Final Programme for VAST 2003
5th-7th November at the Old Ship Hotel
Brighton, UK

Wednesday 5th November

9.00 Registration desk opens

9.45 Welcome and opening

10.00 **Invited Speaker**
Kevin Cain, Director, INSIGHT, The Institute for Study and Implementation of Graphical Heritage Techniques, USA. *Scholarly documentation through digital storytelling: opening the tomb of Ramsses II* 7

11.00 Coffee

11.15 **Session 1: Recording and Processing**
M. Callieri, P. Cignoni, F. Ganovelli, C. Montani, P. Pingi, R. Scopigno, Italy. *VCLab's Tools for 3D range data processing* 9
Paul Kammerer, Ernestine Zolda, Robert Sablatnig, Austria. *Computer Aided Analysis of Underdrawings in Infrared Reflectograms* 19
Michael Ashley Lopez, USA, *Managing the real with the virtual: A role for digital media recording in archaeological fieldwork* 29

12.45 Lunch

2.00 **Session 2: Modelling and Display of Architectural Forms**
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Maria Roussou and George Drettakis, UK. *Photorealism and Non-Photorealism in Virtual Heritage Representation* 47
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3.30 Tea

3.45 **Session 3: Models and Modelling II**
F.J. Melero, J.C. Torres and A. León, Spain. *On the Interactive 3D Reconstruction of Iberian Vessels* 67
M. Kampel, Austria, and F. J. Melero, Spain. *Virtual Vessel Reconstruction from a Fragment's Profile* 75

5.00 Social Event: Lewes Fireworks

Thursday 6th November

9.00 **Session 4: Skeletons in the Cupboard**
B. Magnanti, A. Nicholls and R. Sayle, UK and USA. *Multi-Platform Skeletal Visualisation and Reproduction in Stereolithography* 85
Lars Wilke, Tom Calvert and Rhonda Ryman, Canada and Ilene Fox, USA. *Animating the Dance Archives* 89
S. Seipel, M. Lindkvist and L.W. Pettersson, Sweden. *Interactive virtual mummy dissections in a historical anatomic theatre* 97

10.30 Coffee break

10.45 **Session 5: Virtual experiences**
Markus Grabner, Ralph Wozelka, Manish Mirchandani and Konrad Schindler, Austria and India. *Web-based visualization of virtual archaeological sites* 107
Florian Ledermann and Dieter Schmalstieg, Austria. *Presenting an Archaeological Site in the Virtual Showcase* 119
Nathaniel Williams, Chad Hantak, Kok-Lim Low, John Thomas, Kurtis Keller, Lars Nyland, David Luebke, and Anselmo Lastra, USA, *Monticello Through the Window* 127
Emmanuel Tsekleves and John Cosmas, UK, *The Dissemination & Promotion of Cultural Heritage Sites to People "On the Move" Employing Digital TV* 135

12.45 Lunch

2.00 **Session 6: Navigation**

Ioannis Kotziampasis, Nathan Sidwell and Alan Chalmers, UK, *Portals: Aiding Navigation in Virtual Museums*
V. Vlahakis, T. Pliakas, A. Demiris and N. Ioannidis, Greece, *Design and application of the LIFEPLUS Augmented Reality System for continuous, context-sensitive guided tours of indoor and outdoor cultural sites and museums*

3.00 Tea

3.15 **Session 7: Plans for FP6**
David Arnold, *Plans for the EPOCH Network (Excellence in Processing Open Cultural Heritage)*
Stephen Stead, *Standards for Cultural Heritage*
Rob Davies, Project Manager, *CALIMERA*

4.30 **Session 8: Work-in-Progress**
Peter Becker, Sweden. *Interacting with Cultural Heritage.*
I. Vatanen and K. Uotila, Finland. *The Extended Museum - Augmenting the sphere of cultural heritage interaction through information technology in medieval Naantali, Finland*
Ediz Saykol, Yucel Saygin and Aytul Ercil, Turkey. *MIDAS: A Multimedia Database for Archaeological Sites*
S.Bencetti, G.Dodero and V.Gianuzzi, Italy. *Art images and disabled children: a software tool for therapists*

6.00 Drinks and Dinner

Friday 7th November 2003

9.15 **Session 9: Systems**
J. Cosmas, T. Itegaki, D. Green, N. Joseph, L. Van Gool, A. Zalesny, D. Vanrintel, F. Leberl, M. Grabner, K. Schindler, K. Karner, M. Gervautz, S. Hynst, M.Waelkens, M.Vergauwen, M. Pollefeys, K.Cornelis, T. Vereenooghe, R. Sablatnig, M. Kampel, P. Axell, E. Meyns, *Providing Multimedia Tools for Recording, Reconstruction, Visualisation and Database Storage/Access of Archaeological Excavations*
Georgios Papaioannou, Greece, *Enhancing Virtual Reality Walkthroughs of Archaeological Sites*
Pierre Drap, Julien Seinturier, Marco Canciani and Benjamin Garrett, France, A GIS tool box for Cultural Heritage. An application on Constantine, Algeria, historical center

