CPF & CRD v2 Implementation

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The University of Texas at Austin

CPF v2 Implementation Status

- There is at least one prediction provider distributing daily v2 predictions for each satellite. Only one regular provider (MCC) has not converted. (Their only products are LARETS predictions, which are also provided by DGFI, NSGF, and Peraton (.hts).)
- So far about 15 stations are verified to be using CPF v2 files, and there are probably more.
- On Oct 1, 2021, predictions providers will be allowed to cease producing CPF v1 files. **This date is firm.**

CRD v2 Implementation Status – Work Thus Far

- The OCs and Data Centers have been accepting and distributing CRD v2 files for about 20 months. They vet the contents of the normal point and full rate data for compliance with the format
- To help stations develop and test their CRD v2 files, a tool is available on the EDC website to test the content of CRD files, i.e., format and range of variable fields.
- Van Husson and others are checking the contents of the files for more subtle compliance issues (e.g., is the value really always -1, or should it be “na”; why is this field’s value always 3?)

CRD v2 Implementation Status – Vetting Orbit Residuals

- Stations must provide CRD v1 and v2 files in parallel until files from all the stations are vetted
- The ASC will vet the stations' normal points in batches of 10 or more stations at a time
- There are currently 9 stations that are providing CRD v2 files. Some include too few LAGEOS, LARES, and ETALON passes to allow validation, leaving only 5 or 6 stations that meet ASC testing criteria
- Six to eight more stations are expected to provide CRD v2 data within the next couple of months.

CRD v2 Implementation Status – More on Vetting Orbit Residuals

- Stations will need to provide adequate data in CRD v1 & v2 format for a meaningful comparison of results, especially the agreement of residuals
  - Satellites preferred are LAGEOS I & II, LARES, ETALON I & II, although Starlette, Stella, and Ajisai will be used if there are too few of the others
  - The criteria is a minimum of 4 consecutive weeks of date – more is preferred and will be used if available
- The goal is to complete the conversion effort by the **end of 2021,** though that may be optimistic.

Latest developments in timing technology and future plans

ILRS NESC **Thursday 24th June at 1300UT**

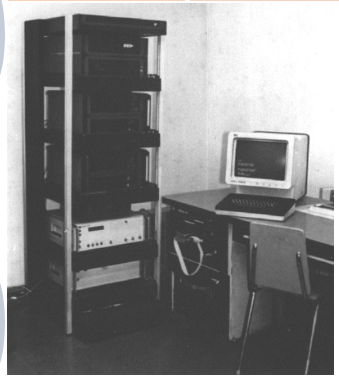
About Eventech

- A “spin-off” from Institute of Electronics and Computer Science (IECS);
- Expand markets and use cases of timing technology;
- Research and develop new timing techniques and it’s use cases.

ELEKTRONIKAS UN DATORZINĀTNU INSTITŪTS
INSTITUTE OF ELECTRONICS AND COMPUTER SCIENCE

Brief history of event timer technology

50ps | 30ps | … | 20ps | <10ps | <10ps | <8ps | … | <3ps | <3ps | … | <1ps?



PICAP

A010 family

A032-ET

A033-ET USB

NEW Event timer generation

1983 | 1991 | … | 2002 | 2003 | 2004 | 2005 | … | 2010 | 2011 | … | 2022

COMTIS

A031-ET

A033-ET

Into the SPACE

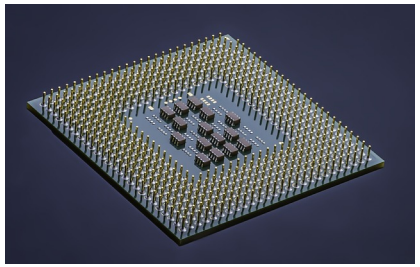
European Space Agency
Agence spatiale européenne

