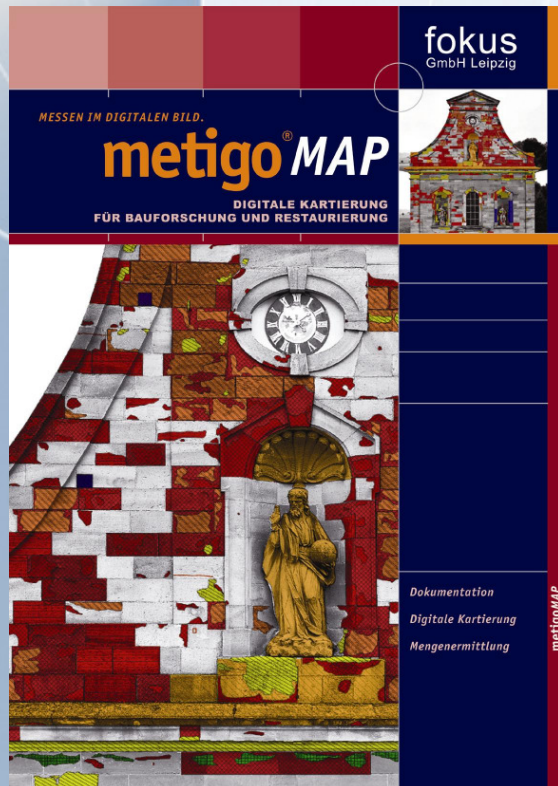


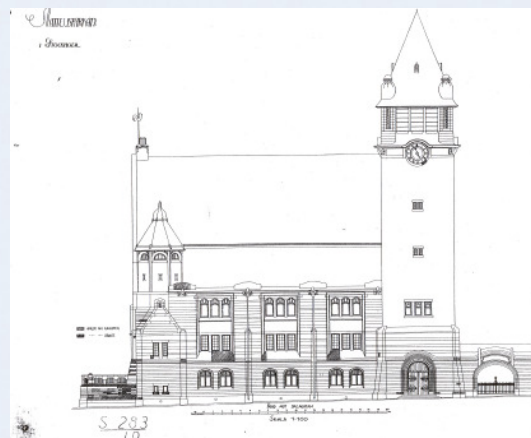
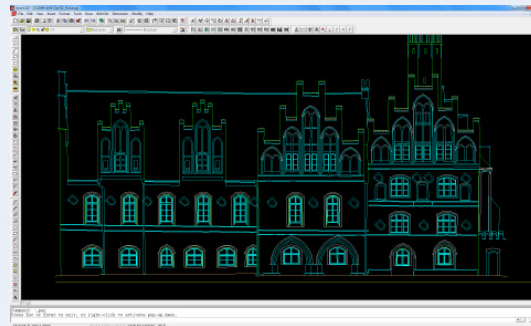
Modern methods of documentation  
for conservation –  
Digital mapping and automated  
3D object documentation in  
software metigo®



# Mapping software **metigo MAP**

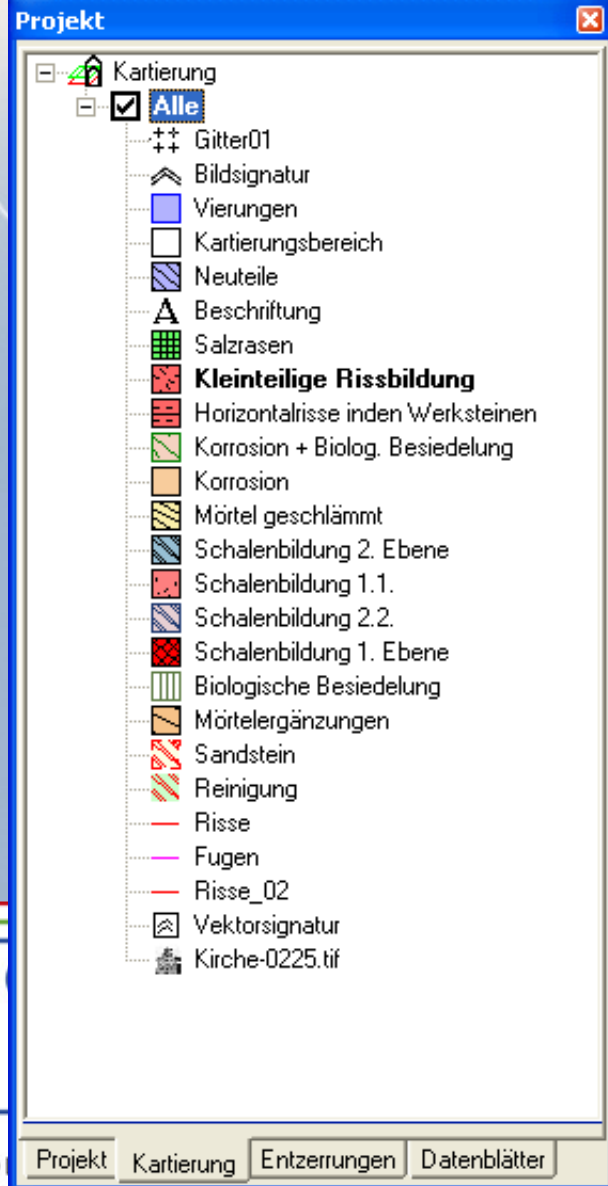


- Structure of a mapping project:
  - mapping basis
  - mapping classes
  - mapping groups
  - legends
- Digital image rectification
- mapping tools
- Object hierarchy

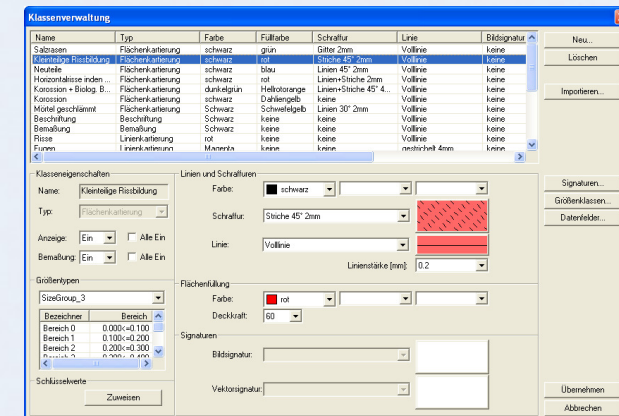


- Digital mapping on true to scale mapping basis
- rectified images, CAD drawings or scaled plans are scaled by project scale into the display of mapping project
- areas, lengths and quantities of mapped elements are automatically calculated
- mapping signatures are scaled by project scale into the display of the mapping project...  
(hatchings, line types and symbols)

# metigo *MAP* – Mapping classes (layer)

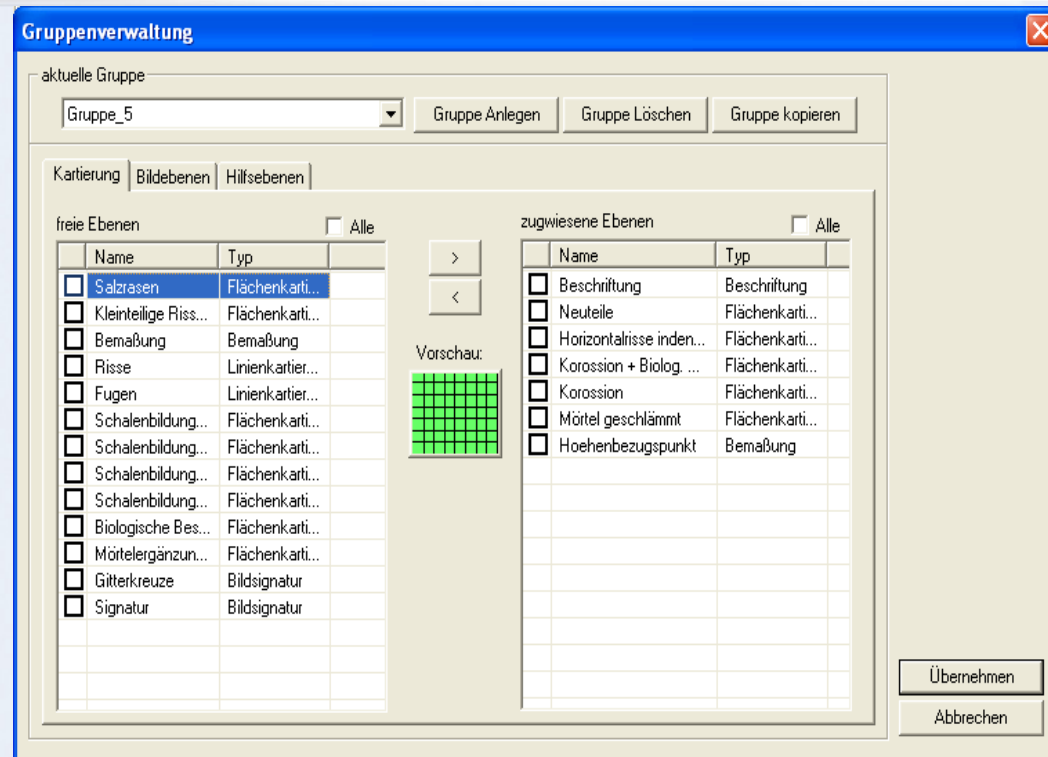
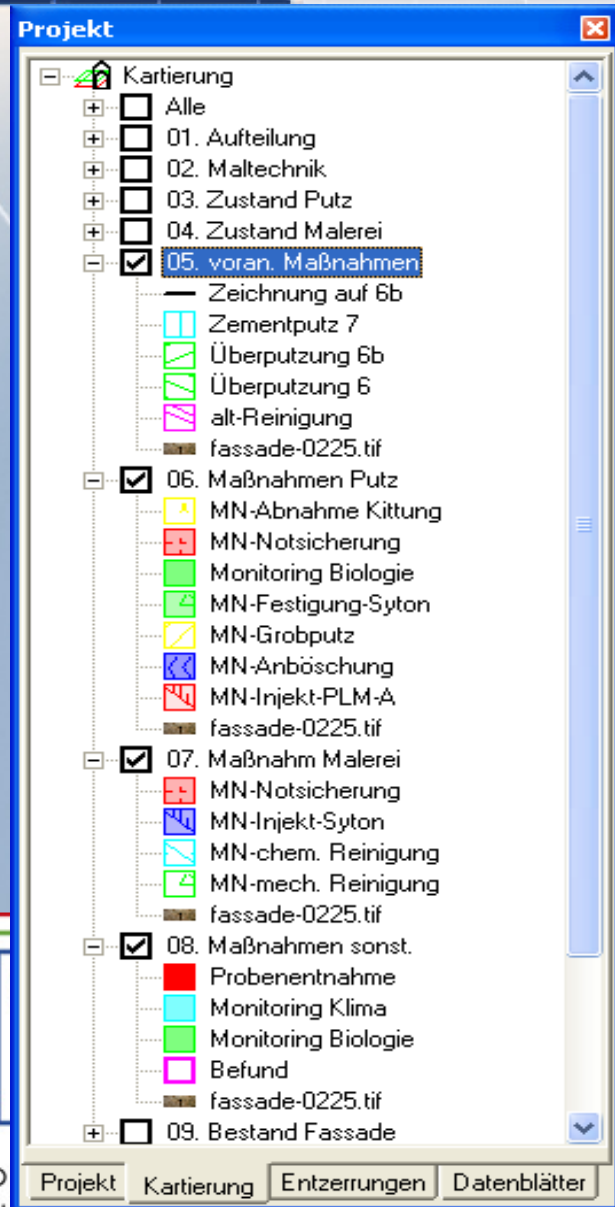


- individual creation of mapping classes for each topic (damages, materials, planned conservation measures...)
- class types for area and line mapping, signatures, detail photos, measurements and annotations
- large library of mapping signatures
  - Hatchings and transparent area
  - Linetypes
  - Vector signatures
  - colour libraries
- for each layer individual assignment of:
  - size classes,
  - data fields,
  - units, fractional digits





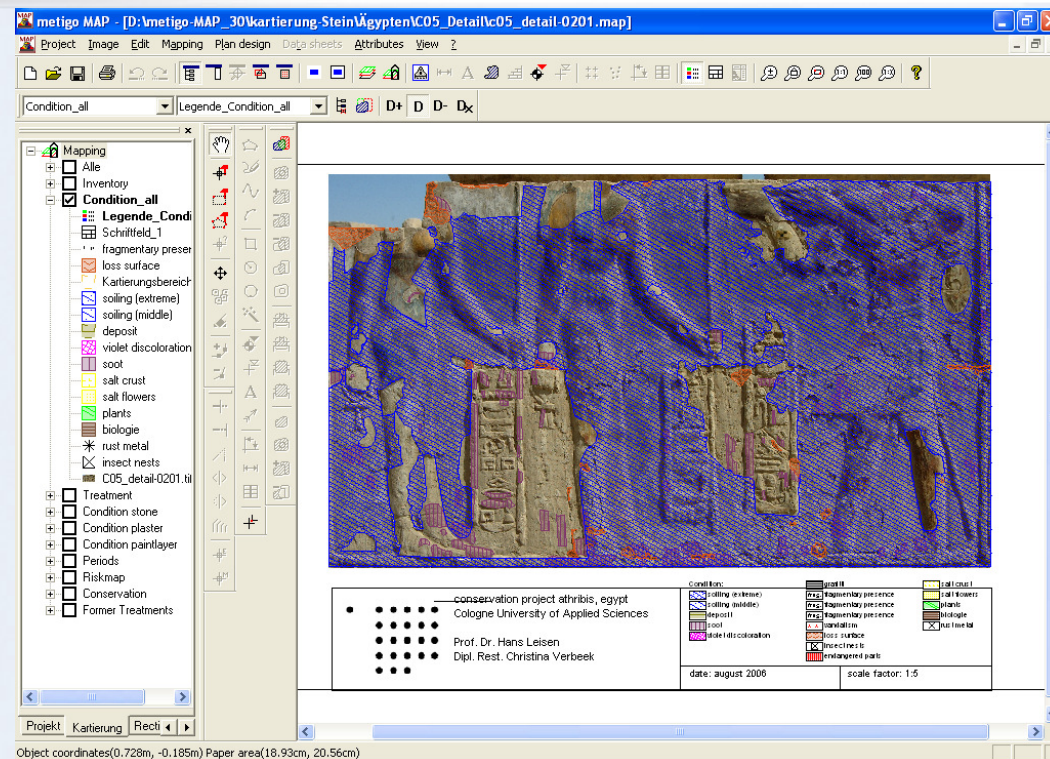
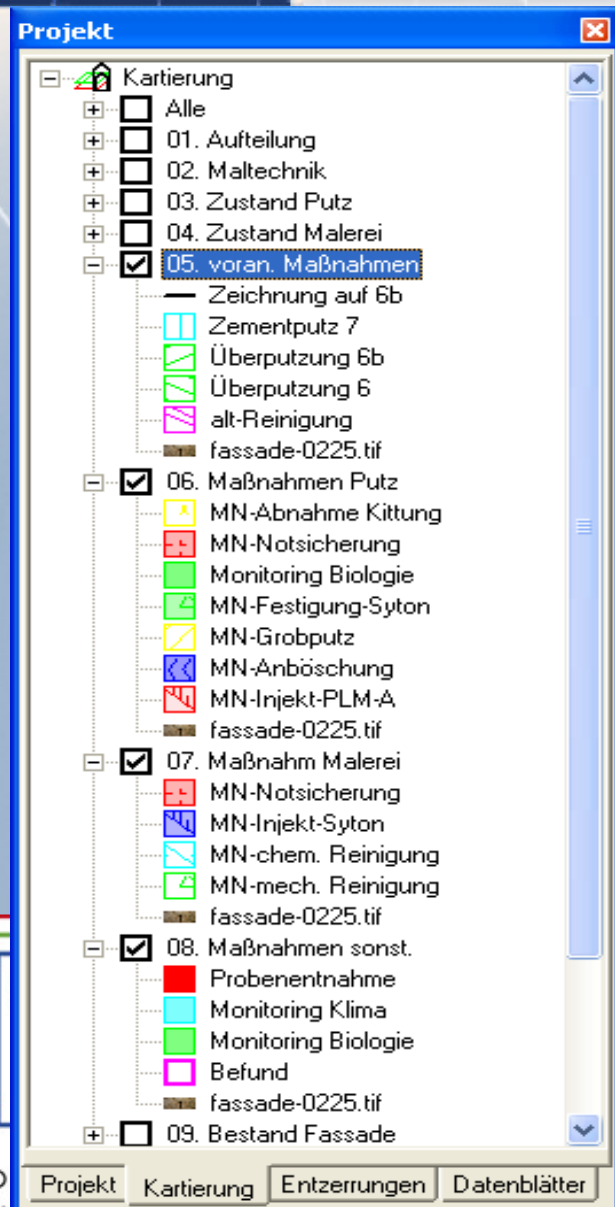
# metigo *MAP* – Mapping groups



(Eqypt, Athribis Project, FH Köln, FB Restoration, Neverhotep e.V.)

- variable combination of:
  - mapping classes
  - image layers (UV-light, Infrared, historical...)
  - Helping planes, legends and title blocks
- display control / arrangement:
  - mapping phases,
  - conservations measures,
  - printing layouts

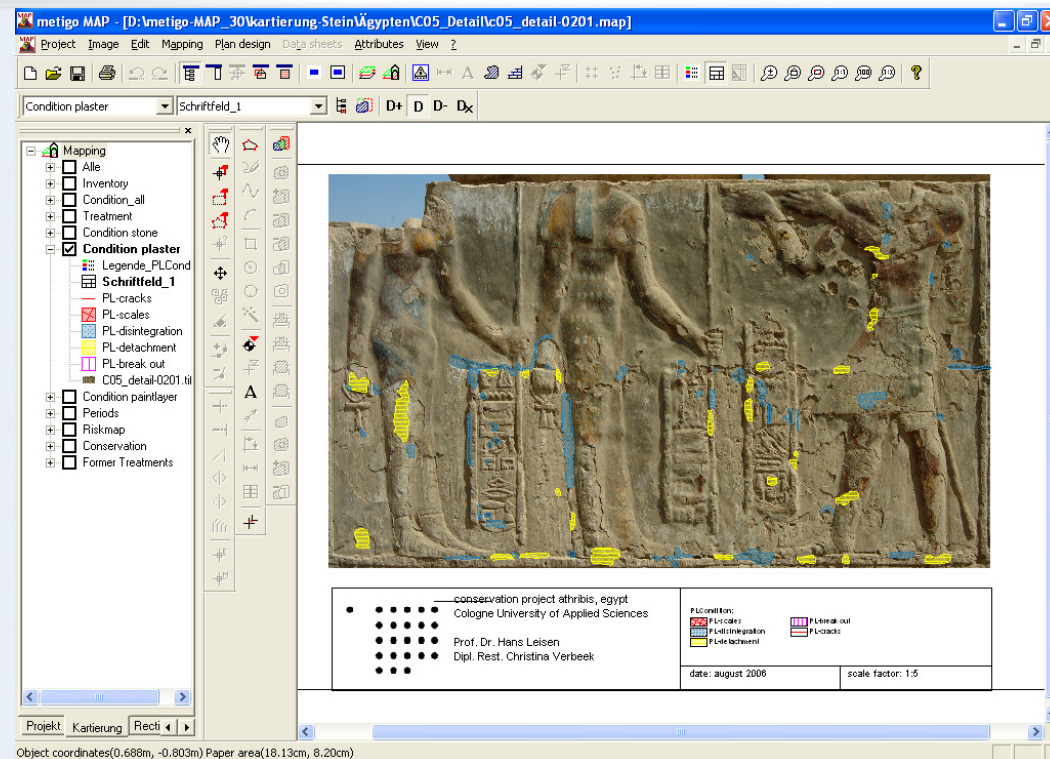
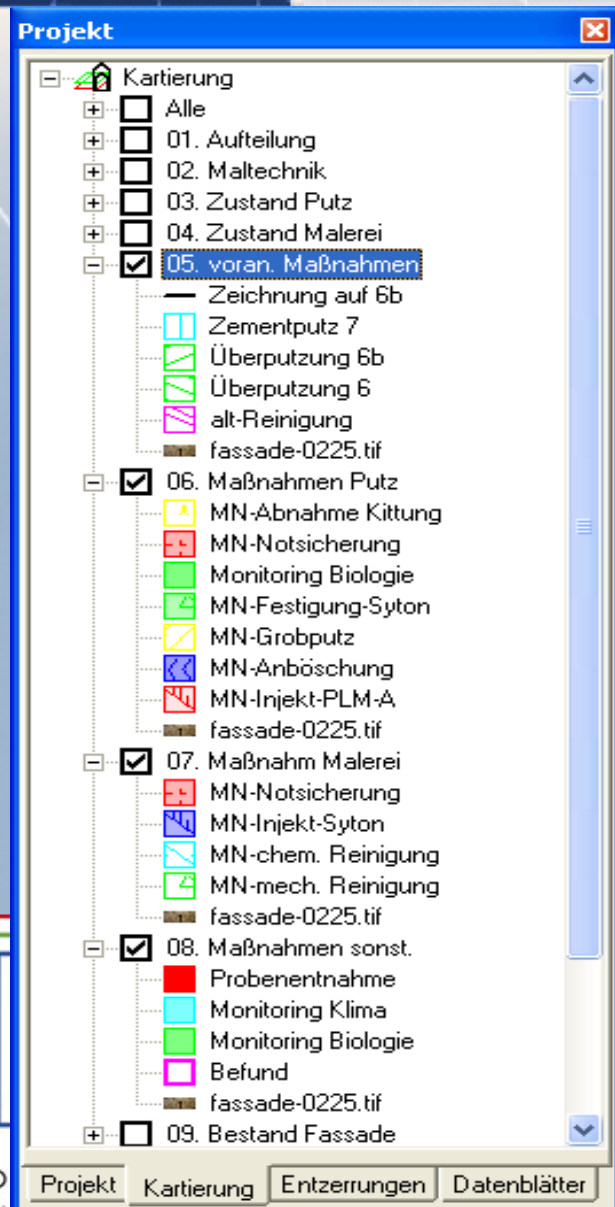
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  - conservations measures,
  - printing layouts

