

On solid ground

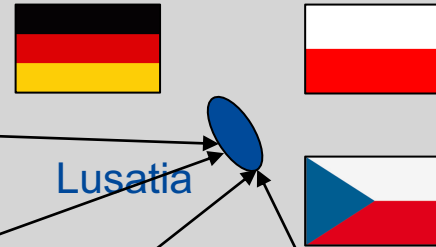
The German Centre for Astrophysics (DZA)
a centre for research, technology, and digitisation.

Michèle Heurs for the DZA team
ET Symposium, 11.05.2023, Cagliari



Neutron star merger, AEI Golm

Lusatia, a region in the centre of Europe



A competition historically unique in Germany

**ANNUAL BUDGET AFTER RAMP-UP PHASE 170 M€,
TOTAL VOLUME OF THE APPLICATION 1.4 B€**

Structural change

KNOWLEDGE CREATES PERSPECTIVES FOR THE REGION!

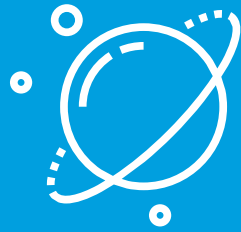
Two new large-scale research centres will be established in Lusatia in Saxony and in the Central German mining region. With "Knowledge creates perspectives for the region!", the BMBF and the Free State of Saxony are launching a competition for the establishment of the centres.

<https://www.bmbf.de/de/wissen-schafft-perspektiven-fuer-die-region-13122.html>

Who we are

The DZA is a joint initiative of German astronomy and astroparticle physics with the idea of creating a national and also international hub of astrophysics. The idea was born out of the need for cooperation, and it is supported by many research institutions, universities and partners.

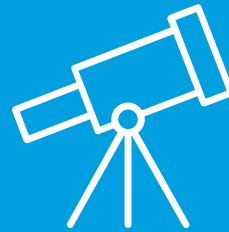
DZA concept : the challenges of astrophysics today



Astronomy

Square Kilometre Array
Observatory (SKAO)

Einstein Telescope
(Low Seismic Lab)



Instruments

Developments for future
astronomical experiments

Strong participation of
Saxon industry



Data Intensive Computing

Processing huge amounts
of astrophysics data from
all over the world

Innovative AI based and
Smart Green Computing

Interlocking of pillars → unique synergies

29. September 2022



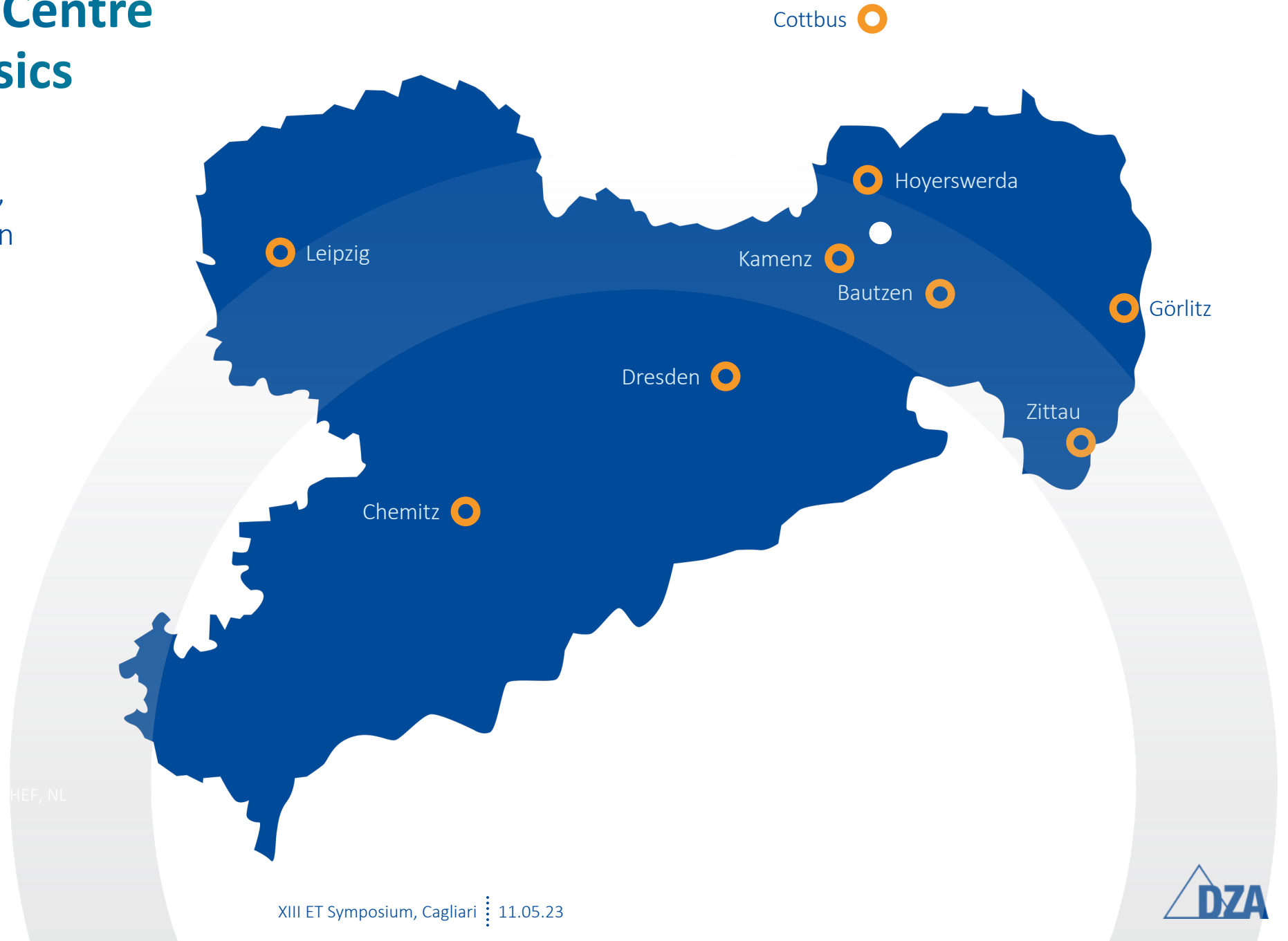
Katharina Henjes-Kunst and Günther Hasinger in Görlitz



Michèle Heurs and Christian Stegmann in Cunnewitz

The German Centre for Astrophysics

Two sites for research,
technology, digitisation



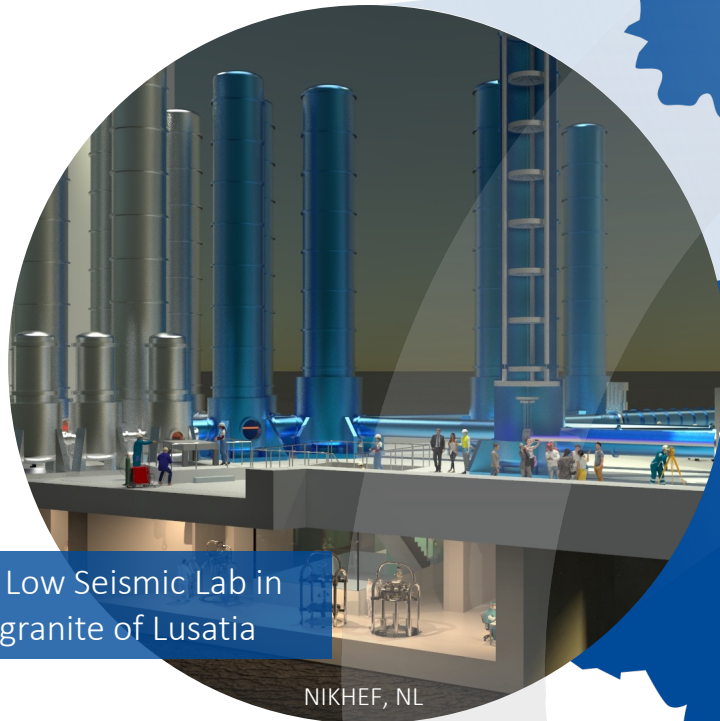
The German Centre for Astrophysics

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The German Centre for Astrophysics

