



# Gruppo II Attività 2019



Elena Vannuccini

# Sigle CSN2-Fi 2018

Linea scientifica 2: radiazione dall'universo  
Linea scientifica 4: onde gravitazionali, fisica generale e quantistica

	FISH	GAPS	HUMOR	LISA	MAGIA-ADV	SUPREMO	VIRGO
RN	FI	TS	FI	TIFPA	FI	NA	GE
	FI+TIFPA	FI+PV+RM2+T O+TS	FI+PG+TIFPA	FI+TIFPA	FI+PI	FI+NA	FI+GE+NA+PA +PG+PI+RM1+ RM2+TIFPA
FTE TOT	6,2	14,15	9,9	13,9	6,7	4,4	94,5
P TOT	11	27	15	23	15	11	145
kEuro 2018	67,5	186	111	72	126	96,5	890
% budget 2018	0,50	1,38	0,82	0,53	0,93	0,71	6,59
kEuro TOT	802,5	239	604,5	72	347	434	10924

@Fi

FTE	3,4	1,1	2,7	3,7	5	2,6	6,8
FTE (%)	55	8	27	27	75	59	7
P FI	5	2	4	6	11	7	10
FTE/P	0,7	0,6	0,7	0,6	0,5	0,4	0,7
kEuro 2018	27	6	27	10	123	33,5	42,5



# Sigle CSN2-Fi 2019

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Sigla	Start	FTE (Fi) 2018	FTE (Fi) 2019	
<b>FISH</b>	2015	3,4	<b>3,4</b>	
<b>ET_ITALIA</b>	2019	-	<b>0,8</b>	<b>nuova sigla</b>
<b>GAPS</b>	2017	1,1	<b>0,7</b>	
<b>HERD_DM P</b>	2019	-	<b>7,2</b>	<b>nuova sigla</b>
<b>HUMOR</b>	2013	2,7	<b>3,7</b>	
<b>LISA</b>	2018	3,7	<b>4,3</b>	
<b>MAGIA_A DV</b>	2016	5	<b>7,7</b>	
<b>SUPREMO</b>	2014	2,6	<b>2,3</b>	
<b>VIRGO</b>	<2005	6,8	<b>5,4</b>	
		<b>25,8</b>	<b>35,5</b>	

Linea scientifica 2: radiazione dall'universo

Linea scientifica 4: onde gravitazionali, fisica generale e quantistica

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# FISH

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**Simulazione quantistica con gas atomici di interazioni e processi della fisica delle alte energie**

@FI 2019:

1.	<u>Leonardo Fallani (RN)</u>	PA UNIFI	0.6 FTE
2.	Jacopo Catani	Ricercatore CNR	0.4 FTE
3.	Giacomo Cappellini	Assegnista UNIFI	0.8 FTE
4.	Lorenzo Livi	Dottorando UNIFI	0.8 FTE
5.	Lorenzo Franchi	Dottorando	0.8 FTE

FTE 3.4

Richieste 2019: CON 35k



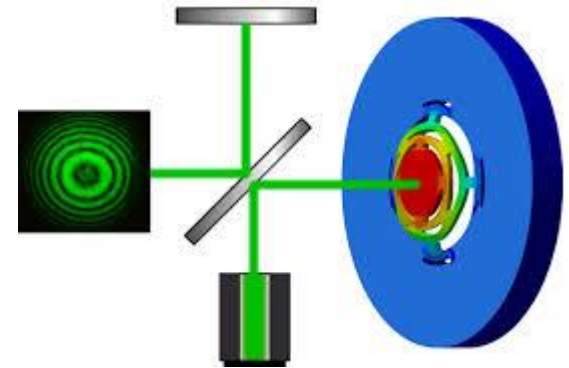
# HUMOR

## Variazioni alla dinamica di un oscillatore meccanico dovute a deformazioni del commutatore x-p.

(FI+PG+TIFPA)

@FI 2019: Misure di decadimento e shift di frequenza su oscillatori meccanici raffreddati otticamente fino ad un numero di occupazione termico vicino ad 1 (a partire da un apparato criogenico, a temperatura 5-10K); collaborazione alla costruzione dell'apparato ultra-criogenico a Camerino

1.	Cataliotti Francesco	PA	50%
2.	Chowdhury Avhishek	AR	100%
3.	<u>Marin Francesco (RN)</u>	PA	70%
4.	Marino Francesco	Ric.CNR	50%
5.	Veziò Paolo*	Dottorando	100%



FTE 3.7 (2,7 nel 2018)

Richieste 2019: 15k



# MAGIA-ADV

## Interferometro atomico con atomi ultrafreddi per misure di gravità

( FI+PI+GE\*+NA\*?)

1.	Brighenti Francesco*	AR UNIURB	40%
2.	Cacciapuoti Luigi	Ricercatore straniero	20%
3.	De Angelis Marella	IFAC-CNR	10%
4.	Enlong Wang*	Dottorando UNIFI/LENS	100%
5.	Fattori Marco	PA	50%
6.	Jain Manan*	Dottorando UNIFI	100%
7.	Pezze' Luca*	(da associare) INO-CNR	50%
8.	Poli Nicola	PA	10%
9.	Rosi Gabriele	INFN TD	100%
10.	Salvi Leonardo	AR UNIFI	100%
11.	Smerzi Augusto*	(da associare) INO-CNR	50%
12.	<u>Tino Guglielmo Maria (RN)</u>	PO	100%
13.	Vetrano Flavio	PO	0%
14.	Vicerè Andrea	PA	40%
15.	Hu Liang	Dottorando	50%
16.	Zhan Su	PostDoc	40%
17.	D'Amico Giulio	Dottorando	30%