# metigo *MAP* – Mapping groups

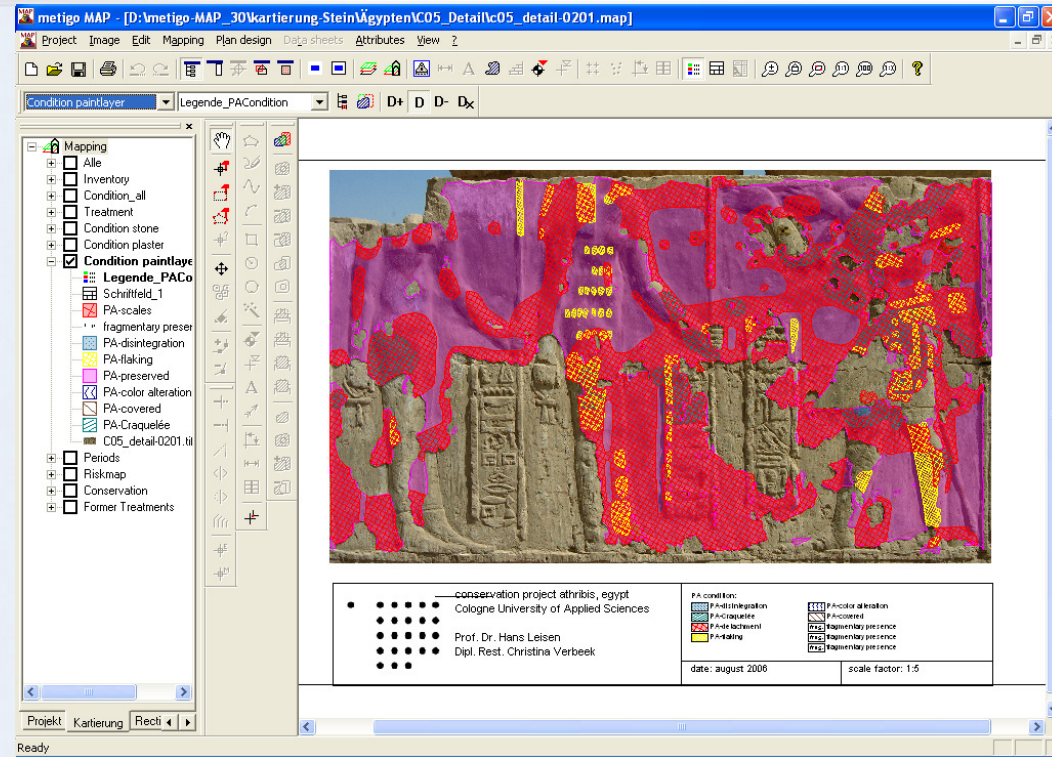
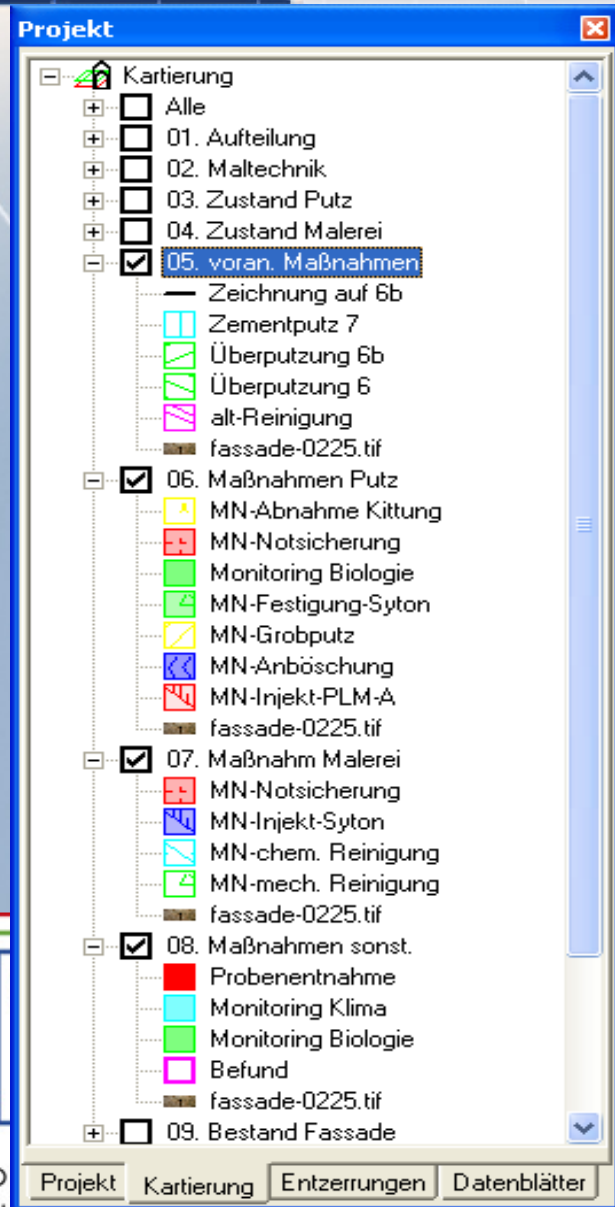


(Eqypt, Athribis Project, FH Köln, FB Restoration, Neverhotep e.V.)

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  - Helping planes, legends and title blocks
- display control / arrangement:
  - mapping phases,
  - conservations measures,
  - printing layouts



# metigo *MAP* – Mapping groups

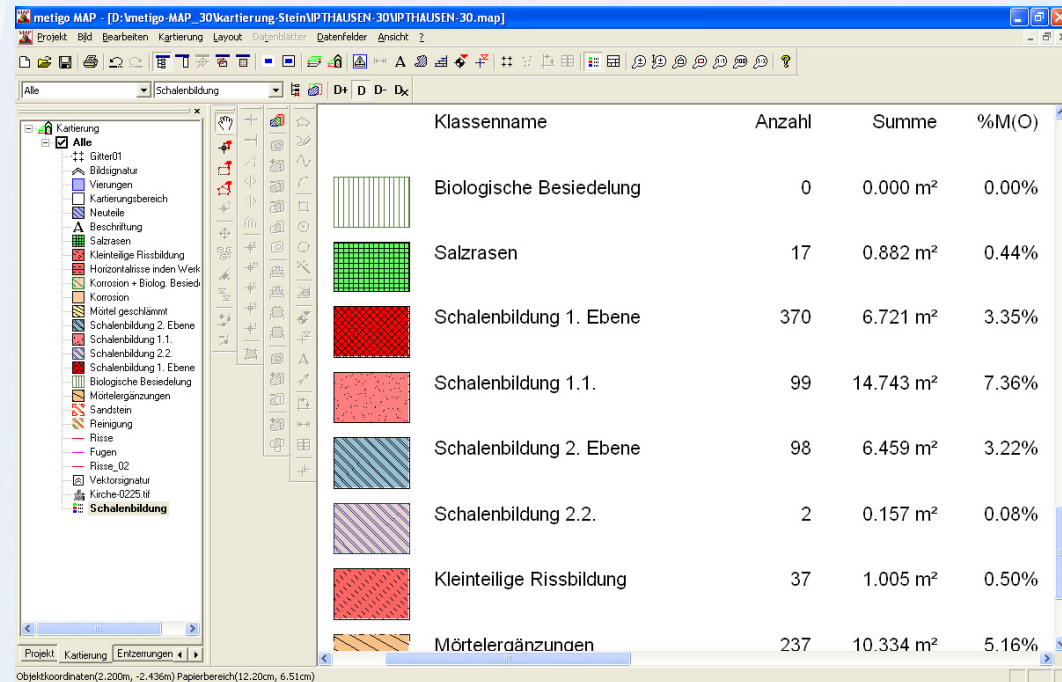


(Eqypt, Athribis Project, FH Köln, FB Restoration, Neverhotep e.V.)

- variable combination of:
  - mapping classes
  - image layers (UV-light, Infrared, historical...)
  - Helping planes, legends and title blocks
- display control / arrangement:
  - mapping phases,
  - conservations measures,
  - printing layouts



# metigo *MAP* – Mapping legends



The screenshot shows the metigo MAP software interface. On the left is a tree view of the project structure, including layers like 'Gitter01', 'Bildsignatur', 'Versungen', 'Kartierungsbereich', 'Neuteile', 'Beschriftung', 'Salzrasen', 'Kleinteilige Rissbildung', 'Horizontale Risse im Werk', 'Korrosion + Biolog. Besied.', 'Mörtel geschlänmt', 'Schalenbildung 2. Ebene', 'Schalenbildung 1.1.', 'Schalenbildung 2.2.', 'Schalenbildung 1. Ebene', 'Biologische Besiedelung', 'Mörtelergänzungen', 'Sandstein', 'Reinigung', 'Risse', 'Risse\_02', 'Vektorsignatur', 'Kirche-0225.tif', and 'Schalenbildung'. The main window displays a table with the following data:

Klassenname	Anzahl	Summe	%M(O)
Biologische Besiedelung	0	0.000 m²	0.00%
Salzrasen	17	0.882 m²	0.44%
Schalenbildung 1. Ebene	370	6.721 m²	3.35%
Schalenbildung 1.1.	99	14.743 m²	7.36%
Schalenbildung 2. Ebene	98	6.459 m²	3.22%
Schalenbildung 2.2.	2	0.157 m²	0.08%
Kleinteilige Rissbildung	37	1.005 m²	0.50%
Mörtelergänzungen	237	10.334 m²	5.16%

At the bottom of the window, it shows 'Objektkoordinaten(2.200m, -2.436m) Papierbereich(12.200m, 6.51cm)'.

- automatic connection of Legend with class management,
- Legend allows display of:
  - quantity survey,
  - percent calculation,
  - size classes...
- group legend for display of group content,
- templates for legends

## Rectification by rectangle

- A rectangle is defined at the object and the width and height are measured.

## Rectification by parallel lines

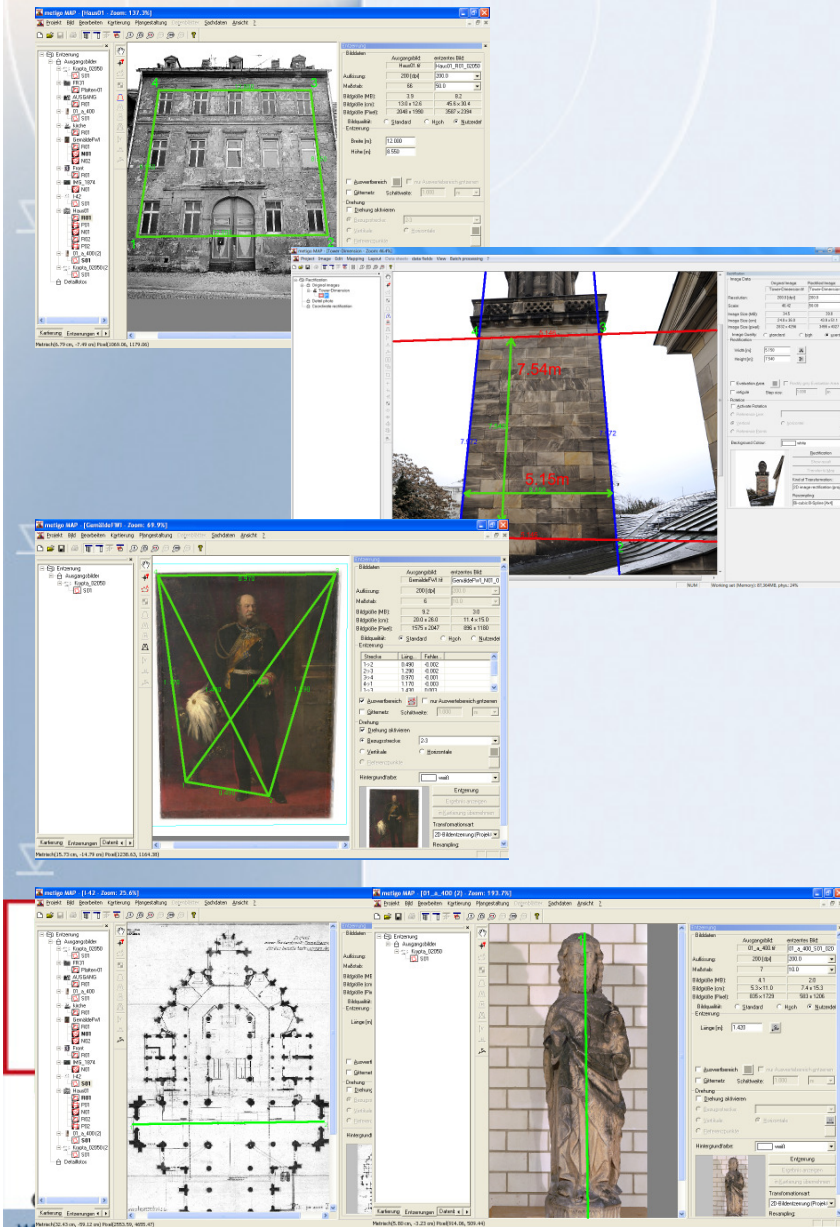
- Horizontal and vertical lines are defined at the object and one measuring section is taken per horizontal and vertical way.

## Rectification by net of distances

- Before photograph 4 points are marked and 6 distances (the 4 border and the 2 diagonals) are measured at the object.

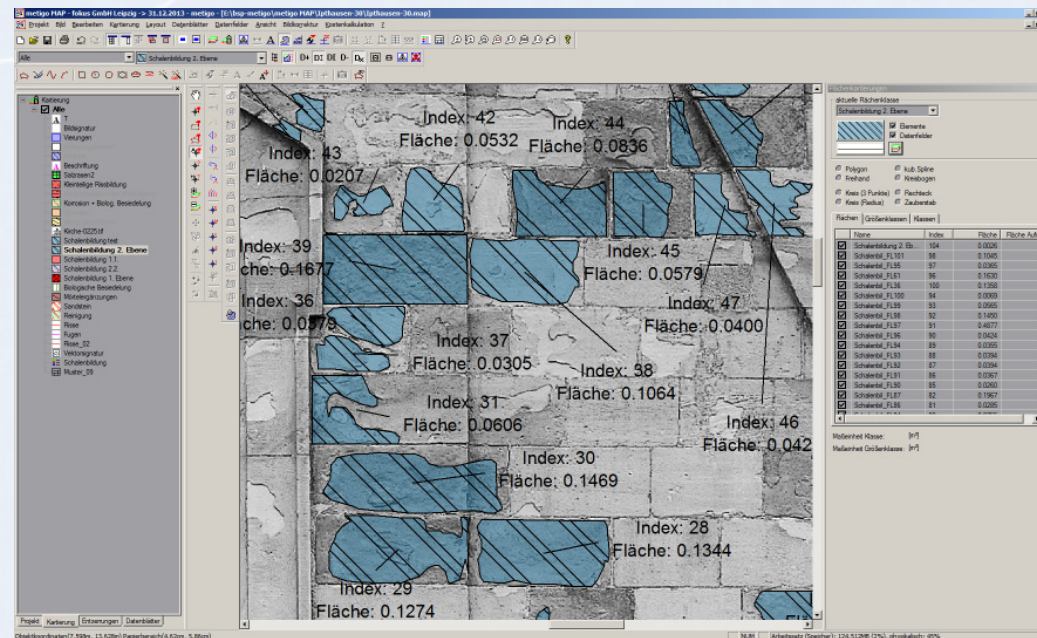
## Scaling function

- Scanned paper plans can be scaled by one object extent or the distance between grid crosses or the scalebar.
- Plastics or bent surfaces can be scaled to one idealized reference extent.



## Drawing tools

- Polygons, splines, free hand line, circle and 3-point arc,
- combined element: Polygon, free hand line, 3-point arc and spline
- CAD- and cutting tools for processing contours of bordering areas and enclosures
- all elements are vector based → offers editing and high quality for output



Wallfahrtskirche Ipthausen, mapping:  
Hendrik Romstedt, Kirchheim/Thür.

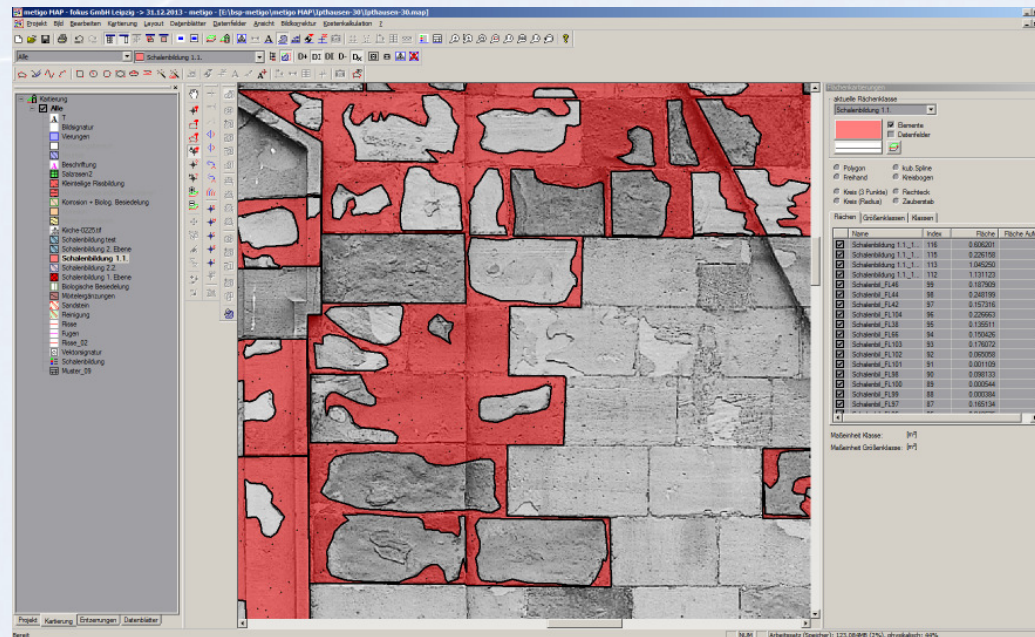
## Quantity survey

- based on true to scale mapping basis (image or CAD-drawing),
- calculate immediately to mapping for each drawn or edited element,
- layer specified assignment of mass calculation (length, area, circumference, depth, volume, sorting in size classes...)



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- Polygons, splines, free hand line, circle and 3-point arc,
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Wallfahrtskirche Ipthausen, mapping:  
Hendrik Romstedt, Kirchheim/Thür.

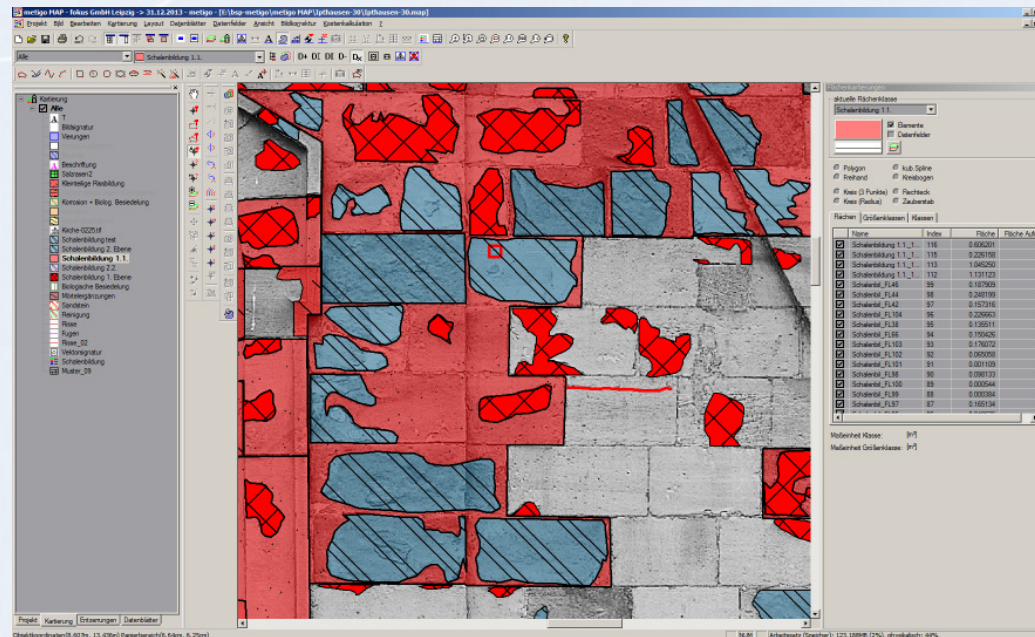
## Quantity survey

- based on true to scale mapping basis (image or CAD-drawing),
- calculate immediately to mapping for each drawn or edited element,
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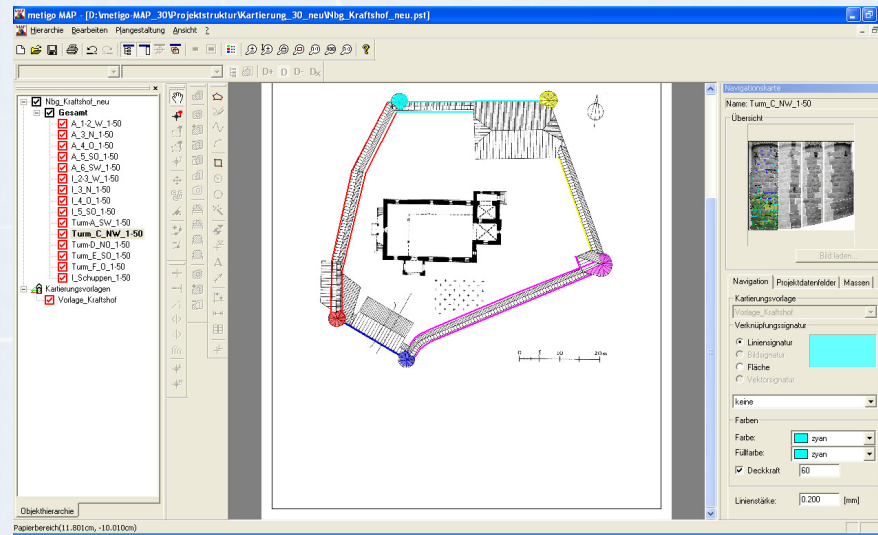


Wallfahrtskirche Ipthausen, mapping:  
Hendrik Romstedt, Kirchheim/Thür.

## Quantity survey

- based on true to scale mapping basis (image or CAD-drawing),
- calculate immediately to mapping for each drawn or edited element,
- layer specified assignment of mass calculation (length, area, circumference, depth, volume, sorting in size classes...)

# metigo *MAP* – Object hierarchy

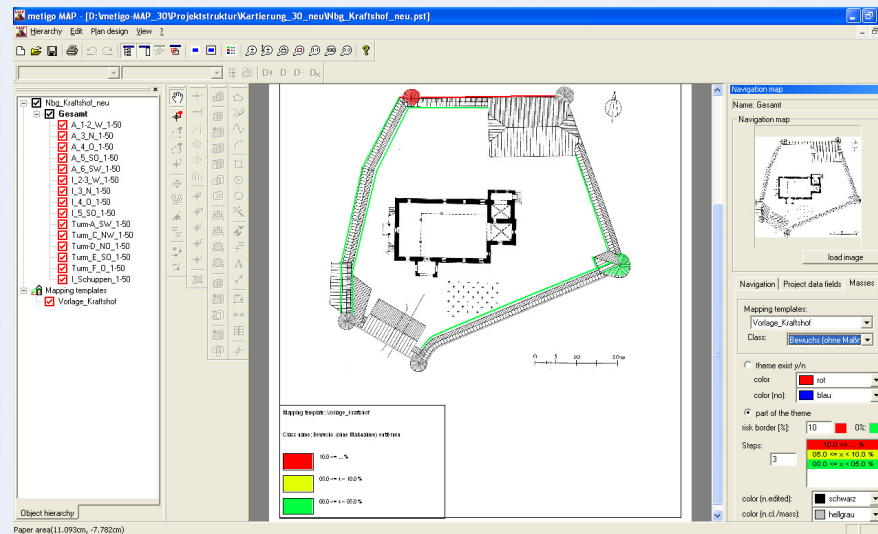


## Mapping template

- Processing of mapping templates,
- adaption of project changes over object hierarchy

## Project organisation

- Projects are saved on harddisk like displayed in object tree



## Projekt navigation

- simple with structure tree
- navigation map with link areas for better navigation in large projects

## Quantity survey

- request of mass protocolls,
- visual analysis of damage in navigation map



metigo MAP - [E:\Bsp-metigo\MAP-Projekte\Hierarchien\Hierarchie Wiesbaden\Hierarchie\_Wiesbaden.pst]

Hierarchie Bearbeiten Layout Ansicht Stapelverarbeitung ?

