TMAS production.
Date: 21/12/11
Version: 2.0
Writer: Sergi R. Hildebrandt (ext.2147)

A) Elements:

1. **ADC**
2. **Cameras**
3. **Coronagraph**
4. **Enclosure**
5. **Filter wheels.**
6. **Filters**
7. **Lenses**
8. **Mechanical design**
9. **Breadboard**
10. **Optical design**
11. **Stargate and GPU**
12. **Room computer(s)**
13. **Rack**
14. **TMAS rear panel**
15. **Redundant alternatives.**
16. **Real-time data processing pipeline.**

B) TMAS tasks

o--------o--------o--------o--------o--------o--------o--------o--------o--------o--------o--------o--------o--------o

A) Elements:

1. ADC:

* Prisms: 3 pairs of wedge prisms in the lab (inside the plastic boxes). They are SK4/KsFN4. Checked. (**Done**)
* We will follow Jack's idea on how to attach them to the rotation stages. He needs final distances to take into account tilting. (**Sergi/Richard/Jack**)
* There is no problem as prisms are rotated. The dimensions are compatible with 216 mm (8.50") of the beam axis height. (**Done**)
* We need to find some pair of n-axis aligner and their combination with the rotation stages. To check if a tip/tilt one is possible and around the lab. Manual. (**Sergi**).
* The 3 connector cables will be extended to 6m. That means: PR50 Series Compact High-Speed Rotation Stage and UTS series High-Performance Precision Translation Stage. These cables are 3 meters long. I can purchase 3 extension cable from Newport for $168. (**Ernest: Done!**)
* Power supply in the Newport main box in the rack. **Fine**.
* Control software for the Newport 3 axis controller. Under Windows for June. (**Sergi**)

Needs to be aligned in the lab:

* Input laser beam (laser, holder, power supply, …). We will check if we can use the one used in Robo-AO.
* Overall alignment procedure to be consulted with Chris Shelton (JPL, jean.c.shelton@jpl.nasa.gov). (**Sergi/Richard**)

2.-Cameras

* "One camera for March/Two cameras, if possible, for June": 1 Neo (March) and 1 iXon.
* We will buy the Neo sCMOS camera for TMAS. (**Done**)
* Where will the iXon camera come from? To be considered when TMAS is looking good with the Neo camera around March. (**Richard/Sergi**)
* Overall functioning: PCI-E card and USB tasks in each camera: iXon 888 and sCMOS: The USB is not necessary at all. The PCI-E card is for data flowing and camera control. (**Done**)
* Source of power supply for the cameras. AC 2 DC in the rack and then powers the camera. It will need a small box to convert AC into DC for the camera(s). (**Done**)
* The cooling system is too expensive as Ernest got a quote from the vendor company suggested by Andor. For the Neo, we may go as low as -30 C easily with other cooling devices -such as air ones. (**Done**)
* Lengths of cables from TMAS to the rack. **5.8 m** from the top, end of the rack to the rear of the farthest camera (Neo sCMOS) in TMAS. So no shorter than 5m.**Done (see at the end).**
* Extension cables for the cameras (**all**) : Not a problem if fiber extensions are used. So two options (**Richard**, final decision):

1) Order 5-6 m Camera link cables. No tested by the vendor (ANDOR). And takes sometime. The control computer (Stargate) goes in the rack. We would need a 6m cable for the potential iXon and the 'new' 5-6 m one for the Neo.
2) Use the available fiber optics in P200: Needs 1 converter box for each camera: Camera link to Fiber. The box can be placed on the exterior enclosure? The control computer, Stargate can then be in the control room. No need to buy other cables from the camera(s) than the one provided by the vendor.

Therefore, the difference in price is the box - the 6 m cable. IXon: $240 with a 5 WEEKS estimated (**Ernest**). Neo ? yet.
The Camera link-Fiber optic option could be something like ~ $ 1100 for a PHOX 24 bit.

3.-Coronagraph

Even though, we do not expect to use a coronagraph in June, we will likely use some occulting step (OD4) for the extragalactic program. (**Richard/Sergi**)

* The exact position will come without the final optical design, but I guess that between the filter wheel and the camera in the main axis (longest one).

Width of approx. 2 inches. Support to be defined. (**Jack/Sergi**)

4.- Enclosure

Needed for the lab testing already, so for mid January. Jack has the idea of using some aluminum bars, of 1x2 inch width, and place the panels in the exterior with some brackets to the breadboard if necessary. Check it can be easily open and closed, for camera change, flip mount, … (**Jack/Sergi**)

5.- Filter wheels

Anna Moore let me know that one of the filter wheels has the internal magnetic pieces corroded and we should test both asap.

