

New Membership Presentation

The Waves Group University of Sannio at Benevento & University of Salerno

Innocenzo M. Pinto
Professor, University of Sannio
TWG Principal Investigator



12-17 August 2005, LIGO Hanford Observatory

LIGO-G050414-00-R



Who & Where

What & How

Whys



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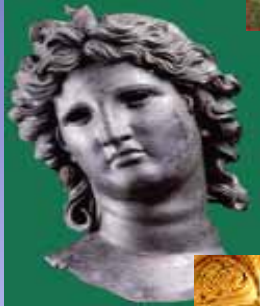
Who & Where, cont.d



Benevento



Salerno





Who & Where, cont.d



University of Salerno
www.unisa.it

40.000 students
9 Faculties



Salerno University Campus



University of Sannio at Benevento
www.unisannio.it
(a subsett of Salerno University until 1998)

6.000 students
4 Faculties



Sannio University Buildings



Who and Where

The Waves Group (TWG) as of Fall 2005

Faculty:

- Innocenzo M. Pinto (professor, Sannio U.)
- Maurizio Longo (professor, Salerno U.)
- Vincenzo Pierro (associate prof., Sannio U.)
- Vincenzo Galdi (associate prof., Sannio U.)
- Stefano Marano (associate prof., Salerno U.)
- Vincenzo Matta (assistant prof., Salerno U.)
- Giuseppe Castaldi (assistant prof., Sannio U.)
- Vincenzo Fiumara (assistant prof., Salerno U.)

- PI
- Shift/serv. Deput. Mgr.
- WP-2 Coord.
- WP-1 Coord.

- WP-3 Coord

PostDoC, MA & BA:

- Francesco Chiadini (PostDoc., Salerno U.)
- Rocco P. Croce (PostDoc, Sannio U.)
- Theo Demma (PostDoc, Sannio U.)
- Adele Fusco (PostDoc, Sannio U.)
- Roberto Conte (PhD fellow, MA, Salerno U.)
- Ilaria Gallina (PhD fellow, MA, Sannio U.)
- Maria P. Clarizia (BA, Sannio U.)
- Maria Principe (BA, Sannio U.)
- Ilaria Taurasi (BA, Sannio U.)



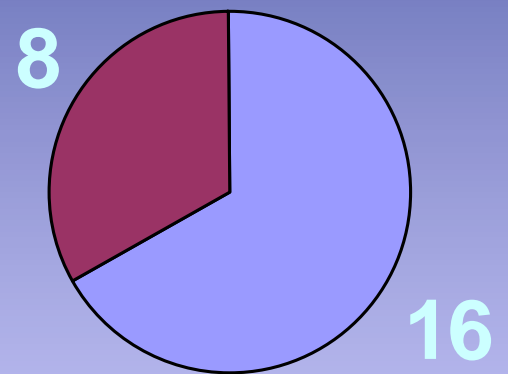
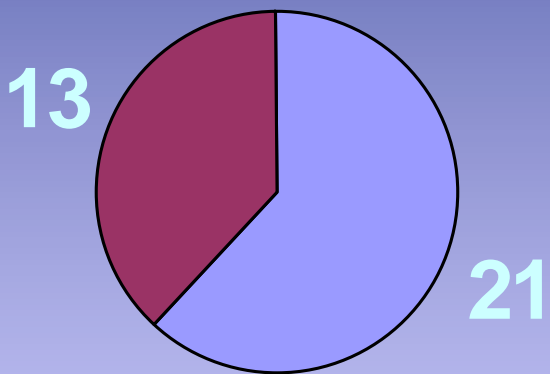
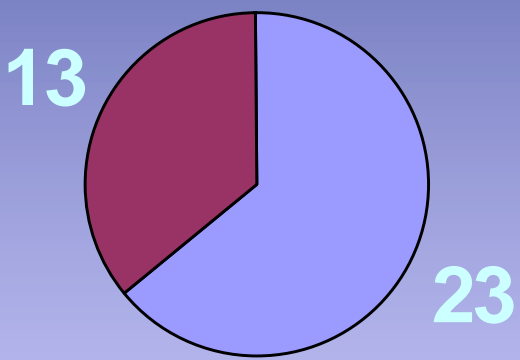