FTE 7,7 (5 nel 2018)

Richieste 2019:in ...linea con il 2018



# SUPREMO

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**Fascio di molecole stabili fredde interrogato spettroscopicamente in configurazione Ramsey da un laser a cascata quantica riferito allo standard primario di cesio attraverso un pettine di frequenze ottiche.**

**→ Verifica della costanza temporale del rapporto massa protone/elettrone.**

FI+NA @Fi 2019:

- completamento delle misure sul profilo spaziale/spettrale del fascio laser infrarosso e misure di spettroscopia a 2 fotoni su molecole di CO
- progettazione di un apparato per laser cooling

1.	Simone Borri	CNR-INO	0.6
2.	Gabriele Santambrogio	INRIM	0.6
3.	Davide D'Ambrosio	AR INRIM	0.3
4.	Paolo De Natale (RL)	CNR-INO	0.2
5.	Maurizio Verde	Dottorando	0.6
6.	<del>Giacomo Inero</del>	<del>CNR-INO</del>	<del>0.4</del>

FTE 2.3 (2,6 nel 2018)

Richieste 2019: APP 22k CON 12k MISS 6k

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# LISA

**Interferometro in orbita eliocentrica (5 10<sup>6</sup> Km di braccio)**

**per rivelazione di GW**

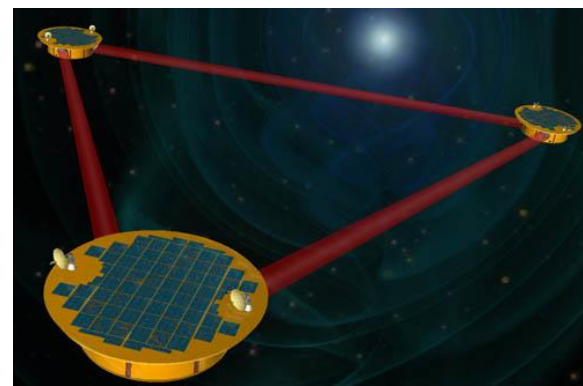
(FI+RM2+TIFPA )

@FI: studio delle variazioni a breve termine della radiazione cosmica e ottimizzazione dei radiation monitor

1.	Catia Grimani (RL)	PA UniUrb	100%
2.	Ruggero Stanga	Ric UniFi	70%
3.	Noemi Finetti	Ric UniAq	60%
4.	Mattia Villani*	Assegnista	100%
5.	Simone Benella	Dottorando	100%
6.	<del>Telloni</del>	<del>INAF</del>	<del>20%</del>
7.	<del>Laurenza</del>	<del>INAF</del>	<del>20%</del>

FTE: 4.3 (3,7 nel 2018)

Richieste 2019 → MISS 17.5k





# VIRGO

## Interferometro a terra di braccio 3 km per rivelazione di GW

(FI+GE+NA+PA+PG+PI+RM1+RM2+TIFPA )

@FI:

- Run O3: produzione delle fibre, montaggio sospensioni monolitiche e analisi dati
- Adv-VIRGO: R&D per coating specchi



1.	Francesco BRIGHENTI*	AR UniUrb	60%	(scad 08/18 rinn.)
2.	Giuseppe GRECO	AR UniUrb	100 %	(scad 04/19)
3.	Gianluca Maria GUIDI (RL)	PA	80 %	
4.	Filippo MARTELLI	PA	60 %	
5.	Matteo MONTANI	Doc. scuola sup	40 %	
6.	Francesco PIERGIOVANNI	Tecnologo universitario	80 %	
7.	Stefano SELLERI*	PA	20 %	
8.	Maria Giuliana STRATTA	AR UniUrb	40%	(scad 07/18+08/19)
9.	Andrea VICERÉ	PA	60%	
10.	<del>Flavio VETRANO</del>	<del>PO</del>	<del>0 %</del>	

FTE 5,4 (6,8 nel 2018)

Richieste 2019: CON 17,7k INV 6,1k APP 21,8k MISS 45k

# ET\_ITALIA

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## Interferometro di nuova generazione per rivelazione di GW

(CA+GSGC+LNS+NA+PD+PG+PI+RM1+FI+GE+RM3+TIFPA)

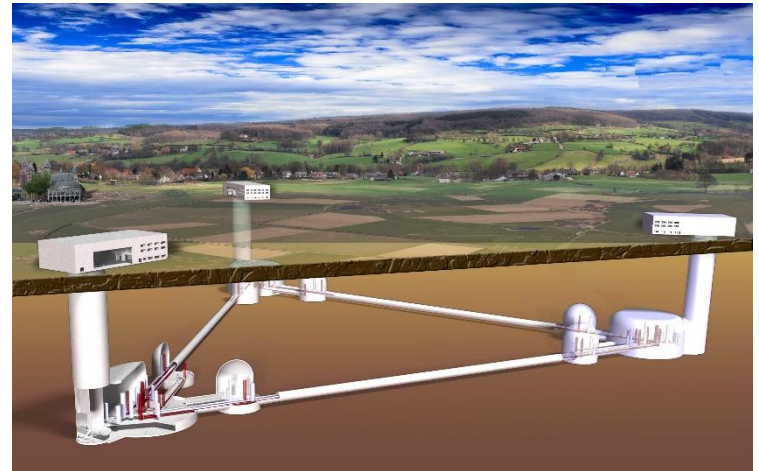
@FI 2019:

- |    |                        |                  |      |
|----|------------------------|------------------|------|
| 1. | Gianluca Maria GUIDI   | PA               | 20 % |
| 2. | Filippo MARTELLI (RL)  | PA               | 40 % |
| 3. | Francesco PIERGIOVANNI | Tecnologo UniUrb | 20 % |