* Two power supplies got 12 V/1.25A. (**Done**)
* Controllers are there, but we need to test the sw. There is a Windows version, from the webpage. (**Sergi**)
* Extend both controller cables for both filter wheels to 6 m. Power supply and ethernet cable will be on the rack. (**No risk: simple cables. Ernest**)
* Integrate them in the RAC and, whenever possible, with the extended cables. (**Almost done**. **Ernest**)

6.-Filters

To be decided together with the science case, before the end of the year. Clearly, V, R, I, but probably also H alpha. Look further into line emissions (Sulfur, OI, OIII) for extragalactic (redshift considered) and for planetary atmospheres (could be high angular imaging of circumpolar clouds in Uranus, for instance) (**Richard/Sergi**)

7.-Lenses

* There are some available brought by Richard. (**Done**)
* Check the ones that need be bought, when the optical design is done.

8.-Mechanical design

* Optical design was given to Jack. **(Done)**
* Include the dichroic and the second channel filter wheel. **(Done)**
* The height of the P3K beam off the P3K bench is 216 mm, i.e., 8.5 inches. (**Done**)
* Include a model for the new rotation stages of the ADC. Add the prisms. 1 filter wheel per channel. (**Done**)
* Include the alignment stages, but looking for something simpler for the tilt. **Done**.
* The rear clear space behind the cameras for cabling is recommended to be 90 mm. It seems fine. Check in the final design, especially in the multicamera one. **(Sergi/Jack)**
* How to carry TMAS in the summit? Chart? (**Sergi**)

9.-Breadboard

* Jack has a quote from a customized 17.5" x 54", thickness of 2.4": $ 1,800.00 and 6 weeks shipment. Final decision awaiting for its purchase (**Richard**).
* Pucks: Basically the puck are on a 10" x 38" rectangular pattern centered on the available 18" X 54" footprint. (SWITFT document, p 140).
* In the mean time, let's start to use the breadboard in the lab. (**Done**)

10.-Optical design

* Mainly finished: uploaded into the twiki (**Sergi**) There are three foci: F1: 16 mas for Neo. F2: 10 mas for Neo. F3: 16 mas for Ixon.

* Final best field of view (as of first meeting, it secured the central 15 arcsec in the worst case). This will be taken into account in the data processing pipeline of some scientific cases. (**Richard/Sergi**)

* Mirror at the exit of P3K in TMAS: It is a fold mirror of 2-4". The support has to be rigid. Richard found one at the summit. Mirror itself? (**Richard/Sergi**)
* Carrier. One to be assigned for TMAS. (**Sergi**)

11.-Stargate and GPU

* Moving to Stargate! Windows, Virtual machine with linux: good for communicating within the dome**. DONE**.
* Bring the GPU from the summit to the lab. **Done**.
* Integrate the GPU into Stargate. **Done**.
* Check memory already available for tests and RAM. 8 Gb the main processor. From GPU: 1.8 Gb. Even maybe some more for the main processor. (**Jennifer**)
* Jennifer got 2.5 Tb of internal memory: 1.5 Tb, 500 Mb and 500 Mb (fast reading speed). **(Done)**

12. Room computer(s)

* Ernest found a spare PC with Windows that will be used. He found a keyboard. Mouse, monitor and 1Gb RAM extra to be asked to Patrick. **(Sergi)**
* This second computer can go in the summit, or we will install the control SW in a laptop in due time.
* Ultimately, we may want to test a full emulation in the lab,using the remote control room. (**Jennifer/Sergi**)
* External disks to bring back the data. We may consider to buy a couple of ~1Tb external disks. Not urgent. (**Richard/Jennifer/Sergi**)

13. Rack

* Locate enclosure panels (**Ernest/Richard**)

* Blank panels for the front. Find standard sizes to adapt the disposition in the rack to them. (**Jack**)
* Overall disposition: cameras, newport controllers, Stargate, IFWs. As low as possible, especially for the cameras since cables cannot be longer than 6 m or they will not be there if the fiber optic is used instead. (**Ernest/Richard/almost done**)
* Overall power supply in the lab for them. (**Done**)
* Install Newport 3-port controllers. (**Sergi**)
* Install Filter wheel controllers and cables. (**Sergi**)
* Get a USB HUB. Not urgent. (**Ernest/Sergi**)
* Get a Network PS. Not urgent. (**Ernest**)

14. TMAS rear panel

* ADC: 2 connector cables for the two rotation stages. 1 connector cables for the axis aligner.
* Cameras. For each of them: 1 PCI-E link, (1 USB **NOT**), 1 Power supply, 1 water pipe (to be confirmed)
* Filter wheels (IFWs). For each one: 1 power supply, 1 ethernet cable, 1 connector cable.
* Make a list, so that Ernest can write the model of each one and give it to Jack. To be finalized in end of January when TMAS is mounted in the lab.
* Attention with potential unwanted illumination from the holes into TMAS: now some tape? another idea? (**Ernest**)
* Others (**All**)

