GWIC Meeting Report

9 July 2000, Rome

Projects and Representatives

ACIGA	D. McClelland
ALLEGRO	W. O. Hamilton
AURIGA	S. Vitale
GEO 600	K. Danzmann, J. Hough
EXPLORER/NAUTILUS	E. Coccia
LIGO	B. Barish, G. Sanders
LISA	W. Folkner
NIOBE	D. Blair
TAMA 300	M.-K. Fujimoto
VIRGO	A. Giazotto
Theory Community	C. Will
Secretary	L. S. Finn

Business

Collaborative Analysis Working Group Report (9:15 AM: A. Giazotto)

Report

At the July 1999 GWIC Meeting a working group, under the lead of A. Giazotto, was created to study and report back to GWIC on algorithms, mechanics, and organization of a collaborative data analysis effort. Giazotto convened this group, which was composed of members appointed by the different detector projects, at the December 1999 GWDAW Meeting. This was followed in February 2000 by a smaller technical meeting involving Lazzarini, Finn, Cella, Mours, Vicere and Giazotto, which focused on estimating the computing requirements associated with a fully coherent search for sources with known waveforms (e.g., binary inspiral). The results of this meeting are described in a technical

report that describes an organization for the calculation which is parallelizable on a supercluster architecture computer and whose computational cost scales linearly with the number of detectors in the network.

It was assumed that the data sets used in analysis would be “best estimate” h(t), from which each participating detector group would have removed all recognizable instrumental and environmental artifacts. The working group recommended that redundant and independent analyses, using algorithmically dissimilar approaches, be performed to provide greater confidence in results arising from analyses. They also recommended that each of the analysis teams should include technically informed members of all the participating projects.

Questions not addressed in report are quantitative criteria for assessing equivalent sensitivity and data reliability.

Discussion

The exchange of event lists, while computationally less expensive, raises difficult questions. Interferometer data is not narrow-band or binary (i.e., yes/no). Corresponding to the wideband are questions of filter details, calibrations and cuts across the data. Even in the present, narrow band bar data the issue of criteria and filters has led to problems. The bar community through the IGEC is moving toward exchanging more data than simply event lists. Nevertheless, while exchange of a full-band h(t) might be the goal to strive for the details of how this is best accomplished and how the data can be used constructively are difficult to understand and work out.

An important question centers on who is allowed to join a network of detectors. The general principle should be that the contribution to the overall quality of the network should be somehow equivalent; however, at this point it is difficult to make that statement precise. It clearly involves sensitivity; it also involves “quality”; however, it is difficult to understand the quality of a detector's data except by comparison with other data.

The bar groups have substantial experience in exchanging event lists. As a general practice “raw” data has not yet been exchanged, but the day is nearing when this might take place. There remain concerns over misuse of data, however: it is perhaps impossible for one group to communicate to another all the understanding of instrumental and environmental artifacts that are part of the data and which are necessary for its correct use.

Correspondingly, data can’t be exchanged or used in a network analysis without also providing project members technically competent to interpret the data and insure that it is properly used. Experience in the bar groups shows that this is a full-time job; this doubles or triples the number of people dedicated to analysis from any project. Additionally there arises the problem of how those project members “on-loan” with the data to another project maintain their competence: the only apparent solution is to rotate the assignment.

The mechanical aspects of data sharing are critical. The protocols for any exchange need to be verified soon. At a fundamental, what is the complete set of information that needs to be exchanged? E.g., calibration information, whitening information, sample-rate information, etc. We need to write down exactly what are the steps that get to *h(t)* on each project. This is the logical next step in the process and cognizant scientists from each project should be assigned to meet and prepare this list now. A preliminary list is available

from the assignments to this working group (which are listed below); however, this list is incomplete, as the bar groups have not yet specified representatives:

- GEO: Sathyaprakash, Willke
- TAMA: Kanda
- ACIGA: Will send names to Giazotto
- LIGO: Finn & Lazzarini
- VIRGO: Cella, Mours, Vicere

VIRGO Computing Resource Requirements (10:20 AM: G. Cella)

VIRGO has proposed to establish a computing center for coalescing binaries. The goal is a total computing rate of 300 Gflop/s, which will handle analysis in to masses as low as 0.5 solar masses (assuming that component spins are not important in determining the templates). The request is staged, with a 120 Gflop/s test facility in Cascina proposed for 2001 and the full 300 Gflop/s facility in 2002. The intent is to increase the capacity of the analysis system in 2003-4 to 1 Tflop/s to accommodate an all-sky periodic source search.

