ENGINEERING DATA FILE PROCESSING AND DISTRIBUTION

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Abstract

Engineering data files (EDF) were proposed by the ILRS working group "Networks and Engineering" as an additional tool to the orbital analysis to deal with the SLR station long-term stability issues by maintaining the history of local station parameters like calibration related values, meteorological data, ranging system data and checking out for the anomalies, comparing data among the SLR stations and exchange these data within SLR community. This paper discusses different ways how to work with EDF files at the station and eventual data distribution procedures within the SLR community and implementation details as well.

Introduction

Original idea for the EDF was developed within the Networks and Engineering Working Group (NEWG) during the meeting in Nice (1) and refined further in the ILRS technical workshop (2). EDF are intended to help orbital analysis to detect station range biases and hardware anomalies by maintaining history of its vital parameters and comparing similar equipments' performance across the tracking network. XML based EDF format was developed to handle requirements for the data exchange and flexibility, including possible future extensions and additional station custom information (3). The main goals for the EDF are following:

- Inter-comparison among parameters of different SLR stations
- Rapid identification of system drifts or degradation effects
- Correlation of system data with bias reports based on orbital analysis
- Easy implementation
- Flexibility

EDF are supposed to be created for each station calibration run and contain information about calibration, meteorological data, hardware description and optional parameters, including station specific parameters. Using EDF data the time series for the station hardware parameters like calibration values, RMS etc. can be built and compared with the other stations, checked for the anomalies (jumps, drifts).

EDF Generation

EDF creation should be treated as an additional station data product like normal points, time biases etc. Each time when the station calibration is done, the corresponding EDF should be created. Information saved in the EDF can be divided in the three groups: mandatory, optional parameters and station custom data. The currently defined EDF content overview is summarized in Table 1, for more details, including formal EDF definition with the XML schema and implementation examples, see (3). Actual EDF example from the Graz station is shown in the Appendix A. EDF can be generated either by using native XML support, available now in the most of the modern operating systems and compilers or just as a text files without using any specific XML techniques. The experience of the existing EDF implementations at the SLR stations Graz and Potsdam shows that the EDF generation shouldn't create large problems at the station, but in some cases there may be a necessity to improve or adjust the internal data handling when required data for the EDF are scattered across different files and computers.

Table 1. EDF elements

Item	Required data	Optional data
EDF epoch	Calibration epoch	
Station data	Name, SOD, System change indicator (SCH), System Configuration Index (SCI), calibration method, timescale used (Name is just a name of the station, all other parameter values are defined by the ILRS)	
Laser	Wavelength (nm), pulse width (ps) , energy (mJ)	Repetition rate (Hz), number of semi train tracks, divergence (mrad)
Signal detector	Detector model, type	Device ID (here and further: unique number/name like serial number to distinguish devices in cases when multiple same model items are available)
Filter	Filter model, bandwidth (nm)	Device ID, filter transmission (%)
Timer	Timer model	Device ID
Meteo data	Temperature (Celsius), pressure (mbar=hPa), humidity (%)	Temperature (Celsius), pressure (mbar=hPa), humidity (%) from alternative (backup) source
Calibration	2-way value (ps) , RMS (ps), 1-way target distance (m)	Skew, kurtosis, sigma criteria used, peak minus mean, recorded points, accepted points, return rate
Custom data	Each station can add their own data here	

EDF distribution and processing

EDF can be exchanged directly among the SLR stations or uploaded to the data centers, where they and results of its processing are available to all community. While the flexibility of XML format allows to write software which can be shared and used at the stations across the SLR network, there are still problems with the different operating systems and the program update management to name a few. To avoid these issues the preferred approach at the beginning would be to perform common analysis and checks at the server, where the results will be immediately available online. The benefit for the server based approach is that any change, introduced in the processing software, will be immediately available to all users. Stations can write additional programs to perform their own or alternative checks with their data when appropriate either before formatting EDF or using EDF as a basis of the station parameter database. Server based processing will allow to build a used equipment database using EDF as an information source, to overview the system parameter history over the time, see (Figure 1) or as numerical data and to compare the performance of similar devices and systems. To achieve it some kind of hardware registry with the commonly used equipment like event timers, discriminators etc. is needed.Users will be able to access the system through the WWW. There is also a possibility to build a web services for the EDF database which will allow to use EDF data in other applications which may require access to the station data.

Conclusions

The first experience with the EDF shows that while there may be a necessity in some cases to rearrange station internal data handling and to modify existing programs, the EDF generation and upload implementation at the station shouldn't create large problems and can be done within 1-2 days. The EDF data will be collected and made accessible to the SLR community at the data center. The preferred way to process EDF at the beginning will be a server based processing, which will allow to acess the results online using WWW, but stations can do their own data checks either based on the EDF usage or not.

