PERSONAL INFORMATION

Edoardo Maria Alberto Redaelli

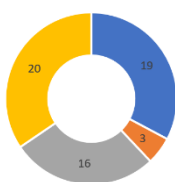📍 Via Giovanni Pascoli 6, La Valletta Brianza (LC), 23888, Italia

📱 +39 3394106954

✉ Edoardo.redaelli@inaf.it

🆔 orcid: 0000-0001-8185-2122

💬 Skype: edoardo.redaelli2
linkedin.com/in/edoardo-redaelli-342692108/

Sex Male | Date of birth 08/08/1992 | Nationality Italian | H index 8 from SCOPUS up to 2022
H index 11 from GOOGLE SCHOLAR

DESCRIPTION

PUBLICATIONS

- PROCEEDINGS ■ CATALOG ■ PAPERS ■ ACCEPTED PROCEEDINGS

- Optomechanical designer for several projects MORFEO, CUBES, ANDES, ESPRESSO, MCIFU
CAD model, 2D drawing
- Alignment and metrological experience PhD thesis, Laser Tracker user, ESPRESSO, SOXS
- **FEA engineer: gravitational, thermal, vibrational analysis for ELT, VLT instrument,** and research project
- **Integration experience ESPRESSO, MCIFU, SOXS**
- Asset for the development for 3d printing technology
- Manufacturing and assembly of mechanical components
- **TOTAL OF CITATIONS 735 (google scholar), TOTAL OF PUBLICATIONS 38, ACCEPTED PROCEEDINGS 20, PATENT 1**

WORK EXPERIENCE

11/2021 – on going

Mechanical and Optomechanical engineer

INAF Osservatorio Astronomico di Brera

Assegno di ricerca tipologia A "di professionalizzazione" dal titolo "Progetto Maory: progettazione dell'optomeccanica dello strumento Maory e uso di metrologia meccanica",

MORFEO ex MAORY @ ELT Ongoing now in PDR closing of the phase B
- **Responsible of the optomechanical work package** of the instrument
- Mechanical analysis of the mountings with trade off
- Collaborating in the alignment strategy based on the laser tracker
- Realizing of the documentation and drawing @ PDR level
- Fundamental in the interface definition

During the different phases of the project, I always cover the role to finalize and analyse the optomechanical design of the instrument. Due to the needs of the project the necessity to reduce the mass imposes a lightweight design that was finalized in the PDR. The alignment system for the optomechanics was built in order to fulfil the uncertainty in the manufacturing of the optics. In my PhD thesis I estimated the uncertainty positioning the 12 one-meter class optics computing the final error budget.

CUBES @ VLT Ongoing PDR in November 2022
- **Responsible of the fiber link design and analysis** from CUBES to UVES
- Mechanical analysis of the sub system
- **Responsible of the handling and cable wrap subsystem**

CUBES is a spectrograph that is installed on the Cassegrain of VLT I follow the mechanical design of the fiber link following all the aspect that involved both the structural part but also the needs to have a modular structure the instrument impose in order to follow the alignment strategy.

BEATRIX test facility for **ATENA ESA mission** now fully operative
- **Mechanical alignment of the laboratory using the laser tracker**
- Alignment of the main optical bench of the test facility
- Characterization of the movement of the CCD using the laser tracker

My role in the project is to follow the mechanical alignment of the whole facility as laser tracker expert. The main goal of the activity is to guarantee the proper positioning of both mechanical and optical elements. Furthermore, the characterization of the CCD positioning in the optical path since it needs to be moved in order to characterize the X-ray parabola.

ANDES @ ELT ongoing now in phase B
- **SCAO mechanical design responsable**
- Deputy mechanical architecture manager

The project enters in the phase B and the definition of the different mechanical components star to be defined. The complexity of the project imposes also to follow different mechanical aspect at the system level where the project involve several architecture manager in order to guarantee the proper interfaces form the different subsystem

TAO-X on going
- **Alignment tool design, analysis and procurement**
- Definition of the different use case
- Realization of the final drawing and realization

I work on the alignment structure that permit to align the x rays shell one respect to the other using a stiffer optomechanics that minimize the flexure due to the gravity. The design, and the thermal characterization are completed.

11/2018 – 09/2023   ## Mechanical and Optomechanical engineer

INAF Osservatorio Astronomico di Brera with Politecnico di Milano

SOXS @ NTT on going integration phase
- Collaborating in the analysis of the main flange of the instrument
- Study the thermal behaviour of the prism optomechanics
- Participating in the integration phase of the instrument @ OAB

ESPRESSO @ VLT 2019
- **Mechanical design of the input end fiber link recovery**
- Alignment in Italy and preparing for the delivery in Chile
- Collaborating in the alignment @ Paranal of the whole fiber link

I was the designer of the input end. I was involved in the integration of the fiber and doublets inside the new mechanics. Then me and my group was involved to the integration the new fiber link on the mountains where I maturate a loto of skill both practical but also in the sprit of the observatory time during the nights

MCIFU @ WHT 2019
- **Responsible of the mechanical design of the whole spectrograph**
- Optomechenical design with 3D printed component

My role in the project was the mechanical design, the managing of the interfaces and the realization of custom 3D printed component. The instrument was integrated in Italy then shipped to the canary island and installed in the WHT.