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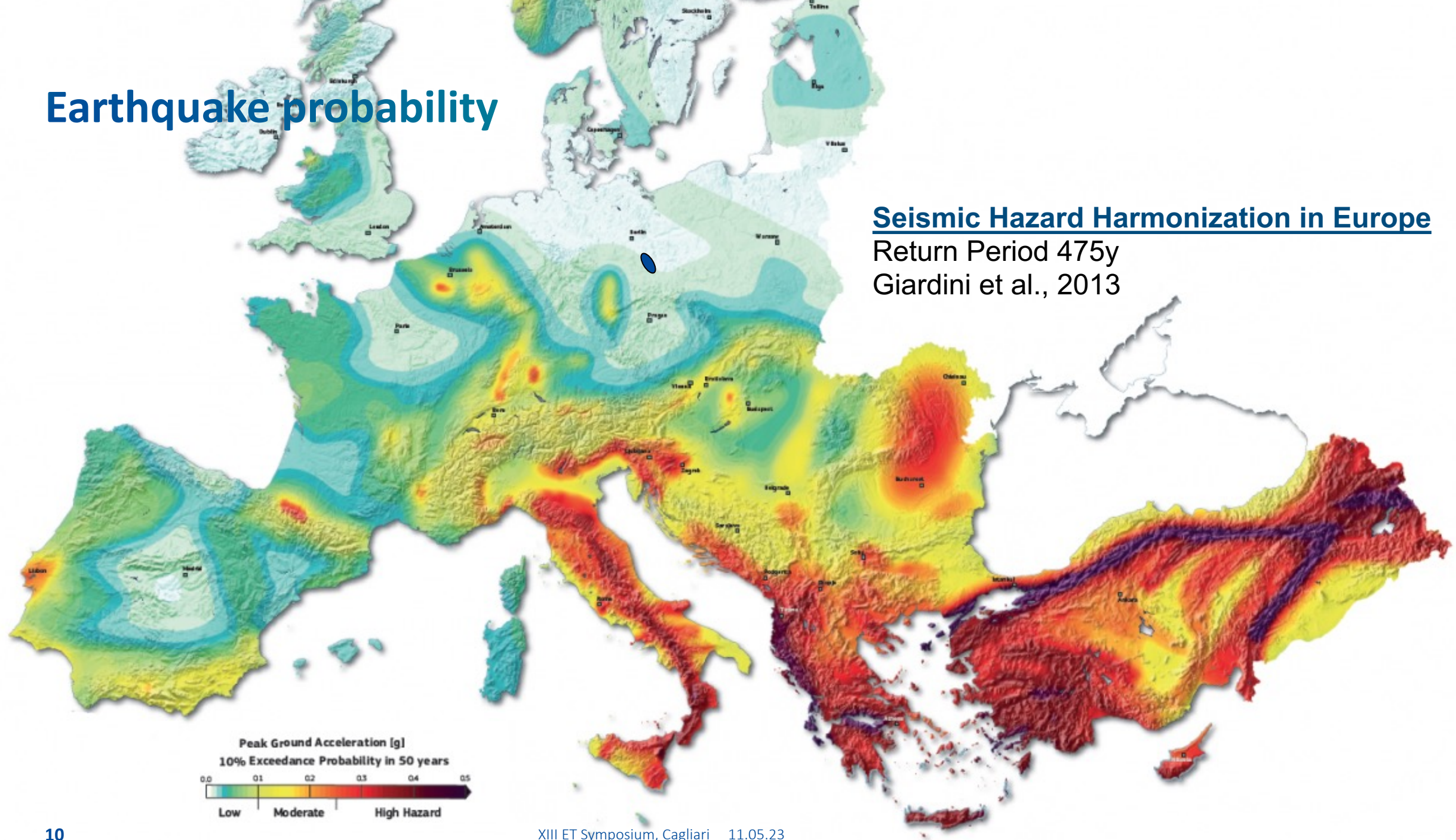
The Low Seismic Lab in
the granite of Lusatia