FTE 0.8%

Richieste: MISS 2k

→ Presentazione Gianluca Guidi



# GAPS

## General Anti-Particle Spectrometer

Esperimento su pallone per la misura di antiparticelle (antiprotoni, antideuterio, antielio) di bassa energia nei raggi cosmici

(FI+PV+RM2+TO+TS)

@FI: simulazione e analisi dati

- |    |                  |      |     |
|----|------------------|------|-----|
| 1. | Elena Vannuccini | INFN | 70% |
| 2. | Bottai Sergio    | INFN | 40% |

FTE 0,7

Richieste 2019: MISS 6k

Nel 2019, possibile AR su fondi esterni (ASI)



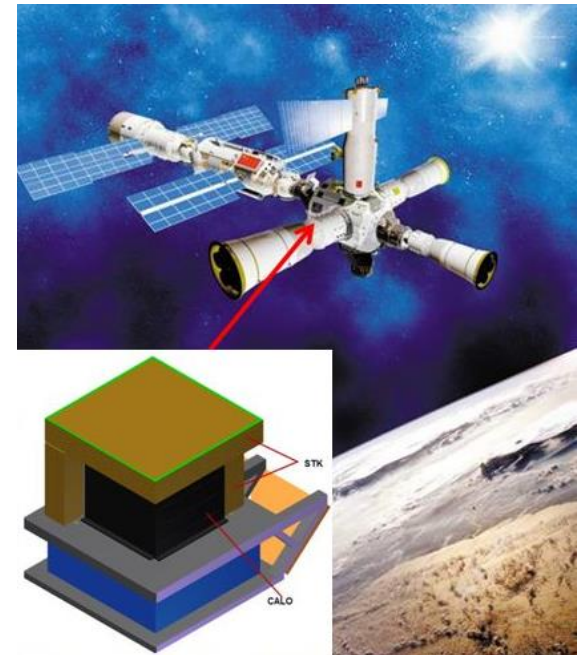
# HERD\_DMP

**Esperimento sulla futura stazione spaziale cinese per la misura calorimetrica di raggi cosmici e gamma di alta energia**

1.	Oscar Adriani	PO	70%
2.	Massimo Bongi	PA	60%
3.	Sergio Bottai	Ric. INFN	80%
4.	Raffaello D'Alessandro	PA	20%
5.	Noemi Finetti	Ric. UniAq	40%
6.	Nicola Mori	Ric. INFN	80%
7.	Paolo Papini	Ric. INFN	100%
8.	Lorenzo Pacini	AR CNR	100%
9.	Sergio Ricciarini	Ric. CNR	100%
10.	Elena Vannuccini	Ric. INFN	30%
11.	Alessio Tiberio	AR UniFi	20%
12.	Eugenio Berti	AR Unifi	20%

FTE 7,2

→ Presentazione Nicola Mori





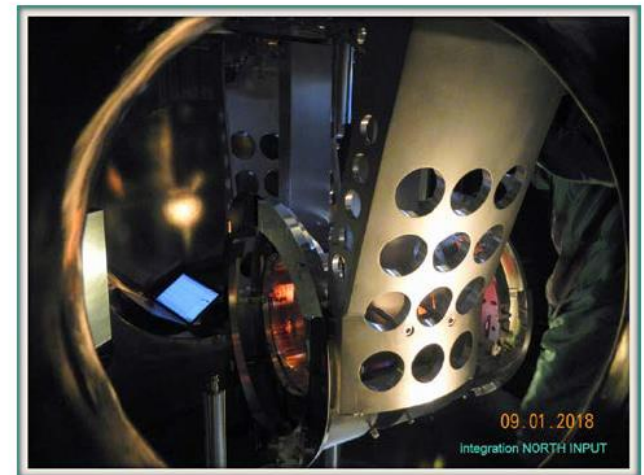
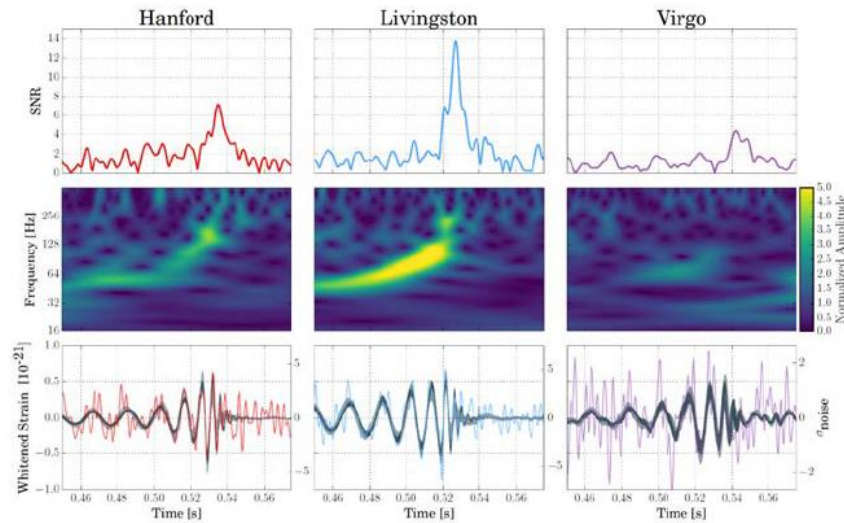
# Spares



(slide fornite dai responsabili locali)

