

Design of Heliostat Fields in HELIOSTAT STUDIO




Victor Grigoriev and Clotilde Corsi

ASTRI

AUSTRALIAN SOLAR
THERMAL RESEARCH
INITIATIVE

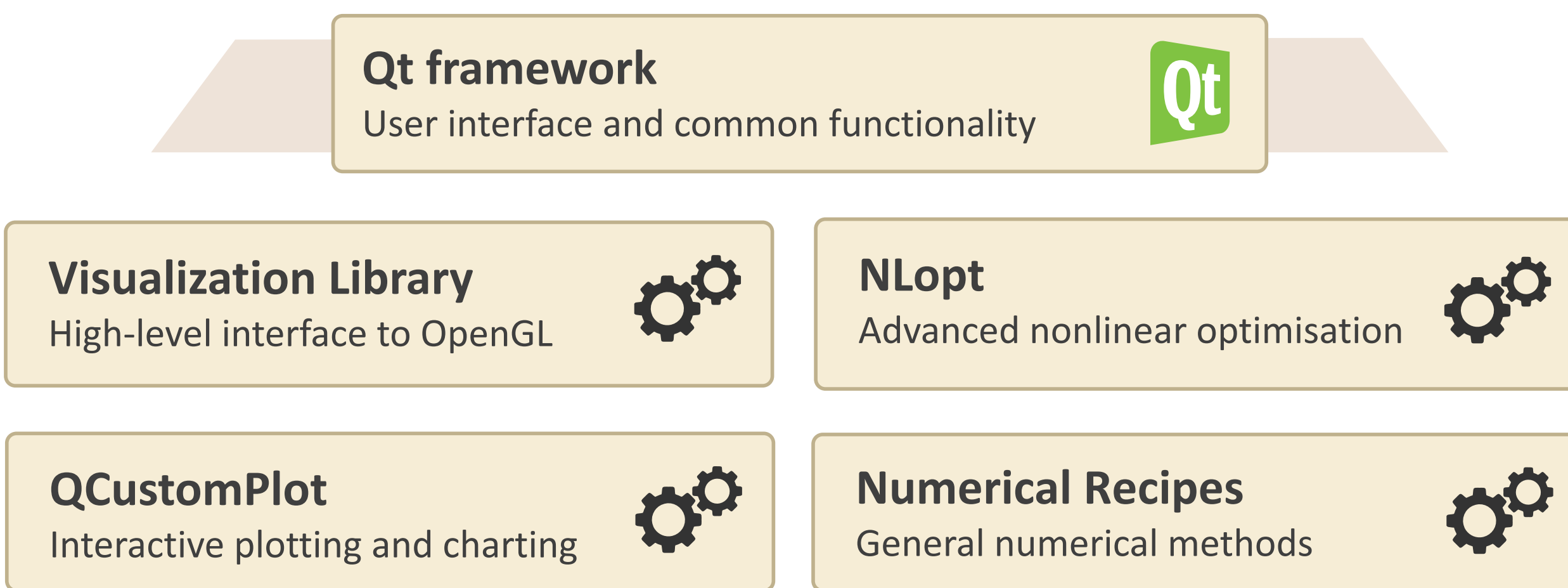
HELIOSTAT STUDIO is an open-source software tool developed by ASTRI for a comprehensive design and modelling of heliostat fields. The modelling is based on a set of customised algorithms which provide a higher level of abstraction than ray tracing and simplify the solution of complex optimisation problems. A significant emphasis is also made on visualisation in all stages of the design process so as to facilitate the choice of the most efficient configuration.

Motivation

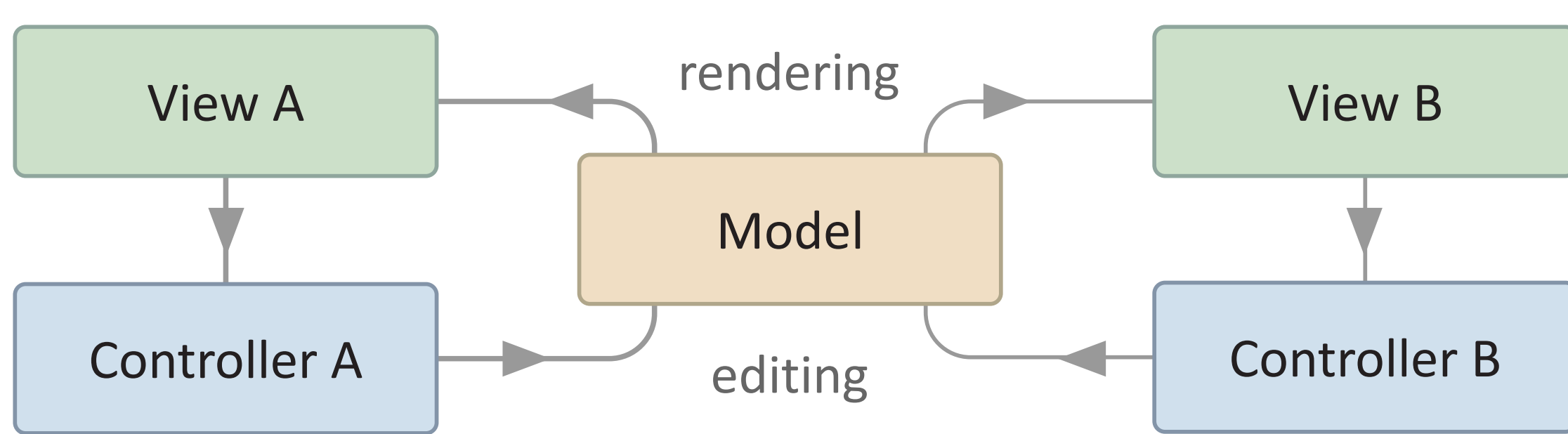
-  The existing tools for the design of heliostat fields tend to be outdated or not distributed openly [1]
-  The ultimate reduction of costs requires a holistic optimisation of power plant with a flexible design of heliostat field [2]
-  A commissioned plant needs a specialised software for a real-time control of heliostat field

