

Calibration and processing status

from 2024-09-01 to 2024-11-30

Introduction

The calibration and processing status provides an overview about calibration activities of Pandora instruments related to laboratory calibration and their corresponding analysis. Additionally, the dataset processing progress as part of the calibration process is summarized.

All Pandoras, official PGN and non-official PGN Pandora instruments are taken into account for the calibration status, as it is expected that datasets will be certified at a certain point. However, it has to be mentioned that official datasets are always prioritized, wherefore the processing status focuses on official ones only.

Lab measurements

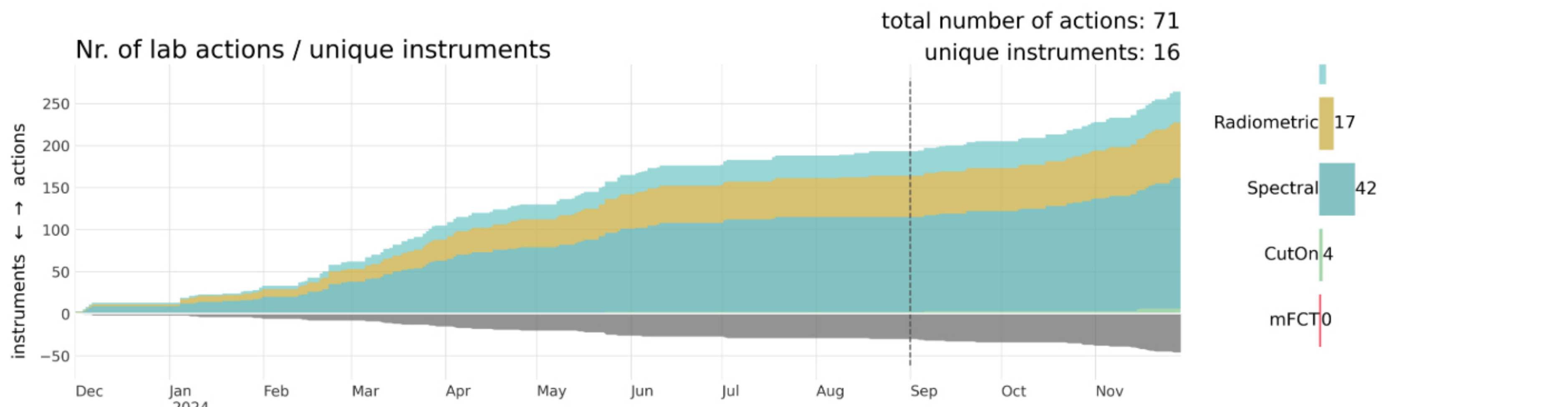


Figure 1

This figure illustrates the number of laboratory actions performed (positive y-axis), and number of unique instruments (negative y-axis) which have got any lab measurements within the shown time period. The color-coding refers to the measurement type:

- **Laser**: laser measurements to determine the straylight characteristics.
- **Spectral**: spectral lamp measurements to determine an instrument's dispersion and slit
- **CutOn**: cut-on filter measurements to refine the analysis of laser measurements
- **Radiometric**: measurements to determine dark properties, non-linearity, pixel response, non-uniformity, filter transmission, and absolute radiometric calibration
- **mFCT**: measurements done with a mobile field calibration tool to obtain filter sensitivities

Note, that not all measurements are necessarily performed on a single day for an instrument. This is mostly caused by stabilizing the system at different temperatures. Additionally, if hardware adjustments have to be applied, certain measurement types have to be repeated.