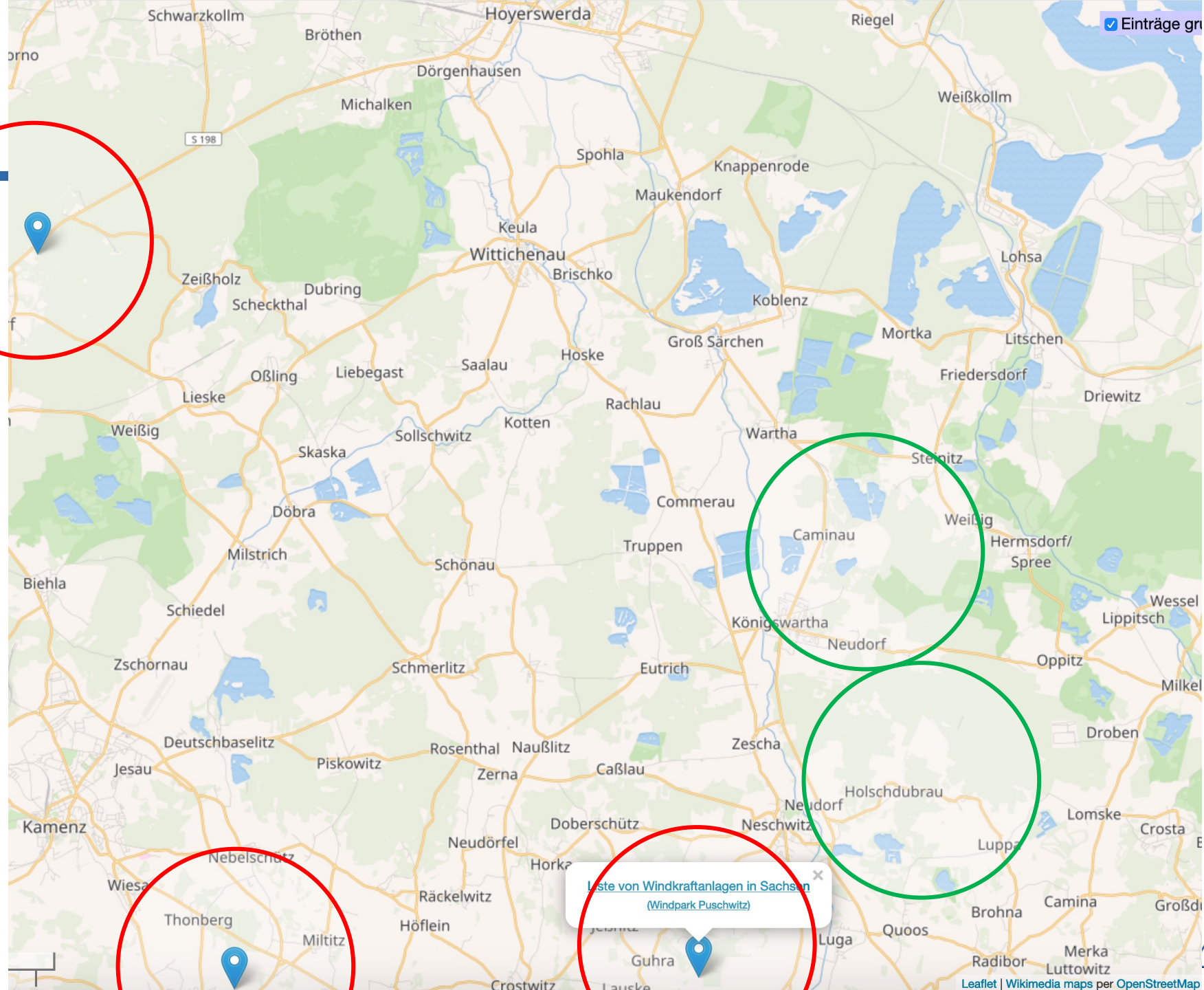
NIKHEF, NL

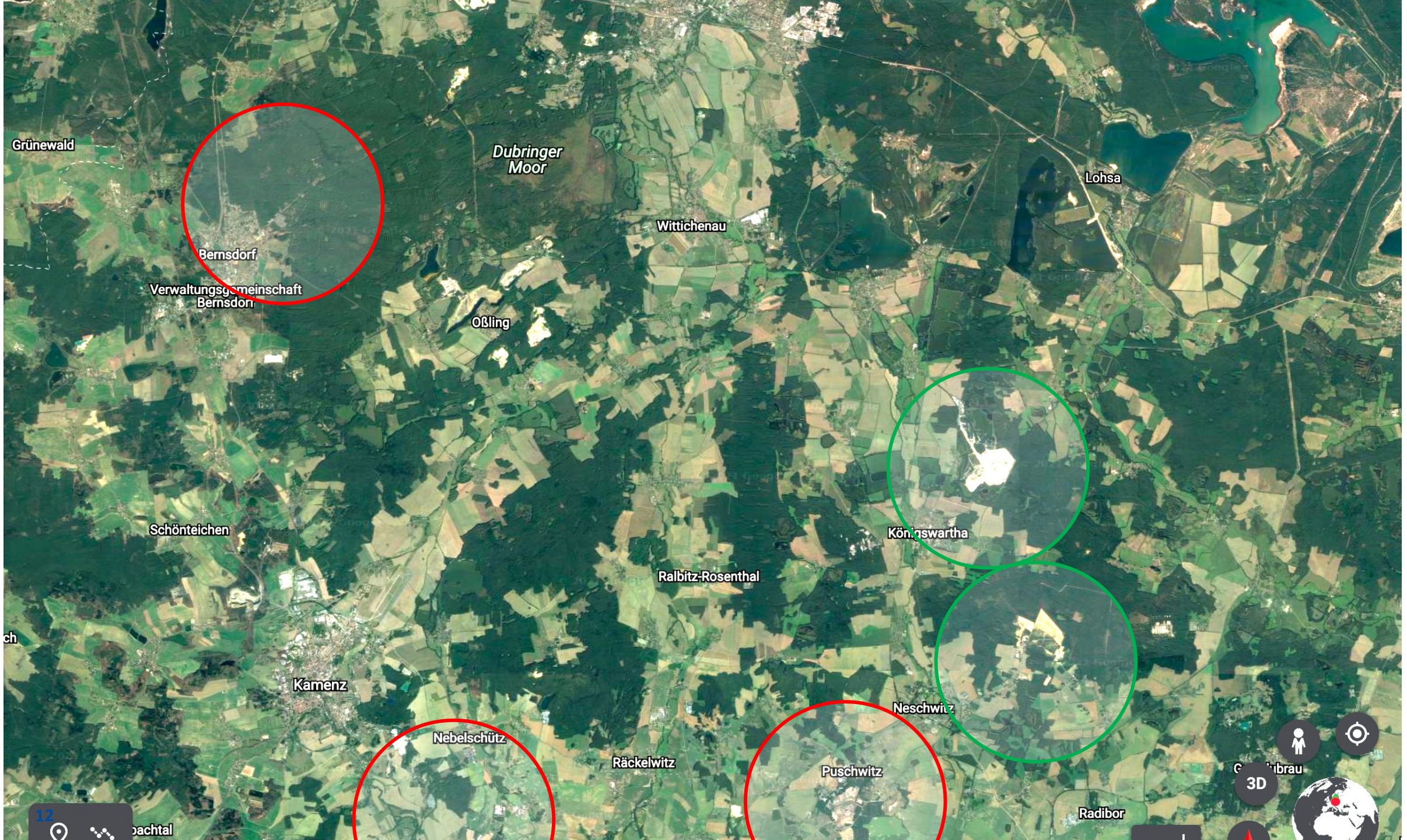


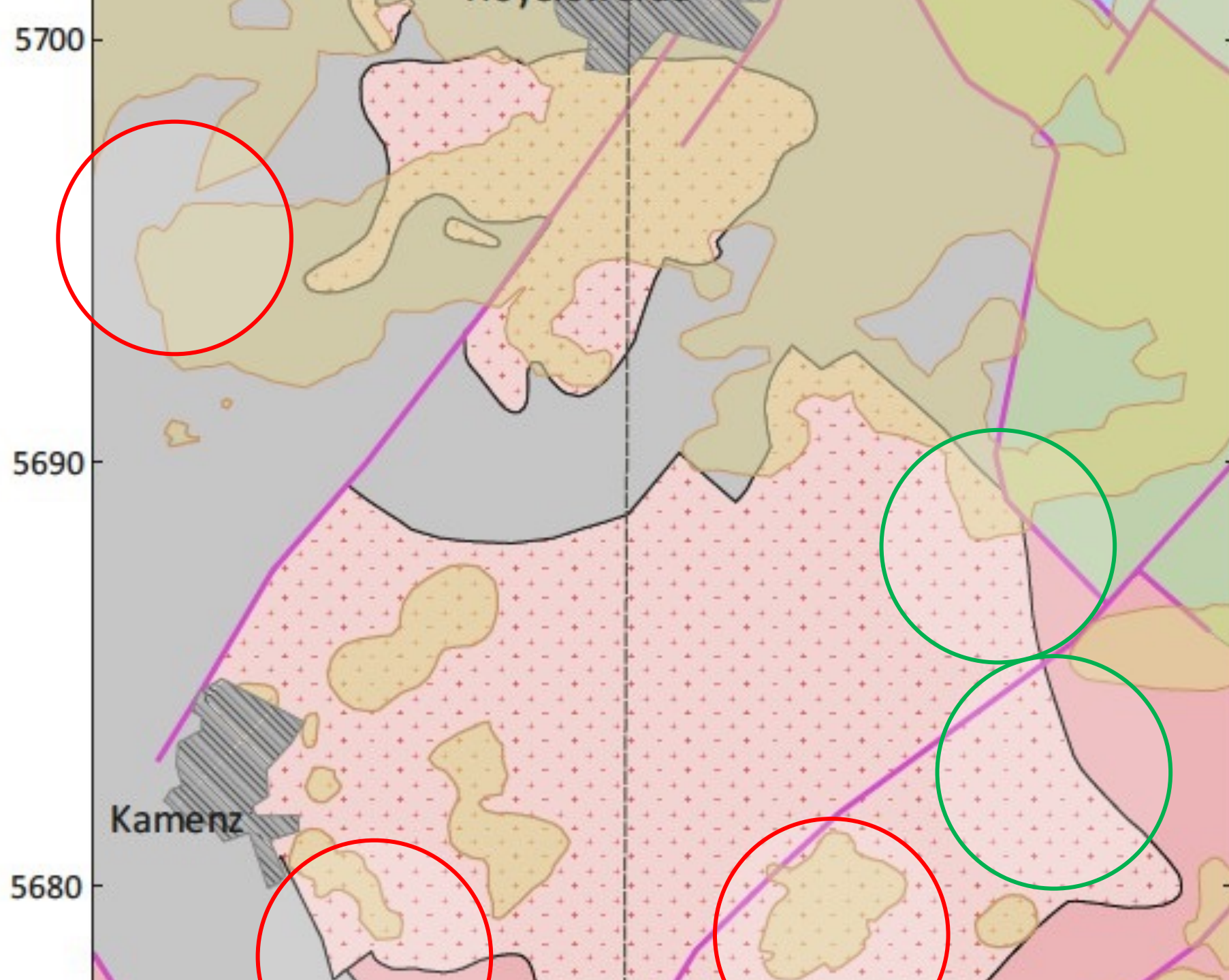
The DZA campus on the
Kahlbaum site in Görlitz

