NectarCAM

Mechanical WP

Progress Meeting / 2021-04-06

Outline

- **Feedback from the Critical Design Review**
- **Status of NectarCAM 1 Mechanical Structure**
- **Production of mechanical structures and windows for cameras #2 to #5**
- **Final remarks / conclusion**

Review Critical items - Mass

- **Camera mass**
  - NectarCAM #1 mass is not compliant with the MST structure / Camera ICD
    - Limit is 2 tons – expected mass is around 2.3 tons
    - Problem for MST structure at CTA-S in case of seismic load

- **Mitigation plan**
  - Overweight authorized for NectarCAM #1, qualification camera, installed at CTA-N
  - Weight reduction for production cameras: target weight to be agreed with MST Structure team
  - Options for weight reduction, expecting around 150 kg
    - Module Holder : reduce thickness of front plate
    - Camera housing: reduce the thickness of the GFRP skins of the sandwich panels
    - Camera window: reduce the thickness of the shutter frame panels
    - Optimize the design of mechanical components

Review Critical items - Shutter

- **Compliance of the Nectar camera shutter with the CTA wind requirements has not been proven**

- **Mitigation plan**
  - Proposal of NectarCAM to follow EN standards to verify and qualify the shutter (EN 13659:2015 - Shutters and external venetian blinds - Performance requirements including safety)
    - Allows to translate the wind speeds into mechanical load that can be applied on the shutter to check its strength
  - Shutter will be tested by CENBG team based on the standard
    - In house preliminary test for a quick feedback
    - Then test by a certified institute for an official resistance level of the shutter
  - Unclear from the review committee report if a class of resistance based on the EN standard is enough

- **Backup option**
  - Add a ground wind protection in front of the camera when in park position
    - Can be common system for NectarCAM and FlashCAM
    - Has to be designed, fabricated and tested: cannot be available for NCAM #1

CDR – Non critical

- **Update/Improve documentation**
  - Mainly maintenance and repair procedures
    - Very preliminary documents were submitted to the review committee
  - Missing information in the design documents
    - Will be updated…eventually
  - Request for additional structural analysis
    - Concerns non structural components, but still has to be done

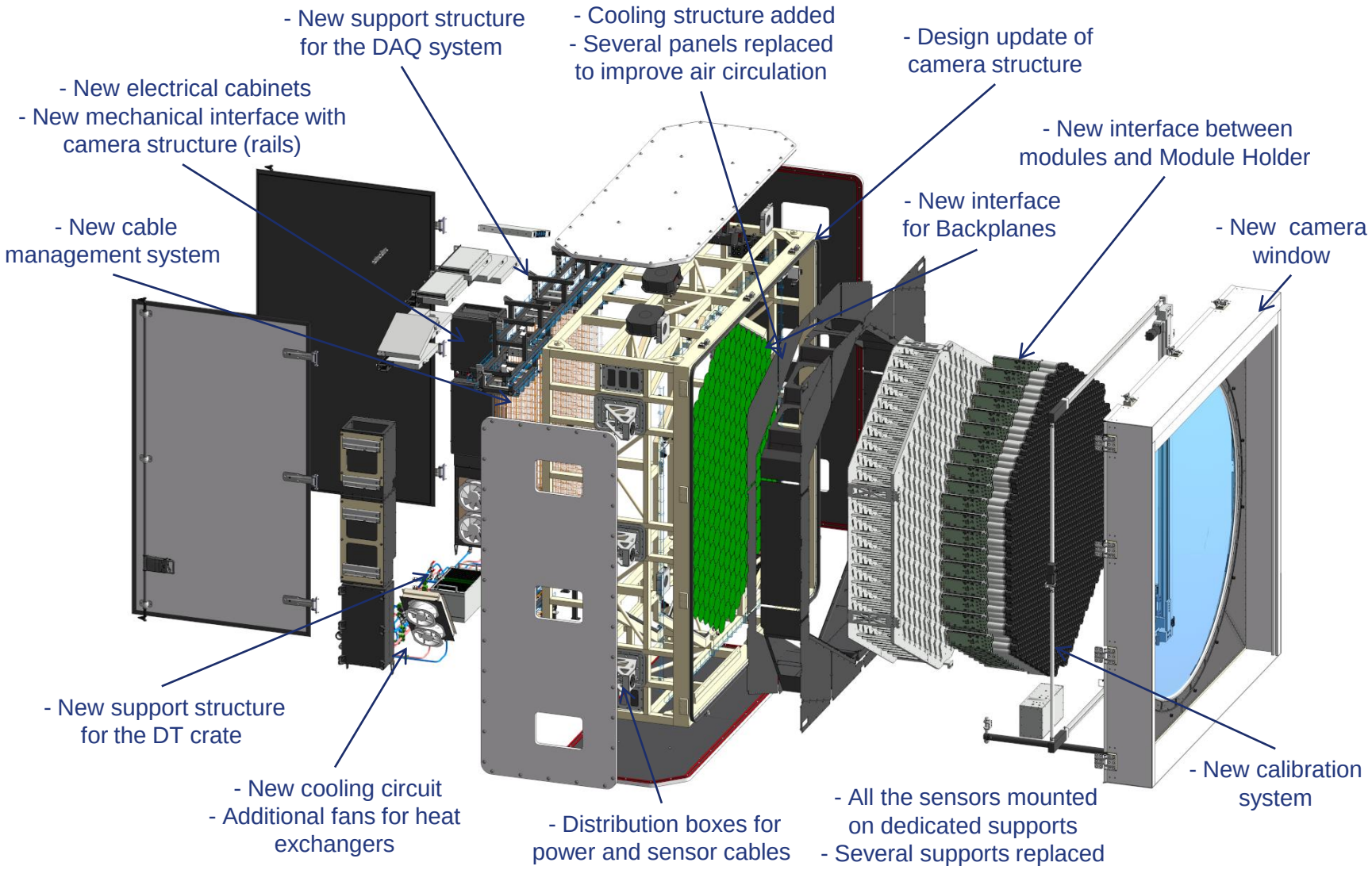
- **Incomplete / Missing interfaces in the ICD between the camera and the telescope**
  - Alignment of the camera focal plane
  - Tolerances on the position of the camera mounting holes

