GeoBLY – a tool for accessing oblique datasets

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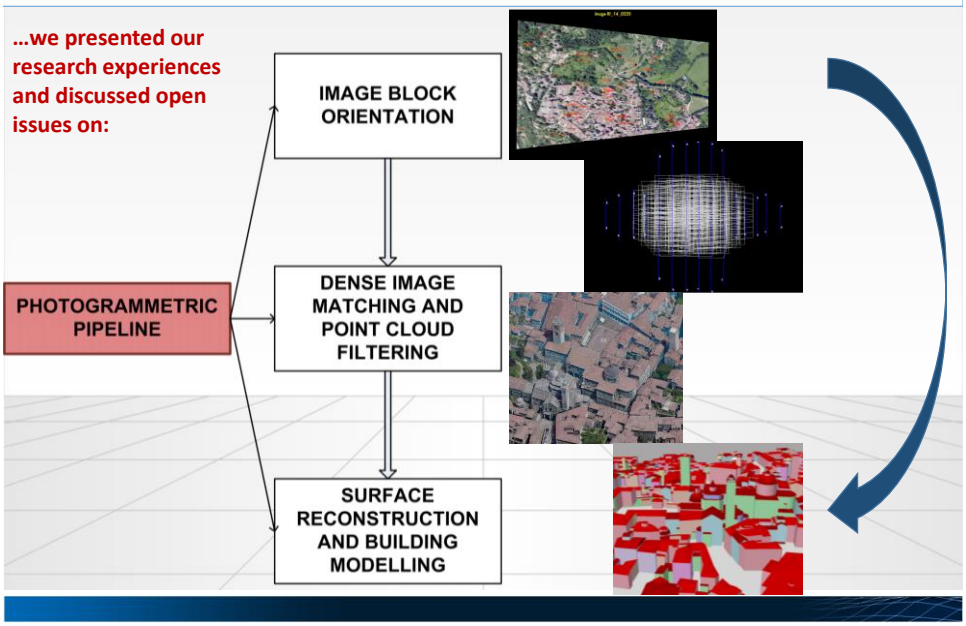
Introduction

Two years ago, in Southampton….

…we presented our research experiences and discussed open issues on:



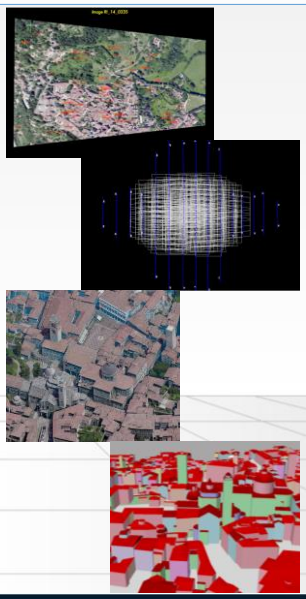
Introduction

Today, our research aims to….

…give an innovative and efficient answer to the questions:

How to <u>manage</u> and fully <u>exploit</u> the potential of these data?

How to <u>increase the usability</u> of these data by the final user?

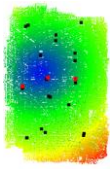


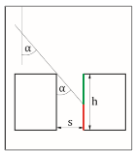
The GeoBLY project

Currently, there are a few companies operating oblique image systems.
However, **usability for the customer** was until now a **brake on the** oblique market **development**.

Bruno Kessler Foundation

3DOM = 3D Optical Metrology





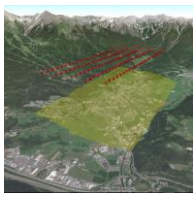
Methodologies and tools for geospatial problems

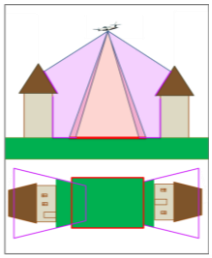
Oblique photogrammetry for precise mapping applications

GEOBly Viewer
Viewing and measurement tool for oblique imagery

GeoBLY -
GEOmetry extraction tool from aerial OBLique imagerY

AVT - Terra Messflug





The GeoBLY project

The **aim** of the project is **to design, implement and validate** an innovative **software solution for:**

- the **management** of oblique aerial surveys ,
- the **extraction** of accurate **3D information**.