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11.00 **Session 10: Rendering**
S. Havemann, D.W. Fellner, A. M. Day and D. B. Arnold, Germany and UK. *New Approaches to Efficient Rendering of Complex Reconstructed Environments*
Ioannis Roussos and Alan Chalmers, UK. *High Fidelity Lighting of Knossos*
Sabry F. El-Hakim, Lorenzo Gonzo, Michel Picard, Stefano Girardi, Andrea Simoni, Eric Paquet, Herna Viktor, Claus Brenner, Canada, Italy and Germany. *Visualisation of Highly Textured Surfaces*

12.30 Lunch

1.45 **Session 11: Plans for FP6 and Work-in-Progress**
Franco Niccolucci, *European Education and Training in an Interdisciplinary Field*
A. Diez-Castillo, Spain. *Managing archaeological excavations with an Archeaological Information System (SIDGEIPA)*
Additional Presentation not available at time of going to press

3.00 **Invited Speaker**
Duncan Brown, Curator of archaeological collections, Museum of Archaeology, Southampton
Genuine Archaeology and Real Computer Graphics

4.00 Closing Ceremony

4.15 Ends

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VAST2003

The 4th International Symposium on Virtual Reality, Archaeology and Intelligent Cultural Heritage,

Incorporating:

1st EUROGRAPHICS Workshop
on
Graphics and Cultural Heritage

The Old Ship Hotel, Brighton, United Kingdom
5-7 November 2003

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4th International Symposium on Virtual Reality, Archaeology and Intelligent Cultural Heritage (2003)
D. Arnold, A. Chalmers,F. Niccolucci (Editors)

Managing archaeological excavations with an Archeaological Information System (SIDGEIPA)

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Abstract
I discuss different aspects of the process we have followed to develop and implement a completely new software to manage archaeological excavations. The software named SIDGEIPA (Distributed System for Integrated Management of Archaeological excavations) includes different modules allowing users to store archaeological data from different sources (excavation, survey, scientific literature, museum collections...) and to process them automatically in order to simplify archaeological research. Technically Sidgeipa is built in Java code, using Postgres as DBMS and with VTK and GEF libraries to visualize the data. The client -server architectures is sustained by Linux and MacOS X platorms.

SIDGEIPA is being used to manage several excavations in the Iberian Peninsula from first agriculturalists sites like the Mas D'Is village (Penàguila, Alicante) to the Iron Age Oppidum of Tos Pelat (Montcada, Valencia). The Arachaeological Information System (AIS) SIDGEIPA has been developed in the framework of the Harris Matrix and to model 3D reconstructions. Both, technical aspects and archaeological questions will be presented and discussed. Examples of the software functionality will be exposed including Geographical Information Systems, Computes Assisted Design and database management. Development of the software have been possible to financial aid from the FEDER program of the European Union being consequence of the full integration of two research projects the Rural Archaeological Park implemented in the Alcoia-El Comtat valleys (Alacant, Spain) and the Distributed System for Integral Management of Archaeological Parks.

Keywords:
Archaeological Information Systems, 3D Visualization, CRM, Harris Matrix.

1. Introduction

In First, we would like to agree with Eiteljorg when in a letter to the Computer Graphics World editor, he distihguishes "between work that aims to represent artifacts, buildings, or sites and work that aims to documents artifacts, buildings, or sites" As he says both "are not incompatible, nor are they mutually exlusive. However, they are different enough that one must consciously aim for one or the other (rarely both)." (Eiteljorg 2001) Keeping in mind similar thoughts, SDGEIPA was born in 1999 aiming to wholly document all kind of archaeological data. Ambition versus reality has convinced us to limit our expectations and just know SIDGEIPA is not more, but no least than wonderful tool to handle all data coming from either surveys or excavations.

The Archaeological Information System SIDGEIPA The basic reason to develop and implement this AIS was the need to have a unique and handy tool in order to manage our archaeological data, to automatize archeological records on the field, aiming to create standardized ways to work and manage archaeological data. Dealing with different commercial programs to cover all our needs -CAD, databases, imaging process, design, statistical packages, GIS packages and so on-, was both expensive and frustrating. In brief, we were looking for a Database Management System able to visualize in three dimensions archaeological data, something like a Geographical Information System applied to archaeology.

Spatial Archaeological Data can be managed successfully with Geographic Information Systems applications (GRASS, MAPINFO, IDRISI, ARCINFO...). This kind applications allow archaeologists to map sites, but more than that GIS systems have a complete set of tools to display and to analyze Spatial Data, some examples good examples of the contribution of GIS to archaeology and anthropology can be found in the literature since 1990 (Allen, et al. 1990, Gillings, et al. 1990, Kvamme 1990, Lock and Stancic 1995, Moscati and Tagliamonte 1998, Petrie 1995, Stoll 1994) until now (Mithen 2001, Stancic, et al. 2001), in them we can find examples of using GIS for environmental analysis and from preservation and planning. But GIS were thought to resolve geographic problems, but we archaeologists have specific needs, specially those related with time (control and treatment of). This problem is essential when we are dealing with data collected in archaelogical excavations. Just for that we decided to develop a software able to visualize and represent **archaeological entities** –stratigpraphical units, features, layers, phases– and **artifacts** and, mainly, to manage both together. The ideal software should be flexible enough, in data capture and information management, to cover since excavations in Paleolithic caves to huge urban projects in CRM. Overall, we wanted to have control over the software core. Just for that we decided to go a little further developing our own Archaeological Information System that try to be more than a GIS adapted to Cultural Resource Management.