Implementation

Software components

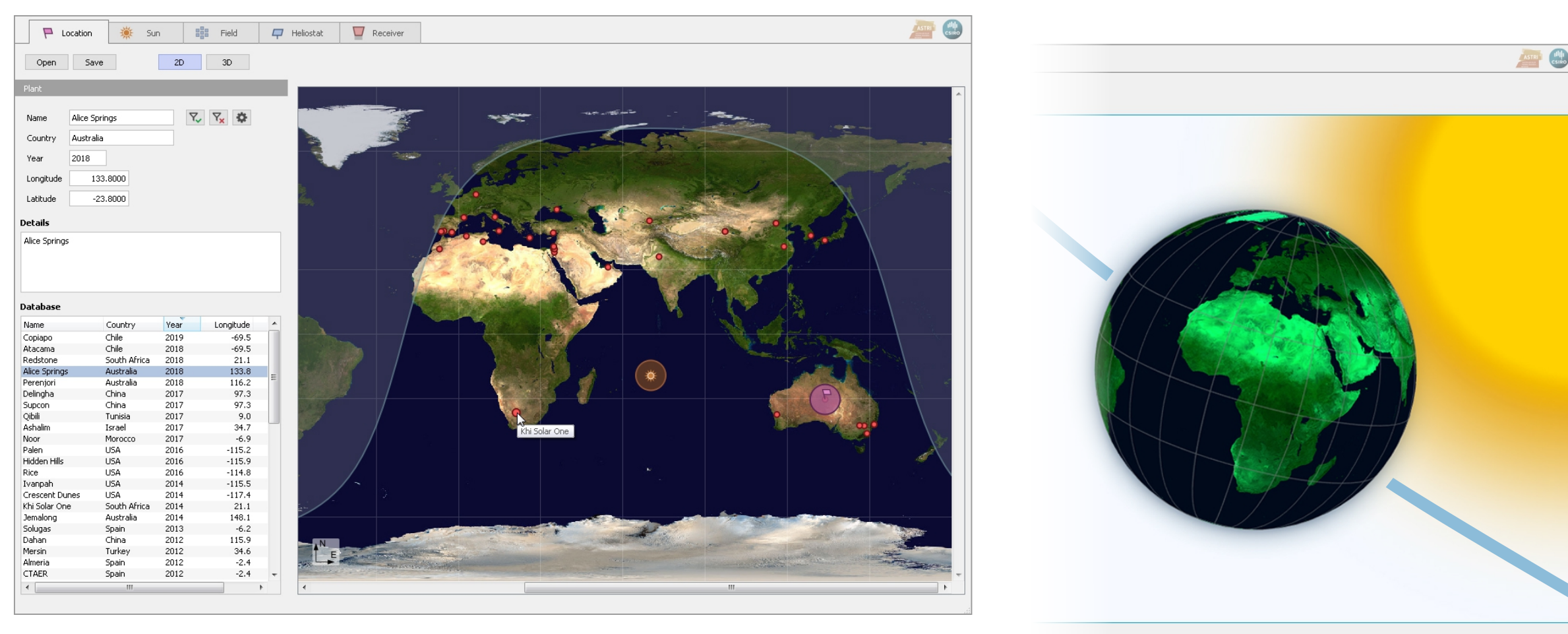