B Calibration measurements in the laboratory

The first step after assembling an instrument is the initial calibration in a laboratory. Currently, two institutions are doing laboratory measurements of the Pandora spectrometer system:

- **NASA**: operational laboratory calibration of new and upgraded instruments
- **LuftBlick**: focus on European instruments if needed, and research calibrations
- **SciGlob**: calibration measurements until 2021-08-12

Before shipping an instrument after the initial calibration, the measurements are checked by LuftBlick and NASA, respectively. Some of the measurements have to be redone since they are not of the best possible quality. An example would be bad alignment of the calibration lamp or an unstable laboratory setup. Another case, in which laboratory measurements have to be redone, is the situation that an instrument does not work properly during the field testing period and repair work has to be done. Then, a new laboratory session is performed. One full calibration, without unpacking, installing and testing the instrument lasts about 2.5 days. This includes dark signal and wavelength calibration at three different temperatures in order to determine the temperature dependence of these two properties.

C Measurements with the mFCT

In WP 2 of the Pandonia CCN project, a mobile field calibration tool (mFCT) has been developed. The idea is to track changes of the instrument without the need to dismount and ship it to a laboratory. For the following scenarios, measurements with the mFCT will be done:

- After hardware changes and other repair work on the instrument.
- After actions on the instrument like unplugging the fiber or dismounting the instrument, in order to keep track of changes of the spectral response and to update the absolute calibration.
- After a long period of time in order to track changes and degradation of the hardware, e.g. of the filters.

Calibration analysis

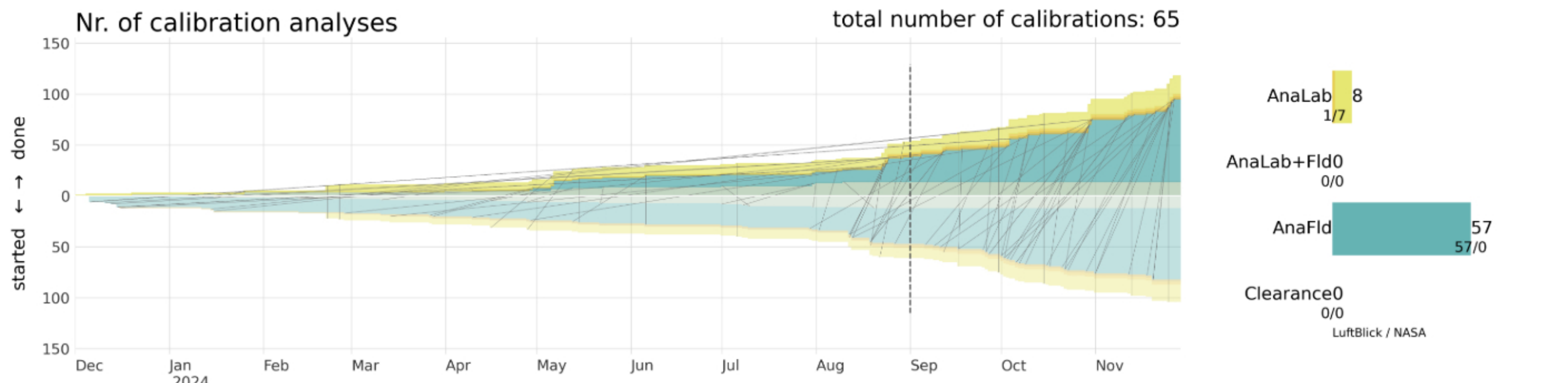


Figure 2

Analysis sessions which have a finished documentation, and which lead to an approved calibration file usable for processing data are taken into account. Figure 1 illustrates the number of produced calibration files (positive y-axis) and when they have been started (negative y-axis).

The brightness refers to the institutions involved:

- **LuftBlick** (dark)
- **NASA** (bright)

The color-coding refers to the analysis type:

- **AnaLab** is the analysis of the measurements taken in the laboratory (details are provided in section B of Figure 2) solely. This category allows to process Out of the Box (OoB) dataproducts, which cover sky data products, or direct sun products which use the literature reference spectra.
- **AnaFid** is a field calibration where solar based L0 data and L1 data are used, for more information we refer to section A. Herein, AnaLab must have been done already by someone else, which means this category results already in a fully usable calibration file to process all official PGN dataproducts. This is typically the case for long-term datatests, where new field calibrations have to be made.
- **AnaLab+Fid** is the combination of the two previously mentioned types, and the very first type as part of a dataset preparation.
- **Clearance** can be seen as type 'AnaLab+Fid'. This analysis type is only done for testing locations to check the initial data quality of an instrument before it is shipped to its final destination. Such datasets are typically very short (less than 15 days), where a proper field calibration is not applicable, and the field calibration is done simply towards a reference dataset.

