This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 824135.

WP6

JRA2 Advanced Instrumentation Development

SOLARNET

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 824135.

Work package number	WP6		Lead beneficiary		IAC	
Work package title	JRA2: Advanced instrumentation development					
Short name of participant	**KIS**	**IAC**	**SU**	**INAF**	**UNITOV**	**MPG**
Person months per participant:	1	74	3	2	24	54
Short name of participant	**USI/IRSOL**	**WO**	**NAOJ**	**ADS**	**BPP E&M**	
Person months per participant:	48	20	20	7	16	
Start month	1		End month		48	

Objectives

Development of instrumentation to improve the existing solar telescopes and with possible application to the future large aperture solar telescopes. The instrumentation developments included in this WP are the following:

- Improvements of techniques of image slicers for 2D spectroscopy
- Microlens-fed spectrograph
- Design concept of a Narrow-Band Tunable-Filter Imager for EST
- Absolute high precision polarization measurements

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Task 1

Improvements of techniques of image slicers for 2D spectroscopy

(IAC lead, WO, NAOJ)

Task 2

Microlens-fed spectrograph

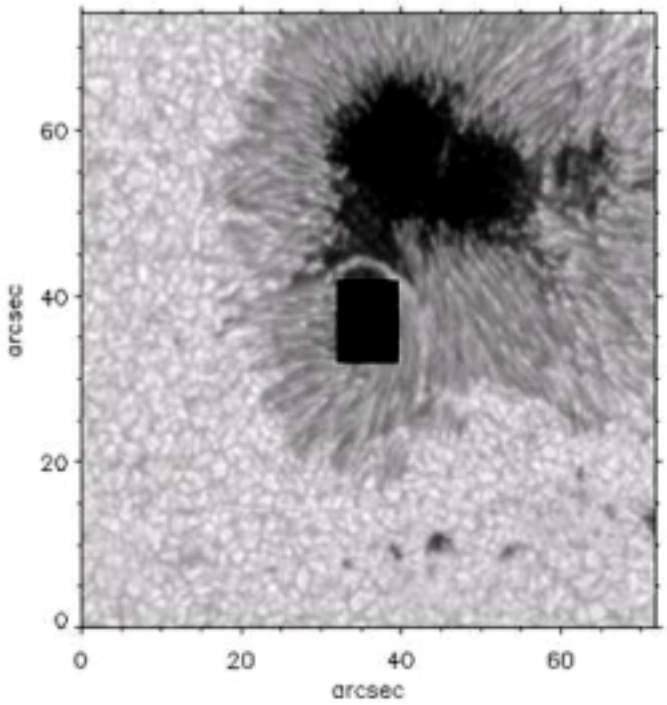
(MPS)

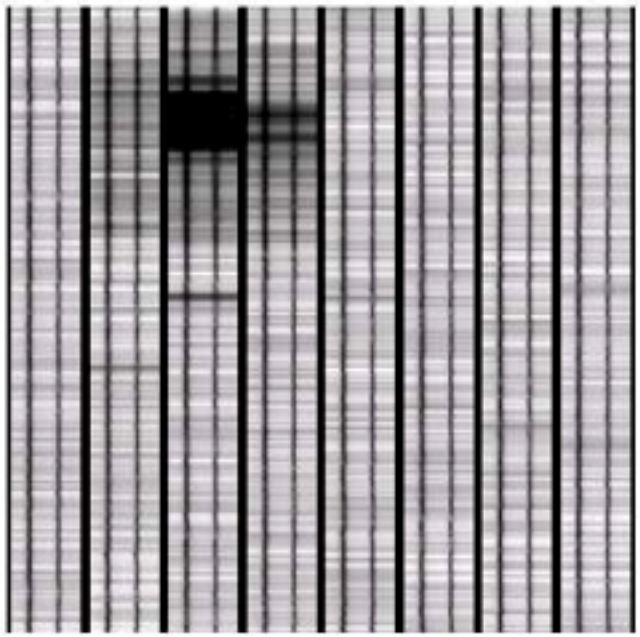
(Heritage of previous SOLARNET and GREST projects and fundamental for the definition of innovative instrumentation for EST)

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 824135.

Integral field units

How do we accomplish simultaneous spectropolarimetry of a 2D FoV?





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Integral field units

Microlens-fed spectrograph

MiHI

(Microlensed-Hyperspectral Imager)

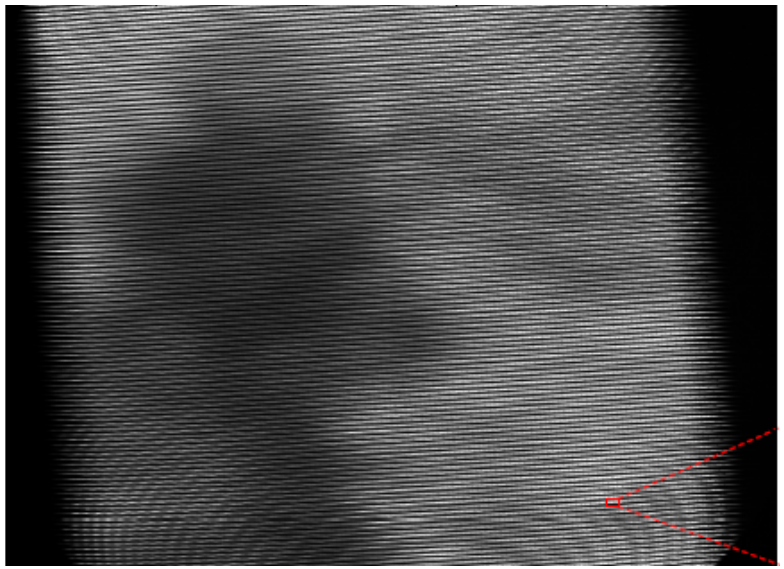
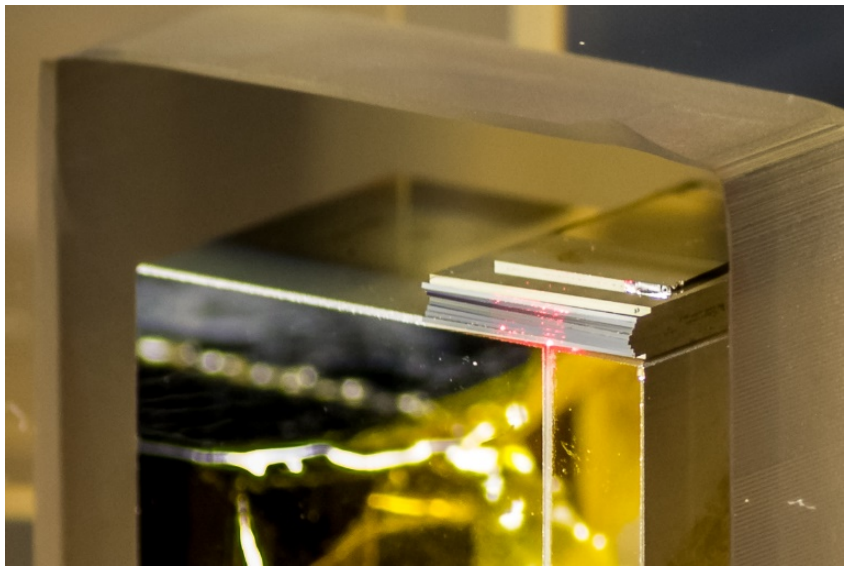