MPET project | **CTUMB project** | **LSTM and SPATILIDAS projects**

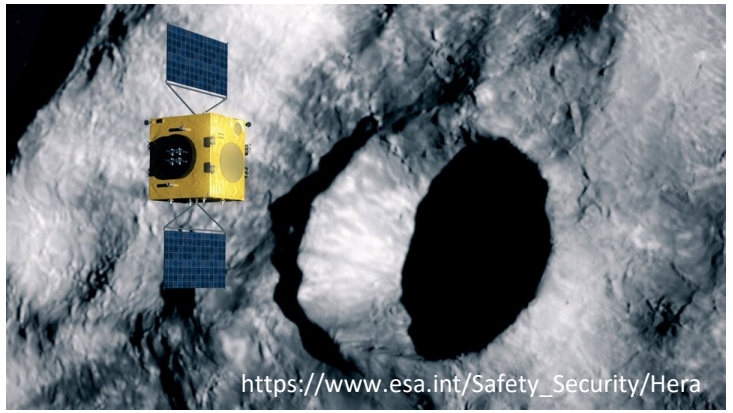
2016 → 2017 → 2018 → 2019 → 2020 → 2021

Multi-Purpose Event Timer

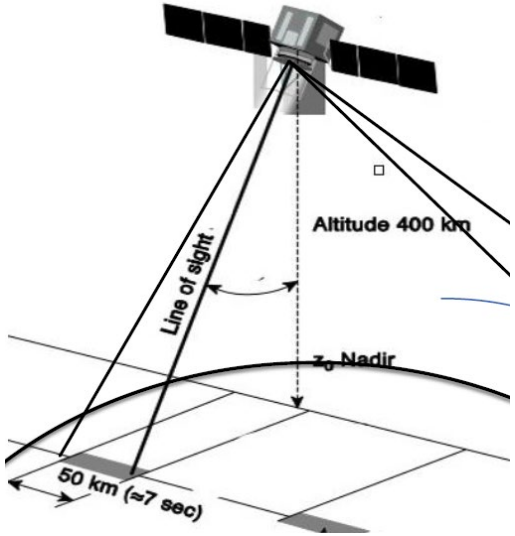
Custom ASIC chip



ESA's planetary defense mission



Correlation Wind Lidars



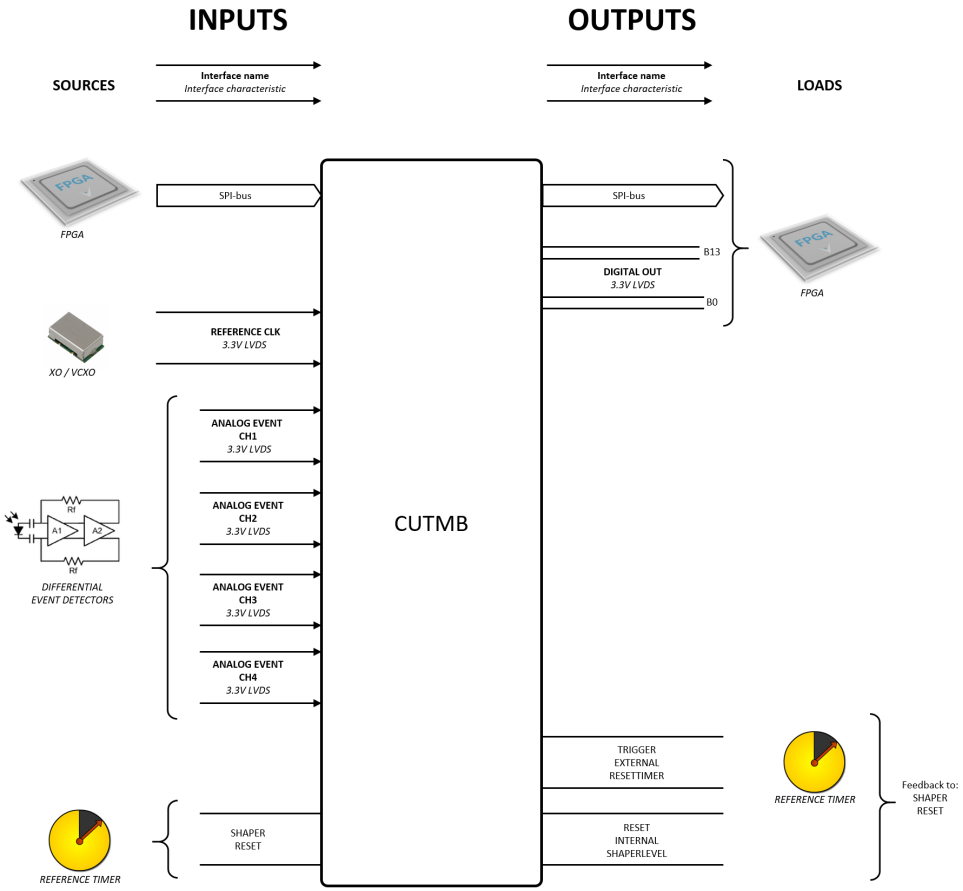
CUTMB - Compact Universal Time Measurement Block