PCDM 2021
- **Mechanical design of the optical mounting for the device**
- Study of the mechanical vibrational behaviour due to the electrical field inside the device
- Final drawing and prototyping
- 3D printed component fully optimized for the stiffness requirements

This is a research activity where the study wants to use a photoconductive substrate and a reflective and conductive membrane as deformable mirror, my role in this project is to develop and realize the prototype then the testing and the optimization of the behaviour where the main goal of my activity.

COVID 19 filter research 2020
- Mechanical and fluid dynamic calculation of the filtering system
- **Mechanical design and prototyping**
- 3D printed component and demonstrator

Due to the pandemic situation, I was involved in the creation of a new kind of filter based on the UV radiation in order to sterilize the air of a possible sick patient. My role is to design the shape and the volume of the filter considering the flow rate of air that must be processed. Knowing the time that the UV rays needs to kill most of the virus in the air.

IBIS 2019
- Participating in the decommissioning phase
- Participating in the recovery phase

ADS COLLABORATION on going
- Laser tracker measurement to M4 @ ELT dummy body
- Laser tracker measurement to the M4 structure

I use the laser tracker in order to perform measurement in the ADS premises. Principally the components measured are in the ELT's environment like the dummy M4 with its optomechanics, or the structure used for the integration.

Others:
- M1 MIRROR ON THE OCA EPSILON TELESCOPE AT CALERN
  Design and analysis of the optomechanical structure for M1
- Additive manufacturing
  Organization of the additive manufacturing laboratory, prototyping and realization of final optomechanics, exploiting the proprieties of different kind of filaments
- Ottica Consonni collaboration
  Measure of the geometrical parameters of a spherical mirror

Mechanical and Optomechanical engineer

02/2018 – 10/2018

MORFEO ex MAORY @ ELT
- Responsible of the optomechnaics
- Design of the mounting

This was my first responsible position at INAF and I saw all the steps that the project overcome to reach the PDR

SINTEA HEXAPOD KINEMATIC RECONSTRUCTION
- Preliminary study for Implementation of the hexapodal kinematic for surgical patients with critical bones realignment needs

EDUCATION

PHD in Mechanical engineering

11/2018 – 09/2023

Politecnico di Milano (writing the PhD Thesis)

PhD thesis. "ALIGNMENT AND INTEGRATION OF OPTICAL SYSTEM BASED ONTO ADVANCED METROLOGY"

The alignment of an instrument plays a fundamental role in its final performances. In the astronomical field, this operation has always been performed using external optical feedback in an iterative process. The aim of my work Is to study a different integration procedure devised to reduce the number of iterations for a big instrument composed by several optical elements in the 1-meter class. The proposed procedure consists to in the geometrical measurement of the as built optomechanical elements followed by the integration in the nominal position. The study case for this work is MAORY @ ELT and the accuracy evaluation since the dimension of the instrument impose the choice of a large metrological system is the Laser Tracker (LT). Furthermore, in the thesis will be discuss the possibility to maintain the LT as on-board facility in order to monitoring the instrument on its lifetime, evaluating the impact of the monitoring procedure on the instrument itself.

As research activity the work has a theoretical part where the system is study using the fundamental physics laws and the data given by the manufacturers of the instruments involved in the measurements. On the other side there are the empirical laws that arise by the experimental campaign. The work is divided in the following parts:

The first one, based on the error management, gives the idea of what is the worst alignment condition reachable with the LT. Involving in the model the uncertainty of all the sensors required like temperature, pressure, and humidity probes.

The second is a Build-up approach where the experiments will compose the final metrological end methodological errors analysis. All the experiment will define the error budget that will point out the possibility to use the LT as alignment and monitoring tool.

At the end the work will show the worst scenario and what is reachable considering a proper compensation strategy for all the errors.