Image slicer

MuSICa

(Multi-Slit Image slicer based on collimator-Camera)



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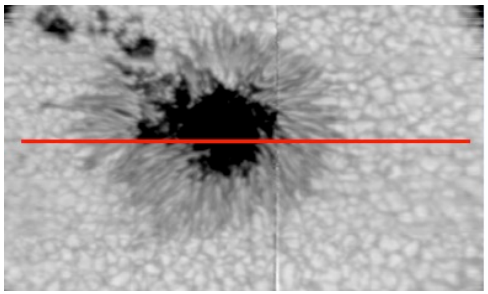
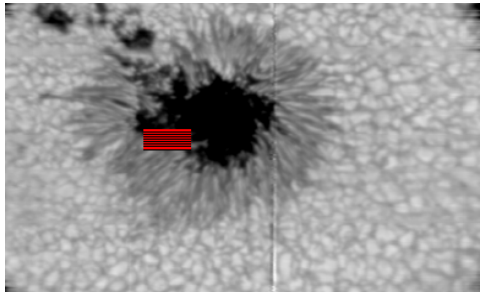
MuSICA: Image slicer

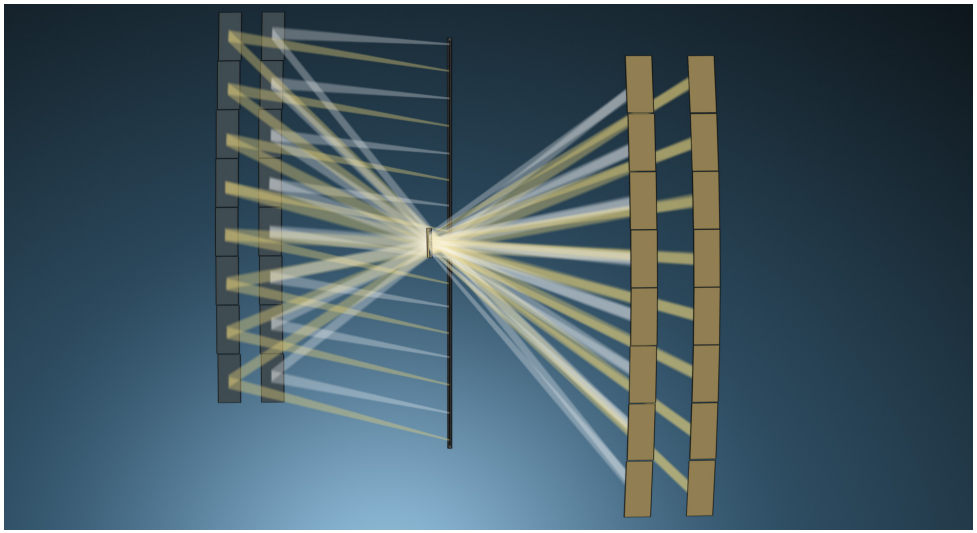


64" × 0.27"



6" × 3"

Calcines et al. (2014)



