THE DESIGN OF VAMP SOFTWARE FOR THE MEASUREMENT AND REDUCTION OF STELLAR SPECTROGRAMS

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We present an outline of the software development for the Utrecht VAMP microdensitometer to complement the hardware description given by Heintze et al.
The VAMP software is divided into two quite different categories:
1. - the control programs for the on-line PDP8 that drive the VAMP to trace plates along prescribed paths;
2. - the off-line reduction programs that convert the measured densities on the spectrograms into astrophysical information.

The present control programs, supplied by the VAMP's manufacturers, form an excellent general-purpose operating system that enables the user to program the motion of the measuring spot over the spectrogram incrementally, using smallest addressable steps in the X- and Y-directions of 1 µm.
The pattern of the spot's movement relative to the plate is generated in incremental plotter fashion as a series of line segments between specified co-ordinate pairs.
The specification of these endpoints is obtained either manually with a "mark" button that dumps the location of the spot on a papertape, or automatically by the computer.
Usually they are defined by the operator using a joystick control to move the spot while observing through the viewer. A straight line will be generated between each two co-ordinate pairs in smallest steps of 0.5 µm in X-axis (plateholder) and Y-axis (spot); the operator specifies with buttons and a teletype whether he wants the VAMP to scan or to skip along that line, as well as scanning mode, resolution and density range. A measurement pattern consists of all line segments that together define all necessary scans through a complete spectrogram. The pattern is punched on papertape during its definition; in the subsequent measurement phase the

de Jager/Nieuwenhuijzen (eds.), Image Processing Techniques in Astronomy. 311-314.

control program reads and executes the whole pattern automatically, transferring the measured densities to magnetic tape.
Of the two possible scanning modes the stepping mode is the more precise since in the "on-the-fly" mode the plate moves appreciably during the sampling process. The advantage of scanning on-the-fly is the higher sampling rate of 100 samples/s, which is about four times faster than in the stepping mode.
This operating system works beautifully for any type of plate or problem: however, we have decided to extend it to a system that is designed exclusively for the tracing of large numbers of standard coudé spectrograms. Its purpose is to minimise operator tasks, both at the machine and in the off-line reduction phase, to produce a larger throughput of plates and to achieve complete standardization of scanning patterns as well as output formats. Also, this control program will not only write the measured positions and densities on the magnetic tape but also all the information needed for subsequent calibrations, e.g. the transmissions of step wedges and the wavelengths of comparison lines. The tape can then control the calibration programs on its own. This automation results in high reliability of the whole procedure that converts plates into digital intensity-against-wavelength data.
The way in which this special-purpose operating system will work can best be demonstrated from a simplified example of the setting-up procedure:
After clamping a spectrogram to the plateholder, the operator skips the time-consuming process of aligning the dispersion direction with the plateholder's X-motion direction.
Instead he dumps two positions that together define the dispersion direction. Subsequently he defines with a minimum of dumped points, and in answer to typed requests, the length of the scans, the positions of the comparison arc spectra, of the intensity calibration spectra and of the "clear plate" lanes that must be scanned. The control program then generates parallel and aligned scans through all these spectra, using on-the-fly sampling where possible. In these on-the-fly scans the spot is kept on the non-aligned spectrum by intermittent 0.5 μm steps of the Y-axis. Also, off-line software routines correct the positional shifts caused by this mode. In this manner the position addressing of the VAMP is exploited to generate non-aligned scans while sampling on-the-fly. The comparison arc spectra are scanned in "zip" mode by measuring only selected lines and zipping fast in between. For this purpose the astronomer has to supply a list of the wavelengths of the calibration lines to be used. Their relative positions are determined and checked on the first plate of a batch of similar spectrograms in an interactive process.
Also, the control program tells the operator when and how to change slit orientation and width, for instance at the start of transverse scans through the intensity calibration spectra.
Finally, there are many options such as scanning double Zeeman