Pinto's (TWG PI) Publications Record (Journals & Books only)

2000-2005

1994-1999

< 1994



 # GW papers
 # EM papers





TWG Main Fundings, 2000-2005

2004 - **250 KEU** (CRC Regione Campania)

*[UniSannio Microwave Antenna Laboratory Upgrade,
I.M. Pinto PI]*

2001 - **750KEU** (CIPE-MIUR)

*[UniSA Direct Broadcast L-S-X Band Remote Sensing,
Ground Station and Image Processing Laboratory,
I.M. Pinto PI]*

2000 – **100 KEU** (MIUR)

*[Y2K National Research Prog.on GW Data Analysis,
IM Pinto PI; G.V. Pallottino National Coordinator]*





Who & Where, contd.

TWG Ongoing Research Coop.s in the US (2000-2005)

Boston University
North Eastern
Clarkson
Chicago
Penn State
Pennsylvania

prof. L. B. Felsen
prof. S. Sridhar
prof. L.S. Schulman
prof. P.L. Uslenghi
prof. A. Lakhtakhia
prof. N. Engheta

→ Might help covering most of TWG member shift-related travel expenses on our own fundings, by proper scheduling



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Who & Where, cont.d

GW-related Research Themes at TWG (1995-2005)

- Time-frequency data analysis;
- Correlator bank economization;
- Tanaka-Tagoshi chirp parameterization;
- Cumulative distribution of bank supremum;
- Binary stars with large eccentricities;
- Radiation-pressure driven chaos in MP-FP;
- Symmetry-breaking based detectors...



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Who & Where, cont.d

...Once upon a time we were VIRGO's...

C. BRADASCHIA, R. DEL FABBRO, A. DI VIRGILIO, A. GIAZOTTO, H. KAUTZKY,
V. MONTELATICI, D. PASSUELLO, A. BRILLET, O. CREGUT, P. HELLO, C.N. MAN,
P.T. MANH, A. MARRAUD, D. SHOEMAKER, J.Y. VINET, F. BARONE, L. DI FIORE,
L. MILANO, G. RUSSO, J.M. AGUIRREGABIRIA, H. BEL, J.P. DURUISSEAU, G. LE DENMAT,
Ph. TOURRENC, M. CAPOZZI, M. M. LONGO, L. LOPS, I. PI. I. PINTO, OTOLI, T. DAMOUR,
S. BONAZZOLA, J.A. MARCK, Y. GOURGHOULON, L.E. HOLLOWAY, F. FULIGNI,
V. IAFOLLA, G. NATALE;

*The Virgo project : a wide band antenna
for gravitational wave detection.*

Nuclear Instruments and Methods in Physics Research **A289**, pp 518-525, 1990




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Who & Where, cont.d

TWG MOU with TAMA started 2000



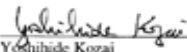
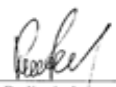

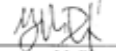
**Memorandum of Understanding
between The Waves Group - University of Sannio at Benevento, Italy
and the TAMA Project, Japan**

The purpose of this MOU is to establish and define a joint collaboration between the Waves Group of the University of Sannio at Benevento, Italy, and the TAMA Project, Japan, under the "guidelines for joint collaborations using TAMA data".