# VIRGO Firenze-Urbino

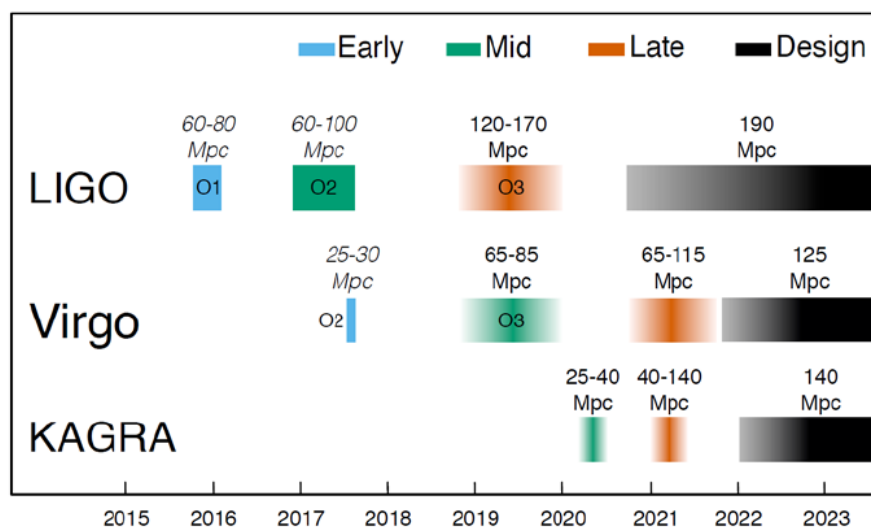
RESEARCH ACTIVITY 2018-2019  
PREVENTIVI FINANZIARI 2019



# Virgo results and planning

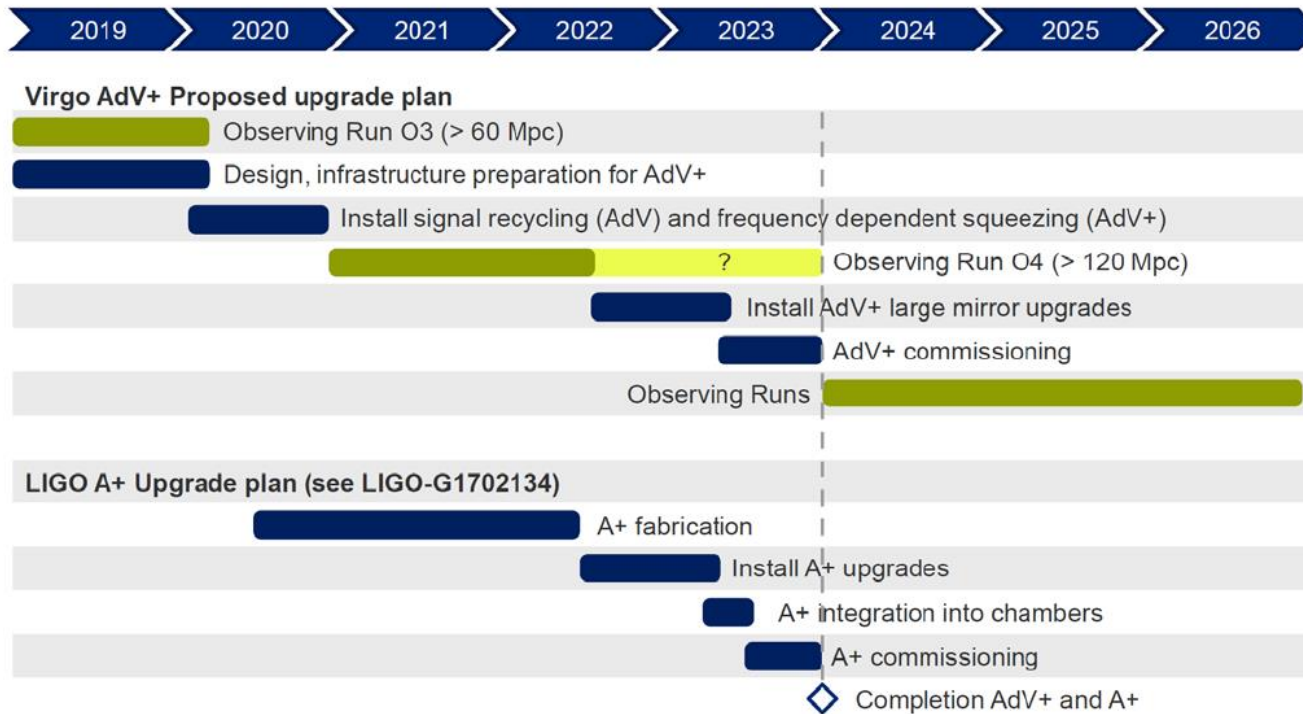
- O2 run:
  - LIGO-Virgo detected 3 binary black holes signals GW170104 ( $z = 0.2$ ), GW170608 (the lightest BBH) and GW170814
  - GW170814 was the first triple detection, i.e. the GW signal was seen also by Virgo
  - LIGO-Virgo detected a binary neutron star signal GW170817 in coincidence with a GRB
  - 16 publications (July 2017- July 2018)

- Next runs:



