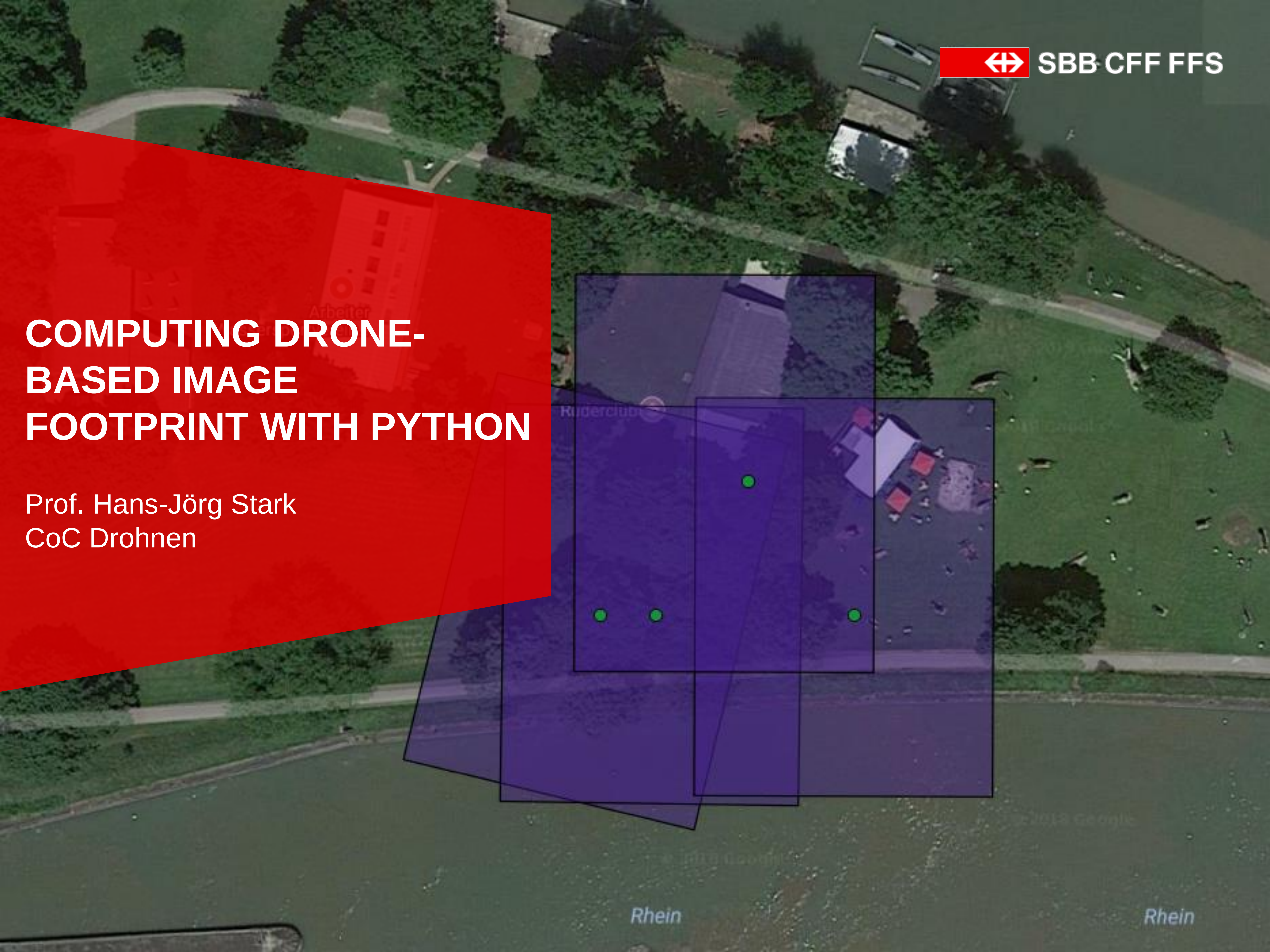
SBB CFF FFS

COMPUTING DRONE-BASED IMAGE FOOTPRINT WITH PYTHON

Prof. Hans-Jörg Stark
CoC Drohnen



What

is

the

Problem?

There

is

NO

Problem!

But...