1. The TAMA Project, Japan, is a cooperation consisting among others of the following Institutions: National Astronomical Observatory (NAO); the Institute of Cosmic Ray Research (ICRR); The University of Tokyo, the Institute of Laser Science (ILS); the High Energy Accelerator Research Organization (KEK), the Yukawa Institute for Theoretical Physics (YITP), Osaka University and Miyagi University of Education. The TAMA project has constructed and is operating TAMA300, a 300m Fabry-Perot recombined interferometer with power recycling system. The goal of TAMA is to detect gravitational waves, and to advance knowledge in the field of gravitational wave detectors.
2. The Waves Group (TWG) - University of Sannio at Benevento is a research group consisting of: Innocenzo M. Pinto (full professor), Vincenzo Pierro (assistant professor), plus typically three post doctoral Fellows, and two Ph.D students. The members of TWG are actively working on several issues relevant to gravitational wave detection experiments.
3. The collaboration between TWG and TAMA will focus primarily on data analysis and the application of the Wigner-Ville time-frequency, methods developed by TWG to the TAMA data, with special reference to data sieving and/or noise characterization.
4. TWG will communicate to TAMA its research results related to data analysis, their interpretation and implications for TAMA.
5. TAMA will communicate to TWG its research results related to data analysis, and make available to TWG reports and internal memos relevant to the issue of data analysis.
6. Any kind of publication arising out of the joint collaboration, including but not limited to Journal articles or oral presentations at Conferences shall be done jointly in the names of TWG and TAMA. The content and fitness for publication shall be investigated jointly, and the parties shall come to a mutual agreement.

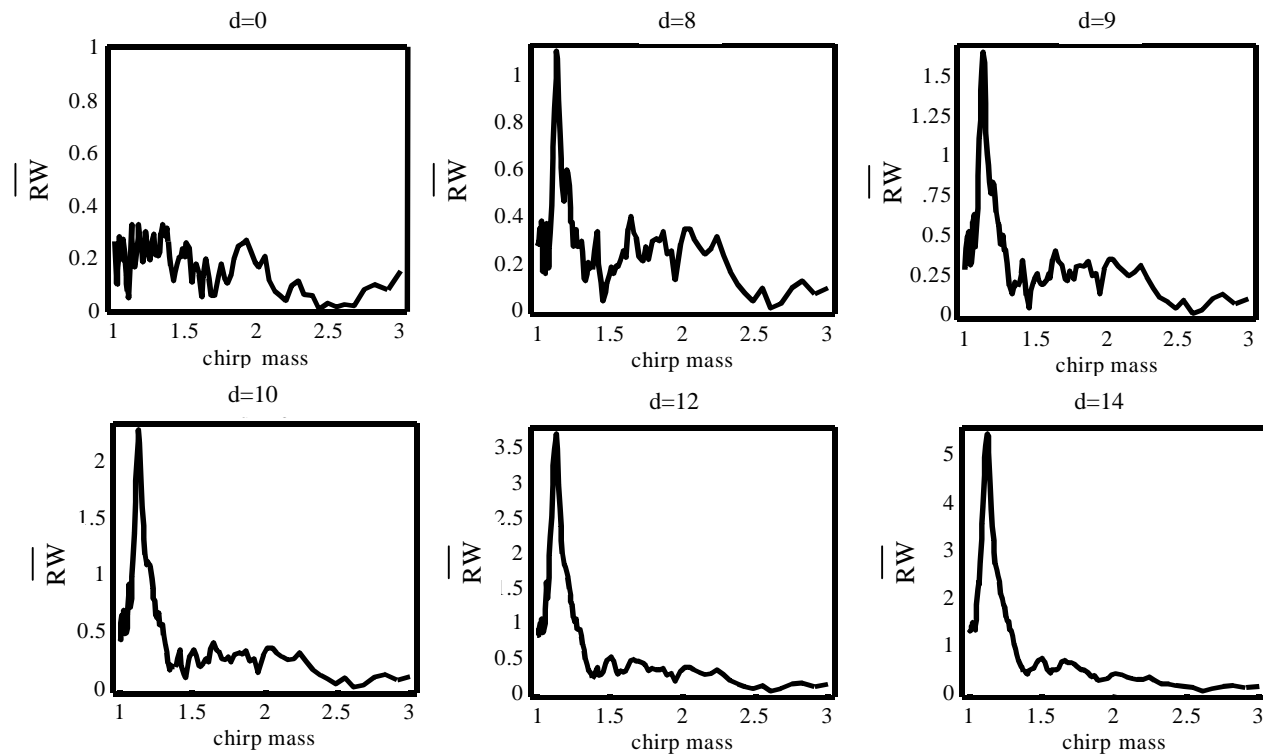
7. Each party in this agreement continues to be responsible for all support of its own staff, including travel costs associated with the activities under this agreement.
8. This Memorandum of Understanding will remain in force until the parties mutually agree to terminate it. Annual Attachments will define specific activities to be carried out during the following year, and list the members of TWG who will participate in the planned cooperation activities.