The computing facility has a proposed storage capacity of 135 TB, which corresponds to 1y integrated VIRGO data.

The computing resources required for VIRGO analysis of binary inspiral are large compared to LIGO's requirement for the same search because VIRGO has a bandwidth that extends to lower frequencies, where the dwell time of the binary inspiral waveform is substantially longer. A longer dwell time means longer templates and, correspondingly, larger DFTs to form the filter output.

VIRGO will pursue a network analysis strategy that combines "coincidence" to reduce the epochs over which a "coherent" search takes place.

VIRGO has identified a list of required activities in anticipation of data exchange: these include

- Definition of reduced data sets to be shared among participating projects
- Definition of the data flow for a network analysis, including its relationship to the data flow for a single detector analysis. This includes
    - Calibration and synchronization procedures
    - Certification of instrumental and environmental artifacts
    - Treatment of dead-times, drop-outs and vetos.
- Definition of protocols for data exchange
- Determination of hardware requirements
    - Network

- Storage
- Computational facilities

- Determination of software requirements

GEO 600 Computing Resource Requirements (10:05 AM: B. Sathyaprakash)

The GEO raw data rate is between 0.5 and 1 MB/s (the rate at turn-on is 0.5 MB/s; however, the infrastructure supports a 1 MB/s capacity so that additional channels can be added as needed). This corresponds to 45 GB/day, 1.3 TB/mo., or 15 TB/yr. The proposed analysis system has three purposes:

- Data conditioning
- Vetoing
    - Estimate: Assume 100 channels diagnostic and form full covariance matrix. Estimate 10 Gflop/s. Probably an overestimate.
- Science Searches
    - 2 clusters of 20 Gflops for CW (Cardiff, Golm)
    - 10 Gflop/s for inspiral at Hanover (0.5 solar masses).

The data flow begins at Ruthe where data is available over a LAN for diagnostic purposes. Scientists will be able to interrogate the system remotely to see any channel. From Ruthe data will be transported via a 34 Mb/s + 4 Mb/s radio links to Hanover. At Hanover data will be buffered to disk and written to tape daily. Tapes will be shipped immediately to ZIB in Berlin, which is a national data archiving center with access to the AEI in Golm. Tapes will also be shipped to Cardiff, which will provide a smaller on-line archive using an Exabyte Mammoth tape robot with 40 tape slots. Both the ZIB and the Cardiff archive will be directly accessible. Tapes for GEO collaborators will be created at Cardiff.

The GEO data analysis infrastructure consists of three small Beowulf architecture systems:

- a 24 node system at Hanover (10 Gflop/s, 25 GB disk), which will be used for binary inspiral and transient searches;
- a 48 node cluster at Cardiff (20 Gflop/s, 50 GB disk), which will be used for follow-up analysis and CW searches; and
- a 48 node cluster at AEI/Golm (20 Gflop/s, 50 GB disk), for follow-up analysis and CW searches

The Cardiff experience is that very few technical people are required to maintain the cluster. Only a few days were required assemble the system and little time has been required to run it.

LIGO Computing Resource Requirements (10:40 AM: L. Finn)

LIGOs computing plans have been driven by what is perceived to be the most computational expensive, realistic analysis: binary inspiral search via matched filtering. The analysis cost of this search is driven by the cost of discrete Fourier Transforms. Based on the Owen analysis of the number of required templates, LIGO estimates 10 Gflop/s for a single detector searching for binary inspirals to a lower mass limit of 1 solar mass.

The binary inspiral computational problem, as well as the other searches that have been discussed, can be formulated in a very parallel way; correspondingly, it is possible to achieve the necessary resources using a Beowulf architecture computing system: low-cost, commodity linux systems hooked together on a fast Ethernet network.

