including the LED controller)
  - Mechanical cabinet could be part of the envelop (TBC)
  - Positioning LEDs, cabling, attenuation filter, mechanical support: CENBG
  - Camera sensors and associated cabling : IRFU

- Production of NectarCAM Spare + NectarCAM2-5 ECC (5 cabinets) are expected to be delivered between Q1 & December 2022 (respectively Q1, April, August, October, December).
  - ⇒ Signature of the tendering process in September 2021
  - ⇒ Tendering process content ready in June 2021
  - ⇒ Funds available in September 2021 (20k€/cabinet)
  - ⇒ Tendering for 5 cabinets + options for NectarCAM6-7 and NectarCAM 8-9
  - ⇒ Option for LST5-8 to be discussed

# Conclusion (ECC part)

- Last 12 months were focused on the development of a production hardware and software + CDMR preparation
- NectarCAM1 ECC delivered end of March to IRFU
  - Extensively tested at LAPP, including PSB & PDB interfaces
  - Delivered with Software V5.0 release and ADP
- CDMR:
  - Major effort to prepare the necessary documentation
  - Precious help of our local quality engineer

- To come
  - CDMR RIX closure
  - Preparation of the tendering process
  - Update of Tower66 cabinet (date ?)

# Questions ?