Furthermore, the figure includes thin gray lines, which are drawn from the starting-date to the done-date for each analysis.

A Field calibration

A crucial part of the calibration procedure for Pandoras is the field calibration. Part of this step is to detect a possible change in the spectral dispersion (wavelength shift). Such changes might appear e.g. during the shipping of the instrument or if the fiber is unplugged. Furthermore, a reference is picked from Pandoras own measurements, and a synthetic absorption free reference is created using a modified Langley extrapolation (MLE). For this MLE we need some weeks or even months of field measurements, depending on the location and weather conditions.

So, new field calibrations are necessary for the following scenarios:

- Initial calibration of an instrument.
- If there is a jump in the data quality parameters (e.g. wrms or wavelength shift) which can e.g. come from repairing works or location changes.
- When the data quality exceeds certain thresholds.

The amount of field calibrations is relatively high at the moment since we are re-calibrating and re-processing the datasets.

Dataset processing

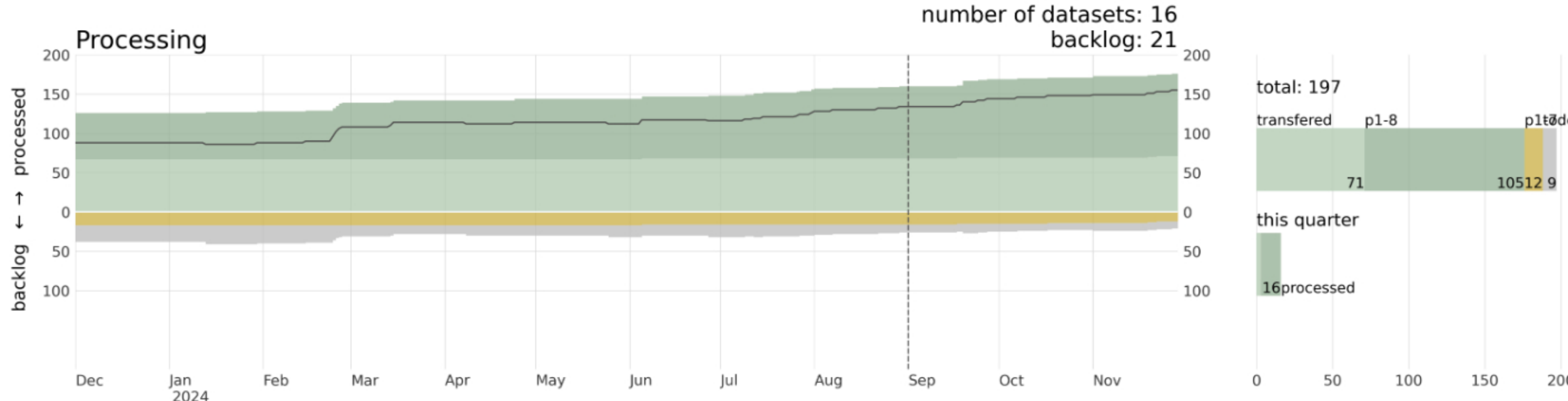


Figure 3

Figure 3 shows the progress of processed datasets for different processor versions (p1-8 and transferred from p1-7) on the positive y-axis vs. the backlog (p1-7 datasets and todo) on the negative y-axis. The dark line directly shows the difference between both. The horizontal stacked bars show the current overall status and the cumulative change in this quarter.

Dataset definition

Datasets are defined by the Pandora plus location-name included in the L0 files that are pushed automatically to the PGN, and . However, official PGN datasets are prioritized over non-official ones. Therefore, the numbers reported cover the subset of:

- non-testing and non-laboratory locations except for certified instruments,
- datasets with more than 15 L0 files, which is the minimum requirement to do a proper field calibration,
- official PGN datasets only.

