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VOTables in TERAPIX software

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Abstract. The management of metadata is one of the critical tasks a data processing pipeline must also perform. VOTables represent a convenient and powerful standard to exchange metadata between the data-processing modules and the pipeline control software. We show how one can benefit from the VOTable output offered by the latest versions of SExtractor, SCAmP and SWarp (three packages of the TERAPIX software suite) in a pipeline environment.

1. Introduction

The TERAPIX center located at Institut d'Astrophysique de Paris (France) specializes in processing Terabytes of wide-field image data. The three main reduction tasks carried out presently at TERAPIX are source extraction, astrometric/photometric calibrations, and image stacking. These three tasks are performed by the SExtractor, SCAmP, and SWarp software modules, respectively. The FITS format (Wells et al. 1981) was chosen for storing images and catalogs at all stages of the pipeline. Because of their simplicity, FITS files can be written and read rapidly; large FITS arrays may even be mapped directly in memory. Unfortunately, FITS headers lack flexibility, and are particularly inefficient for the transport of metadata.

2. VOTables

VOTables were adopted in the context of the Virtual Observatory as a new streamable, self-descriptive data interchange format constructed with XML (Ochsenbein et al. 2000). The VOTable structure chosen for the TERAPIX tools consists of a main resource which may contain optional links to the main data or a catalog table. In the main resource a secondary "MetaData" resource is included, with several tables containing global statistical information. Processing errors and warning are automatically trapped by the software; they have their own table at this resource level. Finally, a third "Config" resource listing the configuration parameters is included as part of the metadata (Fig. 1).

Figure 1. Organization of metadata in TERAPIX VOTables.

3. Interoperability

VOTables produced by the TERAPIX tools can readily be read by popular VO tools like TopCat (Taylor 2005) (Fig. 2).

XSLT (eXtensible Stylesheet Language Transformations) offers a powerful mean to manipulate XML files. The XSLT engine available in modern web browsers can be put to contribution to generate "pretty" and comprehensive diagnostic pages at the end of a processing run without additional software on the client or server side (Fig. 3). Compared to "regular" XML, for which each field value can be identified with an arbitrary tag, the storage strategy of VOTable arrays makes it more difficult to access specific data with XSLT. One possibility is to index the requested field prior to parsing the data array using

```
<xsl:variable name="myindex"
 select="count(FIELD[@name='MyField']/preceding-sibling::FIELD)+1" />
```

The data can be accessed rapidly using simply

```
<xsl:for-each select="DATA/TABLEDATA">
 <xsl:for-each select="TR">
  <xsl:value-of select="TD[$myindex]" />
 </xsl:for-each>
</xsl:for-each>
```

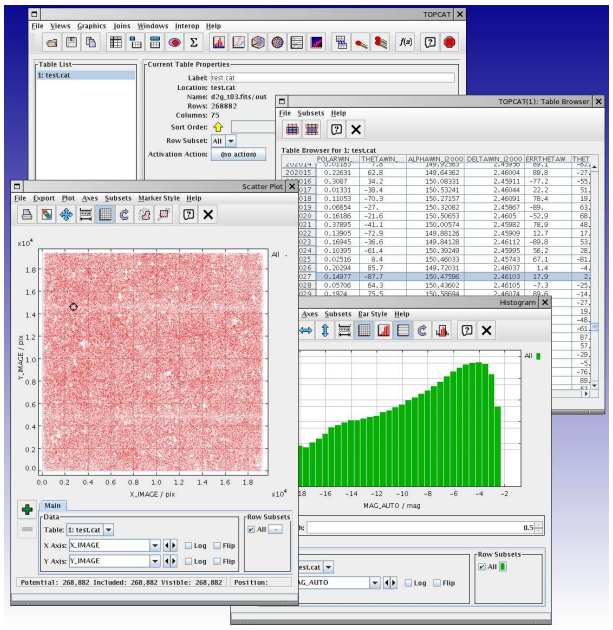

Figure 2. TopCat display of a SExtractor catalog in VOTable format.

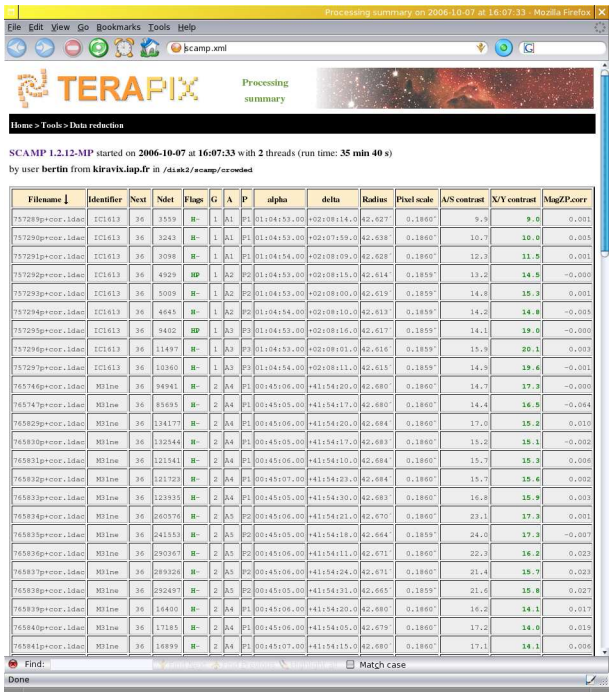

Figure 3. Example of an XSL transformation sheet applied to SCAmP metadata and displayed with the Firefox web browser.

4. The future

The present version of SCAMP is delivered with a fairly simple XSLT sheet. More sophisticated stylesheets should be released for all TERAPIX modules in the coming future. (external contributions are welcome!). VOTables in TERAPIX software are currently restricted to the output. Future versions will read VOTables as configuration files, simplifying even further their inclusion in VO-compliant tools such as the EFIGI[1] web-service (Baillard et al. 2006).

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References

Baillard A., Bertin E., Mellier Y., McCracken H.J., Géraud T., Pelló R., Leborgne J.-F., Fouqué P., 2006, in ASP Conf. Ser., Vol. 351, ADASS XV, ed. C. Gabriel, C. Arviset, D. Ponz, & S. Enrique (San Francisco: ASP), 236

Ochsenbein F., Albrecht M., Brighton A., Fernique P., Guillaume D., Hanisch R., Shaya E., Wicenec A., 2000, in ASP Conf. Ser., Vol. 216, ADASS IX, ed. N. Manset, C. Veillet, & D. Crabtree (San Francisco: ASP), 83

Taylor M.B., 2005, in ASP Conf. Ser., Vol. 347, ADASS XIV, ed. P. Shopbell, M. Britton, & R. Ebert (San Francisco: ASP), 29

Wells D.C., Greisen E.W., Harten R.H., 1981, A&AS44, 363

[1] `http://www.efigi.org`