N 1 X E

**Hierarchie\_Wiesbaden**

- giebel\_nord
- giebel\_süd
- mitte\_nordost
- mitte\_nordwest
- mitte\_südost
- mitte\_südwest
- mittelrum\_nord
- mittelrum\_ost
- mittelrum\_süd
- mittelrum\_west
- nordost
- nordseite
- nordseite\_links
- nordseite\_rechts\_w1
- nordwest
- ostseite
- ostseite\_architr\_links
- ostseite\_architr\_rechts
- ostseite\_balkon\_links
- ostseite\_balkon\_rechts
- ostseite\_links
- ostseite\_nordanbau
- ostseite\_rechts
- ostseite\_südanbau
- ostseite\_umschl\_rechts
- ostseite\_umschl\_links
- südost
- südost\_ba3
- südseite
- südseite\_o1
- südseite\_rechts
- südseite\_links
- südseite\_w5
- südwest
- südwest\_ba3
- turm\_ost
- turm\_süd
- turm\_west
- westseite\_links
- westseite\_mitte
- westseite\_mitte\_links
- westseite\_mitte\_rechts
- westseite\_mitte\_rück
- westseite\_rechts

☐ Kartierungsvorlagen  
☒ Vorlage\_Wiesbaden

Objekthierarchie

Kartierungsvorlage: Vorlage\_Wiesbaden  
Klassenname: 2.4.16 Festigung

15 <= ...  
08 <= x < 15  
00 <= x < 08

Kartierungsvorlage: Vorlage\_Wiesbaden  
Klassenname: 2.4.16 Festigung

Kartierungsvorlage: Vorlage_Wiesbaden	Stückzahl	Prozent
Gesamtsumme	100	100.00%
giebel_nord	10	10.00%
giebel_süd	2	2.00%
mitte_nordost	3	3.00%
mitte_nordwest	3	3.00%
mitte_südost	3	3.00%
mitte_südwest	4	4.00%
mittelrum_nord	2	2.00%
mittelrum_ost	4	4.00%
mittelrum_süd	5	5.00%
mittelrum_west	4	4.00%
nordost	6	6.00%
nordseite	21	21.00%
nordseite_links	6	6.00%
nordseite_rechts_w1	15	15.00%
nordwest	20	20.00%
ostseite	15	15.00%
ostseite_architr_links	0	0.00%
ostseite_architr_rechts	0	0.00%
ostseite_balkon_links	1	1.00%
ostseite_balkon_rechts	2	2.00%
ostseite_links	30	30.00%
ostseite_nordanbau	9	9.00%
ostseite_rechts	51	51.00%
ostseite_südanbau	0	0.00%
ostseite_umschl_rechts	5	5.00%
ostseite_umschl_links	2	2.00%
südost	8	8.00%
südost_ba3	14	14.00%
südseite	34	34.00%
südseite_o1	21	21.00%
südseite_rechts	2	2.00%
südseite_links	8	8.00%
südseite_w5	3	3.00%
südwest	7	7.00%
südwest_ba3	5	5.00%
turm_ost	14	14.00%
turm_süd	13	13.00%
turm_west	7	7.00%
westseite_links	69	69.00%
westseite_mitte	0	0.00%
westseite_mitte_links	7	7.00%
westseite_mitte_rechts	6	6.00%
westseite_mitte_rück	1	1.00%
westseite_rechts	32	32.00%
Summe Stückzahl	474	474.00%

Navigation

Projektdatenfelder Massen Stückzahl

Kartierungsvorlagen:  
Vorlage\_Wiesbaden

Klasse: 2.4.16 Festigung

Thema vorhanden ja/nein

Farbe (ja): Rot  
Farbe (nein): Schwarz

Themenanteil

Gesamtstückzahl: 100

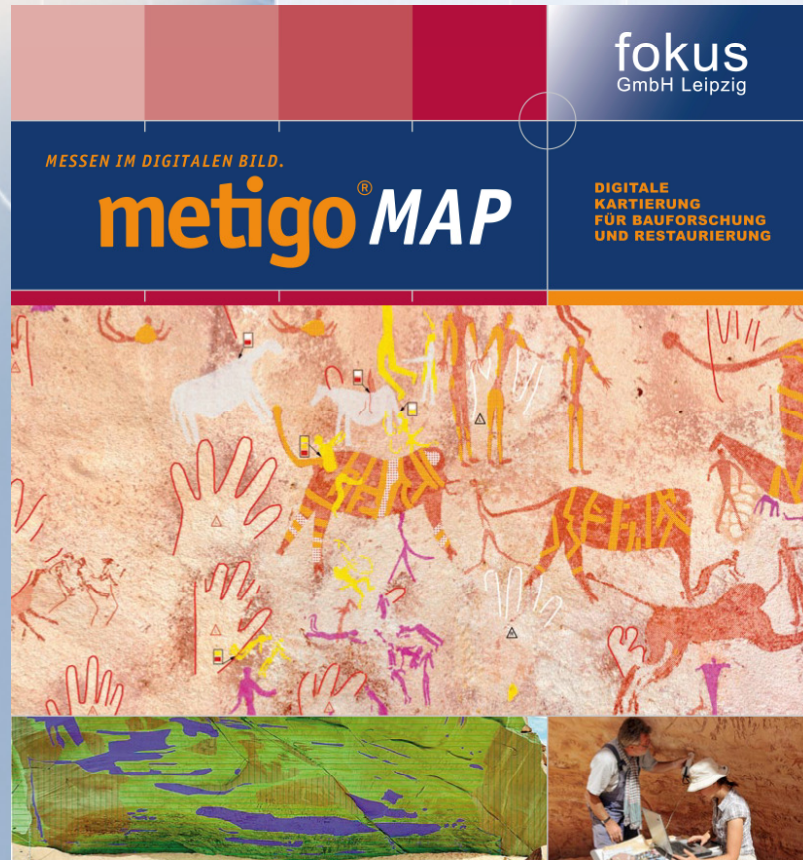
Risikogrenze (Stück): 15 0%  
15 <= x < 15 %  
08 <= x < 15 %  
00 <= x < 08 %

Stufenanzahl: 3

Farbe (K.Klasse): Dunkelgrau

NUM





**Wadi Sura II, Ägypten (Gif Kebir):  
Prähistorische Felsmalerei**

Eines der größten Felskunstdenkmäler der gesamten Sahara ist die „Cave of beasts“ im Wadi Sura („Tal der Bilder“), ein ausgemaltes Felsdach in der ägyptischen Westwüste. Über 8.000 Einzelfiguren – Gazellen, Giraffen, mythische Wesen wie z.B. kopflose Monster, Menschen während schwer interpretierbarer Handlungen – entstanden zwischen ca. 6.500 und 4.500 v. Chr. durch Jäger und Sammler. Projektziel ist, den gesamten Bildbestand und die Felsoberfläche durch 3D-

Laserscanning und hochauflösende Fotografie zu dokumentieren, um eine detaillierte Kartierung von Bestand und Zustand des Objektes zu erstellen sowie die datenbankgestützte archäologische Erfassung der Figuren zu ermöglichen. Neben der Visualisierung von Schadensphänomenen unterstützt die Kartierung die Analyse von Maltechniken, die Klassifizierung der Farben und Pigmente sowie die Erfassung unterschiedlicher Krusten, die während der ehemals feuchteren Bedingungen entstanden sind und die Malereien z.T. überlagern und damit schützen wie auch deren Sichtbarkeit ein-

schränken. Mit den so gewonnenen Erkenntnissen soll eine Konzeption für Schutz und Erhaltung von Felsbildern unter extrem trockenen Klimabedingungen erarbeitet werden.

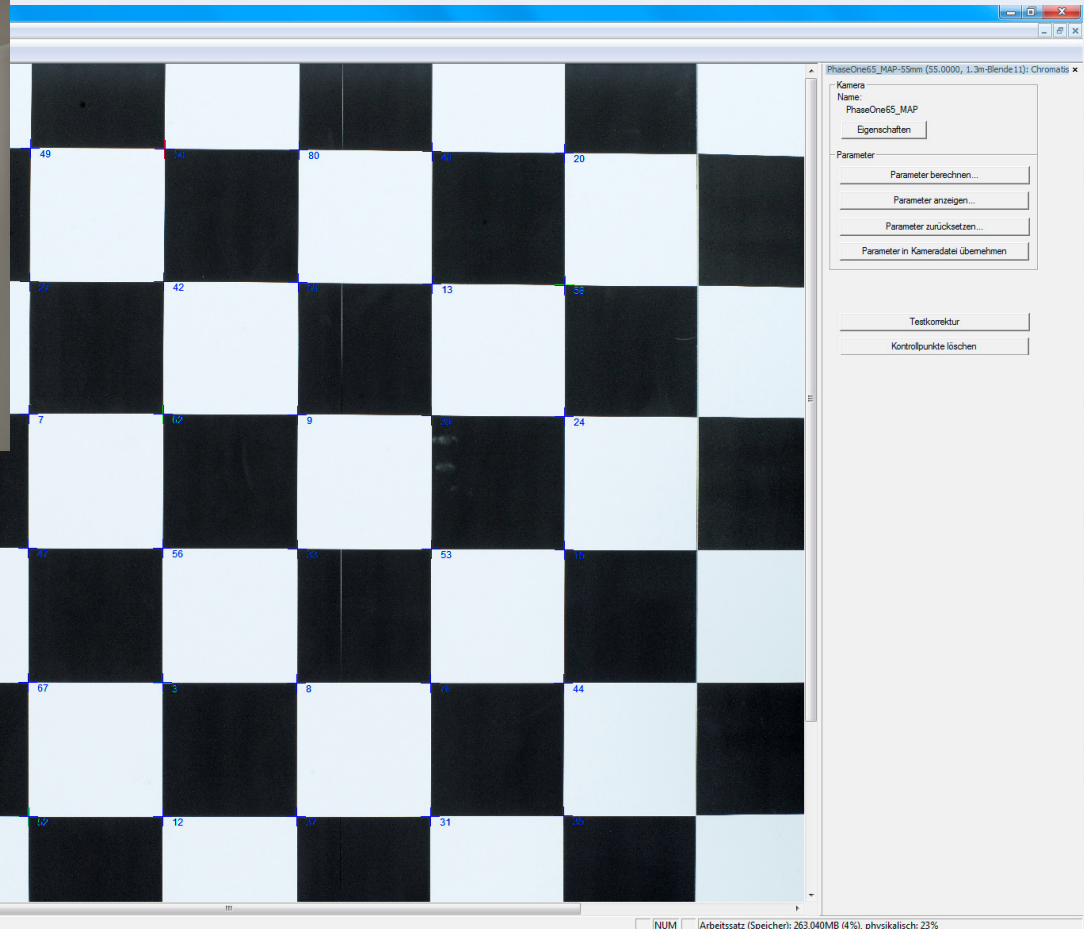
*Kartierung: Prof. Dr. Hans Leisen, Dipl. Rest. Sabine B. Krause M.A., FH Köln, Institut für Restaurierungs- und Konservierungswissenschaft, Fakultät für Kulturwissenschaften  
Projekt: „Wadi Sura – Eine Felskunststation und ihr landschaftsarchäologischer Kontext im Gif Kebir“ (Förderung: DFG)  
Projektpartner: Dr. Rudolph Kuper, Heinrich Barth Institut e.V.*

## New in Version 4.0

- Correction of image defects
- rectification by coordinates
- automated rectification
- evaluation of image stacks
- user management
- Object-orientated mapping
- Module for cost calculation
- 3D mapping

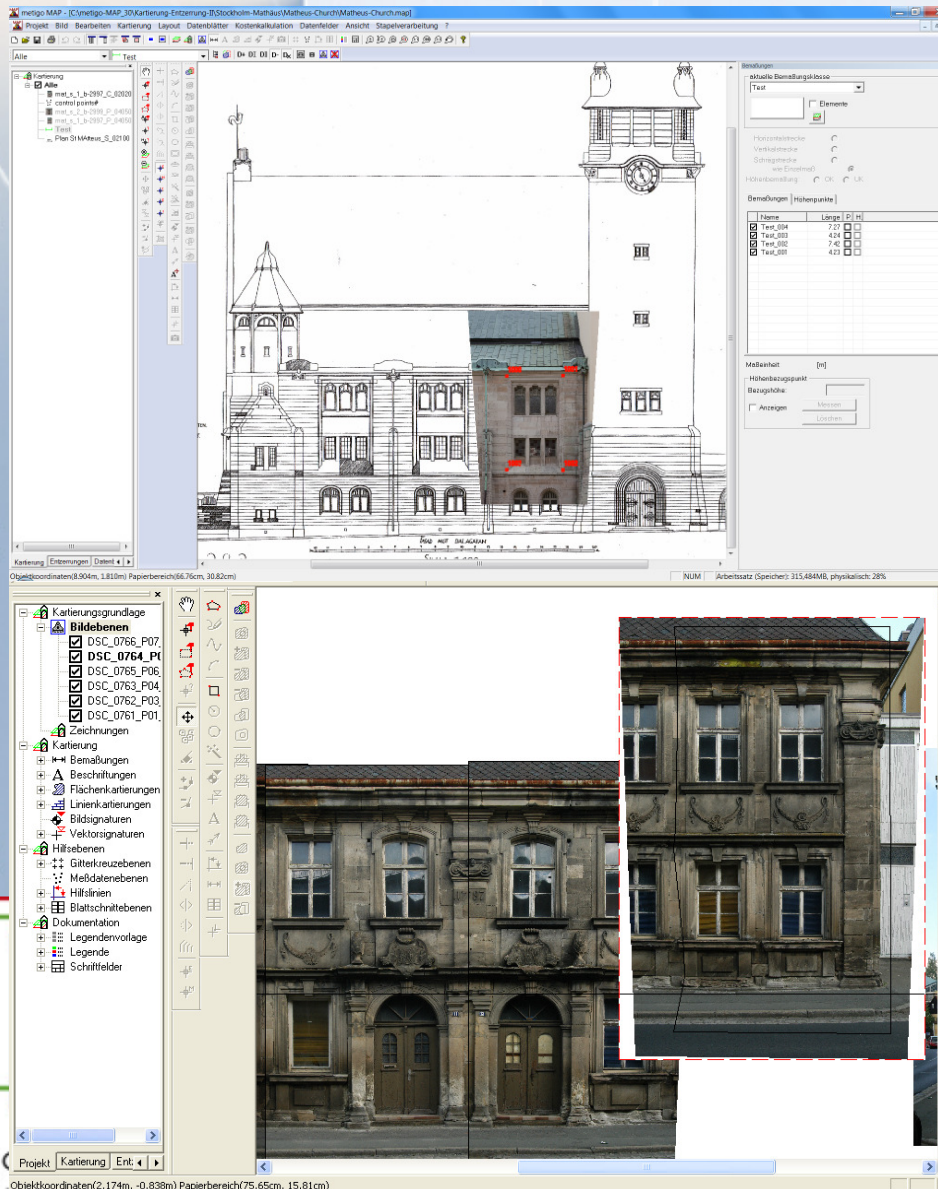


## metigo *MAP 4.0* – Correction of image defects



- recording of chessboard
- automated calculation of correction parameters by polynom  
→ correction chromatic aberration and distortion
- distortion correction is also possible by photogrammetric calibration





## Image rectification by coordinates

- Measurement of coordinates on the basis of a CAD-drawing or scaled plan
- interface for import of 3D coordinates, that are measured with total station.

## Image montage

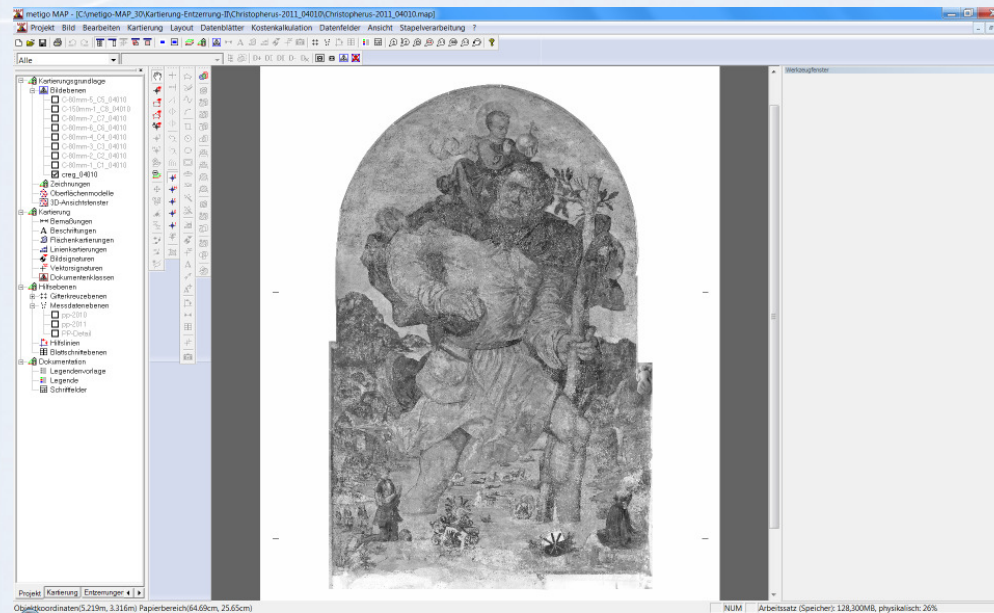
- Montage of image plans with different images scales and qualities (resolution, colour, grey scaled)
- Montage- and image processing functions,
- export multi layer TIFF for additional processing in Adobe photoshop



# metigo *MAP 4.0* – automated Image rectification

## Automated image rectification with Matching

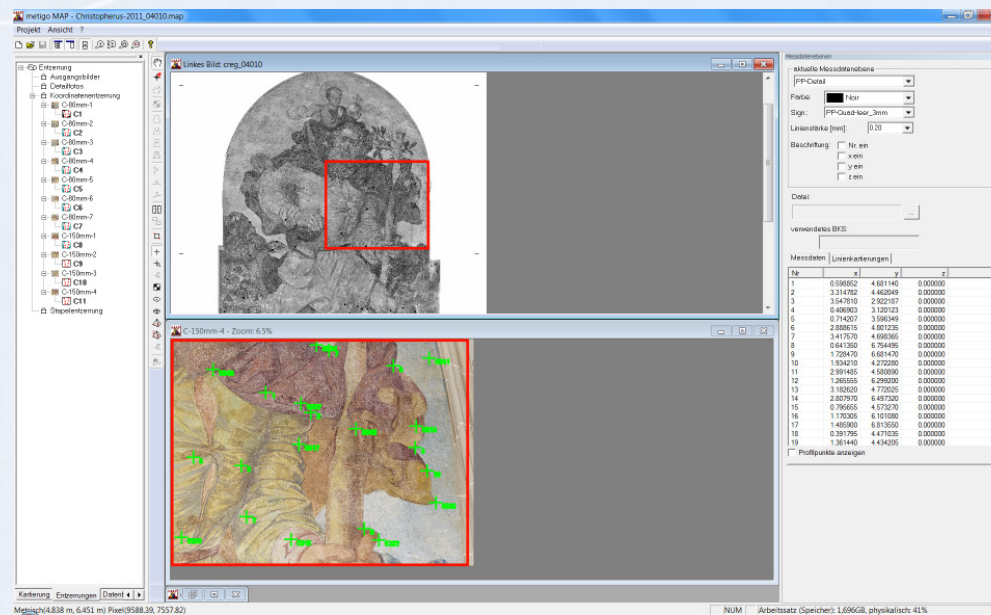
- image rectification of only one total view image  
→ result is used as reference for matching
- for each of the other images user only has to define approximate rectangle on reference



# metigo *MAP 4.0* – automated Image rectification

## Automated image rectification with Matching

- substantial similarity in images of same object allow measurement of subpixel precision for corresponding image points
- congruent rectification on the base of identical points
- higher accuracy for image montage because of subpixel precision

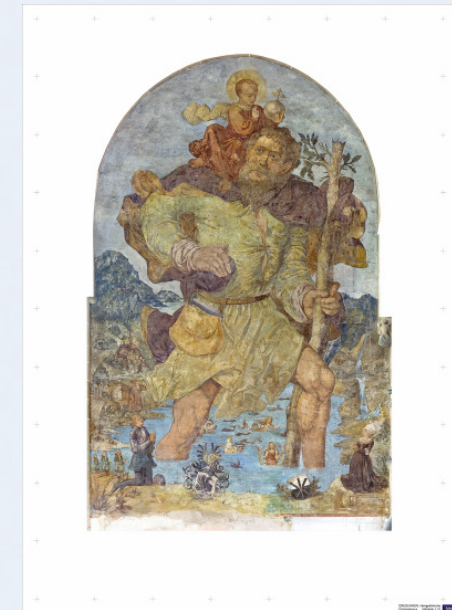
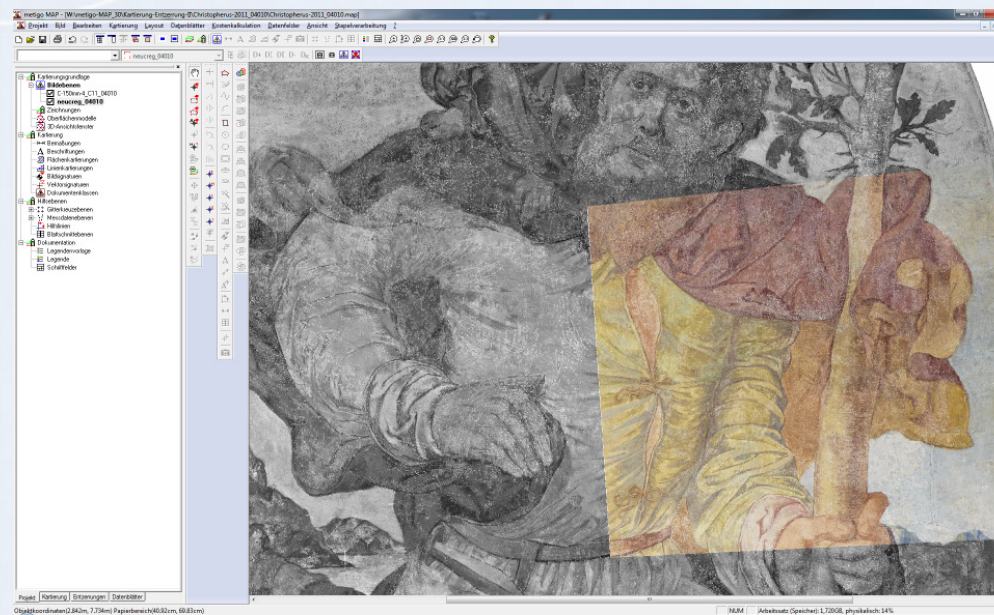