Based on the these requirements and allowing for other analyses and development LIGO has proposed to distribute its computing resources among the two Observatories and the LIGO Lab Universities in the following proportion:

- LHO: 43 Gflop/s (approximately 100 processors)
- LLO: 20 Gflop/s (approximately 52 processors)
- MIT: 12 Gflop/s (approximately 28 processors)
- CIT: 95 Gflop/s (approximately 176 processors)

In the CIT facility approximately 144 processors will be devoted to analysis and 32 to development.

The Lab computers are expected to be used only for organized, production analysis. Additional resources will be required to support interactive, exploratory analyses.

Data Exchange, Cooperative Data Analysis and Operations (11:15 AM: G. Sanders)

LIGO and GEO have been discussing an MoU for data exchange and cooperative analysis. There are many complications in such agreements and both parties did not want to bring the first such MoU to a conclusion without consulting with GWIC regarding the framework for such agreements, which are a counterpart to the technical issues related to data exchange.

LIGO is currently formulating its plans for 2002-6. This includes data analysis, operations, and upgrades. All of these plans raise questions related to inter-project coordination and cooperation.

LIGO “engineering” data is arriving now. The LSC is fully involved both in taking and studying this data. Formal LIGO science data will be available in two years; however, even the engineering data will have scientific value. LIGO and TAMA have already coordinated a short simultaneous observation period with the TAMA 300 and the LIGO 40M, under a particular bilateral project-project agreement. GEO and LIGO have discussed data sharing & cooperative analysis. It is in the course of these discussions that a number of questions have emerged. For example, should agreements for data sharing or analysis sharing be bilateral and individualized, or bilateral but general in structure so that additional partners

can be added-on, or generalized and multi-lateral? Additionally, what might GWIC's role be in supporting development of agreements? Does it author the "model" agreement, or advise and review early and model agreements, or observe only?

As LIGO approaches its science run other questions of cooperation arise. The LIGO Science Run is planned for 2002–4. GEO, TAMA, VIRGO Science Runs will likely overlap with the LIGO Science run. What obligation do all of the projects have to coordinate observing schedules? An illustrative and possibly troubling scenario serves to illustrate the point: VIRGO, LIGO, GEO and TAMA all decide separately to shut-down in 2006 for significant upgrades so that no interferometers are "on the air" during that year. Is this an acceptable risk to our sponsors and us?

LIGO faces a somewhat more involved problem: upgrades of the LIGO facilities involve multiple interferometers. Consequently the upgrade schedule for LIGO as a project will be more drawn out than for other projects where only one IFO is involved. The phasing of LIGOs upgrade schedule places greater stress on other projects participating in a world-wide detector network.

Data

Beyond the structure of data sharing and/or exchange agreements, the content of these agreements also raise difficult questions. LIGO and the LSC have a data analysis policy that involves proposals for access to data, proposals to write publications, full disclosure of the use of data and full ability of anyone in the LIGO I collaboration to participate in any of the analysis or publication activities. Other projects will have other publication and data use policies. Any agreements to exchange data or share in a common analysis must address these different policies. This raises, among others, the question of data access and how control over the data is exercised.

An additional question is what, exactly, is shared? The raw data stream cannot be adequately interpreted in isolation; so, some reduced data set needs to be described. Even then, the proper use of a shared data set will likely require that it be accompanied by expertise: do experts also accompany data that is shared?

There is also the issue of results: how are decisions reached regarding results that involved shared data? A related question is, once data sharing between two projects takes place, is there such a thing as a result that doesn't involve shared data? Projects will inevitably, and correctly, use data to from other projects to validate the performance of their own instruments, gaining confidence in the data set locally obtained.

When results are published, what is the authorship policy? Each project has their own; but these will differ in philosophy and detail between projects. How are the different authorship policies combined into a policy for a collaboration between projects?

If more then data is shared – i.e., if analysis teams composed of members from multiple projects examine the common data set – additional complications arise. In particular, how are teams composed? Are team members proposed by the projects, or are members of the projects free to join based on their own interest? Additionally, how is the analysis managed and how are the analysis activities coordinated? Who is the cognizant manager that the teams report to?

