MAORY Consortium Meeting

Bologna July 1-5 2019

Aim: clarify specifications to the subsystems. Clarify scope and interfaces of the subsystems. Ensure task responsibilities are defined. Detail WPs activities to PDR. Note: It requires a system baseline defined. It requires a decent understanding of system calibration and system operation scheme

This document is created from:
https://docs.google.com/document/d/1FWm_sq_MOy1Qn4hN1pd-tydWoAcpcK2f28unSXpEHG

Agenda

Official agenda at https://indico.ict.inaf.it/event/877/

Monday, 1 July
13.00 - 18.00 Welcome to Galway, discussion on Test and Calibrations

Tuesday, 2 July
9.00 - 13.00 Presentation of new baseline and trade off study
14.00 - 18.00 Calibration Operation Scheme

Wednesday 3 July
9.00 - 13.30 Electronic
14.30 - 18.00 Mechanics

Thursday 4 July
9.00 - 13.30 LGSW / LOR (+summary of LGSW AO4ELT6 from SOb)
14.30 - 18.00 MICADO Cal Unit / Calibration Unit / Test Unit / AIV

Friday 5 July
9.00 - 13.30 Thermal control / RTC / DM
14.30 - 16.30 SW / Wrap Up

Videconf link

Use google meet: https://meet.google.com/pfa-mqma-gao

Folder to collect presentation and documents

http://wwwmaory.oabo.inaf.it/owncloud/index.php/f/31261

Participants List

Who	When
Paolo Ciliegi	1-5
Lorenzo Busoni	1-5
Philippe Feautrier	2-4
Adriano Fontana	2
Zoltan Hubert	3-5
Jean-Jacques Correia	2-4
Davide Greggio	2
Marco Bonaglia	2-4
Jacopo Farinato	2,4 2nd half,5
Demetrio Magrin	2, 4 2nd half, 5
Nicholas Devaney	1-5
Simone Di Filippo	1-2-4
Carmelo Arcidiacono	1(2nd half)-2-3-4-5
Bernardo Salasnich	2-5
Andrea Baruffolo	2-5
Andrea Balestra	2,5
Marco Xompero	2, 3-5 (videocon)
Gianluca Di Rico	2-5
Cedric Plantet	1, 2, 4

Guido Agapito	1-2
Simonetta Chinellato	2-5
Maria Bergomi	2
Mauro Dolci	3-5

Topics

Presentation of Trade-off phase findings

(Paolo Marco Lorenzo Demetrio Guido Cedric)

- new baseline design
- updated performances
- long-term and short-term schedule, next milestones
- trade-offs that are still open (6/8 LGS, LGS Objective, C-More)

Electronics

- Review of subsystem specifications
    - what are the requirements assumed so far for the design?
    - are ALL the specifications and recommendation from ESO taken into account? (materials to be used, standards, connectors, best-practices, …)
    - new requirements from baseline
- Current status of design and analysis
    - overview of the entire electronic system of MAORY
    - distribution of cabinets, routing between cabinets, routing to devices, mechanical interface to the Nasmyth
    - internal layout of the cabinets
    - list of selected devices/controller
    - distributed vs centralized controllers on the main bench
    - prototyping: short term, medium term plan
    - power/mass/cooling budget update
    - operational scheme (what is always on, who switch on/off who)
    - safety (overcurrent / overtemperature / glycol leaks / …)
    - AIV
- Sub-system coordination

    - internal guidelines / standards to be followed by everyone working on electronics
    - common services: power supply, cabinet thermal insulation and cooling, data distribution
    - how do you share activities between electronics of MPO, CalUnit, LGSW, LOR
    - interface with the telescope and MICADO
    - interfaces with bench
    - schedule towards PDR
    - cost estimate

Mechanics

- Review of subsystem specifications
    - what are the requirements assumed so far for the design?
    - requirements from new baseline design
    - requirements from the Optical WP, DM WP, Thermal WP
    - budget split between bench and mounts
- Status of analysis and design
    - overview of the mechanical design
    - earthquake analysis
    - effect of thermal expansion
    - effect of nasmyth platform flexures
    - effect of variable loads (calunit, lgsw)
    - effect of wind
    - elevator for the calibration units
    - AIV
- Subsystem management and interfaces
    - Interface with other subsystems: LGSW, DM
    - how do you share mechanical activities of bench, mounts, LGSW, CalUnit
    - resume contract with Libra: when? scope of Libra's work?
    - interface with the telescope
    - interface with LGSW, CalUnit, MICADO CalUnit, Thermal
    - schedule towards PDR (set WP milestones)
    - cost estimate (bench, mounts, …)

Calibration Unit

- Calibration plan
    - What do we need to calibrate? (how often, synth/optical, night/day)
    - What calibration functionality do we need on the Nasmyth? (must have, good to have, …)
- Requirements
    - For AO calibrations
    - To verify functionality after events (earthquake, LRU replacement, SW releases, generic functionality check)
    - Positioning budget split between elevator and CU

- Status of analysis and design
    - overview of current design
    - Selection unit
    - AIV
- Subsystem management and interfaces
    - Interface with bench and selection mechanism
    - Prototyping ?
    - schedule towards PDR
    - cost estimate

Test Unit

- Test and verification plan
    - What do we need to verify?
    - What functionality do we need on the test unit? (must have, good to have, …)
- Requirements
    - For AO calibrations
    - To verify functionality after events (earthquake, LRU replacement, SW releases, generic functionality check)
    - Positioning budget split between elevator and CU
- Status of analysis and design
    - Possible
- Subsystem management and interfaces
    - Prototyping ?
    - Sharing activities: who is doing what?
    - schedule towards PDR