ESO unpaid associated 01/10/2021 to 31/12/2021

The activity as written in the contract is based on three main points
- Develop the framework for converting metrology measurements into usable alignment correction for the PFS via coordinates transformation

- Perform laboratory experiments to determine the measurement techniques and associated error
- Combine the experimental data into the measurement framework to assess the alignment accuracy error

SPOF school 2018 LISBOA   10-11/09/2018

"Topics in Optics for Space & Ground Based Astronomical Instruments"

Analysis of the actual status of the technology for the astronomical instruments

PhD Italo Gorini School NAPLES summer 2019

"Topics Electrical and Electronic Measurement"

Master of science in Space engineering
Politecnico di Milano
Score: 95/100

Master thesis: Parametric analysis of optomechanical mountings based on hexapodal kinematics

This work is focused on the analysis of optomechanical mountings based on hexapodal kinematics architecture to obtain efficient supports and proper alignment of an optical device. It has been implemented a parametrized approach considering different conditions of load in terms of operative and survival conditions for the analysis. The project is organized in the following steps:
- Definition of the structure with all the geometrical parameters as input for the code. Any type of initial condition (dimension and shape) can be considered starting from the kinematic chain between each part.
- Definition of all the parameters required for the analysis. All the physical proprieties of the materials are defined in terms of mechanical and thermal behaviour.
- Definition of the proper mesh, with the selection of proper elements type, boundary conditions and applied loads.

Thanks to these three steps is possible to obtain practically any layout. Realistic survival and operational requirements of both ground and space-based application has driven the analyses done. A comparison between the numerical simulations and a real example has been done to validate the modelling technique. The final result is a validated code with an user interface, and a parametric analysis of the behaviour of the optomechanical mountings based on hexapodal kinematics architecture.

TESP Tohoku Engineering Summer Program
TOHOKU university, Sendai Japan
Robotics, I have studied the possibility to use robots in harsh environments like space mission, earthquake, and Human health.

Bachelor of science in Aerospace engineering
Politecnico di Milano
Score: 93/100

Bachelor thesis: Design of two-stage rocket system for LEO mission

The aim of the project is the dimensioning of a two-stage launch system which purpose is to enter in LEO a payload of 10,300 kg. The mass of the payload is inspired by the European Columbus Module in order to make the analysis realistic and closely related to a real mission profile. The Columbus laboratory is a research module developed by the European Space Agency (ESA) for the International Space Station (ISS). Delivered in May 2006 at the Kennedy Space Center was launched in the cargo bay of the Space Shuttle Atlantis on February 7, 2008 on flight STS-122.
In this project, the problem is solved with the use of a first solid-propellant stage and a second cryogenic-liquid stage. They are arranged in series and each one satisfies the required thrust for distinct launch phases. The system achieves sufficient power in order to reach the altitude of the above-mentioned ISS, equal to 400 km.

High school diploma
Sotto ten. di Vasc. A.Badoni

Score: 90/100
Title of: PERITO EDILE E DEL TERRITORIO
The principal subject is related with the word of the civil construction regarding all the aspects from the economical to the realization of the buildings

LANGUAGES

Mother tongue   Italian

Other languages

	READING	WRITING, LISTENING, AND SPEAKING	CERTEFICATION
English	Excellent	Excellent	C1 level certificate (2014)
French	Intermediate	Elementary	-
German	Elementary	Elementary	A1 level certificate (2016)

TEACHING AND COFERENCES

Politecninco di Milano   Laboratory assistant in the course of "Mechanical and thermal measurements" @ Politecnico di Milano (2019)

INAF   Seminar PMI/INAF in Project Management & Systems Engineering (2021)

SPIE
- Astronomical telescopes and instrumentation (2022) - Montreal
- Astronomical telescopes and instrumentation (2020) – Online
- Astronomical telescopes and instrumentation (2018) - Austin

PATENT

Title: "APPARATO PER LA MISURAZIONE DI UNA DOSE DI ESPOSIZIONE A UNA RADIAZIONE"
Domanda numero: 102022000009350
Data di presentazione: 06/05/2022

CERTIFICATION

FEA certification   Participation certificate (SPIE course, 2018)
Spatial Analyser   SPATIAL ANALYZER SOFTWARE ADVANCED TRAINING (ESO 2021)
PMI   PMI/INAF in Project Management & Systems Engineering (2021)
HACCP   ATTESTATO DI FORMAZIONE PER GLI OPERATORI DEL SETTORE ALIMENTARE (2020)
Lavori in quota   LAVORI IN QUOTA e D.P.I. DI 3° CATEGORIA
Manovra corroponti   "Operatore addetto alla conduzione di Carroponte e GRU a Bandiera" (2022)
Sicurezza / Emergenze / GDPR   Corso Base sulla sicurezza, Gestione delle Emergenze, Privacy e GDPR (Politecnico di Milano)
Driving licence   B

SKILLS

IT skills   MS Office tools, LaTeX
Tool: Matlab, Minitab
CAD software: (Inventor, SolidWorks)
FEM/CFD software: Nastran, Abaqus, Comsol, Ansys
3D editing and printing   Z-SUITE, PRE-FORM
Measurement   CAM2, SPATIAL ANALISER
Capability to use all kind of trackers FARO, LEICA, API experience performed @ INAF and @ ESO
Analysis of the data and optimization of the measuring, features and cloud point.

PRODOTTI TECNOLOGICI

I prodotti tecnologici postati all'attenzione della commissione sono i seguenti

Luogo e data……………………..   Il dichiarante…………………………………..