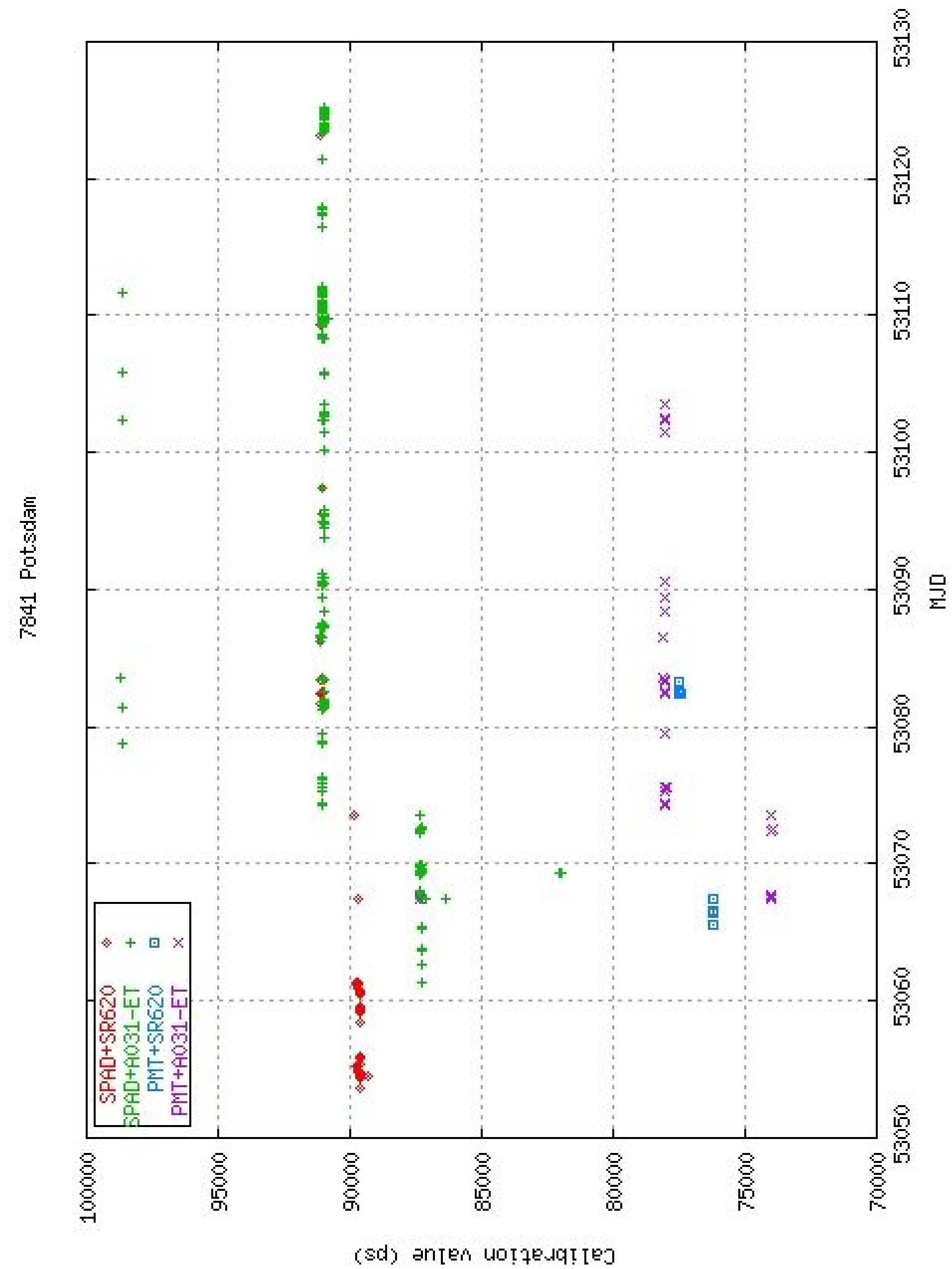

Figure 1 7841 calibration history

References

1. Agenda Items for NEWG Meeting, http://cddisa.gsfc.nasa.gov/ilrs/working_groups/networks_and_engineering/networks_activities/nice_2003_agenda.html , 2003.
2. ILRS Technical Workshop, Koetzing, Germany, http://ilrs.gsfc.nasa.gov/reports/ilrs_reports/oct_2003_technical_workshop.html , 2003.
3. SLR Engineering Data Files, http://www.astr.lu.lv/EDF , 2004.

Appendix A.


```
<EDF Version="1.0"  MJD="53275.7083796296"  Epoch="2004-09-27T17:00:04"
   xmlns:Graz="http://www.astr.lu.lv/Graz">
 <Station  SOD="78393402"
   SCH="0"  SCI="1"  CalibMethod="0"  TimeScale="3"  Name="Graz" />
 <Hardware>
   <Laser  Wavelength="532.0"  Energy="0.0004"
     PulseWidth="10"  Divergence="0.000050"  RepRate="2000" />
   <Receiver>
     <Detector  Model="C-SPAD"  DeviceID="1"
       DetectorType="SPAD"  TWCompensation="Yes" />
     <Filter  Model="Andover 003FC10-25"
       DeviceID="20010705"  BandWidth="0.3" />
   </Receiver>
   <Timer  Model="Graz_ET"  DeviceID="Module 1+2"  CorrectionID="0" />
 </Hardware>
 <Meteo Temperature=" 13.2" Pressure="962.8" Humidity="58.8"
    Graz:InternalTemperature="24.4" Graz:InternalHumidity="33.8"/>
 <Calibration TargetDistance="1.742" CalValue="129700" PeakMinusMean="   0"
   RecordedPoints="10000" AcceptedPoints=" 8741" SigmaUsed="2.2" RMS=" 15"
   Skew=" 0.000" Kurtosis="2.343"
   Graz:ReturnQuote=" 55.0" Graz:RawCalValue="141326"/>
 <CustomData></CustomData>
</EDF>
```


Text 1 EDF example. Data items with the prefix "Graz:" marks station specific data.