Geomagnetic Flux Concentrator for Earth s' Magnetic Power Plan

(INSINas 2012-2014)

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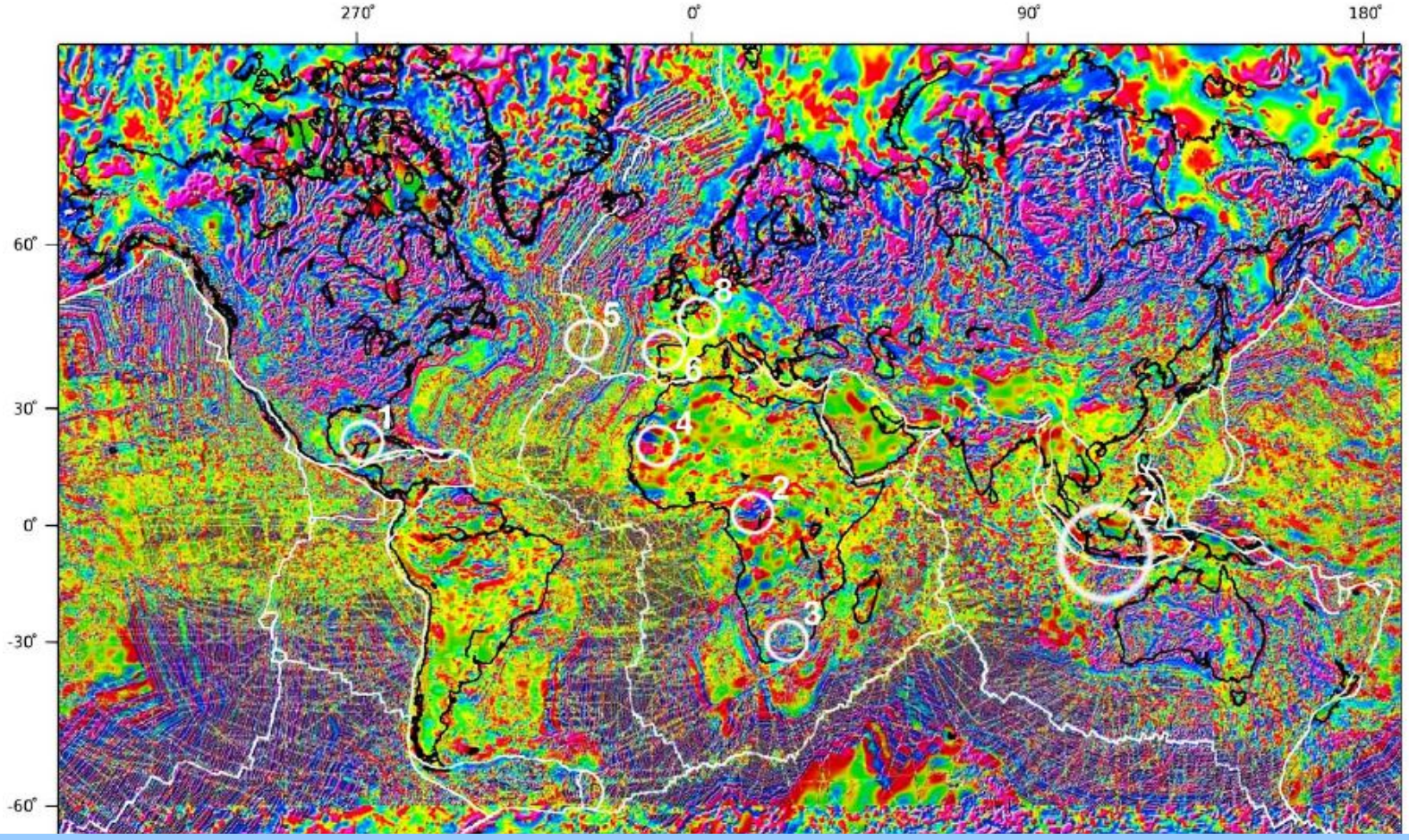
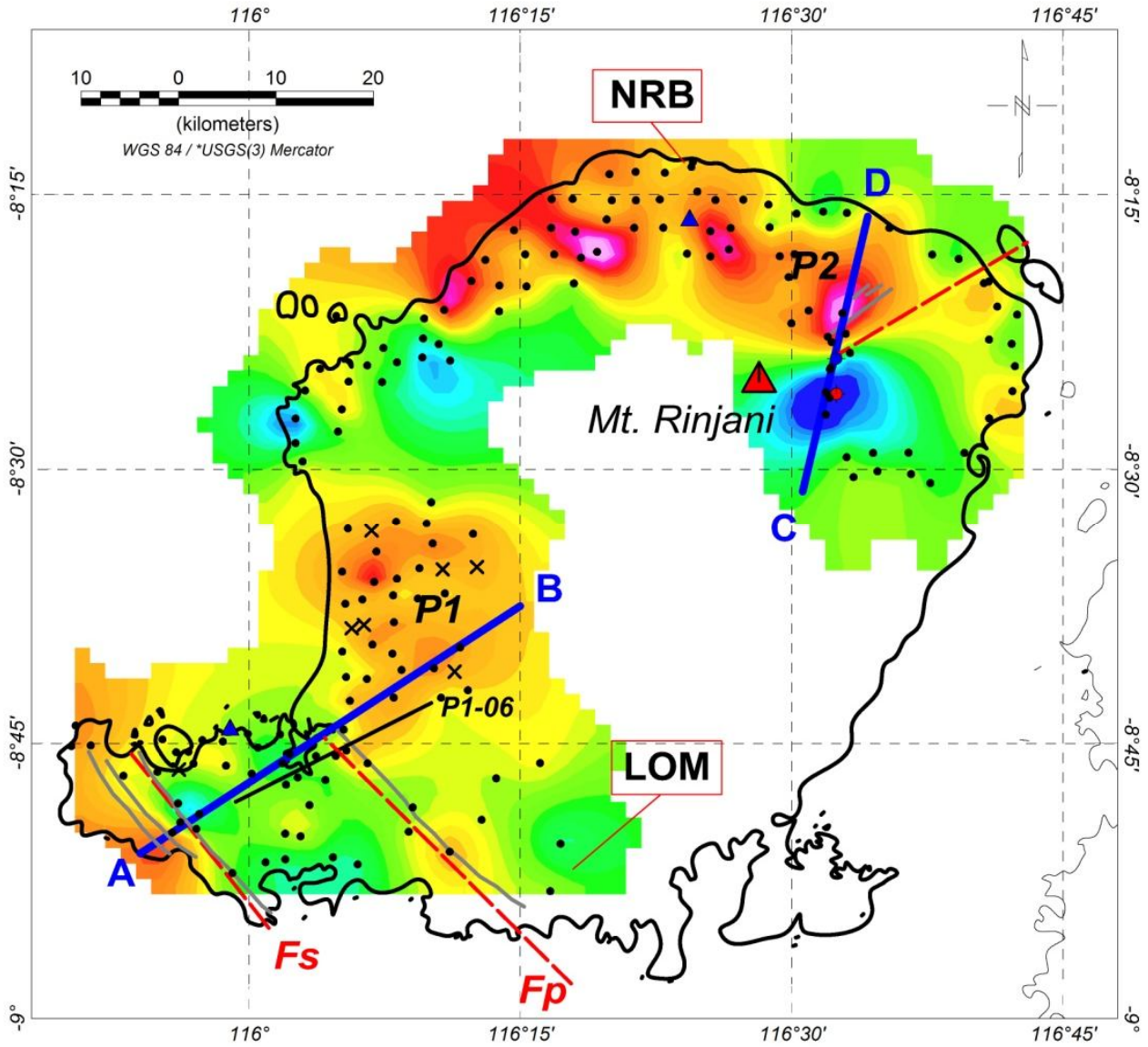
QiR 2015 Exhibition

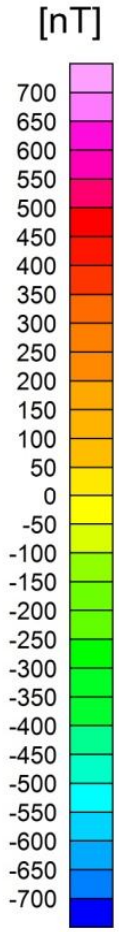
10-13 August 2015

World Digital Geomagnetic Anomalies Map



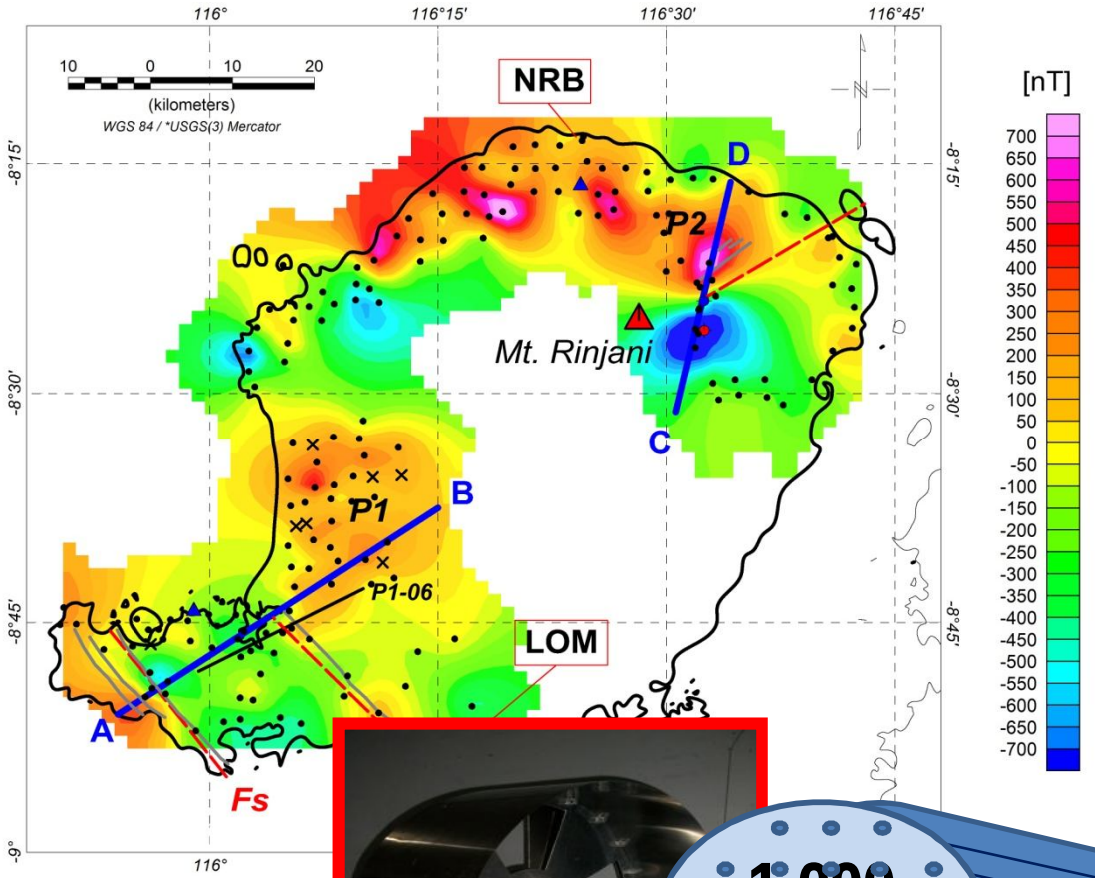
1) Chicxulub crater; 2) Bangui anomaly; 3) Thromsberg anomaly; 4) Richat structure; 5) Atlantic ridge; 6) Bay of Biscay; 7) Java Trench; 8) Paris Basin (Mandea and Thébault, 2007).



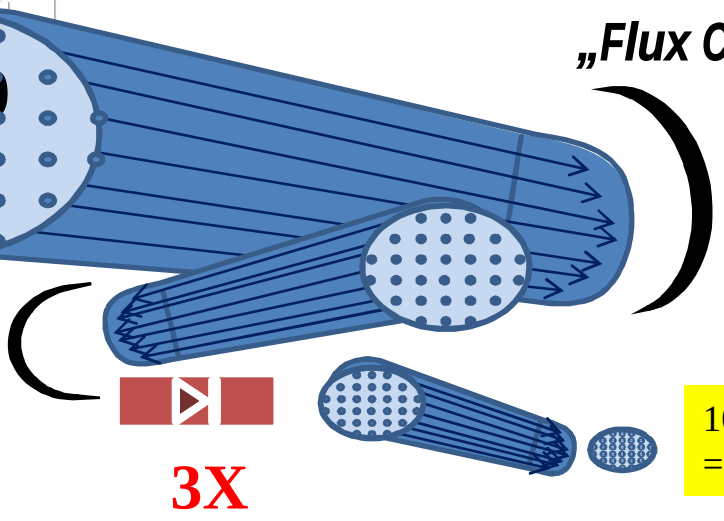


- Lombok Island is located on the highest geomagnetic anomaly region in Indonesia.
- Dipolar strength up to 1000 nT.

(Zubaidah, 2014)



(Zubaidah, 2014)



10.000 nT =
1 gauss

100.000.000 nT
= 10.000 gauss

How to use geomagnetic as an energy resource?

Geomagnetic fields
= Static magnetic field

"Flux Manipulator"
Pulses of Field → directed
& concentrated through Waveguides

„Flux Concentrators"

Research Activities

2012:

- Magnetic chamber 3mx3mx3m
- Helmholtz coils calibration
- Manipulator with 8 holes

2013

- Expansion of magnetic chamber 6mx3mx3m
- Manipulator with 16 holes & wave guide

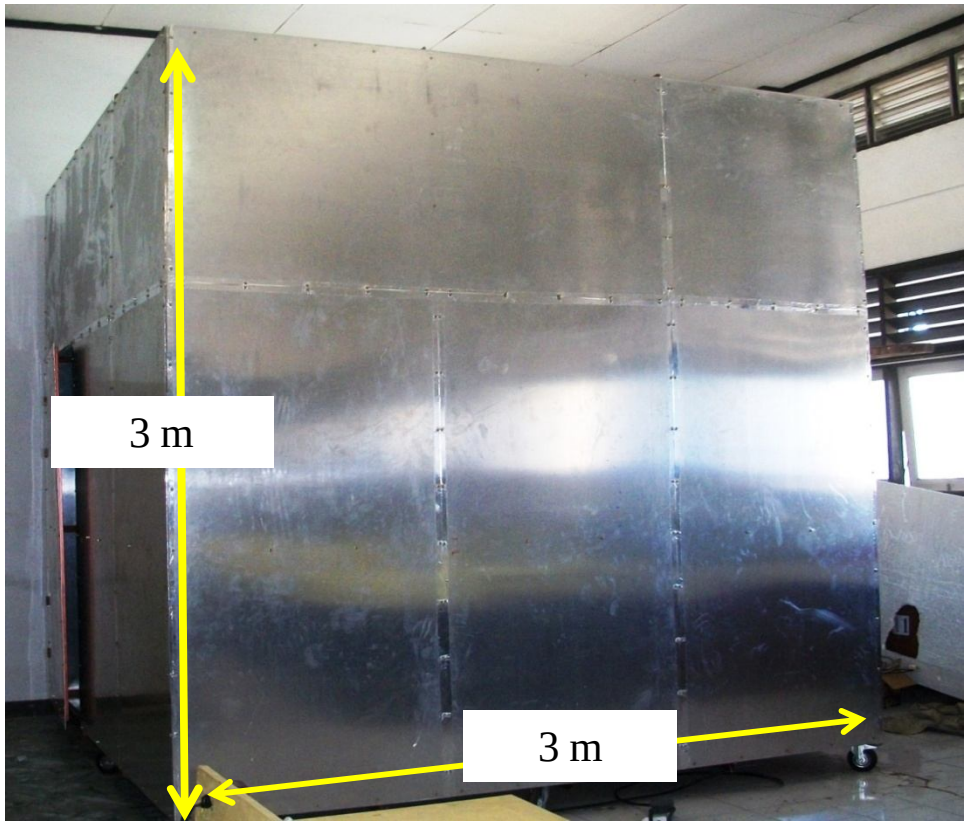
Tahap-3:

- 3D mapping of new chamber
- 3D measurements and flux distribution mapping of manipulators
- Mini Manipulator with 8 holes