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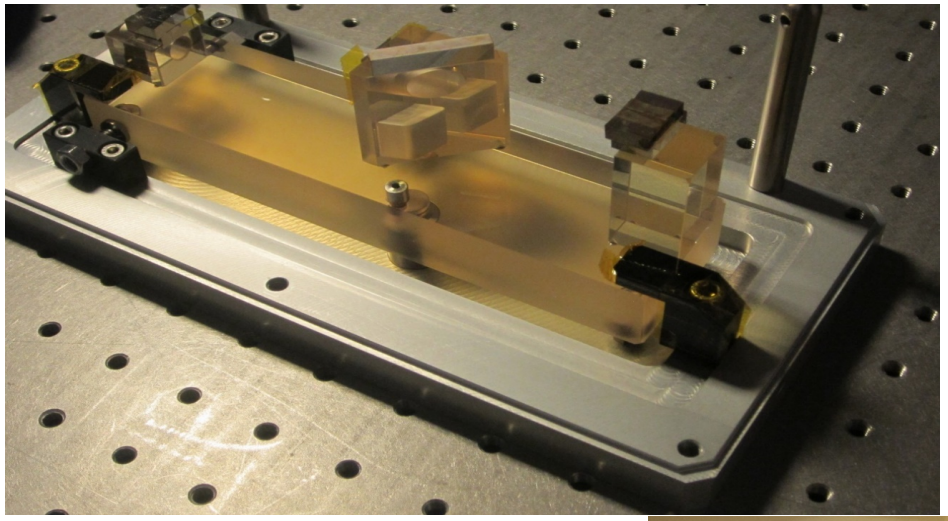
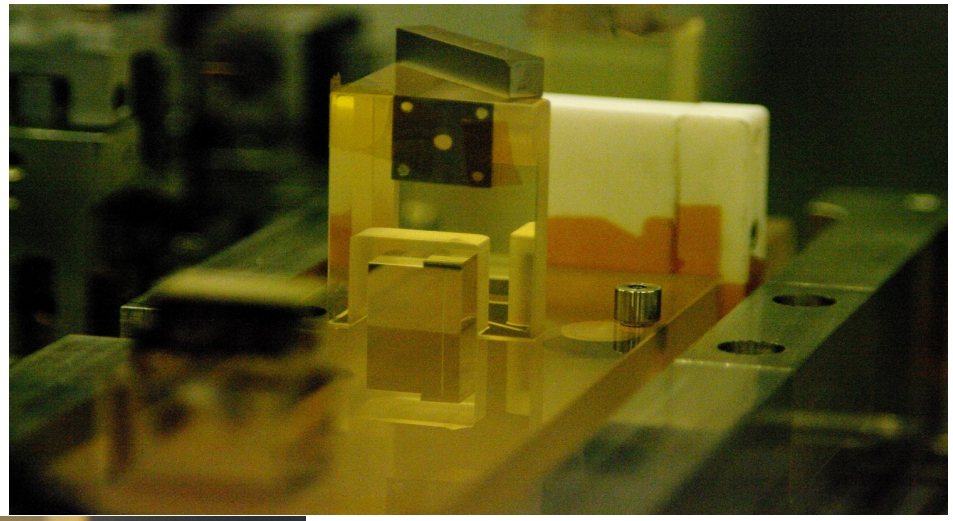
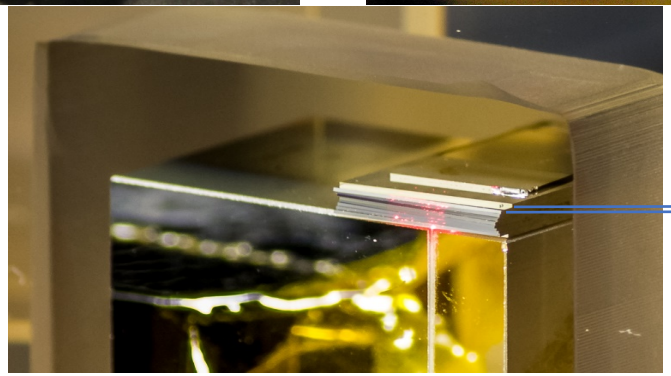
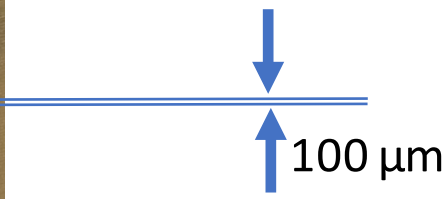
MuSICA: Image slicer





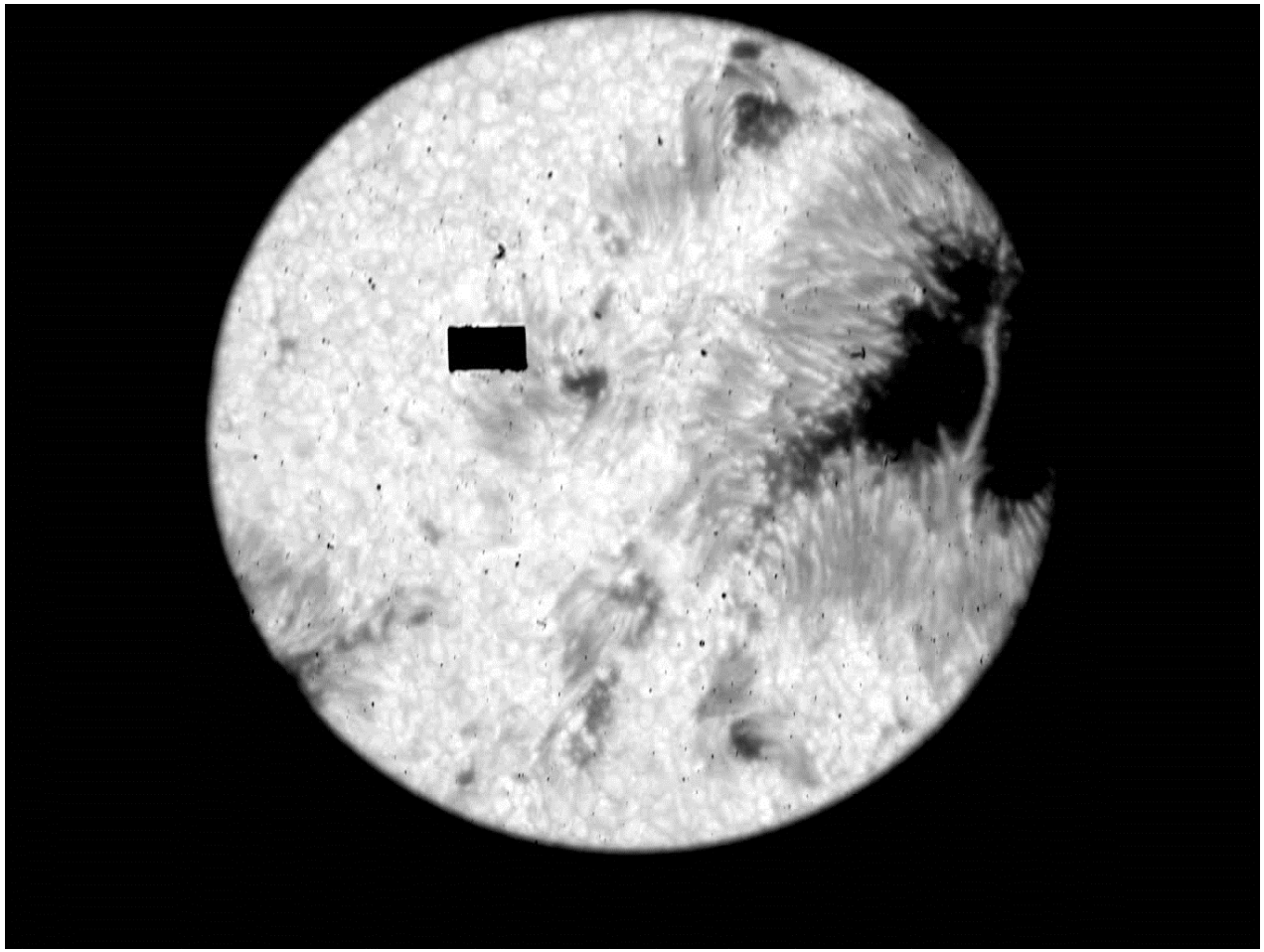




prototype built for GREGOR

Now a common-use instrument

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 824135.