    - cost estimate

Thermal Control Unit

- Requirements
    - Mitigation of external temperature gradient
    - Dissipation of internally generated thermal loads (quantify!)
    - Is it possible to keep the entire bench at 0C +/- 2C (reduce thermal background effect on spectrograph. Will get this question from ESO)
    - Is daytime-only stabilization good enough to keep temperature stable to within a couple of degrees all-night long?
    - Do we need to stabilize the temperature of the bench to keep optical alignment? To which extent?
- Status of analysis and design
    - overview of current design and analysis
    - what kind of insulator? how thick?
    - Explore daytime active cooling: what is providing the cooling power? how to exchange heat?
    - Horizontal stratification of temperature in the bench: effect on OPD. How to model? How accurate it is?
    - AIV
- Subsystem management and interfaces
    - Interface to bench and to electronics
    - schedule towards PDR
    - cost estimate

LGSW

- Requirements
    - what are the requirements assumed so far for the design?
    - requirements from new baseline design
    - global focus vs individual focus
- Analysis and design
    - overall status review
    - 8 LGS vs 6 LGS: trade off
    - C-More vs LISA: trade off
    - LGS Objective: F/5 vs HARMONI like
        - is it possible to fit the additional folders?
        - does the HARMONI WFS
    - global focus vs individual focus

    - AIV
- Subsystem management and interfaces
    - Interface with the mechanical bench and other workpackages
    - schedule towards PDR
    - cost estimate

LOR

- Requirements
    - what are the requirements assumed so far for the design?
    - requirements from new baseline design
    - do we need ADC?
    - do we need acquisition camera?
    - do we need a field stop (what size)?
- Analysis and design
    - overall design
    - support structure
    - Anticollision system
    - AIV
- Subsystem management and interfaces
    - Interface with MICADO and SCAO
    - Interlock system with SCAO Dichroic
    - Electronics: volume in cabinets, share with MICADO
    - schedule towards PDR
    - cost estimate

SW

- Requirements
    - what are the requirements assumed so far for the design?
    - MAORY operation scheme and how it translates into SW requirements
- Analysis and design
    - overall SW design (actually we probably don't care now :-))
- Subsystem management and interfaces
    - integration between CAMEO models (requirements of MRiva and SW model)
    - how to be sure that you are aware of what the WPs believe that the SW should do
    - Sharing of activities between partners within the WP
    - schedule towards PDR

RTC

- Requirements
  - what are the requirements assumed so far for the design?
  - requirements from new baseline design
- Analysis and design
  - religion war of GPU/CPU/FPGA: an insight from AB
- Subsystem management and interfaces
  - share / cooperate with other ELT instruments?
  - schedule towards PDR
  - cost estimates

DM

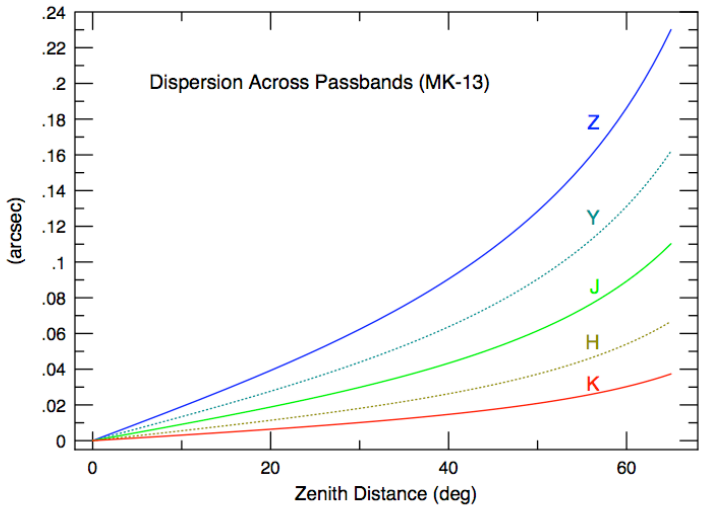
- Requirements
  - what are the requirements assumed so far for the design?
  - requirements from new baseline design
- Analysis and design
  - what is missing from Microgate to go to PDR
  - Hexapod (electronics/actuators)
  - AIV
- Subsystem management and interfaces
  - Cooling needs, Power needs
  - Cable routing
  - Location of Electronic cabinets
  - Mechanical interface
  - schedule towards PDR
  - cost estimates

Monday 1st July

People:
Paolo Ciliegi
Guido Agapito
Cedric Plantet
Sasha Goncharov
Nicholas Devaney
Simone Esposito
Sylvain Oberti
Italo Foppiani
Carmelo Arcidiacono
Lorenzo Busoni

Notes:

- We exclude AIV and alignment tools from today's discussion.
- Alignment quality check --> source in calibration unit may/must have means to assess need of realignment (e.g. after earthquake)
- Is the calibration unit supposed to be a reference for the alignment of MAORY ?
    - That could allow performing the alignment at Nasmyth independently from what is happening at the telescope
    - Step1: align calibration unit w.r.t. telescope focal plane targets (PFS) + pupil position
    - Step2: Align MAORY sequentially w.r.t. calibration unit. This can be done in a closed environment, rather independently from what is happening at the telescope
- **It's not a requirement for the calibration unit to be an alignment reference**
- Synergies with MICADO calibration unit ? We will learn more about what they need Tuesday.
- Test unit shall provide all the needs to verify the dynamical aspects of the system (like variation of elevation, field rotation)
- Atmospheric refraction compensation by an open loop law between the H band LOR and the science channel
    - Via an update of reference slopes ?
    - Via an offset to the LOR arms ?
- Should the Test Unit simulate atmospheric dispersion?



On the ADC in LOR there is Redmine issue http://wwwmaory.oabo.inaf.it/redmine/issues/140

How to simulate turbulence on the bench:

- Phase screens may not simulate easily the frozen flow in the full FoV
- SLM as for HARMONI: 1 per WFS channel + some on the science field, i.e. ~10

Discussion about the need for a High Order WFS **on-sky** to optimize tomography and verify the model: difficult (almost impossible) to add it inside LORs. We can use one LOR 10x10 Ref WFS on-axis?

Phase screens in Test unit: looks difficult to have a set of phase screens that must be synchronized (???)