# Short term evolutions

Five year plan for observational runs, commissioning and upgrades



**Note: duration of O4 has not been decided at this moment**

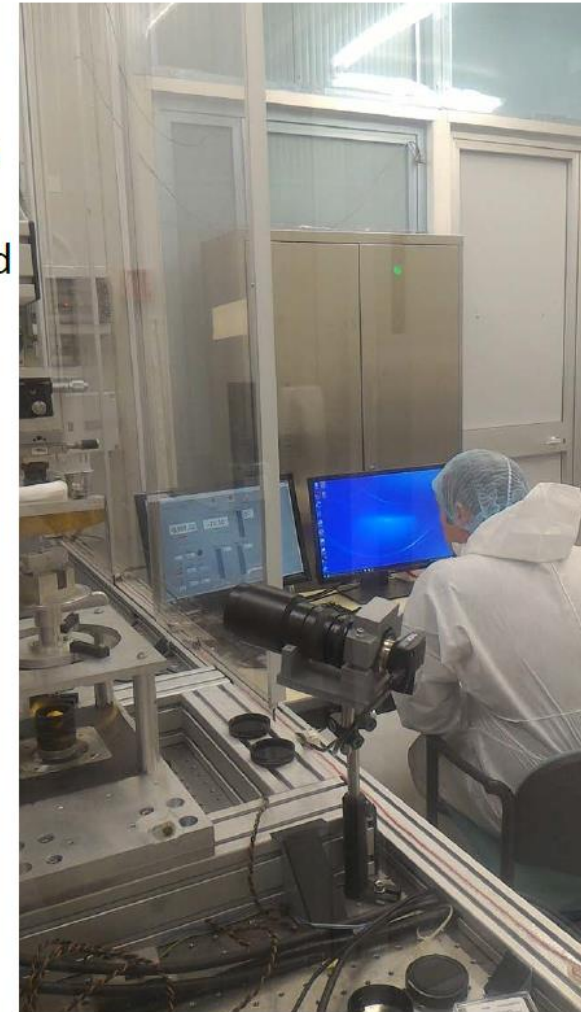
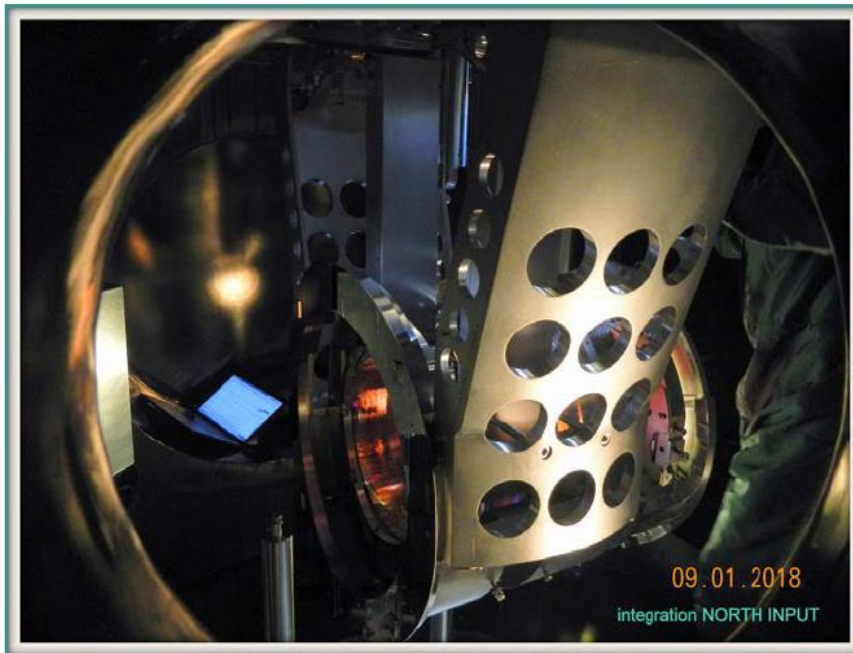
VIR-0943A-17



# Florence Activity – 2018

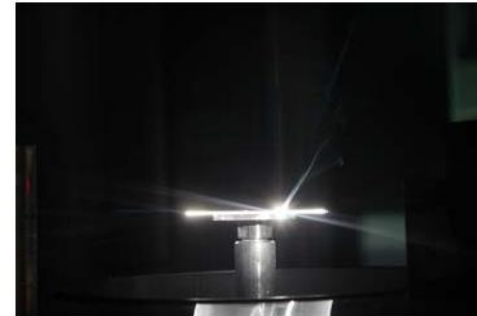
## 1. Silica fibers and monolithic payload assembly:

1. Construction, characterization and set-up of silica fibers for O3
2. All the payloads were successfully suspended by the end of february in line with the planning



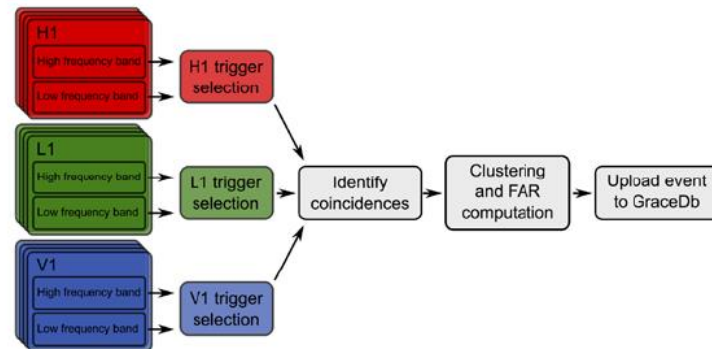
# Florence Activity – 2018

2. **AdV+: Virgo Coating R&D.** Samples thermal treatment and characterization with GeNS machine

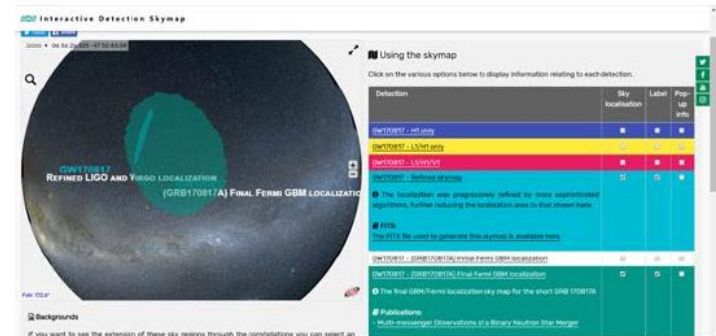


## 3. Data Analysis:

- Development for O3 of the low latency detection Virgo pipeline (MBTA) for coalescing binary systems
- GW and Gamma Ray Bursts events
- Multimessenger activity