FoV_{window} = 6" x 3"

Sampling:
0.136" x 0.187"

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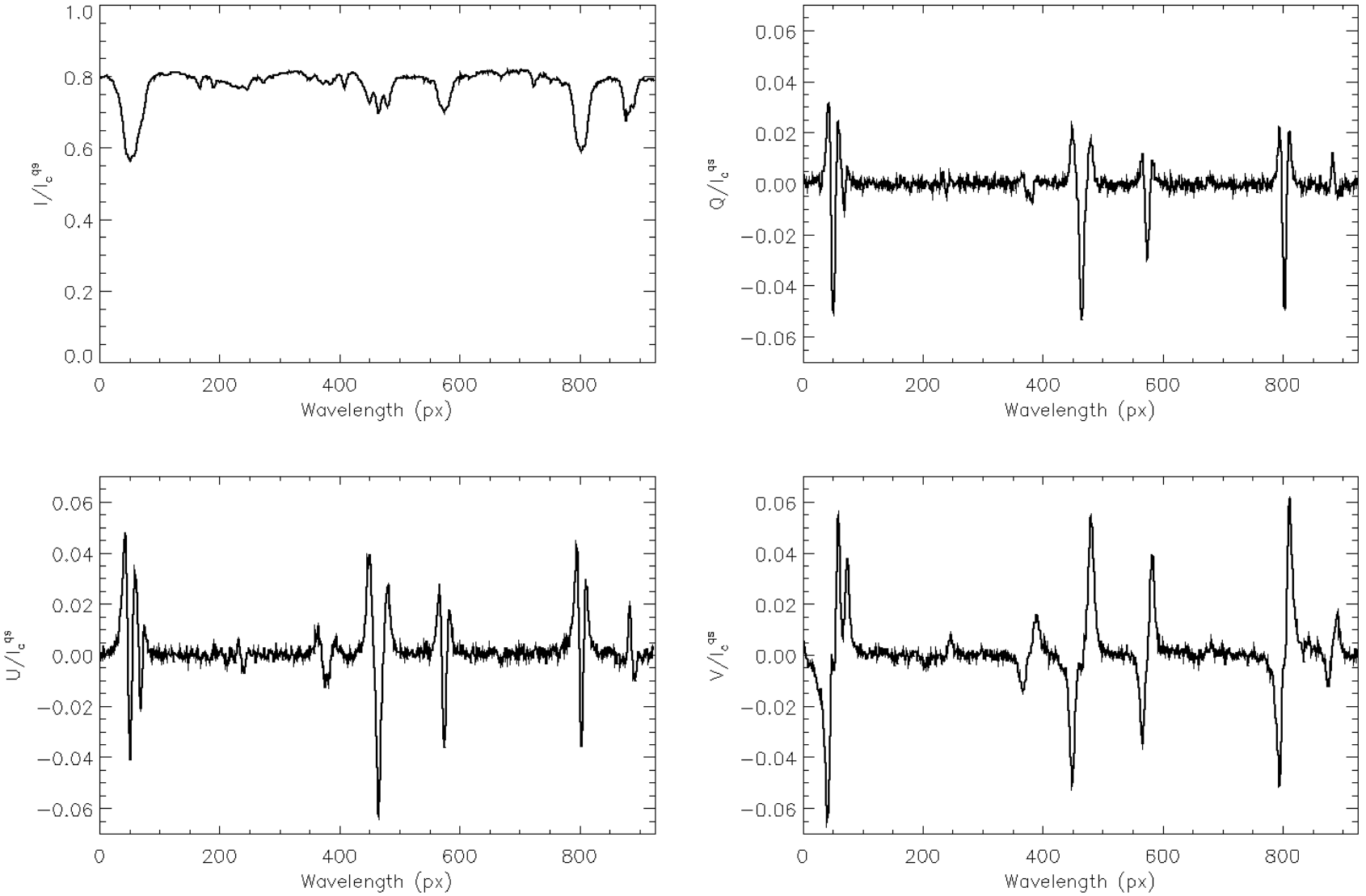
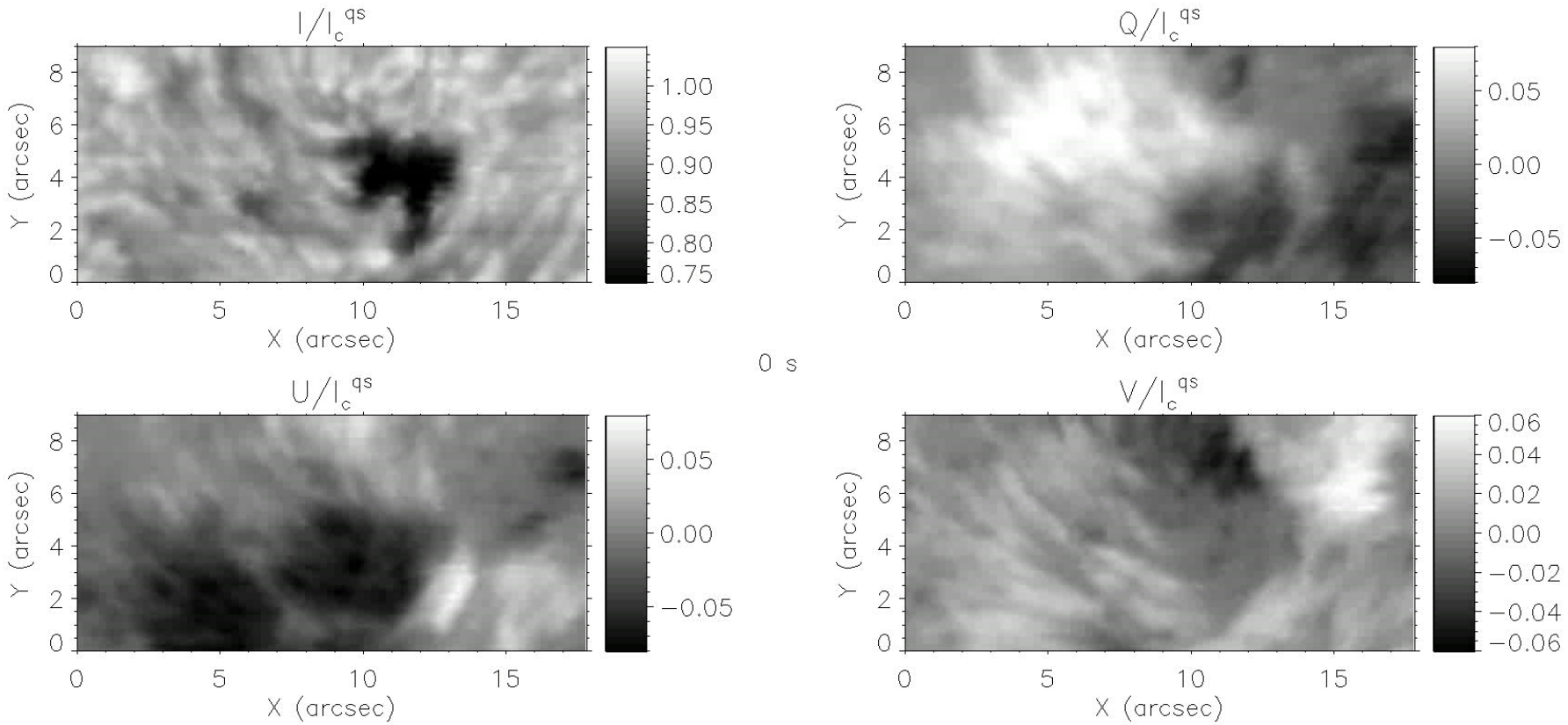