Model-view programming

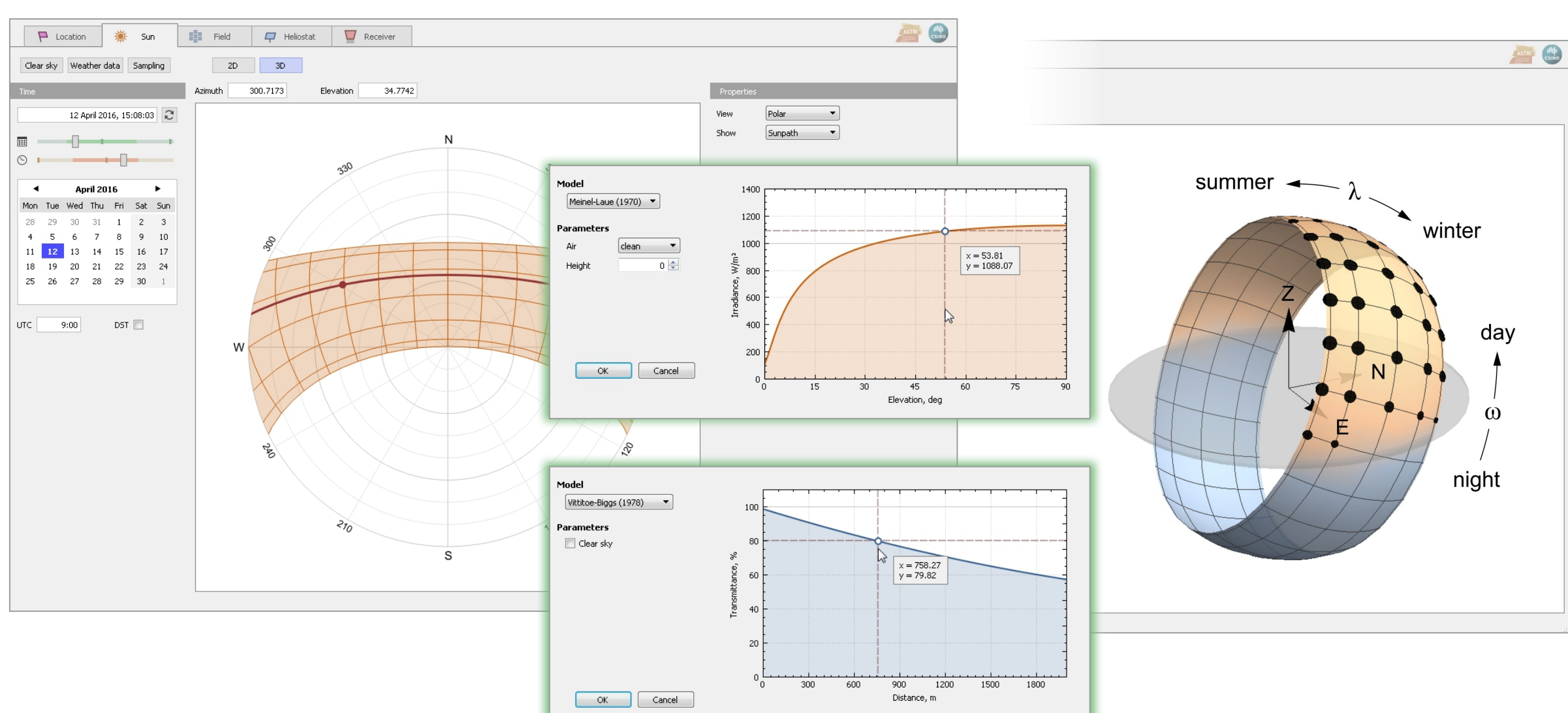


Workflow