Sidgeipa was developped upon the experience of other

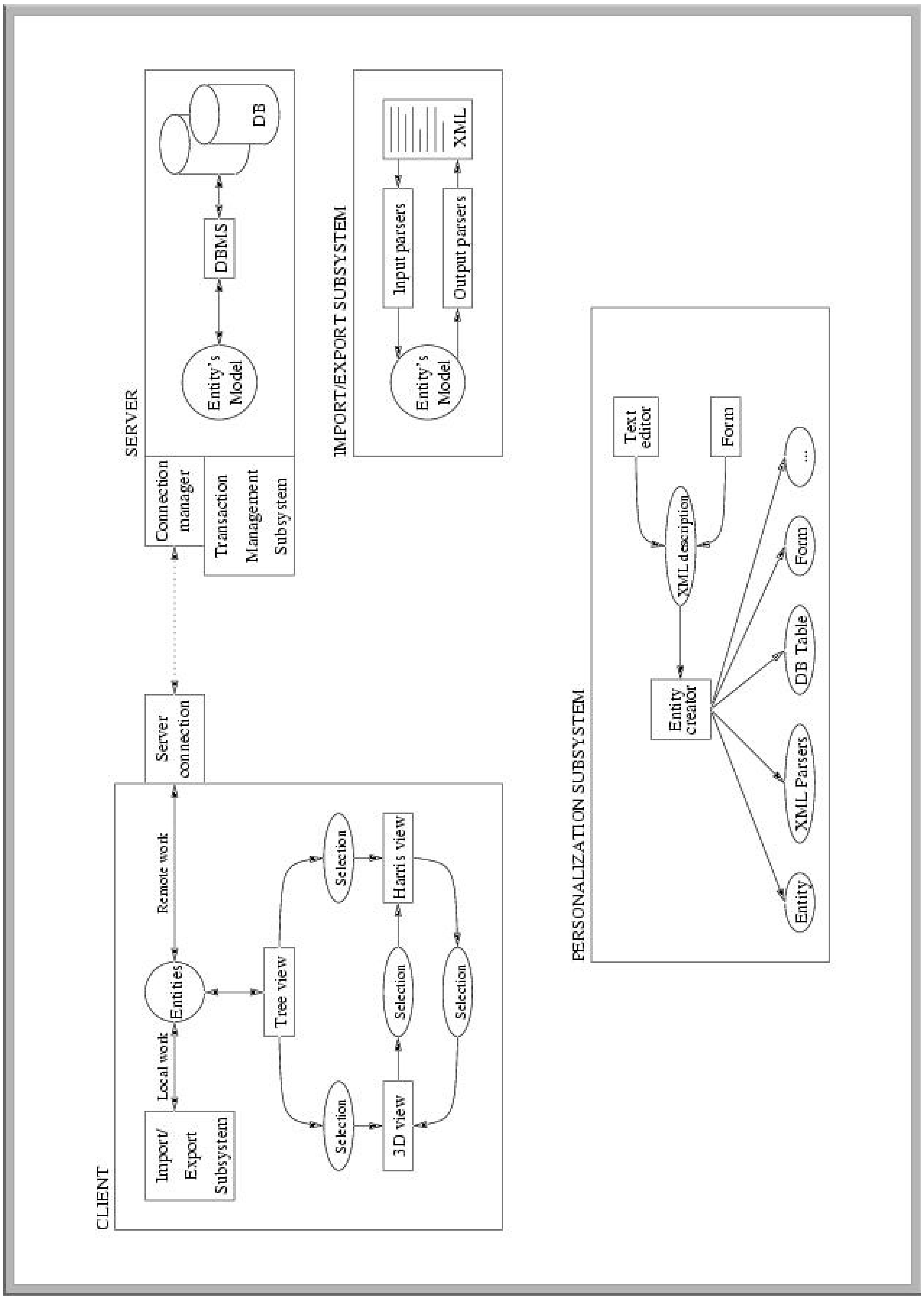

Figure 1 SIDGEIPA Architecture

archaeologically oriented applications. Methodologically SIDGEIPA is oriented towards, but not exclusively, the Harris Matrix.