This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 824135.



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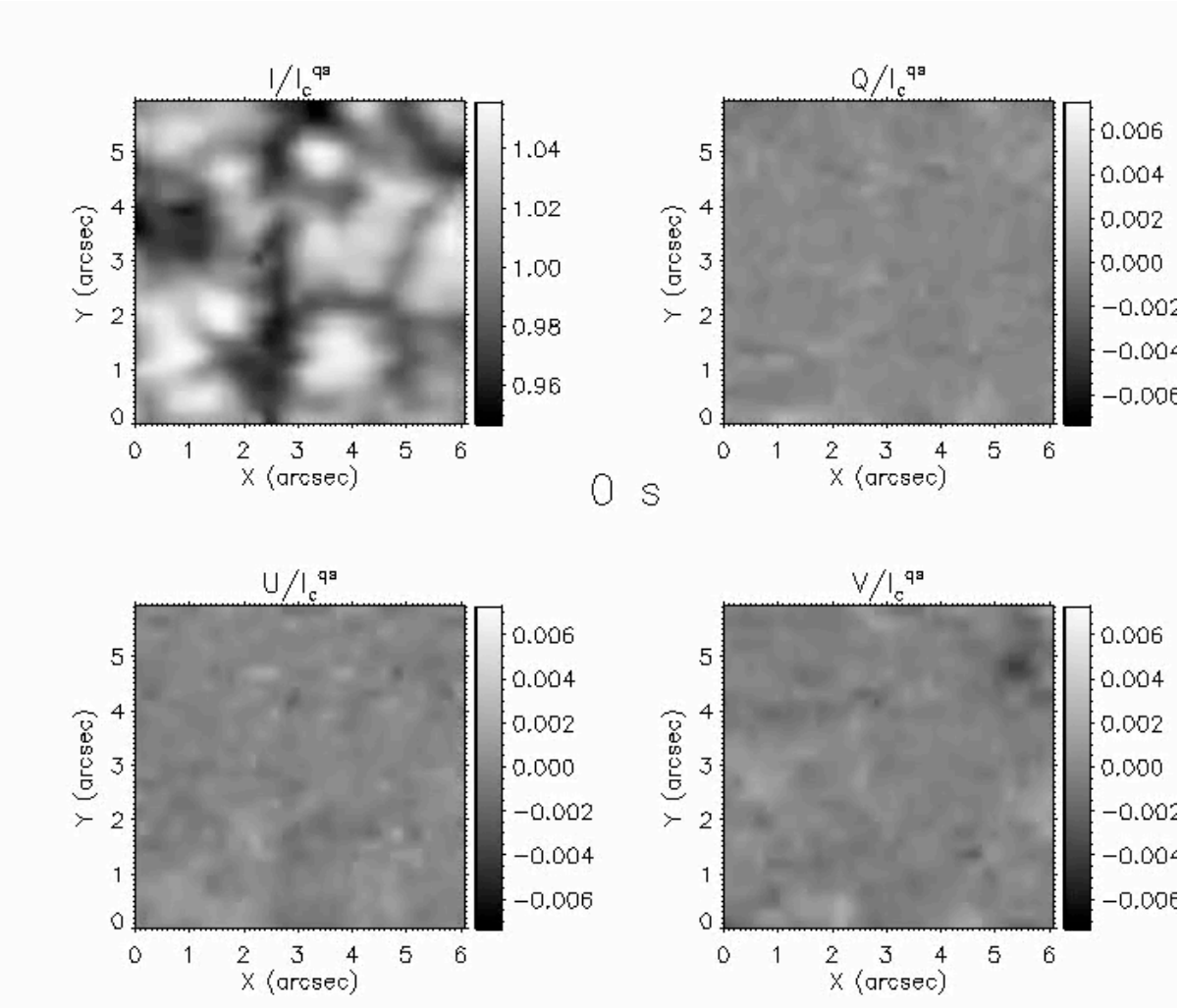

λ = 1.56 μm – Cadence = 8 sec – Duration = 89 min

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Task 1

Improvements of techniques of image slicers for 2D spectroscopy

Goal: increase the spatial resolution, which can only be achieved by having thinner slicers (100 → 50-70 microns)

Two strategies will be followed to that aim:

- glass slicers (to be produced by WO)
- metallic slicers (to be produced by NAOJ)

The two alternatives will be pursued and compared in order to decide the best option for EST.