4. **Outreach/open science activity**

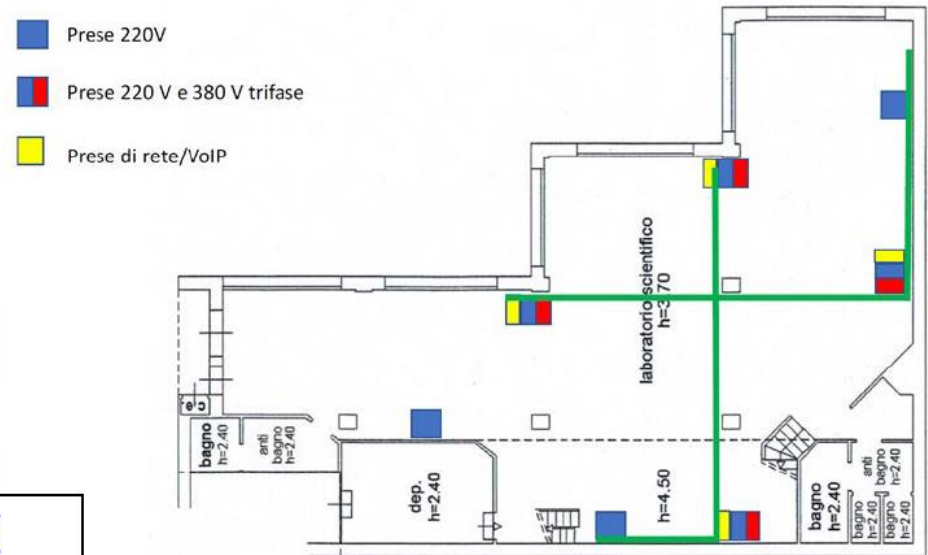


<http://www.virgo-gw.eu/skymap.html>

# Laboratory transfer to Urbino January 2018



<http://virgolab.uniurb.it/>



# Florence activity 2019

## 1. O3 activity

1. Monolithic fibers maintenance
2. Commissioning/data taking
3. Data Analysis (MBTA, Multimessenger)
4. Outreach/open science

## 2. Advanced Virgo+:

1. Monolithic fibers for large mirrors: facilities set-up, production and characterization
2. Virgo Coating R&D: room-temperature dissipation measurement
3. Virgo Coating R&D: set-up of a cryogenic GeNS facility for dissipation measurement