# metigo *MAP 4.0* – automated Image rectification

## Examples

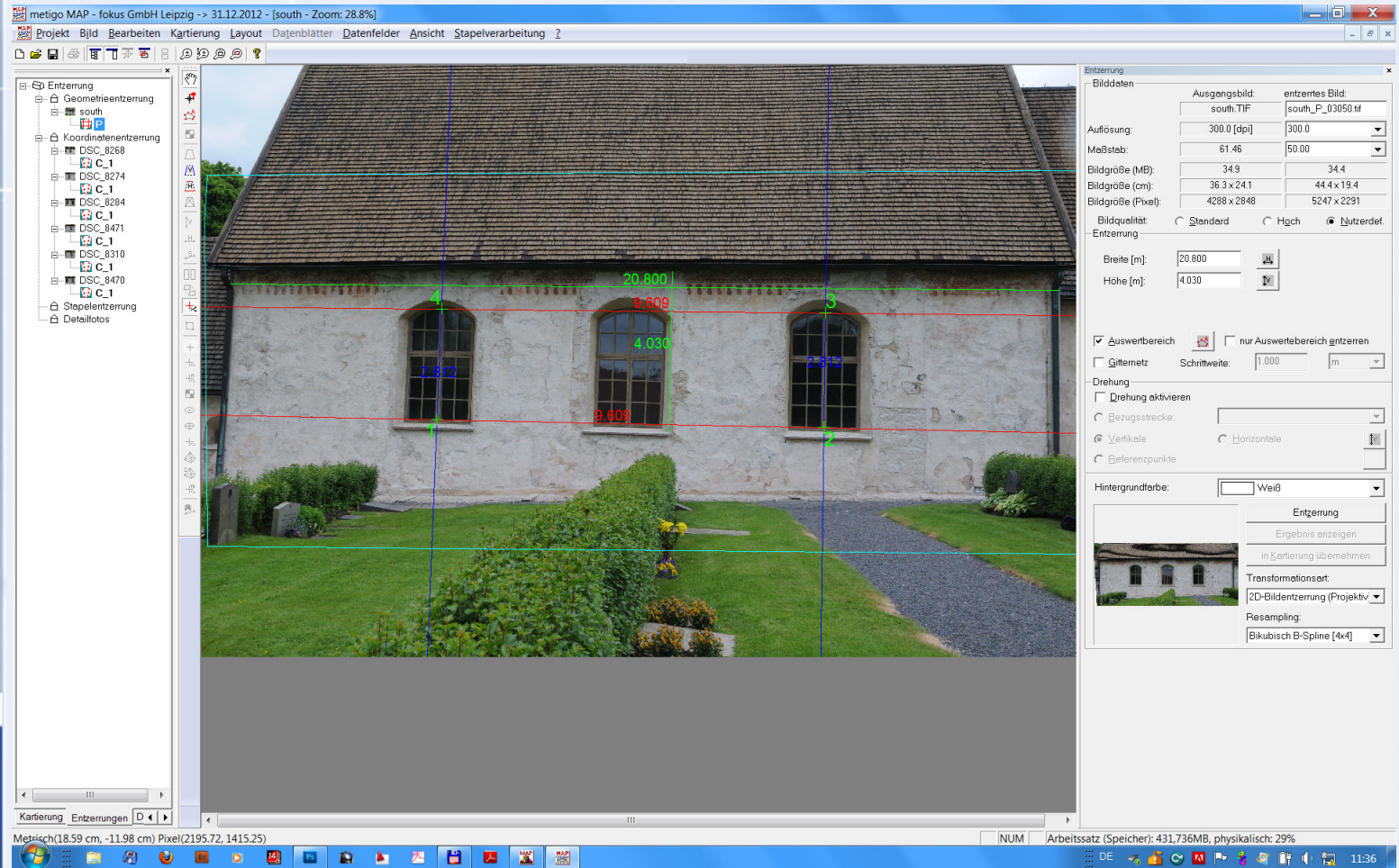
- additional documentations of preliminary results can be made during conservation process and can be transformed to the first image / existing documentation
- transform detail image with high resolution on existing image plan  
→ only for selected detail or whole image plan in higher resolution



- Creglingen, church Herrgottskirche, Christopherus Fresco, 2012  
Image plan in scale 1:10

# metigo *MAP 4.0* – automated Image rectification

- Alvesta, Sweden, 2012



- overview image rectified by geometry (parallel lines)





# metigo *MAP 4.0* – automated Image rectification

metigo MAP - fokus GmbH Leipzig -> 31.12.2012

Projekt Ansicht ?

Entzerrung

- Geometrieentzerrung
- south
- P
- Koordinatenentzerrung
- DSC\_8268
- C\_1
- DSC\_8274
- C\_1
- DSC\_8284
- C\_1
- DSC\_8471
- C\_1
- DSC\_8310
- DSC\_8470
- C\_1
- DSC\_8310 (2)
- C\_1
- Stopelentzerrung
- Detaillfotos

aktueller Messdatenebene

Neupunkte

Farbe: Grün

Sign.: PP-Quad-leer\_3mm

Linienstärke [mm]: 0.20

Beschriftung: ☒ Nr. ein  
☐ x ein  
☐ y ein  
☐ z ein

Datei:

verwendetes BKS:

Messdaten | Linienkartierungen

Nr	x	y	z
1	11.684713	1.508219	0.000000
2	11.722813	-1.323881	0.000000
3	9.449513	-0.430647	0.000000
4	14.368646	-3.375119	0.000000

automatische Punktsuche

☒ Raster Breite: 4 Höhe: 4 ☐ Punktliste

Pu	R	V	R	NV	gr F	RMS[m]	Tl...
<input checked="" type="checkbox"/> 11	X	2.1...	51...	1.2...	-4...	-0.005	0.0...
<input checked="" type="checkbox"/> 11	Y	-0...	58...	0.0...	0.1...	-0.000	0.0...
<input checked="" type="checkbox"/> 18	X	-2...	86...	0.9...	2.4...	-0.004	0.0...
<input checked="" type="checkbox"/> 18	Y	-1...	89...	0.8...	2.1...	-0.004	0.0...
<input checked="" type="checkbox"/> 25	X	-0...	88...	0.3...	0.8...	0.002	0.0...
<input checked="" type="checkbox"/> 25	Y	1.4...	89...	0.6...	-1...	0.003	0.0...
<input checked="" type="checkbox"/> 34	X	0.5...	76...	0.3...	-0...	-0.001	0.0...
<input checked="" type="checkbox"/> 34	Y	0.6...	78...	0.3...	-0...	0.002	0.0...
<input checked="" type="checkbox"/> 65	X	0.2...	75...	0.1...	-0...	-0.000	0.0...
<input checked="" type="checkbox"/> 65	Y	0.3...	79...	0.1...	-0...	0.001	0.0...
<input checked="" type="checkbox"/> 74	X	-2...	55...	1.4...	4.8...	0.007	0.0...
<input checked="" type="checkbox"/> 74	Y	-1...	61...	0.6...	2.0...	-0.003	0.0...
<input checked="" type="checkbox"/> 80	X	-0...	66...	0.1...	0.2...	-0.000	0.0...
<input checked="" type="checkbox"/> 80	Y	1.0...	67...	0.1...	0.2...	-0.000	0.0...

167 gefundene Punkte

Startpunktnummern: 1

☒ Filtere Punkte nach dem Berechnen

Berechnung Protokoll anzeigen

Parameter: Anzeigen

OK Abbrechen

Kartierung Entzerrungen

Metrisch(40.26 cm, -17.15 cm) Pixel(4755.00, 2025.00)

NUM Arbeitssatz (Speicher: 729.048MB, physikalisch: 33%)

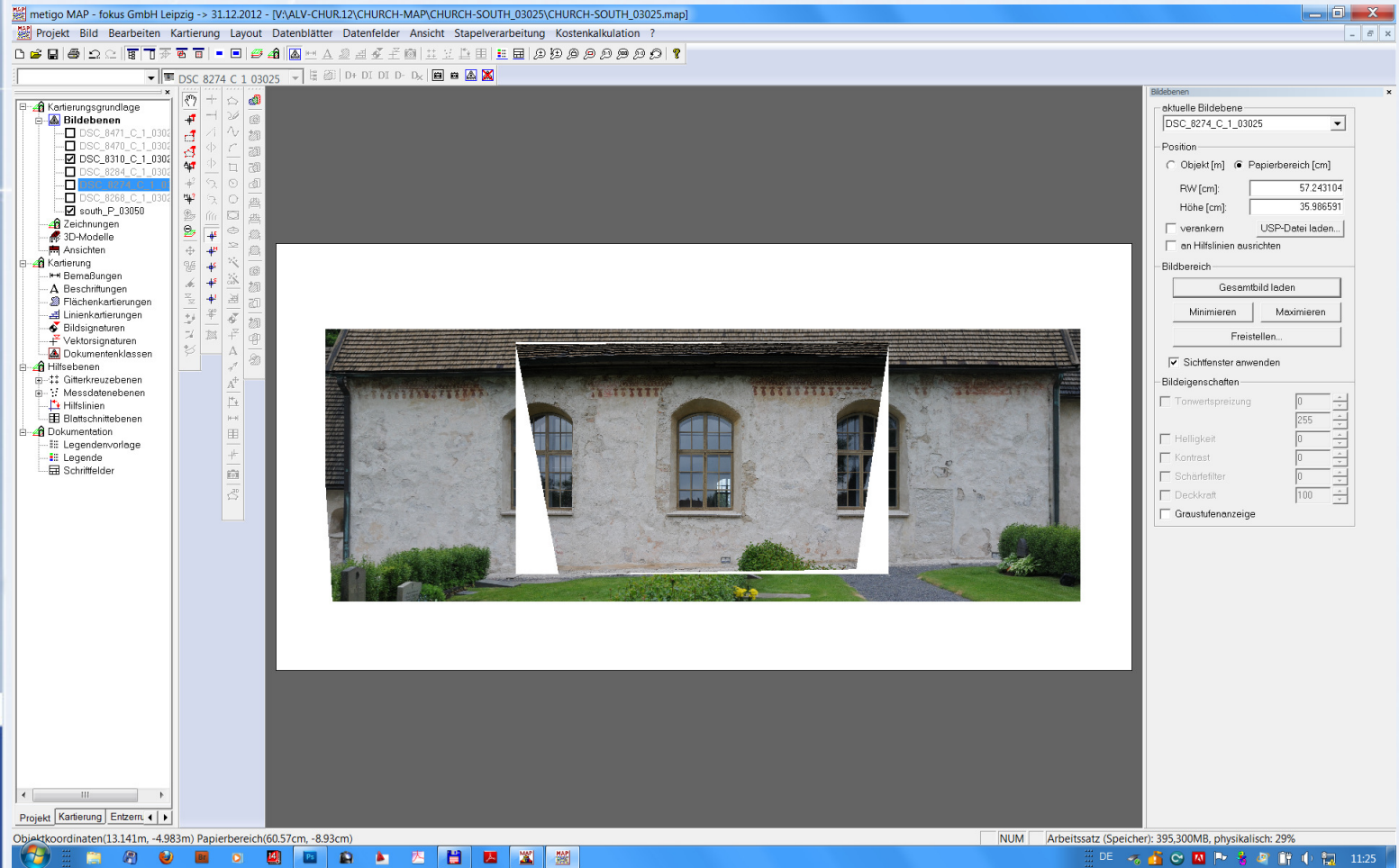
DE 11:44

- automated detection of identical points in search area of details





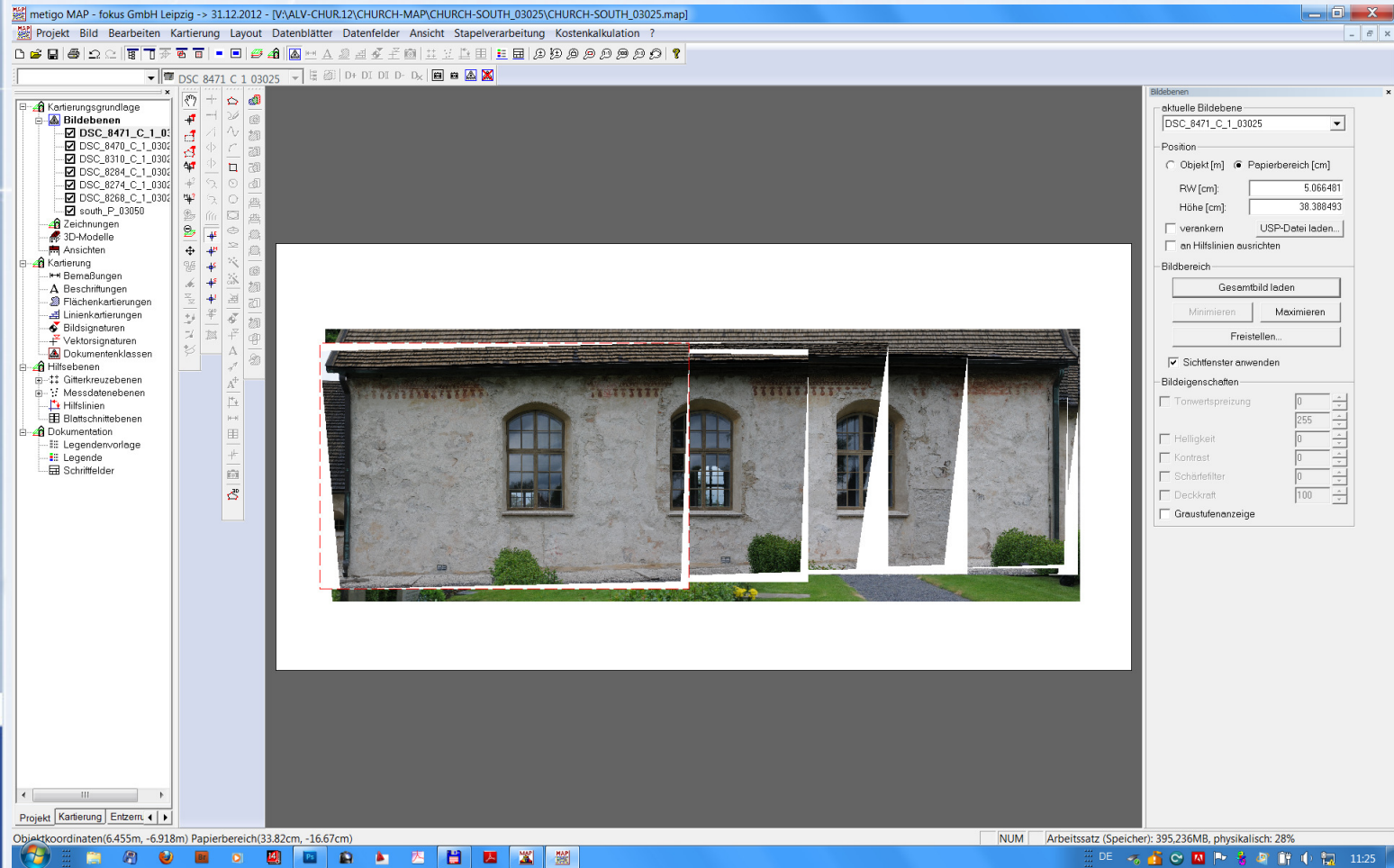
# metigo *MAP 4.0* – automated Image rectification



- overlay of one detail rectification on rectified overview image



# metigo *MAP 4.0* – automated Image rectification



- overlay of all detail rectifications





Abstand Gitterkreuze: 1.00m

CHURCH-SOUTH\_04050  
Maßstab 1:50



## metigo *MAP 4.0* – Image stacks

### Automated rectification of thermografic image sequences

(Kühren, church , 2012 - development project with IDK Dresden, Dr. rer. nat. C. Franzen)

- nondestructive detection of local separations of mural paintings
- heating of wall area in small steps
- documentation of heat up and cool down phase in fixed time steps by infrared camera

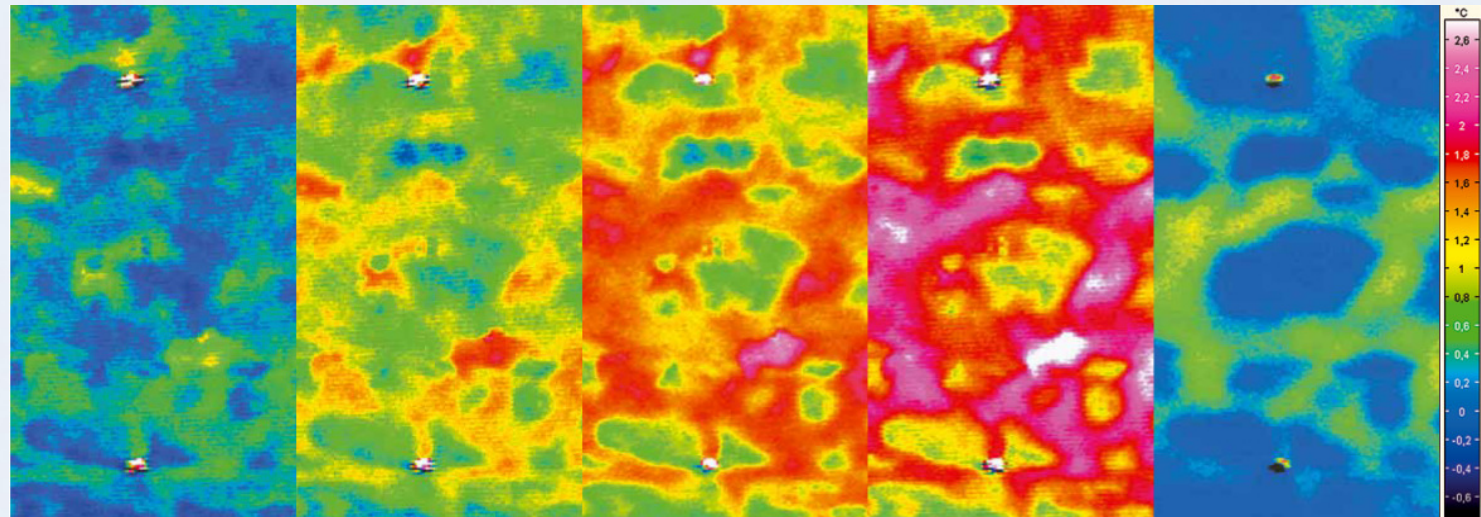




## Automated rectification of thermographic image sequences

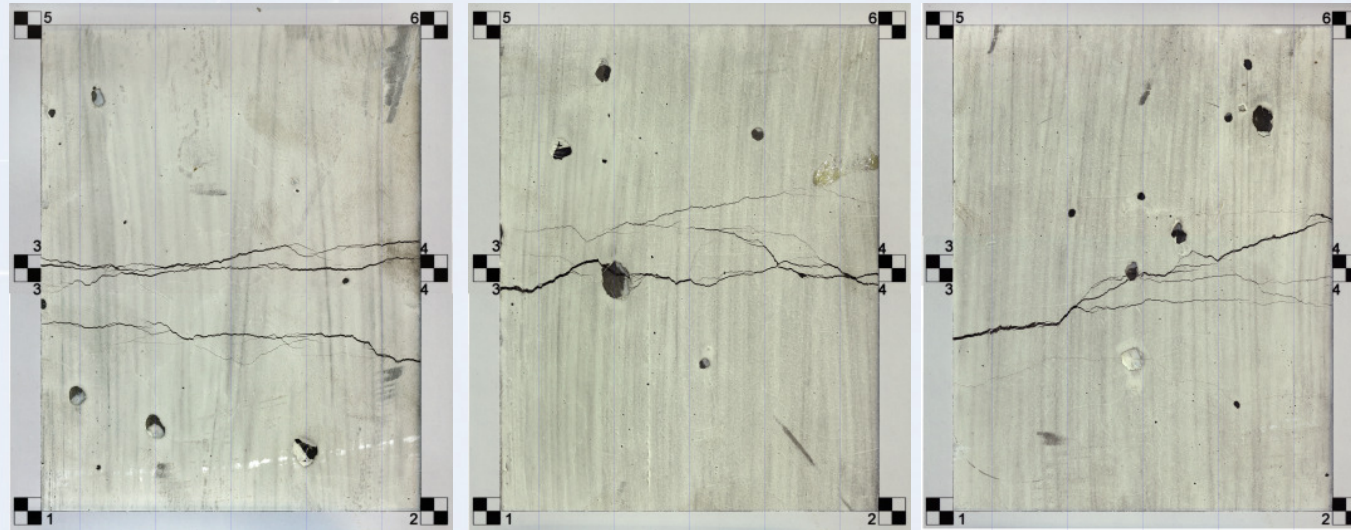
(Kühren, church , 2012 - development project with IDK Dresden, Dr. rer. nat. C. Franzen)

- varying heat conduction to underlying brickwork allows conclusions about detachment of plasters from the wall
- thermographic reference points for automated rectification
- automated rectification of image sequence and Integration in structure of a mapping project
- 5 images of one sequence of 58 images shown temperature  
blue:  $-0,6^{\circ}\text{C}$  until magenta:  $+2,8^{\circ}\text{C}$



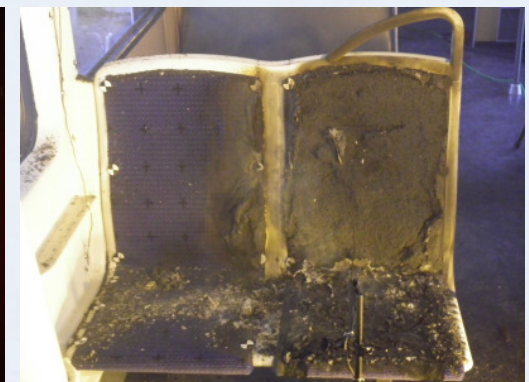
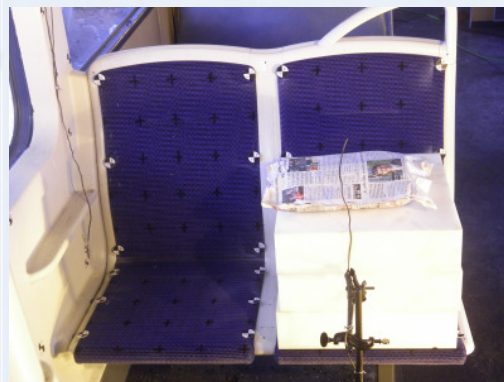


## Automated rectification of image stack



Tensile tests on SHCC-concretes (fibrated concrete)

Evaluation of width, number, arrangement of cracks, HTWK Leipzig, faculti buildings



Fire tests for city trains (Nuremberg),  
Brandschutz Consult Ingenieurgesellschaft mbH Leipzig



