Georeferenced 3D Laser Scan
Correct Documentation and Descriptive Visualization

Project and Historical Sources

The BFAD Heyse organizes exca-
vation projects in southern Ger-
many since 1995. Many investi-
gations took place in medieval
towns like Nürnberg, Würzburg
and Schwabenfert.

Prior to construction works near
the old town centre in Würzburg
the BFAD recorded the area of
‘Platz ‘scher Garten’ once a
prince-dominant hall, and the ‘Geb-
hand’s Keller’, a narrow alley
with a tavern. Both facilities
had been destroyed during air
raids in World War II. After the
bombing the still intact cellar
system remained untouched
for decades and had then been
recovered and documented (figure
below).

The origin of the cellar system
dated back into 1815 when it
was built by Martin Gähndel,
The owner of a nearby brewery.
He needed them for the storage
of beer kegs. The original buil-
ding consisted of two north-
south-oriented cells. The time
when the cellar was used and the
south extension declared as an air
raid shelter is not known.

A schematic diagram concerning
the behavior during air raid in
the Platz ‘scher Garten’ (figure
right) shows that the ‘Gebhardt-
keller’ had been included into
the system of air raid shelter.
The air defense area in the in
the three rooms (including a
gas lock and an emergency
exit) of the southern vault
offered a total capacity of
95 persons.

According to an estimate from
1948 the degree of destruction
of the buildings caused by war
was about 90% and the remains
were considered completely use-
less for reconstruction. The site
then remained undestroyed until
the present time. More recently,
an entrance has been installed
in the vault of the cellar. In ad-
dition there is a small Japanese
Garden with gazebos. The modern
access via a staircase along the
elevator shaft ends at the cellar
floor about 9 meters below the
present surface. The basement
consists of an access area, an
elevator and stairs. Each vaulted
cellar offers an access to a ven-
tilation shaft with an emergency
ladder.

Scan Record and further processing

The precise documentation of
the architectural structures of
the ‘Gebhardt’s Keller’ could be
achieved by applying a FARO
Focus 3D Laser Scanner, an
uncomplicated and at the same
time highly precise measuring
instrument.

The measuring procedure starts
in the laser unit, from where a
rotating mirror directs the laser
beam into the area of measure-
ment. The distance is distinctly
determined via the running time
delay of the transmission beam
and the reflected laser beam.

With the help of the angle of
the rotating mirror and the angle
of the laser scanner itself the faro
module calculates the coordi-
nates and stores the 3D-position
of the point. This procedure is
repeated several hundred times
per second and creates a dense
point cloud and a detailed 3D
image of the environment (figure
up and below). The resolution is
up to a hundred times higher
than with a commercial mega-
panel camera. Reference targets
make it possible to connect
scans of different visible ranges.

In the instance of the Gebhardt’s
Keller the scan record shows a
highly resolved 3D image with
the clearly visible precautions written
on the wall. The record may also
be used to extract data for CAD
drawings and further processes.

Distances or sizes in the point
cloud can be roofed easily with
the faro software. Through pro-
cessing the data with AutoCAD
software different isometric views
could be produced. The records
were georeferenced with a total
station on the surface. The requi-
red fixed points have been produ-
ced by using a GPS. High accuracy
of the measurements could be rea-
ced with correction data of the
mobile provider.

In the southern part of the cellar
precariously in case of flight attack
written on the wall marks the
entrance to the air raid shelter.
The visible reference targets were
lately covered with silver paint
for complete documentation of the
construction system.