Approved:

 Yoshinide Kozai TAMA Principal Investigator	  Pietro Perlingieri President, University of Sannio
 Nobuyuki Kanda TAMA Data Analysis Group Leader	 Innocenzo M. Pinto The Waves Group Principal Investigator
Date <u>Feb. 9, 2000</u>	Date <u>10 Feb. 2000</u>

Started while IP was a EC visiting scientist at NAO. Still in force; current attachment february 2005.

Radon-WV Histogram. NS-NS in TAMA DT2 noise





What & How

TWG Proposed Activity in LIGO/LSC (2005-2006)

WP#1 – Mirror Coating optimization for Ad-LIGO

Stacked M-tuplet optimization; Multi-objective Genetic Optimization; Fractal multilayers

WP#2 – Cardinal interpolation of inspiral correlators

Implementation in LAL of our Tanaka-Tagoshi based tiling; Implementation in LAL of our correlator interpolation scheme; work on hierarchical.

WP#3 – Validation of a SIRP model of LIGO-I noise

Simple manageable non stationary/non-gaussian noise model. Parallel work done for TAMA.



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What & How - WP # 1

TWG background - TWG core expertise is in advanced electromagnetics including *Optics, Diffraction* etc.

Relevance to LIGO - Coating thermal noise reduction is key-issue for AdLIGO

Links - Cooperation w. CALTECH started March 2005. First set of (promising) results already available. Interest on behalf of VIRGO (Vetrano), TAMA (Tsubono), Glasgow (Rowan).

Fundings – INFN (V) COAT funding proposal (2005-2006) (50KEU, pending, I.M. Pinto PI)

Manpower - 2.2 FTE.