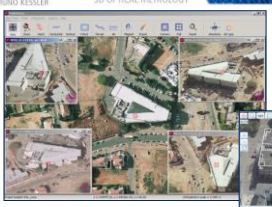
The tool should meet the **requirements** of being**:**

- **efficient** AND **accurate**,
- easy to be **customized** for different needs,
- **user-friendly** for both expert and non-expert operators;

The tool should address the **markets** of**:**

- civil and construction **engineering**,
- **building monitoring** at public administrations,
- **GIS departments** in public administrations.

The GeoBLY project



MultiVision by Ofek

Oblivision Viewer by Idansoft

BlomUrbex by BLOM

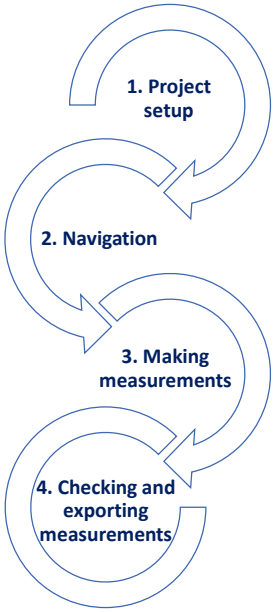
virtualcityMAP by visrtualcitySYSTEMS

…why another software??

The project seeks to **fill the gap** in the actual software panorama and develop a tool that**:**

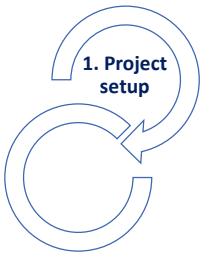
- is flexible and easy to be **customized to different input** (sensors/datasets/EO formats);
- **exploits** all available info, i.e. **2D** (images), **2.5D** (DTM)and **3D** (mesh) data;
- gives quality figures (**precision**) of the measurements;
- is **not** a **black-box.**

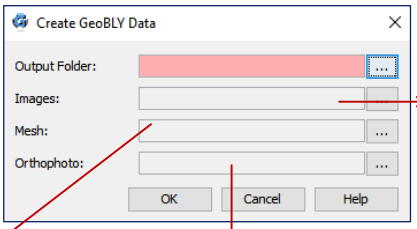
Workflow and main applications



- **Visualize** a building of interest and rotate around it **at 360°**;
- **measure the length, height and area** of any feature visible on the façade (i.e. windows, balconies, etc.) or on the roofs (i.e. chimneys, solar panels, etc.);
- **verify and update** the 3D cadastral database;
- **monitor the status** of buildings and infrastructures and identify structural **damages.**

The GeoBLY workflow





NADIR AND OBLIQUE IMAGES

When a project is created, all **images** are pre-processed in order to create **tiled** (512 x 512 pixels) **pyramids** (6 levels). These data are used to speed up the rendering of images into the GUI.

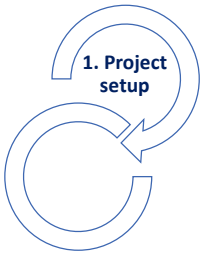
3D MESH (if available)

KD-tree structure of the 3D mesh is generated to speed up the ray-tracing algorithm.

ORTHOPHOTO OF THE AREA (if available)

Tiled (512 x 512 pixels) **pyramids** (9 levels) are generated to speed up the rendering of the ortho in the navigation panel.

The GeoBLY workflow

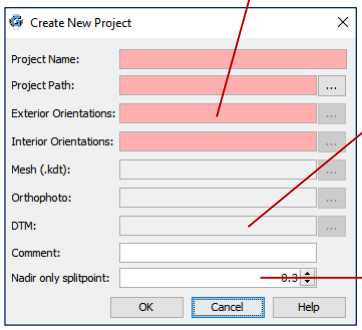


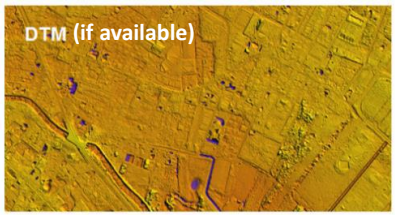
Once the pre-processing is done, the **available data can be imported** in the new project. **In addition**, the user can import:

INTERIOR AND EXTERIOR ORIENTATION (mandatory)

IO (txt file): <camera type> <pixel size> <focal length> <PPAx> <PPAy>

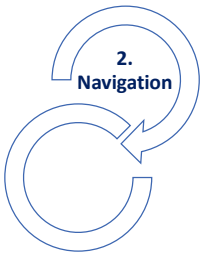
EO (txt file): <image filename> <camera type> <X> <Y> <Z> <ω> <ϕ> <κ>