Telescope Phasing / Petaling: clarify to ESO the MAORY performance loss with petaling. We don't have a phasing sensor, and it is hard to add it now.

Telescope pupil motion simulation: 1% diameter excursion
LGS rotation w.r.t. NGS: could be simulated by SW ?
Do we want to specify the system test bench to be able to characterize the LGS objective optical model ? [LBu: from the discussion of the next days the answer is yes]

Tuesday 2nd July

People:
Paolo Ciliegi
Guido Agapito
Cedric Plantet
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Simone Esposito
Sylvain Oberti
Italo Foppiani
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Vincenzo De Caprio
Enrico Cascone
Vincenzo Cianniello
Christian Eredia
Ivan Di Antonio
Mauro Dolci

Paolo Ciliegi - Project status

Presentation of PCi about TradeOff Phase (motivation, schedule, costs)
http://wwwmaory.oabo.inaf.it/owncloud/index.php/f/32271

AI [LBu] : CILAS: reopen http://wwwmaory.oabo.inaf.it/redmine/issues/45 and ask for their best offer for DMs with only 2k acts. They will probably offer a 200mm DMs. Then it's a problem of optical design :-) and electronics.

RTC: Feasibility study HAA (JP Veran) to study CPU based RTC (TMT like)
Durham: collaboration on hold, not because of technical reason. Someone has to push to proceed.
MICADO-SCAO: ESO is periodically resuming the discussion about having a single RTC with SCAO (for maintenance). Historically motivated by joint SCAO development. Now SCAO and MCAO development diverged.

Galway enters the consortium with a WP on Verification Plan and Unit

New PM on duty at the end of October. Contract to be signed soon. He needs three months to be really ready.

Closing Trade Off Phase with ESO: we asked for written questions. Suzy answer was blurry. Insist on getting precise questions and feedback from ESO specialists. They should arrive on Fri 5th.
AI [PCi]: Provide written answer to Suzy's email. PCi to insists on restricting the scope of the meeting.
AFo: We want the consolidation phase to be closed by July. Focus on the consolidation phase, avoid overall review of the instrument (keep it for PDR). Separate managerial review from technical review. They should reply to Paolo's letter: if no showstoppers then the consolidation phase is successfully closed. No need for a meeting to discuss technical items.
PhFea: This meeting is not necessary. ESO should explain the request, a meeting of Co-I with ESO would be enough.

Lorenzo Busoni - System Design Overview

Slides http://wwwmaory.oabo.inaf.it/owncloud/index.php/f/32427

Modified Offner Relay Optical Design:

- Design with the Schmidt Plate, 2DMs 800mm,
- Optical Quality is fine for: pupil optical quality on the DM… We are just slightly off the allowed volume. The second port is inside our volume. Any 2nd instrument will need its own LOR. A few meters of focal extraction are needed, however there is not space now.
- Critical Point: In MICADO Interface Meeting it was explained that the astrometric requirement should be met on distance of a few arcsec, footprint separated of 6mm on the Schmidt plate.
- Critical Point cost of the Schmidt Plate: (DeMa: SESO says the feasibility is not assured, is a work in progress, it's possible)
- MaBe: Dichroic is critical, not impossible.

Mass:

35 tons, we are over the allocated budget.

LGS WFS design:

The Rotator follows the elevation rotation, one focusing stage common for all LGS, the LGS objective reduce the F/20 to F/5.

Open Points:

1. Number of LGS (we design for 8 LGS),
2. Action on us asking ESO to provide extra LGSWFS objective HARMONI Like?
3. Single focus stage is enough?

DeMa design without aspherical.

LoBu: the design is still a closed loop on post focal DMs.

This design is our baseline, #actuator 700-2000 per DM, according to pitch allowed by microgate. We design for the most demanding one.

NGS WFS:

1. Green Donut. FoV is 2 arcsec, trying to do 4 arc sec. ADC is under investigation by Cedric: some issue about pointing accuracy.

System Architecture:

1. Mirror Seeing, we may need to thermalize the air inside the unit.

MAORY DOCUMENT LIST:

1. Document divided by type in owncloud in LIST of Documents
2. Google docs sheet with the list of document, it's automatic, reading the folder
3. Document for PDR… Many missing version 0, some is old (pre 2017)
4. One document One Folder (Lorenzo and Paolo contact Points)

Guido Agapito - AO Performances and Control

Slides: http://wwwmaory.oabo.inaf.it/owncloud/index.php/f/32243 and http://wwwmaory.oabo.inaf.it/owncloud/index.php/f/32244

Telescope control: we understand that we control M4/M5 and via offloads to ELT we drive pointings/focus/other telescope aberrations
CAr: How do we offload platescale (ELT doesn't know about static shapes on PFDMs)?
SOb: A new document Interface between TCS and RTC is going to be released
(LBu: What about field derotation?)
SOb: In case of a single NGS does the control scheme change?

MRi: 145nm in the TechSpecs and need for a CRE. LBu it was already in the list of amendments from SRR
AI [MRi]: Clarify with ESO the situation of SRR amendments. LBu recall they agree to provide a written amendments to the Tech Specs as AD for the PDR

LBu: Guido, can you do a plot with the 5 Pxx profiles for 4 configurations (6lgs, 700modes), (6lgs, 2000modes), (8lgs, 700 modes), (8lgs, 2000modes). Let's discuss about it

Sylvain Oberti - Calibration Plan

Slides: http://wwwmaory.oabo.inaf.it/owncloud/index.php/f/32296

Calibration plan describes task required to MAORY to provide configurations needed to operate the system. Is not a verification nor an alignment

Calibration task types: at PAE, in Chile/lab, in commissioning/recommissioning, daily checks, maintenance.