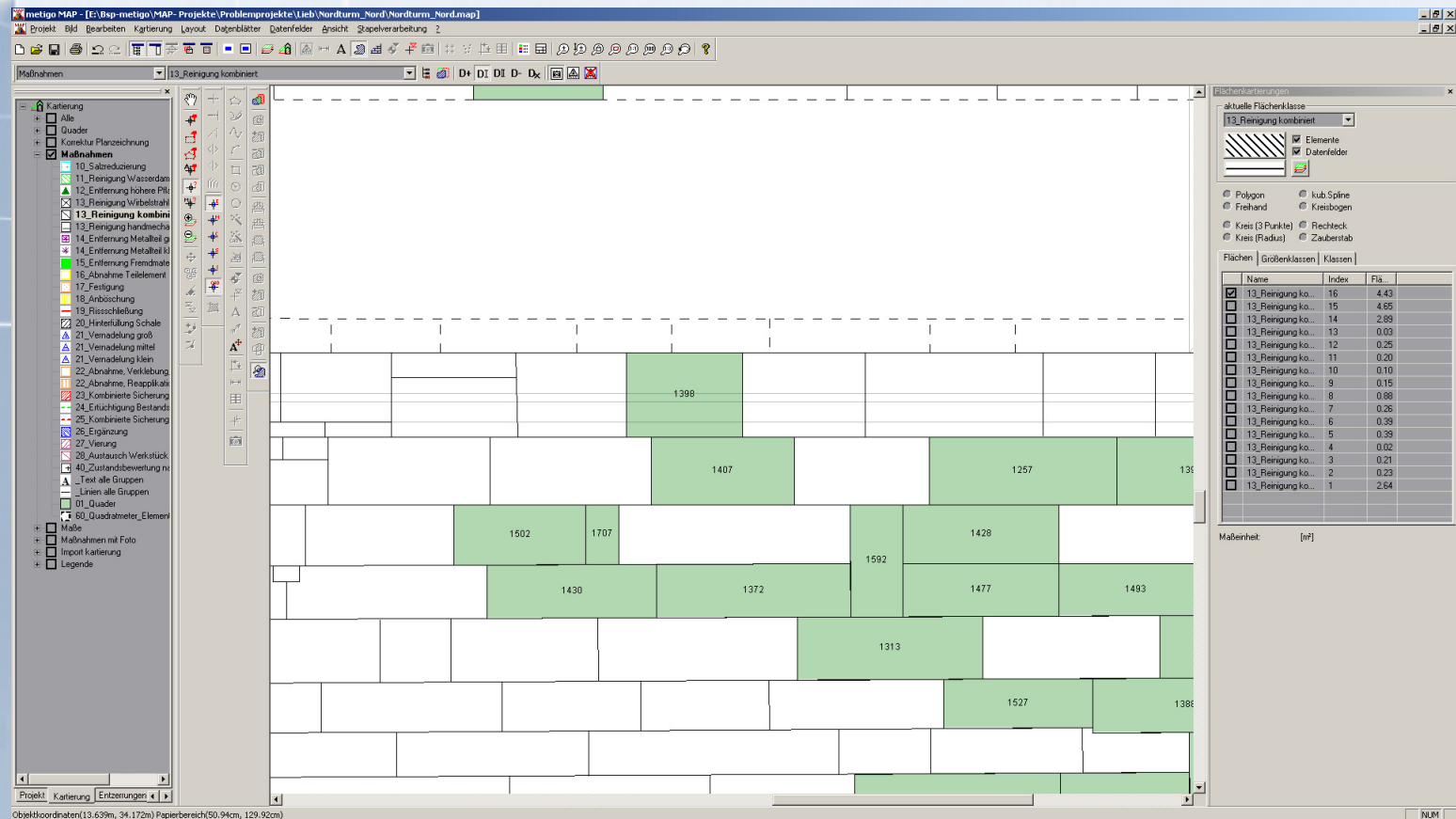
# metigo *MAP 4.0* – Object orientated analysis

The screenshot displays the metigo MAP 4.0 software interface. The main window shows a map with various colored areas and lines. A detailed 'Flächenanalyse' (Area Analysis) dialog box is open, showing a list of areas and their properties. The dialog box includes a 'Flächenklasse' (Area Class) dropdown set to '01\_Quader' and a 'Flächenanalyse' section with a list of areas and their properties. The 'Analyseoption' (Analysis Option) section includes radio buttons for 'alle gewählten Klassen sind enthalten' (all selected classes are included), 'mind. 4 Klassen sind enthalten' (at least 4 classes are included), and 'Verschnitt kleiner Flächen/Strecken' (mixture of small areas/lines). The 'Verschnitt kleiner Flächen/Strecken' section includes a dropdown for 'Element mit Flächen-/Längenanteil zum Quellelement von max. 5 [%] ist ein kleines Element (Fläche, Länge)' (Element with area/length ratio to source element of max. 5 [%] is a small element (area, length)). The 'Analyseoption' section also includes radio buttons for 'kleine Flächen erhalten' (keep small areas), 'ignorieren' (ignore), and 'einer größeren zuweisen' (assign to a larger one). The 'Flächenanalyse' section includes a list of areas with checkboxes for 'Kartierung' (mapping), 'Quader' (cube), and 'Maßnahmen' (measures). The 'Kartierung' section includes checkboxes for 'Alle' (all), 'Quader', and 'Maßnahmen'. The 'Quader' section includes checkboxes for '\_Text alle Gruppen', '\_Linien alle Gruppen', '01\_Quader', and '60\_Quadratmeter\_Element'. The 'Maßnahmen' section includes checkboxes for '10\_Salzreduzierung', '11\_Reinigung Wasserdampf', '12\_Entfernung höhere Pflanze', '13\_Reinigung Wirbelstrahl', '13\_Reinigung kombiniert', '13\_Reinigung handmechanisch', '14\_Entfernung Metallteil groß', '14\_Entfernung Metallteil klein', and '15\_Entfernung Fremdmaterial+Bes'. The 'Analyseoption' section includes radio buttons for 'alle gewählten Klassen sind enthalten', 'mind. 4 Klassen sind enthalten', and 'Verschnitt kleiner Flächen/Strecken'. The 'Verschnitt kleiner Flächen/Strecken' section includes a dropdown for 'Element mit Flächen-/Längenanteil zum Quellelement von max. 5 [%] ist ein kleines Element (Fläche, Länge)'. The 'Analyseoption' section also includes radio buttons for 'kleine Flächen erhalten', 'ignorieren', and 'einer größeren zuweisen'. The 'Flächenanalyse' section includes a list of areas with checkboxes for 'Kartierung', 'Quader', and 'Maßnahmen'. The 'Kartierung' section includes checkboxes for 'Alle', 'Quader', and 'Maßnahmen'. The 'Quader' section includes checkboxes for '\_Text alle Gruppen', '\_Linien alle Gruppen', '01\_Quader', and '60\_Quadratmeter\_Element'. The 'Maßnahmen' section includes checkboxes for '10\_Salzreduzierung', '11\_Reinigung Wasserdampf', '12\_Entfernung höhere Pflanze', '13\_Reinigung Wirbelstrahl', '13\_Reinigung kombiniert', '13\_Reinigung handmechanisch', '14\_Entfernung Metallteil groß', '14\_Entfernung Metallteil klein', and '15\_Entfernung Fremdmaterial+Bes'. The 'Analyseoption' section includes radio buttons for 'alle gewählten Klassen sind enthalten', 'mind. 4 Klassen sind enthalten', and 'Verschnitt kleiner Flächen/Strecken'. The 'Verschnitt kleiner Flächen/Strecken' section includes a dropdown for 'Element mit Flächen-/Längenanteil zum Quellelement von max. 5 [%] ist ein kleines Element (Fläche, Länge)'. The 'Analyseoption' section also includes radio buttons for 'kleine Flächen erhalten', 'ignorieren', and 'einer größeren zuweisen'. The 'Flächenanalyse' section includes a list of areas with checkboxes for 'Kartierung', 'Quader', and 'Maßnahmen'. The 'Kartierung' section includes checkboxes for 'Alle', 'Quader', and 'Maßnahmen'. The 'Quader' section includes checkboxes for '\_Text alle Gruppen', '\_Linien alle Gruppen', '01\_Quader', and '60\_Quadratmeter\_Element'. The 'Maßnahmen' section includes checkboxes for '10\_Salzreduzierung', '11\_Reinigung Wasserdampf', '12\_Entfernung höhere Pflanze', '13\_Reinigung Wirbelstrahl', '13\_Reinigung kombiniert', '13\_Reinigung handmechanisch', '14\_Entfernung Metallteil groß', '14\_Entfernung Metallteil klein', and '15\_Entfernung Fremdmaterial+Bes'.

digital mapping (areas, lines, symbols...) and graphic evaluation of stone contours (area)

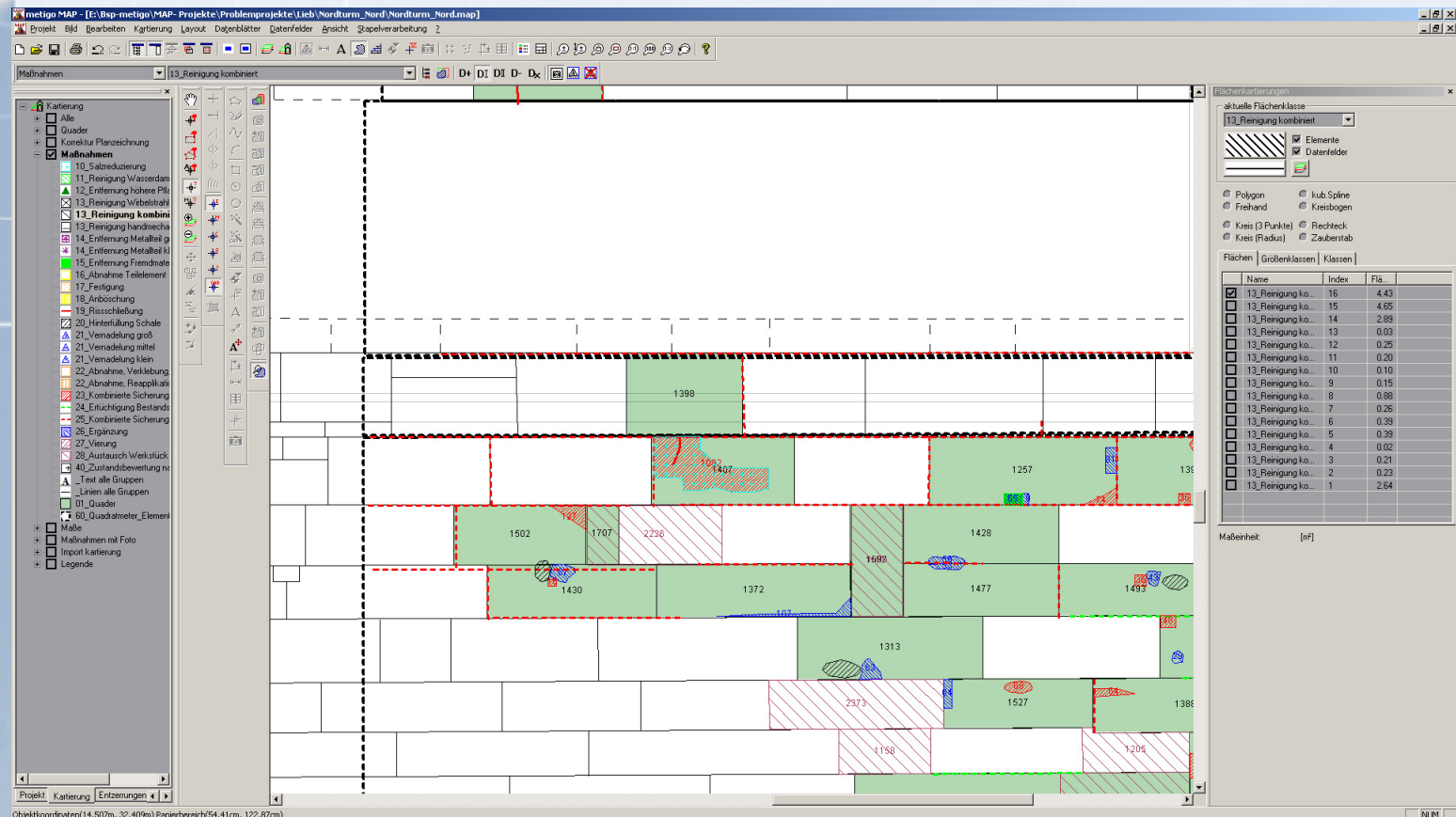
area analysis of mapping by drawn stone contours

# metigo *MAP 4.0* – Object orientated analysis



- display of filtered stones (green), with or without mapping content
- output with the help of data sheets
- area analysis usable for any area classes (lines of scaffold, wall sections, ...)

# metigo *MAP 4.0* – Object orientated analysis



- display of filtered stones (green), with or without mapping content
- output with the help of data sheets
- area analysis usable for any area classes (lines of scaffold, wall sections, ...)



# metigo *MAP* 4.0 – User management

- define user with individual rights
- Analysis of mapping processes:
  - WHAT was mapped by WHOM in wich time (for billing) ?
  - differential quantity export
- merge of partial mappings to one mapping project

**metigo MAP**

aktueller Nutzer: Gunnar Nutzer wechseln

aktueller Nutzer: ☺ Mario Nutzer anlegen Nutzer löschen Nutzer kopieren  
Nutzer exportieren Nutzer importieren

Eigenschaften

Nutzername:  Passwort ändern

Passwort:

Passwort-Wiederholung:

Firma:

Abteilung:

Nutzerrechte

Nutzertyp: Standardnutzer

	Voll	Anzeigen	Anlegen	Bearbeiten	Löschen
Nutzer	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Kartierung	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Kartierungselemente	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Kartierungselemente anderer Nutzer	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Klassenverwaltung	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Klasseneigenschaften	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Klasseneigenschaften anderer Nu...	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Objekthierarchie	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Kartierungsvorlage	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Kartierungsvorlage anderer Nutzer	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Kartierungsprojekte	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Kartierungsprojekte anderer Nutzer	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

☒ Nutzer - 'metigo' in Nutzerverwaltung erhalten Übernehmen Abbrechen

# metigo *MAP 4.0* – Cost calculation

- till now: quantity export to chart calculation for further calculation
- Why integration of cost calculation in metigo *MAP* ?
  - Data in mapping project are already well structured
  - complexity of process can be supported by input of additional data during mapping

Microsoft Excel - export.xls

Bereit

	A	B	C	D	E	F	G	H	I
1	Exportdatum	07.02.2012							
2	Exportzeit	08:04							
3									
4									
5	Klassenname	Anzahl	Summe Fläche [m2]	Kalkulationsmenge					
6	5_5_10 _ Vierungen	12	2,5138	0,722113 m3					
7									
8	Klassenname	Größenklassen	Name Gk	A(GK)	M(GK) [m2]				
9									
10	Kartierungselemente								
11	Name	Index	Fläche [m2]	Bemerkung	Länge Aufmaß [m]	Höhe Aufmaß [m]	Tiefe Aufmaß [m]	Stückzahl Aufmaß	Fläche Aufmaß
12									
13	5_5_10 _ Vierungen_5_5_10 _ Vierungen_001	1	0,0089		0,08	0,11	0,2	1	
14	5_5_10 _ Vierungen_5_5_10 _ Vierungen_002	2	0,0081		0,06	0,13	0,2	1	
15	5_5_10 _ Vierungen_5_5_10 _ Vierungen_003	3	0,0283		0,1	0,28	0,2	1	
16	5_5_10 _ Vierungen_5_5_10 _ Vierungen_004	4	0,0133		0,25	0,05	0,2	1	
17	5_5_10 _ Vierungen_5_5_10 _ Vierungen_005	5	0,0767		0,25	0,37	0,11	1	
18	5_5_10 _ Vierungen_5_5_10 _ Vierungen_006	6	0,0479		0,13	0,29	0,1	1	
19	5_5_10 _ Vierungen_5_5_10 _ Vierungen_007	7	0,1853		0,52	0,36	0,2	1	
20	5_5_10 _ Vierungen_5_5_10 _ Vierungen_008	8	0,1924		0,54	0,36	0,21	1	
21	5_5_10 _ Vierungen_5_5_10 _ Vierungen_009	9	0,0331		0,1	0,3	0,13	1	
22	5_5_10 _ Vierungen_5_5_10 _ Vierungen_010	10	0,1449		1,01	0,18	0,1	1	
23	5_5_10 _ Vierungen_5_5_10 _ Vierungen_011	11	0,0392		0,23	0,15	0,1	1	
24	5_5_10 _ Vierungen_5_5_10 _ Vierungen_012	12	1,7357		2	1,48	0,2	1	
25									
26									
27									
28									
29									
30									
31									
32									
33									
34									
35									
36									

5\_5\_10 \_ Vierungen/ 5\_6\_20 \_ Steine\_austauschen\_Ver / 5\_6\_40 \_ Neuverfugung\_Zegefä / 5\_7\_10 \_ Rissanierung\_bis\_10\_m / 5\_7\_20 \_ Klammern\_von\_Rissen\_in / 5\_8 |





# metigo *MAP* 4.0 - Cost calculation

- additional cost factors for material & work for each class
- workload can be described in several worksteps and persons with different skills
- different prices for material and working time → several variants for comparison
- ➔ better planning, preparation and control of conservation
- *separat modul, can be purchased in addition to metigoMAP*

**Kostenkalkulation Klasse**

aktuelle Klasse: **5.5.10 - Vierungen** Kalkulationseinheit: m3

Tätigkeit | Material | Gerät | Nachunternehmer

verwendbare Daten

Tätigkeit	Qualifikation
Antragen	Steinmetz
Mauerwerk Ausstemmen m2	Maurer
Reinigung JDS	Facharbeite
Reinigung HD	Facharbeite
Oberflächen mit Chemikalien behandeln	Facharbeite
Loch bohren, Naturstein bis 12mm	Steinmetz
Kompressen aufbringen	Facharbeite
Ziegel ausstemmen	Maurer
Ziegel einmauern	Maurer
Ziegel verfugen, Handverfugung zurückliegend	Maurer

zugewiesene Daten

Menge	Tätigkeit	Qualifikation	Preis	Zeiteinheit
2400	Vierun...	Steinmetz	0.60	min
2400	Vierun...	Steinmetz	0.60	min
2400	Vierun...	Steinmetz	0.50	min

Kalkulationsmenge

GAEB-Import: 2.20 kartiert: 0.722113 individuell: 2.00

Preise der Klasse

	pro Einheit	mit Zuschlag	GAEB-Import	mit Zuschlag	Kartierung	mit Zuschlag	GAEB-Export	mit Zuschlag
Tätigkeiten	4080.00 €	4202.40 €	8976.00 €	9245.28 €	2946.27 €	3034.64 €	8160.00 €	8404.80 €
Materialien	1420.34 €	1784.80 €	3124.75 €	3926.56 €	1025.72 €	1288.90 €	2840.68 €	3569.60 €
Geräte	13.00 €	13.39 €	28.60 €	29.46 €	9.45 €	9.74 €	26.00 €	26.78 €
Nachunternehmer	0.00 €	0.00 €	0.00 €	0.00 €	0.00 €	0.00 €	0.00 €	0.00 €
<b>Summe</b>	<b>5513.34 €</b>	<b>6000.59 €</b>	<b>12129.35 €</b>	<b>13201.30 €</b>	<b>3981.44 €</b>	<b>4333.28 €</b>	<b>11026.68 €</b>	<b>12001.18 €</b>

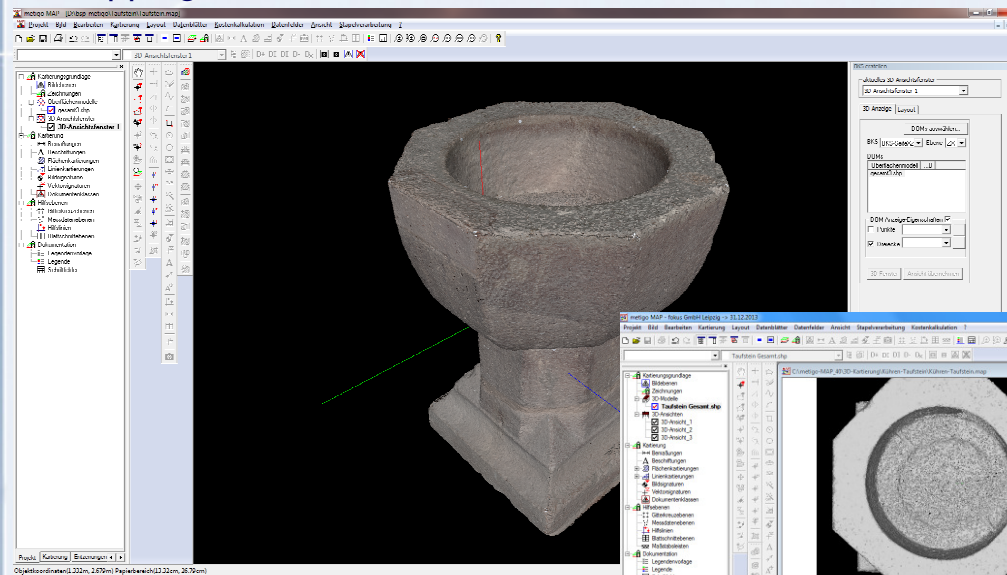
Übernehmen Abbrechen



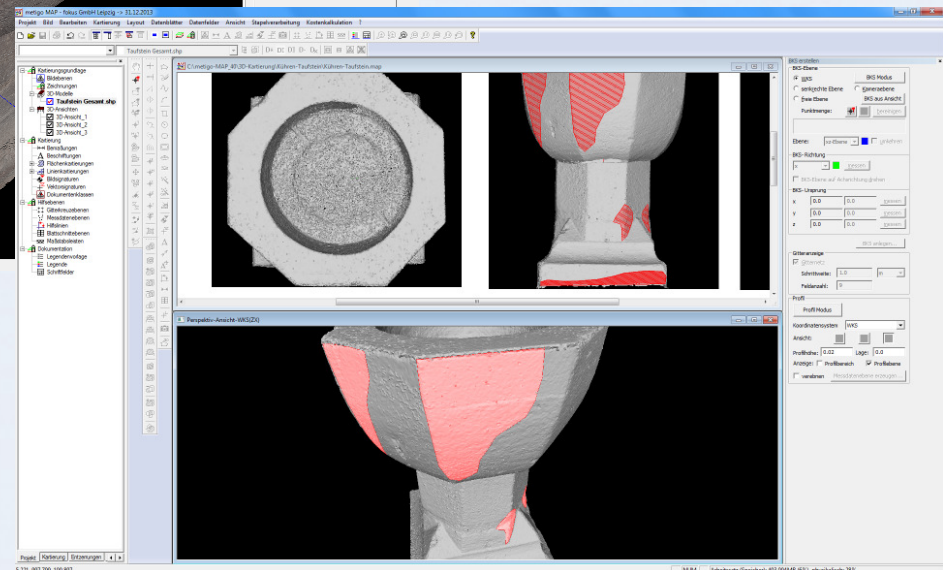
# metigo *MAP 4.0* – 3D mapping

## 3D mapping

- import of 3D surface models (STL, SHP) as mapping base
- 3D models by scanner or photogrammetric systems with image matching (metigo3D)
- orthogonal projected views for 2D true to scale output
- mapping in 2D window or 3D window