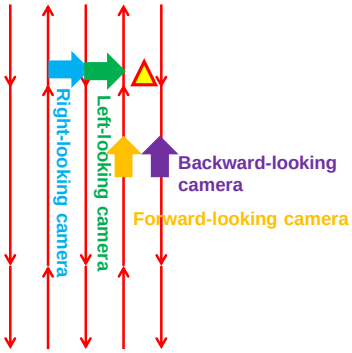
NADIR SPLIT-POINT FOR SEMI-OBLIQUE IMAGES (see later)

The GeoBLY workflow



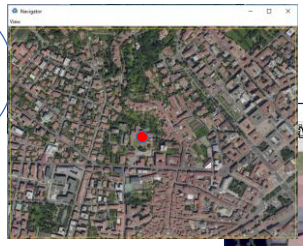
5-viewport main window, where images can be grouped:

- **by camera** (right, left, nadir, backward and forward);
- **by cardinal direction** (Nord, East, South and West).

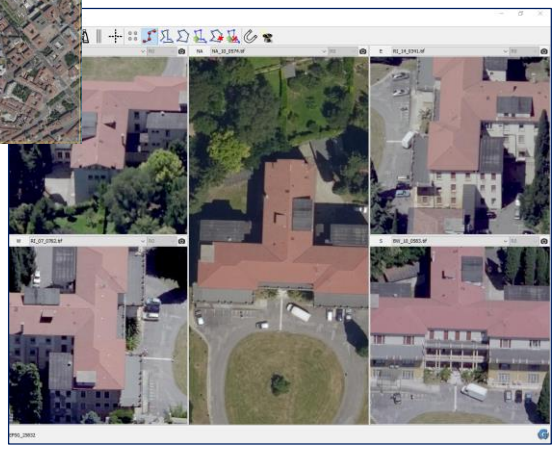


The GeoBLY workflow

2. Navigation



A single click in the orthophoto will **search all images (NA/LE/RI/BW/FW) viewing this point.**



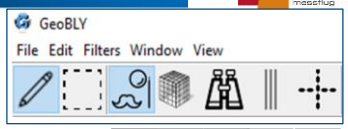
The view can be also re-centered by selecting one (or more) measurement(s) and applying the "**Filter by Visibility**" option.

The GeoBLY workflow

3. Measure

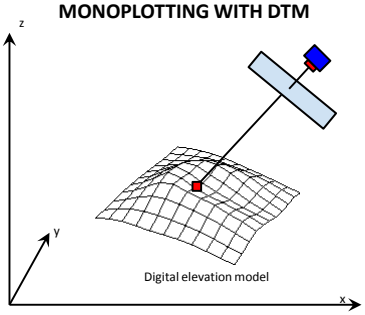
Different methods for making measurements are allowed, according to:

- **available data**
- **accuracy requirements**.

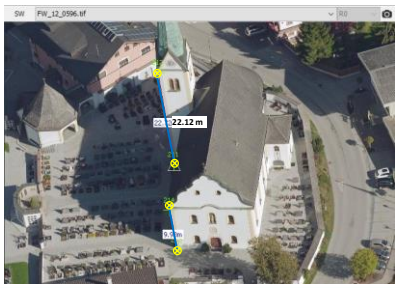


Monoplotting | **Mesh mode** | **Multi-ray FI** | **Vertical snapping** | **Orthogonal snapping**

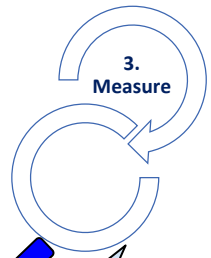
MONOPLOTTING WITH DTM



VERTICAL (OR HORIZONTAL) SNAPPING FOR FAST HEIGHT (OR LENGHT) MEASUREMENT.

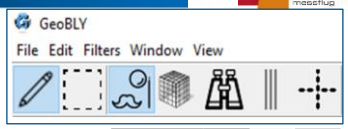


The GeoBLY workflow



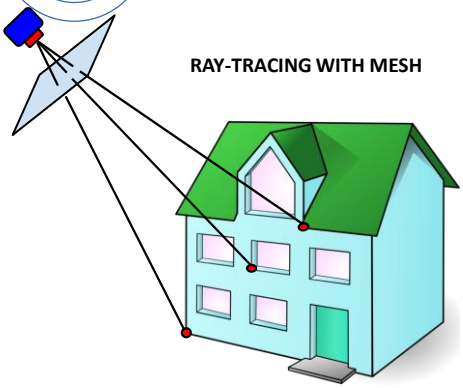
Different methods for making measurements are allowed, according to:

- **available data**
- **accuracy requirements**.