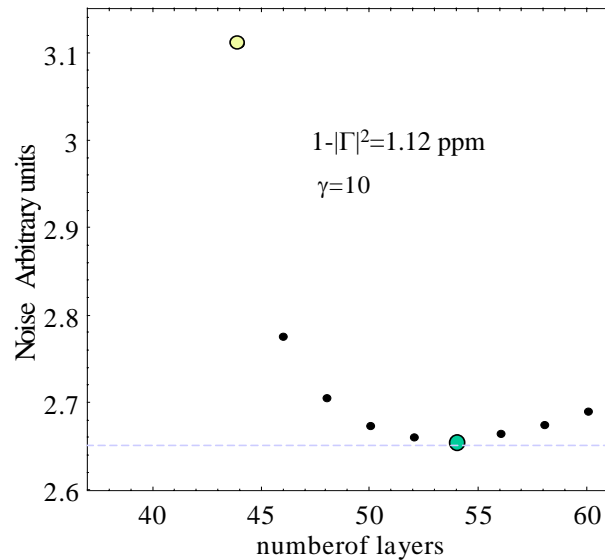


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LIGO

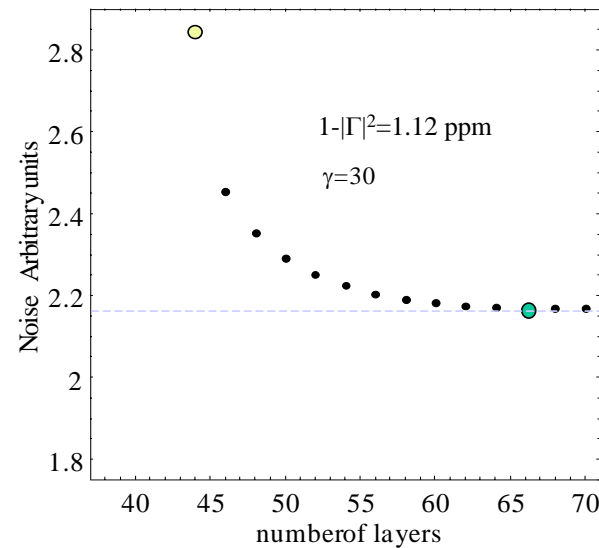
Quarter Wavelength (yellow bullets) vs. Optimized (grey bullets) Stacked Doublet Design. Transmissivity 1.12 ppm. Different $\text{SiO}_2/\text{Ta}_2\text{O}_5$ loss ratios.

LIGO G-050363-00-R



~14% noise reduction.
 N_d raised from 22 to 25-28
(absolute optimum at 27)

$\Delta[\text{SiO}_2]= 251.871$ nm
 $\Delta[\text{Ta}_2\text{O}_5]= 60.5726$ nm



~24% noise reduction.
 N_d raised from 22 to ≥ 28
(absolute optimum at 33)

$\Delta[\text{SiO}_2]= 278.465$ nm
 $\Delta[\text{Ta}_2\text{O}_5]= 60.5726$ nm



What & How - WP # 1, contd.

TWG Coating Workgroup						
	Name	%	Stacked	Genetic	Fractal	Testing
Faculty	Galdi*	50	×	×	×	×
	Castaldi	20	×	×	-	-
	Pierro	10	×	×	-	-
	Pinto	20	×	×	×	-
	Fiumara	20	-	-	×	-
	Cacciani	30	-	-	-	×
Staff	Chiadini	30	×	-	×	×
	Gallina	20	-	-	×	
	Taurasi	20	-	-	-	×
	FTE	2.2				

§ TWG Topical Workgroup Coordinator

	2005										2006					
	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	Jun	Jul	Aug
M-tuplet	Yellow															
Genetic	Cyan															
Fractal						Blue										
Prototyping (LMA) & Testing (TNI)												Brown				



What & How - WP # 2

TWG background - TWG originated the idea of cardinal interpolation among correlators [PRD 62 (2000) 124020; PRD 62 (2000) 12101R, PRD 70 (2004) 122001], and gave substantial contribution on extending the Tanaka-Tagoshi uniform-PN-tiling concept [PRD 64 (2001) 042005, PRD 65 (2002) 102003].

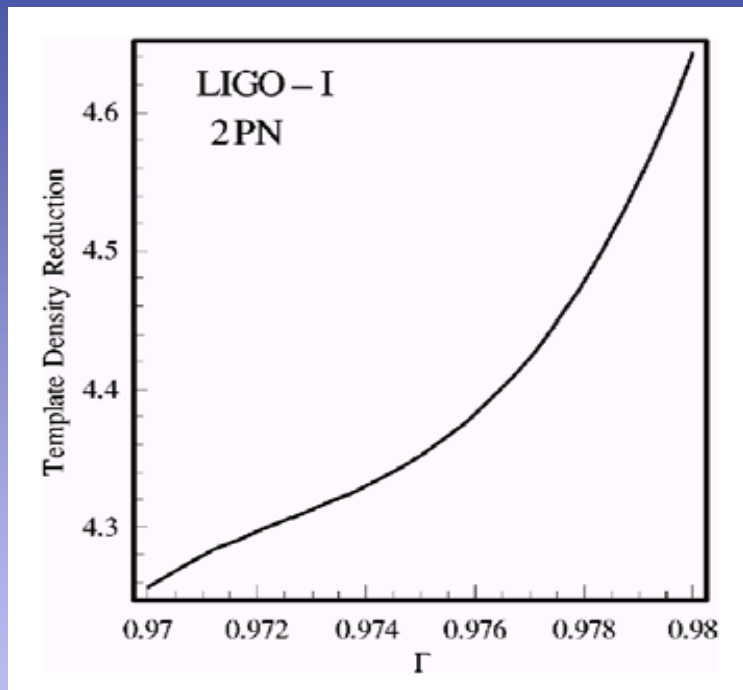
Relevance to LIGO - Reducing the computational burden of the bank [LIGO G-000049-00-D; LIGO G-000219-00-G].