# LISA Pathfinder

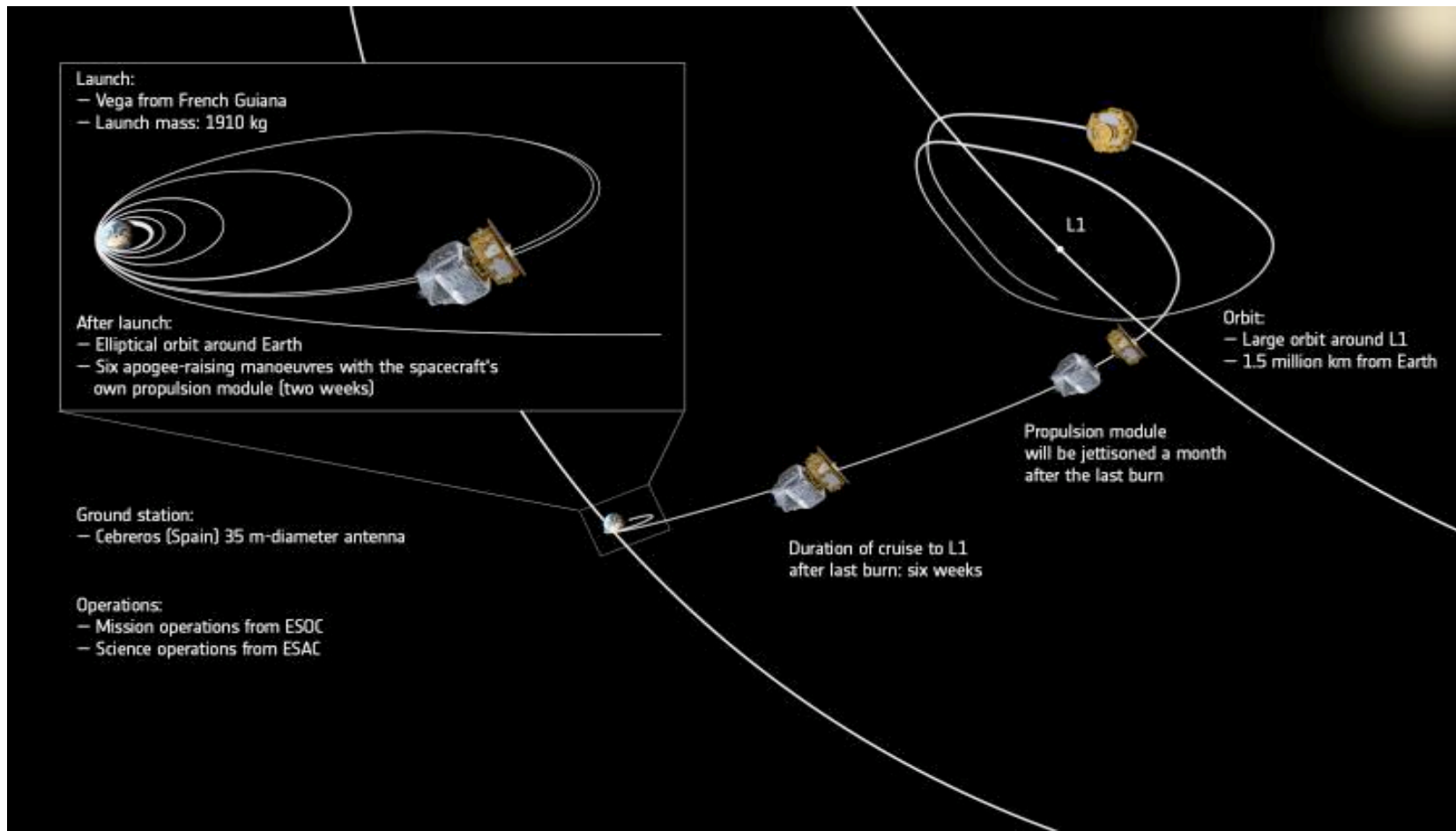
“PREVENTIVI FINANZIARI 2018 FIRENZE” – RESEARCH ACTIVITY 2019

# and LISA



# LISA-PF Orbit

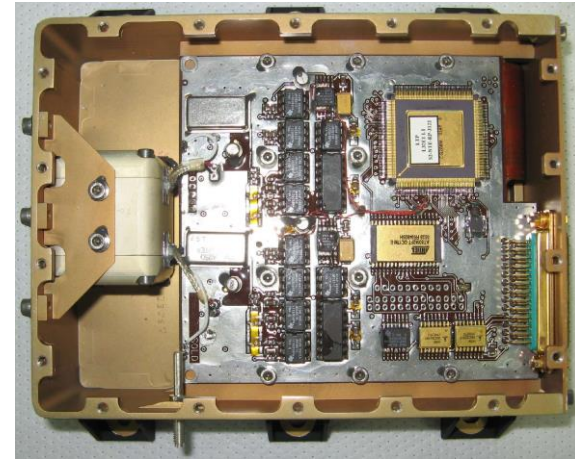
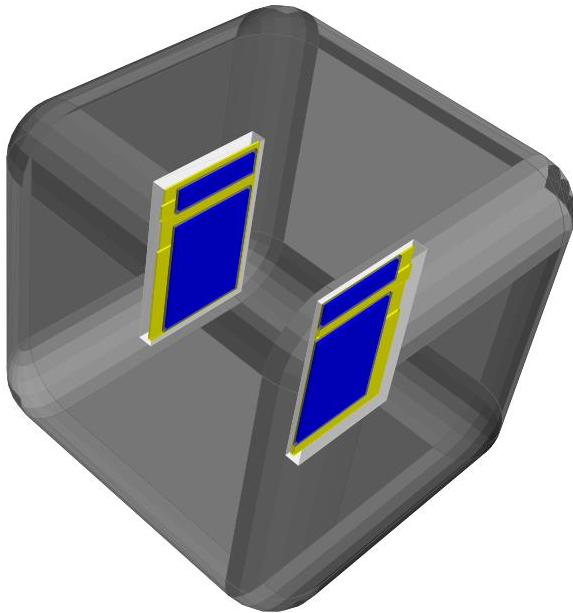
Data availability: 2016 February 18 – 2017 July 3



# PARTICLE DETECTOR CHARACTERISTICS

2 silicon wafers  $1.4 \times 1.05 \times 0.0003 \text{ cm}^3$   
inside a shielding copper  
box 6.4 mm thick  
Minimum p and ion energy 70 MeV/n

P. Cañizares et al., CQG, 28, 094004, 2011



GCR count rates are available 0.067 Hz.  
Variations of the order of 1% will be  
observed with one hour binning data