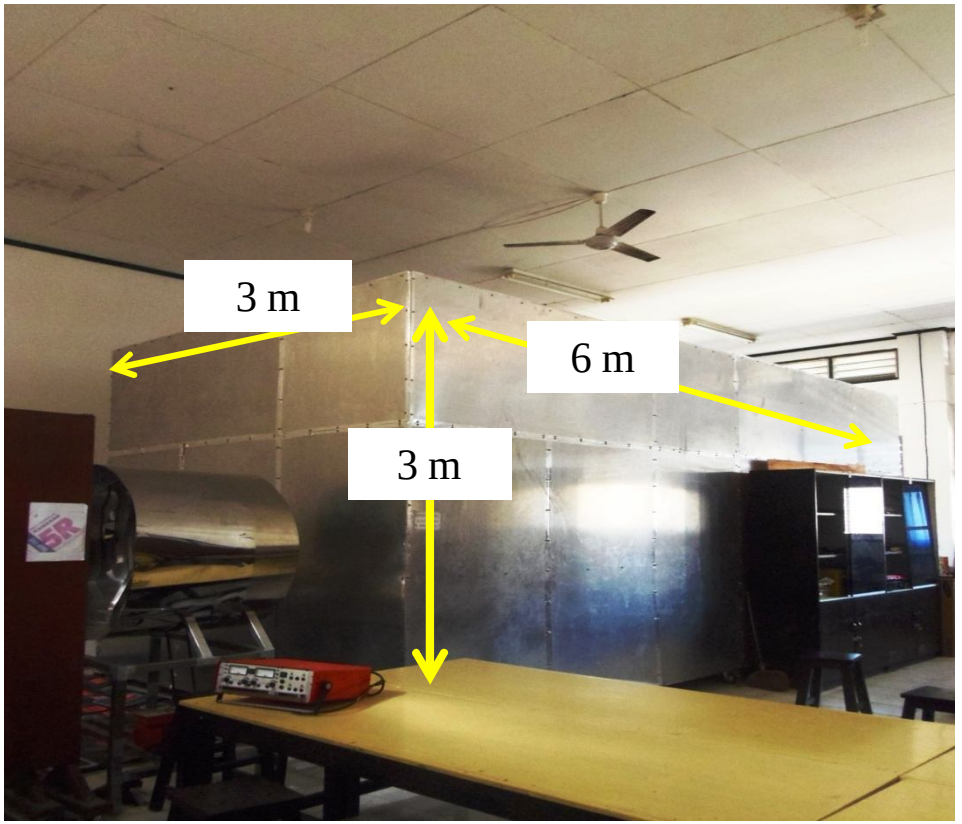
Semi anechoic chamber

at the Control Laboratory of Mataram University

2012



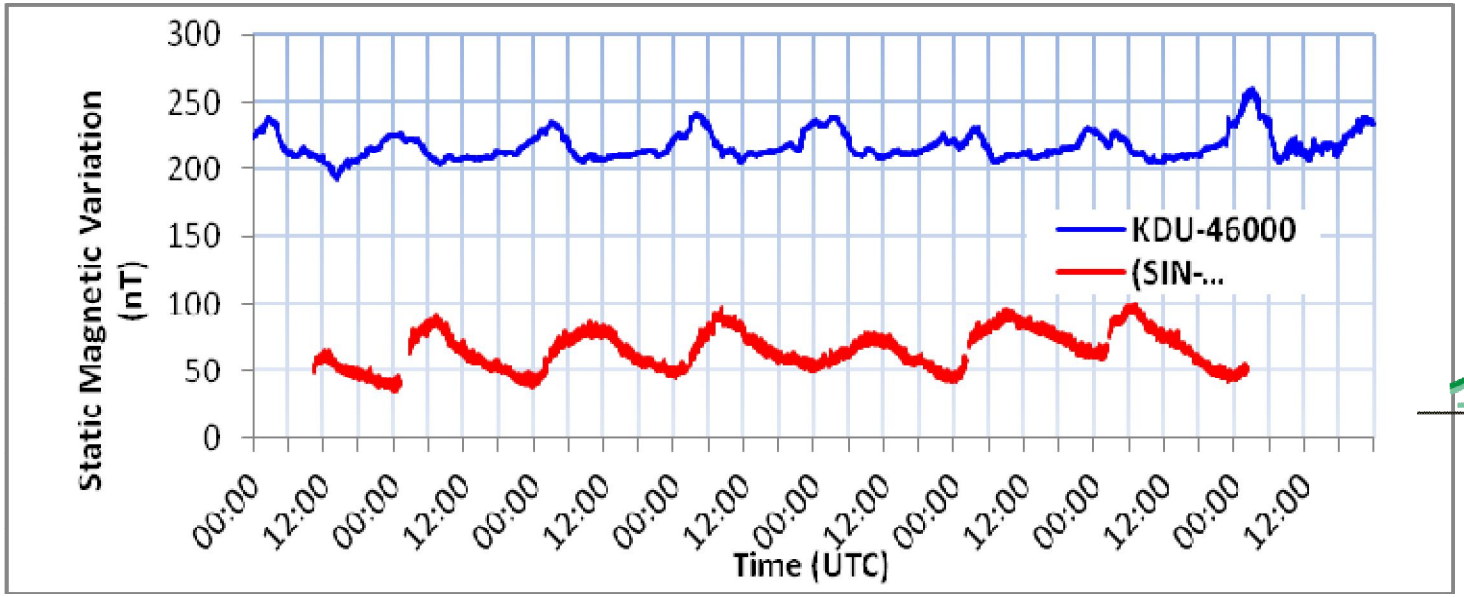
2013



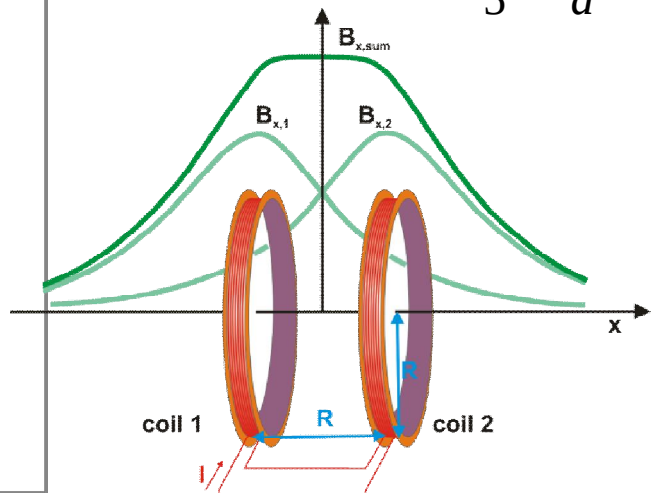
Inside the new chamber

Helmholtz coil

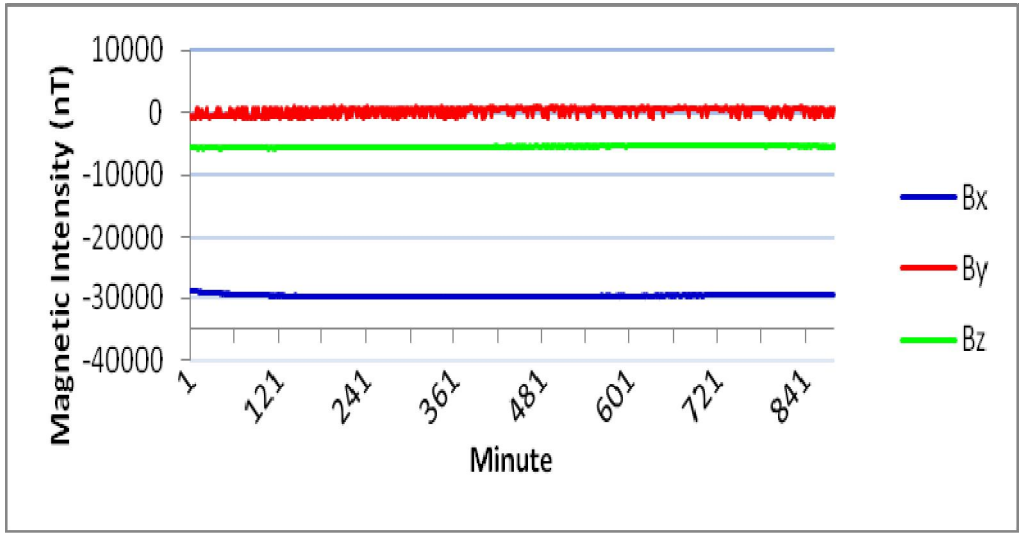
3D Measurements on the old chamber (2012)



$$\mathbf{B}_x = \frac{8\mu_0 IN}{5^{3/2} a}$$



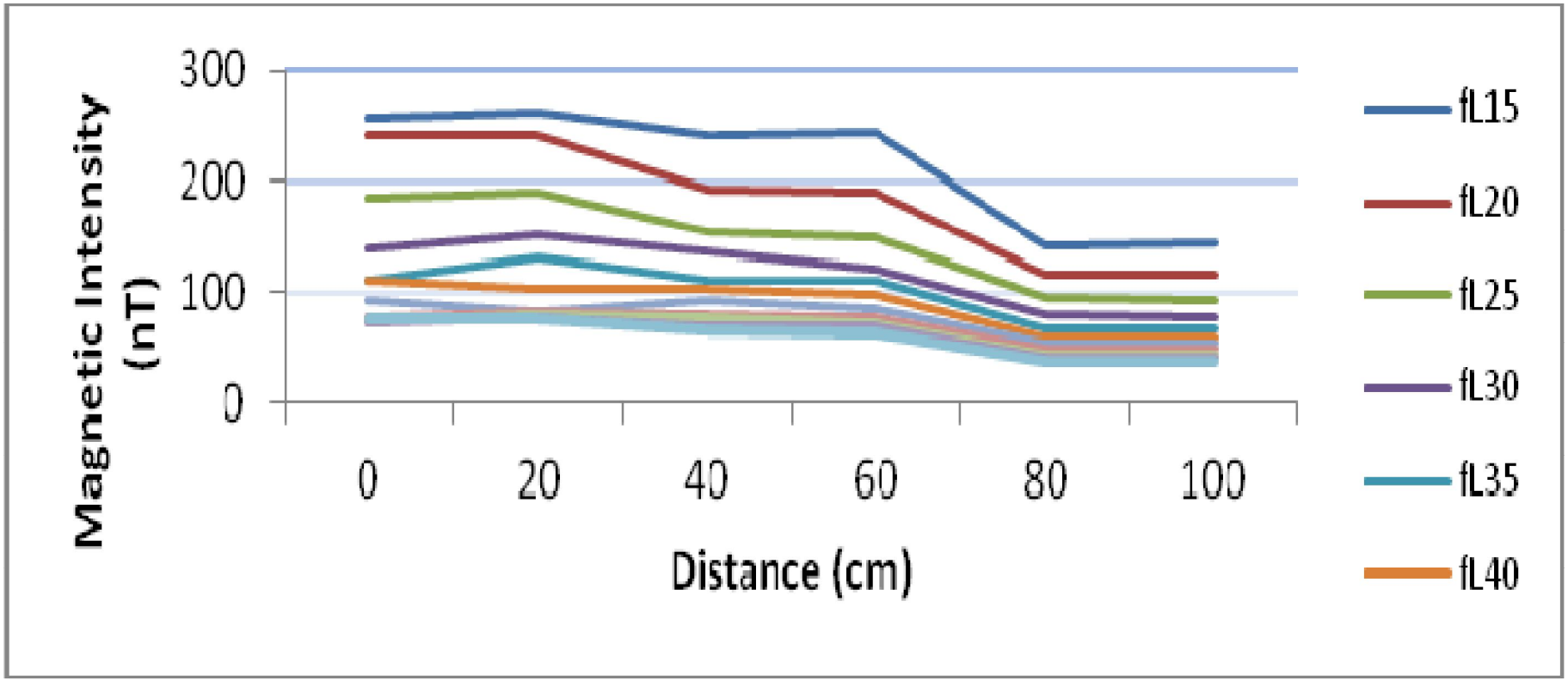
- Static magnetic field variations are in agreement with KDU Observatory
- Main field direction is along x-axis



Placement of Manipulator on the chamber

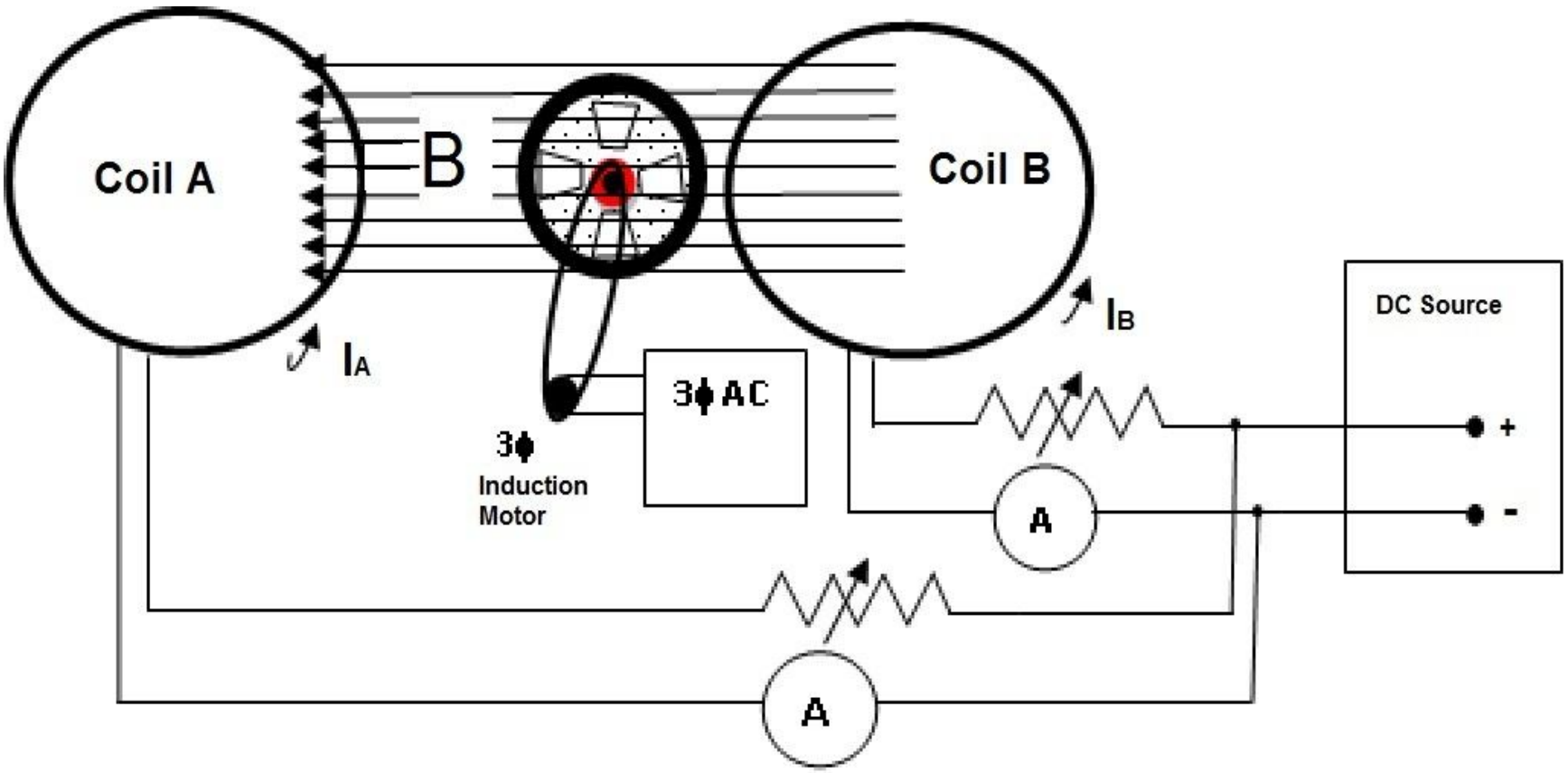
2013

1D Measurements on the new chamber (2013)

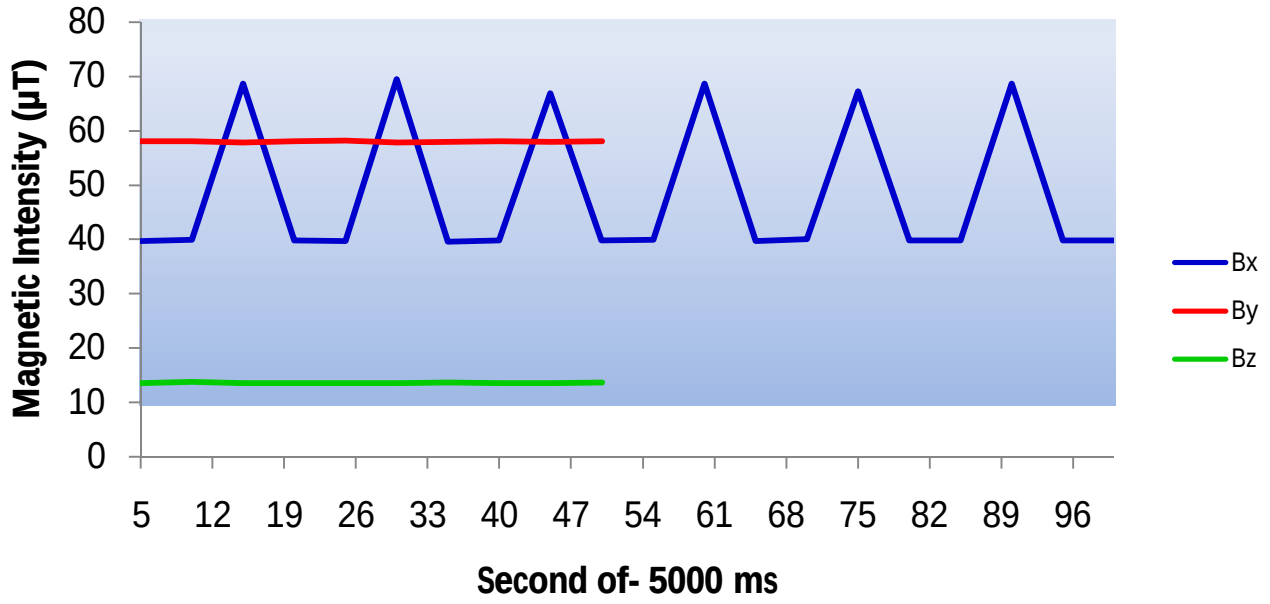


- The new chamber is dominated with static magnetic fields
- Field intensities decrease with larger distance from coils