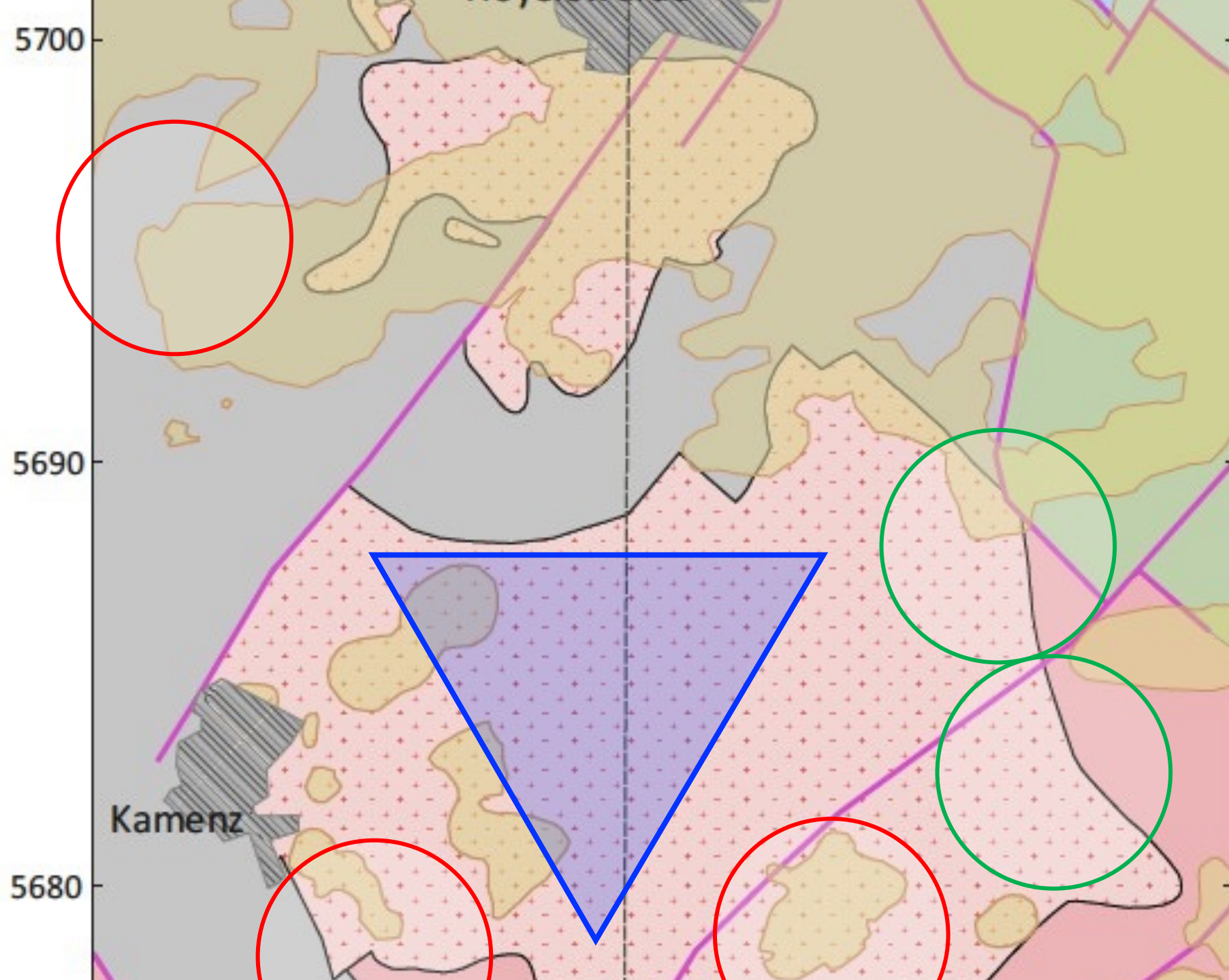
Earthquake probability



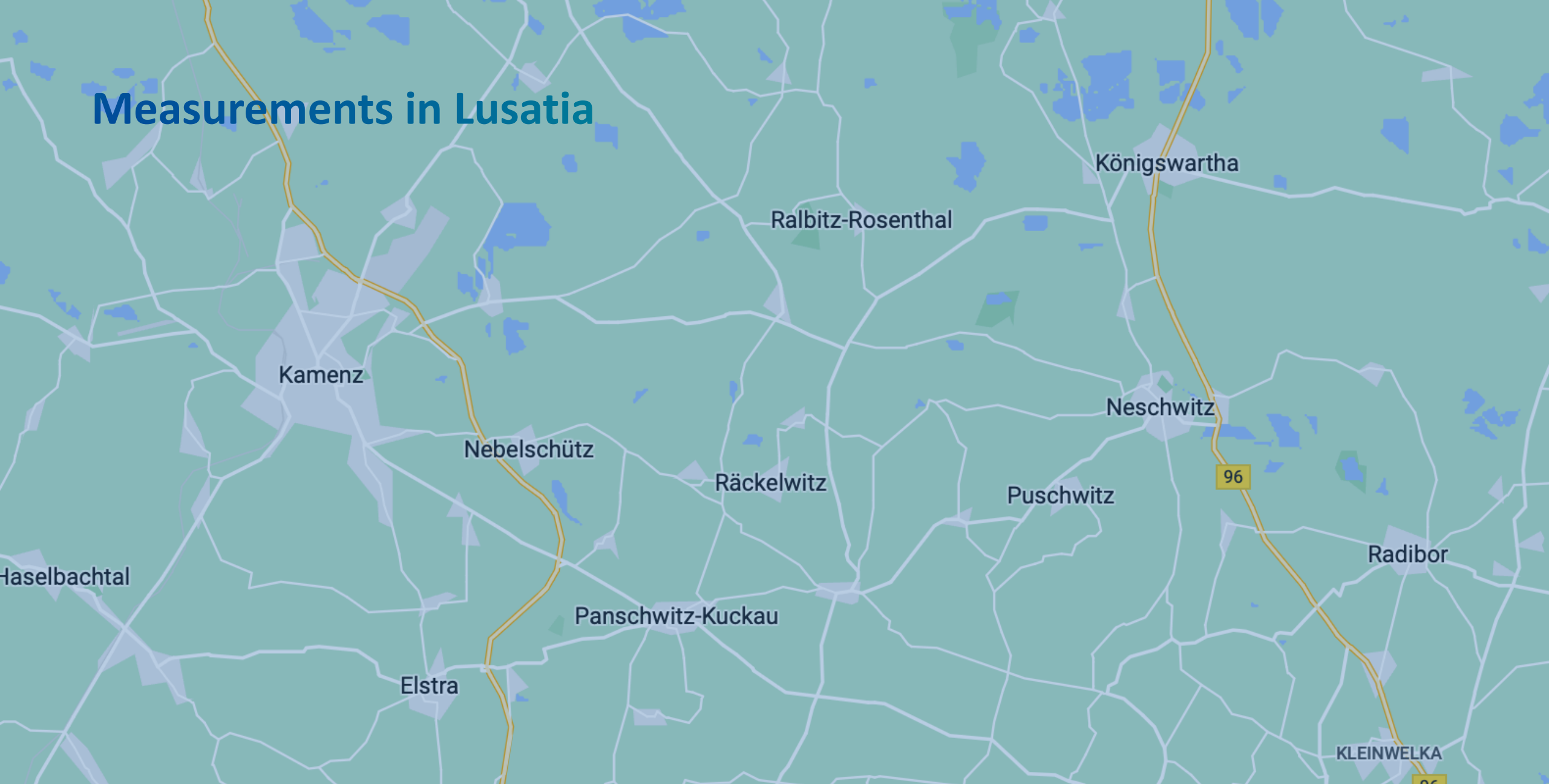




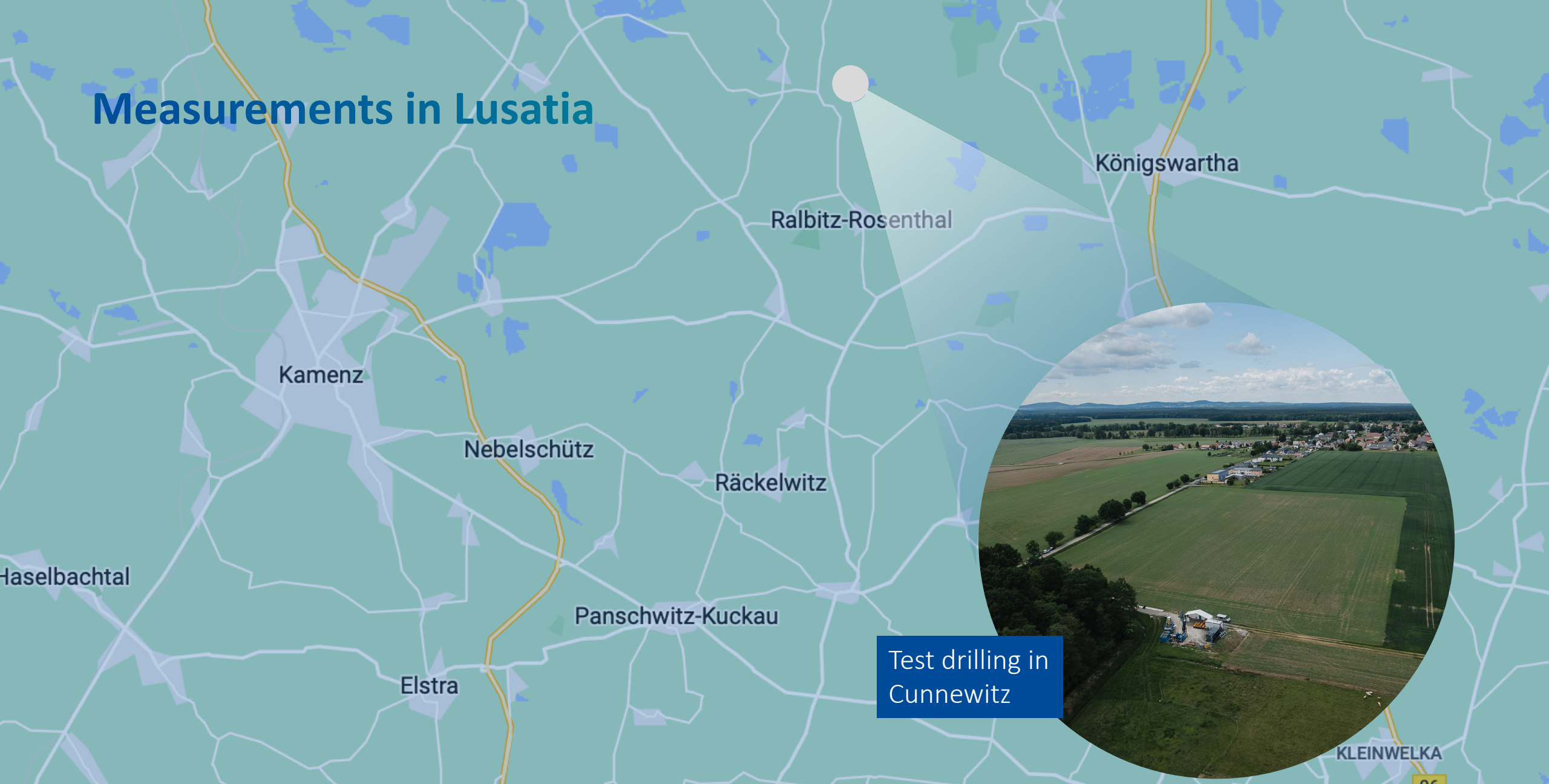




Measurements in Lusatia



Measurements in Lusatia



Test drilling in
Cunnewitz

Measurements in Lusatia



Cunnewitz, part of Ralbitz-Rosenthal





Bundesministerium
für Bildung
und Forschung



Probeförderung

für das Deutsche Zentrum für Astrophysik



Wissenschaftliche Bohrung bis in 250m Tiefe zur Prüfung der möglichen Ansiedlung des geplanten europäischen Gravitationswellen-Observatoriums Einstein-Teleskop und eines unterirdischen Forschungslabors im Granitstock der Oberlausitz. Die Bohrung ist Teil der Initiative zur Gründung des Deutschen Zentrums für Astrophysik in der Lausitz.

Die Besichtigung der Bohrstelle ist nach Absprache möglich. Auch Schulklassen sind herzlich willkommen vor Ort mehr über das Projekt zu erfahren. Kontakt: dza@desy.de

Probowa

točenje za Němski centrum za astrofiziku (DZA)

Wědomostne točenje hač do hłubokosće 250 m k pruwowanju móžneho připrawjenja planowaneho europskeho observatorija grawitaciskich žotmow Einsteinoweho teleskopa a podzemskeho slědžerskeho labora zornowcoweho zakłada Hornjeje tužicy. Točenje je wobstatk iniciatiwy k załoženju Němskeho centruma za astrofiziku we tužicy.