The goals:

- embedding the event timing into ASIC
- reach small size and low power consumption

The result:

- Complete roadmap to Application Specific Integrated Circuit development and it costs



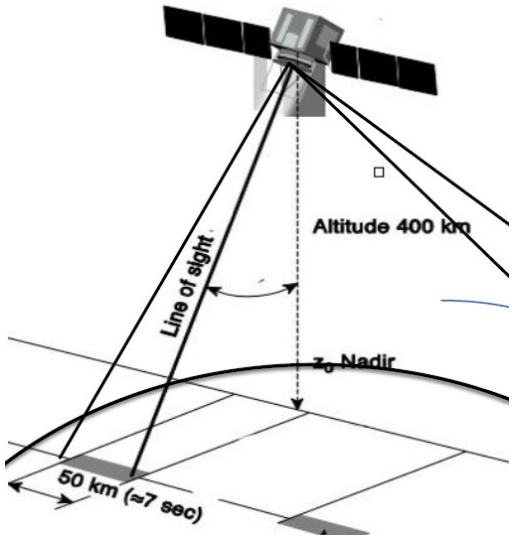
SPATILIDAS - SPace TImer for LIDars and Autocorrelation Sensors

The goals:

- Lidar systems which is less complex
- space qualify (in future)
- reduced system resources thanks to intelligent and integrated processing

The result:

- First prototype of Eventech Photon Counter
- Follow-up project to integrate data processing for wind data retrieval



LSTM - LIDAR and altimetry Specialized Timing Module

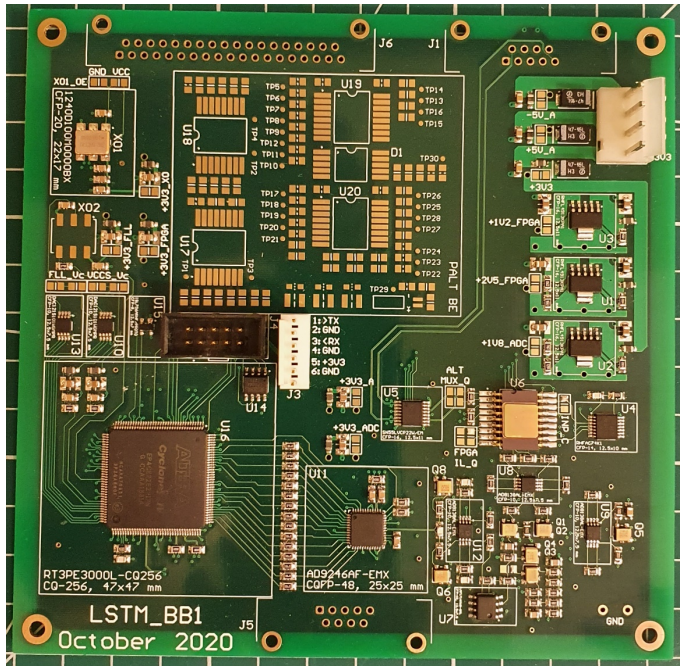
The goals:

- Develop timer Engineering Model (EM);

The result:

- Developed timer breadboard for Planetary Altimeter;
- The EM with space components is currently in production;
- The follow-up project to develop Flight Model.

