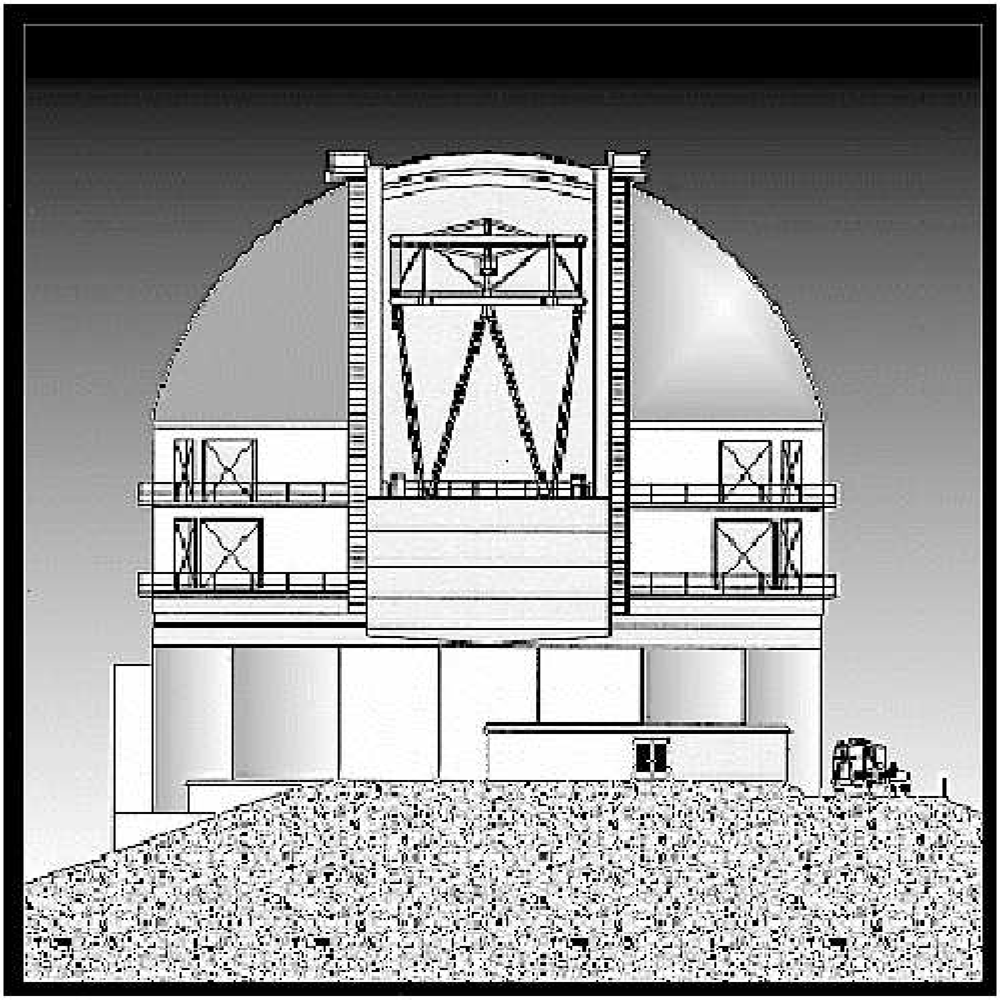
GEMINI
8-M Telescopes Project

RPT-C-G0013

PV-Wave Evaluation



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This report may compare products from different vendors and may contain a specific decision to purchase which may be based on this comparison. The evaluation contained in this report is related only to the specific needs and requirements of Gemini, and should not be construed to apply to the needs and requirements related to any other application.

The contents of this report should in no way be viewed either as an endorsement by Gemini for a particular vendor's product or as Gemini's opinion that other vendor's products are unsuitable for any application.

Gemini makes this report available in the spirit of keeping its user community informed of the background behind its decisions. It urges this community to make decisions based on its own requirements.

1. INTRODUCTION

1.1. Purpose

The purpose of this product evaluation is to decide on the suitability of Precision Visuals, Inc's PV-WAVE data analysis system to the image and signal processing tasks that are expected to be encountered during the design, construction, and operations phases of the GEMINI project.

The primary motivation of examining a commercial package is to have use of a system that enjoys widespread use and has a clearly defined user and technical support infrastructure. This is not intended to be a full replacement for other standard astronomical packages (IRAF,ADAM) but is meant to be a package that should be viewed as the default tool.

1.2. Method

The method used for product evaluation consisted of two distinct phases: installation & overview and study of user requirements. The principal considerations associated with each stage are as follows:

1) Installation and Overview

Ease of installation, general sense as to what the product can be used for.

2) Study of User Requirements

Product capability as it relates to the particular tasks at hand.

1.3. Products Tested

- PV-WAVE CL Version 4.000 (Open Look)
- PV-WAVE Point & Click Version 1.610 (Open Look)

1.4. Pricing

Pricing for each floating license (includes 90 days of Software Update Subscription Service (SUSS)):

	FULL	**GSA (no educational discount available)**
CL	4,500.00	3,320.00
P&C	2,495.00	1,660.00
Subtotal		4,980.00
1 Year SUSS for CL		680.00
1 Year SUSS for P&C		425.00
Total		6,085.00

1.5. Testing Environment

- SUN SPARCstation 2
- SunOS Release 4.1.2
- OpenWindows Version 3

2. TESTING

2.1. Installation And Overview

Installation of the PV-WAVE CL (Command Line) package was straightforward and presented no difficulties.

