POST-FOCUS DETECTORS FOR SOLAR SPECTROGRAPH (PFDSS)

AISAS REMARKS TO THE ORIGINAL CONCEPTUAL PROPOSAL OF PFDSS from HAO

ver. 4 – 2013/04/09

Acronyms:

BS – dichroic beam splitter
CAM – camera
LEN – divergent achromatic lens system
PC – polarizing beam splitting cube
PFDSS - post-focus detectors for solar spectrograph

Remarks:

1. basic concept – main parts: skeleton(s) + baseplate + thermal insulation + coverings

2. basic concept – compartments: one "optical" compartment above the baseplate and one "electronics" compartment below the base plate

3. basic concept – assembly: the baseplate with two metal skeletons above/below (as a sandwich) or the baseplate mounted into a single skeleton

4. basic concept – skeleton technology: skeleton(s) prepared using the same technology as in the case of the Filter Module of CoMP-S

5. basic concept – single baseplate solution: no intermediate platforms for separate VIS and IR channels (each of 1 PC and 2 CAMs) above the baseplate. Is this better solution?

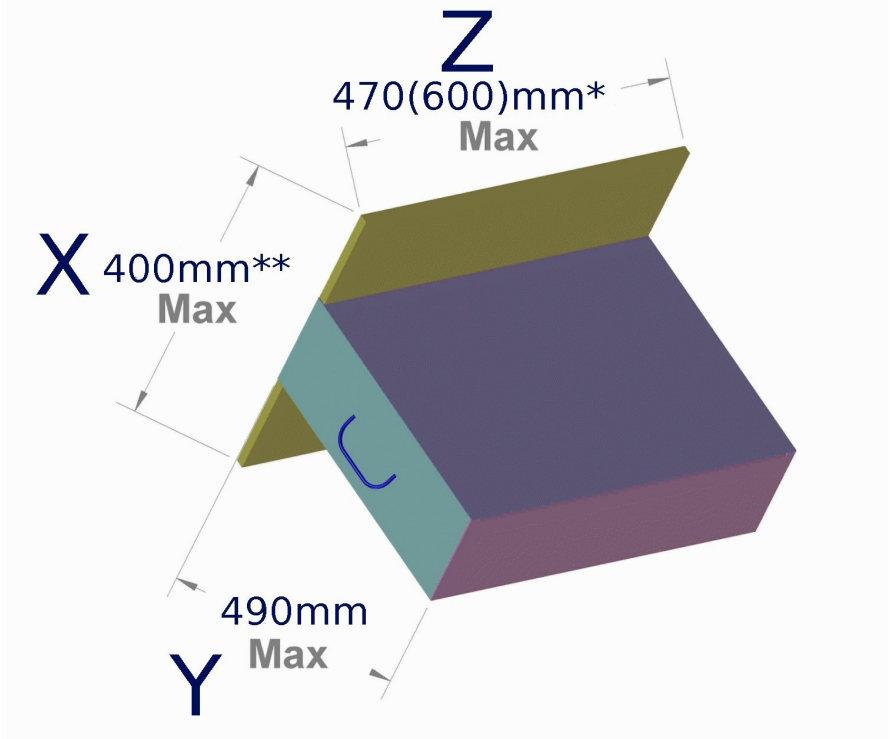
6. basic concept – fixing: fixing the PFDSS to the back side of the Filter module using existing holes for screws in the inner ribs at the rear side of the CoMP-S Camera Module

7. basic concept – fixing: to advance a mechanical solution to adjust the whole PFDSS in order to coincide the optical axis of the coronagraph and the Lyoot filter with the attached PFDSS

8. Maximum dimensions of the PFDSS: X (47cm or up to 60cm) x Y (49cm) x Z (40cm or more) where:
   - Y = axis along the optical axis of the coronagraph:
     49 cm – this is the maximum between the rear part of the Filter module and the floor in the dome, skeleton only up to 47 cm
   - X = axis parallel to a baseplate of the PFDSS and perpendicular to Y:
     47 (60) cm – (47 cm is Y dimension of the Filter module), in case of a need for more space up to 13 cm can be added on the side opposite to the existing Harting connector, i.e.

max. 60 cm)

- Z = axis perpendicular to the baseplate of the PFDSS and perpendicular to X:
  40 cm or more – (40 cm is this dimension of the Filter module)



* extension from 470 to 600 mm is asymmetric to the optical axis of the coronagraph – see item 8/ for text on axis Y

** 400 mm is the actual width of the CoMP/S Camera module, an extension here is possible

9. LEN attached directly to the front side of the PFDSS with the only one positioning axis along the the optical axis of the instrument while rotating the whole LEN on a large diameter thread