https://www.heramission.space



Back to Earth

NACIONĀLAIS ATTĪSTĪBAS PLĀNS 2020

EIROPAS SAVIENĪBA
Eiropas Reģionālās attīstības fonds

IEGULDĪJUMS TAVĀ NĀKOTNĒ

Current state of technology

Multi-channel picosecond time tagging system with amplitude measurements

Q4 2023

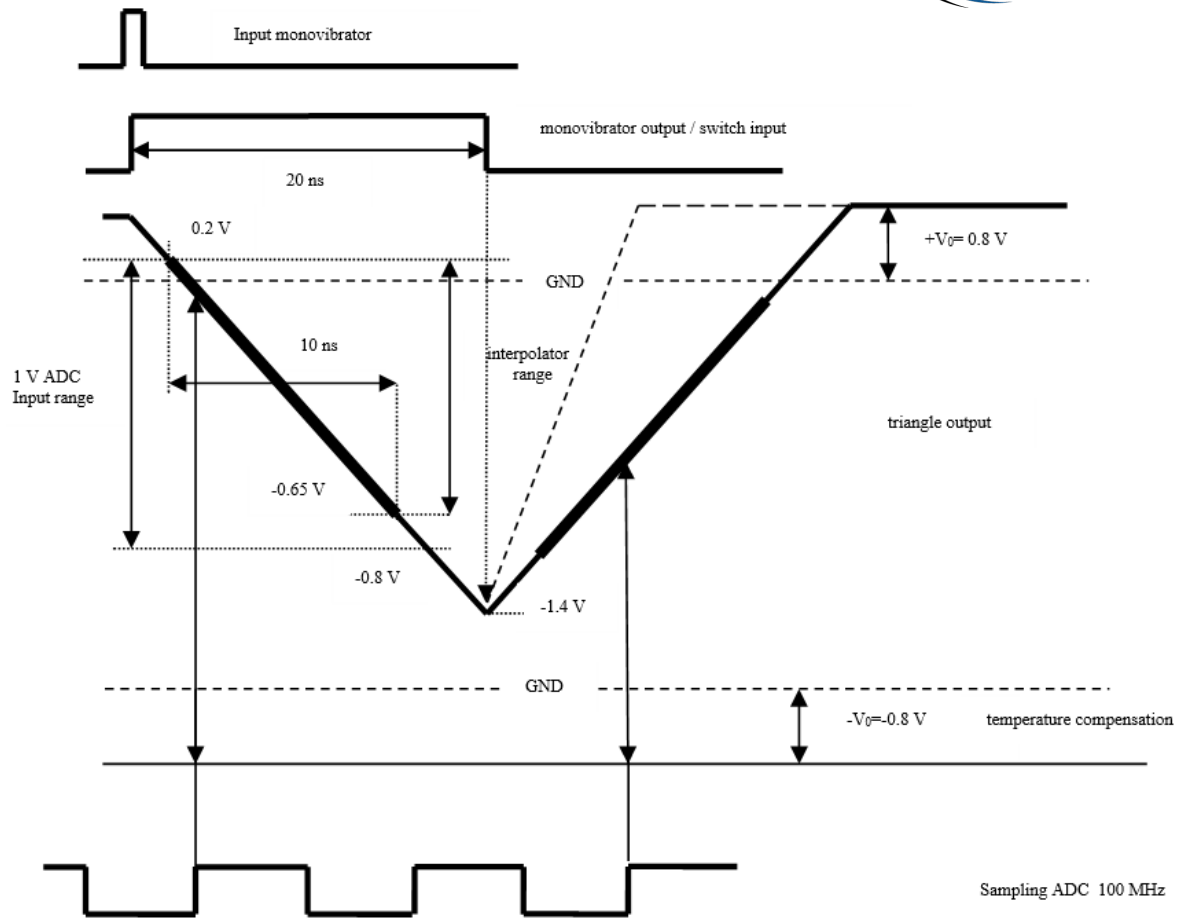
NEW classical two input (start and stop) timer

Q4 2022

Research 80% financed from European Regional Development Fund (ERDF)

The need for new terrestrial timer

- The A033 timer was developed over 10 years ago;
- Some components were discontinued;
- Other components received more advanced analogs;
- The new implementation of timer nodes were developed;



Stages of development

1ST

- New PLL board
- PCB rework and discontinued component replacement
- Input comparator and ADC replacement with more advanced analogs
- New modern FPGA

2ND

- New user software
- USB3 as default
- NIM/TTL automatic switching
- New calibration and gate signal generation

The expected results

1ST

- Improvement on precision

2ND

- increase in productivity up to 20-25 M event/sec
- improvement of the user interface
- possibly an increase in the precision and stability

Thank You!