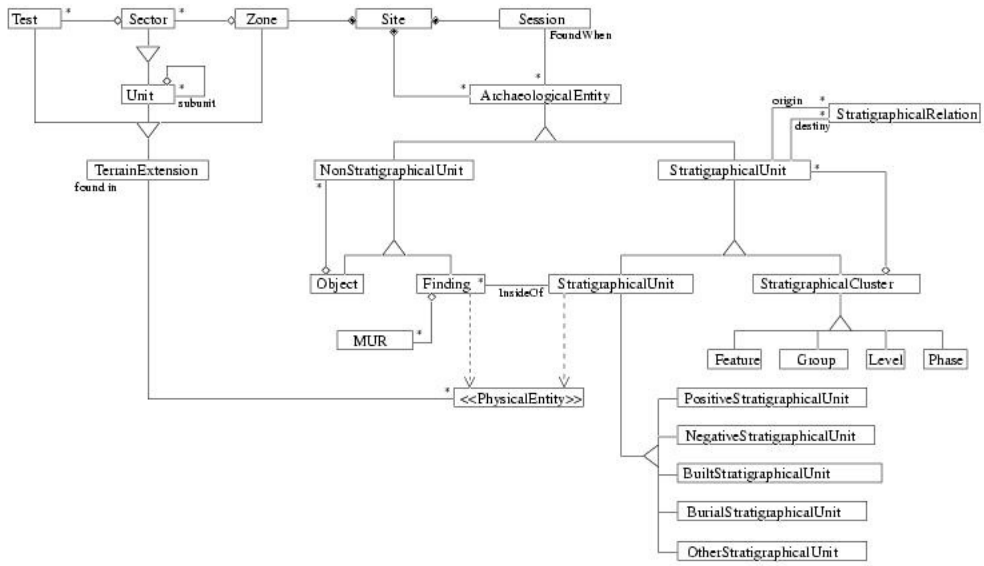

Figure 2 SIDGEIPA Stratigraphical manager chart flow

Up to date, SIDGEIPA has been sucessfully used in several excavations including some CRM projects (Colata), an Early Neolithic village with monumental causewayed in Western Mediterranean (Mas D'Is), a Chalcolithic forthill (Peña Oviedo) in North Spain and an Iron Age oppidum (Tos Pelat).

2. SIDGEIPA ARCHITECTURE

Main features of SIDGEIPA are:

It is a Multiplatform AIS, as far as it has been programmed in Java code;

Ability to render 3D views through the VTK library,

Automaticatic Harris Matrix construction reading stratigraphical relations from its own database,

Import and export capabilities through high compatible XLM format

It can be customized, it is highly flexible,

Sidgeipa is based on a Sever/Client architecture. As such the application is divided in two parts: one server where all the data from the sites are stored in several tables and an undetermined number of clients that can solicit for different **views** of each site (figure 1).

2.1. Server side

In the server resides the infrastructure related with the database management, in a way that the displayed interface is independent from the database being use. This allows superusers to easily change the Data Base Manager System (DBMS). Interface used by clients is adapted to the site forms including all the entities inside them –stratigraphical units, artifacts, layers, features-, …–.

Such architecture allow more than one client accessing the same data concurrently. This will be the origin of consistency conflicts storing or viewing data not updated from other clients. To avoid those conflicts, SIDGEIPA has a transaction manager allowing only clients with the correct privileges in each moment to modify the server resident database; at the same time the transaction manager sends out a message to the other clients informing that data in use by them have been modified.

The server machine has a connection manager in charge of serving data to the clients following the established procedure. Such connection manager has information about connected clients in order to inform them of changes in the database when they occurred.