10. BS, PCs, CAMs optical parts fixed directly to the baseplate of the PFDSS

11. broader holes for fixing BS,PCs, CAMs in the baseplate for fine adjustment of XY position or XY mechanical positioners for fixing BS, and PCs to the base plate in order to allow a fine shift of these mechanical parts

12. a mechanical tilt of the BS, and PCs relatively to the passing light beam axis (at least 3 points)

13. positioners for CAMs: manual adjustment in axes perpendicular to the light beam, motorized adjustment along the beam axis (range of ~12.5 mm), the computer controlled LabView operation of positioners

14. an auxiliary VIS/IR laser (or just a VIS laser and a VIS-to-IR light transformation device): wavelengths within the spectral response of the VIS and IR cameras, a mechanical holder for mounting in front of the PFDSS body for adjustment of all optical parts in a lab at HAO and in an office at Lomnicky Peak Observatory

15. ZEMAX calculations of the optics and location relatively to the Filter module and the coronagraph

providing the ZMX files to AISAS

16. the VIS ANDOR NEO cameras and IR Goodrich GA1280J cameras with synchronized data acquisition using an external TTL trigger with 2 + 2 frame grabber cards in one dedicated computer with operation in one LabVIEW code selecting only one pair of cameras (VIS or IR) for actual data acquisition depending of the focused wavelength in coronagraph

17. Thinklogical FL extenders for data download from the cameras to the server room (same system as already used for existing Camera Module – 2 for IR cameras, 1 as a spare one – from HAO, 2 for VIS cameras from AISAS)

18. enough space behind the cameras for cables and for hands while performing a mechanical adjustment of the stages and optical elements

19. at least 4 layers of the thermal insulation (type used in the original CoMP-S)

20. ribs for holding the electronics in the electronics compartments perpendicular to the base plate

21. optimizing a weight balance of the PFDSS by distribution its internal parts as much as possible

22. purchase also spare LEN, BS, PCs (if possible)

23. side and back coverings as plain metal sheets

24. more ribs/stiffeners inside the optical compartment for better mechanical stability

25. no new types of NI boards to purchase and use the same type of boards already installed in the 19inch box of the CoMP-S in the dome

26. spare insulation sheets for later improvement of insulation using and outer envelope

27. cooling of the flowing air inside the Camera+Filter modules using a dedicated air channels and TE Peltier devices operated under a temperature control

Sharing of duties:

HAO/Boulder: optical calculations, development and fabrication of the PFDSS structure, purchase of all other parts needed, assembly of the PFDSS and adjustment of all optical parts, development of a Labview operation for the IR cameras using an external trigger, tests with all electronics parts using a new dedicated computer, transport of the PFDSS with all parts to Tatranska Lomnica

HAO+AISAS/Boulder: incorporation of the Goodrich and ANDOR cameras to the complete CoMP-S LabVIEW code using the current data management and an external trigger; dismounting/assembly/alignment/dismounting of the whole optical system at HAO

AISAS/Tatranska Lomnica: tests of the ANDOR cameras with LabVIEW code using the current data management and an external trigger; assembly of the optics, electronics, and mechanics of the PFDSS, optical adjustment of the optics, performance tests of the electronics

Schedule of the project:

- February 26: contract signed for 10 month (end of the project on December 31, 2013)
- March - September: all HAO actions for the preparation of the PFDSS
- July-September: all AISAS actions at Lomnicky Peak
- October - November: stay of Matus Kozak at HAO – all AISAS+HAO actions in Boulder
- December: transport of the PFDSS to Tatranska Lomnica

Content of the PFDSS order:

We propose the order consisting of the following items (prices in kEur, no VAT included, USD/EUR = ~1.3) for the PFDSS:

- **IR detectors:** 2 high resolution NIR/SWIR cameras Goodrich GA1280J-15 including lens, enclosed version, power supplies, cables, software: 2 x ~43.0 = ~86.0

- **Camera-Link fiber optics extenders:** 3 Thinklogical Camera Fiber-Link 4000 devices with cables and power supplies (2 for 2 IR cameras, 1 as spare one): 3 x ~3.3 = ~10.0

- **Optical elements:** an achromatic negative lens system, an dichroic beam splitter, an IR polarizing cube, a VIS polarizing cube (each part twice): 2 x (~0.35 + ~0.45 + 2x~0.35) = ~3.0

- **Stages for the optical parts:** XY mechanical stages with a vertical (Z) adjustment and 3-point tilt of the optical parts - BS, PCs: ~ 2.0

- **Camera positioning stages:** 4 XYZ stages with 2 mechanical adjustments and 1 motorized adjustment with the required electronics and software: ~8.0

- **Dedicated computer:** a rack 2U mounted with a PCI Express x8 slot Windows + MS Window 7 Pro + LabView full license - ~15.0