Kühren church,  
Medival font, 2012

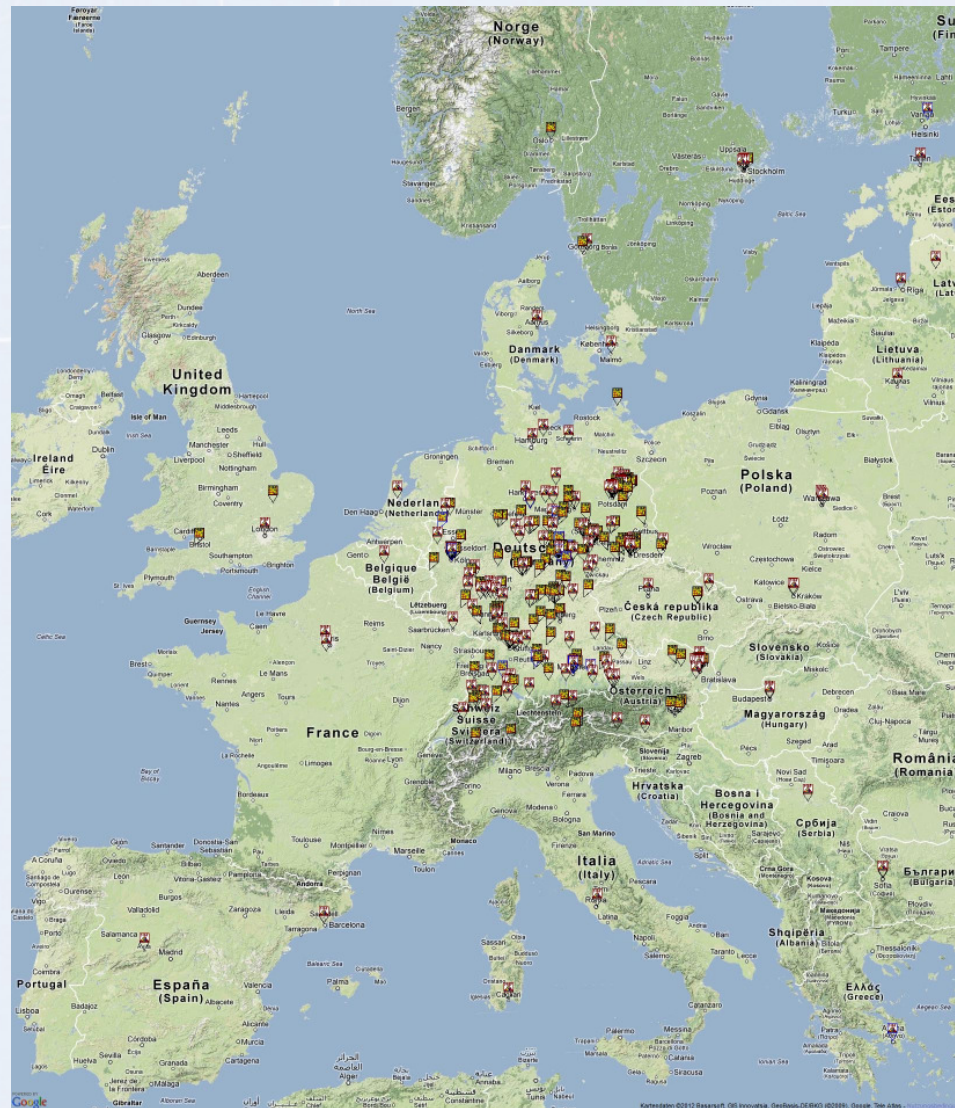


- top: 3D evaluation window
- right: 2D views within mapping project





# metigo *MAP* - Customer topology



- development since 2000  
(more than 600 Licences)
- ca. 80% of customer are free conservators and restoration companies
- usage in departments:
  - 70% stone
  - 20% wall
  - 10% wood, paintings, paper, textile and glas
- languages:
  - english version since 2005
  - polish version since 2009
  - spanish and french version since 2012

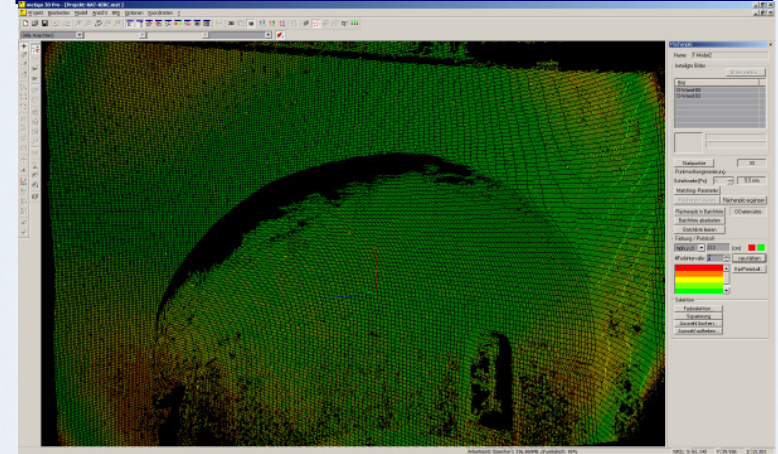


# metigo3D - Software for 3D Object documentation

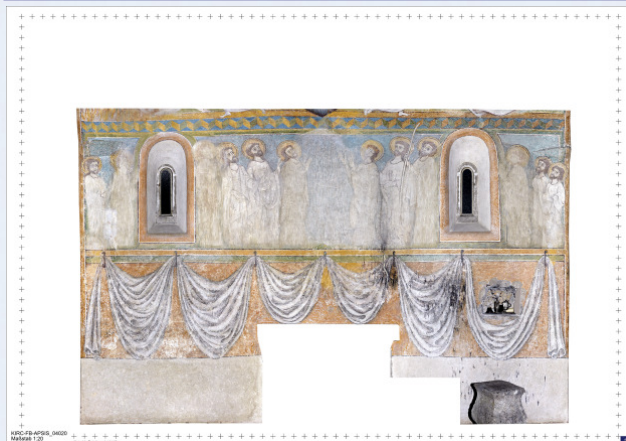
## I. Image recording & orientation



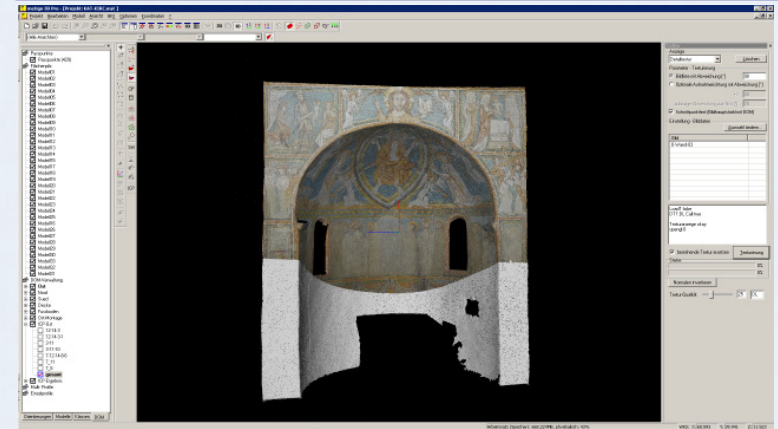
## II. Generation of point clouds



## IV. True to scale image plan



## III. 3D surface model (DSM)





## Stereo models (image pairs):

- Digital SLR camera (full frame sensor), photogrammetric calibration is needed!
- image recording by hand or from recording rail (on tripod)
- ratio of basis to recording distance in the field of 1:5 until 1:10  
(e.g. recording distance 7m → camera basis ~1m)

## Reference measures at the object:

- distance at object
- distance between 2 cameras
- tacheometer for measuring of reference points



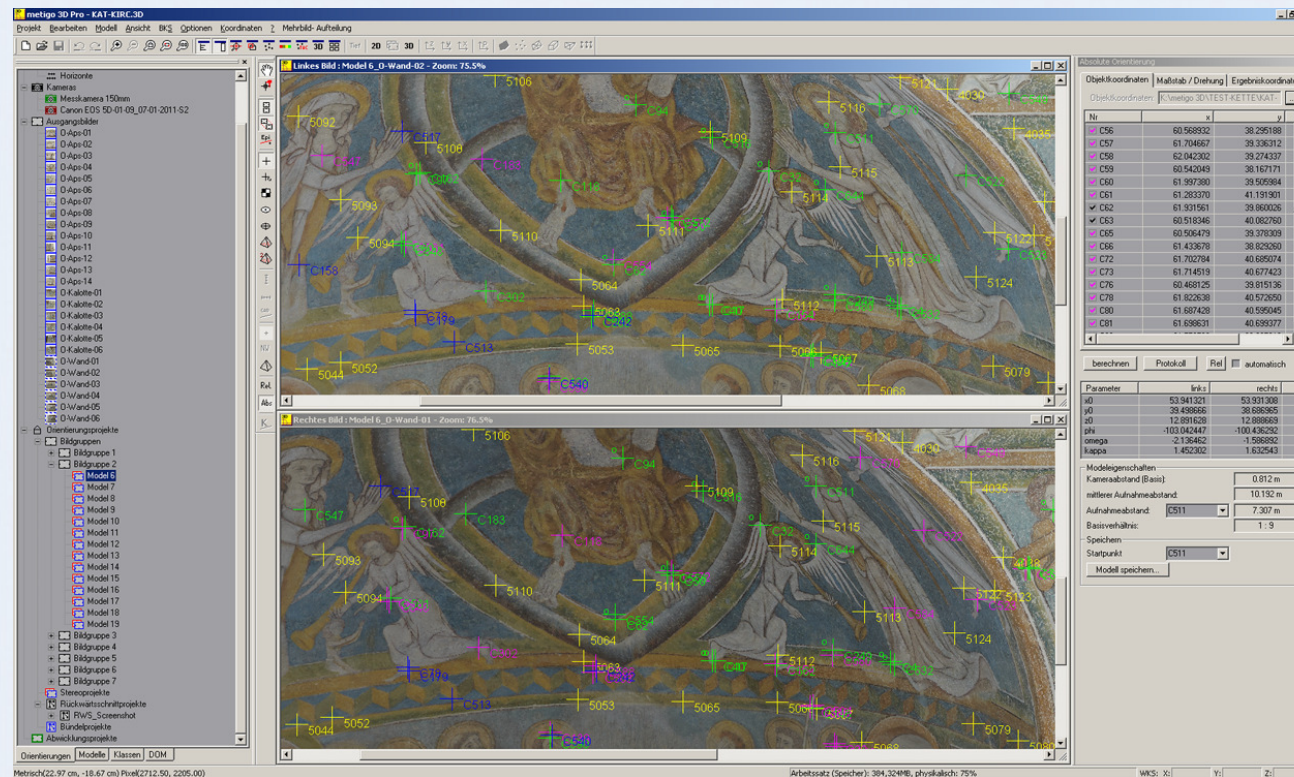
Recording rail for 2 SLR- cameras

## Image analysis:

- automated detection of identical points in set of image
- automated detection of Stereo models

## Orientation:

- orientation for images is calculated on base of known control points and
- 3D-Reference measures
  - 3D reference points measured by tacheometer
  - distance at object or between cameras



Orientated stereo model with image coordinates



## metigo3D - point cloud generation

## Point matching:

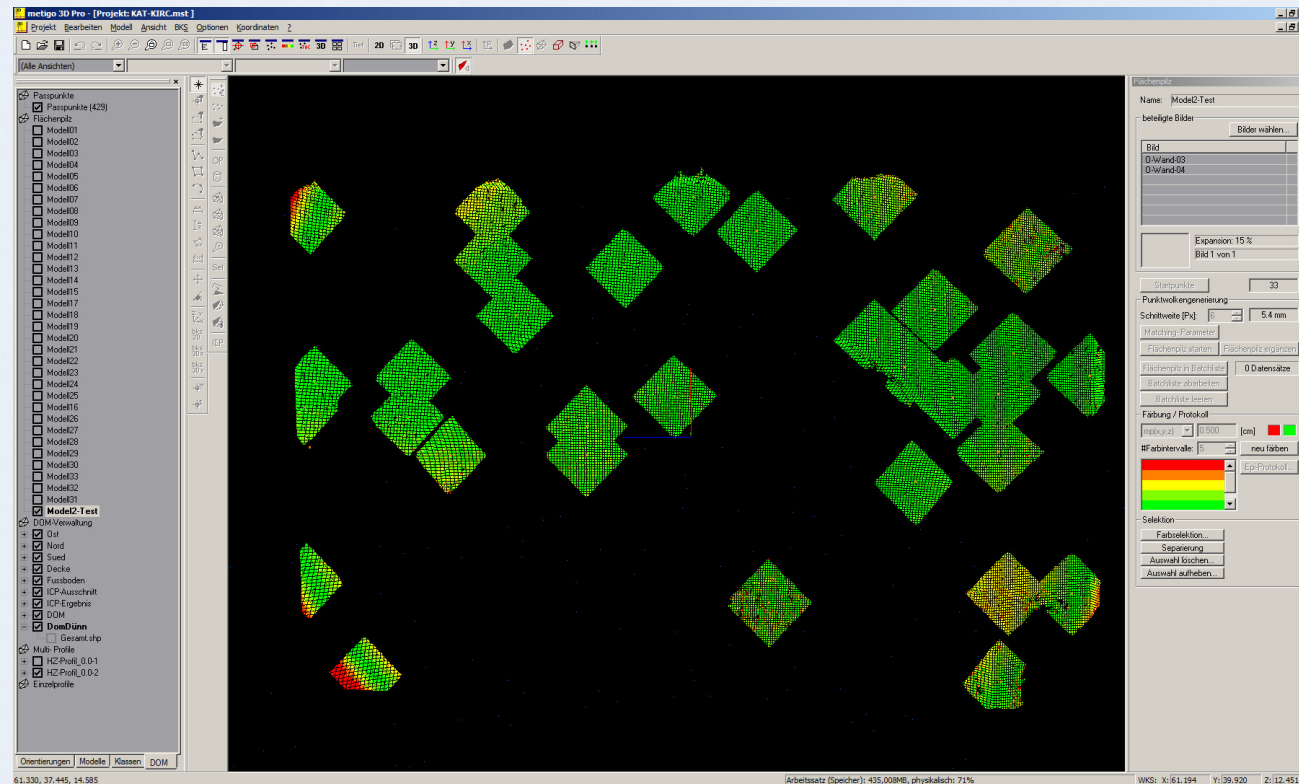
- surface of object is „scanned“ by expansion algorithm

### Parameter:

- point distance at the object
- accuracy of evaluation (point colours, automated filtering)

## Batch process:

- point cloud per model with ca. 500.000 points in ca. 1 minutes



# metigo3D - point cloud generation

## Point matching:

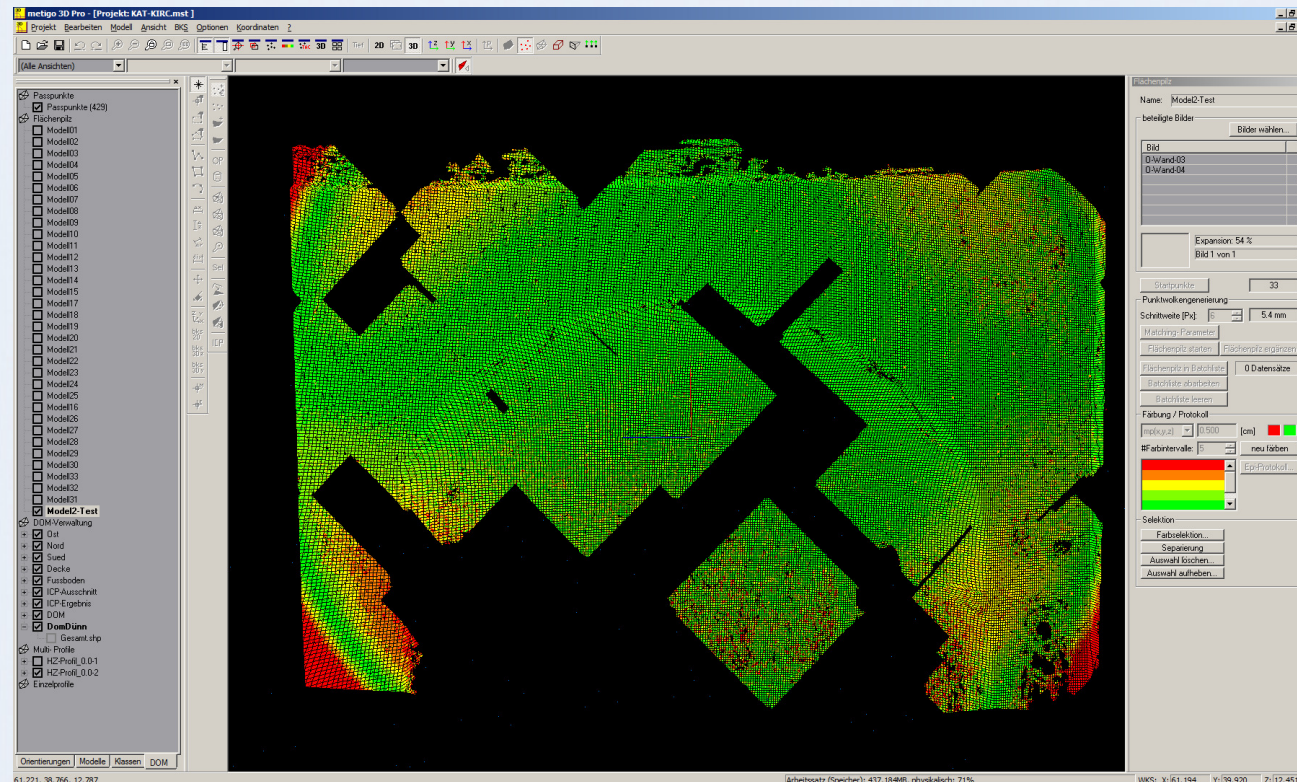
- surface of object is „scanned“ by expansion algorithm

## Parameter:

- point distance at the object
- accuracy of evaluation (point colours, automated filtering)

## Batch process:

- point cloud per model with ca. 500.000 points in ca. 1 minutes



Generation of point cloud



# metigo3D - point cloud generation

## Point matching:

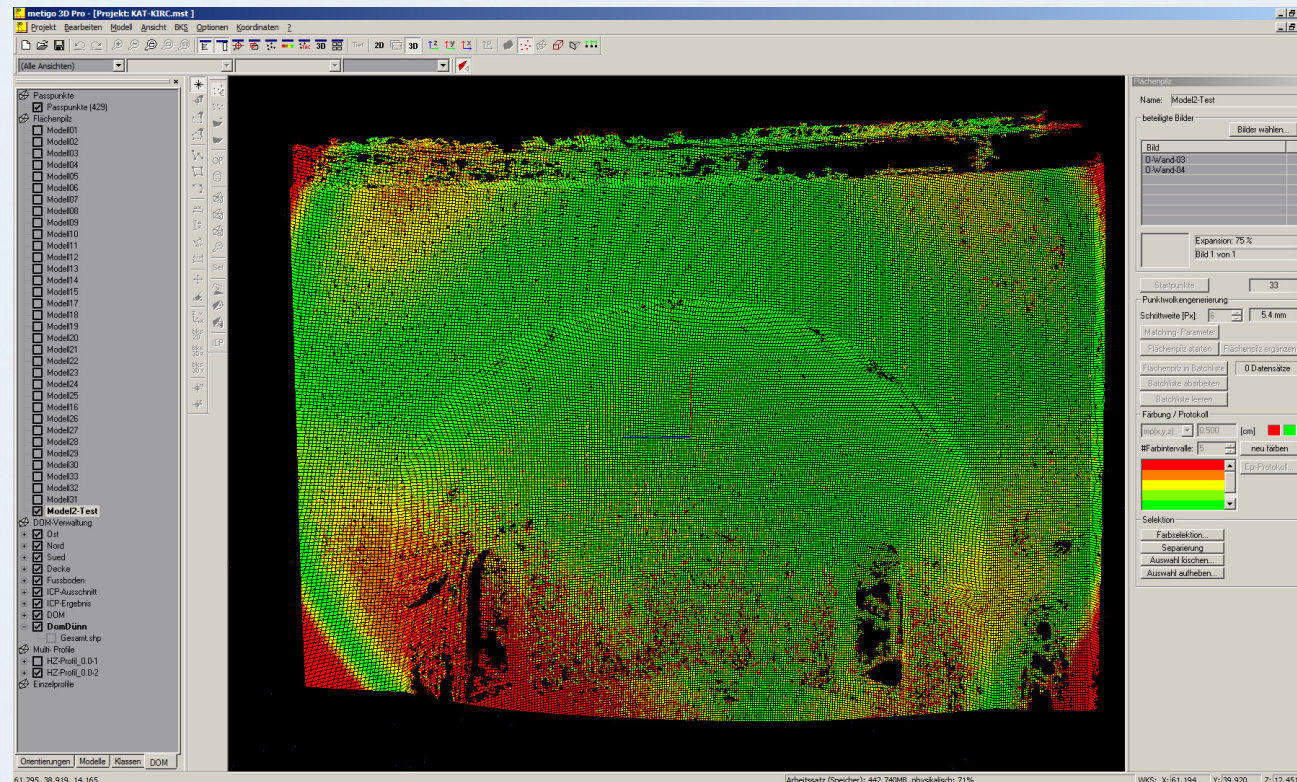
- surface of object is „scanned“ by expansion algorithm

## Parameter:

- point distance at the object
- accuracy of evaluation (point colours, automated filtering)

## Batch process:

- point cloud per model with ca. 500.000 points in ca. 1 minutes



Generation of point cloud



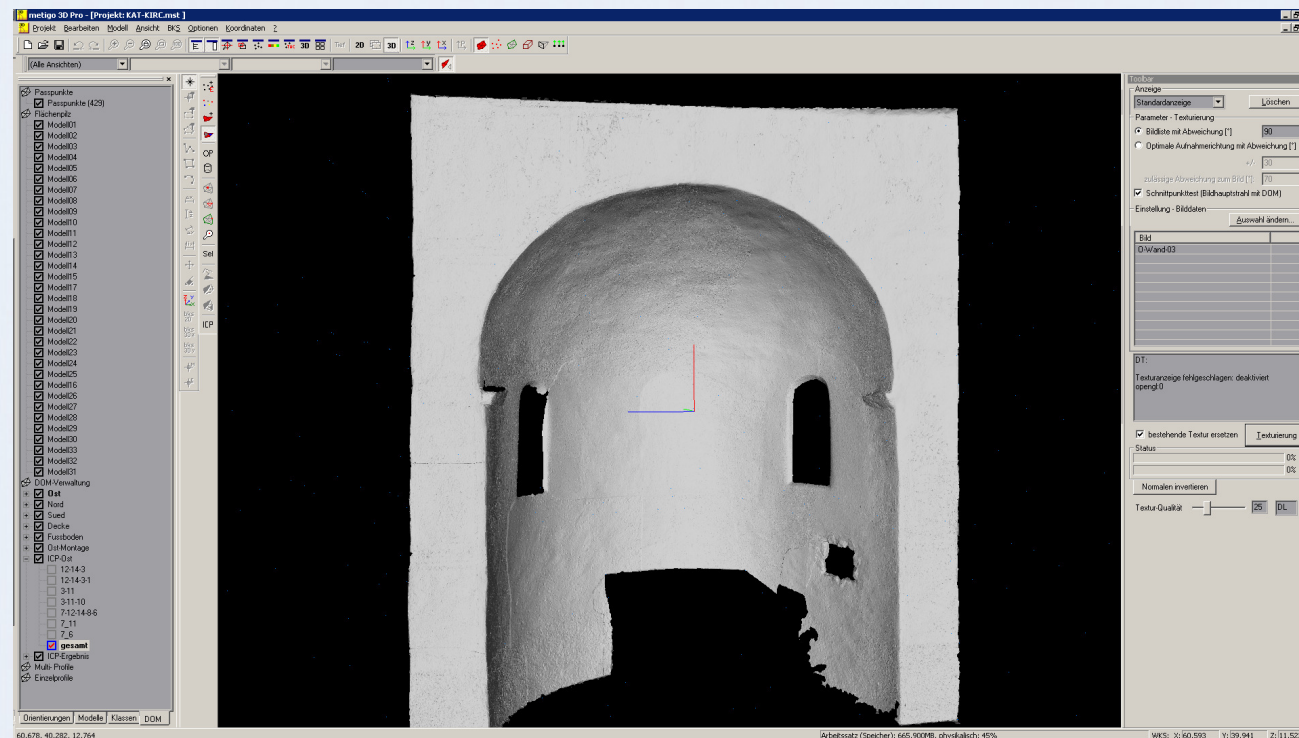
# metigo3D – Triangulation and Texturing