Predictive maintenance

Field Mapping for LOR WFS positioning: which accuracy do we need to have in positioning the probe at acquisition? it is <0.1" or 1"? Is it affecting Astrometric accuracy?
LOR WFS: Do we have a Filter Wheel to reduce flux in case of bright NGS?
NCPA: Technique to measure NCPA requires fast readout from MICADO. Be sure that the fast readout mode will be implemented by MICADO.
Identification of Pupil Misregistration technique from AOF.

Wednesday 3rd July

People:
Paolo Ciliegi
Nicholas Devaney
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Italo Foppiani
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Bernardo Salasnich
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Andrea Balestra
Simonetta Chinellato
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Zoltan Hubert
Vincenzo De Caprio
Enrico Cascone
Vincenzo Cianniello
Christian Eredia
Ivan Di Antonio

Demetrio Magrin - Post Focal Relay Optical Design

Slides: **AI [DMa]**: upload slides in http://wwwmaory.oabo.inaf.it/owncloud/index.php/f/32300

Dichroic mitigation: 2 proposal: prototyping and IR-Transmitted

AI [DMa]: Look details of IR-Transmitted to be sure of feasibility (LGSW position, aberrations/chromatism in MICADO, ...) Define specs for IR-Transmitted and ask quotation

SOb: This is an important topic - looks important to be solved now

Req: Add Notch Filter in the LGSW - Not present now, probably nice to have

2nd Port - JFa: add lenses to relay the focal plane? MRi: Negotiate a collimated output?

We are missing a full understanding of ESO specifications on the 2nd port : this is delaying the design of bench, optics and so on.

LBu: What about rejecting completely the argument and saying that the 2nd instrument will have to build its own relay (as any other current instruments has built its own relay after the ELT focal plane)? This thing is delaying now the entire project for something which is completely undefined.

SOb: we are formally compliant with the current design? Period

SOb: About SRR unclosed: add a JIRA ticket? Also to state our official position on the 2nd port, add a JIRA Ticket (“MAORY understanding of 2nd port requirement is ... “)

Design with Smaller DMs: 600mm diameter, similar Offner. Looks very attractive
Pro:

- smaller bench, lighter. How much?

Drawbacks:

- we’ll have 33acts on the diameter. OK. Still about 800modes with 18mm pitch
- more complex plate and 2nd mirror
- in the current folding MICADO is not in the proper position
- last mirror is colliding with the MICADO tower
- there may be optics in the MICADO footprint, to be removed with

Even: similar optics size, likely similar price
LBu: Do we go on with the old design, and in the meanwhile we look into details?
MRi: No, let’s go now on with this and design mechanics with this
PFe: Easy to sell it to ESO as optimization
[LBu: Discussion was resumed at the end of this day, with opposite decision: going on with bigMOC and study smallMOC optically and mechanically to assess pro and cons, before PDR]

Schmidt Plate -
Waviness of 50nm ptv is creating a displacement between beams spaced 1” apart of 500 microarcsec, 10 times larger than the overall

LBu: what is a reasonable lower limit for waviness for this kind of plate? Ask to vendors
CAr: 50 microarcsec is applicable only to MICADO small field observations. TBC.
CAr: Involve Rodighiero
AI [DMa]: clarify waviness that can be obtained on real optics of plate-like size produced with similar manufacturing techniques

Marco Riva - Cameo

Slides: http://wwwmaory.oabo.inaf.it/owncloud/index.php/f/32328

Requirements are divided in Tech Spec, Common ICD, Common Req, External Interfaces
Each Interface has one or all of Optical, Mechanical, Fluid, Electrical, Alignment

Requirements datapack: from Cameo -> Excel files -> given to subsystems
LBu: Find a way of exchanging the requirements that allows to get comments from anyone and let everyone be capable of reading the last version and commenting on it.

MRi: Each subsystem is presenting Analysis Document, Design Document (separated), MAIV Document.

AI [LBu]: Prepare ANR and DER templates for the subsystems

Long discussion of ICD: where they should be? There is a master doc describing every interface between every pair of subsystems. Maintained by MRi and being the reference.
A description of interface can be added in the Design Document (only for information)

Example on PH0: requirements (budgets), interfaces

Enrico Cascone - PH0

Slides: **AI [ECa]** Upload slides in http://wwwmaory.oabo.inaf.it/owncloud/index.php/f/32300

Slides of MRiva about PH0 Requirements:
http://wwwmaory.oabo.inaf.it/owncloud/index.php/f/32327

Overview of the ICH Design and Analysis Report
Electronic cabinets will be located under the Nasmyth platform. Mandatory. But what about power supplies of cameras, piezo length?
SCP are on the Nasmyth, above the Electronic Cabinets Platform

DM: MXo: space is allocated for DM? Where? Microgate has still to specified.
AI [ECa]: Verify that the needs for DMs electronics are considered in the design. Agree on interface with MXo

There are several cabinets:

- 1.5 on corotating
- 3 for LGS (maybe 2)
- 1 for thermal (NO: it will)
- 2 for PFRO
- 1 for Calibration Unit
- 1 for Power distribution

Cooling is distributed by the Thermal Control Cabinet (under responsibility of Matteo Aliverti)

Each cabinet has:
A single PLC per subsystem to monitor all cabinets of that subsystem: manage control valve to keep temperature constant, overtemperature, leak

PH0 provides the design of the unit to refrigerate the cabinets

Safety Power Budget: who is in charge to understand system needs and negotiate from ESO? ECa, MRi, IFo.
AI [ECa]: Analyze Safety Power needs, design system strategy about safety power usage and get approval from ESO

Remote switches: circuit to power-cycle devices. To be used? Boh, not clear

In case of power loss, each cabinet must be re-armed manually. It is an ESO requirement. Or only the main switch?
AI [ECa]: Clarify power up scheme of the MAORY cabinets

ECa must validate the choice of each electronic device from the various subsystems and inform BSa in case "SW special devices" are needed

Feedback: what in the case of a device going from A to B? It is enough to have 2 limit switches, or do we need encoders? Absolute / Relative? No general agreement on system guidelines.