15. Redundant system.

* Determination of those components that may need a redundant element in the lab. Replacement/Alternatives for breakdowns and failures of those components that are critical (Stargate, Control room (sw installation), chiller, etc …). To be considered until June. (**All**)

16. Real-time data processing pipeline

* Test the RAM/CPU capabilities of the GPU with some simulated images: readout speeds & array sizes. (**Jennifer/Sergi**)
* test the precision in the time stamps for the fast reading modes. Is it enough or do we need a GPS or is it available a fast communication with some summit device? (**Jennifer/Sergi**)
* Basic algorithm(s). Discussion (**Jennifer/Sergi**) and implementation (**Jennifer/Sergi**)
* Refined memory optimization (subarray processing, external array accumulation, etc …) (**Jennifer/Sergi**)
* Tests of scientific program targets (**Sergi**)
* Tests with ADC alignment (**Sergi**)

B) TMAS TASKS

Richard:

* Decide if we go for fiber optics at the summit or for testing the extension cable for the Neo.
* Check the availability of some elements: fold mirror and support (**done**), dichroic?
* Science program for the two nights (possible targets, priorities and alternatives, integration time, working temperature, filters, rough estimation of memory needs) with Sergi. Adapt the program to the Neo camera.
* Order the lenses that are not available (how many are available now? We will check them).
* Optical design. second/third arms disposition: double 'Z' design. Quite advanced for present needs. Not urgent till February/March.
* Best field of view. Relevant for the data processing pipeline and memory considerations.
* More cables, connectors than the ones in item 14 above?

Ernest:

* Put the power supply and the IFW fasten in the rack. (**Partly done**).
* Stargate in the lower end if it finally goes. It is not rack mounted.
* More cables, connectors than the ones in item 14 above?

Jack:

* Mechanical design with the ZMAX design. Enough as of today. More in February/March for the case of the other two foci.
* Waiting for a decision on the purchase of the Bread board (17.5" x 54"). Quote: $ 1800.
* Blank panels for the front. Find standard sizes.
* More cables, connectors than the ones in item 14 above?

Jennifer:
on-going ...
* if Stargate goes in the rack, order the corresponding hardware mounting.
* Test GPU capabilities with simulated data.
* Discussion of basic algorithms of real-time processing and implementation.
* Discussion of refined processing algorithms, aimed at optimizing speed and less memory consumption according to the science target.
* Test of the former concepts in the lab.
* More cables, connectors than the ones in item 14 above?

Sergi:

* Take a look to the new optical and mechanical elements in the new box in the lab (flip mount, fold mirror holder, …) and decide what is worth, what is still missing.
* Do not forget to check for any design that "the rear clear space behind the cameras for cabling is recommended to be 90 mm. It seems fine". Especially in the multicamera one

* Enclosure. Sergi to check if Roger Smith can help us with some ideas/suggestions and perhaps even with some material not used anymore in the PPP project.
* Install the control software for the IFWS and test them.
* If a room computer will be used, check the 1 Gb additional with Patrick.
* Ask about the element/model/support for the occulting stop, in place of the chronograph and the occulting stop, itself: OD4.
* Best field of view. Relevant for the data processing pipeline and memory considerations. Work with Jennifer for the optimization of the on-line data reduction pipeline.
* Installation of controllers software in Stargate.
* Test GPU capabilities with simulated data.
* Input laser beam. Check available elements.
* Discussion of basic algorithms of real-time processing and implementation.
* Discussion of refined processing algorithms, aimed at optimizing speed and less memory consumption according to the science target.
* Test of the former in the lab.
* Try to find a means to carry TMAS at Palomar.
* More cables, connectors than the ones in item 14 above?

Lengths relevant for TMAS at P200:

Richard:
Here are the measured dimensions from P3K, relevant to TMAS:

distance from (further) camera position to bottom of p3k encl cover (dropping down the side): 14"
end of bench over to Cass ring rotation axis: 24"
from p3K encl cover drop to cage floor: 44"
straight run along the floor of the Cass cage to the bottom of SE rack location where TMAS installs: 68"

Total 150" = 3.8 m

This gets us from the (further) camera position to the bottom of the TMAS rack, then we decide how far up and deep into the rack we want to go. Here is, I think, the worst case:

Rack depth 24"
Rack height 54"

So, the maximum total distance from the camera location to the back of top of rack = 228" = 5.8 m.