CONTACTS

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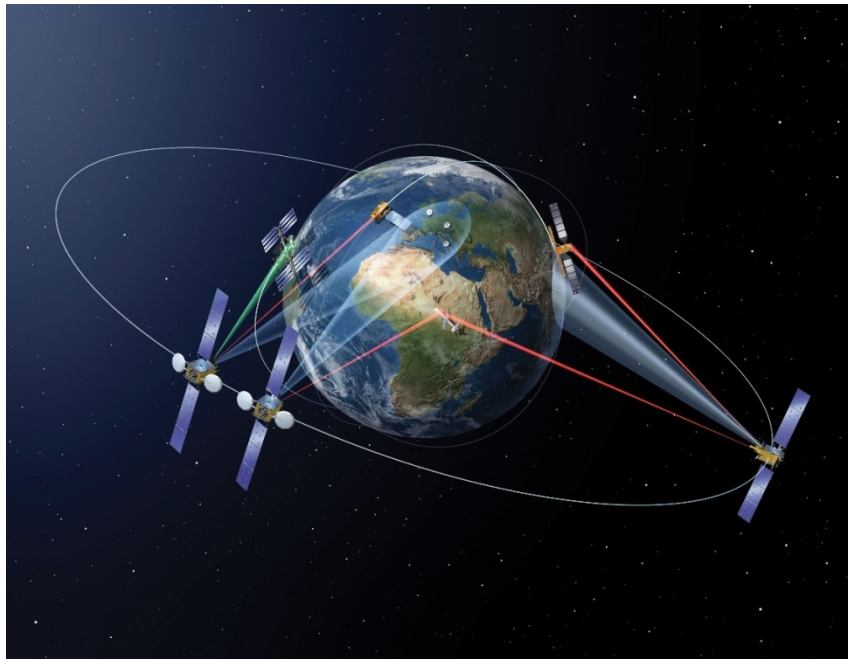
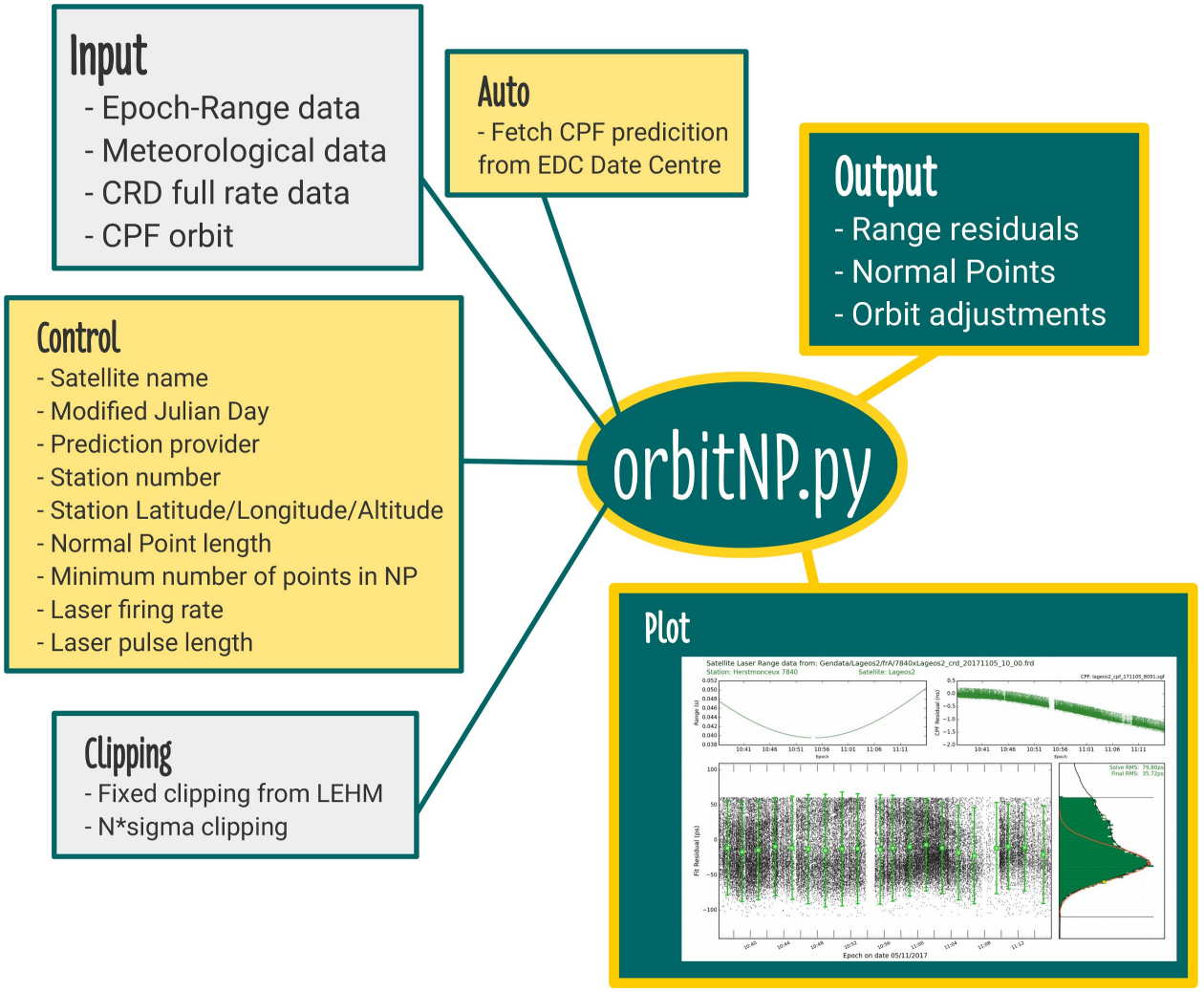