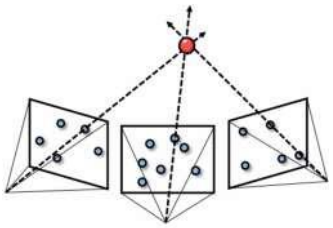


Monoplotting | Mesh mode | Multi-ray FI | Vertical snapping | Orthogonal snapping

RAY-TRACING WITH MESH

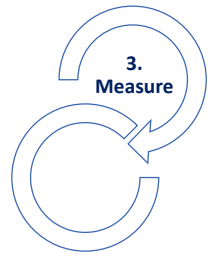


MULTI-FORWARD INTERSECTION

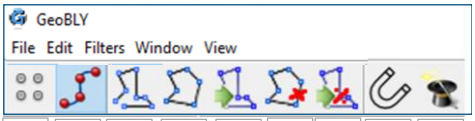


n-view triangulation

The GeoBLY workflow

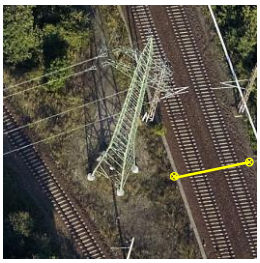


Different methods for vector digitalization are allowed, according to the mapping needs.



Point mode | Line mode | End open polyline | End closed polygon | Insert vertex into polygon | Un-close polygon | Split by vertex | Snap | Auto-select

- **lines creation for road/rail/fence-like structures**
- **polygons creation for footprints/façades/parking-lots**



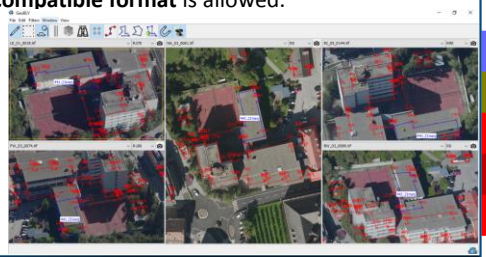
The GeoBLY workflow

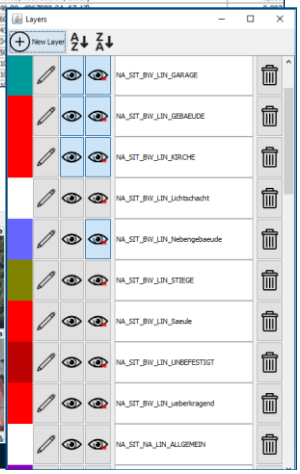
Info on measurements (**3D coordinates, length, height, perimeter, area, measurement mode and precision**) can be easily accessed and checked.

pid	image	img_x	img_y	method	layer	3d point	rep_error
6	027_055_jd3056c82579_123855_Nadir.tif	5965	3870	MONOPLOT	drain	(691668.96, 4967995.86, 53.21)	0
8	027_055_jd3056c82579_123855_Nadir.tif	6029	4170	MONOPLOT	drain	(691658.97, 4967982.35, 53.26)	0
15	027_063_jd3048c81616_123839_Forwar...	4321	2212	MONOPLOT	drain	(691653.68, 4967987.58, 53.53)	0
0	027_046_jd3065c81615_123914_Backwa...	6054	4779	MULTIPLOT	footprint	(691665.16, 4967994.88, 67.33)	0,358
0	031_056_jd3429c81607_125741_Right.tif	6747	3811	MULTIPLOT	footprint	(691665.16, 4967994.88, 67.33)	0,526
1	027_063_jd3048c81616_123839_Forwar...	4437	2356	MULTIPLOT	footprint	(691646.90, 4967988.04, 67.17)	0,002
1	031_056_jd3429c81607_125741_Right.tif	6617	4277	MULTIPLOT	footprint	(691646	
2	027_046_jd3065c81615_123914_Backwa...	5738	4693	OSNAP	footprint	(691664	
3	027_046_jd3065c81615_123914_Backwa...	5197	4730	OSNAP	footprint	(691643	
4	023_055_jd2446c81614_120623_Left.tif	4970	5448	OSNAP	footprint	(691674	
5	027_046_jd3065c81615_123914_Backwa...	5655	4850	OSNAP	footprint	(691659	
11	027_066_jd3045c81616_123833_Forwar...	4299	3990	MULTIPLOT	height_building	(691519	
11	031_058_jd3431c81607_125746_Right.tif	7008	4086	MULTIPLOT	height_building	(691519	
13	027_058_jd3456c81607_111418_Right.tif	3547	3236	MULTIPLOT	height_building	(691454	