Hierarchical structure of the system allows more than

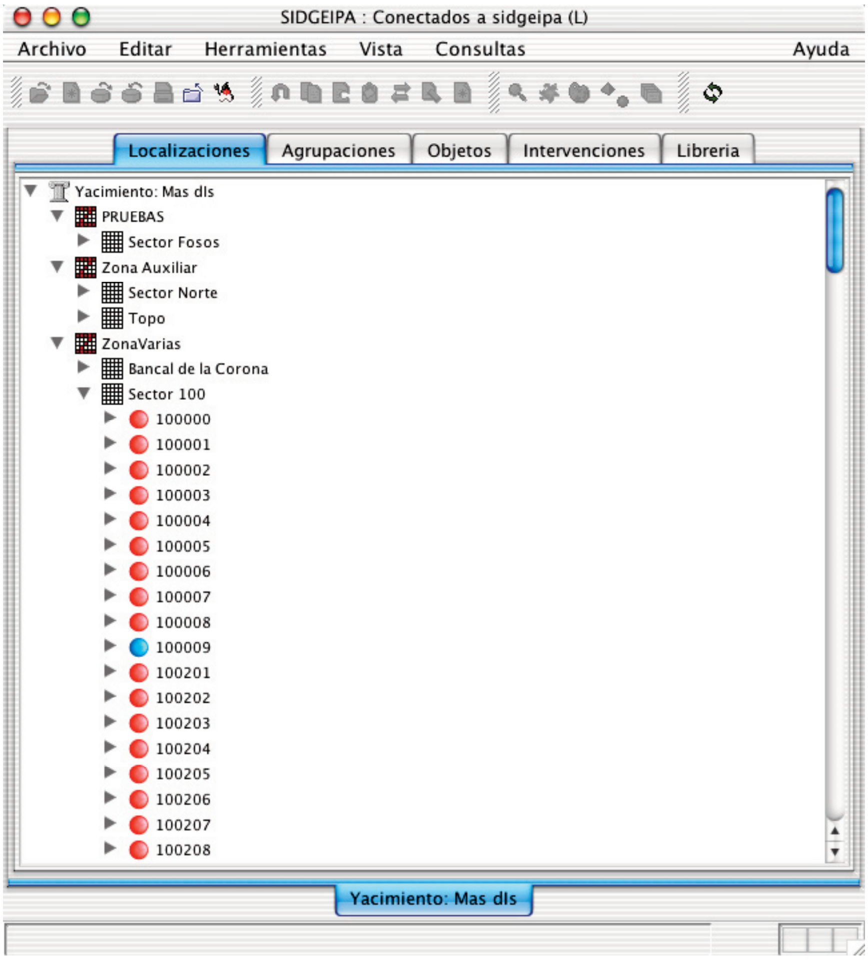

Figure 3 Localiztion tab

one stand alone server, but all of them need to be slaves of the master server. Those different servers can work independently of the master being synchronized only when needed to the master one.

2.2 Client side

Most of the times, even taking into consideration recent developments in wireless and satellite networks, archaeologists working on the field are unable to connect their computers to an external network. When such incidence happens Sidgeipa workstations are able to work in local mode like clients of a server resident in the same machine. In this way, workstations allow to work both remotely and locally.

There is a subsystem to search and recover data from the DBMS at users requirements. The subsystem resides in the client and is formed by a set of fixed SQL queries in command of reading and writing data from the database following the designed pattern. This pattern stores and gets the data from objects residing in the site model.

3. The user interface

In both modes -remote and local- clients have a set of entities (stratigraphic units, features, groups, layers, objects, ...) according to the site model. These entities are displayed in different site views; a new view is obtained through the selection of any entities in the current view.

To ease database management, views are hierarchical and somewhat strict. Users have two options, when opening the user interface in the client side: either to connect to their own server or to connect to the remote one –the master server–. Connections to the former will allow users to select the site where they want to work in the current session, connections to the latter will allow users to work directly in sites not residents in the local server or to recall remote sites that will be incorporated to the local database (figure 2).

Once the site is open, the default view is a hierarchical tree of the selected site showing the localization tab (Figure 3). From this tab users can access different levels: the site, the zones in which the site is divided, sectors inside of zones, three types of stratigraphical units (positive, negative and built) and all findings related with. All this information is displayed according with its internal hierarchy.

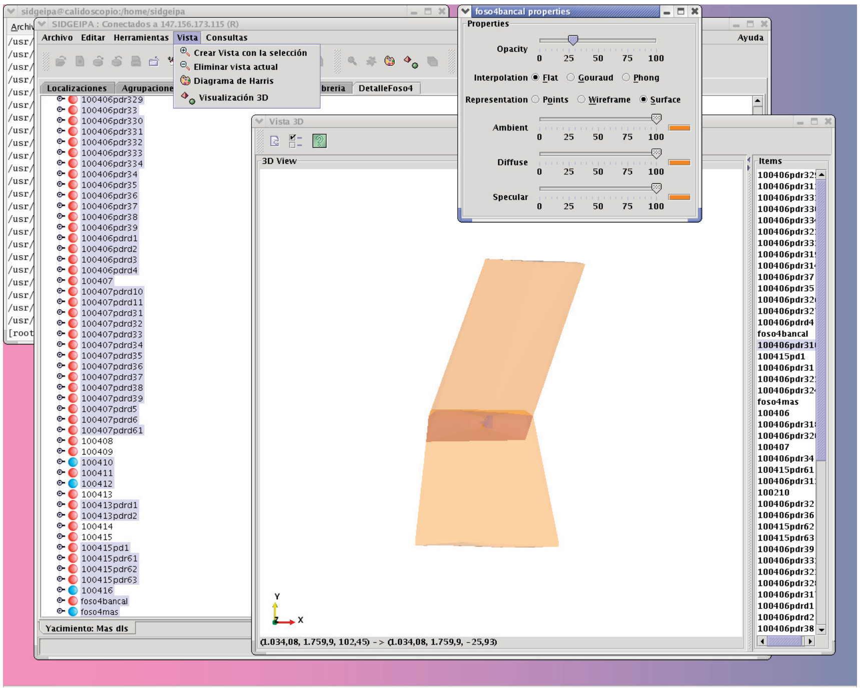

Figure 4 Changing propeties -color, transparency- in a 3D view

By default the main view has other four tabs: Stratigraphical entities, objects, seasons and library. The second tab features stratigraphical entities –phases, layers, groups and features, groups, layers–, and it is where users can group stratigraphical units as needed. The objects tabs allow users to manage composite findings, like several ceramic sherds forming a vase or a lithic refitting (we will come back later). Seasons tab is where we introduce field season descriptions and all information related to them like crew members, beginning date and ending date that will be used in the other forms. Finally, the library tab is where attribute description of findings are defined. Besides the standard tabs users can define in each session new views based upon selection of diferents entities. In each of these tabs the user can open a form to fill out the information that will be automatically update to the corresponding tables of the main database.