orbitNP.py

– Forthcoming Update

Matthew Wilkinson

OrbitNP.py


Input
- Epoch-Range data
- Meteorological data
- CRD full rate data
- CPF orbit
Auto
- Fetch CPF predicition from EDC Date Centre
Output
- Range residuals
- Normal Points
- Orbit adjustments
Control
- Satellite name
- Modified Julian Day
- Prediction provider
- Station number
- Station Latitude/Longitude/Altitude
- Normal Point length
- Minimum number of points in NP
- Laser firing rate
- Laser pulse length
orbitNP.py
Clipping
- Fixed clipping from LEHM
- N*sigma clipping
Plot

OrbitNP.py 1.1 -updates

Version 1.1

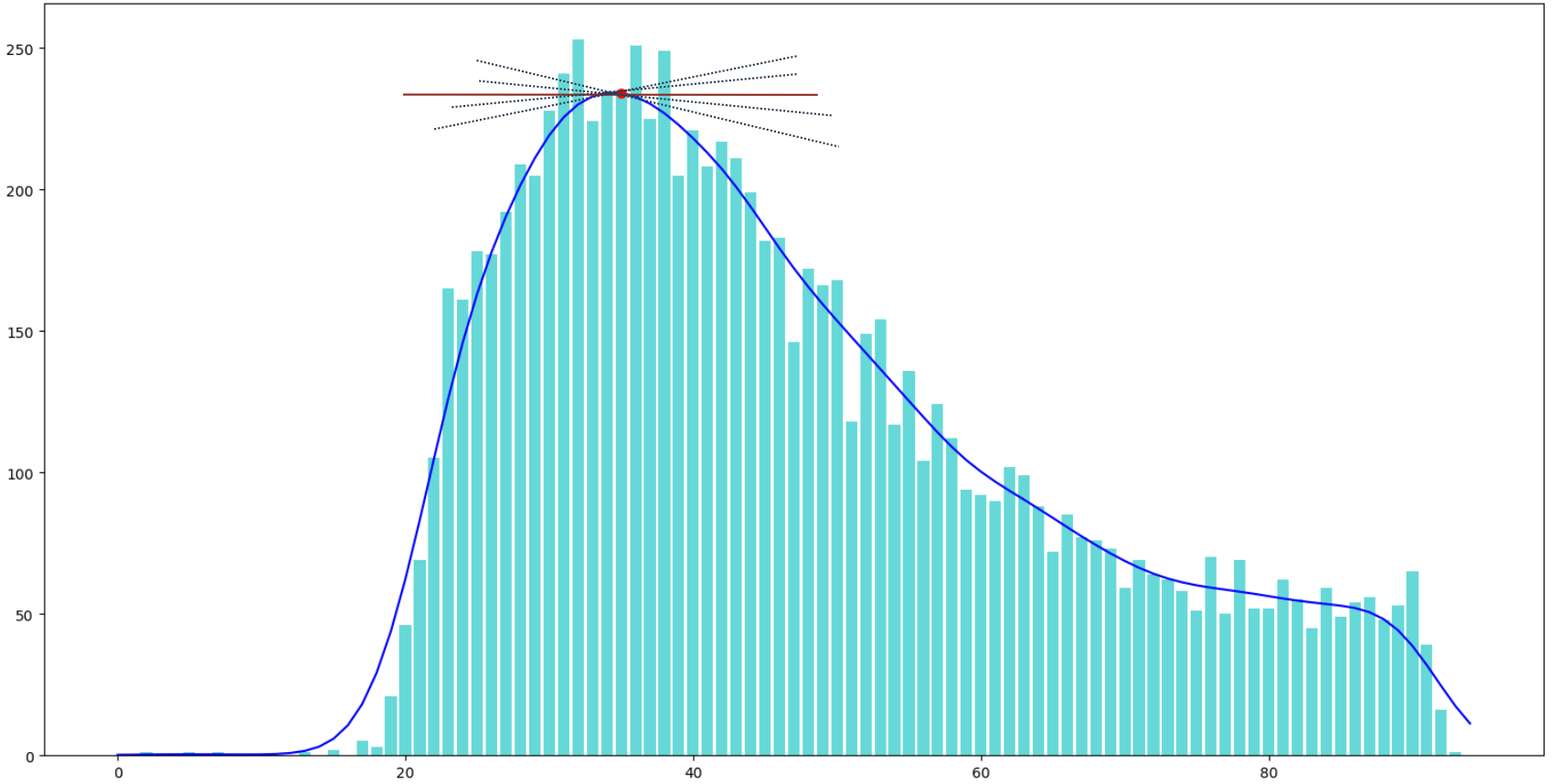
- New method for cal2mjd() and mjd2cal()
- Include option for full CRD normal point output file.
