



# Where

A new geodetic software being developed at the  
Norwegian Mapping Authority

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# A short history

The **Where** project was started in the fall of 2015 with the goal of building software that can analyse and combine data for *VLBI*, *SLR*, *GNSS* and *DORIS*.

- ▶ **Where** builds on ideas and experiences from the *Geosat* software
- ▶ The **Where-team** consists of five researchers at the Norwegian Mapping Authority (NMA):
  - ▶ Michael Dähnn (GPS)
  - ▶ Ingrid Fausk (SLR)
  - ▶ Geir Arne Hjelle (VLBI, GPS)
  - ▶ Ann-Silje Kirkvik (VLBI)
  - ▶ Eirik Mysen (VLBI)
- ▶ NMA is currently building / expanding the observatory at Ny-Ålesund

# The new Ny-Ålesund observatory



Figure 1: VLBI antennas were installed last week

## Current status

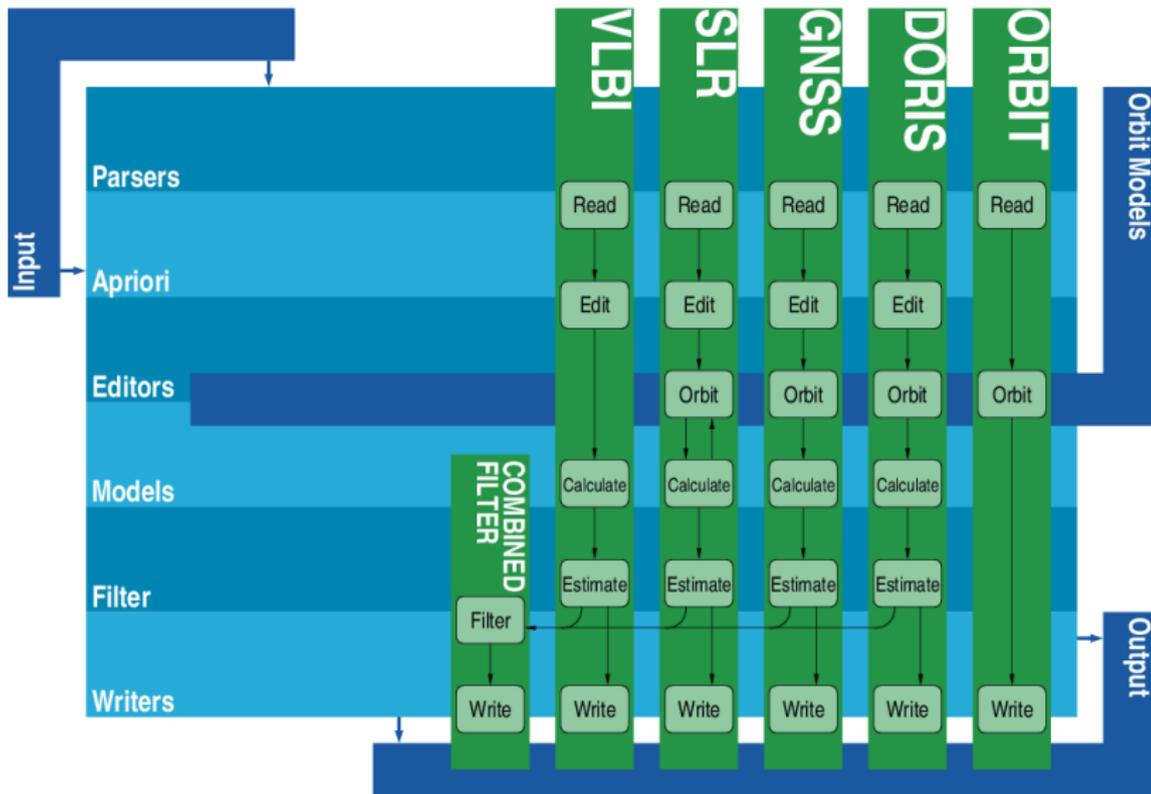
- ▶ All models from the *IERS Conventions* are implemented for *VLBI* and *SLR*
  - ▶ Many of the models can be reused for the other techniques
  - ▶ We participated in a *VLBI Analysis Software Comparison Campaign* organized by Onsala with *Geosat*, and are currently testing **Where** against these results
  - ▶ We are almost done with an orbit integrator for *SLR* satellites
- ▶ We are currently working on Precise Point Positioning (PPP) for *GPS*
- ▶ We have only done very simple tests for *DORIS* data so far