Installation of the PV-WAVE P&C (Point and Click) package had one minor hitch in that the GRIDDER process expected to dynamically link with the FORTRAN object library `libF77.so` which also had to have its location pointed to by the `setenv` variable `LD_LIBRARY_PATH`.

2.1.1. Caveats

The capabilities of both products seemed quite comprehensive with the following caveats:

1) The graphics model does not easily accommodate the concept of overlays. The principal techniques used are to redraw the entire image and the overlays at every change or to draw the overlay lines using XORs on the original image. The drawbacks are that of speed on the former and no choice of colors plus only one distinct overlay with the latter.
2) The cursor is implemented using the standard SUN cursor - limited to a 32 by 32 bitmap.
3) The P&C macro library, primarily used for recording sequences, does not easily allow use of a wait-for-event kind of statement. It does implement a pause statement. which waits for user response.
4) There are no predefined 2-D Gaussian fit routines.

2.1.2. Features

Some of the features of the products are:

1) Extensive signal processing and display library.
2) Extensive image processing and display library.
3) ASCII, PostScript and HPGL output to disk or printer.
4) Multiple interconnection paths with user systems:
    a) PV-Wave can call user written C routines.
    b) User programs can invoke PV-Wave products
    c) PV-Wave and user code can communicate via Remote Procedure Calls (RPCs).
5) PV-Wave CL supports creation of GUI objects via a Widget toolbox for either OpenLook or MOTIF.
6) PV-Wave P&C supports customization of command sequences and can invoke CL program statements.

2.2. Study of User Requirements

The initial scenario envisioned for use of PV-WAVE is the acceptance testing of both CCD imagers and spectroscopic instruments. A survey of the Instrumentation Group resulted in creation of distinct tests for each type of device.

2.2.1. Imagers

1) Bad Pixel Detection
Tools: Standard Image Processing and Display packages includes data subsetting by value as well as location.

2) Encircled Energy Profiles on Point Sources
Tools: Sub-image definition.
Row and column profiles.
1_D gaussian fit.
First and Second order Bessels.
FFT

3) Flat Field Calibrations
Tools: See 1.

4) Geometric Distortions (Optics)
Tools: 2-D Wrap.

2.2.2. Spectrographs

1) Cross-correlation between spectra - repeatability tests
Tools: Correlation function.

2) Linearization of wavelength axis aided by iterative line identification
Tools: User selection of target lines.
Polynomial fit between target line positions and references.
Correction of wavelength axis.

3) Isolation of groups of a few (less than four) lines and subsequent fitting of Gaussians
Tools: Baseline identification and subtraction.
Line area isolation.
1-D Gaussian with fit of background to 2nd order polynomial

2.3. Additional Study of User Requirements

Discussions with the Enclosure Group revealed an additional use for PV-WAVE system.

2.3.1. Analysis of Temperature Sensor Data

1) 3-D Display of temperature versus date and time.
Tools: Gridding of irregularly spaced data (in this case in date and time) to produce regular 2_ D array.

2) Typical daily temperature profile.
Tools: Projection (sum) onto an axis.

3) Modeling of short term temperature variations.
Tools: Sub-image isolation.
Profiles.
FFT.
Polynomial curve fitting.

2.4. User Requirements

2.4.1. Prospective Users

Enclosure Group:	Robert Ford
Instrumentation Group:	Bill Weller, Stephen Pompea
Optics Group:	Myung Cho, Eugene Huang, John Roberts

2.4.2. Enclosure Group Requirements

1) Ability to select data based on values of two different independent variables (in this case date and time).
2) Standard 1-D analysis.

All of the above requirements were met by PV-WAVE.

2.4.3. Instrumentation Group Requirements

1) Standard image and signal analysis.
2) Correlations.
3) Knowledge of spectral lines and automatic routines for recursive line identifications and linearization.

The first two requirements were met by PV-WAVE's standard library.

The third requirement is not immediately met, but the CL system is flexible enough to permit the use of user written CL scripts or C language routines to be added to the system. See section 2 1 2

2.4.4. Optics Group Requirements

1) Standard image analysis.
2) Presentation quality output graphics (PostScript or HPGL).
3) Mathematics functions (BESSEL, etc.).
4) Ability to interface to user written F77 code.

All of the requirements except for the fourth were easily met by the standard library and functions of PV-WAVE.

As of the current release (4.01A) PV-WAVE can interact with user written C or FORTRAN code.

3. CONCLUSIONS

Given the wide range of features available with the PV-Wave products and the feedback gathered during

4. RECOMMENDATIONS

It is recommended that the Gemini project purchase one floating license of PV-WAVE CL (command language) for use in the Tucson office as the product has extensive performance for a low-to-moderate pricing structure.