…there

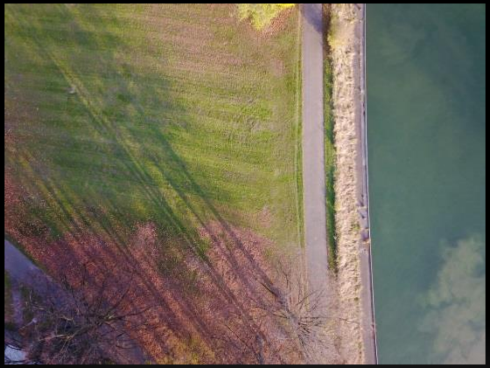
is

Curiosity!

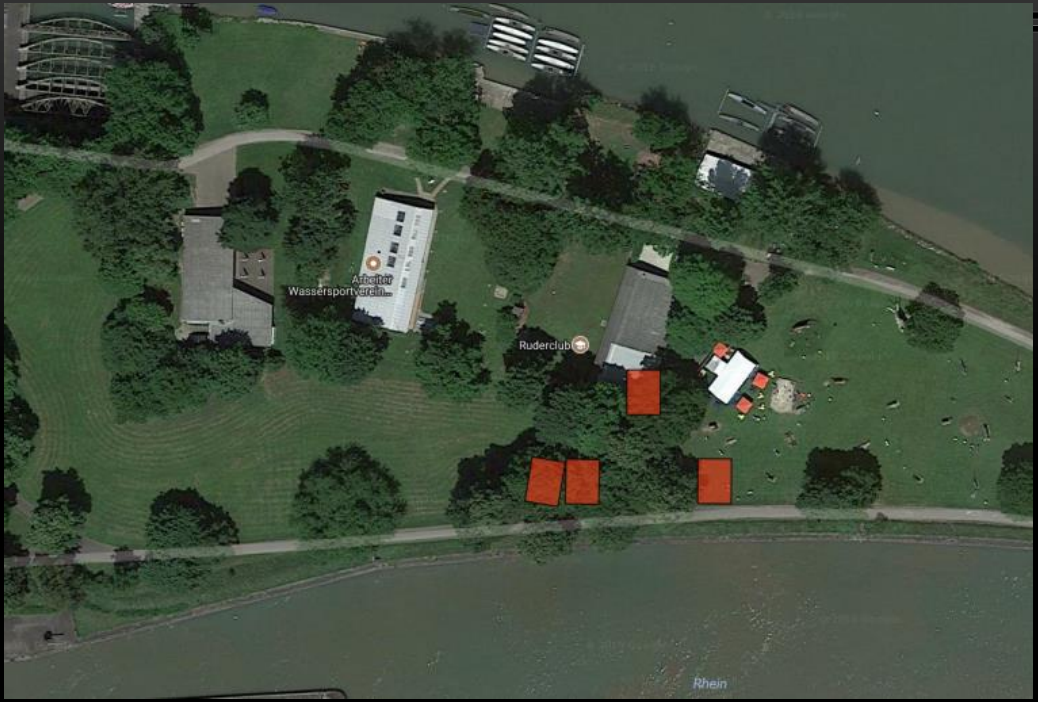
CHALLENGE…

I have…

- … a set of drone-based images



CHALLENGE…



I want…

- … the ground foot print as vectors / polygons

PROCEDURE

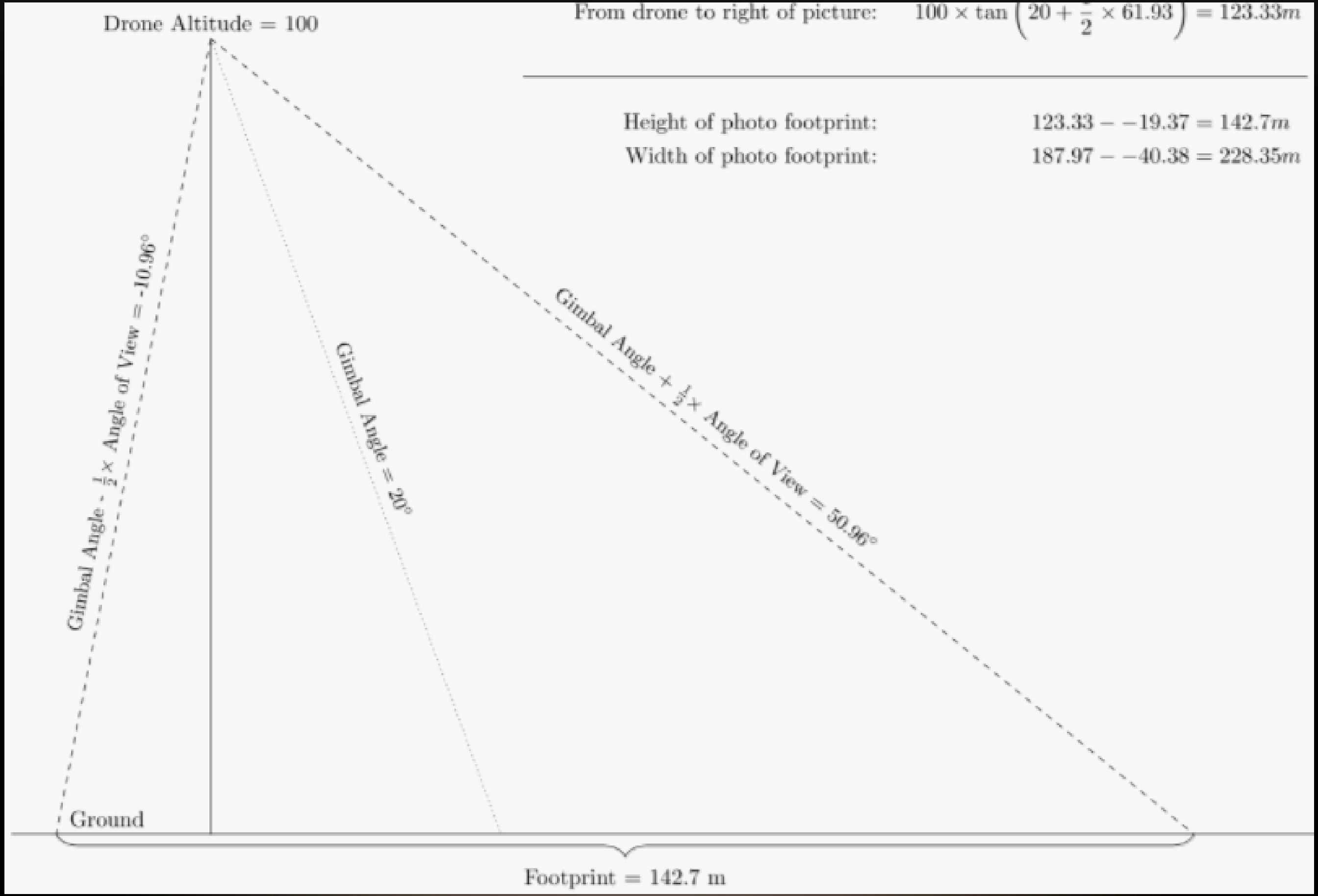
Using Jupyter Notebook with…

```
from PIL import Image
from PIL.ExifTags import TAGS, GPSTAGS
import os, glob, sys
import ogr, osr, math as m, datetime
```

PROCEDURE

… and some Geometry…

PROCEDURE



From drone to right of picture: $100 \times \tan\left(20 + \frac{1}{2} \times 61.93\right) = 123.33m$