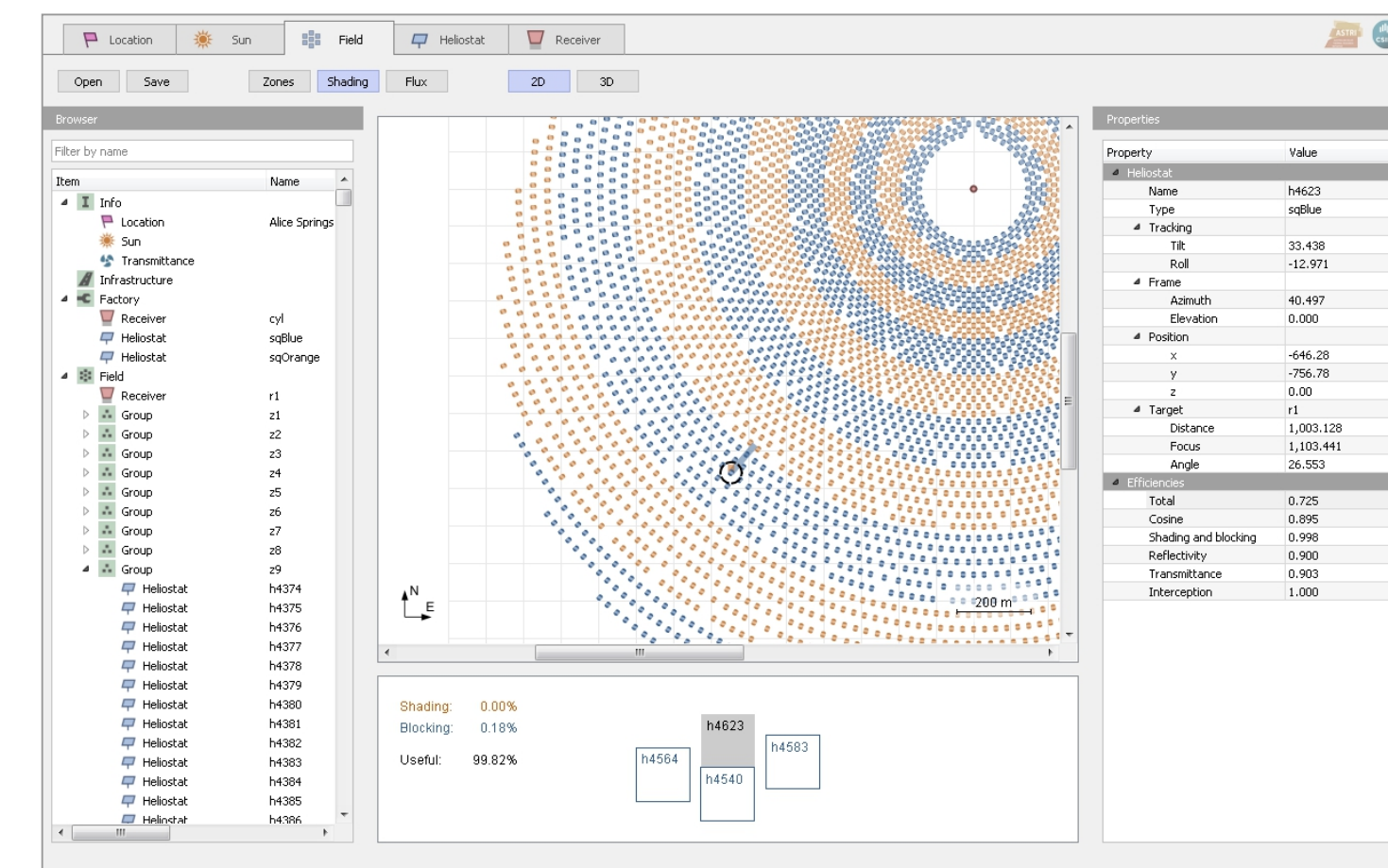
Location selector



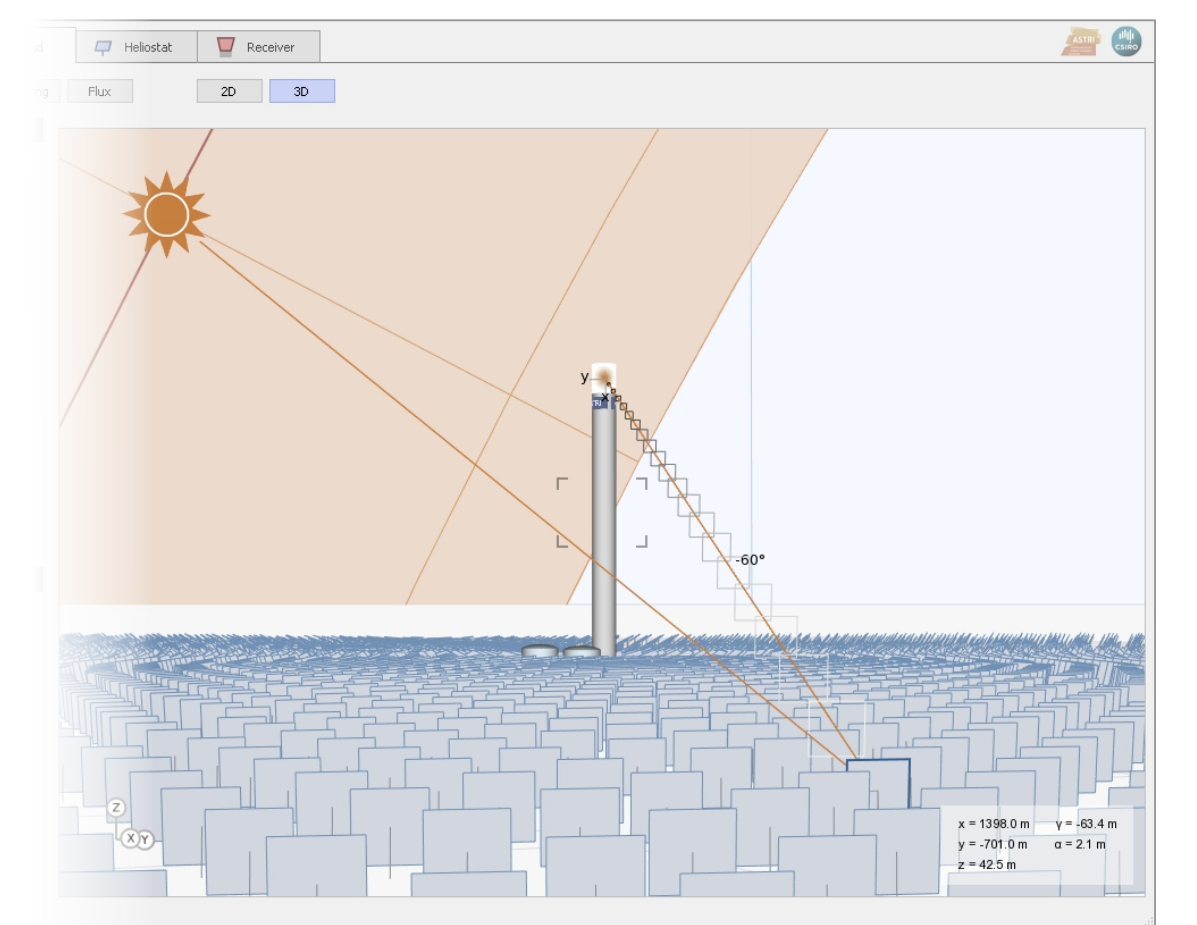