- Calculate a '50' record if not included in full-rate CRD file.
- Include input of 'System Configuration ID'.
- Adjusted method for gauss fit to front of residual distribution.
- Allow for disagreement in first epoch and H4 record.
- Gauss fit filter added.
- Include option to output final ranges in CRD format with met and calibration values.

OrbitNP.py 1.1 -updates

Version 1.1

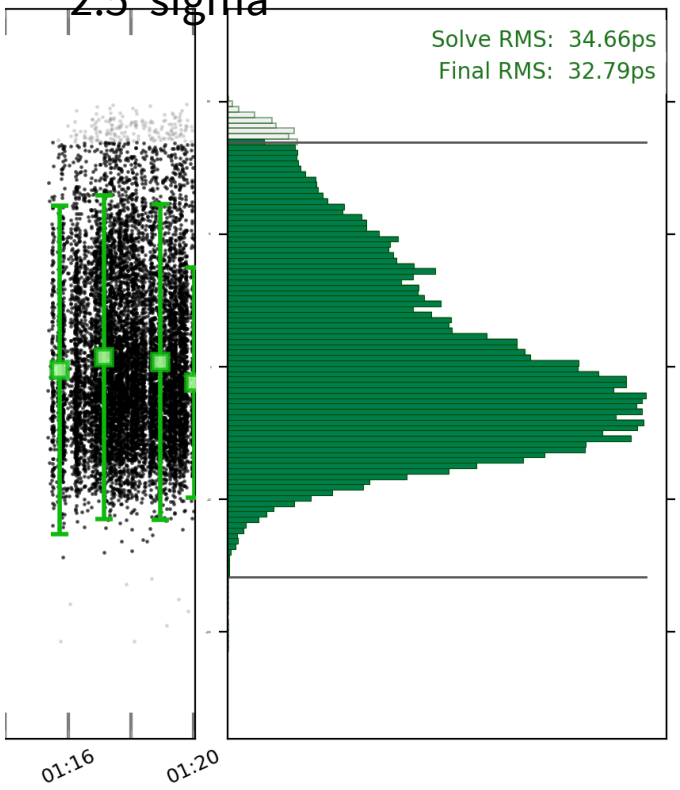
- Include 1st iteration quick-pass option to prevent high density segments dominating pass fit.
- Station coordinates and velocities taken from an ILRS SINEX solution file
- Peak-Mean calculated using a tangent fit to a smoothed profile.
- Filtering at two levels. The first is to form normal points and 2 to include in the full-rate output