Height of photo footprint: $123.33 - -19.37 = 142.7m$

Width of photo footprint: $187.97 - -40.38 = 228.35m$

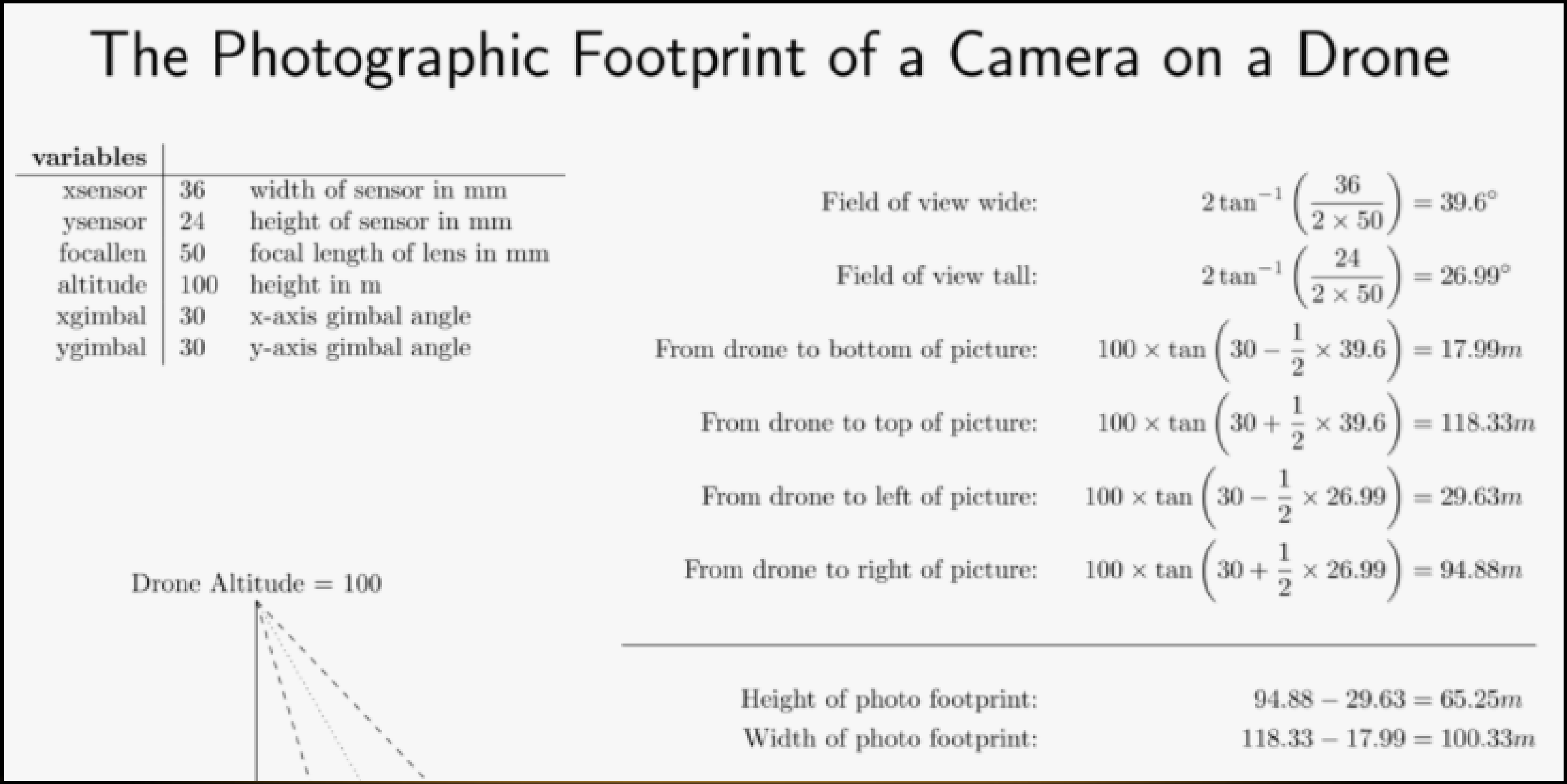
Drone Altitude = 100
Gimbal Angle - ½× Angle of View = -10.96°
Gimbal Angle = 20°
Gimbal Angle + ½× Angle of View = 50.96°
Ground
Footprint = 142.7 m

Source: https://photo.stackexchange.com/questions/56596/how-do-i-calculate-the-ground-footprint-of-an-aerial-camera

PROCEDURE

… and some Math…

PROCEDURE



The Photographic Footprint of a Camera on a Drone

variables		
xsensor	36	width of sensor in mm
ysensor	24	height of sensor in mm
focallen	50	focal length of lens in mm
altitude	100	height in m
xgimbal	30	x-axis gimbal angle
ygimbal	30	y-axis gimbal angle

Field of view wide: $2\tan^{-1}\left(\frac{36}{2\times 50}\right) = 39.6^\circ$

Field of view tall: $2\tan^{-1}\left(\frac{24}{2\times 50}\right) = 26.99^\circ$

From drone to bottom of picture: $100 \times \tan\left(30 - \frac{1}{2} \times 39.6\right) = 17.99m$