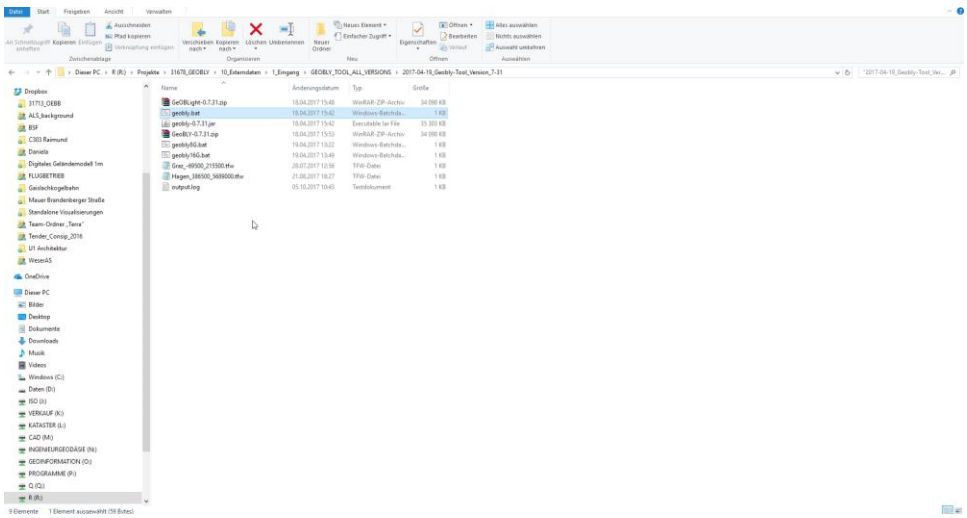
Vector data (digitized in the project **or imported** from external file) can be **organized in a multi-layer structure.**

Export in **GIS-compatible format** is allowed.





GeoBLY: how it works



Mapping in GeoBLY: examples

Three **examples** of mapping in GeoBLY **with different inputs** (sensors/datasets) are showed.
If you want to play with the data, ask us for **live demos at the stand**.

BORDEAUX (FRANCE)
oblique and hybrid dataset

BERGAMO (ITALY)
oblique dataset

NORCIA (ITALY)
semi-oblique dataset

Oblique dataset: Bergamo

SENSOR

	UltraCam Osprey Prime (Vexcel)	
	Nadir	Oblique 45°
Sensor size (mm)	70 x 45	53.4 x 39.9
Focal length (mm)	82	123

DATASET

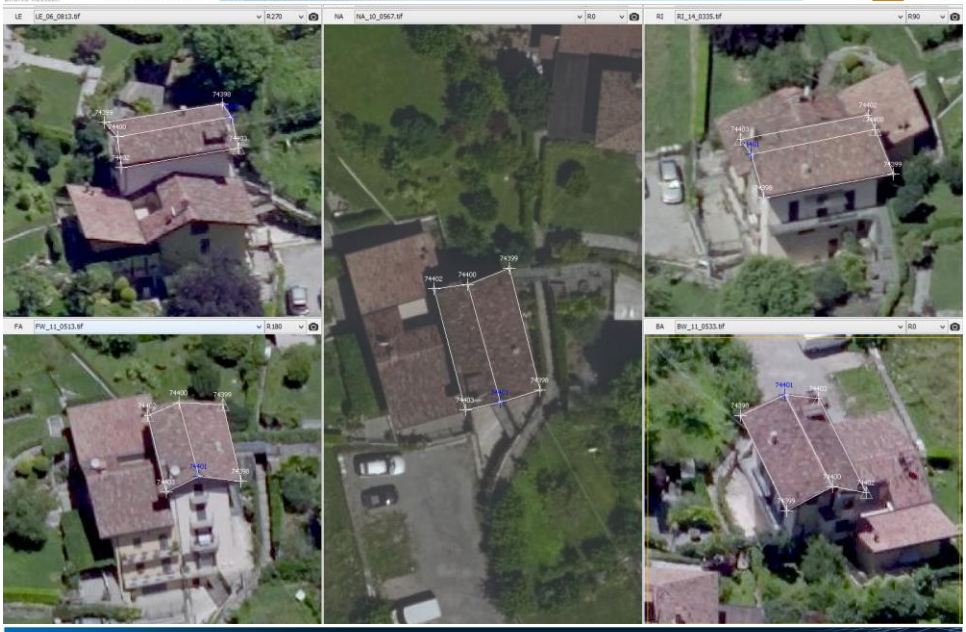
- 20 strips, 5 x 1051 images
- Average GSD (Nadir): 8 cm
- Overlap: 80% - 60%
- Flight: AVT

