FLY EYES

Fiber Assembly specification

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Pascal Puget
1 Scope

This document will present a general view of the fiber assembly for the Fly Eyes project, defining what are the specifications for FlyEyes but also the final goal, which is what will be needed for PueoNui, allowing people developing the technology to verify if every techniques used are usable for PueoNui.

2 PueoNui needs

PueoNui will use 2 CCD-35 integrated in the same cryostat (the cryostat is ready to use now) using around 64 sub-aperture each. Two independent bundles of fibers arrive from outside the cryostat through 2 independent vacuum feedthroughs.

Each Vgroove/fibers assembly is mounted in front of each CCD by means of a mechanical system allowing adjusting precisely the fiber pattern with the lines and columns of the CCD. No adjustment is planned for the focus; the mechanical accuracy of all parts shall guarantee the positioning with the requested accuracy (around +/- 20 µm).

The bundle of fibers outside the feedthrough shall be integrated in a flexible but enough strong jacket avoiding damaging the fibers.

3 Scheme of PueoNui Vgroove/fiber assembly 80 fibers

Each Vgroove is aligned onto the lines of the CCD the corresponding pith is 550 µm with 9 fibers, as the pile of up to 10 Vgrooves is along the columns the thickness of the Vgroove associated with the depth of the groove will lead to a pitch of 360 µm matching the pitch of the macropixels of the CCD.

The distance between the extremity of the fiber and the CCD 450µm TBC should be acceptable in term of assembly and guarantee that each fiber illuminates only one macropixels 360x360 µm².
4 FlyEyes needs

FlyEyes will use the PueNui cryostat equipped with the 2 CCD-35, but will need only the 19 sub-apertures used with Pueo, so only one Vgroove/fiber assembly is needed, with enough fiber in order to:
- be able to work as Pueo, but with some possibility of redundancy (as usual 10\% or \(n^{1/2}\)) which means at least 5 spare fibers.
- Test the accuracy of our mounting in adjustment over the whole array (for examples with one fiber at each corner (4 more fibers).

7 lines with 5 or 6 fibers by line may constitute the FlyEyes Vgroove/fiber assembly.
The techniques used for the vacuum feedthroughs as well as for the connectors mount should be directly applicable for PueoNui: 2 bundles of 80 fibers (including spares).

5 Assembly procedure

After some preliminary exchanges with Laurent Jocou from Grenoble I would propose the following procedure for the complete assembly of a bundle of fibers with connectors at one end, vacuum feedthrough and fiber/Vgroove block ready to install in the adjustable mount in front of the CCD.

5.1 Specification for the FlyEyes test assembly

The precise dimensions and relative positions of the different elements are not yet defined but the following ones may be considered, if needed we may reconsider it to solve some technical issues:

- Number of fibers 40
- 7 lines (7 Vgrooves + lid) each line 5 or 6 fibers
- Overall length of the fibers 1m
- Distance feedthrough/Vgroove block 200 mm (part inside the cryostat naked fibers)
- The fiber may go 200 µm out of the Vgroove block with an accuracy of +/- 10 µm
- The Vgrooves shall be aligned with an accuracy of +/- 5 µm
- Connectors: SMA

The vacuum feedthrough should be typically a 25 mm square plate with standard O ring.

5.2 Proposed procedure for the assembly

It is more a guideline to be discussed, and after preliminary tests the “real” procedure will be finalized.
- Fibers are cut at the overall length and outside jacket is stripped on 10mm.
- Vgroove are populated one by one under binocular
  - each fiber is maintained in front of the Vgroove by means of lightly adhesive tape
  - after adjustment in length the fiber is maintained in place by a silicon retainer
  - when the 6 (or 8) fibers are in place they are glued by capillarity with Epotek 301
  - when glue is properly cured the silicon retainer may be “easily” removed
    and we obtain a Vgroove populated with his fibers

- we may now assemble the Vgroove in a mounting package which define the alignment between Vgrooves and allow to glue all together.
- A “pure” mechanical assembly is also possible; in that case the reference surface to use shall probably be the rear one, as we have some risk of interferences with the bondings above the CCD.
- The bundle of fibers may be protected by a light jacket (vacuum compatible).
- The fibers may be passed through the vacuum feedthrough plate and glued probably with under vacuum curing in order to avoid any risk of leak due to trapped bubbles, also with “not to hard” glue like Epotek 301.
- Each fiber is passed inside an individual jacket
- The external jacket is installed around jacketed fibers and secured to the vacuum feedthrough plate.
- Finally the connectors could be mounted on each fiber and secured on the individual jacket.

Remarks: the vacuum feedthrough associated with the jacket around fibers should also avoid any light entrance inside the cryostat.