Six menus allow user to active different program features. The File menu allows the usual open, close, import/export, exit, print and new referred to the whole site. From the Edit menu users are able to undo actions, and to copy, cut and paste entities subsidiary entities from and to other superior ones; and to select, delete or duplicate them. From the Tools menu users can set up the preferences, connect (=upstream synchronization) the open site with the master server or disconnect (=downstream synchronization); from here they can create stratigraphical and non stratigraphical entities, the menu is interactive allowing different tasks related to the selected entity.

The View menu will be where users can either visualize three dimensional displays of their selection, or they can build the Harris Matrix of the same selection. Resulting views are interactive allowing users to access the form interface of any selected entity. In the 3D reconstruction of previously selected entities, users can navigate through the scene, cut the entities, and change visual properties of each or a set of entities (figure 4). The matrix can be displayed in different levels, groups, features and Stratigraphic Units (figure 5). This tab allows users to automatically draw and sort the selected entities, in addition an editor is provided to retouch the final view.

One of the most important features in SIDGEIPA is that from any view an entity can be selected and from there get information about its characteristics through a form that allows users to modify it -in case they have the privileges to do so-

Finally, we put a Query menu where user can ask the database to retrieve information through preset SQL queries. Results can be exported in HTML format to further treatment in other applications.

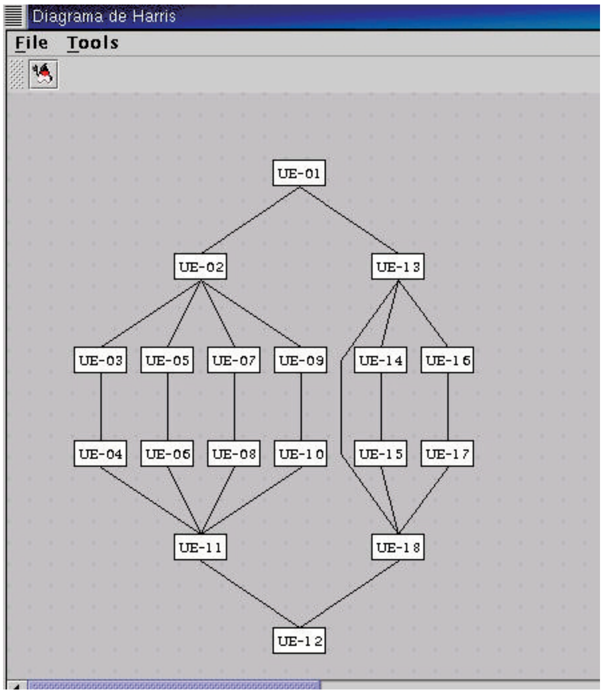

Figure 5 Harris matix built in SIDGEIPA

3.1. Personalization in SIDGEIPA

In SIDGEIPA there is a part of the application independent of both the client and the server. It is a module to edit and personalize new entity forms from an basic one, for instance if a user wan to create a new type of artifacts that share essential attributes the new entity (i.e. lithic scrapers) can be created from the basic one (i.e. lithic tools).

Findings managements, meaning the minimal record unit for any artifact found during excavation or survey, is open to be defined by users. Users can construct as many kinds of findings (lithics, ceramics, figurines, metal, coins) as they want, but each of them need to be included in an already created stratigraphical unit and to share a basic set of common attributes to allow the DBMS to query them. The latter is true for the objects, meaning any composite set of findings that could become a superior entity (ceramic vase, lithic refitting) but in this case they are not related to any particular stratigraphical unit.

To create these new entities, user can use a form where the new attributes are defined forming groups (figure 6). This form will generate a XML file describing the new entity, those files go into a compiler where the new kind of entity will be generated with all the attributes needed to be incorporated into the database -the new kind of entity to be included in the sites, parsers in and out to be imported, tables to be incorporated in the DBMS, edition form, ...- Finally the new created entities and objects will be introduced in its location, either in the server, the clients or both.

4. Technical features

All the programming has been done in Java language, using Swing to develop graphic interfaces, because it allows launching the application in any computer where a Virtual Java Machine is implemented. This allows easy use of SIDGEIPA in any multi platform environment.

To implement 3D views on the clients, it has been used a visualization library call VTK (The Visualization ToolKit) and to implement the Harris Diagram a Java graphs library call GEF (Graph Editing Framework) it is being used.

Lastly, files to store entities and the ones allowing user to personalize the application have been created using XML language. To parse those files we are using Xerces, a Java library. For now, we are using Linux like development platform, because its distribution is open source code, it is powerful, and have a great variety of development software available. To cite some example the freely distributed Postgres DBMS is being using at this stage of the application. Nevertheless, as far as clients and server are isolated machines, SIDGEIPA is open to use other commercial DBMS.