Operations

Coordinated operations also raise a series of important questions. The first step in coordinated operations is an easy one: each detector project simply reports to the others its planned up and down times. As soon as we decide that we want to insure that at least two (or three or more) detectors are on-line at any one time, however, the problem becomes more complicated. LIGO anticipates that its “down” time will be 12-18 months for the upgrade of one interferometer. In light of this substantial down time is it possible to coordinate upgrades among several projects, with at least two interferometers always remaining on-line, without some project suffering a significant delay in their own upgrade plans?

When coordinated operations are considered together with data sharing agreements another set of questions arises. When one detector that is part of a data sharing agreement goes down for an upgrade the reciprocity implicit in a data sharing agreement is broken. Does the sharing agreement end at that point, or does “sharing” continue, with the project providing the data while another is upgrading sharing in the data from the improved detector when it later upgrades?

Bilateral vs. Multilateral Agreements

The question of bilateral vs. multilateral agreements also bears examination. Bilateral agreements negotiated can become inconsistent and non-associative: i.e., A and B may have a sharing arrangements, and B and C a sharing arrangements, but A and C not. How does analysis proceed in a circumstance like that? Do bilateral agreements form obstacles to more general agreements?

Communication from Alain Brillet:

Well before we get interferometer data to exchange for a coherent "matched filter" search, we should begin exchanging "environmental data". This exchange will teach us how to produce and read data in a standardized format as well as reveal interesting and unexpected correlations between USA, Italy, Germany, Japan, and Australia.

We can start this exchange now with the exchange of a few accelerometers and E.M. monitors. Only two or three people from each site need to be involved in establishing the exchange, producing the data, and sharing in the analysis.

Beyond this first step we could start exchanging "noise data", or even simulated data, in order to prepare for future coherent detection searches. This exchange will train people, improve the data exchange methodology and data format, and attract new people to the field.

Separately, all projects will need an identical set of astronomical databases, providing things like pulsar frequencies and position as well as more dynamic information like the arrival time and location of X-ray and γ-ray bursts, supernovae, neutrino bursts, etc.

GWIC should take care of this common need, at the very least coordinating this common, international effort, in order to avoid the duplication of effort as well as the need for each project to establish its own agreements with the Centers or Collaborations that own these data.

Discussion

Agreements that are either multilateral, or bilateral but written to accommodate parallel bilateral agreements within and between other groups, are favored. There is a strong consensus that attempts to write a true multilateral agreement, at least at this early stage, will fail. The best path, then, is to frame a general – not specific - bilateral agreement with the expectation that it will be revised in several years. Perhaps at that time the path toward a multilateral agreement will be clearer.

An important point, not discussed, is how to assemble an agreement that keeps the data quality high and consistent. One possibility is a panel that examines the data from an experiment that proposes to join the network and decides whether the data they bring is of sufficiently high quality and sensitivity

The ownership of data is a difficult one. LIGO data is "owned" by the project indefinitely; however, it is not clear that, e.g., GEO data can be similarly held: the funding agency may forbid that. The question is then what gets released. GEO can't build a LSC: there is too much administration for a project of GEO's size. At present the project is not certain of who is a "member" of GEO for the purpose of publications.

The IGEC has adopted the policy that unanimous agreement is required before a publication using data that has been shared is allowed. This may be too high a bar. In particular, it raises the question of why people whose name would not go on a have a say on whether a paper is submitted or what it says? There is a step short of this veto, and that is non-concurrence, but publication allowed.

Brillet's suggestions for beginning the exchange of data and the assembly of databases should be implemented as soon as possible. The database issue is both important and hard. Its payoff is analogous to that accompanying the Particle Data Group. Data as it exists and is tabulated is not organized or collected in a way that is useful for GW astronomy. Would Brillet want to take charge of coordinating assembly of the data base?