Electrical Diagram of Manipulator Testing

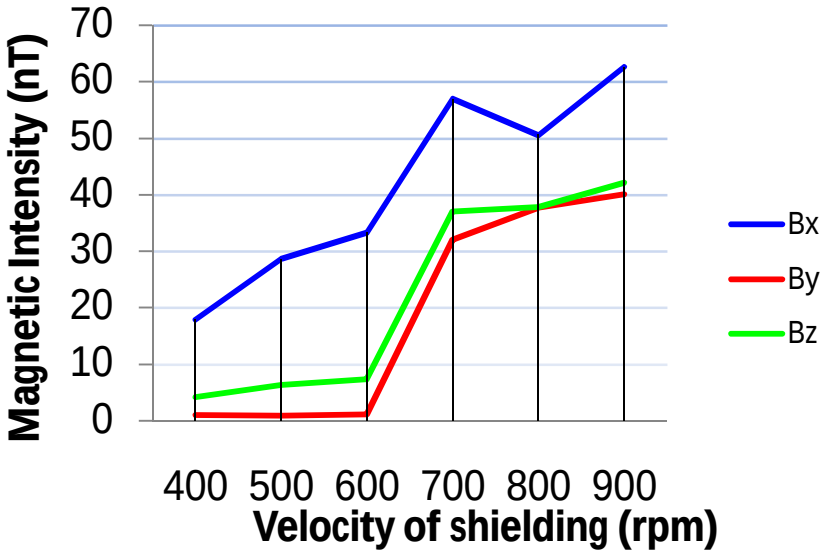


Shielding Effectiveness

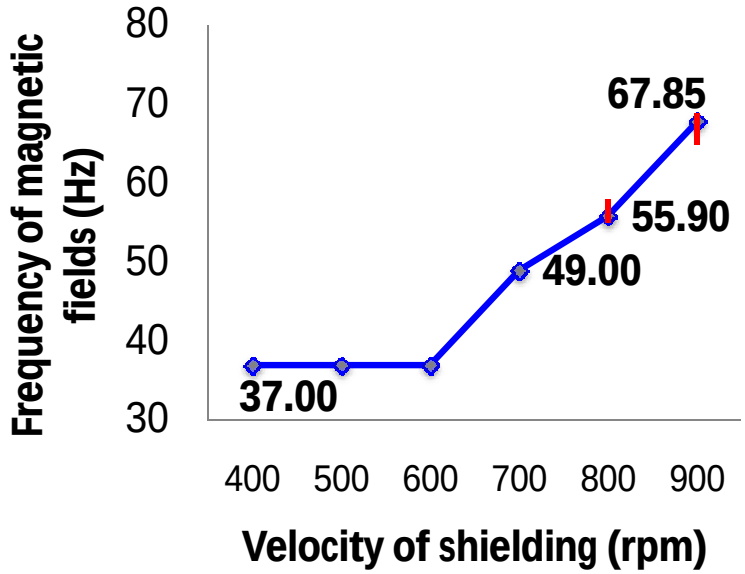


The shielding material with its holes is quite effective to stop the flux in the direction orthogonal to it, evident by generated discrete pulses of very low frequency of some 2 Hz.

Frequency Response



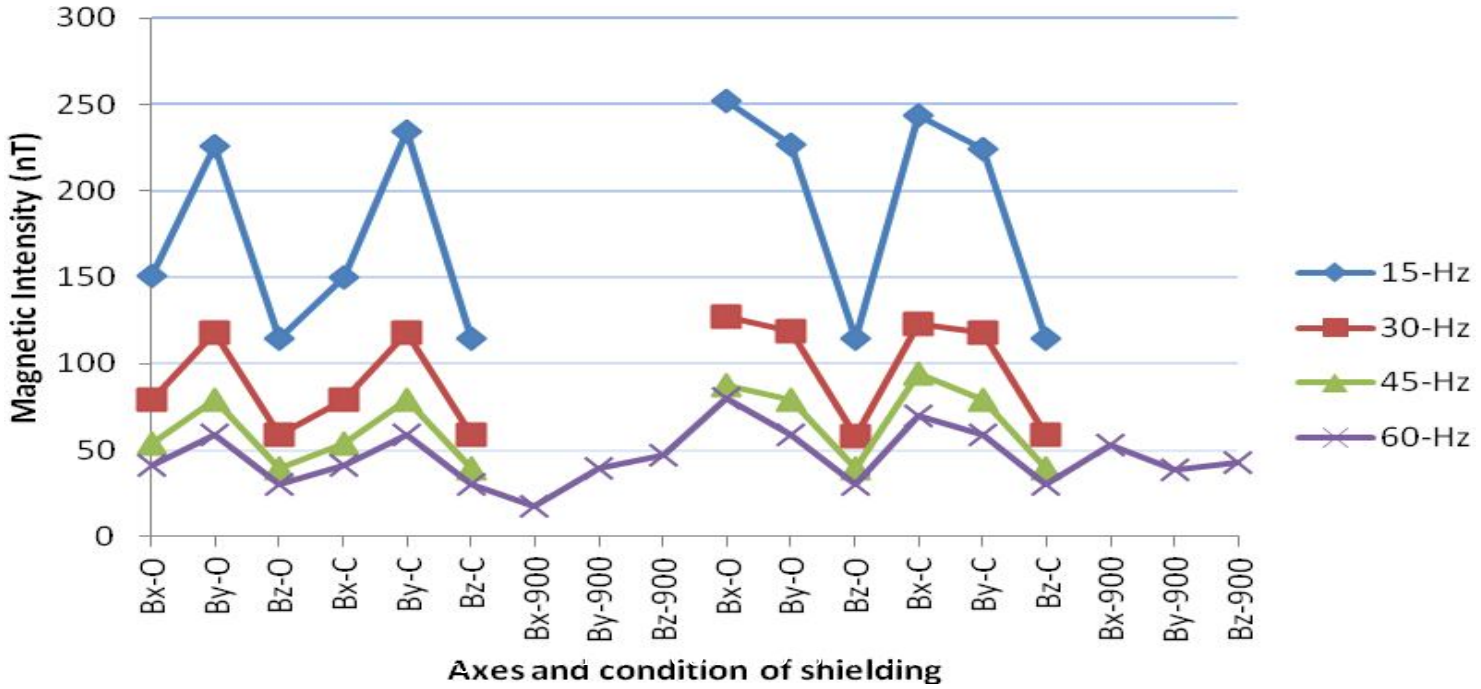
(a). Magnetic intensity when the shielding is in motion with various speeds.



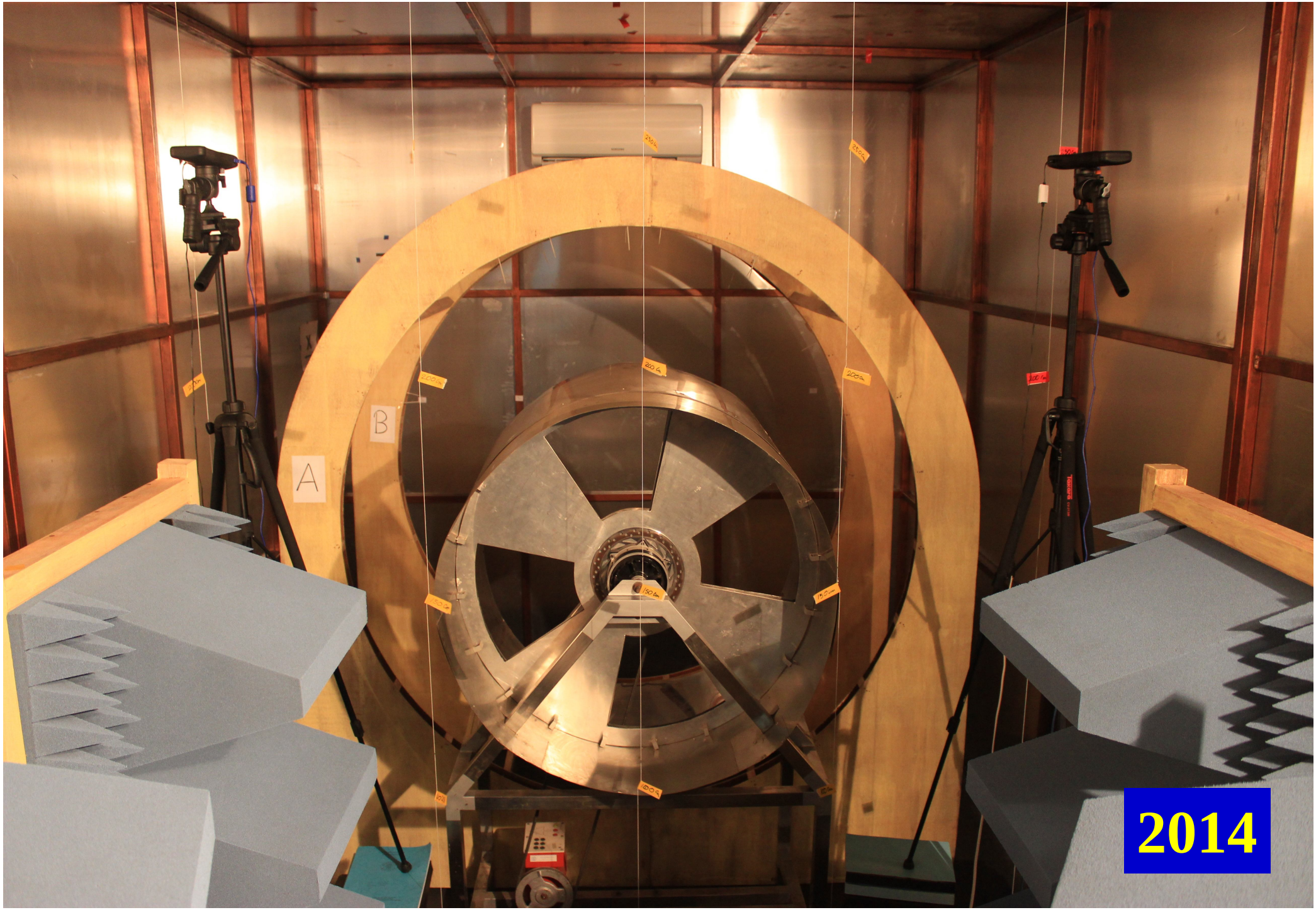
(b). Frequency response of induced magnetic fields due to shielding motions.

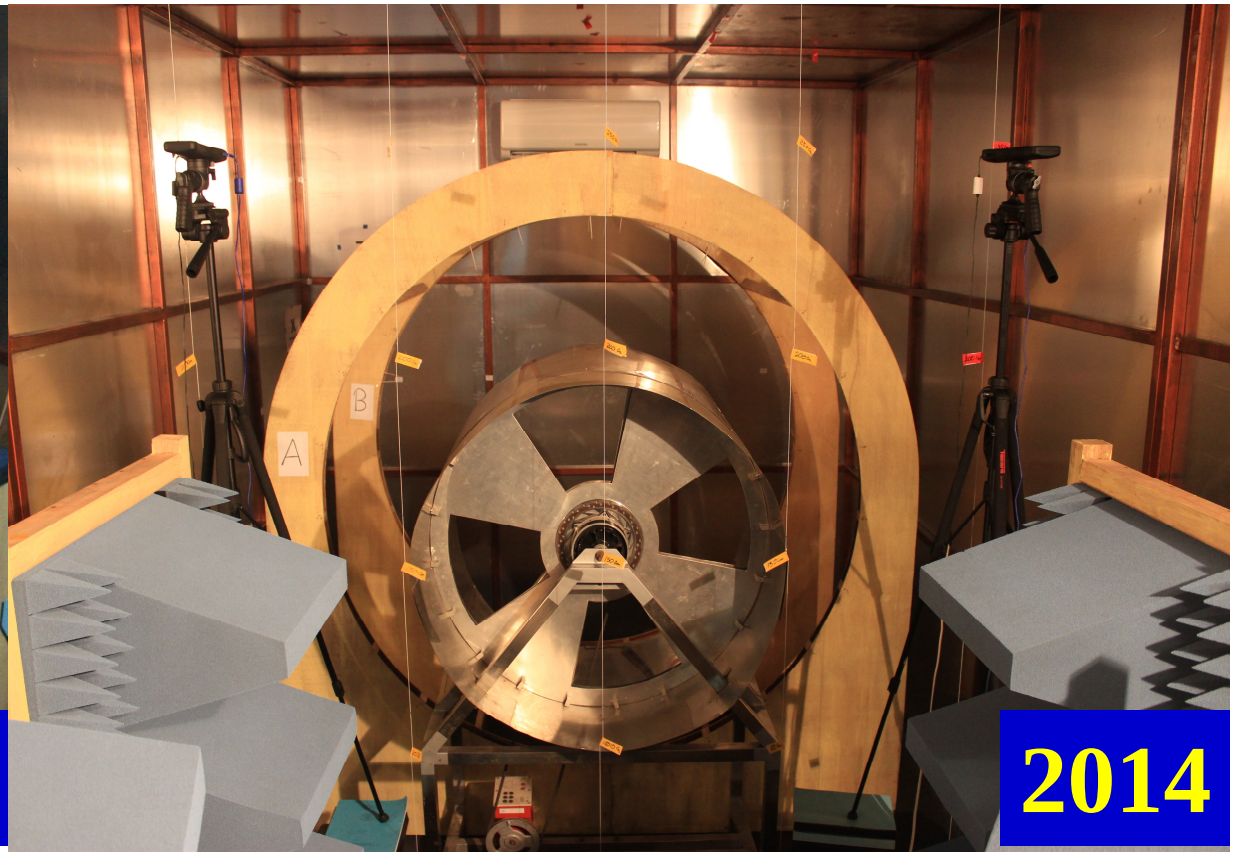
The frequency responses of manipulator are quite good, nearly similar to the theoretical values. Magnetic intensities are linear to the velocity of shielding; due to how frequent the fluxes can pass the shielding through the holes.