Official dataset categories

A dataset consists of a multiple dataproducts (codes+processor version). The current official datasets for different processor versions are:

- **products_p1-7**:
 - rout0p1-7 (direct sun total O3)
 - rmvs1p1-7 (direct sun total NO2)
- **products_p1-8_OoB** (Out of the Box):
 - rout2p1-8 (direct sun total O3)
 - rwvt1p1-8 (direct sun total H2O)
 - rmvh3p1-8 (tropospheric, surface, profile NO2)
 - rfuh5p1-8 (tropospheric, surface, profile HCHO)
- **products_p1-8**:
 - products_p1-8_OoB
 - rmvs3p1-8 (direct sun total NO2)
 - rsus1p1-8 (direct sun total SO2)
 - rfus5p1-8 (direct sun total HCHO)

Dataset status categorization

Based on the processing status of each official dataproduct, a dataset status is categorized into the four classes of:

- **p1-7**: only products_p1-7 are available
- **p1-8**: no p1-7 products, but either all products_p1-8 or all products_p1-8_OoB is available
- **transferred**: all products for both p1-7 and p1-8 are available
- **todo**: either no data product is available or not yet all data products are available for the previously mentioned dataset categories, which can be the case due to ongoing re-processings when new data products are released

EVDC dataset transfer status

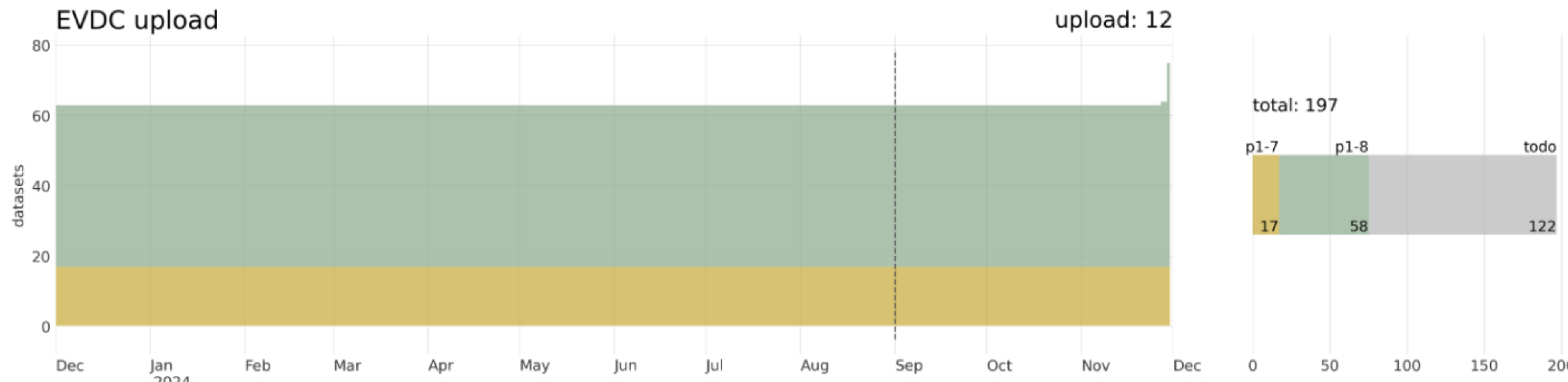


Figure 4

PGN datasets are submitted to [EVDC](#), in a [GEOMS](#) compliant format. This figure shows the cumulative number of datasets already uploaded to EVDC for different processor versions (1.7 and 1.8). Note that older versions are replaced by newer ones, wherefore the number of older versions will decrease over time. The horizontal stacked bar shows the current status also in relation to the number of open datasets (todo).

Notable events

About this section

This section of the reporting web tool serves as deliverable D6 of the [ESA](#) project Pandonia Operations 2 (POp-2).

POp-2 is contracted to [LuftBlick](#)