The bar detector community's experience is that coordination of operations is very difficult. For IFOs there is both a long-term and short-term coordination question, where long-term is going down for 12–18 months and short-term is "instrument studies" time. On the long-term side no one is going to want to wait and let someone else get ahead of them through an upgrade except perhaps if they share in the data from the upgrade. The question of data sharing may thus be linked to the question of coordinated operations: e.g., when A is down for upgrade and is not producing data it still participates in network analysis, mortgaging its future data to B-E, who are running and waiting their opportunity to upgrade. They participate in the analysis and publications from the upgraded detector data.

Proposed Working Group on a Southern Hemisphere Detector (12:10 PM: D. McClelland)

Progress in astronomy has historically depended on the ability to locate sources. This suggests a criteria that can be used to quantify the desirability of a new detector in a particular location. The science issues that have been identified include pointing, polarization identification, increased sensitivity and increased sky-coverage.

National interests and regional interests, however, cannot ignored in these decisions, since they are often critical in funding decisions. Thus, a study of this kind can help to make the case for the siting of a detector, but not to form global priorities.

GWIC is interested in the results of this study, which will be undertaken independently of the organization

Project Reports and Planning of Advanced IFOs

ACIGA (D. McClelland)

Current status: working on resonant sideband extraction experiments, sapphire properties, high-powered lasers, and data analysis. All are coupled strongly with LSC activities. The Gingin facility is built and plans are to build an 80m long cavity with Mwatt circulating power (2^{nd} generation IFO). Funding has been applied for and the success of the proposal will be known in August. LIGO has donated sapphire mirrors and power recycling mirror.

This is a critical year for ACIGA: everything is up for renewal

Owing to efforts of Kuroda and TAMA there is a funded program to support R&D collaboration between TAMA and ACIGA. In the most recent funding cycle the most disappointing result is that the data analysis proposal was not funded.

ALLEGRO (W. Hamilton)

ALLEGRO is warm for the foreseeable future while waiting for the move to a new building to take place. The move schedule has been in a state of constant flux and, at this time, no promises are regarded as reliable. ALLEGRO is taking this opportunity to change its transducer, which should increase the detector bandwidth to about 80 Hz. To make this change will require several months, after the lab space is finished, before the detector can go cold.

The floor of the new lab space has been specially done. The bar will be mounted on an air bearing support so that the cross-correlation between LIGO and ALLEGRO can be modulated by rotating the ALLEGRO detector. It may even be possible to rotate ALLEGRO while it is operating.

AURIGA (S. Vitale)

AURIGA is currently warm for maintenance and repair of cryogenics. It should begin cooling in fall or late fall. In addition to the repair of the cryogenics is an upgrade to a new transducer to increase the coupling. In the transducer test AURIGA has now demonstrated a 300hbar squid at 4K and also made back reaction measurements. Which of these technologies will be incorporated in the next run will be decided shortly.

On the analysis front AURIGA is reprocessing the 97–98 data and adding the 99 data to increase coverage time.

Finally, AURIGA is investigating a high finesse optical transducer.

GEO 600 (K. Danzman/J. Hough)

Optical components are currently being installed into vacuum system. The infrastructure ready, but installation is being slowed down by Expo2000 visitors: GEO is an official Expo2000 site.

The control systems for the laser and both mode cleaners are installed and working. Light is going around all the mode cleaner bends. As we meet working on getting right (EW) arm into lock. GEO will operate one arm for a while, ramping-up all the gains and tweaking all the control systems using this 1200m cavity.

Optics is now on the GEO critical path. GEO is awaiting the arrival of its beamsplitter and far mirrors. Its contractors are having difficulty making optics with coatings that are both big and of sufficiently high quality: they can make high quality coatings, but not on optics of the requisite size, or coatings on large optics, but not of the requisite quality. Another contractor has been brought in who can do produce the optics with the required combination of size and surface quality. These optics won't be ready for approximately two months; however, once they are delivered the critical path will switch from optics delivery to available FTEs.

GEO no longer has test optics: they went for tests and aren't coated well enough. The new contractor won't do both the test and the final optics; so, GEO is now working with its final optics.

GEOs goal is to begin data taking in December 2000.