Background Frequency of Chamber

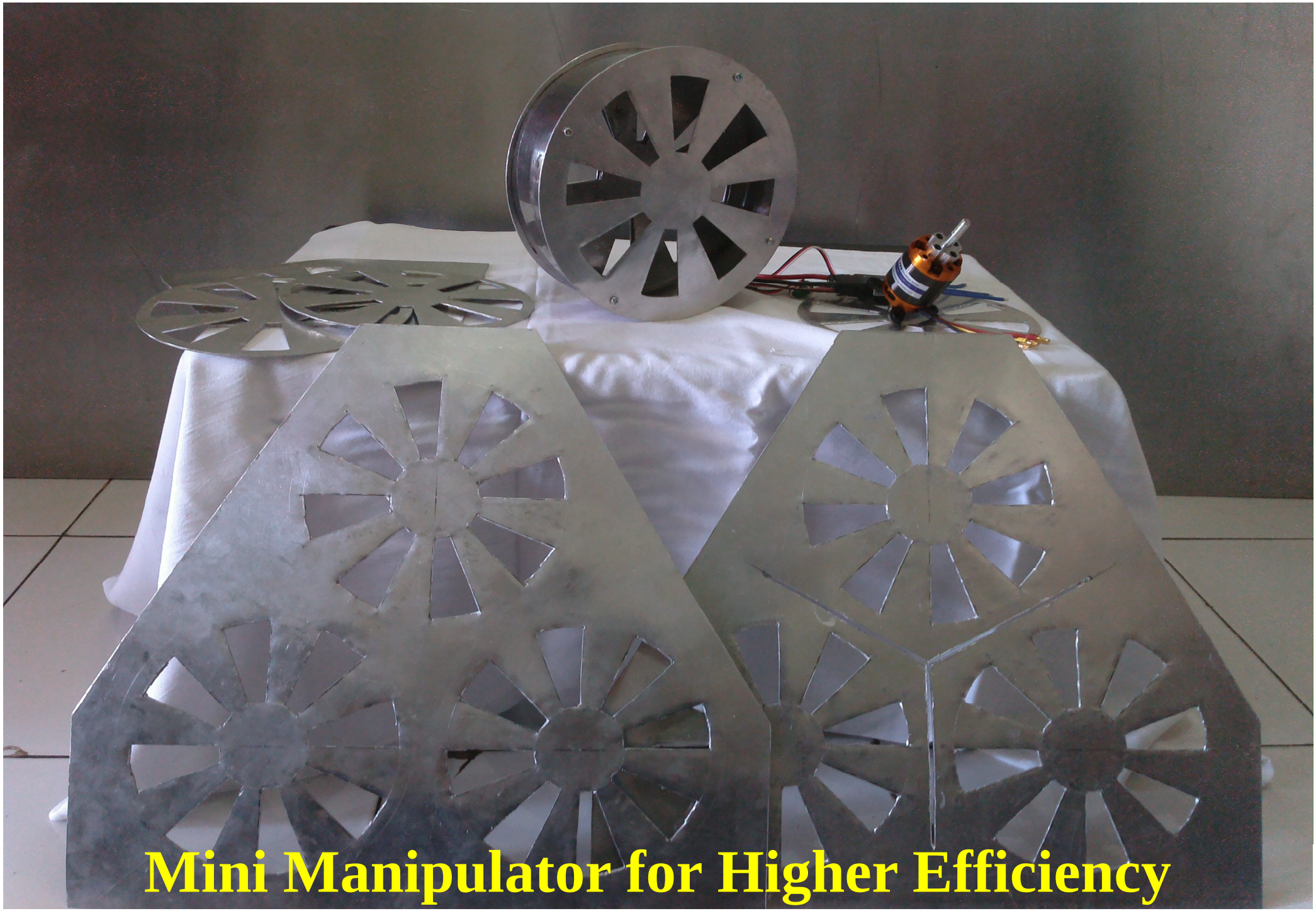


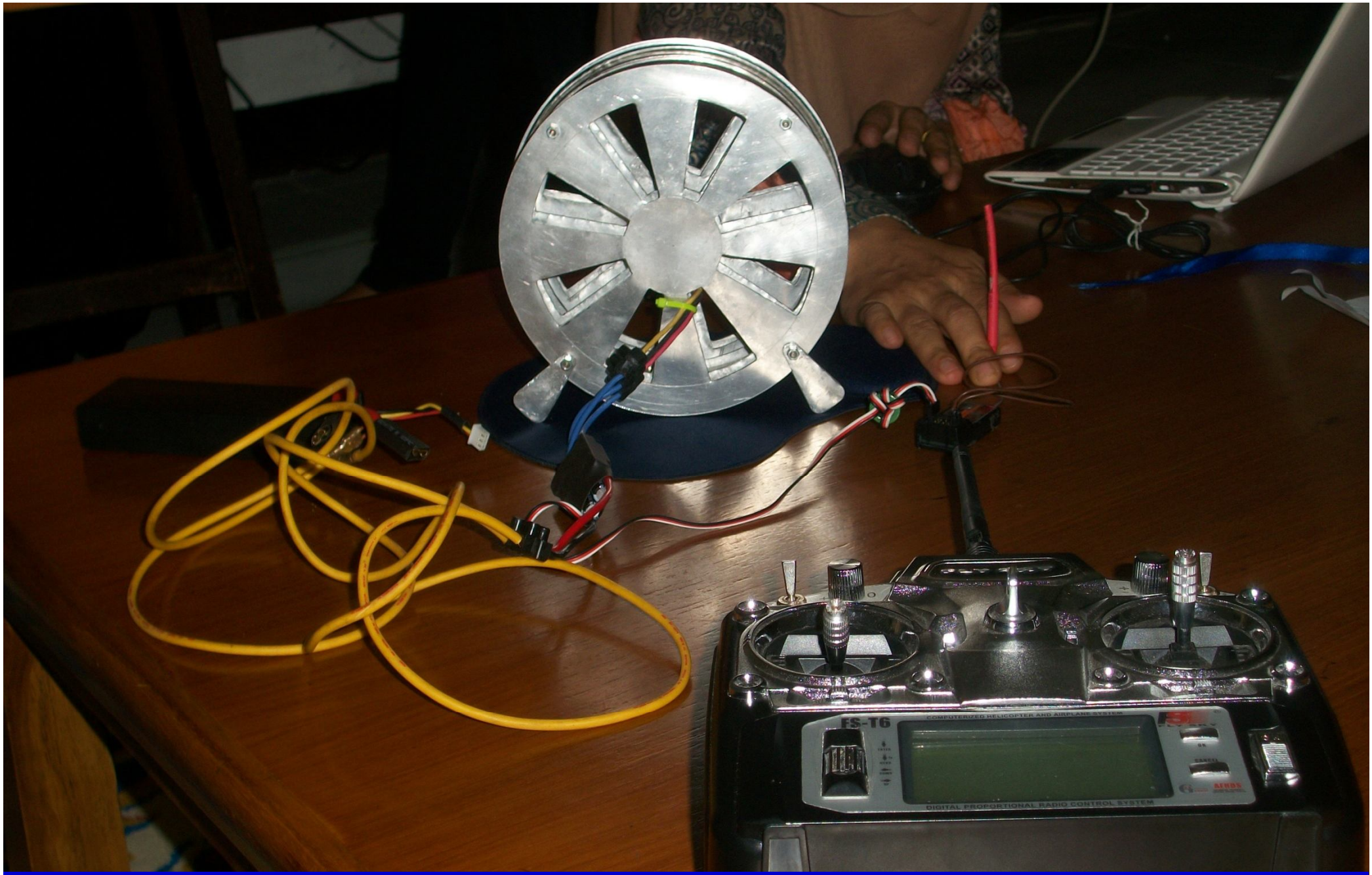
When no motion of shielding, the coils induce static magnetic fields only. In the direction orthogonal to the shielding, magnetic intensities will decrease for the higher frequency ranges.


A
B
2014



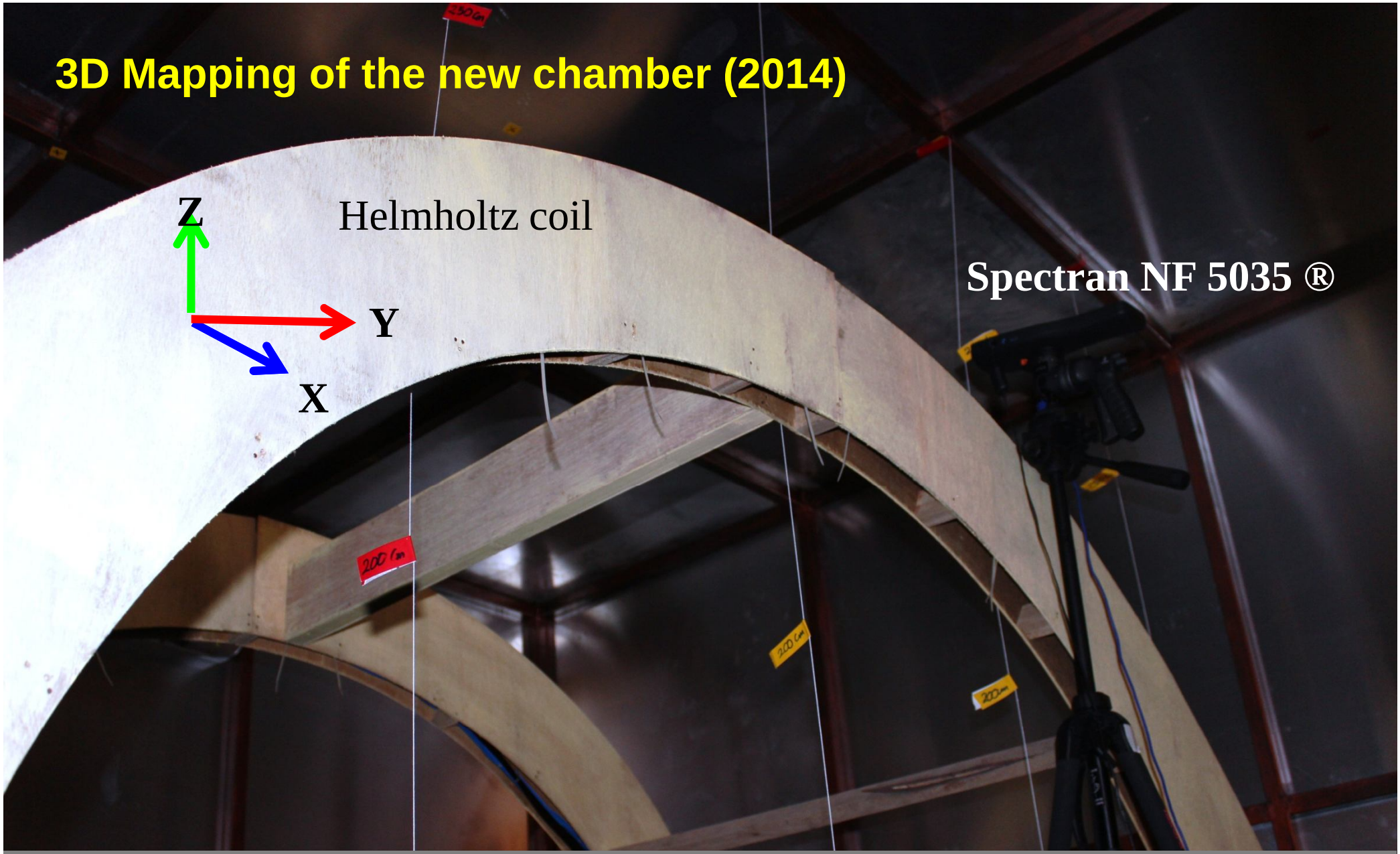
Different setting arrangement of measurements based on 3D fields mapping results of the new chamber


Mini Manipulator for Higher Efficiency

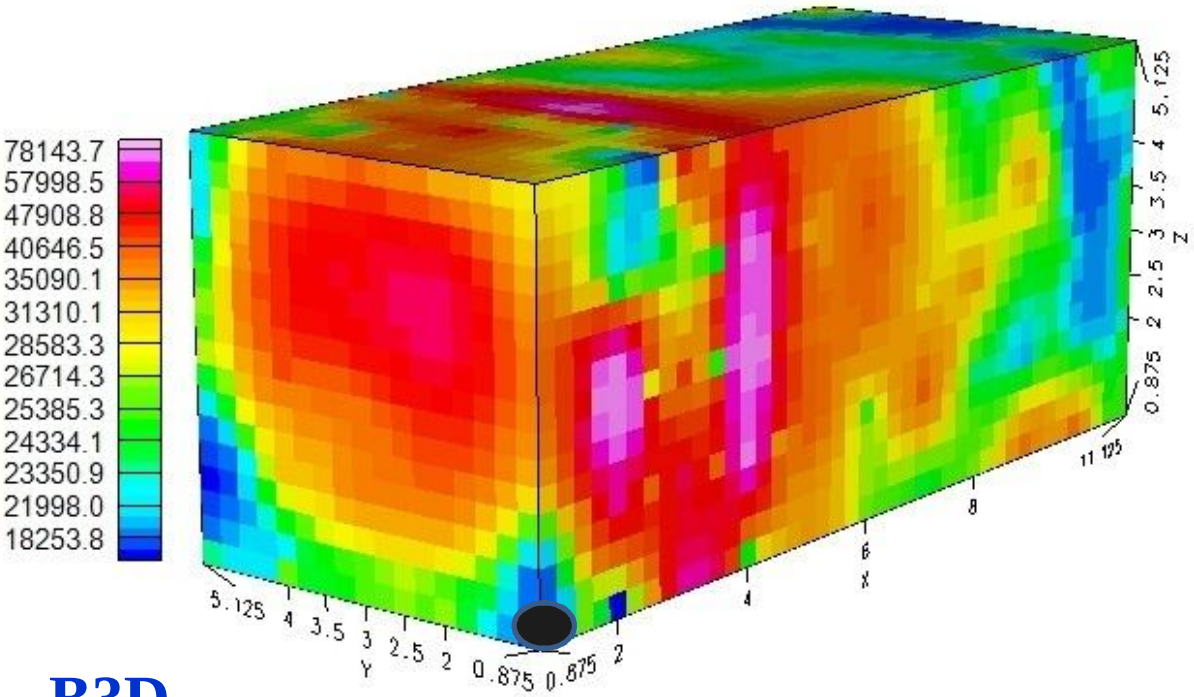


Mini Manipulator for Higher Efficiency (2014)

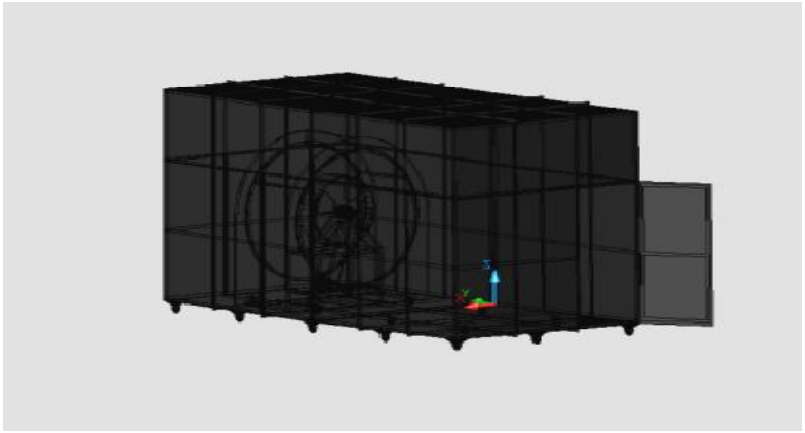
3D Mapping of the new chamber (2014)



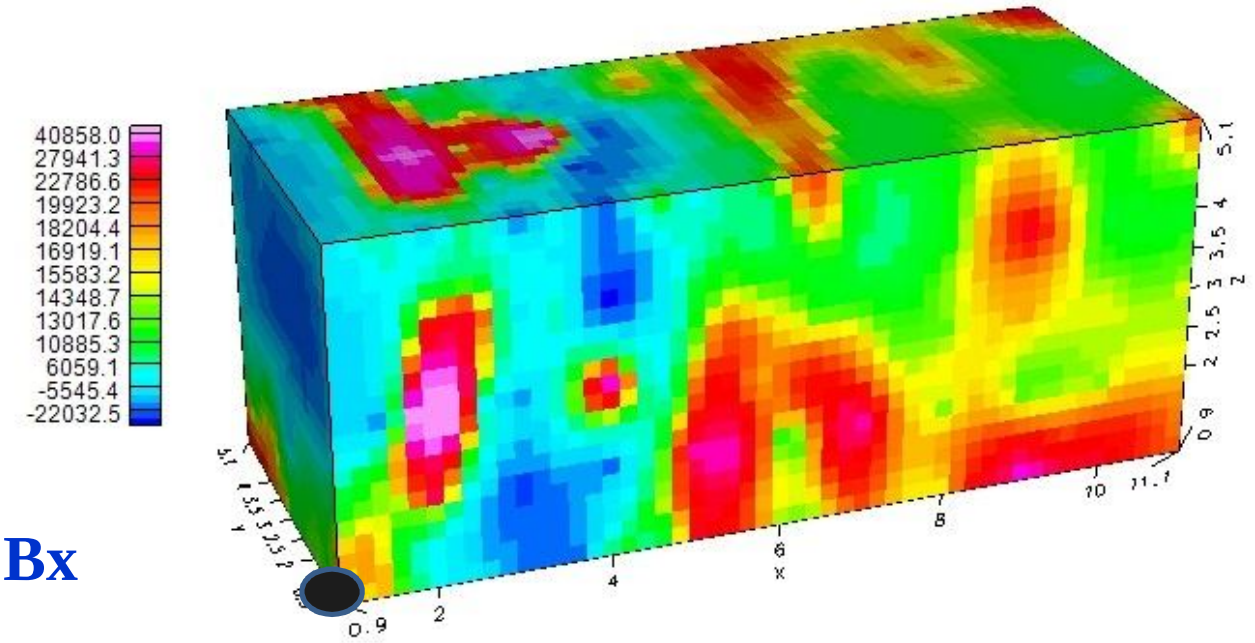
Regular grids of 50 cm x 50 cm. Where the Helmholtz coil is placed, extra grids of 25 cm x 25 cm are inserted to sharpen fields' depictions.