Distributed/Centralized: distribute motor controllers. It needs a Request for Waiver to use Beckhoff EtherCAT Box modules
AI [ECa]: Finalize Distributed/Centralized trade off. Produce report. Interact with ESO to clarify if the distributed system is acceptable

What goes in the DER of PH0? The design of all electronics of every subsystems? No. But put summary tables

AI [ECa]: in PH0-DER please split section with general guidelines and system related stuff from topics related to Main Electronics only.

Vincenzo De Caprio - PM0

Slides: http://wwwmaory.oabo.inaf.it/owncloud/index.php/f/32518

Slides of MRi about PM0 requirements:
http://wwwmaory.oabo.inaf.it/owncloud/index.php/f/32417

Structures for the MOC
Case 1) Cage - Box-shaped frame structure: steel, 10.2T (without contingency and without enclosure), 10.9Hz first natural frequency
Loads on Nasmyth are <1250KN with 1.5 safety margin: OK!

Case 2) Truss Bench Frame: 9.6T (without as before) 11.7Hz
Loads are 730kN: even better than case 1

Analysis about Nasmyth deformation and about deformation of the optomech after LGSWFS motion or Elevator motion is to be done in the future.

Will we suffer from people moving on the bench during alignment?

Elevator: long discussion about accessibility of the focal plane.
LBu: It is wise to assume that the elevator loads must be able to access the focal plane.
Req: the load of the elevator must have access to the natural star focal plane

LGSW: discussion about accessibility. General maintainability is from below.
Interface between table and the LGSW rotation: a plate with 3 points?
Alignment: there is the fold mirror, but not easy to adjust pupil and pointing

ZHu: MAIV can be studied while LIBRA is doing the final design.
LIBRA: How to resume activity of design while the smaller optical design is evaluated?

Decision: We go on with the design with the big MOC, and LIBRA can start its activity. DMa can evaluate the sMOC in the meanwhile (and VDC in the meanwhile for a possible new table) with a timescale up to the PDR. If sMOC is >> then bMOC (for mass, optics, whatever) we can decide to change after the PDR

AI [DMa]: Study in detail an sMOC solution to compare with MOC in case a reduction of volume / mass is mandatory.
AI [VDC]: Evaluate the impact on the bench of the sMOC solution, expecially in term of mass saving

Thursday 4th July

People:
Paolo Ciliegi
Nicholas Devaney
Sylvain Oberti
Italo Foppiani
Lorenzo Busoni
Bernardo Salasnich
Andrea Baruffolo
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Marco Riva
Marco Bonaglia
Enrico Giro
Gianluca Di Rico
Philippe Feautrier
Jean-Jacques Correia
Zoltan Hubert
Vincenzo De Caprio
Enrico Cascone
Vincenzo Cianniello
Christian Eredia
Ivan Di Antonio
Mauro Dolci
Simone Di Filippo
Cedric Plantet
ADD YOUR NAME HERE

Sylvain Oberti - LGS Tomography and Spot Truncation

Slides http://wwwmaory.oabo.inaf.it/owncloud/index.php/f/32443

C-More vs LISA

What is the real pro of Global Shutter ? Spatial reconstrution (fast jitter can be seen as astigmatism). Smaller delays (if you read and process in smart way).
AI [GAg, CPI]: Quantify impact of C-More on AO performances
AI [ZHu]: Verify effects of C-More acceptance Cone of about +/- 5°
AI [ZHu]: C-MORE 9um px -> different optics for the lenslet / Verify feasibility - impact on Optical Design
AI [MRi]: Investigate with ESO about MAORY contractual binding with LISA
All Simulations from SOb CVe MLL have been done with the elongation aligned to the diagonal. Req: Do we have it as a spec on the LGSW?

Spec: Elongated spots must be about aligned with subaps diagonal to minimize truncation

LGS Flux: Spec 8MPh/s/m2 corresponds to 70% availability at Z=60, 90% at Z<50
AOF scaled to ELT -> 2000ph/SA/Frame (considering 80x80, 500 Hz, 0.23 overall troughput)
<NO: WRONG - AOF scaled to ELT is consistent with TechSpecs>
From Tech Spec -> 90% availability at 470 ph/SA/frame - 50% availability at 820 ph/SA/frame
Design using TechSpecs 470 ph/SA/frame should give margin in reality.
Max flux about 5000: no problem of saturation, no ND filters.
What dynamic range in AOF? 10bits?
Do we have the correct dynamic range in the simulations?

Req: we need to defocus the spot in super good seeing to have always more than 1px/FWHM. We do it with the laser launch? Or permanently designed to have always at least 1.5" defocused spot?

ZHu: What is the effect on slopes of the shape of a defocused spot? Experiment with AOF?

AI [SOb]: Ask MLL which ones of the 8 launchers are going to be populated with the 6 lasers

Regularizations a-la Tallon with elongation discard threshold
Target: the fraction of discarded long-axis slopes doesn't need to be modified with elevation, according to the simulations.

FoV 10" needs 30% of discarded long-axis slopes for optimal results
FoV 20" discard 0% and fixed binary map of valid pixels is ok for any operating conditions: no optimal, but ok.

In case of sodium profile variations the slopes are biased (50-100nm) and the optimal performances are retrieved by increasing the number of discarded slopes.
FoV 20" is the most robust: no calibration, no rec tuning.
FoV 10-15" is still ok, with

AI [SOb]: Check Tallon-like regularization results with different atmospheric profiles.

Number of subapertures: 60 seems are ok from simulations (superresolution)

Req: conjugate LGSWFS to pupil, not to M4. Also rotate lenslet grids wrt each other.

Robust design choices: using C-MORE and/or superresolution we can have 20" FoV and proper sampling without spot enlargement.