Links - Started in coop. with B.S. Sathyaprakash. Recent related work by Mohanty (private communication) and by Finn & Dhurandhar (gr-qc/0507011). Cooperation foreseen.

Fundings – TWG participates COFIN 2005 national research program on “GW Data Analysis” (59.4 KEU, pending, I.M. Pinto PI)

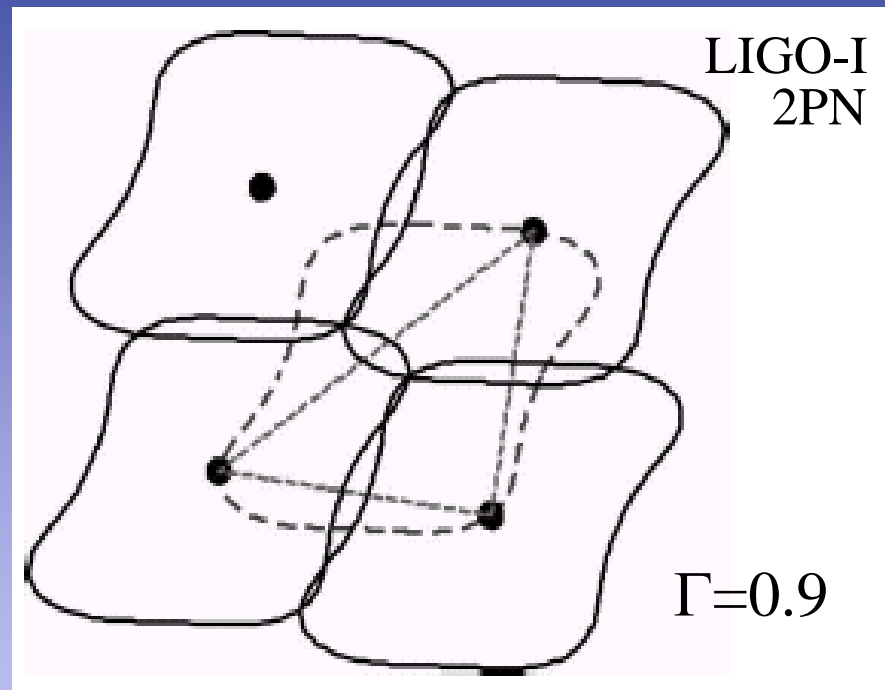
Manpower - 2.8 FTE.

Template density reduction upon cardinal interpolation



R.P. Croce et al., PRD64, (2001) 042005.

Optimum tiling of Tanaka-Tagoshi 2PN template space



R.P. Croce et al., PRD65, (2002) 102003



What & How - WP # 3

TWG background

TWG (Longo's group) originated a substantial part of SIRP literature, in the context of RADAR detection.

Relevance to LIGO

If the SIRP model is valid, one could easily implement an *optimal* CFAR detector despite the non-gaussian non-stationary features of the noise.

Links

TWG is checking the SIRP model on TAMA DT-8 in the frame of its MOU with TAMA. Cooperation with Mohanty and Mukherjee foreseen.