B3D

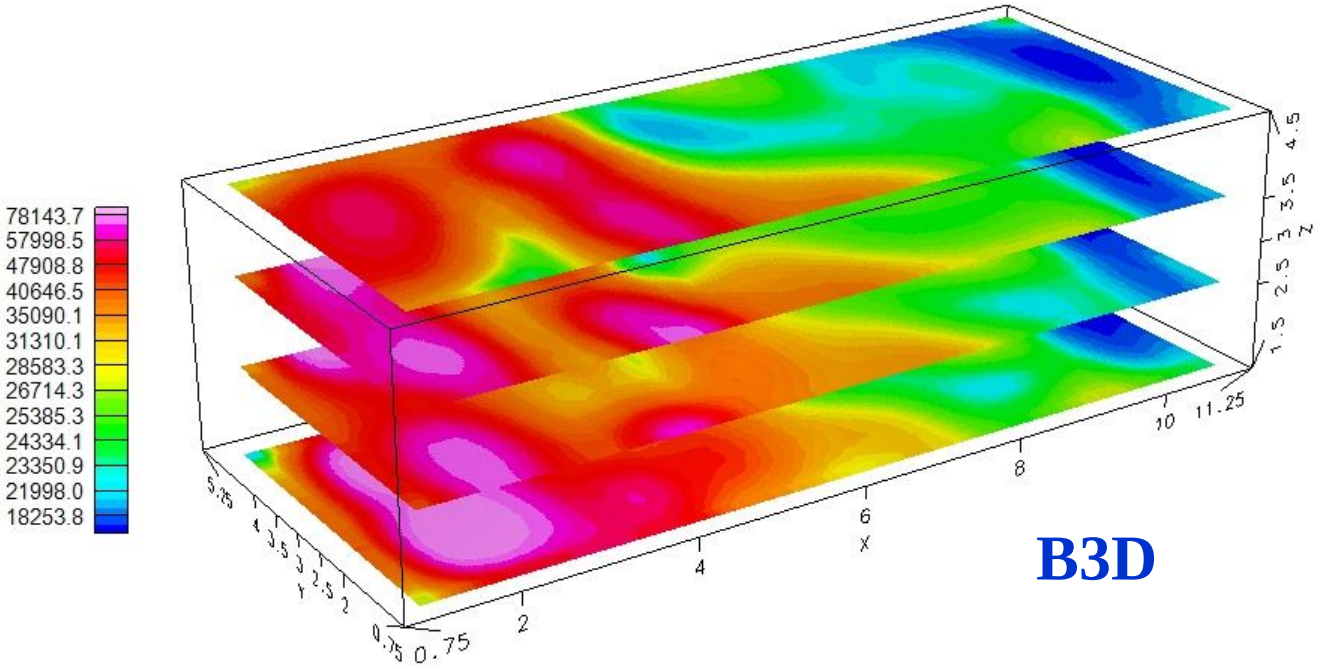


With 1A induction current on each coil



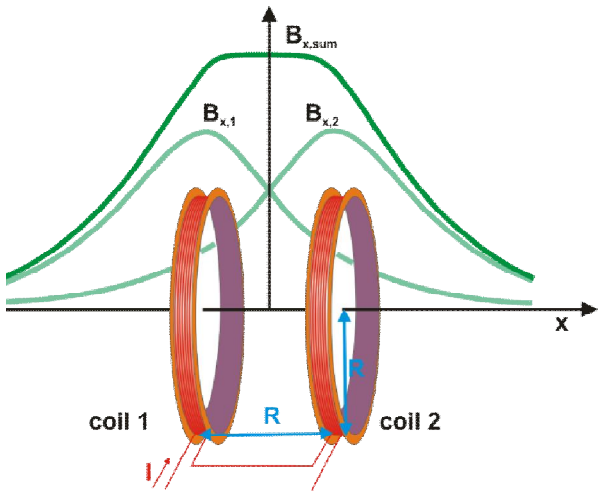
Bx

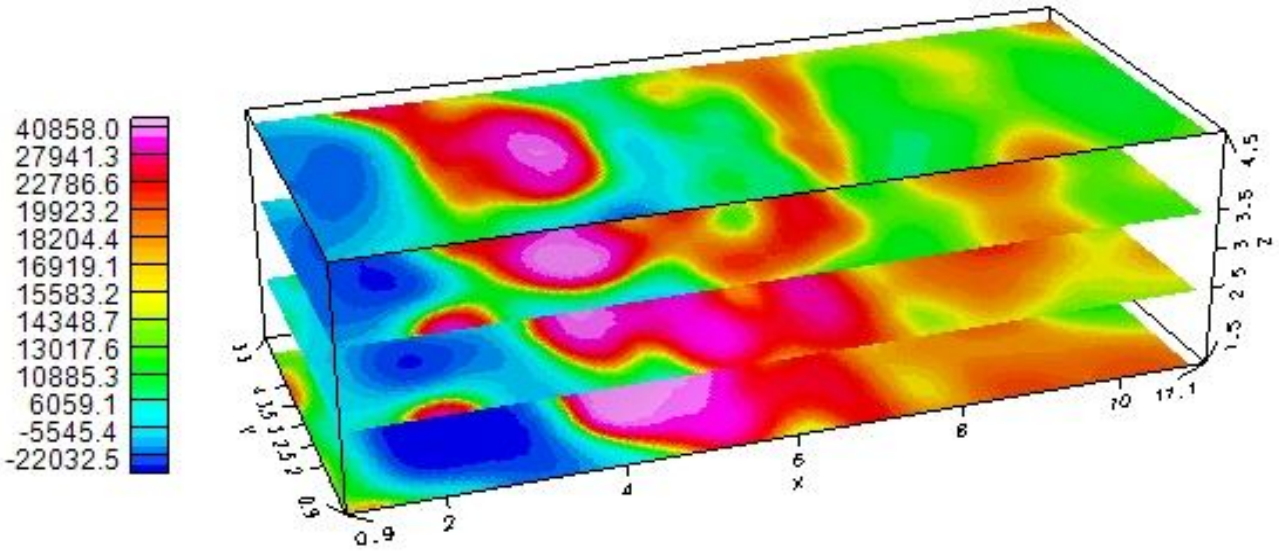
•Nearly homogenous fields in between the two coils



B3D

$$\mathbf{B}_x = \frac{8\mu_0 IN}{5^{3/2} a}$$

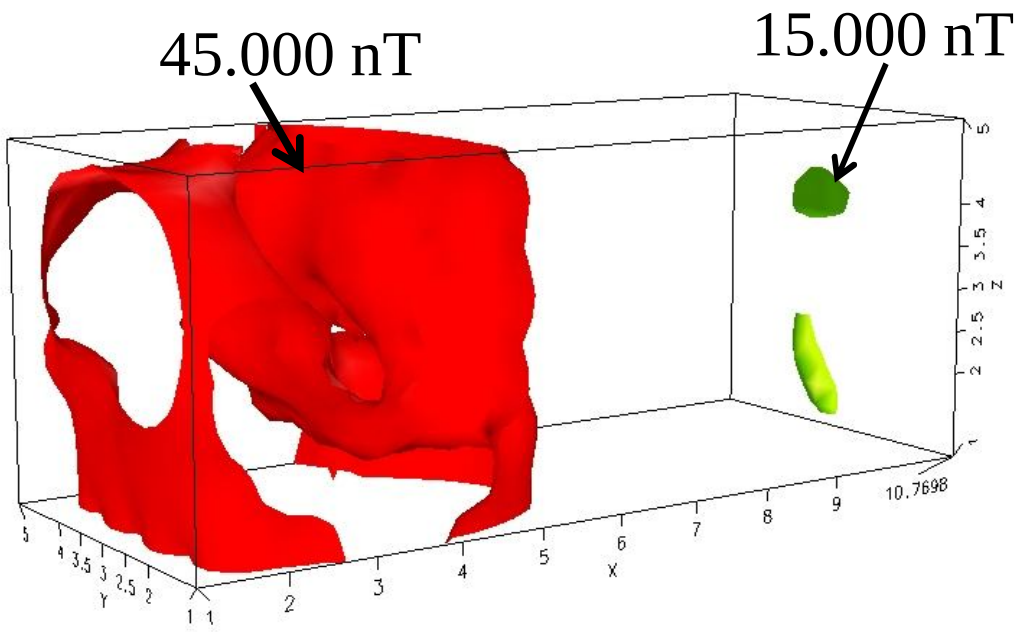




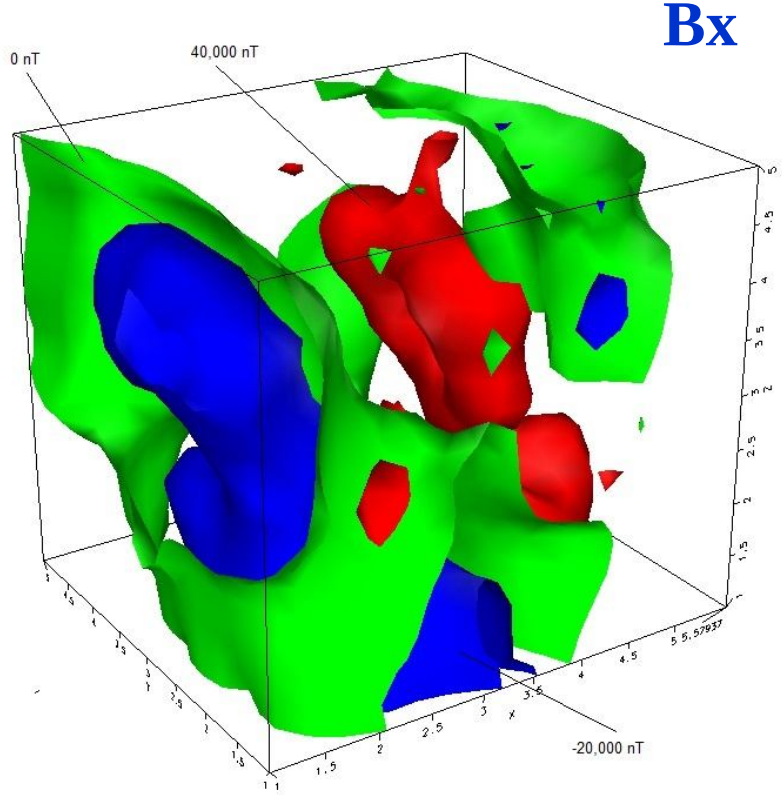
Bx

- Nearly homogenous fields in between the two coils
- Maximum 3D values represent total geomagnetic intensities of Lombok
  - Bx = + in the area of front coil
    - in the area of rear coil
    0 in between the two coils

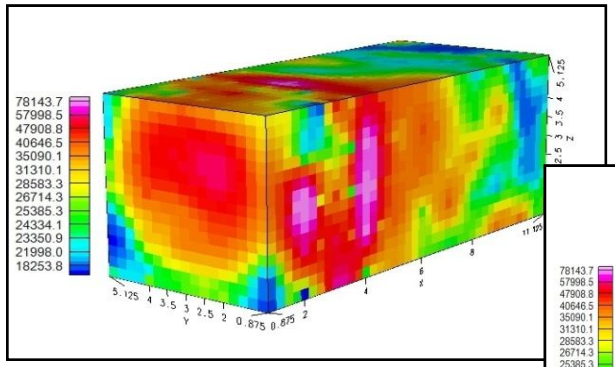
B3D

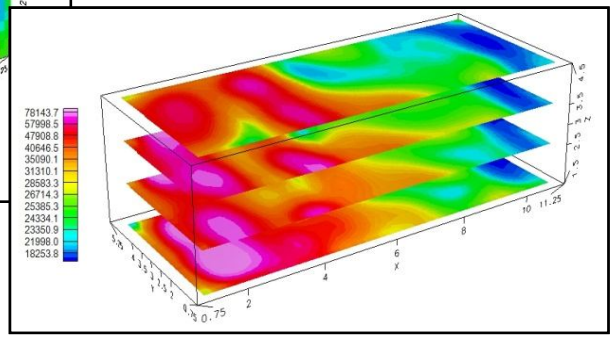


Bx



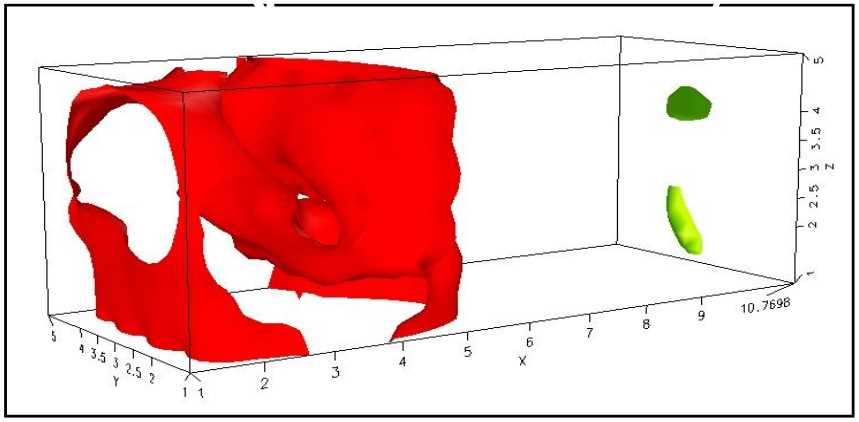
3D mapping of new chamber (2014)

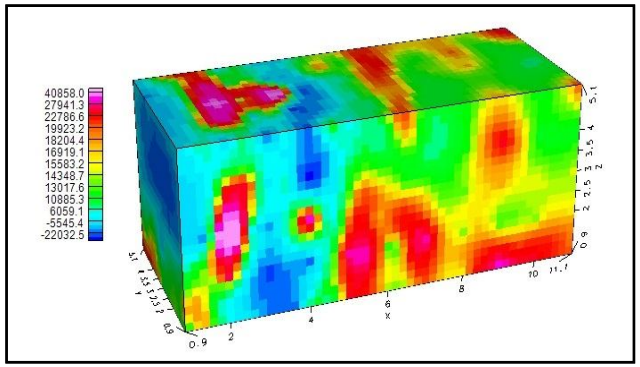


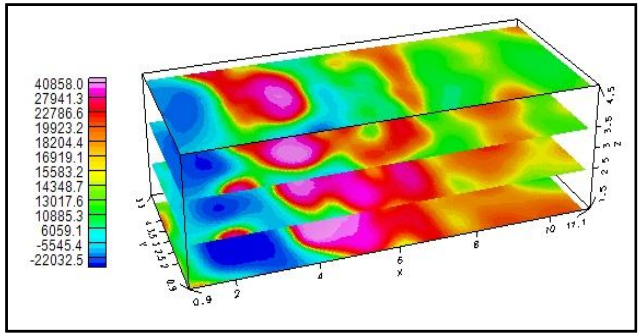


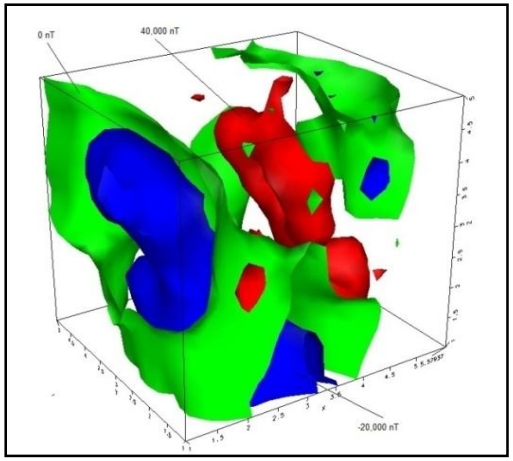
45.000 nT

15.000 nT



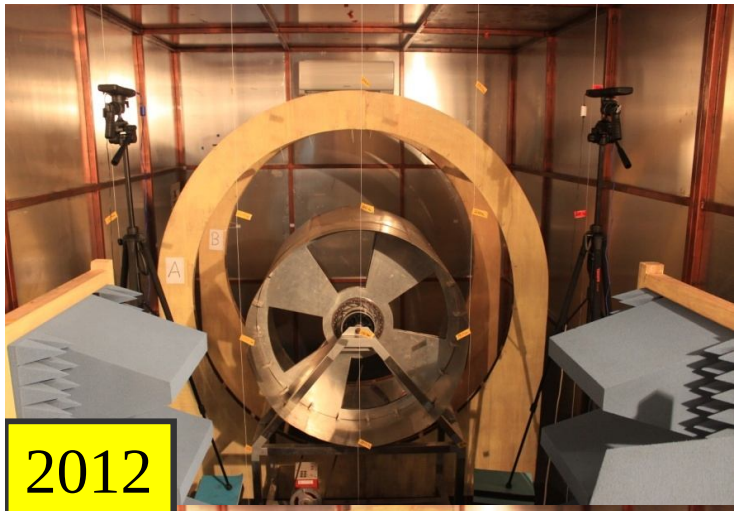


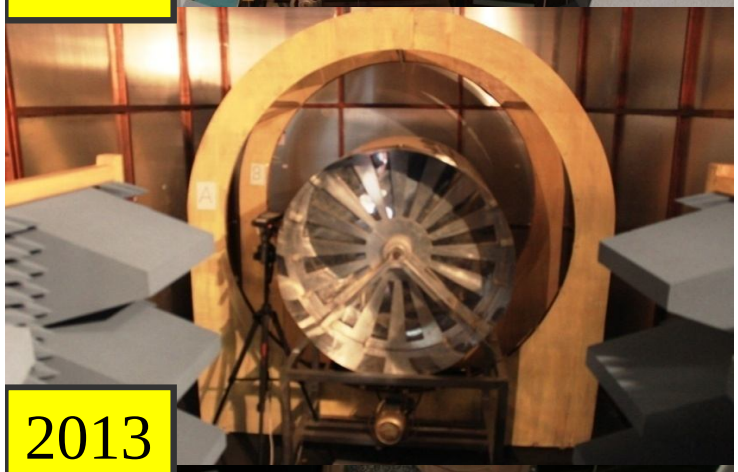


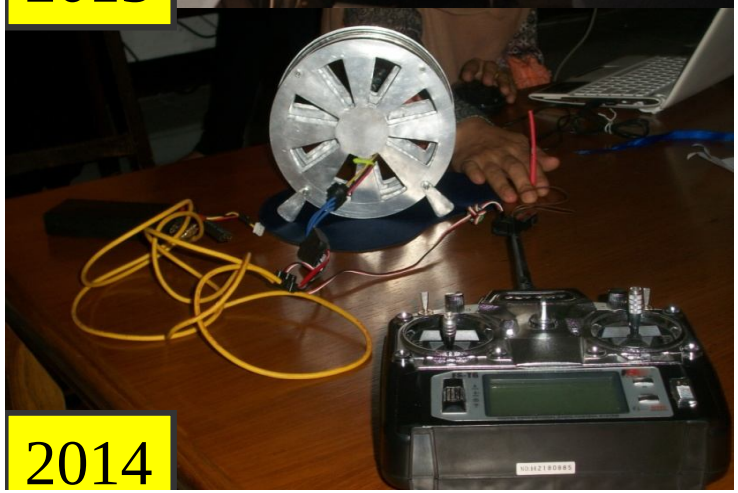


- Chamber & Helmholtz coil represents geomagnetic fields over Lombok Island
- Field distributions on x-axis (Bx) can be exactly identified