From drone to top of picture: $100 \times \tan\left(30 + \frac{1}{2} \times 39.6\right) = 118.33m$

From drone to left of picture: $100 \times \tan\left(30 - \frac{1}{2} \times 26.99\right) = 29.63m$

From drone to right of picture: $100 \times \tan\left(30 + \frac{1}{2} \times 26.99\right) = 94.88m$

Height of photo footprint: $94.88 - 29.63 = 65.25m$

Width of photo footprint: $118.33 - 17.99 = 100.33m$

Source: https://photo.stackexchange.com/questions/56596/how-do-i-calculate-the-ground-footprint-of-an-aerial-camera

WE NEED

Information from the sensor:

- Camera type and settings (focal Length etc.)
- Gimbal information (pitch, yaw, roll)

WE MUST SPECIFY

Vector-Data Settings

- Format
- Filename
- Localisation

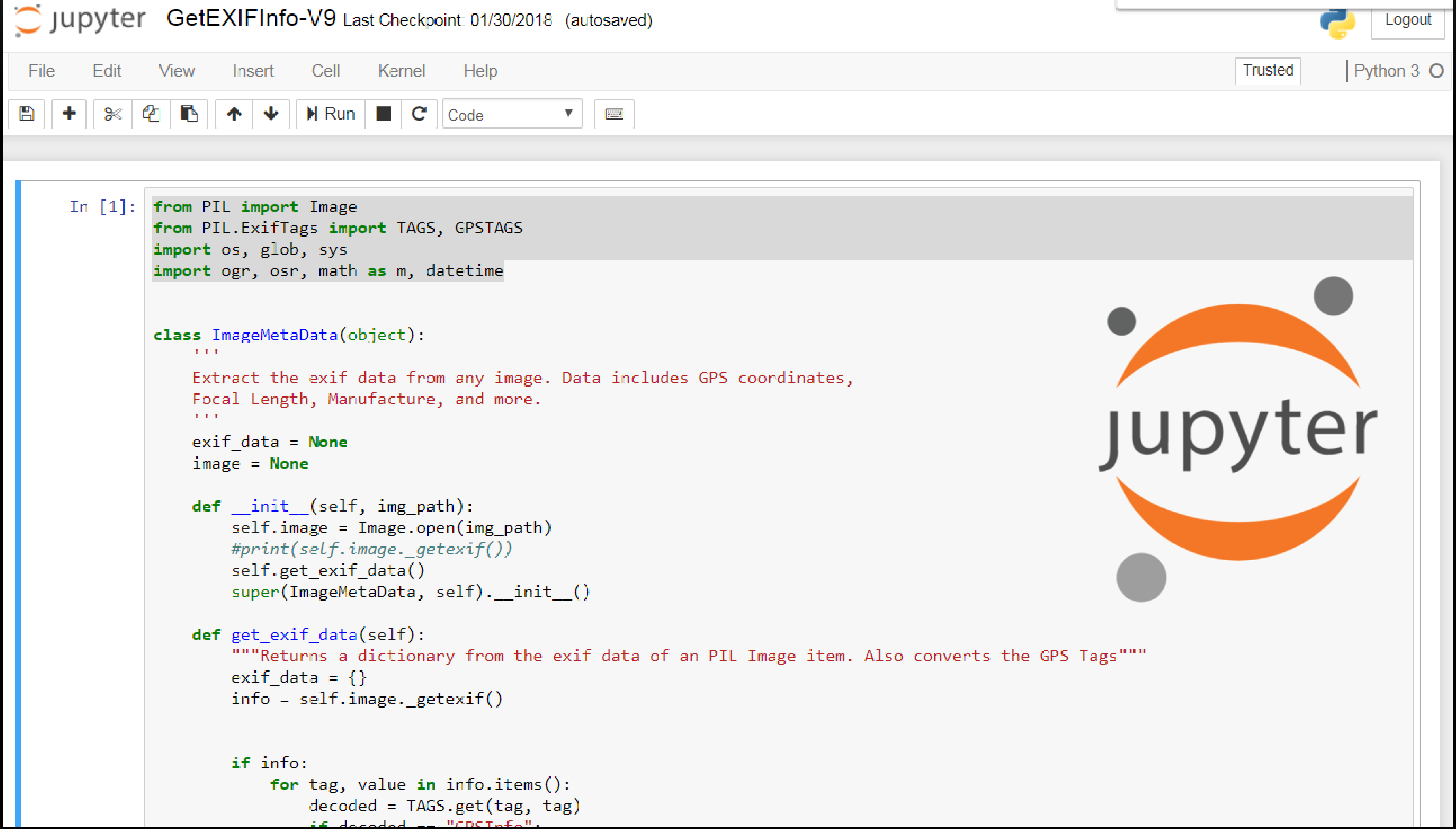
AND THEN....