## Digitale 3D surface model (DSM):

- connecting of neighboured points to triangles

## Texturing:

- with images, that were used for Matching  
→ higher image resolution than with coloured point clouds is possible



Digital surface model

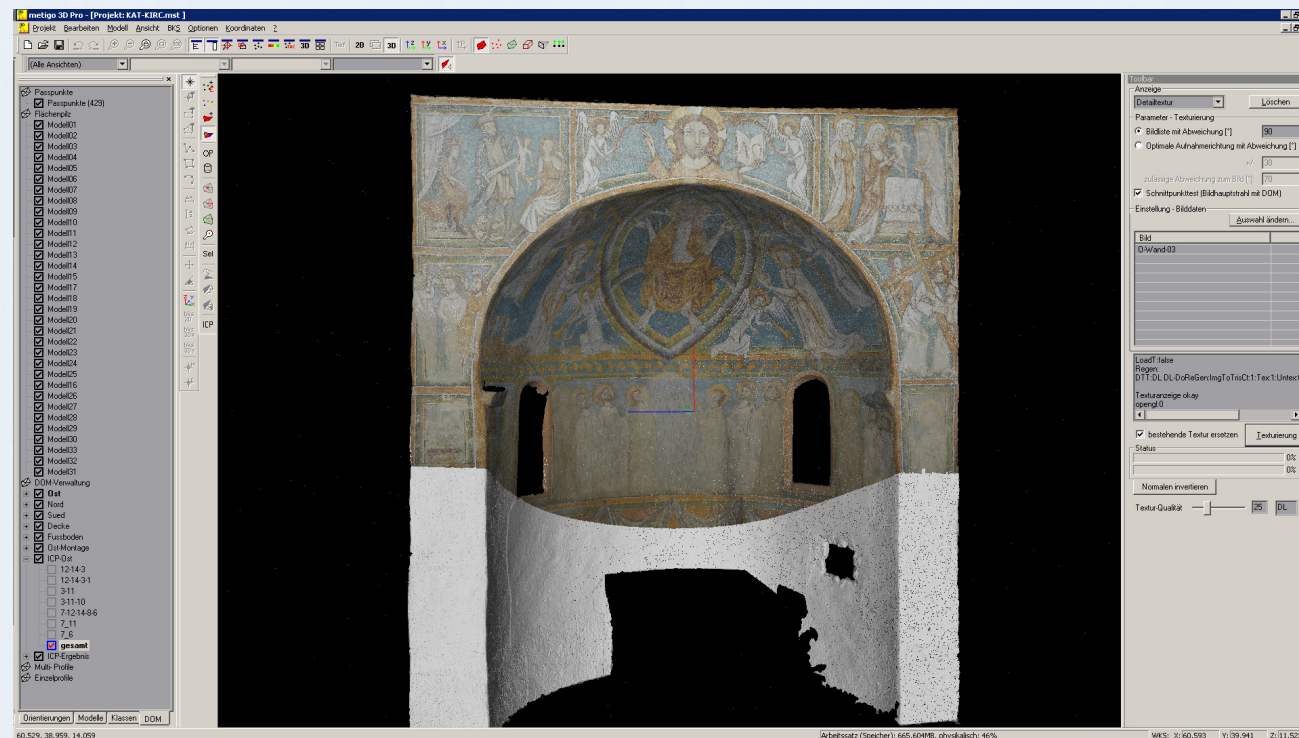
# metigo3D – Triangulation and Texturing

## Digitale 3D surface model (DSM):

- connecting of neighboured points to triangles

## Texturing:

- with images, that were used for Matching  
→ higher image resolution than with coloured point clouds is possible



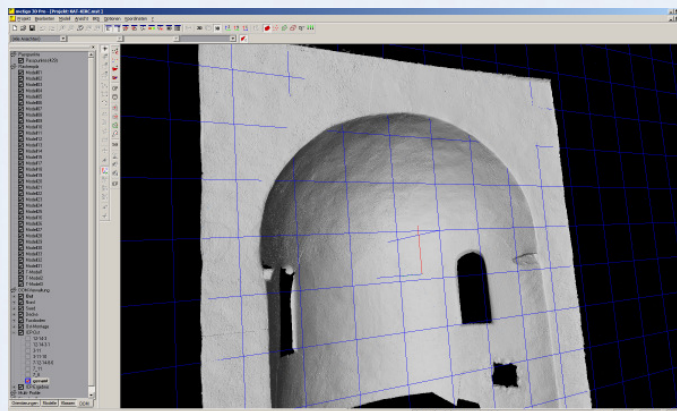
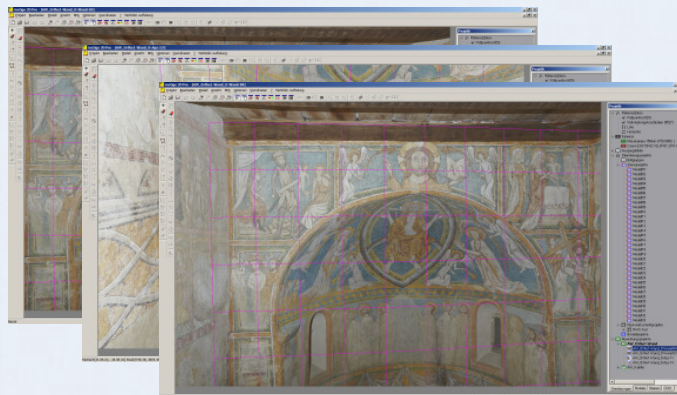
Digital surface model textured with one image

## Projection geometry:

- Definition of plane or cylinder with user coordinate system

## Calculation of true to scale image plans:

- Projection geometry (plane, cylinder)
- correction by 3D surface model
- user defined scale and resolution



Projection plane in user coordinates system

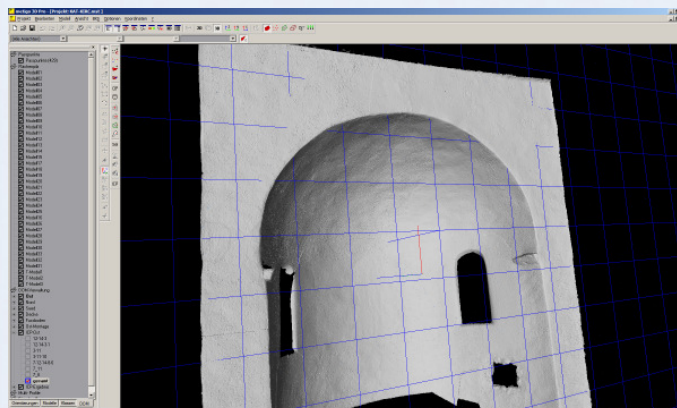
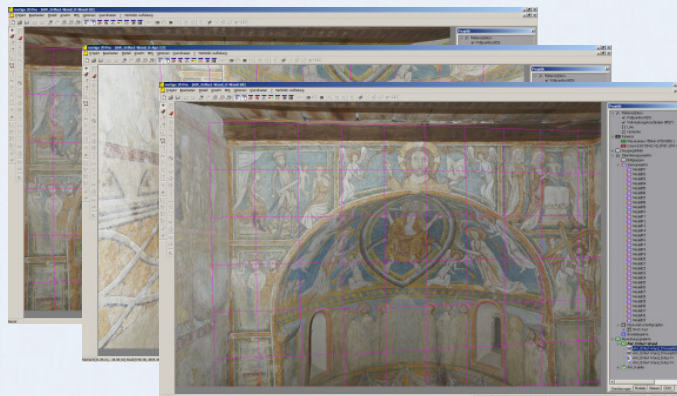


## Projection geometry:

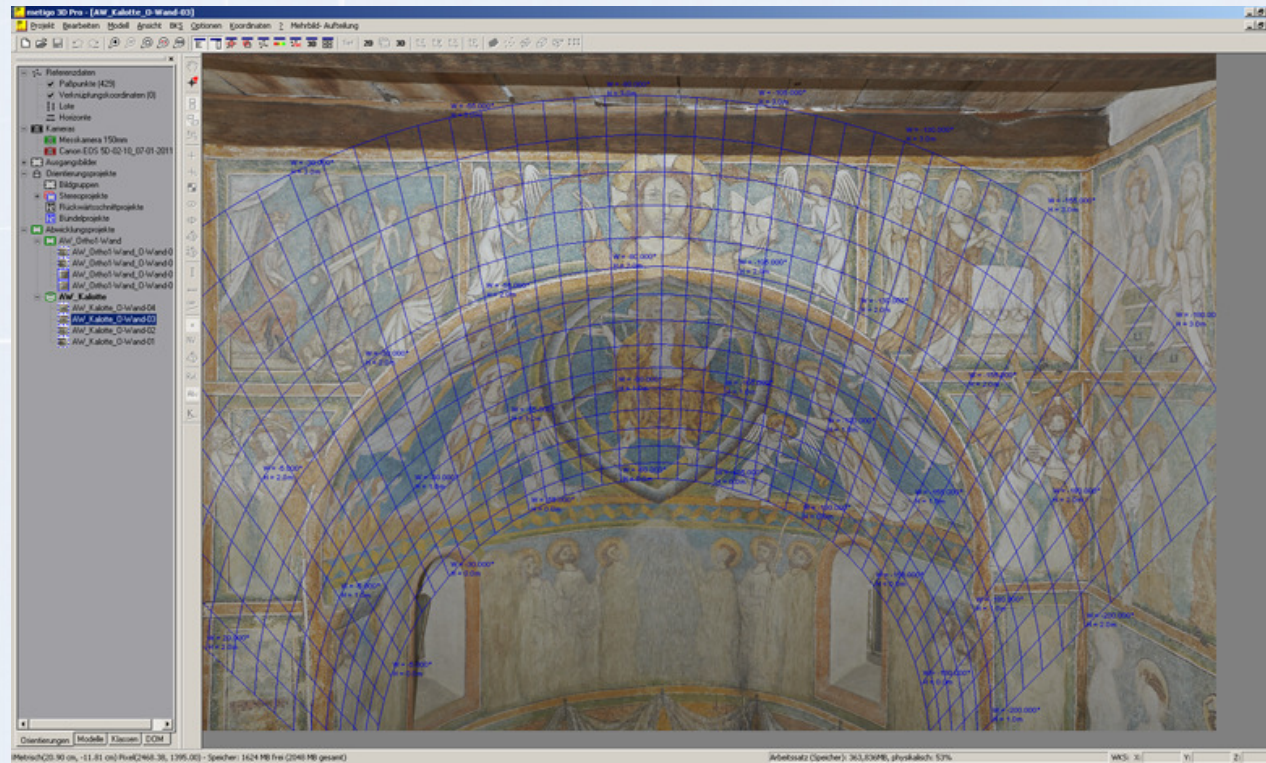
- Definition of plane or cylinder with user coordinate system

## Calculation of true to scale image plans:

- Projection geometry (plane, cylinder)
- correction by 3D surface model
- user defined scale and resolution

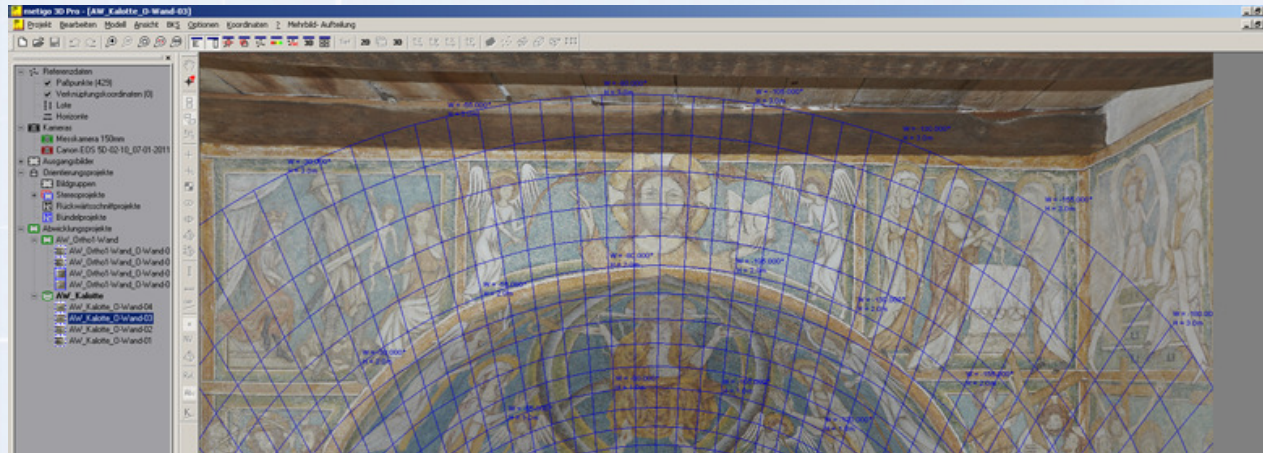


**Orientated image  
with Projection  
of cylinders**  
Castle Katzenstein





**Orientated image  
with Projection  
of cylinders**  
Castle Katzenstein



**Unwrapping with  
Orthoprojection**  
Coloured images  
Original 1:5, 300dpi

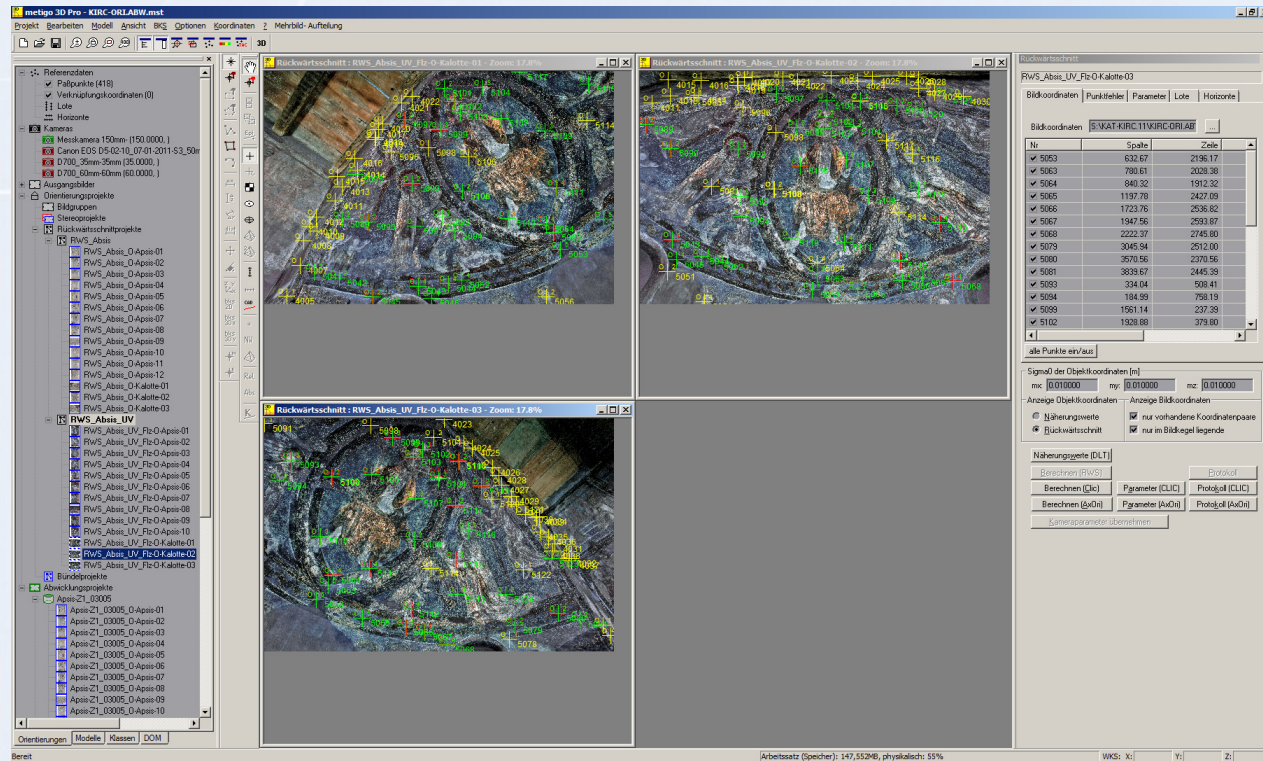


COLOR & SPACE IN  
CULTURAL HERITAGE  
[www.fokus-GmbH-Leipzig.de](http://www.fokus-GmbH-Leipzig.de)

## UV light images:

- orientated by spatial resection
- orientated UV-images projected on the same geometry like colour images

**Orientated image  
UV-light  
castle Katzenstein**

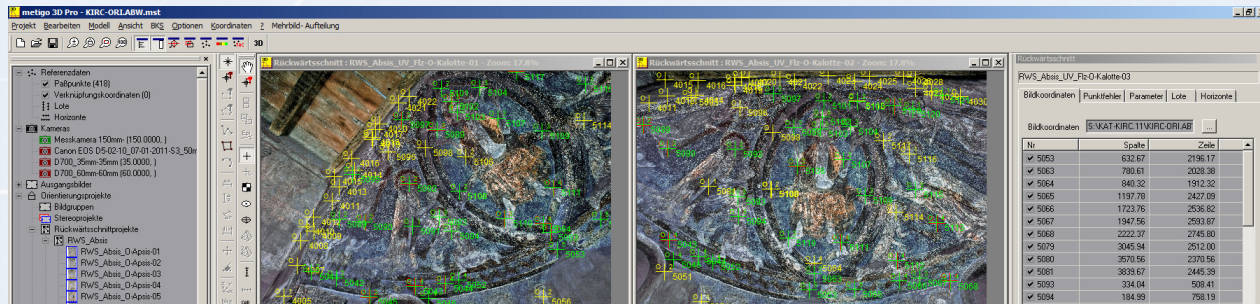




## UV light images:

- orientated by spatial resection
- orientated UV-images projected on the same geometry like colour images

**Orientated image  
UV-light  
castle Katzenstein**



**unwrapping with  
Orthoprojektion  
UV light images  
Original 1:5, 300dpi**

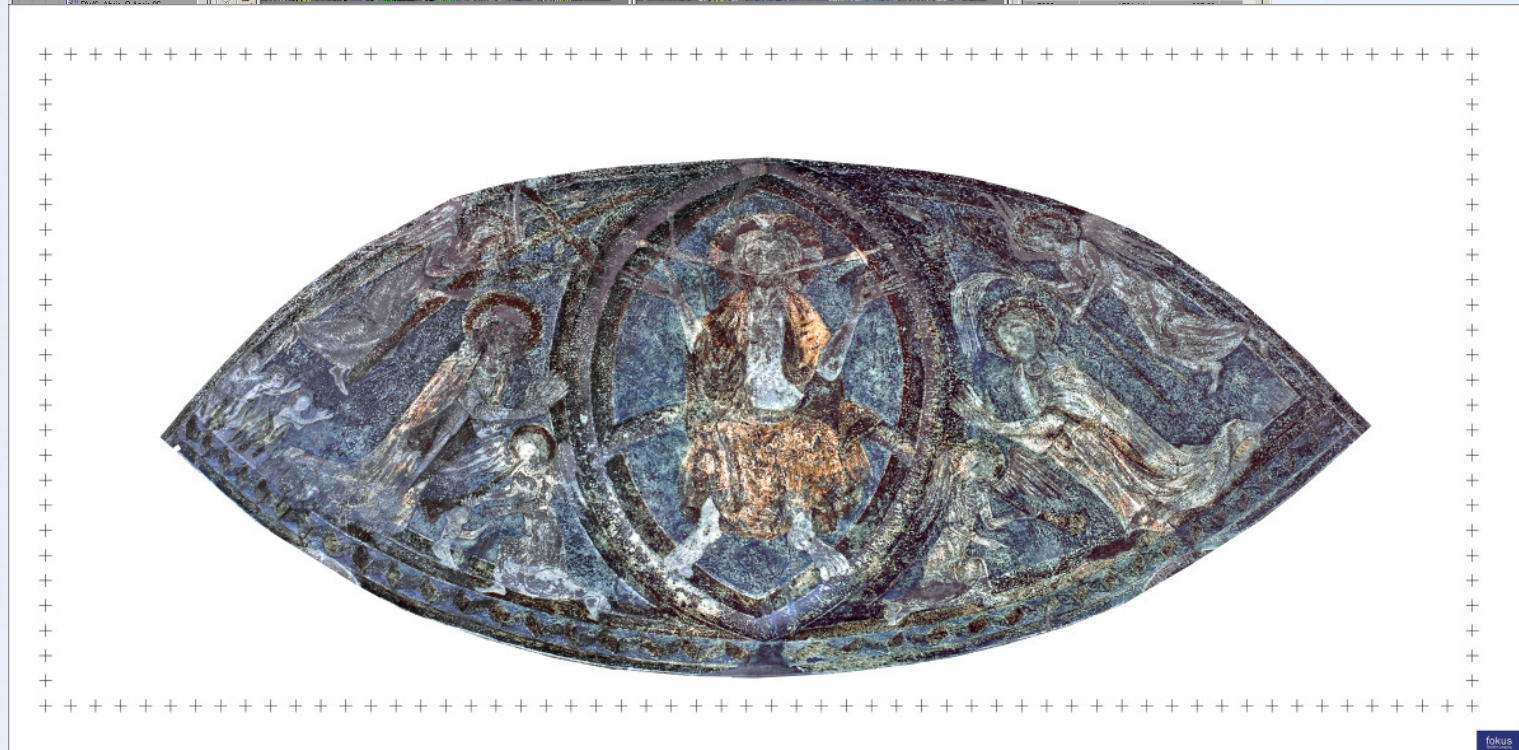




Image plan of Apse  
im Original 1:5  
Colour images  
Castle Katzenstein





Image plan of Apse  
im Original 1:5  
Colour images  
Castle Katzenstein

Image plan of Apse  
in Original 1:5  
UV light images



COLOR & SPACE IN  
CULTURAL HERITAGE  
[www.fokus-GmbH-Leipzig.de](http://www.fokus-GmbH-Leipzig.de)