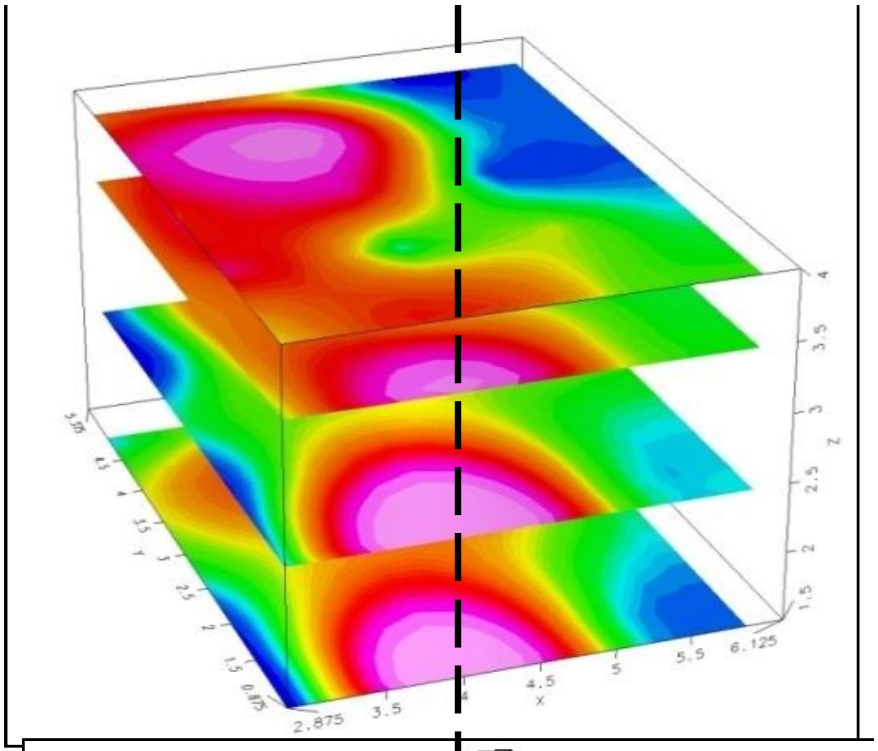
Bx







Close



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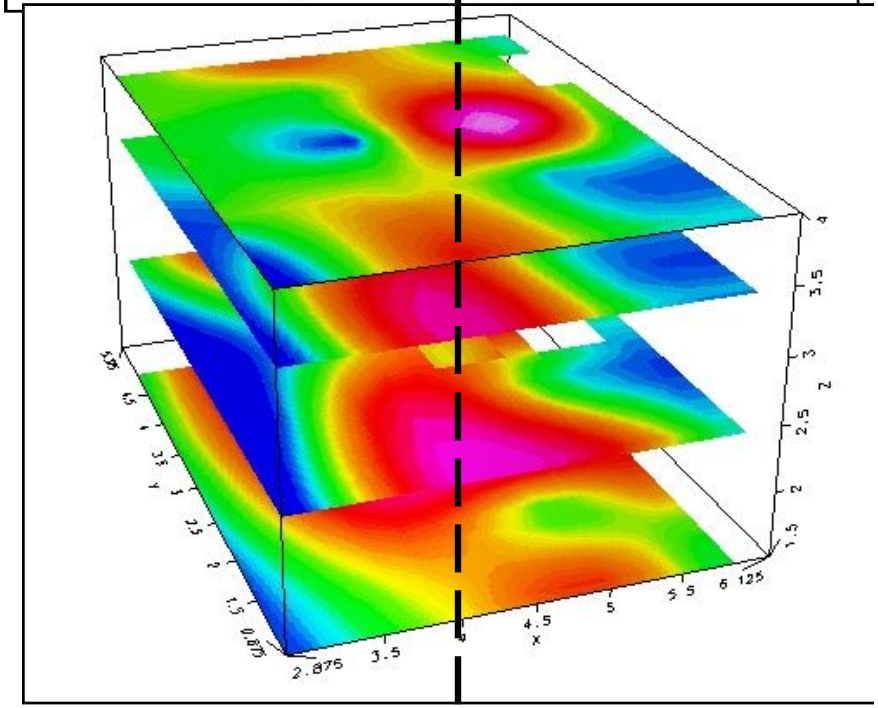
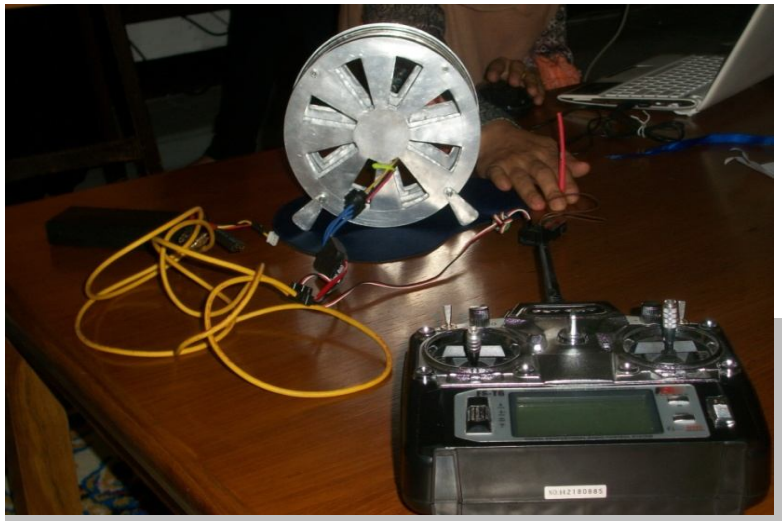
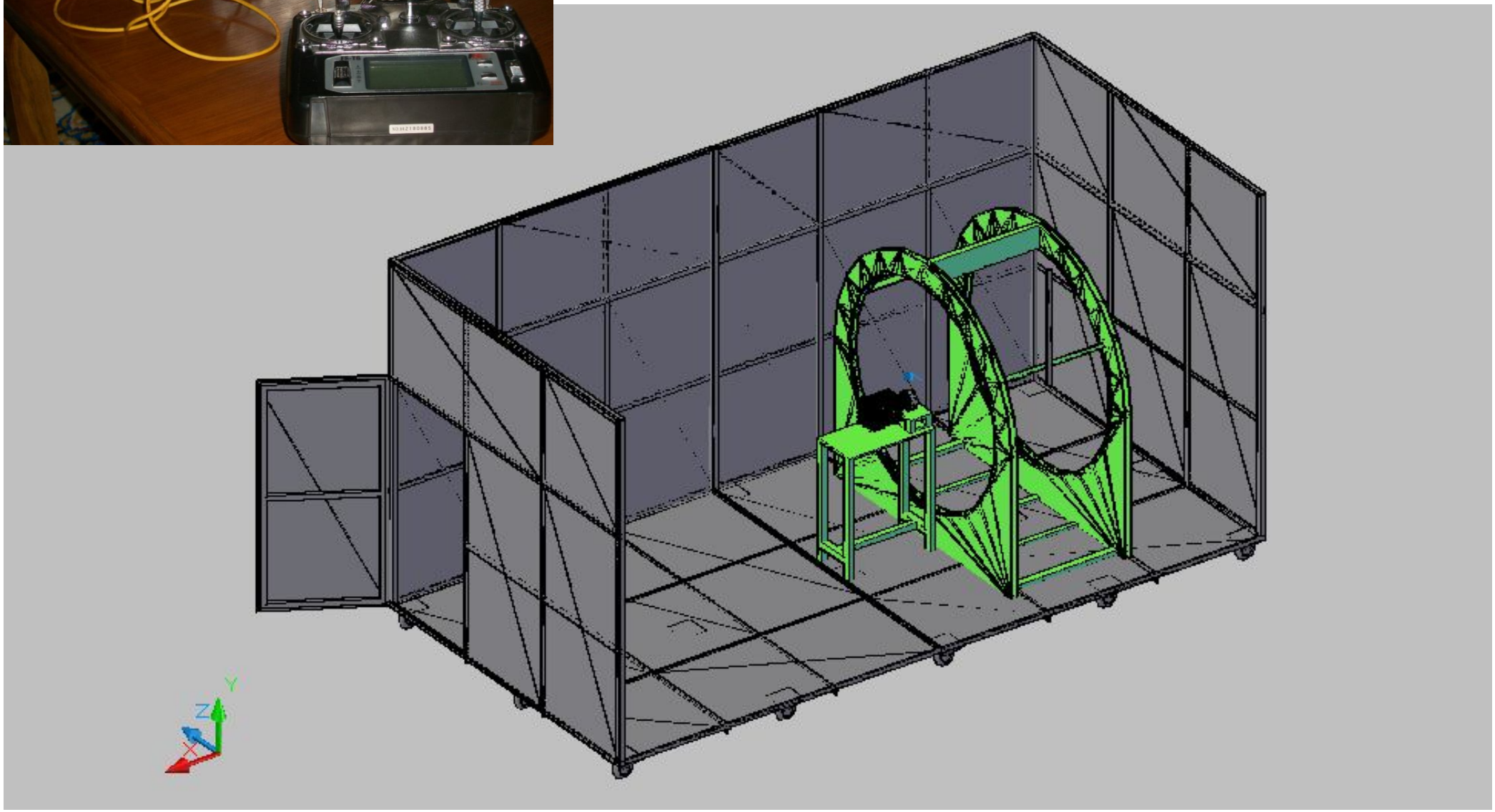
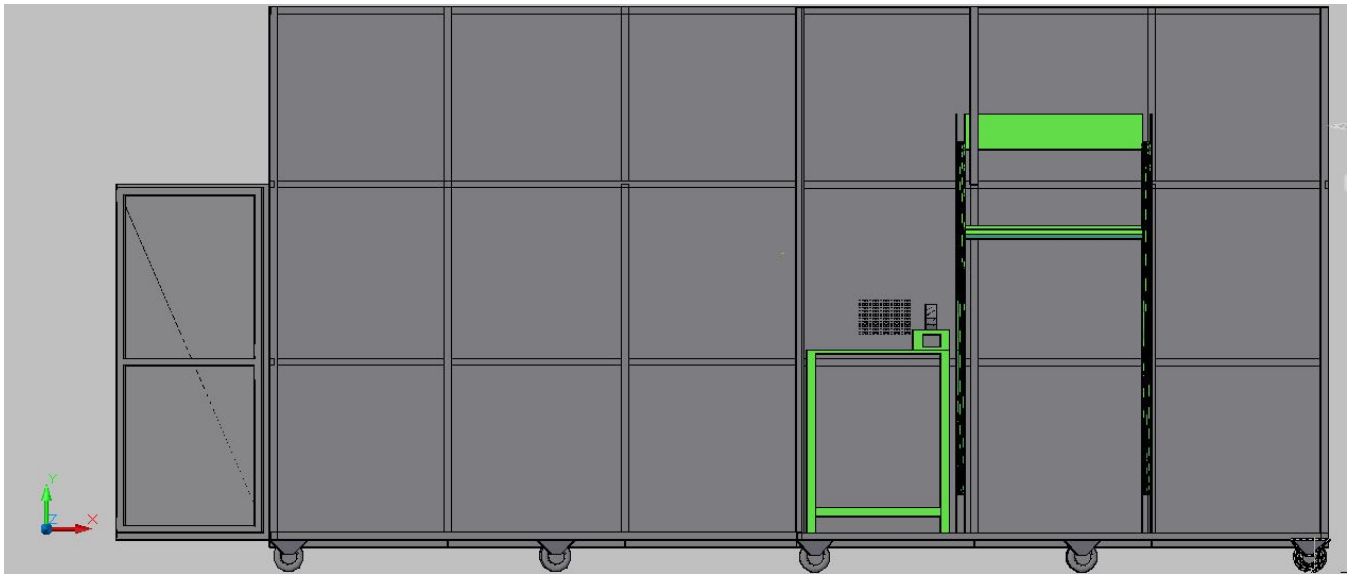


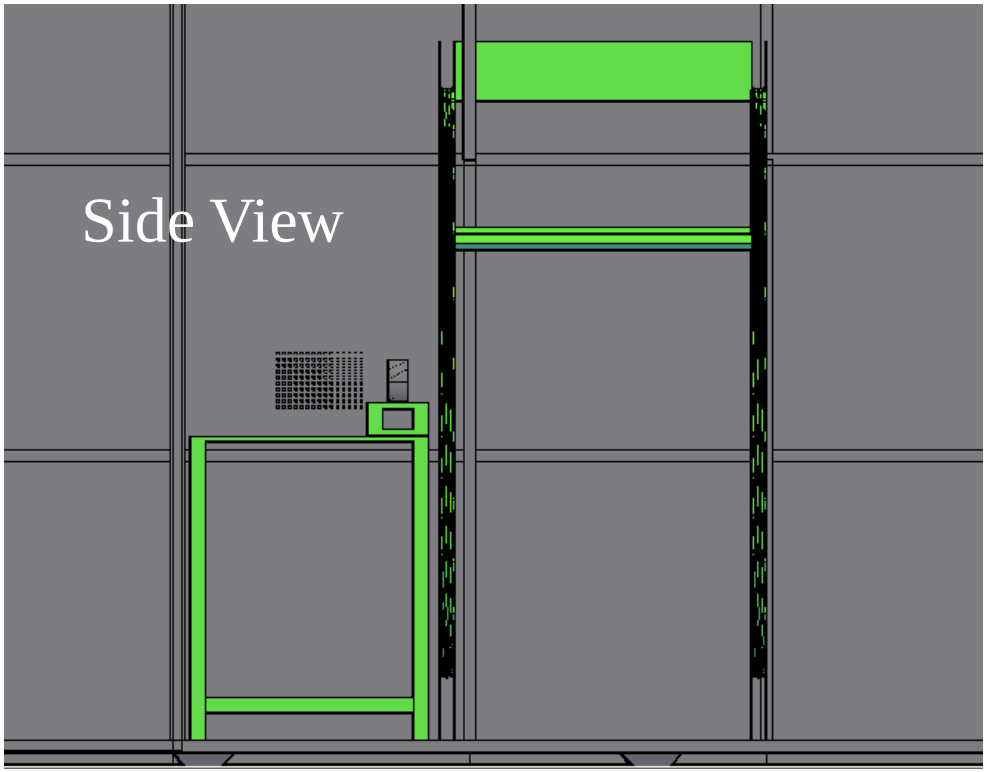


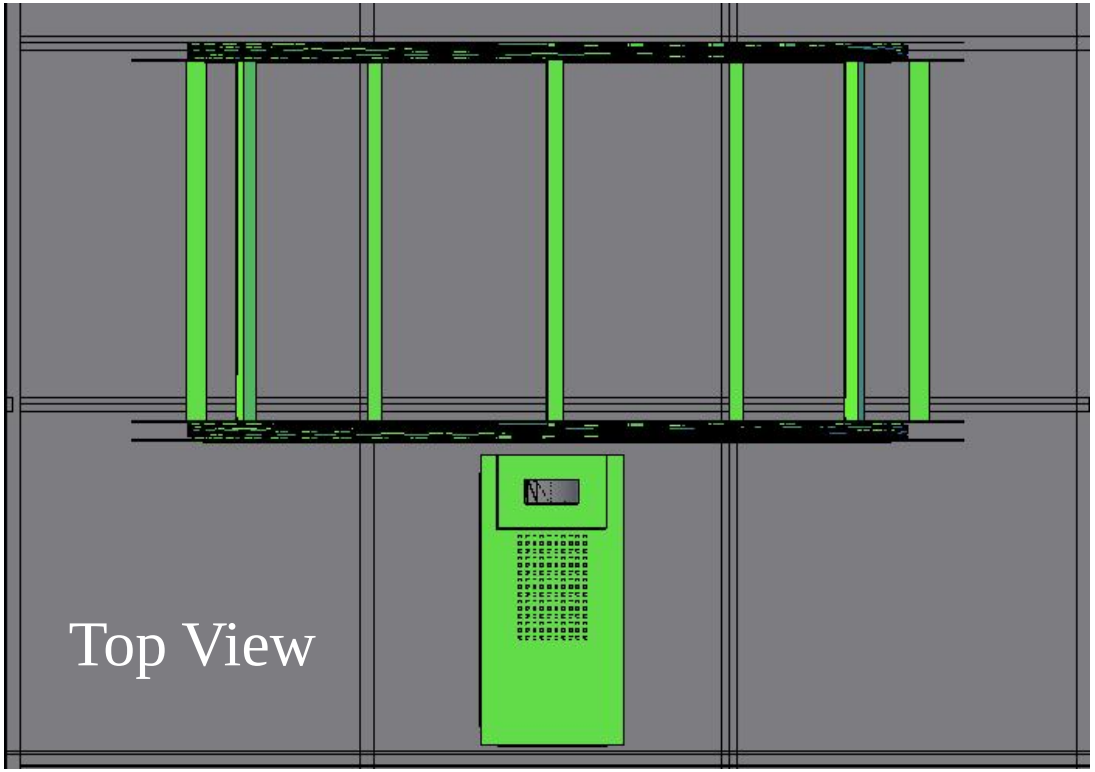
Testing of Mini Manipulator (2015)



Testing of Mini Manipulator (2015)







Paper on 13th QiR, 23-28 August 2013

→ *Available on IEEE Explore*

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ISSN 1411-1284

Magneto-Static Flux Manipulator Prepared for Future Geomagnetic Power Plant

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***Abstract*—Magnetic flux resulting from geomagnetic anomaly is a natural energy source that never runs out, driven by tectonic settings or specific rock structures. Unfortunately, this natural resource has not been exploited at all; therefore frontier** natural resources have not been utilized at all, hence necessitating a frontier technological innovation in electromagnetic in order to practically utilize the geomagnetic field for electrical generator

The Best Paper on 1st AEMT, 11-15 April 2014

→ *Submitted to the International Journal of Technology (IJTech)*

Three-Dimensional Mapping of Static Magnetic Fields over a Semi Anechoic Chamber

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Abstract— **Geomagnetic field is a kind of natural potential field in the Earth. A three years research for exploration of this field has been conducted in the Lombok Island-Indonesia, where extreme geomagnetic anomalies with two very strong dipolar structures exist. The research aims to construct a system to**

the tectonic settings of this region which is between two active subductions [6, 7].