Fundings – TWG participates COFIN 2005 national research program on “GW Data Analysis” (59.4 KEU, pending, I.M. Pinto PI)

Manpower - 1.8 FTE.



What & How - WP # 3, contd.

TWG Noise Characterization Workgroup					
	Name	%	NBW & Poisson removal	SIRP hypoth. testing	SIRP characterization
Faculty	Matta§	40	×	×	×
	Longo	20	-	×	×
	Pinto	20	×	-	×
	Marano	30	-	×	×
	Pierro	10	×	-	-
Staff	Conte	10	-	×	-
	Croce	10	×	-	-
	Fusco	10	-	-	×
	Gallina	10	×	-	-
	Clarizia	20	-	×	×
	FTE	1.8			

§ TWG Topical Workgroup Coordinator

	2005					2006							
	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
NBW & Poisson Removal													
SIRP hyp. testing													
LIGO SIRP characterization													



Proposed TWG Manpower Distribution

	Name	Position	TWG Working Group %			LIGO I	AdvLIGO	Total
			Coating	Noise	Inspiral	%	%	%
Faculty	Pinto [§]	(Full Prof.)	20	20	20	40	20	60
	Longo [×]	(Full Prof.)	-	20	10	30	-	30
	Pierro*	(Assoc.Prof.)	10	10	40	50	10	60
	Galdi*	(Assoc.Prof.)	50	-	-	-	50	50
	Marano	(Assoc.Prof.)	-	30	10	40	-	40
	Cacciani	(Assoc.Prof.)	30	-	-	-	30	30
	Castaldi	(Assist.Prof.)	20	-	-	-	20	20
	Fiumara	(Assist.Prof.)	20	-	-	-	20	20
	Matta*	(Assist.Prof.)	-	40	10	50	-	50
	# Faculty members			6	5	5	-	-
Faculty FTE			1.5	1.2	0.9	2.1	1.5	3.6
Graduate, PhD, & PostDoc	Chiadini	PostDoc	30	-	-	-	30	30
	Conte	PostDoc	-	10	40	50	-	50
	Croce	PostDoc	-	10	40	50	-	50
	Demma	PostDoc	-	-	50	50	-	50
	Fusco	PostDoc	-	10	40	50	-	50
	Gallina	PhD Fellow	20	10	-	10	20	30
	Clarizia	Graduate	-	20	-	20	-	20
	Principe	Graduate	-	-	20	20	-	20
	Taurasi	Graduate	20	-	-	-	20	20
# Staff members			3	5	5	-	-	-
Staff FTE			0.7	0.6	1.9	2.5	0.7	3.2
# Researchers			9	10	10	-	-	-
Total FTE			2.2	1.8	2.8	4.6	2.2	6.8

§ TWG Principal Investigator

× TWG/LIGO Shifts and Services Deputee Coordinator

* TWG Workgroup Coordinator



What & How, contd.

The UniSannio-RCOST Cluster Facility



- 40 bi-processor nodes
- Xeon @ 3.06GHz, 2GBRAM,
- Dual Myrinet + GigaEthernet
- SCSI320 (10kRPM)
- 6*146.9GB, RAID
- Linux - MOSIX

Declaration of intent signed by
Univ. of Sannio RCOST Director



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What & How, contd.

TWG Own Computing Facilities

- 16 bi-processor nodes cluster
- PIII @ 1GHz, 1GBRAM + 120GBHD per node
- GigaEthernet
- Linux – MOSIX

- C6701 based quad × DSP board
- XP-30 TMS multi-DSP board (within 2006)

- GRID Mathematica[©]



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Why's

What LIGO/LSC might expect – Support from a group featuring a special blend of engineering (optics, data analysis) and physics expertises.

What TWG might expect – Significant boost in our ability to attract BA and grad. students to work on GWs.



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Conclusions

In the most authentic American spirit, we request a chance to show you what we might be able to do for LIGO.

We are ready to invest (and already started doing so) our own human and material resources in it.



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