Req for Demetrio/Patrick: we are going back to the 20" FoV :-) Joking: we can live with 15. But 20" allows easier life at the telescope

ZHu: try to avoid laser defocusing that has never been tested.
With LISA also 57 and 14 pixels is ok, actually better

Philippe Feautrier - LGSW

Slides http://wwwmaory.oabo.inaf.it/owncloud/index.php/f/32432

AI [ZHu]: Piezo actuator in the pick-off mirror for pupil tracking. It is not in the focal plane, and pivot not on the surface, so introduces a pointing error. Small (<1”) according to ZHu. Please verify.

Check that in the case of C-MORE the acceptance angle iso ok.
Fixed asterism: surely ok on-sky. to be verified with CalUnit, but large FoV and platescale should help.
Req: Orientation of the lenslet: Have spot elongation roughly along the diagonal. Avoid overlapping the 8 lenslet grid projected on the pupil to benefit from pupil supersampling
Now cameras are parallel to each other. It is possible to rotate?
AI [ZHu]: Current design of pick-up probes is for 15”: if we increase to 20”, maybe it is not possible to do 8x45”. Please check.

Req: Rotative stage: specs missing. Speed, motion accuracy, pupil run-out, focal plane wobble
Req: Focus stage: specs missing as above
Individual vs global pointing: now individual, justify if needed. Anyhow we have some range using slope offsets.
AI [LBu] Individual LGS WFS focus adjustment is needed? *[Check Laura's report]*

Installation from top? Or bottom? MRi will find a smart solution as always. Install from bottom in the integration hall. Can’t be done when legs are in place.
Interface plate / ICD: to be discussed
Decision: LGSW is installed from top *[LBu I guess I got this wrong. Please correct]*

Access from bottom to access LGS.
Access from the side: agreed. Could use 2nd floor of HARMONI platform.
Location of electronic cabinets: which devices are to be close to the unit?
AI [ECa]: Decide where to put the electonics cabinets. Decide fixation points and earthquake chose/design dumpers.

Spec: Rotation: 90° degree is enough. 360 is useful for maintenance or some fancy operations. *[LBu: 360 could ease the design of the internal calibration unit]*
Bench material: most probably steel
Bench thermal control:
TRL 5 at PDR: no need to prototype for PDR. Only critical components are the camera.

Spec: Internal Cal Unit. Fine displacement of the spot across the full field spots to measure SH response.
AI [SOb]: Resend Internal Cal Unit specs to MRi. *[LBu: part of larger work on calibration units requirements]*
SW: Secondary Loops are out of LGSWFS scopes. Long discussion that drives in the direction of saying that more or less everything has to be defined at system level.
LBu: this approach has a consequence at MAIV level: if a secondary loop such as the Pupil Recentering is not specified as a requirement to the LGS WFS, then it will not been verified at Subsystem MAIV and its verification will fall at System MAIV

AIT Strategy: what has to be tested in Grenoble? The things that are specified in the Requirements

Req: specify notch filter.

Decision: Summary of main specs for LGSW:

- LISA (but design allows to use C-MORE) - (LISA is liquid cooled and larger volume)
- FoV 15”
- 60x60 subaps
- Fixed asterism 8x45”

G. Rodeghiero - MICADO Calibration Unit

Shift of the focal plane along z axis: MICADO-FCU is currently illuminated from the front.
Speed of elevator reduced. VDC knows it.
Astrometric mask: 1 pinhole/” and mask dithered with hexapod
Fiber: 10 mas
Tungsten lamps.
Flat field FoV: slightly bigger of the FoV of MICADO. 90% uniformity over the full field.
No pupil mask, just fibers. Pupil is inside MICADO.
Can MAORY use the MICADO Cal Unit? Yes

M. Bonaglia - LOR

Slides: http://wwwmaory.oabo.inaf.it/owncloud/index.php/f/32436
AI [MRi]: Review LOR slides, there are a lot of points to be turned into spec

From a videoconf with ESO it looks like they are outside of the current volume interface.
LOR has no margin.

Getter and Barbecue: getter must be regenerated every 1 or 2 months. It must be removed from the unit because the camera becomes very hot.
MBo is thinking of a mounting solution to extract and replace the camera.
Pumping: currently no way of repumping without dismounting it.
No spares of FREDA.

AI [LBu, MRi]: Review the FREDA maintenance strategy suggested by ESO. Do we really accept the need to dismount cameras so often? Explore alternatives. Understand real needs of FREDA. Needs spare?

FREDA vibrations: PSD exists and are unofficially available.
AI [MBo]: Get vibrations info
SOb: You need blocking filters 2H+2K (2mm thickness filters).
AI [MBo]: understand filter needs and specify filters to ESO.
AI [MBo]: Stray-light analysis: field stops, cold stops, blocking filters.

Req: R-WFS FoV must be >2". Current design is 4"
Req: 10x10 subaps, 24 px
AI [MBo]: MBo asked ESO to install the R Lenslet array in ALICE. MBo wants to have a dedicated agreement about that.
A dedicated spare of ALICE is foreseen
Req: specify filters cutting
Req: specify operating frequency of the cameras.
Req: who is clocking the cameras to be synchronized? different framerate.
ZHu: experience from CANARY: don't synch, it doesn't work. RTC must fix it on its own. There will be dropped frames anyhow.

AI [IFo]: describe the strategy that we want to use to synchronize the cameras. Not a LOR task, it is a system task

SOb: extend LO to J+H and specify needs for FWs. Analyze. Most of the observations in MUSE AO are done in Clear (J+H). SOb provides examples of what is done in MUSE.
Req: restrict to zen<60
Spec about thermal background (135 and 136). Review numbers. 10 e/s?
Req: Focus trombone: stroke +/- 10mm, 50um accuracy (Z4 10nm rms, can be better)
Req: ADC yes or no?
AI [CPl]: Cedric confirms the need of an ADC for the LO.
Req: specify the need for a notch filter to filter out the 589nm
Req: do we need an acquisition camera? not because of the field (telescope pointing is better than 4 arcsec).
Req: limiting magnitude is about 20 in H, 22 in R.
AI [LBu, SOb]: Define a system acquisition strategy from which to derive LOR spec

Req: update Tech Field radius to 80"
Req: speed, minimum velocity of acquisition stages
Req: do we need a full spare of the stages?