A three years research has been conducted to utilize these extreme geomagnetic anomalies as natural energy resources,

Posters on 1st AEMT, 11-15 April 2014

Geomagnetic Flux Concentrator Prototype INSINas 2012

Teti Zubaidah, Bulkis Kanata, Paniran
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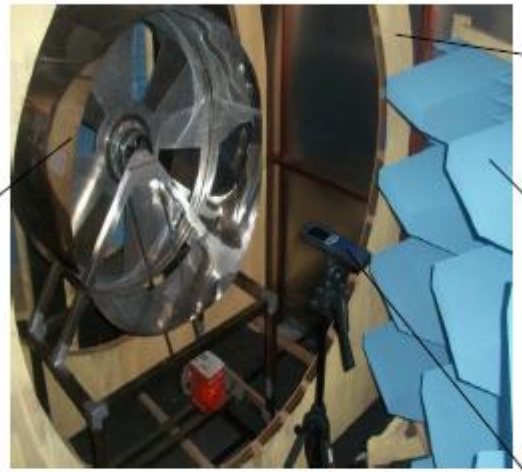
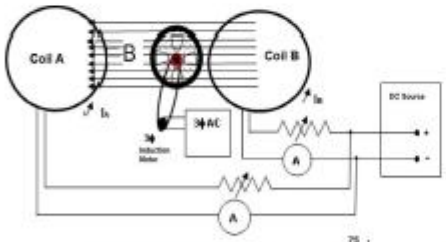
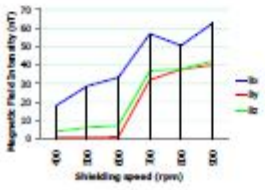
Email: tetizubaidah@te.ftunram.ac.id

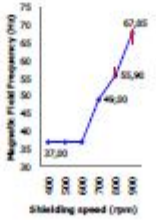
RISTEK





3 x 3 x 3 m³ chamber





4 holes Flux Manipulator

Geomagnetic Flux Concentrator Prototype INSINas 2013

Teti Zubaidah, Bulkis Kanata, Paniran
Cipta Ramadhani, Denek Binie T.R., Rizal Bahteran, Ahmad Yani, Nurlaily Agustiarini

Jurusan Elektro, Fakultas Teknik, Universitas Mataram
Jl. Majapahit 62 – Mataram 83125 - INDONESIA
Email: tetizubaidah@te.ftunram.ac.id

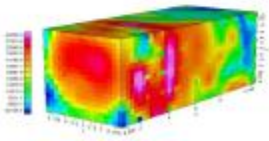
RISTEK

OCTV monitor & speed control

Computer control of SPECTRAN ®

6 x 3 x 3 m³ chamber with Helmholtz coil inside

Manipulator with wave guide



3D mapping of magnetic field intensities inside 6 x 3 x 3 m³ chamber

16 holes Flux Manipulator

The International Conference on Applied Electromagnetic Technology

1st AEMT, 11 – 15 April 2014

The International Conference on Applied Electromagnetic Technology

1st AEMT, 11 – 15 April 2014

Pameran Pendidikan dan Kebudayaan

Olimpiade Sains Nasional

5 – 7 September 2014

National Research Council visiting into the chamber

The Lombok Geomagnetic Observatory

Google Terjemahan | CET: Central European Tir | Lombok - Helmholtz Cent

www.gfz-potsdam.de/en/research/organizational-units/departments/department-2/earths-magnetic-field/infrastructure/observatories/lombok/

- Observatories
- Niemegk
- Wingst
- Villa Remedios
- Panagyurishte
- Keetmanshoop
- Yakutsk
- Magadan
- St. Helena
- Alibag
- Hyderabad
- Surlari
- Paratunka (Petropavlovsk)
- Santa Maria/Azoren
- Pantanal
- Odessa
- Lombok

Home ▸ Research ▸ Organizational Units ▸ Departments of the GFZ ▸ Department 2 ▸ Earth's Magnetic Field ▸ Infrastructure ▸ Observatories ▸ Lombok

Geomagnetic Observatory Lombok (LOK*)

Variation buildung, absolute house and main building (from left to right)

The Geomagnetic Observatory Lombok (LOK*) is run in co-operation of the Fakulty of Engineering, Mataram University and the GFZ since the year 2014. The geomagnetic field intensity and directions are continously recorded at the observatory.

(* provisional identification)

Location: Indonesia

Geographic Coordinates:
Latitude: 8.83 S Longitude: 116.29 E

Geomagnetic Coordinates:
Latitude: 18.65 S Longitude: 171.13 W

The geomagnetic Coordinates refer to IGRF-11 for 2010.

Data:

Geomagnetic data are available on request.

Contact

Dr. Monika Korte

Adolf-Schmidt-Observatorium
Lindenstr. 7
14823 Niemegk
Germany

T: +49 33843 6240
F: + 49 33843 62423

Email

Cooperation partner

Dr. Teti Zubaidah

Jurusan Elektro, Fakultas Teknik
Universitas Mataram
Jl. Majapahit 62
Mataram 83125
Lombok - Nusa Tenggara Barat
Indonesia

Phone +62 370-636126/ 636755
Fax +62 370-636523

Email

GFZ Helmholtz-Zentrum Potsdam

Universitas Mataram

Lombok Tengah

24/01/2011

17/09/2013

2/04/2014

Inauguration of Lombok Geomagnetic Observatory (LOK) 11.04.2014

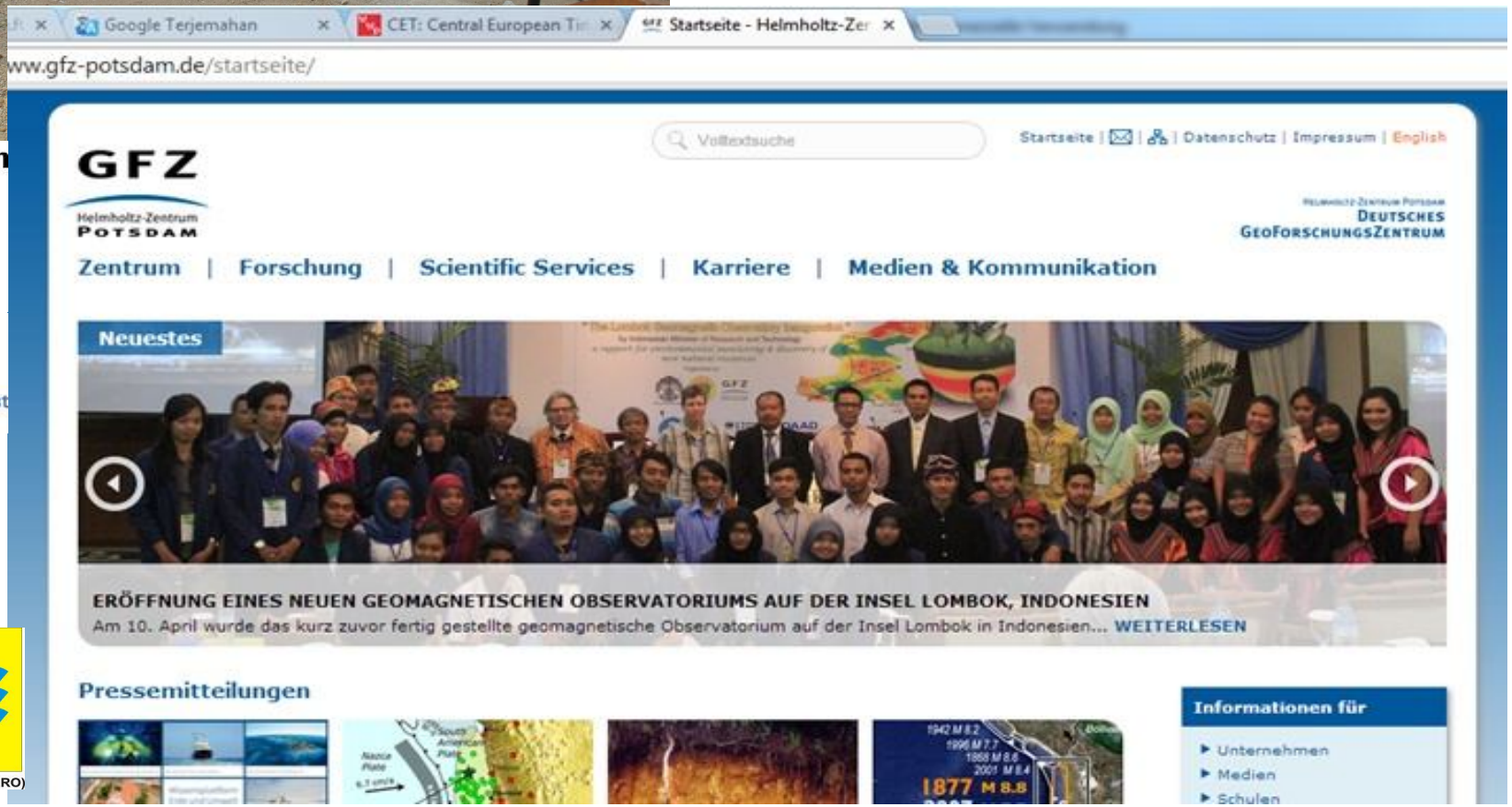
Bundesministerium für Bildung und Forschung

DAAD
Deutscher Akademischer Austausch Dienst
German Academic Exchange Service

PT Newmont Nusa Tenggara

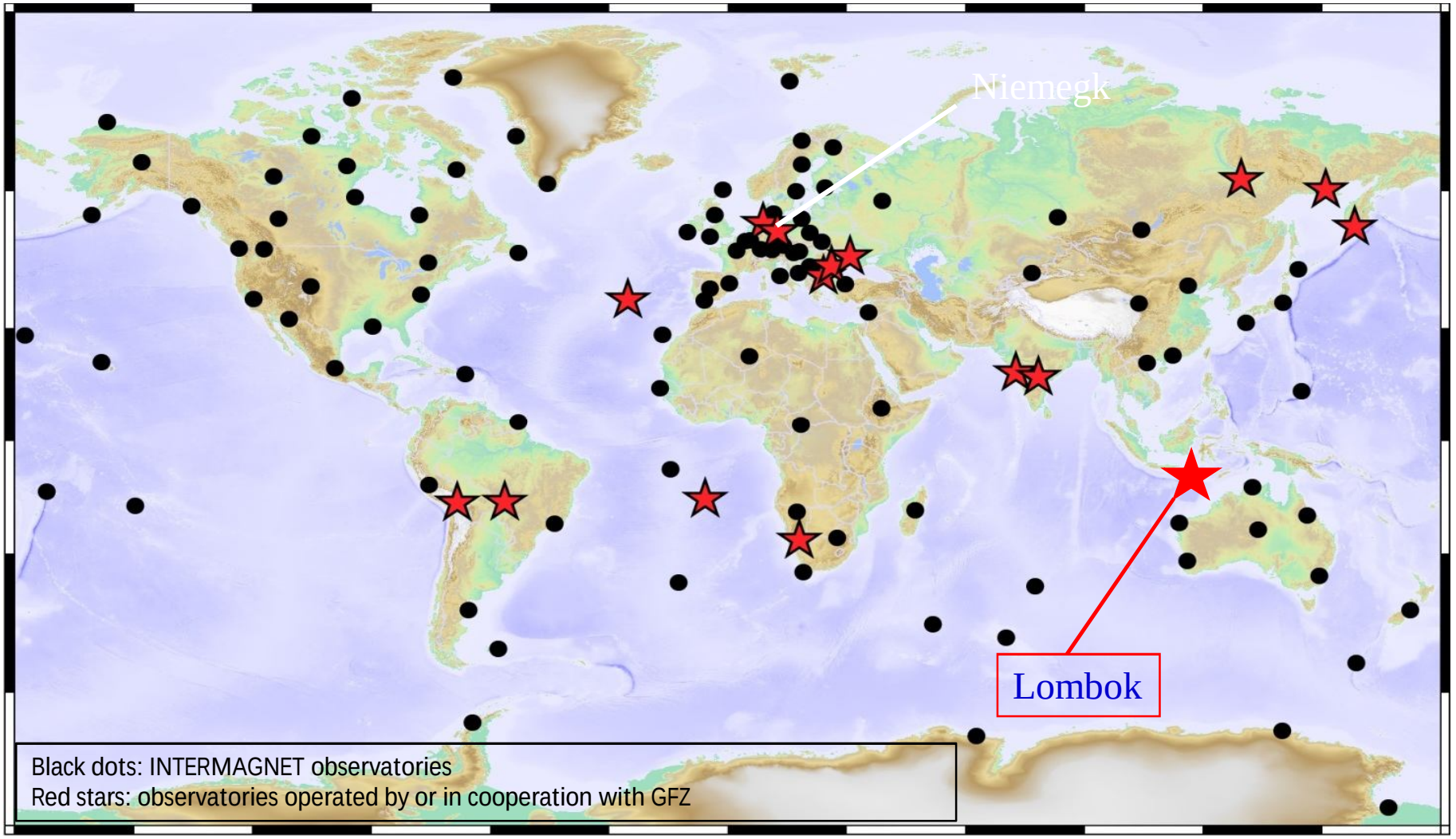
AARONIA AG
WWW.AARONIA.DE

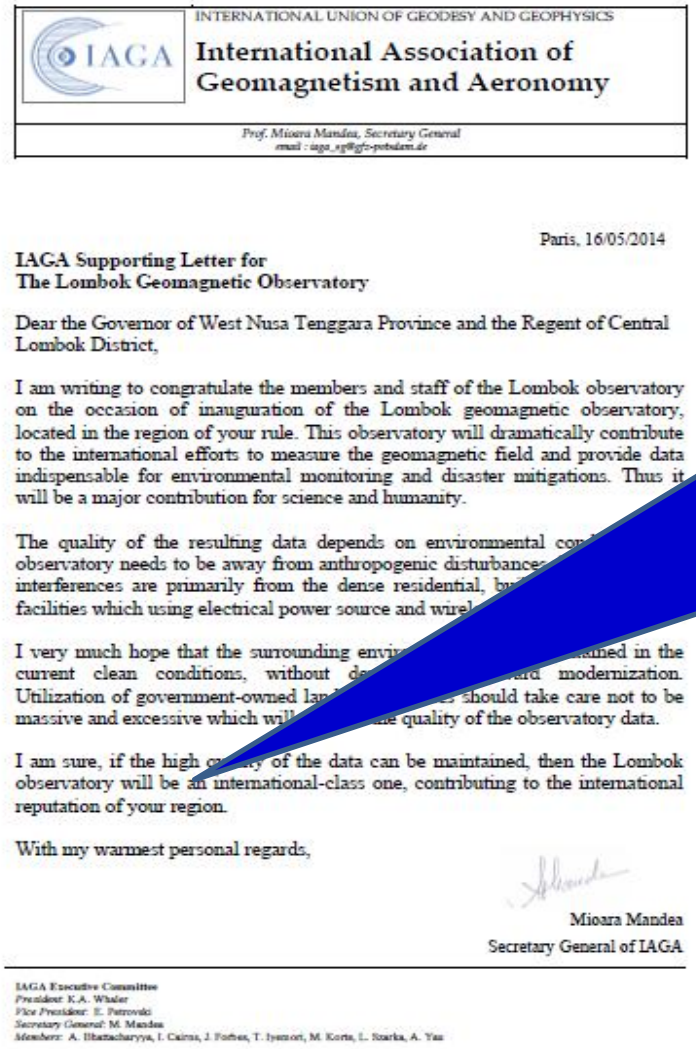
PT. PLN (PERSERO)



Lombok Geomagnetic Observatory

will be integrated into **INTERMAGNET***





INTERNATIONAL UNION OF GEODESY AND GEOPHYSICS

IAGA International Association of Geomagnetism and Aeronomy

Prof. Mioara Mandea, Secretary General
email : iaga_sg@gfz-potsdam.de

Paris, 16/05/2014

IAGA Supporting Letter for
The Lombok Geomagnetic Observatory

Dear the Governor of West Nusa Tenggara Province and the Regent of Central Lombok District,

I am writing to congratulate the members and staff of the Lombok observatory on the occasion of inauguration of the Lombok geomagnetic observatory, located in the region of your rule. This observatory will dramatically contribute to the international efforts to measure the geomagnetic field and provide data indispensable for environmental monitoring and disaster mitigations. Thus it will be a major contribution for science and humanity.

The quality of the resulting data depends on environmental co
observatory needs to be away from anthropogenic disturbance
interferences are primarily from the dense residential, bu
facilities which using electrical power source and wire

I very much hope that the surrounding envi ained in the current clean conditions, without d ard modernization. Utilization of government-owned la s should take care not to be massive and excessive which wil e quality of the observatory data.

I am sure, if the high q y of the data can be maintained, then the Lombok observatory will be an international-class one, contributing to the international reputation of your region.

With my warmest personal regards,

Mioara Mandea
Secretary General of IAGA

IAGA Executive Committee
President: K.A. Whaler
Vice President: E. Petrovski
Secretary General: M. Mandea
Members: A. Bhattacharyya, I. Cairns, J. Forbes, T. Iyemori, M. Korte, L. Starka, A. Yau

"I am sure, if the high quality of the data can be maintained, then the Lombok observatory will be an international-class one, contributing to the international reputation of your region."