... comes

python™

into action

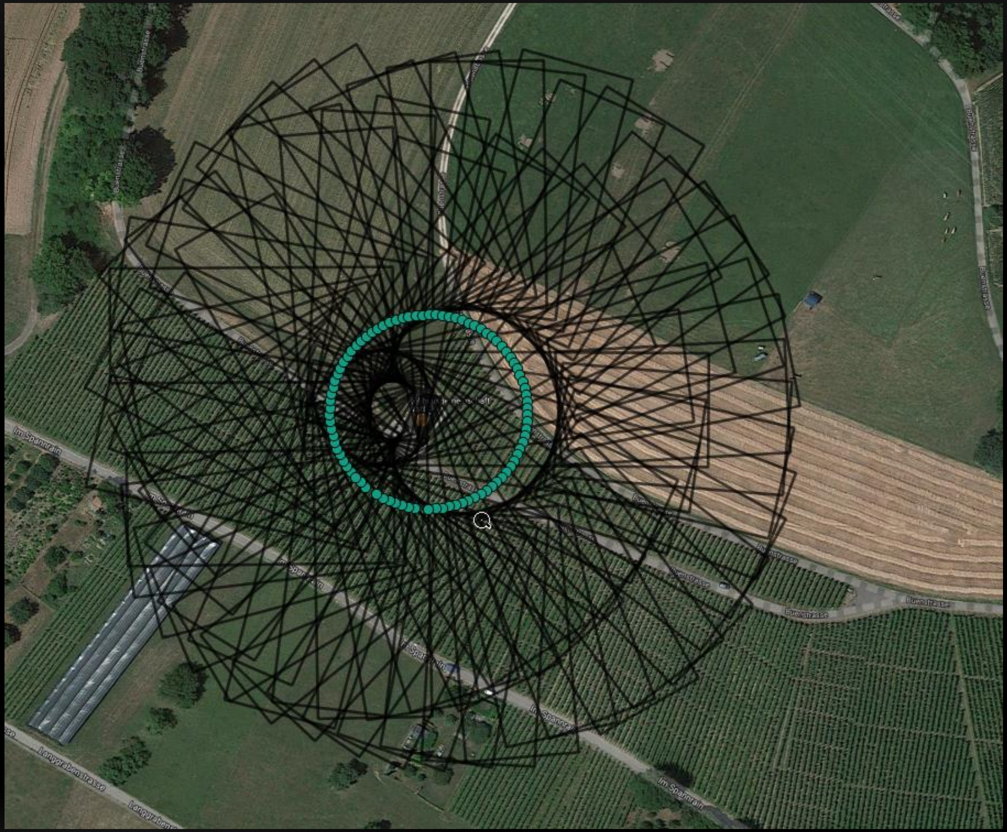
JUPYTER NOTEBOOK



```
In [1]: from PIL import Image
        from PIL.ExifTags import TAGS, GPSTAGS
        import os, glob, sys
        import ogr, osr, math as m, datetime


        class ImageMetaData(object):
            '''
            Extract the exif data from any image. Data includes GPS coordinates,
            Focal Length, Manufacture, and more.
            '''
            exif_data = None
            image = None

            def __init__(self, img_path):
                self.image = Image.open(img_path)
                #print(self.image._getexif())
                self.get_exif_data()
                super(ImageMetaData, self).__init__()

            def get_exif_data(self):
                """Returns a dictionary from the exif data of an PIL Image item. Also converts the GPS Tags"""
                exif_data = {}
                info = self.image._getexif()


                if info:
                    for tag, value in info.items():
                        decoded = TAGS.get(tag, tag)
                        if decoded == "GPSInfo":
```