Peak-Mean calculated using a tangent fit

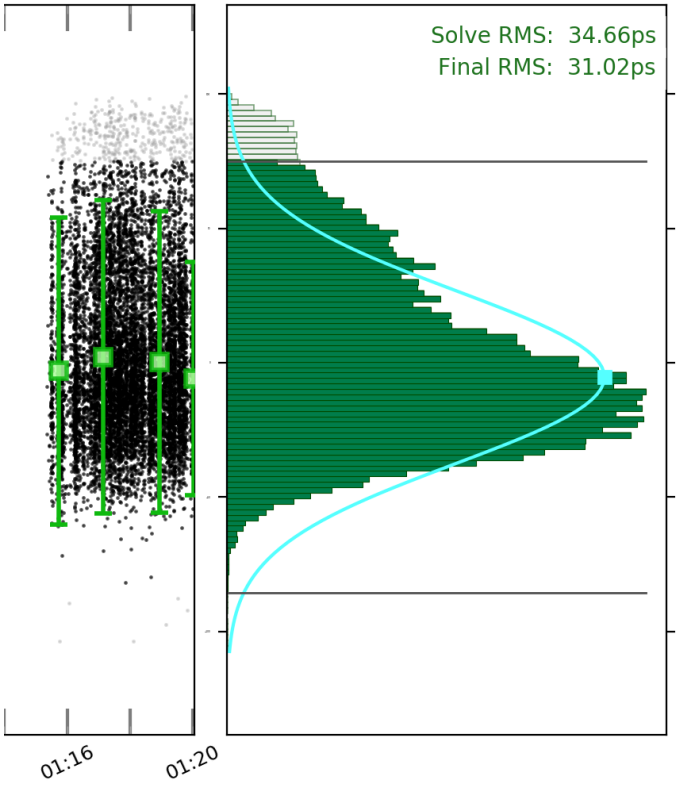


Clipping

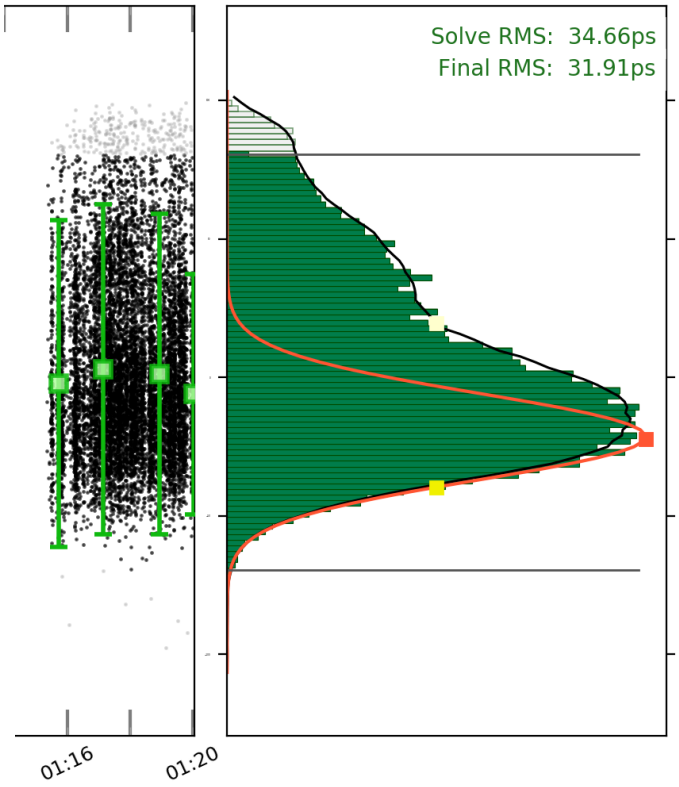
Iterative Mean, 2.5*sigma



Gauss Peak, 2.5*sigma



Fixed clipping from LEHM



2 Level Clipping