- **Data storage system - 54GB:** Promise VessRAID 1840i+ with add.devices: ~18.0

- **Supplementary parts** (e.g. screws, insulation, FO connectors, 2m FO cables, NI RS-232 to USB cable, …): ~5

Technical suggestions:

All our suggestions have to be checked/reconsidered:

- **Beamsplitter: THORLABS DMLP900L - Ø2" Longpass Dichroic Mirror**,
  50% Trans./Refl. at 900 nm , 350 USD

Reflection Band (Ravg > 90%): 400 - 872 nm
Transmission Band (Tavg > 90%): 932 - 1300 nm
http://www.thorlabs.de/thorProduct.cfm?partNumber=DMLP900L
http://www.thorlabs.de/images/TabImages/DMLP900_sm.gif

- **Cube VIS: Cube-Mounted Polarizing Beamsplitter, 620 - 1000 nm , 255 USD**
  http://www.thorlabs.de/thorProduct.cfm?partNumber=CM1-PBS252
  We do not know what is its performance down to 580 nm ! Please, try to find a better one!

- **Cube IR : Cube-Mounted Polarizing Beamsplitter, 900 - 1300 nm** , 255 USD
  http://www.thorlabs.de/thorProduct.cfm?partNumber=CM1-PBS253
  This seems to be completely satisfying our requirements but please, check this.

- **dedicated PC:** rack 2U mounted, PCI Express x8 slot, Windows 7 64bit, LabView,
  proposed platforms:
  a/ Intel Server System R2308IP4LHPC (max. 512 GB RAM)
  http://ark.intel.com/products/63160/Intel-Server-System-R2308IP4LHPC
  or
  b/ Intel Server System R2308GZ4GC (max. 768 GB RAM)
  http://ark.intel.com/products/56265/Intel-Server-System-R2308GZ4GC

  Final configuration should be specified according the needed performance to operate the VIS and IR cameras and data storing to HDDs.

- **Data storage system consisting of:**

  a/ Promise VessRAID 1840i+ (without HDD) but including a
  redundant power supply and 2GB ECC cache memory,
  LCD Panel, Front Bezel, Sliding Rail, Battery Backup Unit
  http://www.promise.com/media_bank/Download%20Bank/Datasheet/VessRAID_1000iplus_%20DS_English_20110314.pdf

  b/ 18 HDDs - Harddisk SATA-3, 3TB, Seagate ST33000650NS
  http://www.seagate.com/ww/v/index.jspvgnextoid=6a0505f79edac210VgnVCM1000001a48090aRCRD&
  vgnextchannel=f424072516d8c010VgnVCM100000dd04090aRCRD&locale=en-US&reqPage=Support

  c/ 2 pieces - On-Line UPS, 2kVA, APC SURT2000RMXLI with
  Network Management Card AP9631 ib each UPS
  http://www.apc.com/resource/include/techspec_index.cfm?base_sku=SURT2000RMXLI

  d/ Switch for connection of the data storage system to different servers simultaneously
  HP ProCurve 1810G-24 Switch
  http://h20195.www2.hp.com/v2/GetPDF.aspx/4AA2-6799EEE.pdf

- **Camera positioning stages: XYZ pieces, each of 2 mechanical and 1 motorized translation with required electronics**. A suggestion to be checked/considered:

  NEWPORT Company:
  - Gothic-Arch XYZ Translation Stage, 40x40 mm Platform, M4 and M6
  http://search.newport.com/?q=*&x2=sku&q2=9062-XYZ-M
  with:
  - Micrometer, 0.5 in. Travel,

http://search.newport.com/?x2=sku&q2=9355
- Picomotor Actuator, 1 in. Travel, 30 nm Resolution, 9.5 mm Shank
http://search.newport.com/?x2=sku&q2=8302
and
- Six-Axis Picomotor Driver Module Kit, iPico
http://search.newport.com/?q=*&x2=sku&q2=8766-KIT-NF

- **Camera-Link fiber optics extender Thinklogical Camera Fiber-Link 4000** consisting of:
  - CFL-000M04-LCRX Camera Fiber Link 4000, Full, Frame Grabber Side, Multi-Mode, LC
  - CFL-000M04-LCTX Camera Fiber Link 4000, Full, Camera Side, Multi-Mode, LC
  - VOP-M05 Camera Fiber Link 4000 Optics Option for Transmitter or Receiver, Multi-Mode, 3 Fibers, 50m, LC
  - FCR-010017-050M Simplex fiber riser, 3 mm, 50 uM, LC to LC, 50 M
  - FCR-020017-050M Duplex fiber riser, 3 mm, 50 uM, LC to LC, 50 M