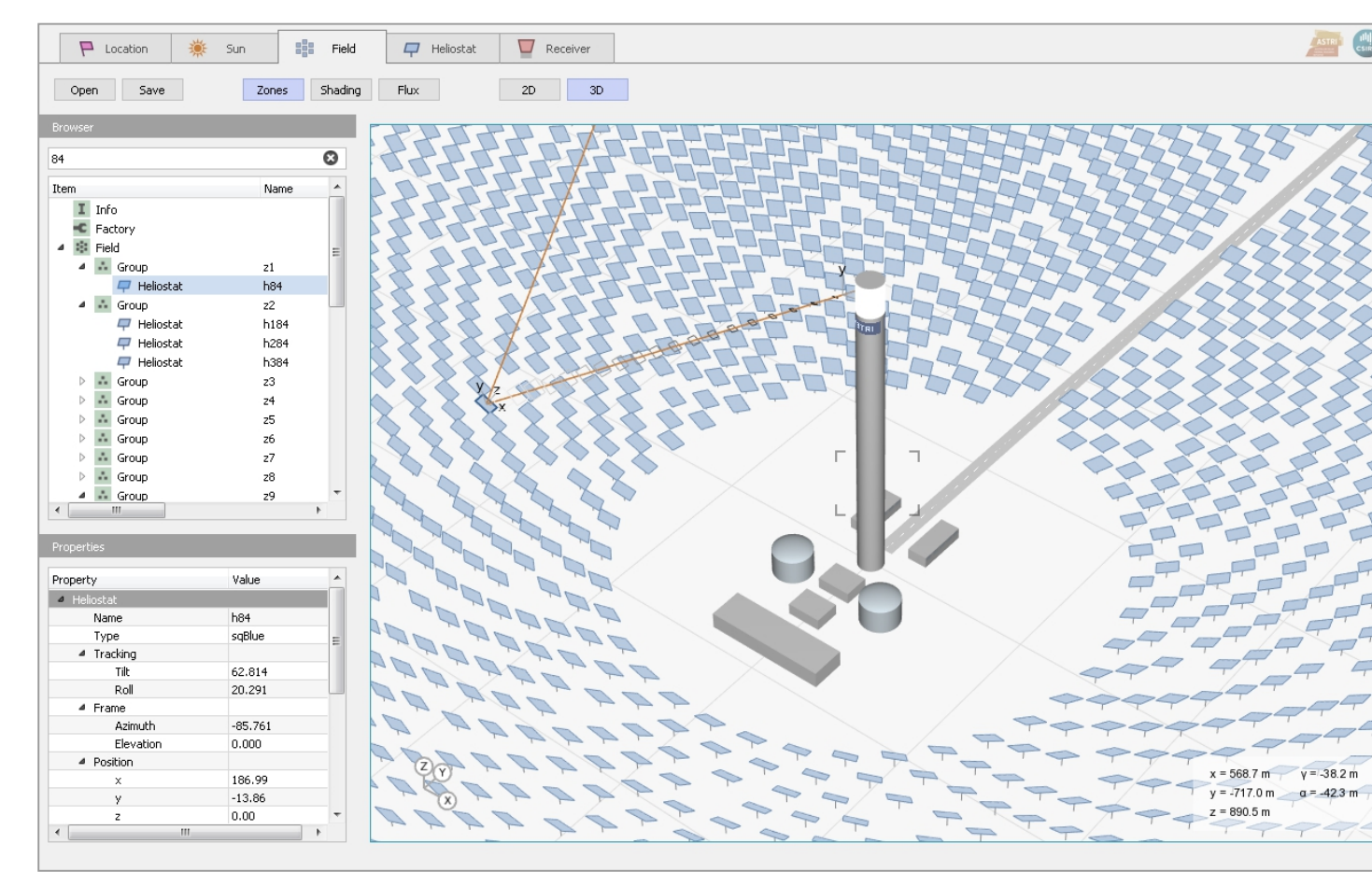
Sun calculators