Experimental gravitational wave work has, in Germany, traditionally had a home in institutes whose primary focus is in other areas. The MPI is now set to establish two new experimental departments for gravitational wave research – one in Golm and one in Hanover – under a single administrative roof. The formation of these two new departments has been approved at all but the final level; however, no surprises are expected. The formation of these new departments will add four faculty and quite a few staff positions to the field, together with reliable funding for the foreseeable future.

Finally, Germany is completing a decadal review of astronomy. Gravitational wave astronomy will be identified in that report as a priority area for the next ten years. Moving into mainstream science.

EXPLORER/NAUTILUS (E. Coccia)

Both the Explorer and Nautilus detectors are cold, with Nautilus in a superconducting state (0.14K). Nautilus calibrated with Newtonian field. Explorer has an improved transducer with lower read-out noise, increasing the detector bandwidth to 40Hz. This is an improvement by a factor of 40: Explorer no longer a narrow band detector.

There appear in the data to be and anomalously large number of strong coincidences with large cosmic ray air showers: in four months of data there are eighteen with showers whose down particle density is greater than 300 particles/m^2. The expected number of accidentals, on the other hand, is just over two. When the cut on down particle density is raised to greater than 600 particles/m^2 there twelve coincidences where the accidentals rate is expected to be 0.78. Apparently the calibration from energy deposition in bar to cosmic ray shower power shows much higher than expected shower energy. The why of this is currently under investigation.

LIGO (B. Barish)

LIGO's major construction has ended. The last significant procurement is for computers; otherwise, the project is fully into its commissioning stage.

A major lesson already learned is that it is too difficult, and a poor strategy, to try to commission three IFOs at once. It is a significant drain on FTEs and does not leverage the knowledge and experience gained in the course of commissioning. This has led to a change of strategy and schedule. LIGO is now using the LHO 2Km as a pathfinder, with the emphasis on speed of installation: that is, learn as quickly as possible what the problems are so that they can be addressed early on. Simultaneously, the LLO 4Km team is focusing on the commissioning of the input optics. The LHO 4Km IFO is on hold until these studies are complete.

This experience is also affecting plans for the upgrades leading to LIGO III. The earliest date when upgrade activities will require removing an IFO from operations is 2005–6. The planning horizon is to replace one IFO beginning in 2005; possibly making incremental changes in the IFOs before then. To make best use of this additional time LIGO will have a greater number of interleaved science and commissioning runs. The first "science" run will likely involve the LHO 2Km and LLO 4Km detector, following by commissioning on the LHO 4Km detector, etc.

A major focus of activity is simulations, data analysis and computing infrastructure. Simulations will be needed for commissioning and LIGO II design activities in early 2001; correspondingly, validation of the LIGO End-to-End model is an important focus today.

On the analysis front LIGO is planning its first Mock Data Challenge, a system integration test of its data analysis system, starting at the end of July. Engineering data run on 2Km lock data.

At the sites all three IFOs have all their optics installed. Each arm of the LHO 2 Km detector has been locked separately and work is proceeding to bring the 2 Km IFO into operation. The current schedule has the first robust locked IFO in December 2000.

LIGO continues to be funded for visitors program, which involves both U.S. and non-U.S. visitors (e.g., Benoit Mour is visiting LIGO under this program). This is also a special exchange program with VIRGO operating under a joint CNRS/NSF arrangement.

Over last year plans for LIGO II have developed rapidly, including especially a definition its physics and science goals. The general goal for LIGO II is an IFO that will get as close as possible to quantum limit over its band. During the last year the LSC wrote a whitepaper describing a LIGO II IFO. This was accompanied by a Lab cost schedule. A second-round set of documents is being prepared for submission to the US National Science Foundation by the end of the year.

The major features of this plan are sapphire optics, resonant sideband extraction, the GEO double pendulum suspension, and an improved seismic isolation and suspension system. Many paths are being pursued and few decisions are set in stone: in particular, sapphire optics has problems with impurities and these are being closely examined. Nevertheless, downselects on the alternatives being pursued need to be made soon. The first downselect, dealing with the technical approach for seismic isolation, has already taken place. It is clear that R&D must get to large scale prototypes before LIGO II is built. For this purpose the LASTI facility at MIT will be invaluable: it is a single arm cavity with

the size chambers as in LIGO. Using LASTI LIGO can carry-out full--scale prototype tests prior to installation at the sites.