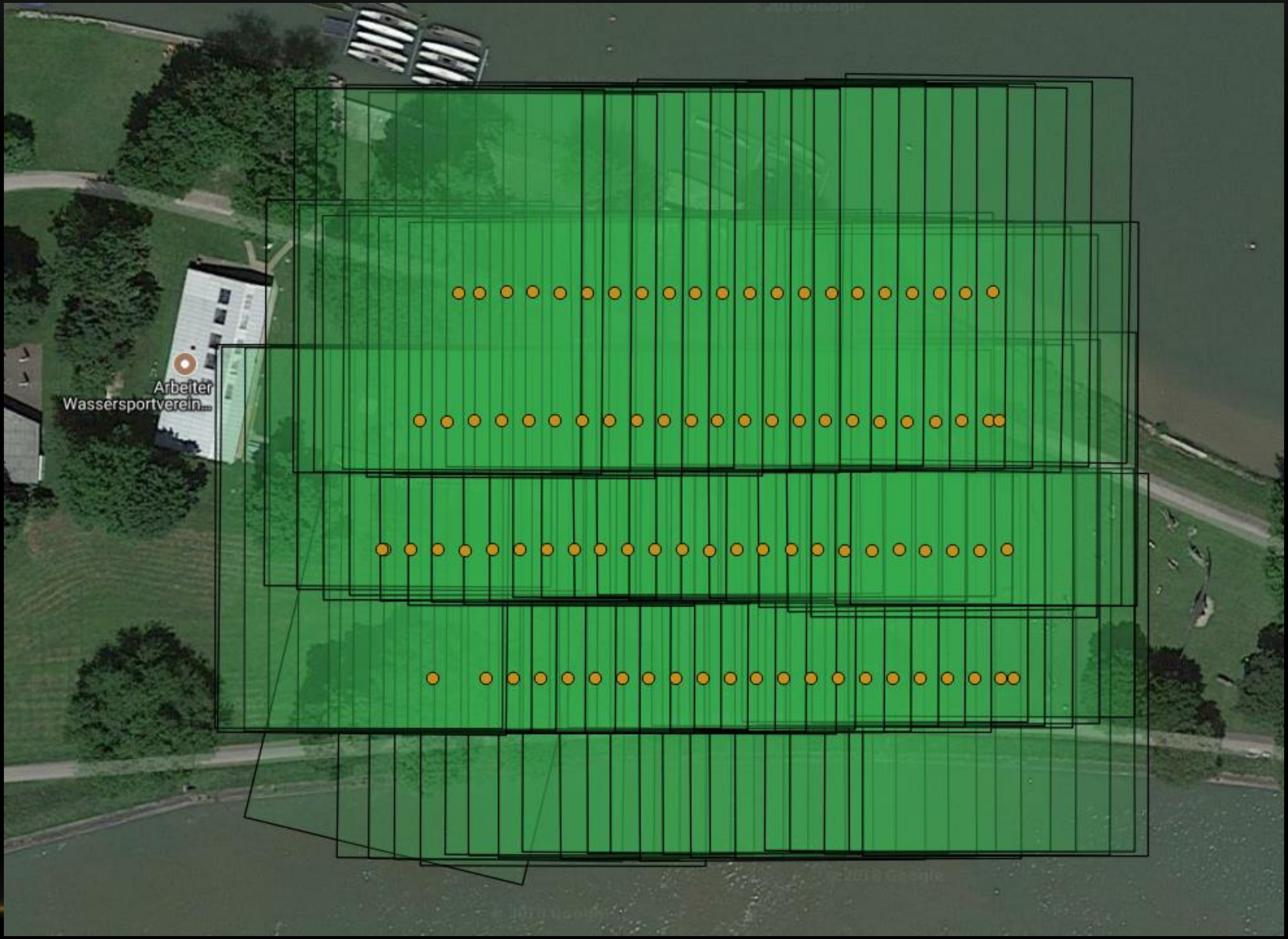
AND FINALLY...

The Result



AND FINALLY…

or



BUT

Am I right…?????

CONTACT

Jupyter Notebook / Sourcecode can be freely requested via:

hans-joerg.stark@sbb.ch

@GIrambler