Field editor

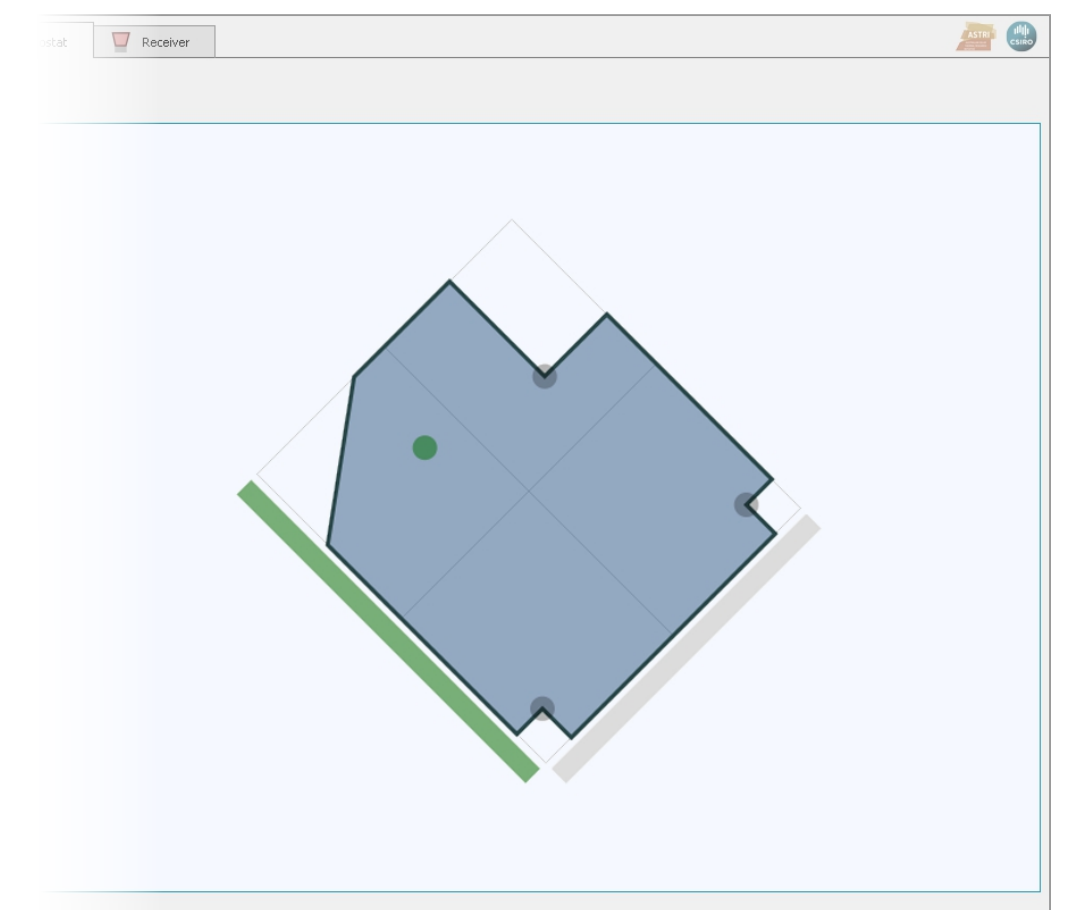
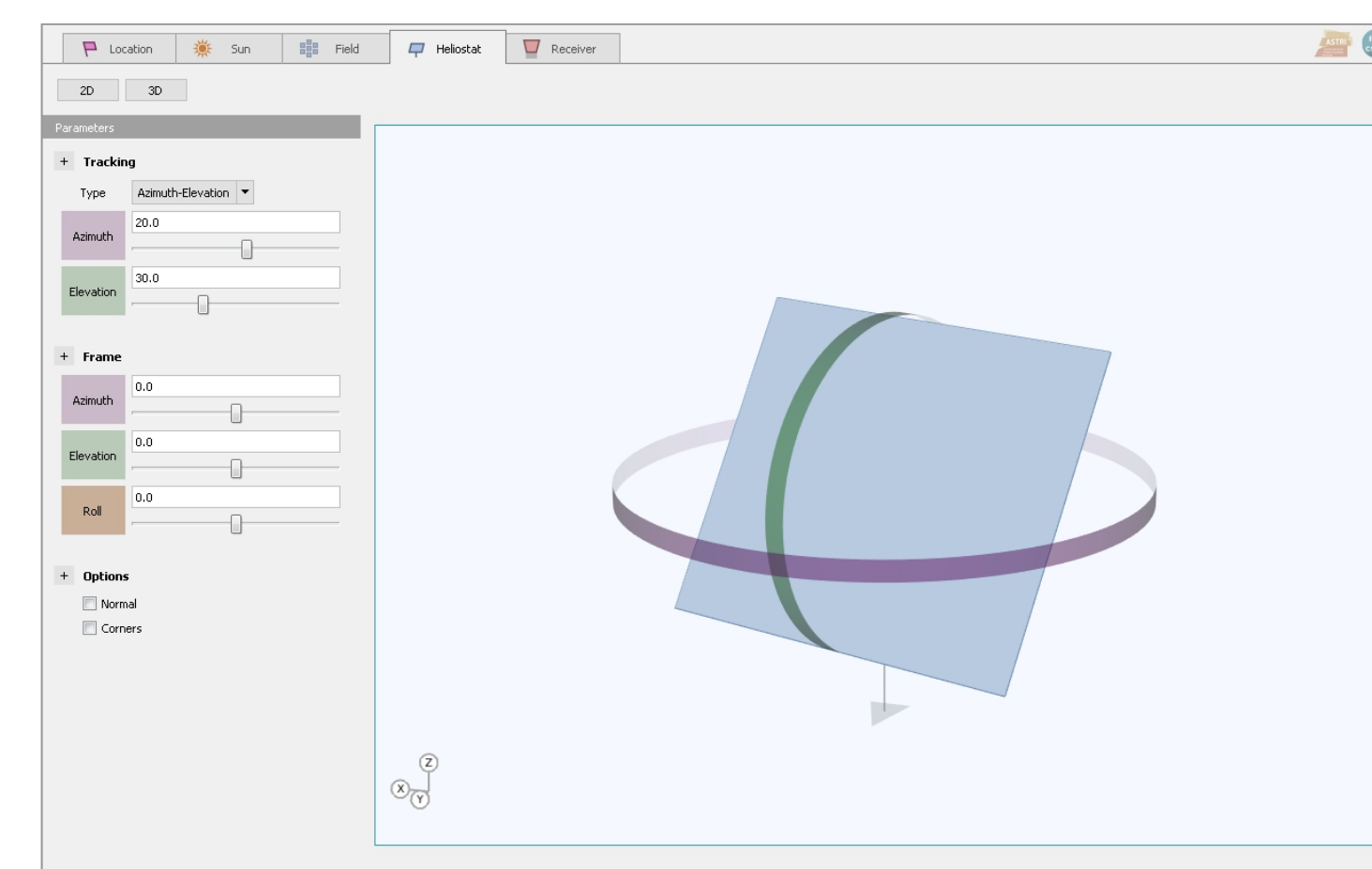


```
XML view
<Heliostat-Field version="1.0">
  <Receiver name="r1" type="cyl">
    <Position x="0.000" y="0.000" z="173.980"/>
  </Receiver>
  ...
  <Group name="z1">
    <Heliostat name="h1" type="sq">
      <Position x="-12.179" y="-146.120"/>
    </Heliostat>
  </Group>
  ...
</Heliostat-Field>
```