Wobhladanje točenskeho městna je po dorěčenju móžne. Tež šulske rjadownje su wutrobne witane na městnje wjac wo projekće zhonić. Kontakt: dza@desy.de



Auftraggeber: Deutsches
Elektronen-Synchrotron DESY
in der Helmholtz-Gemeinschaft
Platanenallee 6
D 15738 Zeuthen
www.desy.de



Bohrunternehmen:
Brunnenbau Conrad GmbH
D 99947 Bad Liebenberg
www.bpc.de





The borehole on Tuesday (09.05.23)

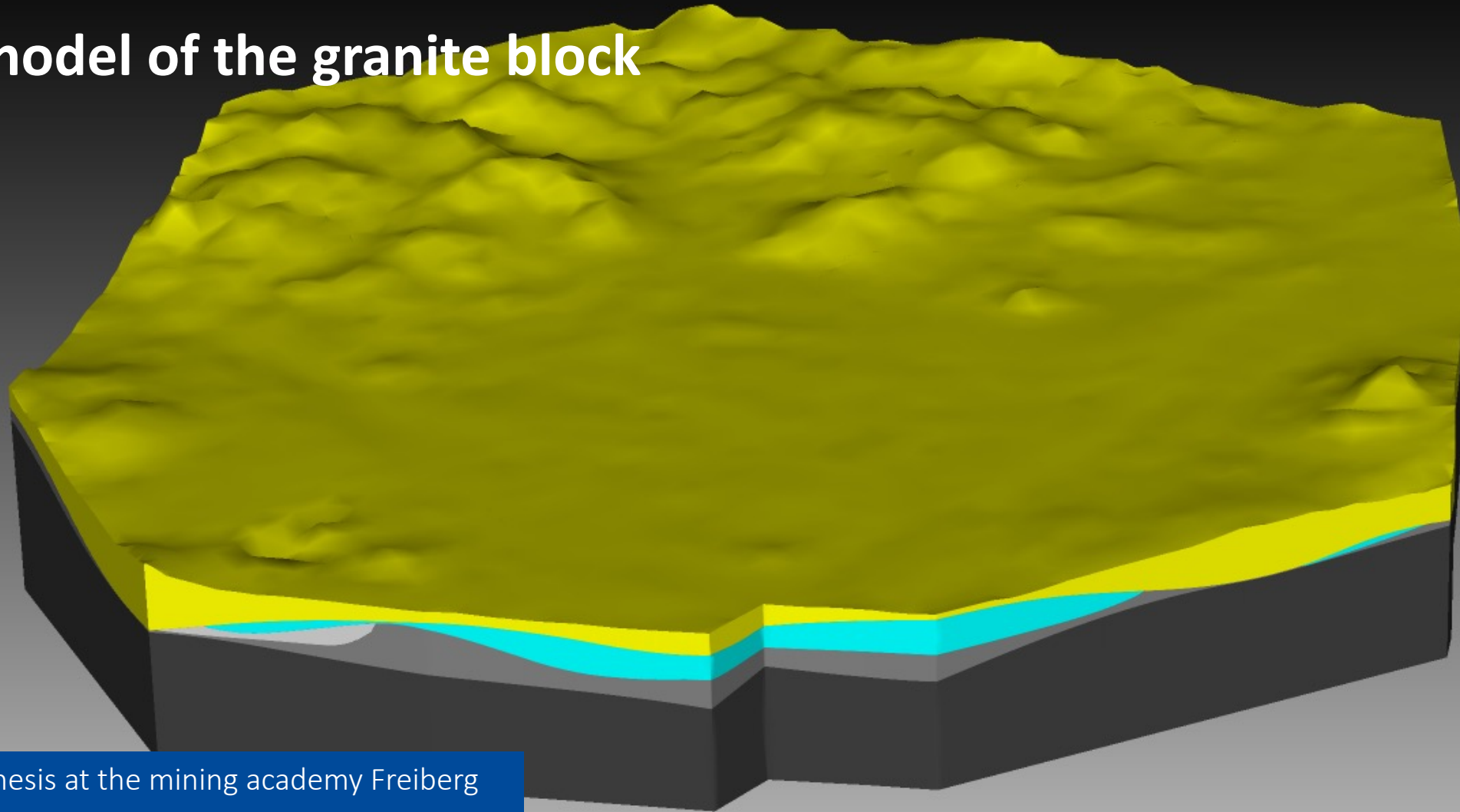


Drill cores

Great public interest



A model of the granite block

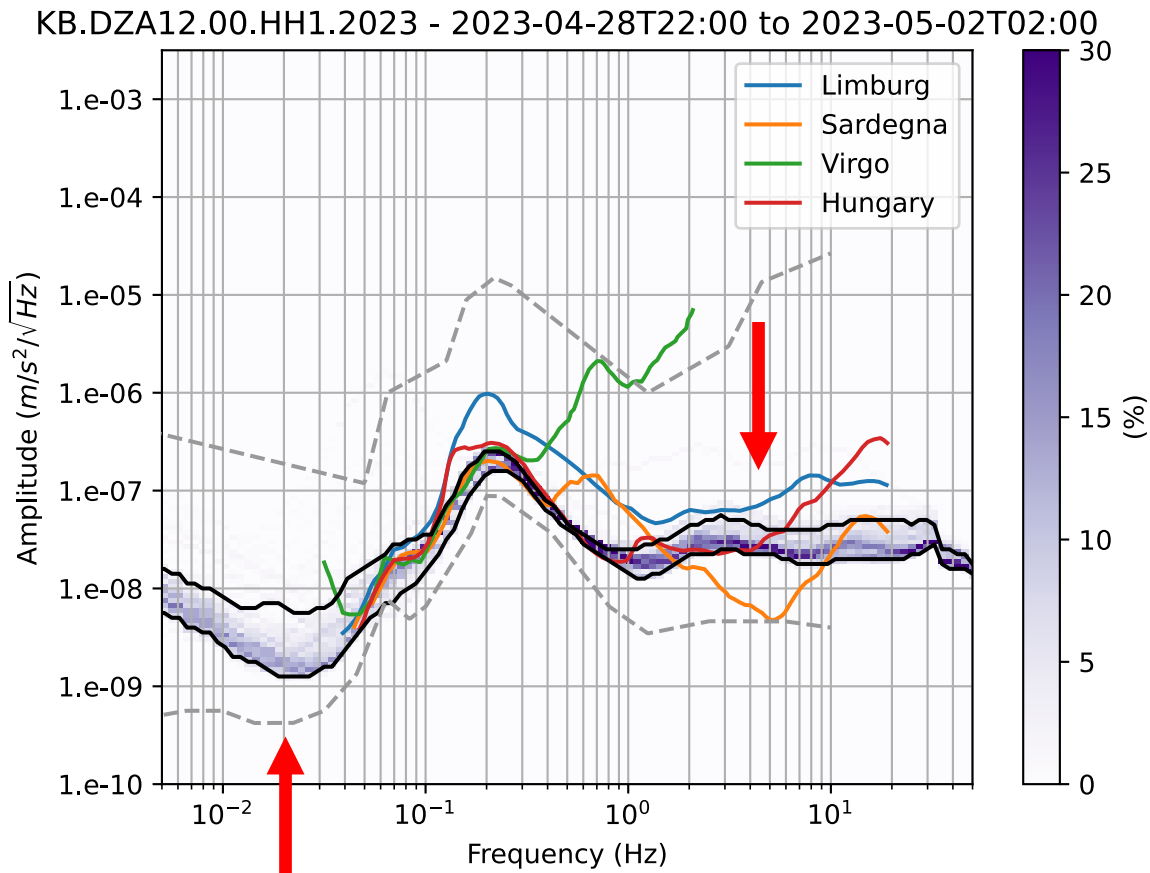


DZA Master thesis at the mining academy Freiberg

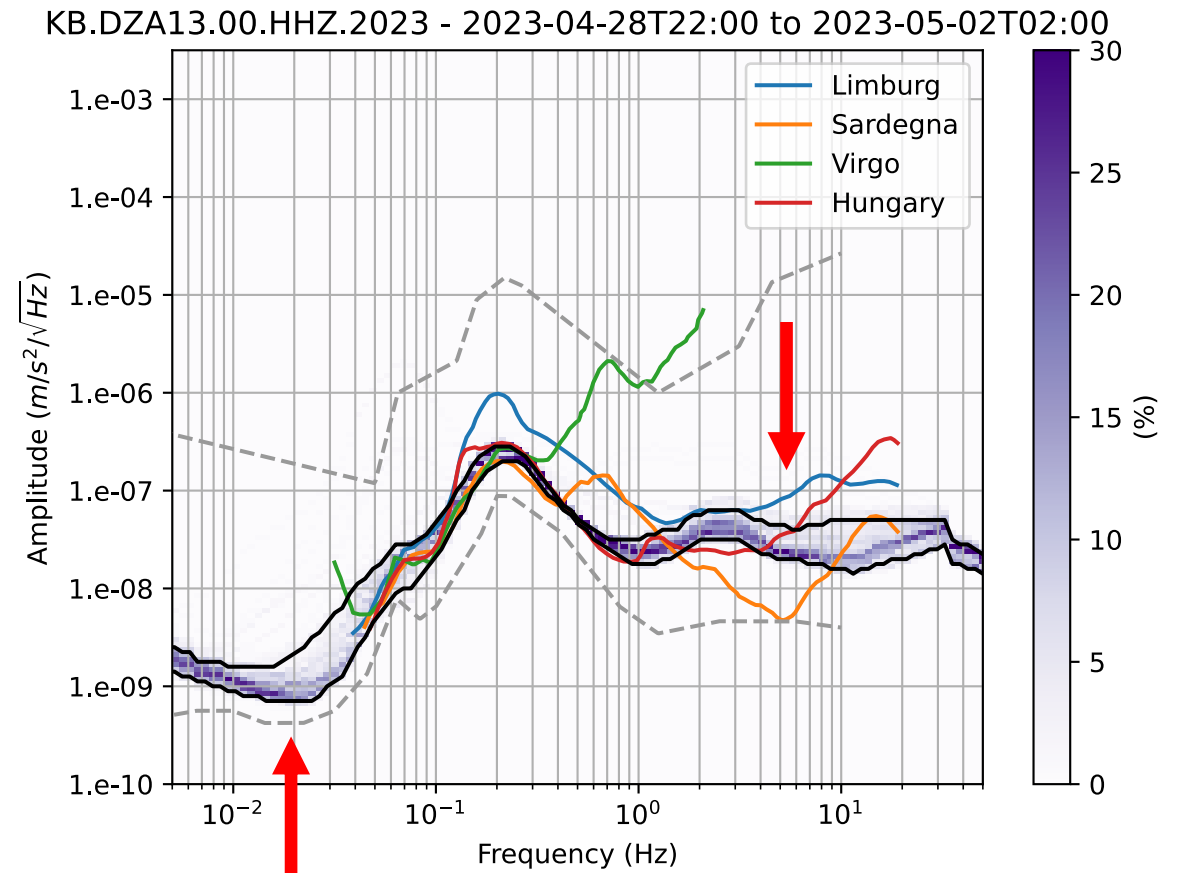


Current measurements in the Lausitz

Borehole 1: 165m (2nd hole)



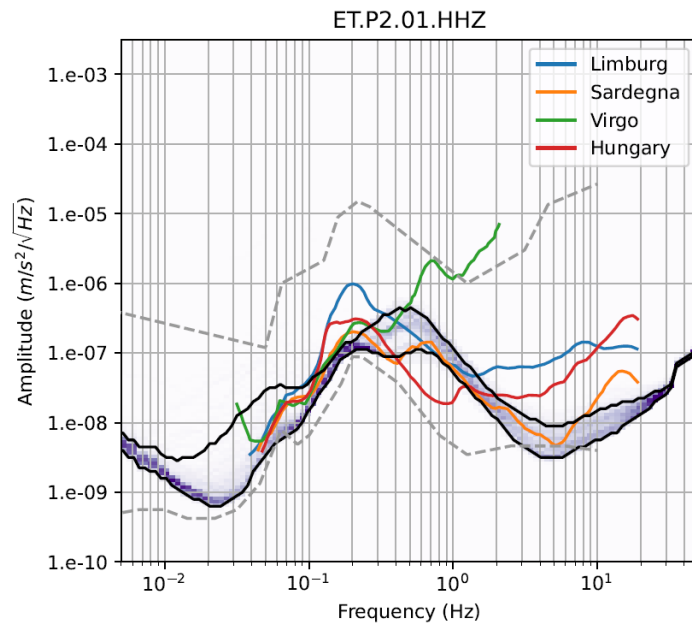
Borehole 2: 170m (1st hole)