INPUT FOR GeoBLY

- Images
- EO/IO (AT in Pix4D)
- DTM (1 m resolution, from DSM with in-house algorithm)
- 3D MESH (in SURE, by nFRAMES)

Toschi, I., Ramos, M.M., Nocerino, E., Menna, F., Remondino, F., Moe, K., Poli, D., Legat, K., Fassi, F., 2017: **Oblique photogrammetry supporting 3D urban reconstruction of complex scenarios**. ISPRS Int. Arch. Photogramm. Remote Sens. Spatial Inf. Sci., Vol. XLII-1-W1, pp. 519-526.

Mapping in GeoBLY: Bergamo



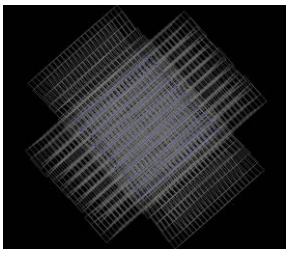
Oblique and hybrid dataset: Bordeaux

SENSOR: CityMapper (Leica)

Camera heads		LiDAR unit	
Nadir	Oblique 45°	Hyperion (FOV 40°)	
Sensor size	53.7 x 40.3 mm	Point density	Typically 8 pts/m^2 @1000m
Focal length	83 mm	156 mm	Ranging accuracy	< 2 cm RMS

INPUT FOR GeoBLY

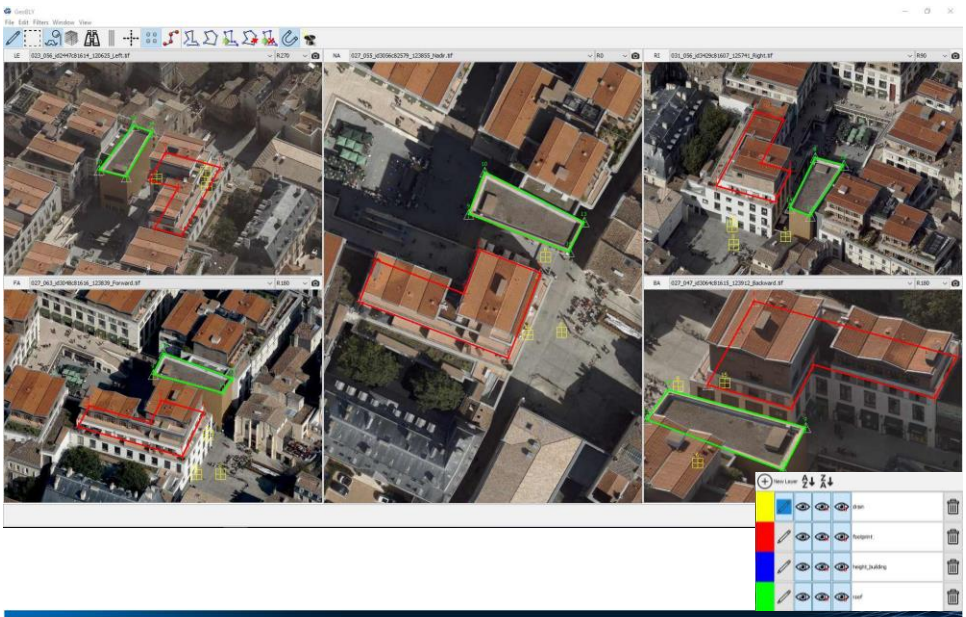
- Images
- EO/IO (AT in HxMap)
- DTM (0.5 m resolution, from LiDAR classification)
- ....