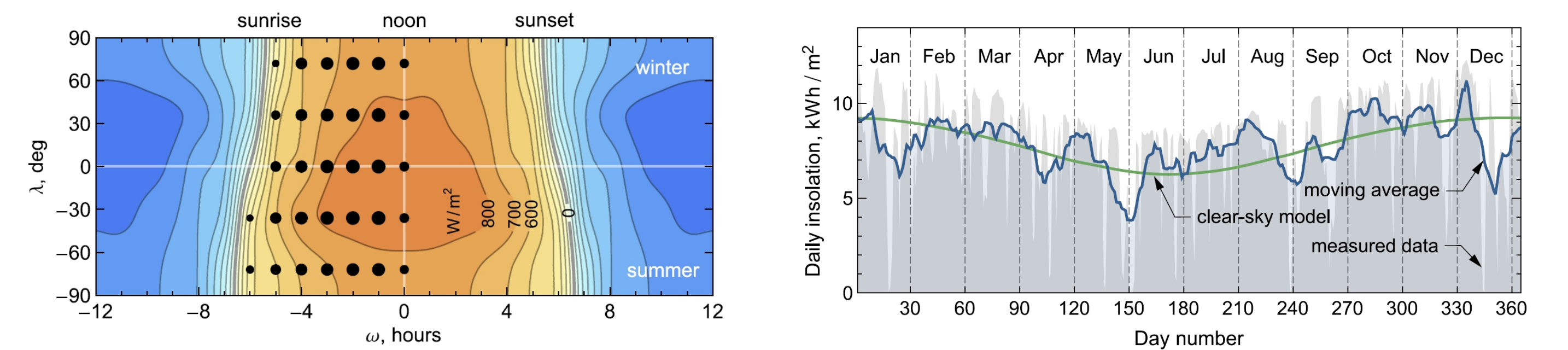
Shading and blocking losses are computed via parallel projection and polygon clipping [3]. Flux distribution is computed by convoluting the principal image of heliostat with a sun shape [4].