LISA (W. Folkner)

LISA progress is mostly political. In the last year several major review hurdles were passed. LISA is being scheduled as a new start as rapidly as can be done, with an anticipated launch in 2009–2010. This was cemented by the very favorable NASA Astronomy Decadal Study. The final hurdle is congressional authorization. For this purposes LISA is bundled with Constellation X and in a package called Cosmic Journeys. If all goes well then funding begins 2002 with a funding profile consistent with flight in 2010.

There is a possibility of funding sooner for a technology demonstration study. There is a unique opportunity to do this on ST3 (2005 launch), a space interferometry mission. To make that date LISA will need funding by October 2000. NASA is fully committed to that funding.

NASA and ESA are negotiating to have a joint officially approved science team. In US that will be by proposal. There won't be an AO because no funding, but it will involve application and peer review.

NASA has also asked for a white paper describing a LISA follow-on mission. This is really a place-holder: until LISA flies one won't know what LISA II will look like.

On the ESA side, a Phase-A study has been completed, concluding that LISA can be flown for the estimated cost.

The next six months should see the new LISA science team officially formed and a NASA/ESA official agreement to allow technology exchange.

NIOBE (D. Blair)

Niobe has been warm for the last two years. During the first year the project fully tested (cryogenically) a 10hbar quantum amplifier. Assembly problems have delayed the installation for a year. These problems, now overcome, are directly attributable to a loss of knowledge from the first assembly 5 years previous.

While warm there has been a careful recalibration of the detector. The calibration depends sensitively on the shape of the mechanical oscillator. Errors in an earlier calibration have been discovered and corrected with the result that the detector was actually more sensitive than previously thought, with a newly calibrated noise temperature of 800 mK.

The new transducer, with its lower amplifier noise, should provide a better detector bandwidth. Cooling will begin soon and Niobe should be operating again in December.

Niobe has submitted a new proposal for funding. A feature of this proposal is that it includes as co-investigators all of the IGEC members. Niobe is generally looking for closer participation by all: less an individual detector and more a part of a world-wide network.

The review system for science funding in Australia is changing to a system where there will be a program officer, similar to, e.g., the US National Science Foundation. On the other hand, owing to the smaller size of the Australian system, the program officer will have a broader portfolio than in the United States.

TAMA 300 (M.-K. Fujimoto)

TAMA funding has been extended for two years. During these two years the projects goals are to observe with the existing detector and to plan and implement improvements that will increase its sensitivity and operational stability.

During this period TAMA must make advances toward the LCGT. The LCGT will be hosted by ICRR and University of Tokyo. Review committees have recommended further R&D work on advanced technologies before funding a construction proposal and the funding agencies are looking for a budget for this R&D.

Previously had two collaborations: TAMA and LCGT. While there was considerable overlap in personnel the funding sources were different and so they were different collaborations. Planning is now focused on LCGT and there is only one collaboration.

Preliminary results of data analysis indicated that TAMA can detect NS/NS inspiral to 30 Kpc and the inspiral of a pair of 0.5 solar mass black holes within our galaxy.

To increase operational stability active isolation is being installed at all of the stations. Installation has already taken place at one tank with a marked reduction in the noise associated with that station.

One problem area is that, at present, only three people have the skill-set necessary to operate the detector. Correspondingly a major focus of activity right now is to make the detector easier to operate.

TAMA is planning a two week period of operations at the end of August. After that it will complete the installation of the active isolation and improved suspension throughout detector. A one month period of operations is then planned for December or January 2001. There will be one more period of extended operations; however, it has not yet been decided what technology to test during that final period of operations. One possibility is to test new suspension system (currently being implemented by DeSalvo); however, another possibility is to test a recycling system.