Req: Convert pointing accuracy into something that can be tested at subsystem level
Req: update to new optical interface

Cabinets: the cabinet on MICADO platform. Must understand what MICADO is providing: empty cabinet? empty cabinets with services? Clarify housekeeping, cooling, power, services etc etc. for the shared half-cabinet and for the empty one.
AI [MBo, MRi]: clarify LOR cabinets interfaces with MICADO

J. Farinato - MAIV

ESO wants at PDR to see a detailed AIV plan
System MAIV can assume that the subsystems have been verified accordingly to their individual MAIV plans, whose V in turn depend on the specifications
System MAIV can/will put requirements on the subsystems

G. Di Rico - Calibration unit

Slides http://wwwmaory.oabo.inaf.it/owncloud/index.php/f/32481

Spreadsheet in which requirements were collected.
https://docs.google.com/spreadsheets/d/1j8Qg8jqKmig4xlhxIUPTzCgd9N9rOBTx-lF86znlvv4/edit?usp=sharing

Mask: 36 NGS DL source @ 0.8 um (among them 9 are in MICADO up to K band)
5-22 mR
Tolerancing in source positions?

Use cases of Cal Unit.

1) Functionality test in day time (close loop with both NGS and LGS)
2) Calibration (before the Schmidt plate and only a couple of elevation angles)

AI [SOb, LBu, MRi]: to update use cases of the Calibration Unit and update requirements

Friday 5th July

People:
Paolo Ciliegi
Nicholas Devaney
Sylvain Oberti
Italo Foppiani
Lorenzo Busoni
Bernardo Salasnich
Andrea Baruffolo
Simonetta Chinellato
Marco Riva
Enrico Giro
Philippe Feautrier
Jean-Jacques Correia
Zoltan Hubert
Vincenzo Cianniello
Christian Eredia
Ivan Di Antonio
Gianluca Di Rico
Mauro Dolci
Jacopo Farinato
Demetrio Magrin

Marco Riva - Thermal Control

Slides: http://wwwmaory.oabo.inaf.it/owncloud/index.php/f/32492

1 deg of dT between air and glass creates about 0.2-0.4” of mirror seeing according to literature
Criteria: avoid dT > 1 C between structure/mirrors and air in the optical path
Passive insulation is not able to provide a sufficient delay

Active temperature control. 350W of cooling power (14000m3/h) to stabilze at 1C on a step of 5C

Req: keep dT < 1C between air and structure under operating conditions
Req: keep 5C static, in any environment? Or allow following seasonal temperature
It poses constraints on sealing the bench
Analyze how to avoid condensation on the entrance window.

Nicholas Devaney - Test Unit

Slides: **AI [NDe]**: add the slides in http://wwwmaory.oabo.inaf.it/owncloud/index.php/f/32490

What should it do? Complex to simple

- Full-blown atmosphere + ELT (M4) + LGS + NGS + dynamics ?
- Static turbulence, dynamics of LGS (rotation + defocus)
- Single Layer of Turbulence
- Mimic M4 or no?
- All static
- Calibration unit

Why?

- Close the loop or just verify measurements?
- Effects not included in models
- Verify performance

Use cases:

- Verification of performances: the Test Unit implements an environment which is not the real one (no ELT and M4), but we should aim to an environment providing 30% SR to have MAORY working as close as possible to operating conditions.
- We will adapt the simulation of Cedric and Guido to the test environment. So the verification will aim at reaching the simulator results. If the system agrees with the expected simulated results in the test environment, it means that will be ok also for the sky.
- Use Case: Learn about producing control matrixes (includes M4 vs PFDM rotation)
- Use Case: Test secondary loops algorithms (control matrixes updates, offloads)
- Use Case: Verify Split tomography: LO - HO. Needs reasonable tomographically distributed turbulence (like 3 layers conjugated to DMs + one/a few layers not conjugated to DMs)
- Use Case: Calibrate LGSW aberrations NCPA
- Use Case: Vibrations (simulating things faster than)
- Use Case: Verify Truth sensor scheme
- Use Case: Measure SR somewhere in the scientific field. Assess uniformity in a few fixed position. H band
- Use Case: Verify pupil image quality on the MICADO
- HO WFS at the exit port.

Bernardo Salasnich - SW

Slides http://wwwmaory.oabo.inaf.it/owncloud/index.php/f/32499

AI [MRi]: there is a complete list of missing specifications in the presentation
Architecture scheme about interfaces especially with SCAO
We provide the infrastructure to operate the SCAO
Discussion about the current scheme that requires the MAORY ICS to be deeply involved in the details of SCAO observation. No decision taken. MCAO should be invoked only for the preparation-for-a-SCAO-Observation, and nothing more.
AI [BSa]: clarify details of SCAO mode

Andrea Baruffolo - RTC

Slides http://wwwmaory.oabo.inaf.it/owncloud/index.php/f/32501

HRT and SRT requirements: update
Storage capability & diagnostic data stream
What is needed for PSF reconstruction is: everything at loop rate without WFS images (so called “decimation”). Done
GPU vs CPU: let’s decide at PDR
Main Loops Reqs: let’s fix them on the high level 8 x 80x80 with C-MORE (1600x1100) and 5000+1500+1500
Exploit commonalities: nothing against it. Needs coordination.
NRC feasibility study: VAT and money.
AI [ABa]: finalize NRC contract

Marco Xompero - DM

Slides http://wwwmaory.oabo.inaf.it/owncloud/index.php/f/32519

Current design based on spherical DMs for 2018 baseline
Req: specify/confirm stroke for static shapes (currently Z4=6um…, involve understanding offloading strategy)
Req: specify coating. But little margin, must be Al.
Req: specify bafflings /

Electronics: total 16U (10U for positioner, 5U for power supply with batteries)
All electronics can be far away.