Heliostat editor

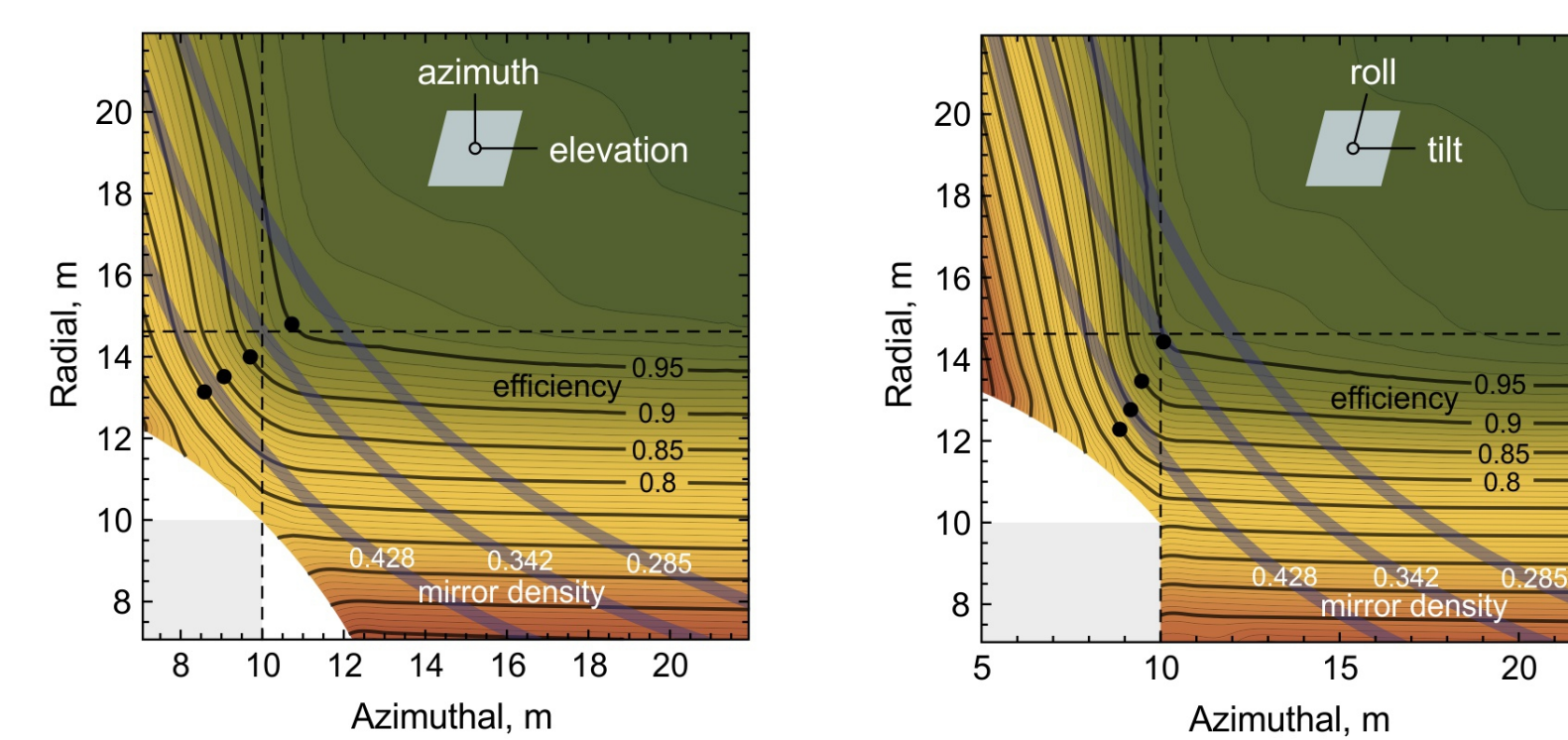


Development


Weather browser with post-processing of irradiance data [5]



Receiver editor, more analysis and optimisation tools



AUTHOR CONTACT

 **Victor Grigoriev**
victor.grigoriev@csiro.au
astri.org.au

REFERENCES

- [1] S. Bode and P. Gauché, "Review of optical software for use in concentrating solar power systems," South African Solar Energy Conference, Stellenbosch (2012).
- [2] C. Gertig, A. Delgado, C. Hidalgo, and R. Ron, "SoFiA – A novel simulation tool for Central Receiver Systems," Energy Procedia 49, 1361 (2014).
- [3] C. Corsi, V. Grigoriev, and M. Blanco, "Far-field optimisation of heliostat shape and spacings", Asia-Pacific Solar Research Conference, Brisbane (2015).

- [4] V. Grigoriev and C. Corsi, "Unified algorithm of cone optics to compute solar flux on central receiver", SolarPACES, Abu Dhabi (2016).
- [5] V. Grigoriev, C. Corsi, and M. Blanco, "Fourier sampling of sun path for applications in solar energy", SolarPACES, Cape Town (2015).

ACKNOWLEDGEMENTS



The Australian Solar Thermal Research Initiative (ASTRI) program is supported by the Australian Government, through the Australian Renewable Energy Agency (ARENA).