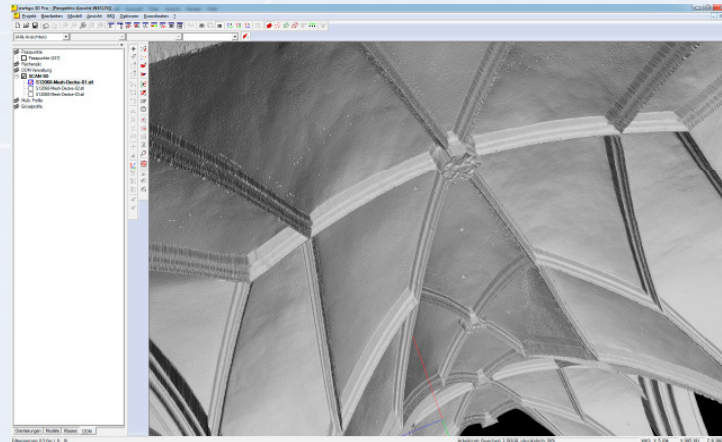




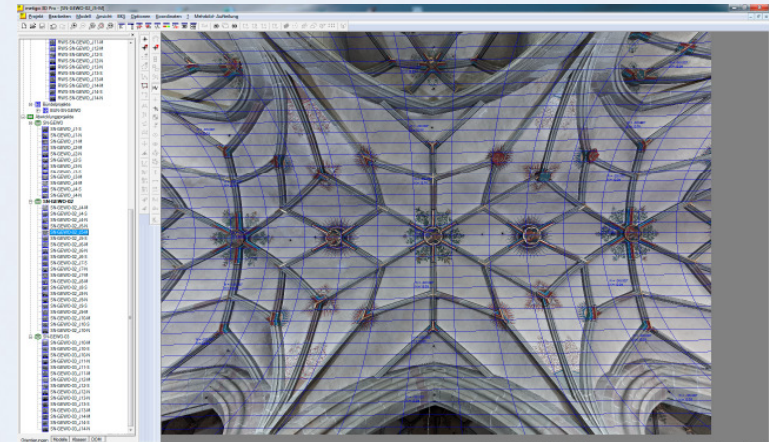
# metigo3D – Orthogonal projection

## Combination of Laserscandata with high resolved images:

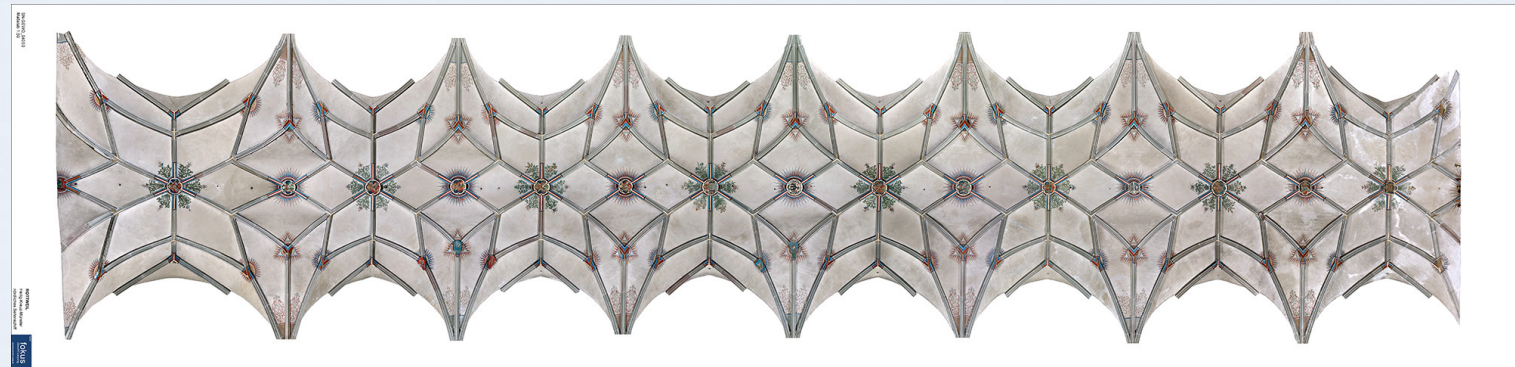
- Rottweil, church Heilig-Kreuz-Münster, south aisle, 2012
- Digital unwrapping with Orthogonal projection



(Laserscan: Scan 3D GmbH, Berlin)



photogrammetric orientated image  
( 1 of 17 images)



Digital unwrapping with orthogonal projection in scale 1:25



## metigo3D - Orthogonal projection

### Combination of Laserscandata with high resolved images:

- Rottweil, church Heilig-Kreuz-Münster, 2012
- Digital unwrapping with Orthogonal projection, Detail in image plan in scale 1:25

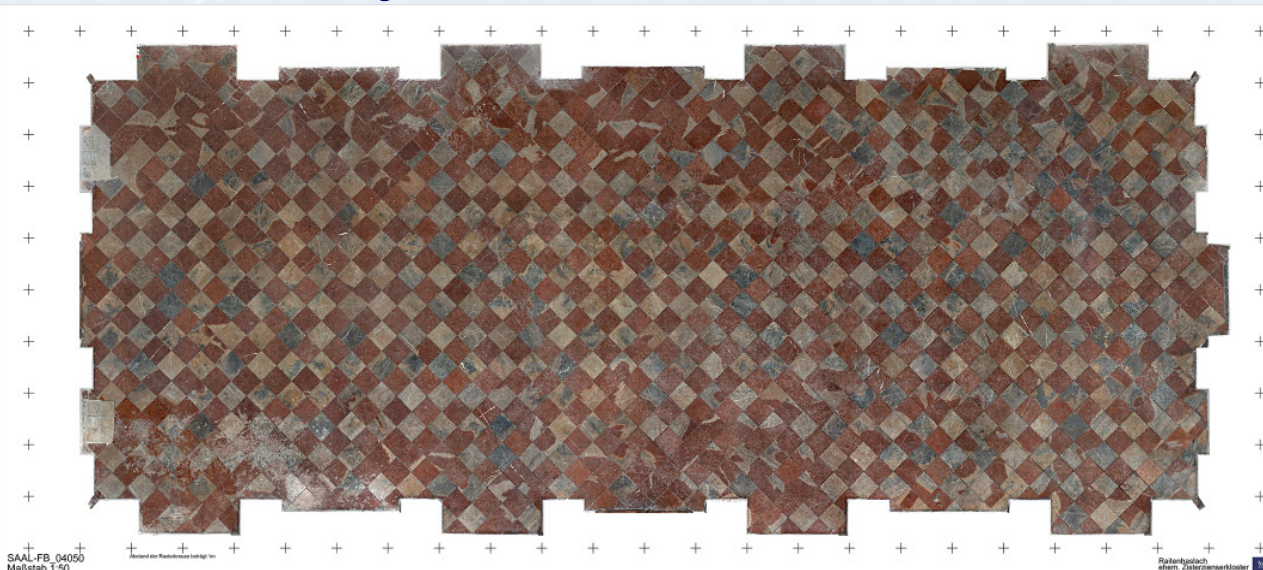




## Calculation of true to scale image plane:

- coordinate plane for Deformation analysis is defined
- DSM is coloured in dependence of distance to plane
- image export with user defined scale and resolution
- Integration in mapping project
- shown deformation: green: +4cm until red: -2cm

**Image plan of stone floor**  
(rectification & montage)  
1:10, 400dpi  
monastery Raitenhaslach,  
Steinerner Saal



COLOR & SPACE IN  
CULTURAL HERITAGE  
[www.fokus-GmbH-Leipzig.de](http://www.fokus-GmbH-Leipzig.de)

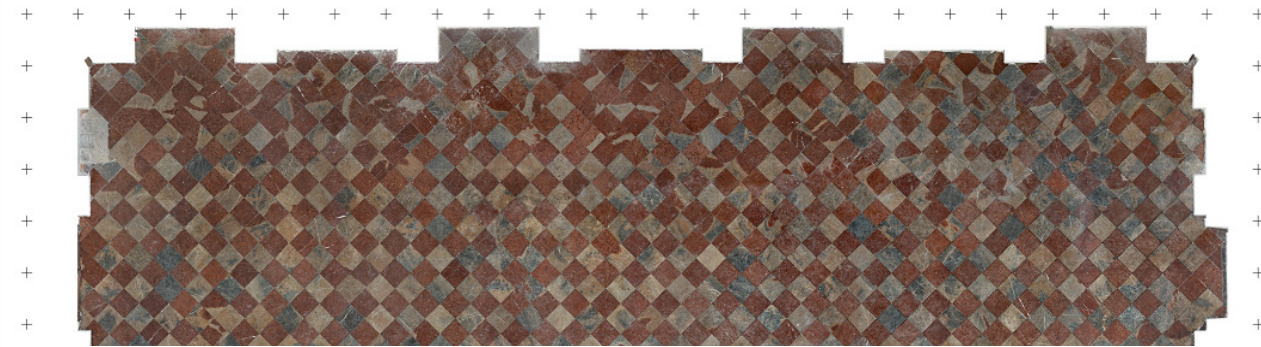
Raitenhaslach, monastery, Steinerner Saal, 2012 - Digital image plan of floor; scale 1:10



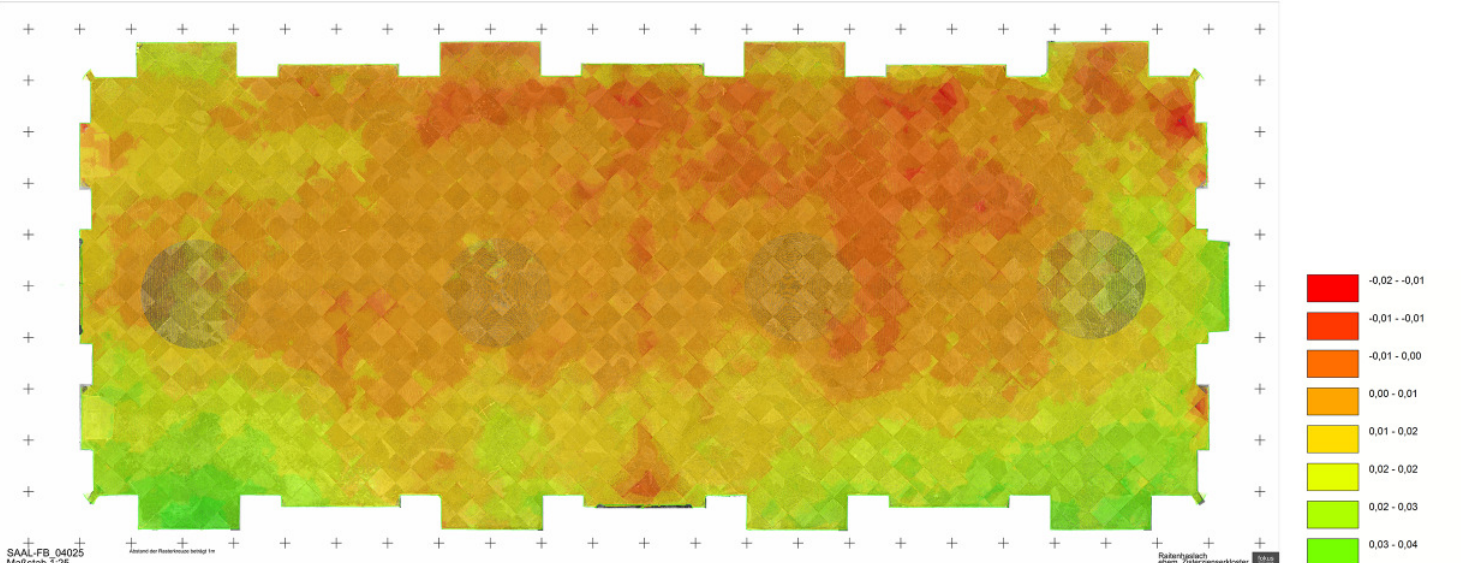
## Calculation of true to scale image plane:

- coordinate plane for Deformation analysis is defined
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- image export with user defined scale and resolution
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- shown deformation: green: +4cm until red: -2cm

**Image plan of stone floor**  
(rectification & montage)  
1:10, 400dpi  
monastery Raitenhaslach,  
Steinerner Saal



**Deformations analysis**  
Point cloud of Laser  
scanner  
1:25, 400dpi

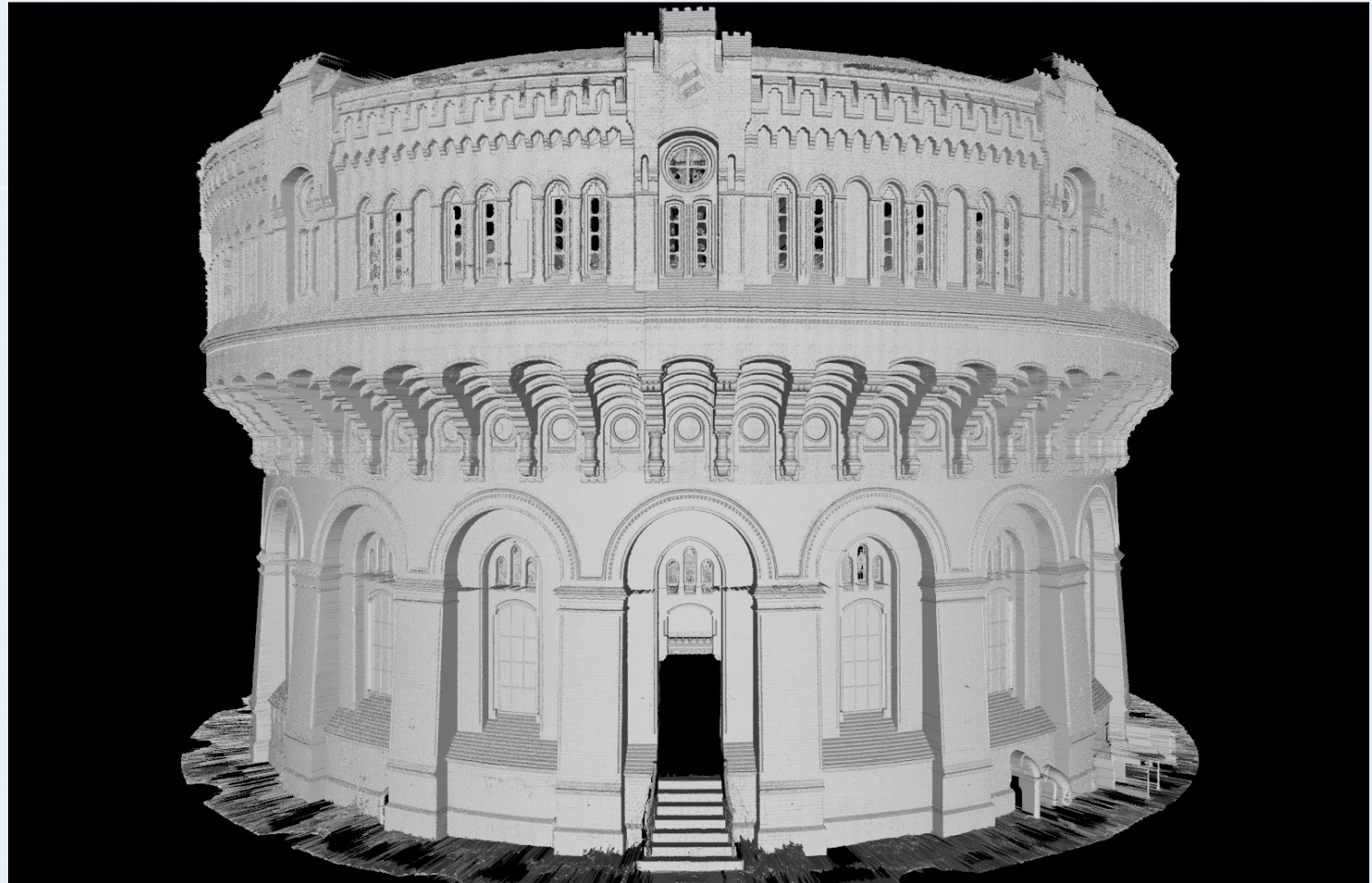


Raitenhaslach, monastery, Steinerner Saal, 2012 - Digital image plan of floor; scale 1:10

## metigo3D - Orthogonal projection

### Combination of Laserscandata with high resolved images:

- Kiel, water tower, 2012, Digital unwrapping with orthogonal projection





# metigo3D - Orthogonal projection

## Combination of Laserscandata with high resolved images:

- Kiel, water tower, 2012, Digital unwrapping with orthogonal projection, 1:25

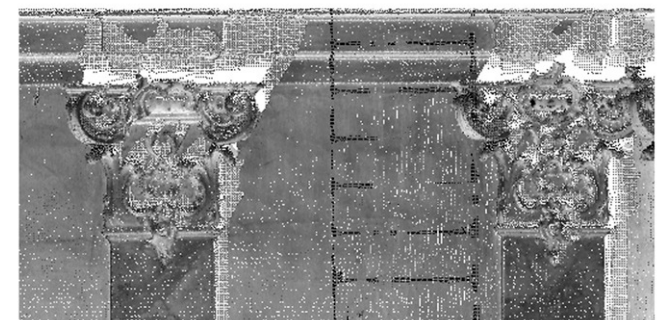
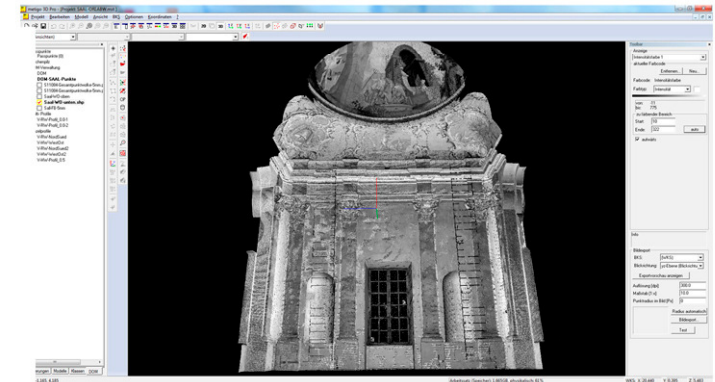
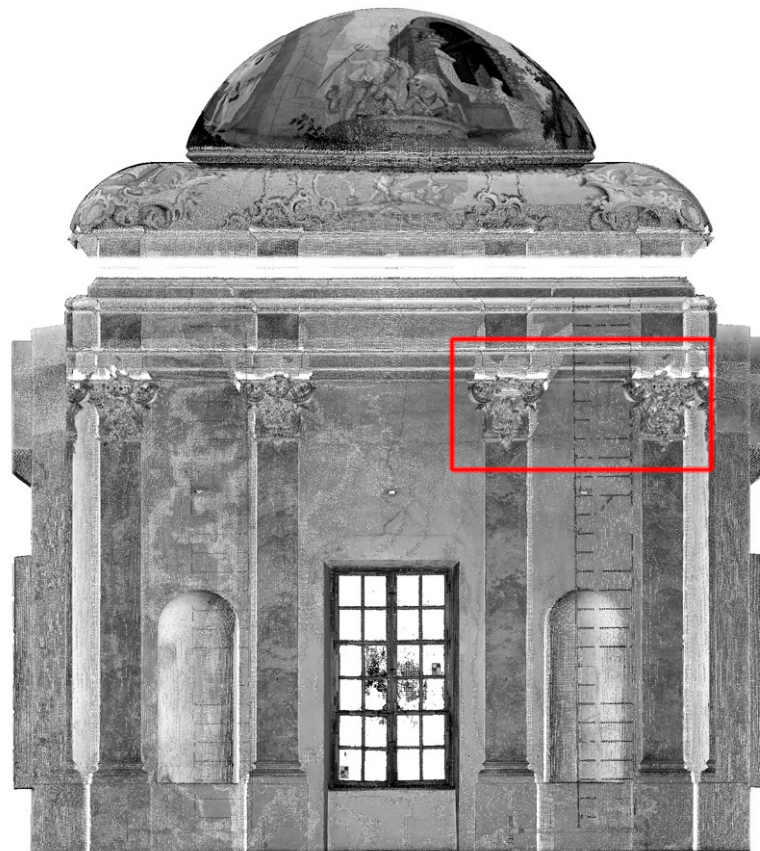




# metigo3D - Orthogonal projection

## Combination of Laserscandata with high resolved images:

- Raitenhaslach, monastery, Steinerne Saal, 2012,
- Photogrammetric documentation 1:20



- Orthoprojection with Intensity colours 1:50
- Laserscan 5mm point distance  
(Scan 3D GmbH, Berlin)

- detail 1:20



# metigo3D - Orthogonal projection

## Combination of Laserscandata with high resolved images:

- Raitenhaslach, monastery, Steinerne Saal, 2012,
- Photogrammetric documentation 1:20



- Digital image plan 1:50  
(projective rectification)

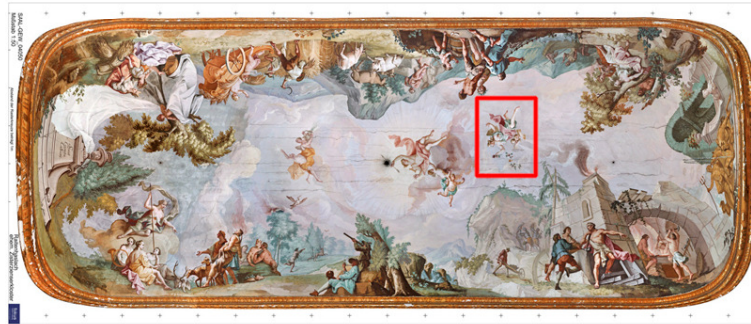
- detail 1:20



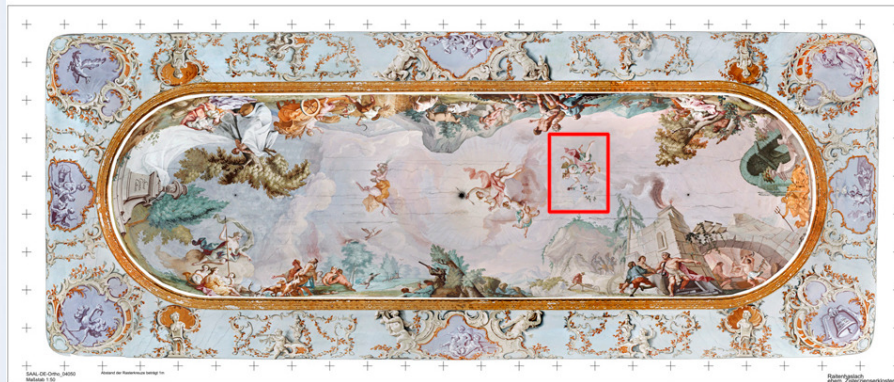
# metigo3D - Orthogonal projection

## Combination of Laserscandata with high resolved images:

- Raitenhaslach, monastery, Steinerne Saal, 2012,
- Photogrammetric documentation 1:20



- unwrapping with Orthoprojection



- Orthoprojection  
(Means ton and vault, each with 12 images,

- Detail 1:10





Raitenhaslach, ehem. Zisterzienserkloster  
Steinerner Saal  
Photogrammetrische Dokumentation

W Wandansicht  
FB Fussboden  
DE Deckengewölbe  
V Voute  
K Kalotte  
Ni Nische

Auflösung / Maßstab  
03 300 dpi  
010 Maßstab 1:10



SAAL-DE



SAAL-VN



SAAL-DE-KW



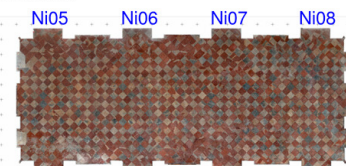
SAAL-VW



SAAL-WW



SAAL-WN



SAAL-DE-Ortho



SAAL-DE-Ortho



SAAL-VS



SAAL-WS



SAAL-DE-KO



SAAL-VO



SAAL-WO



SAAL-DE-Ortho



SAAL-VS



SAAL-WS