- **Performance of the camera cooling system has to be proven by test**
  - Temperature sensitivity of the signal acquisition and processing chain needs to be measured

NectarCAM 1 Status

- **Slow mechanical integration process since the test campaign on the MST prototype telescope**
  - Almost all the mechanical components of the camera structure have been modified or replaced
  - NCAM 1 is a prototype with trials and errors. As assembly progresses:
    - Problems are being fixed
    - Improvements are being made
    - Parts are being redesigned and fabricated
- **But mechanical assembly is now close to be complete and mounting of sub-systems is about to start**
- **Still a couple of missing mechanical components**
  - Sandwich panel to access the sensors and the valves of the cooling circuit (panel below the rear doors)
    - Drawings sent for quotation
  - Protection for patch panel connectors and support for cables and hoses
    - Drawings are ready
  - Front door hinges
    - Design and stress analysis still ongoing

NCAM 1 Changes



Production

- **Agreement with AIV team to minimize the amount of mechanical assembly at integration facility**
  - Camera structures will be delivered with an assembly level similar to the current state of NectarCAM 1
  - The cooling system is in place (heat exchangers and fans)
  - All the mounting holes for the sub-systems are prepared

- **Tasks left for AIV**
  - Attach the electrical cabinets
  - Install the Ethernet switches, TIB and UCTS boxes, the DTC crate
  - Attach the camera sensors
  - Attach the Backplanes and insert the Nectar Modules
  - Route the cables

- **More complex assembly to be managed by the sub-contractor**
  - Need to target company with experience in integration, not just mechanical fabrication
  - Additional documentation needs to be prepared for the call for tender

Production

- **Preparation of the tendering process**
  - European call for tender
  - Not directly managed by the lab but by the institute CNRS
  - Typically a 6 months process from the publication of the call for tender to the signature of the contract

- **Preparation of the documents**
  - Engineering drawing
    - Ready, except for a couple of assembly drawings
    - Have to be reviewed before the fabrication starts but can be done as the bidding process runs
  - Specifications for all the main camera structure components
    - Still significant amount of work to be done
    - Documents have to be ready to start the tendering process
  - Assembly procedures
    - Only a couple of very preliminary documents are available
    - Can probably wait for the beginning of the fabrication

Production schedule

- **Expecting similar schedule for camera structures (managed by LLR) and camera windows (managed by CENBG)**
- **Around 6 months between the start of the contract and the delivery of the first camera structure / window to AIV**
- **Production rate of one camera structure / window every 3 month**

Production schedule – Camera Structure

- **Completion of the documentation _____ June 2021**
- **Start the call for tender process _____ June 2021**
- **Selection of the contractor _____ December 2021**
- **Delivery of camera structure to #2 to AIV _____ June 2022**
- **Delivery of the Camera structure #3 _____ September 2022**
- **Delivery of the Camera structure #4 _____ December 2022**
- **Delivery of the Camera structure #5 _____ March 2023**

Final remarks

- **Still a bit of work to finish the mechanical assembly of NectarCAM #1 but integration of electronics and sub-systems is about to start**

- **Production of mechanical structures for next cameras will be done with a high level of mechanical integration**
  - More complex documentation has to be prepared
  - Allocated budget is likely to be short
  - Delivery of the first camera will probably be late
  - But integration at AIV facility should be easy and fast (expecting to recover the delivery delay)

- **Mech. WP expects to know how many camera structures will have to be produced before the call for tender starts**