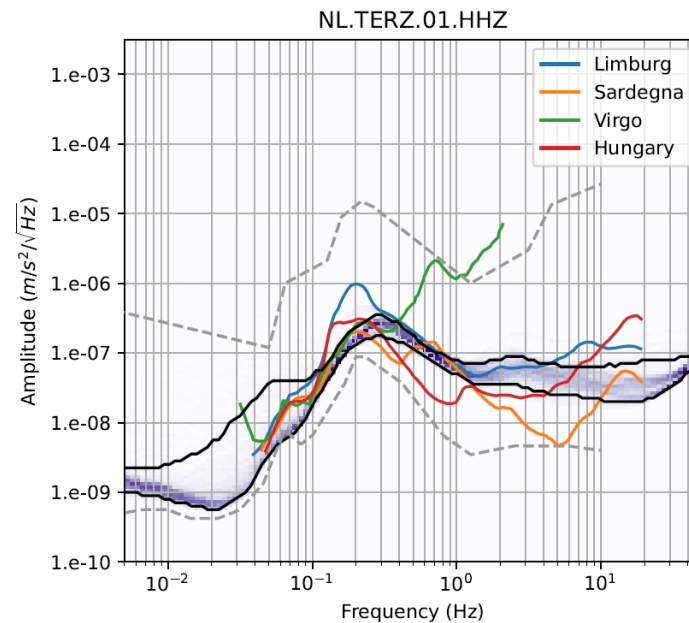
A. Rietbrock, KIT

A very preliminary comparison

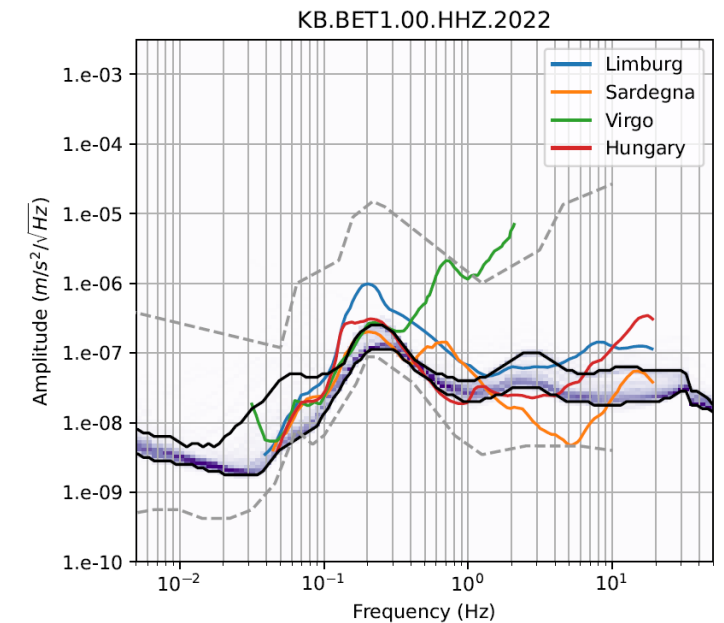
- Sardinia



- Limburg



- Lusatia



A. Rietbrock, KIT

Future seismic noise and geophysical investigations

- DESY, as a partner of the DZA, will perform the investigations in the coming years together with KIT, GFZ, Bergakademie Freiberg, LfUG Sachsen, RWTH Aachen
- **Programm**
 - Development of a 3D subsurface model of the seismic properties of the subsurface (backbone model).
 - Investigations of incident seismic noise field and its temporal and spatial coherence will be investigated.
 - Comparison with the seismic data observed in the pilot borehole at different depths for predictions for potential further borehole locations.
 - Passive seismic measurements on a 10 km x 10 km grid to determine the three-dimensional shear wave velocity.
 - 2D reflection/refraction lines to determine the seismic velocities and calibration of the passive experiment.
 - Development of an integrated geological map for Lusatia incl. evaluation of old data and drill cores
 - Characterisation of the seismic noise including borehole measurements and development of a seismic-geological "back-bone model".
 - 5 further boreholes incl. further geophysical investigations

The Low Seismic Lab

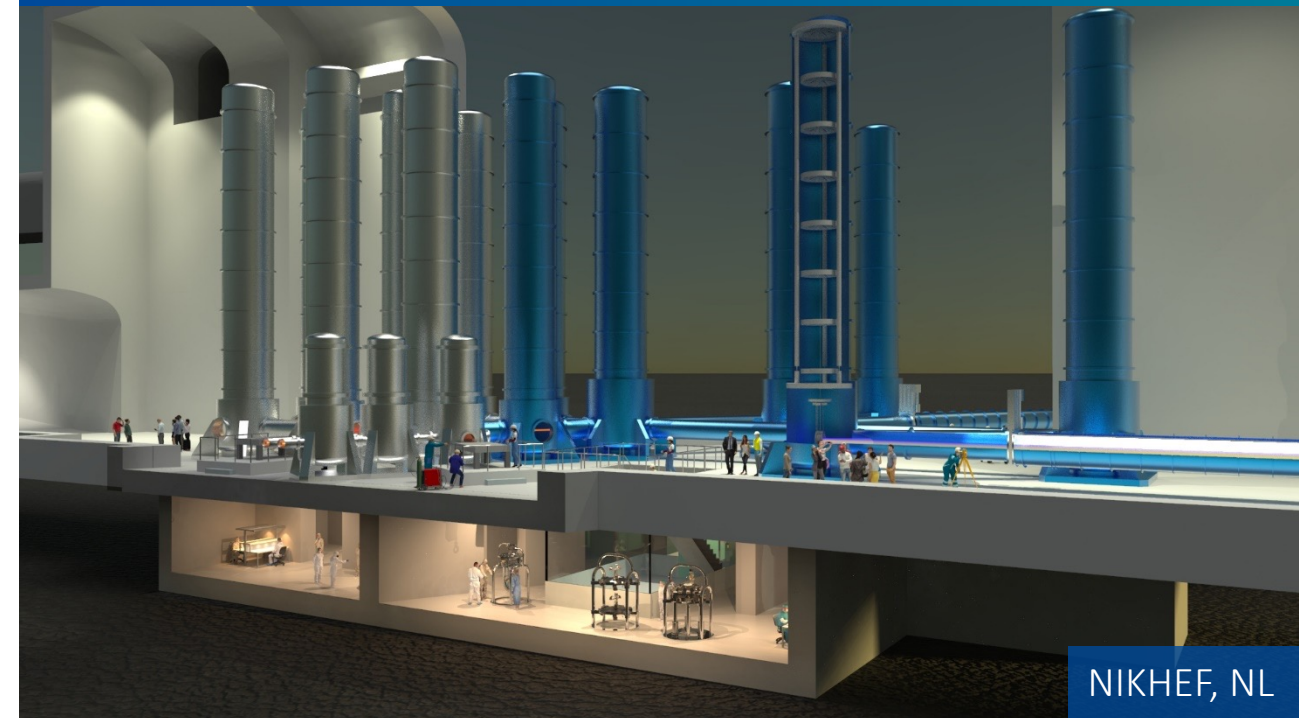
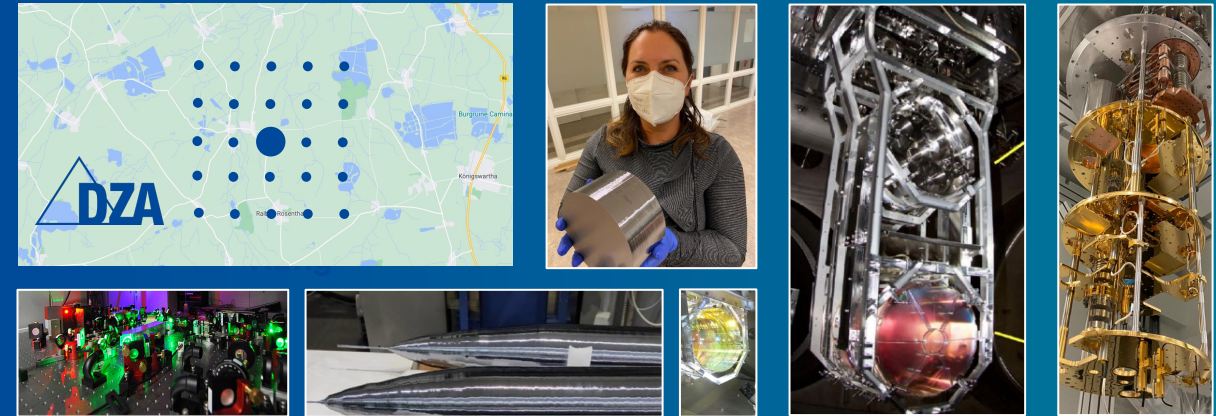
Innovation platform of approx. $(40 \times 30 \times 30) \text{ m}^3$ in 200m depth in the Lusatian granite

With a square kilometre 3D seismometer sensor array.

→ Metrological validation of advanced seismic isolation concepts on a large scale

THE PLACE FOR FUTURE "DEEP TECH":

- Technology development for gravitational wave astronomy
- Adaptive seismic noise reduction
- Subnanometer microscopy and photolithography
- Quantum computing experiments
- Astrophysics with accelerators



The German Centre for Astrophysics in Lusatia

A big success for fundamental science (or more specifically astronomy, astrophysics and astroparticle physics) and an important step towards a significant German participation in the Einstein Telescope

PROJECT PHASE (2023-2026):

- Further test drills and geological / seismic investigations to determine suitability of granite for LSL & ET

"FULL FUNDING" PHASE (2026 ONGOING):

- Buildings and underground lab construction, full ramp-up of personnel and research & science

IN ANY CASE:

- DZA will conduct technology development for gravitational wave astronomy and in particular for ET



The main points and questions (IMHO)

Our position is an offer to the European GW Community. The investigations and preparations for the Low Seismic Lab and the site for ET are very similar – we're doing them anyway!

We are offering the investigation of a potential site (along the criteria below), so the community is able to find the best location for ET.

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We are offering the investigation of a potential site (along the criteria below), so the community is able to find the best location for ET.

- 1) Can ET's scientific programme be implemented at this location?
- 2) Can ET be built at the site cost-effectively and with foreseeable risks?
- 3) Can ET be operated at the site for decades?
- 4) Is there political support for the site, i.e. is the host country willing to cover at least half of the investment?

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