# Technology

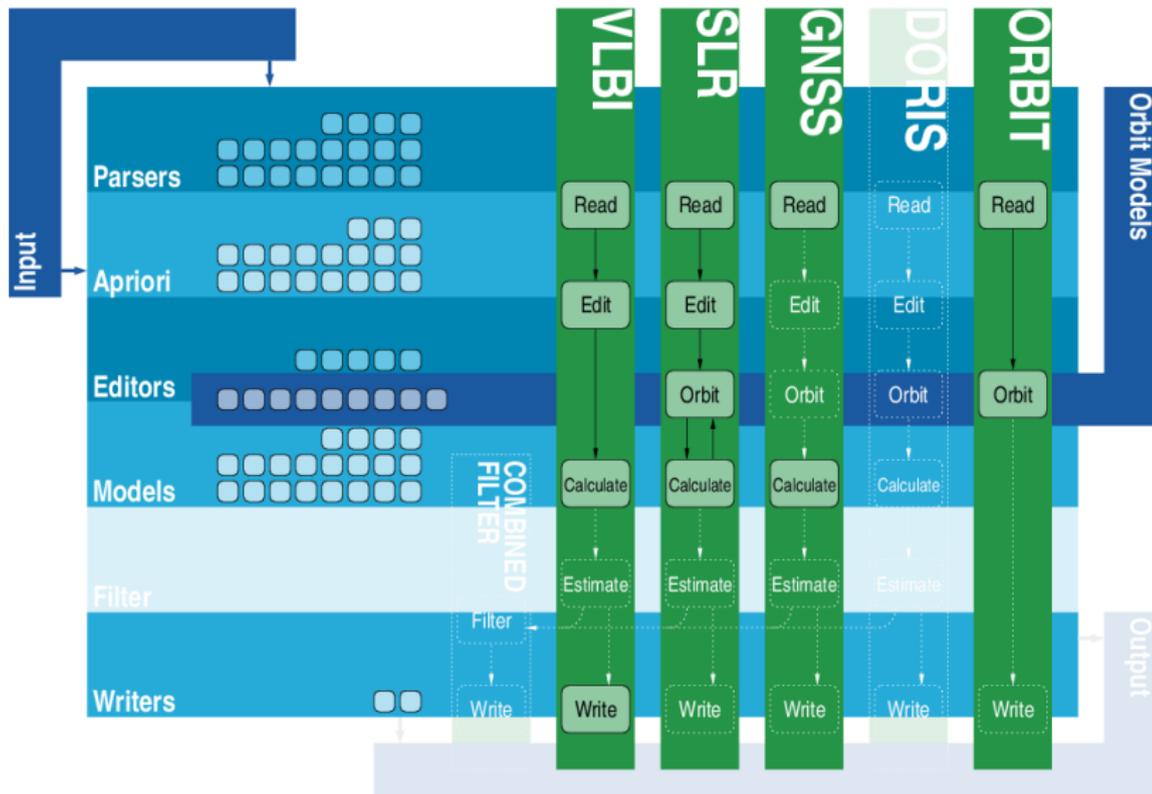
The **Where** software is mainly being written in *Python*

- ▶ Solid, flexible and fast libraries like `numpy`, `astropy`, `matplotlib` and `scipy` are available
- ▶ We use a **HDF5**-based format for storing data while the program is running
- ▶ *Python* has effective interfaces to *C* and *Fortran* code, and we can use the **Sofa** and **IERS** software libraries directly

# Technology – plans



# Technology – current



## Future plans

At the moment, the highest priorities for **Where** are

- ▶ finishing the *VLBI* analysis
  - ▶ The filter / estimation module
  - ▶ Proper output and reporting
- ▶ finishing the *SLR* analysis
  - ▶ The orbit integrator needs some more work
- ▶ finishing PPP for *GPS* and starting to look at *Galileo* and possibly *Glonass*
  - ▶ Orbit integration for GNSS-satellites



## Where is *DORIS*?

Unfortunately *DORIS* has been put somewhat on hold due to lack of resources. However,

- ▶ we implemented a *DORIS*-Rinex 3-parser in an early prototype of the software
- ▶ we did some experimental analysis in the old *Geosat* software
- ▶ we hope to do some simple tests quite soon
  - ▶ use Rinex 3-data and given orbits
- ▶ the proper implementation of *DORIS* will be after *VLBI* is finished
  - ▶ many models can be reused from the other techniques