5. Results

Briefly, we are to present some practical examples of excavation management through SIDGEIPA with some comparative results. In order to manage data in Sidgeipa we need to create the spatial setting of at the site. As we said before, SIDGEIPA has been tested in several Early Holocene open-air sites in Iberia, but for space constraints we will focus in Mas D'Is (Penáguila, Alacant). This huge site is being excavated since 1998 under the direction of Professors Joan Bernabeu and Teresa Orozco (Bernabeu et alii 2003). Mas D'Is is a whole Neolithic hamlet where several main features have been found -houses, storage pits, ditches, furnaces, -.

SIDGEIPA is being developed to fulfill the needs of recording such amount of data. In Sidgeipa once a new site is created users need to define Zones, Areas, Sectors and grids -at least one of them- in a hierarchical mode. To date, in Mas D'Is there is one Zone divided in almost 100 sectors of 40 by 40 meters -0.4 acres-, the default excavation unit is 2x2 mts. Only a few of them have been excavated, being sectors 80, 99 and 100 where the SIDGEIPA team have thoroughly tested all potentialities of the different versions –current is SIDGEIPA 1.13–.

In the 2001 field season both the traditional way of recording data and the SIDGEIPA beta version were in use at Mas D'Is. One of the most important archaeological features found at the site two concentric ditches of monumental proportion more than 10 meters width by 4 meters depth and XXXX meters of diameter for the inner and XXXX for the outer dating back to the very first occupation of West Mediterranean inlands by agriculturalist decorating their ceramics with *Cardium* impressions.

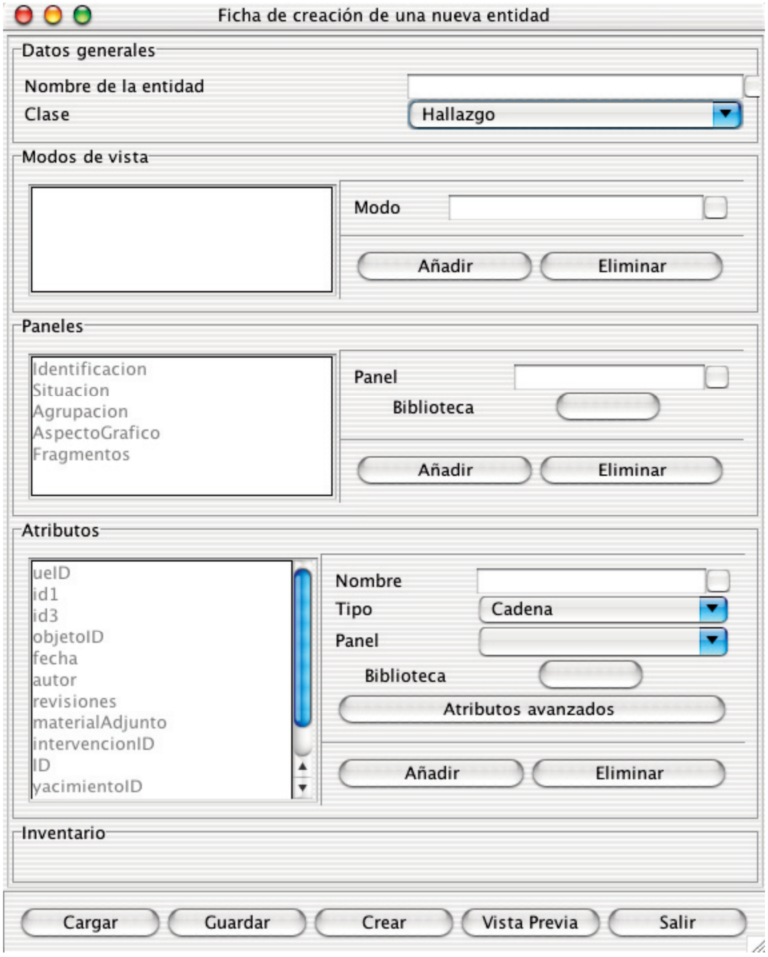

Figure 6 Creating new kinds of artifacts

SIDGEIPA is being used concurrently with a Total Station to do measurements on the field. Usually, we use a Sokkia 4100, the setting up of the equipment was easy because thorough topographical work including several stations had been done at the site. After that, a systematically data recording process was implemented in the field where strict codes (stratigraphical unit, kind of point and the like) were enclosed to each of the measurements. Data from the total station can be download directly to Sidgeipa using the standard SDR file type, or a comma separated values CSV text file containing either three attributes by coordinate (X, Y, Z) or five (Point, Northing, Easting, Z, code).

In order to download data into SIDGEIPA the corresponding Stratigraphic Unit should have been created already. From inside the Stratigraphical Unit form the SDR file defining its volume, or the CSV can be download through selection of defining points. Once this is done we can see its 3D reconstruction launching the modeler (figure 7),.

SIDGEIPA potential was clearly stated when data from the ditches were downloaded into the application. Ditches were detected in several trenches cut at the site; for the first moment SIDGEIPA show that there was a concentric succession of ditches at the site.

Maybe SIDGEIPA potential is more clearly stated when reconstructing the house 1 in the sector 80. The reconstruction of house 1 combining data from the total station, hand drawings from seasons earlier than 2001 and pictures is amazing in his zoom in and navigation features (figure 8).