They will be tested at the lab and the best slicer will be tested at GREGOR telescope.

SOLARNET

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Task 1

Improvements of techniques of image slicers for 2D spectroscopy

Deliverables

Deliverable Number	Deliverable Title	Lead beneficiary	Type	Delivery Date
D6.1	Image slicer design	IAC	Report	13
D6.2	Ability to manufacture thin glass slices	WO	Report	14
D6.3	Ability to manufacture thin metallic slices	NAOJ	Report	14
D6.4	Glass image slicer	WO	Demonstrator	37
D6.5	Metallic image slicer	NAOJ	Demonstrator	37
D6.6	Tests (at laboratory and at telescope)	IAC	Report	48

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Task 1

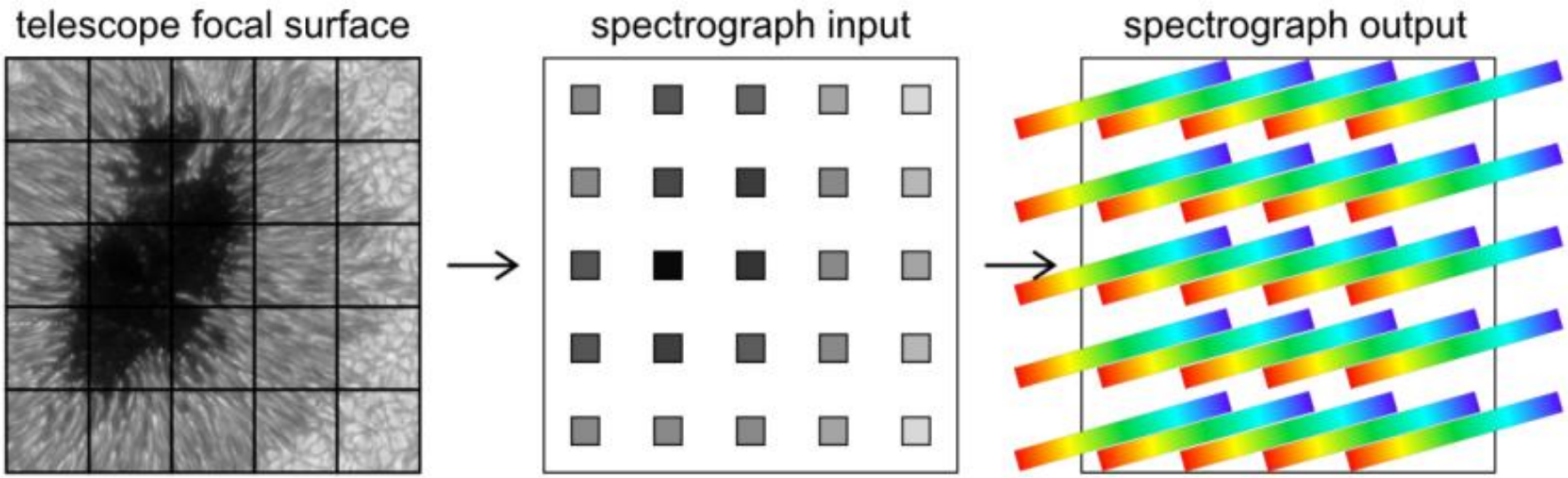
Improvements of techniques of image slicers for 2D spectroscopy

Milestones

Milestone Number	Milestone Title	Lead beneficiary	Delivery Date
MS10	Validation of the ability to manufacture thin metallic slices	IAC	13
MS11	Manufacture thin glass slices	WO	36
MS12	Manufacture thin metallic slices	NAOJ	36
MS13	Integration with the reimagination optics	WO	39

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 824135.

MiHI: microlens-fed spectrograph



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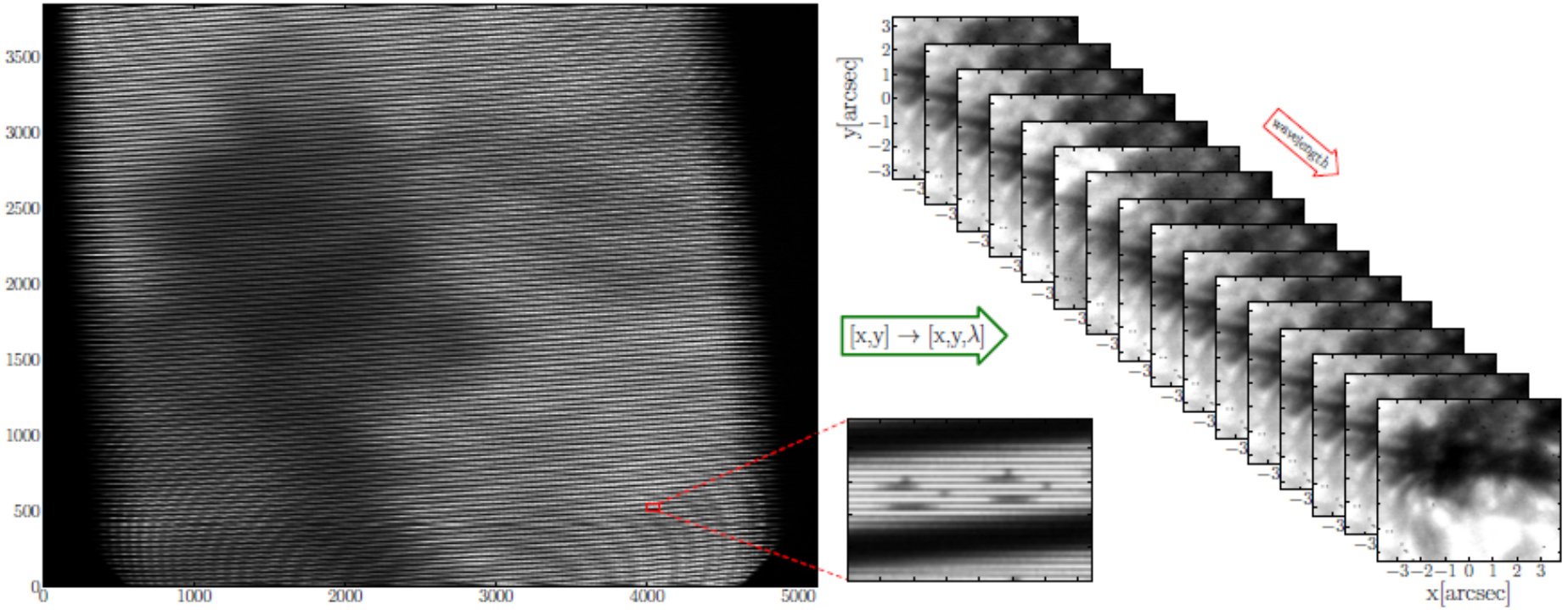
MiHI: microlens-fed spectrograph