VIRGO (A. Giazotto/D. Enard)

Installation of the suspension system in the corner is currently underway. The control at the top of the inverted pendulum has been tested and found to be very stable: it has run for several months as a closed-loop system without a collapse. The control system is able to reduce the rms displacement noise by a factor of 10^4 at 0.1 Hz.

Another focus of activity is the attempt to lock the 144m mode cleaner. A critical mode cleaner mirror was ground/polished to the wrong curvature radius and this may require that the mirror be replaced.

Following discussions between INFN and CNRS VIRGO will become a laboratory, which new institutions can join as members by adding their financial and personnel support. This

new laboratory will support additional gravitational wave experiments and concentrates the existing funding in the area of GW R&D.

VIRGOs current schedule is to finish commissioning the central IFO in May 2002. Commissioning of the central area will begin in Summer 2001, with all commissioning completed in September 2002. Looking ahead, GEO signal recycling will be incorporated in 2005–6, and the Euro project will commence construction in 2008.

Meetings

Amaldi Meeting (D. Blair)

- Dates: 8–14 July 2001
- Budget:
  - Have applied for IUPAP funds (pending);
  - Meshkov has prepared application to NSF for travel support (application not due yet, but will need program in place with speakers before NSF will consider);
  - Discussions underway with INFN for Italian participants. At the last meeting 3-4K was available to conference organizers to sponsor participants; a better plan is to have INFN fund its participants directly, instead of through the conference organizers.
  - TAMA may have some money available for participants from Japan
  - The University of Western Australia, which is the institutional sponsor, has contributed US$10K.
  - Will have low-cost University housing (US$30/night shared bath, some double rooms). All the participants can be accommodated in the college: the question is, how many participants may prefer 3-star or 4-star accommodations in town.
  - The planned registration fee is US$300 (US$350 late) and includes an excursion, dinner, morning and afternoon teas, conference bag and proceedings.
- Announcement
  - First announcement has been sent out to the mailing list of the last Amaldi meeting and also to MacCallum's list. An attempt will be made to have it sent to the participants at MG9
  - Web registration is not yet ready, but it will be possible to register and pay over the web.
  - Visa requirements should be highlighted for many participants.
  - International Scientific Advisory Committee has been appointed (picked-up from last Amaldi meeting); David McClelland is the chair. A preliminary has been sent to the international advisory committee for comments.

- Venue
    - There is a very good auditorium scheduled for the plenary sessions.
    - Space has been arranged for posters that will allow them to be more accessible and accessible for longer periods of time. Additionally the proposed schedule has a plenary poster session with “sparkler” talks (1m on a poster).
- Program:
    - Need names of convenors and speakers. Convenors should be people who can organize best session; speakers should be good young people who can speak well.
    - To do this need program better defined: subjects, etc.
    - Need to have enough theory to attract theorists. Last Amaldi meeting didn’t do as well as could have at done.
- Proceedings:
    - Try CQG or IJMPD for refereed publication.

GWDAW (W. Hamilton)

- At LSU on 14-16 Dec (Thu-Sat). Can slip one day in either direction. May have one day at LLO, with conference dinner on site. Reserved rooms on campus (in buildings not under construction). Will have full data projectors, etc. Trying to keep as inexpensive as possible. Registration under US$100 (dinner may be separate). No intent of any published proceedings. Meeting along lines of Penn State meeting in terms of organization.
- Program: data, data characterization. What is necessary to bring up an IFO up, keep in lock, and diagnose. Maybe some stuff on “analysis” (hierarchical searches, etc.).
- Traditional size: on order 100 or less.
- Announcement will go out to everyone at last meeting. Web page. Registration can be paid ahead of time on the web.
- Warren is contacting people about convenors or topics.
- Will endeavor to keep as complimentary with other meetings as possible

Aspen Workshop (G. Sanders)

Previous Meeting: Aspen is now a GWIC sponsored workshop. Last meeting GWIC decided to focus on advanced detectors. Good meeting: lots of working groups with good things coming out. Next Meeting: the intention is to continue with advanced detectors as the basic thrust. Dates not yet settled. Will be settled August, September time-frame. An idea being pursued is to put it after astrophysics workshop in the hopes that there will be some overlap of participants.