The best way to see a group of stratigraphical units and features is through the group tab where users can create new groups of features.

In the default view users can create new objects inside of a stratigraphical unit. In this step users can add new findings to a Unit (pottery, lithics, metal and so on). Currently, we have in Mas D'Is more than 9000 pottery pieces catalogued.

Artifacts can be managed in the objects tab and, of course, users can move, delete, copy and paste those elements from

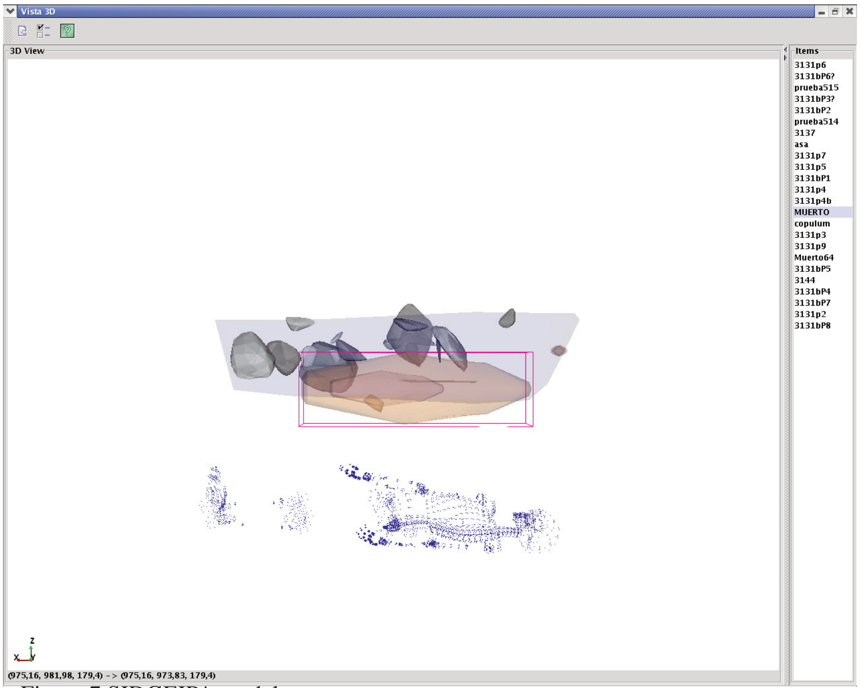

Figure 7 SIDGEIPA modeler

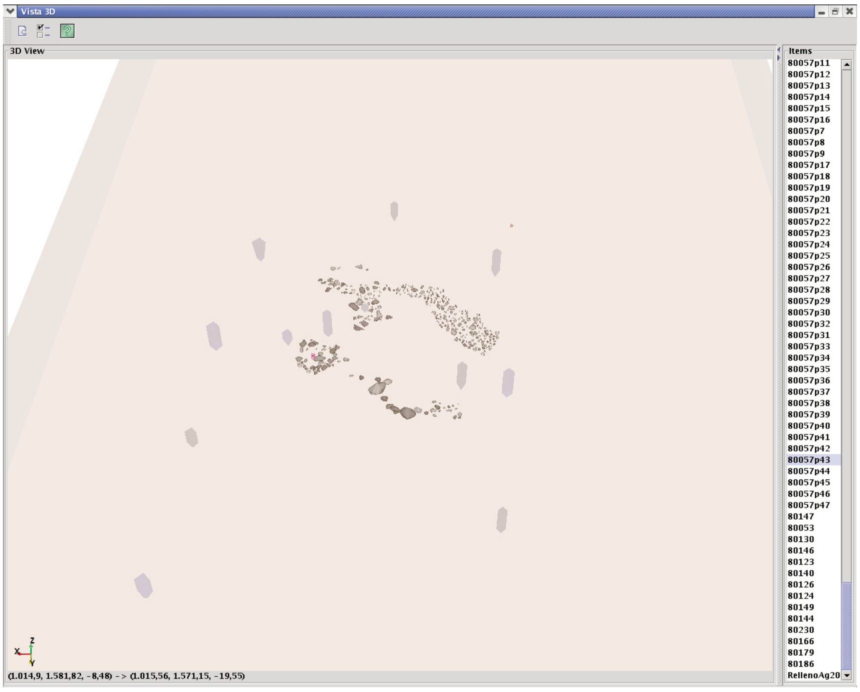

Figure 8 House 1 at Mas D'Is

tag to tag. In the artifact form users can include pictures and drawings of the objects.

6. CONCLUSIONS AND FUTURE WORK

To sum up: SIDGEIPA is a wholly integrated Archaeological Information System. I would to remark some features in Sidgeipa :

Ability to manage from planning to artifact inventories

- It has been developed with open source code software.

- 3D displays and georeferenced of all the data contained in the database.

In the future, the project team has in mind to develop virtual reconstruction of ancient landscape from actual data.

Acknowledgements

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This paper has been possible thanks to the contribution of a good amount of colleagues. I would like to mention specially to Mgdalena Gomez, Carlos Martines, Alberto Niedmyer and Profs. Joan and JM Bernabeu.

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