$$\frac{S}{N} \simeq \frac{A}{\sigma} \sqrt{N_{TB}}$$

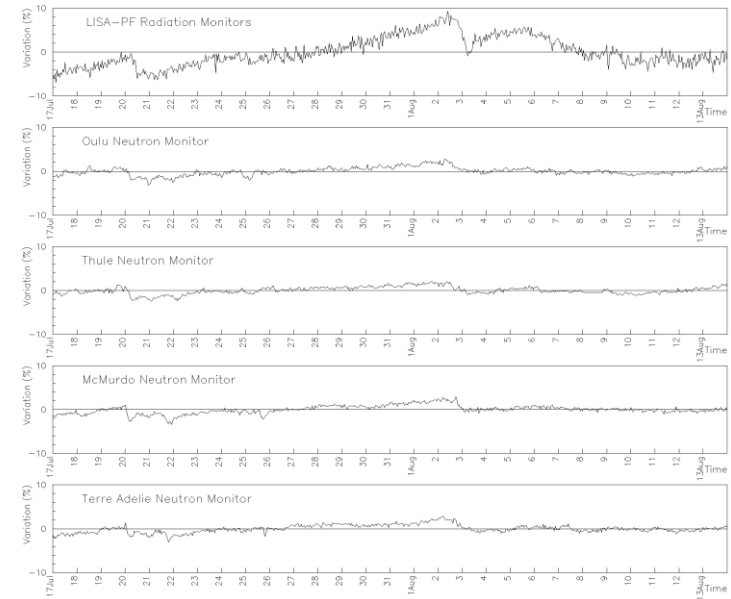
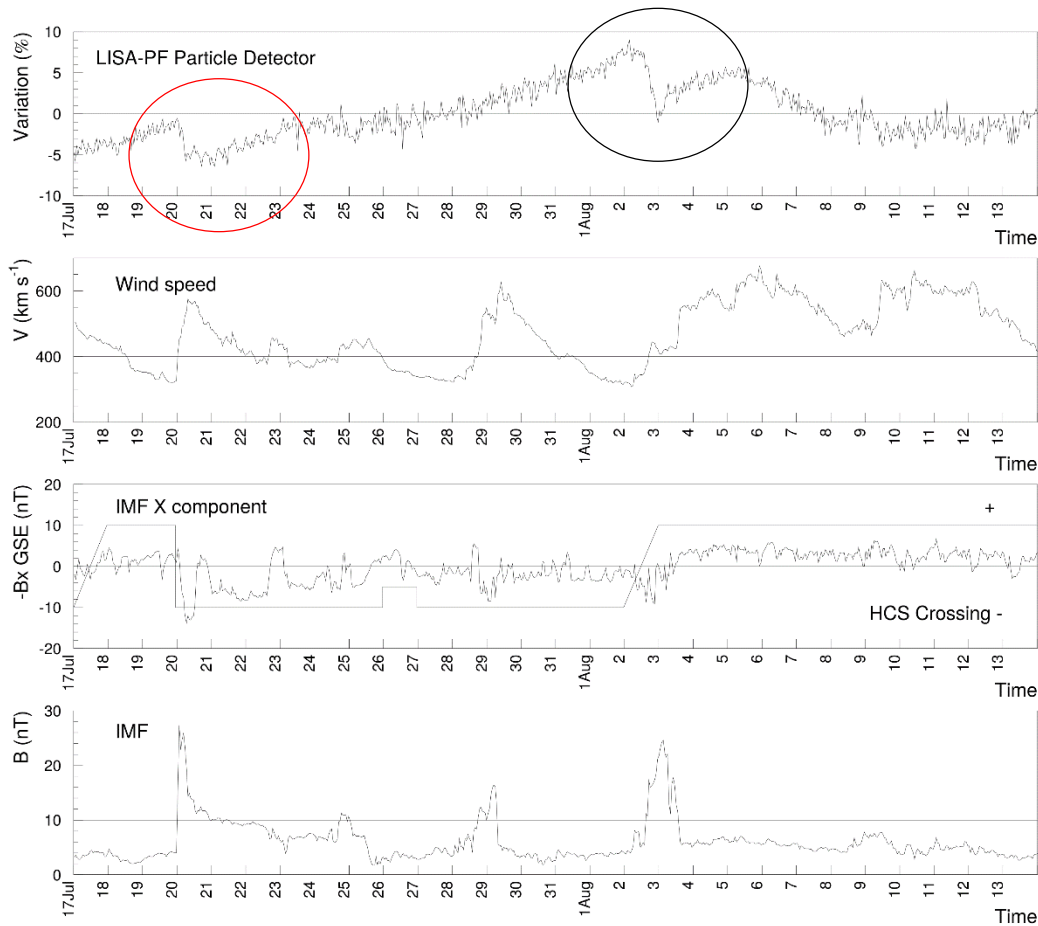
C. Grimani et al., CQG, 32, 35001, 2015

# Florence Activity – 2018

## cosmic-ray short-term variations

- ANALYSIS OF PARTICLE DETECTORS DATA AND INTERPLANETARY SOLAR WIND PARAMETER FOR SPACE WEATHER APPLICATIONS
- DATA ANALYSIS FROM MAGNETOMETERS
- PRELIMINARY STUDY OF THE OPTIMIZATION OF THE PARTICLE DETECTORS FOR LISA WITH BARCELONA TEAM
- TEST-MASS CHARGING ON LISA (PRELIMINARY): SEP CONTRIBUTION





Armano M. et al., *ApJ*, 854, 113, 2018  
 Armano M. et al., in preparation

[http://omniweb.sci.gsfc.nasa.gov/html/polarity/polarity\\_tab.html](http://omniweb.sci.gsfc.nasa.gov/html/polarity/polarity_tab.html)

cdaweb.gsfc.nasa.gov

# BARTELS ROTATION 2496

45 GCR flux recurrent variations  
 3 Forbush decreases  
 23 <2 days GCR flux non-recurrent variations

## LISA Group – 2019 Florence

- Catia Grimani 100%
- Ruggero Stanga 70%
- Noemi Finetti 60%
- Simone Benella 100%
- Mattia Villani 100%
- **FTE: 4.3**

# FINANCIAL REQUESTS 2019

## 17.5 keuro MISSIONI:

3 italian LISA collaboration meetings x 3 p	4.0 keuro
2 collaboration meetings with Slovakia collaborator x 1 p	2.5 keuro
ICRC Wisconsin, USA	3.5 keuro
3 int. Collaboration meetings x 2 p (LISA Consortium)	6.0 keuro
Invited talk Ecole Chalonge- De Vega Paris	1.5 keuro

# Recent publications (cyan Fi+Ub)

**Armano M. et al., Ph. Rev. Lett., 116, 231101, 2016**

**Telloni D., Fabi M, Grimani C, Antonucci E, AIP Conference Proceedings 1720 (1), 100001, 2016**

**Grimani, C., MNRAS 460 (2), 2186-2192, 2016**

**Armano, M. et al., CQG, 33 (23), 235015, 2017**

**Armano M. et al., PRL, 118 (17), 17110, 2017**

**Armano M. et al., PRL, 120, 061101, 2018**

**Armano M. et al., Astrop. Phys., 98, 28, 2018**

**Armano M. et al., ApJ, 854, 113, 2018**

**Armano M. et al., PRD, 97, 122002, 2018**

**Armano et al.; to be submitted to ApJ (soon)**