Sphrolinders vs screw and (spine). Vibrations and resonance frequency

Question: do we need really an hexapod? DMs are in an almost collimated beam, so we should not need focus compensation. Translation of the flat mirror is not needed. So we need only tip/tilt. TBC.
AI [LBu, MXo]: Clarify stroke management and hexapod needs for the PFDMs

Cooling: Total Coolant DeltaT 6.9C - 2.2 l/min for DM.

Optical Test? Flattening. It can be done in MG, but we need a collimator.
And how to redo it in Chile? Ask ESO to use M4 tower? Need adapter and calibration will be done with the DM horizontal.
AI [MXo]: Explore options for flattening facility in EU and at ELT

Cold test was included in previous offer: but a flat DM is not easy to do it in MG cold chamber.

Action Items

Who	What	Redmine Issue link
MRi	Clarify with ESO the situation of SRR amendments. LBu recall they agree to provide a written amendments to the Tech Specs as AD for the PDR	http://wwwmaory.oabo.inaf.it/redmine/issues/188
DMa	upload slides in http://wwwmaory.oabo.inaf.it/owncloud/index.php/f/32300	
DMa	Look details of IR-Transmitted to be sure of feasibility (LGSW position, aberrations/chromatism in MICADO, ...) Define specs for IR-Transmitted and ask quotation	http://wwwmaory.oabo.inaf.it/redmine/issues/50
DMa	Clarify waviness that can be obtained on real optics of plate-like size produced with similar manufacturing techniques	http://wwwmaory.oabo.inaf.it/redmine/issues/189
LBu, MRi	Prepare ANR and DER templates for the subsystems	

ECa	Upload slides in http://wwwmaory.oabo.inaf.it/owncloud/index.php/f/32300	
ECa	Clarify number of cabinets and their layout on the telescope	http://wwwmaory.oabo.inaf.it/redmine/issues/80
ECa	Analyze Safety Power needs, design system strategy about safety power usage and get approval from ESO	http://wwwmaory.oabo.inaf.it/redmine/issues/93
ECa	Clarify power up scheme of the MAORY cabinets	http://wwwmaory.oabo.inaf.it/redmine/issues/190
ECa	Finalize Distributed/Centralized trade off. Produce report. Interact with ESO to clarify if the distributed system is acceptable	http://wwwmaory.oabo.inaf.it/redmine/issues/191
DMa	Study in detail an sMOC solution to compare with MOC in case a reduction of volume / mass is mandatory.	http://wwwmaory.oabo.inaf.it/redmine/issues/198
VDC	Evaluate the impact on the bench of the sMOC solution, especially in terms of mass saving	http://wwwmaory.oabo.inaf.it/redmine/issues/198
GAg, CPl	Quantify impact of C-More on AO performances	http://wwwmaory.oabo.inaf.it/redmine/issues/196
ZHu	Verify effects of C-More acceptance Cone of about +/- 5°	http://wwwmaory.oabo.inaf.it/redmine/issues/197
ZHu	C-MORE 9um px -> different optics for the lenslet / Verify feasibility - impact on Optical Design	http://wwwmaory.oabo.inaf.it/redmine/issues/197
MRi	Investigate with ESO about MAORY contractual binding with LISA	
SOb	Ask MLL which ones of the 8 launchers are going to be populated with the 6 lasers	
SOb, CPl, GAg	Check Tallon-like regularization results with different atmospheric profiles.	http://wwwmaory.oabo.inaf.it/redmine/issues/195

ZHu	Piezo actuator in the pick-off mirror for pupil tracking. It is not in the focal plane, and pivot not on the surface, so introduces a pointing error. Small (<1”) according to ZHu. Please verify.	http://wwwmaory.oabo.inaf.it/redmine/issues/194
ZHu	Current design of pick-up probes is for 15”: if we increase to 20”, maybe it is not possible to do 8x45”. Please check	http://wwwmaory.oabo.inaf.it/redmine/issues/193
LBu, ZHu	Individual LGS WFS focus adjustment is needed?	http://wwwmaory.oabo.inaf.it/redmine/issues/192
ECa	Decide where to put the electronics cabinets. Decide fixation points and earthquake chose/design dumpers.	http://wwwmaory.oabo.inaf.it/redmine/issues/80
CPl	Bandwidth of the LO WFS	http://wwwmaory.oabo.inaf.it/redmine/issues/175
CPl	Quantify the dynamical range of the LO WFS	http://wwwmaory.oabo.inaf.it/redmine/issues/174
IFo	describe the strategy to synchronize the WFS cameras	http://wwwmaory.oabo.inaf.it/redmine/issues/156
CPl	Confirms the need of an ADC for the LO.	http://wwwmaory.oabo.inaf.it/redmine/issues/140
LBu, SOb, CAr	Define a system acquisition strategy from which to derive LOR spec	http://wwwmaory.oabo.inaf.it/redmine/issues/40
MBo	Obtain information about FREDA vibrations	http://wwwmaory.oabo.inaf.it/redmine/issues/179
MBo	Define thermal blocking filters needed in FREDA	http://wwwmaory.oabo.inaf.it/redmine/issues/158
MBo	Perform stray light analysis for the LO WFS	http://wwwmaory.oabo.inaf.it/redmine/issues/180
MBo, MRi	Clarify LOR cabinets interfaces with MICADO	http://wwwmaory.oabo.inaf.it/redmine/issues/1

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SOb, LBu, MRi	update use cases of the Calibration Unit and update requirements	
BSa	Clarify details of SCAO mode	http://wwwmaory.oabo.inaf.it/redmine/issues/177
ABa	Finalize NRC contract for RTC feasibility study	http://wwwmaory.oabo.inaf.it/redmine/issues/134
LBu, MXo	Clarify stroke management and hexapod needs for the PFDMs	http://wwwmaory.oabo.inaf.it/redmine/issues/101
MXo	Explore options for flattening facility in EU and at ELT	http://wwwmaory.oabo.inaf.it/redmine/issues/176