prototype built for SST

+ improved instrument on the way



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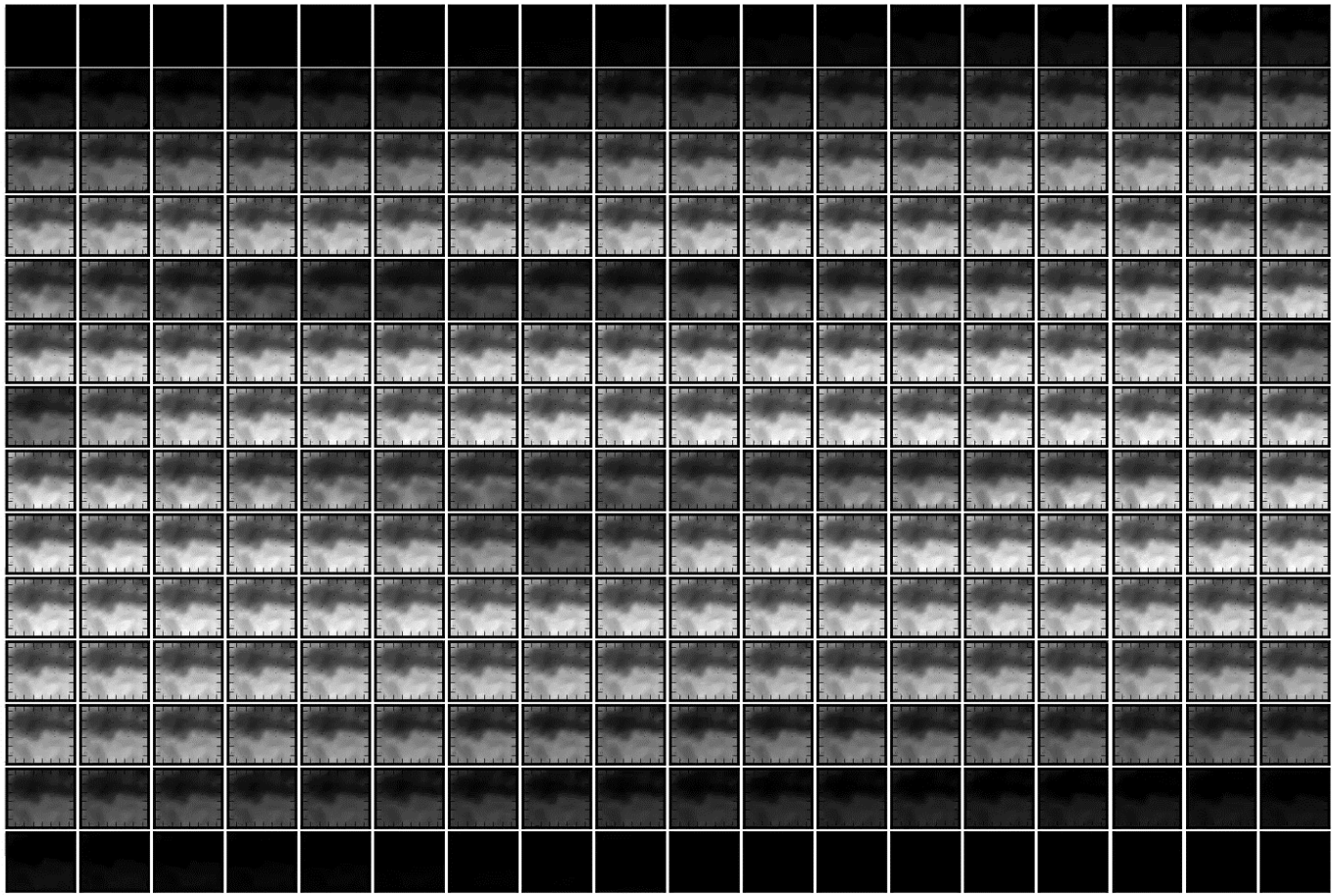
MiHI: microlens-fed spectrograph



FoV = 7.5" x 6.5"

Sampling:
0.08" x 0.08"