DATASET

- LiDAR point cloud:
  - More then 40 mln. points
  - Average resolution (on the ground): ≈ 10 cm
- 11 strips, 5 x 241 images
- Average GSD (Nadir): 5 cm
- Overlap: ≈80% - 60%
- Flight: Leica

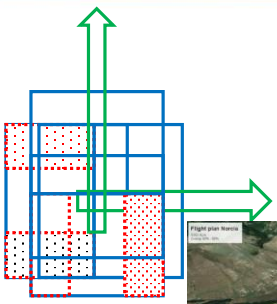
Mapping in GeoBLY: Bordeaux

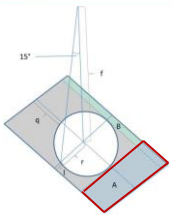


Semi-oblique dataset: Norcia

SENSOR

	UltraCam Eagle Mark 1 (Vexcel)
	Nadir
Sensor size (mm)	104.05 x 68.02
Focal length (mm)	80





INPUT FOR GeoBLY

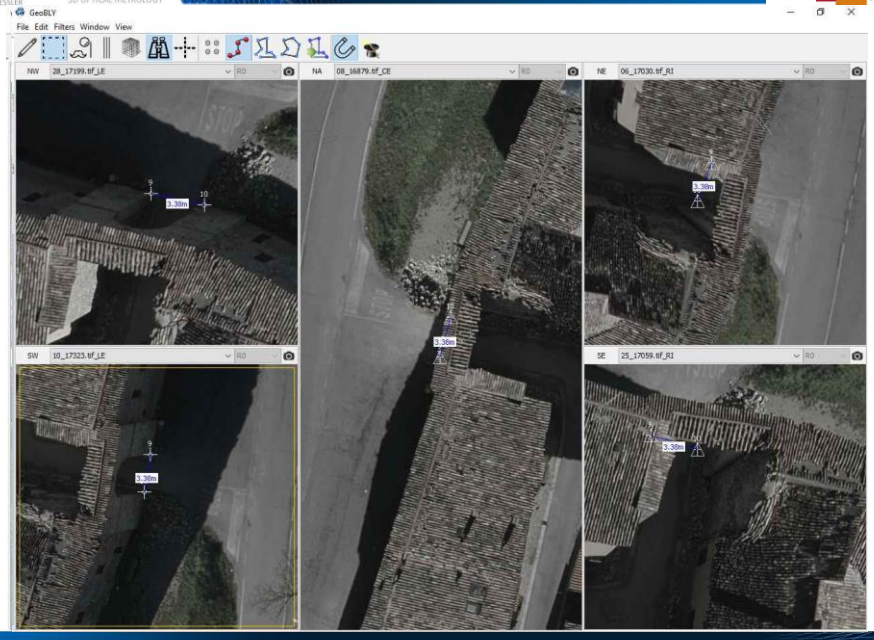
- Images
- EO/IO (AT in MatchAT)
- DTM (1 m resolution)
- 3D MESH (in SURE, by nFRAMES)

DATASET

- 1341 images
- Average GSD: 5 cm
- Overlap: 80% - 60%
- Flight: AVT

Poli, D., Moe, K., Legat, K., Toschi, I., Lago, F., Remondino, F., 2017: **Use of vertical aerial images for for semi-oblique mapping**. ISPRS Int. Arch. Photogramm. Remote Sens. Spatial Inf. Sci., Vol. XLII-1-W1, pp. 493-498.

Mapping in GeoBLY: Norcia



Conclusion – Current state

- Our answer to the question of "**how to use the data?**" is to **derive accurate measurements** (points and lines) from the imagery **by exploiting all available info** (both 2D original imagery and 2.5D/3D value-added products).

- The **GeoBLY tool** represents **a flexible means** to accomplish this task and gives several options of data management and features measurements **according to different requirements** (accuracy, time, etc..) **and different input** (sensors/datasets/formats).

- **A free and light version of the tool** (called **GeoBLight**) is developed for viewing of oblique imagery and for making simple measurements. This free version is normally **given to project customers**.

Conclusion – Future developments

- **Import, edit, and save geometry**: file format will be **extended** , as well as the available tools for geometry handling;
- A **direct link to external software** (e.g. Global Mapper, ArcGIS, qGIS, etc…) and **overlay of WMS/WFS** may help the final user.
- **Web-viewer** version (?)
- Search via address (**database background**)

….Any other wishes?

Thank you for your attention! We are available for questions/demos