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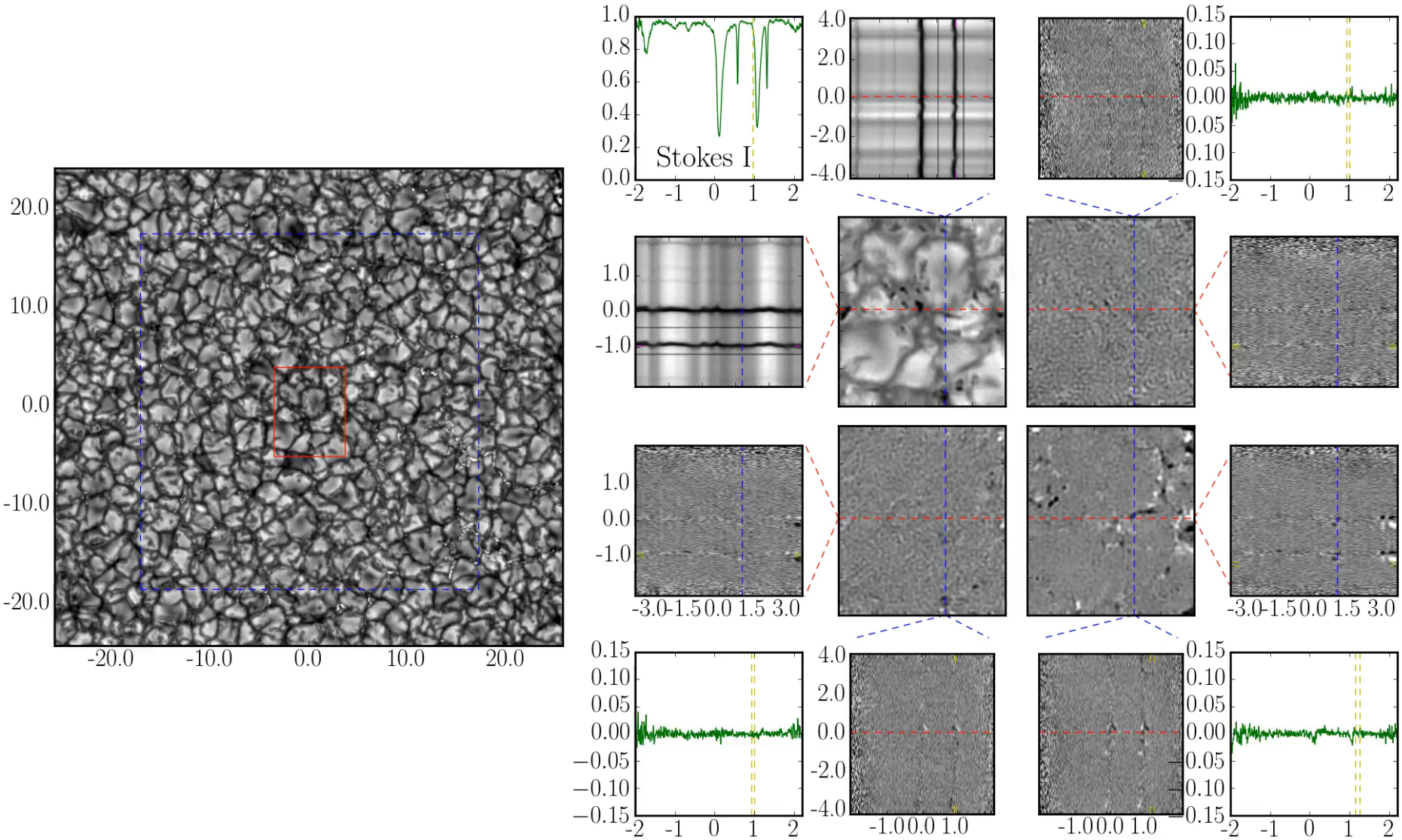
MiHI: microlens-fed spectrograph



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Task 2

Microlens-fed spectrograph

Goal: increase the field of view

Requirements

- Larger number and smaller microlenses are needed
- 30k × 30 k detector would be needed → FoV splitting + sensor mosaic
- Challenge: data handling, reduction and restoration

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Task 2

Microlens-fed spectrograph

Deliverables

Deliverable Number	Deliverable Title	Lead beneficiary	Type	Delivery Date
D6.7	Field splitter design and MLA specs	MPG	Report	14
D6.8	Data reduction tools for single field data	MPG	Other	24
D6.9	Field splitter and MLA lab tests	MPG	Report	36
D6.10	Data reduction tools for multi field data	MPG	Other	36
D6.11	Final report on microlens-fed spectrograph	MPG	Report	48

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 824135.

Task 2

Microlens-fed spectrograph

Milestones

Milestone Number	Milestone Title	Lead beneficiary	Delivery Date
MS14	Field splitter optics complete	MPG	24
MS15	Large format MLA delivery	MPG	30

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Task 3

Design concept of a Narrow-Band Tunable-Filter Imager for EST

(UNITOV lead, IAC, INAF, KIS, SU, BDP E&M)

Goal: define the optimum configuration of the EST Narrow-Band Tunable-Filter Imagers

1. Configuration trade-offs
   - telecentric or classical mount
   - lens, mirrors or catadioptric system
   - plane or 3D set-up

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Task 3

Design concept of a Narrow-Band Tunable-Filter Imager for EST

(UNITOV lead, IAC, INAF, KIS, SU, BDP E&M)

Goal: define the optimum configuration of the EST Narrow-Band Tunable-Filter Imagers

2. Optical design
   - optical performance
   - tolerances with Monte Carlo analysis
   - stray light analysis
   - adjustments for integration
   - imager volume

SOLARNET

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Task 3

Design concept of a Narrow-Band Tunable-Filter Imager for EST

Deliverables

Deliverable Number	Deliverable Title	Lead beneficiary	Type	**Delivery Date**
D6.12	Review of the scientific requirements of Narrow Band Imager	UNITOV	Report	12
D6.13	NBI Trade-off analysis	UNITOV	Report	
D6.14	NBI Optical design	BPD E&M	Report	36
D6.15	NBI Review and Analysis of tolerances	UNITOV	Report	48

No milestones

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Task 4

Absolute high precision polarization measurements

(USI/IRSOL)

Goal: Technique to measure absolute (linear and circular) polarisation, with high spatial resolution and applicable to solar telescopes with large aperture

Technique based on combined slow+fast modulation

1. Analytical study of optimum modulation schemes
2. Tests to explore the strengths and limitations of the method
3. Design and construct a prototype system for GREGOR
4. Telescope tests

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Task 4

Absolute high precision polarization measurements

Deliverables

Deliverable Number	Deliverable Title	Lead beneficiary	Type	**Delivery Date**
D6.16	Performance report of the new measurement technique at IRSOL	USI/IRSOL	Report	24
D6.17	Performance report of new measurement technique at GREGOR	USI/IRSOL	Report	48

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 824135.

Task 4

Absolute high precision polarization measurements

Milestones

Milestone Number	Milestone Title	Lead beneficiary	Delivery Date
MS16	Device to be used on GREGOR	USI/IRSOL	34