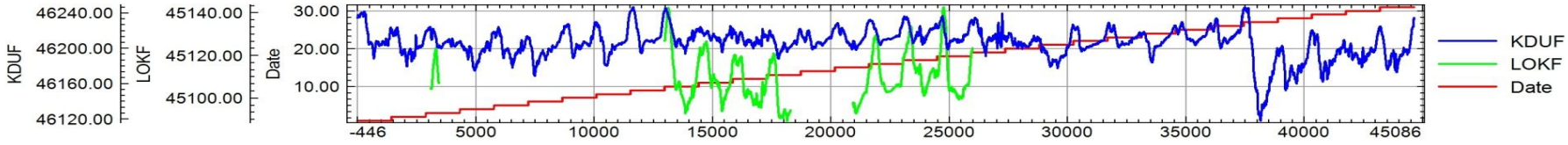
(Supporting Letter from Prof. Mioara Mandea, IAGA General Secretary to the Governor of West Nusa Tenggara Province)

Diseminasi Observatorium Geomagnetik Lombok
di LAPAN-Bandung, 21.05.2014

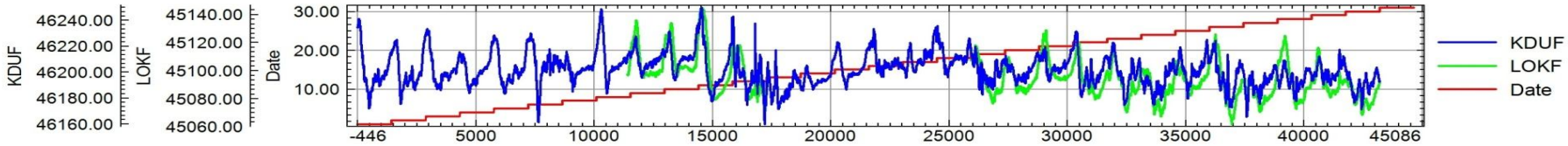
Seminar Nasional Sains Atmosfer-Antariksa
di LAPAN-Bandung, 25 November 2014

Observation on LOK

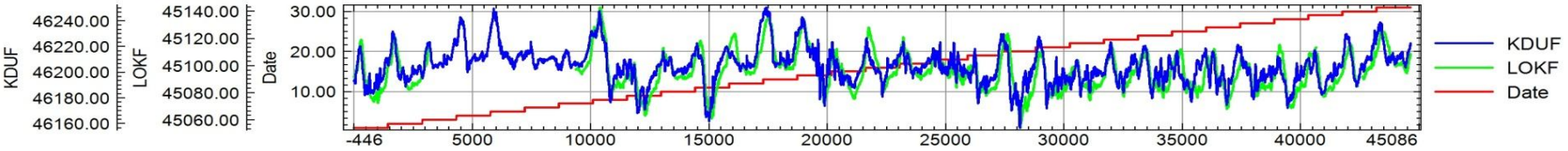
LOK- KDU Agustus 2014



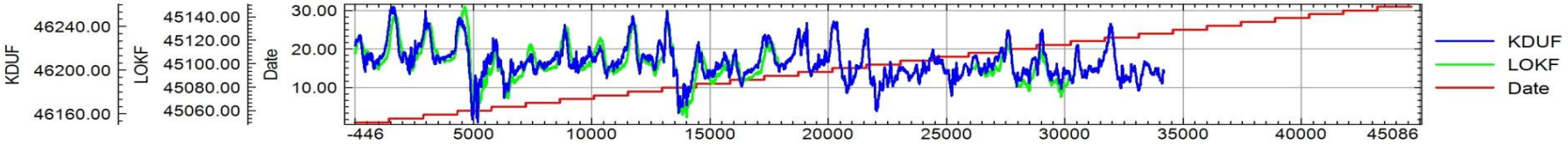
LOK- KDU September 2014

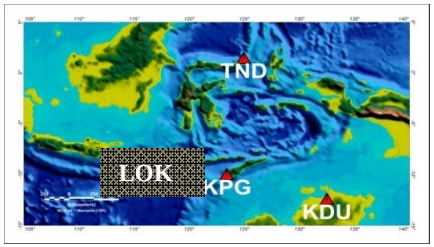


LOK- KDU Oktober 2014



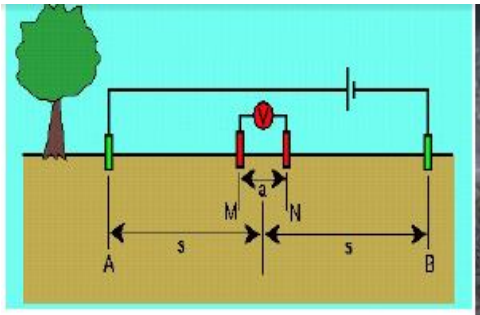
LOK- KDU November 2014



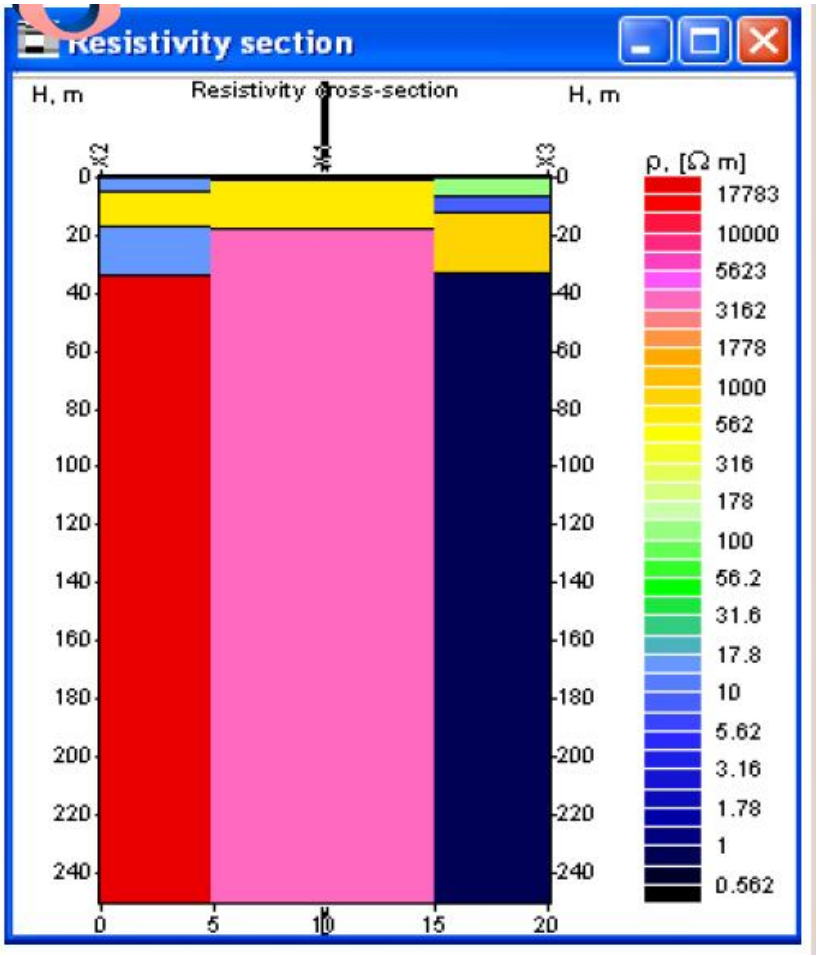


Survey Geomagnetik Regional (2004 – 2008)

Regional Geoelectrical Survey

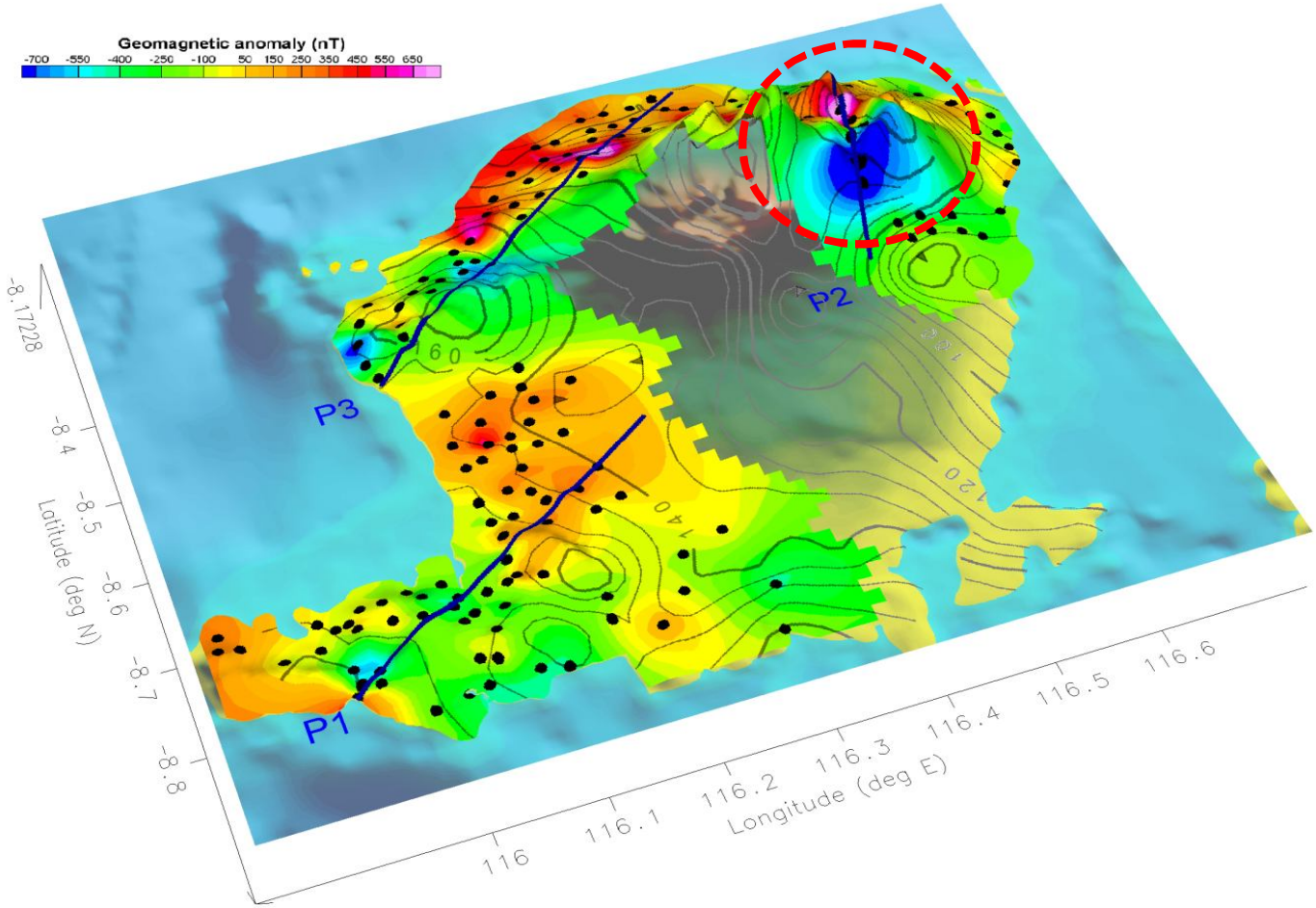


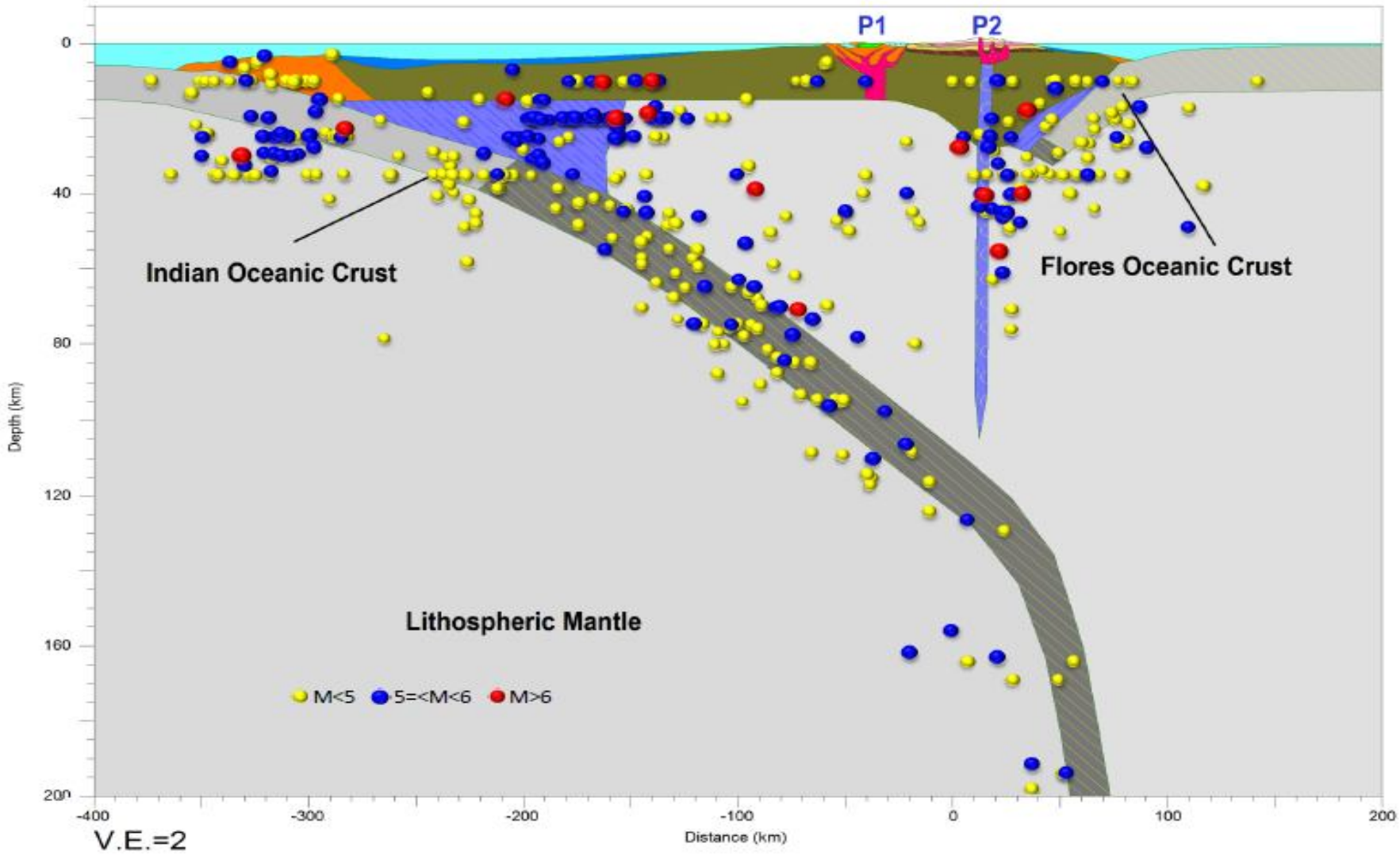
VES configuration



European Geothermal PhD-Day 2010

February 12th 2010 at the Helmholtz Centre Potsdam
German Research Centre for Geosciences GFZ

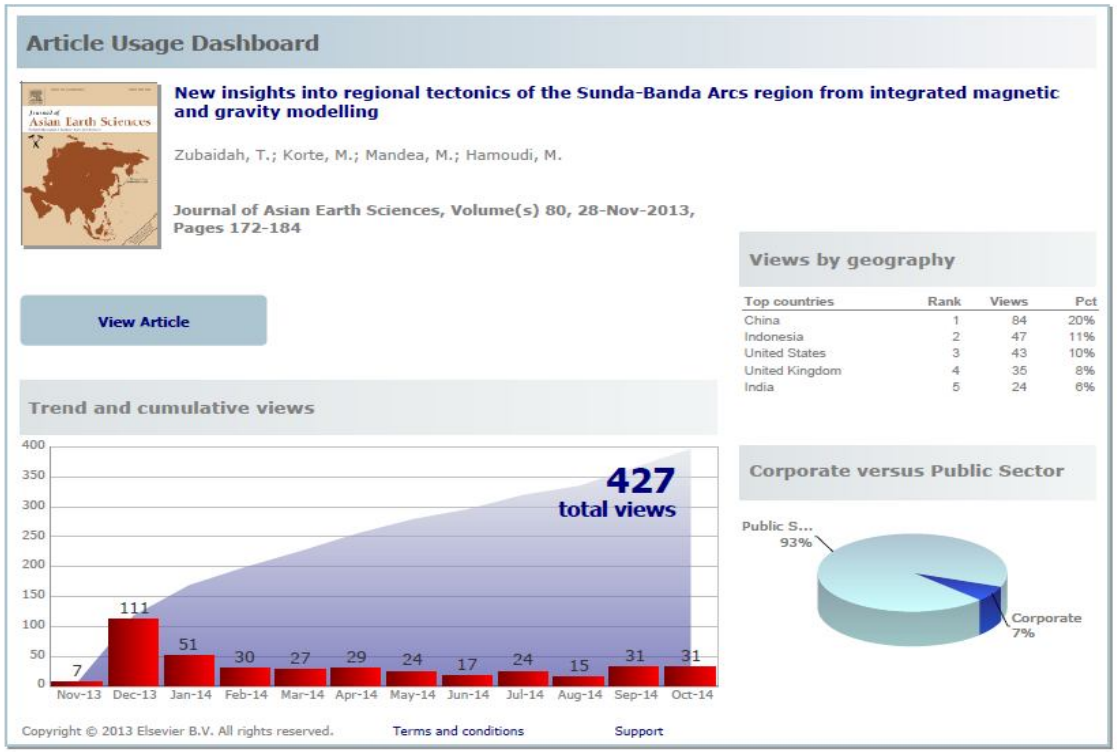


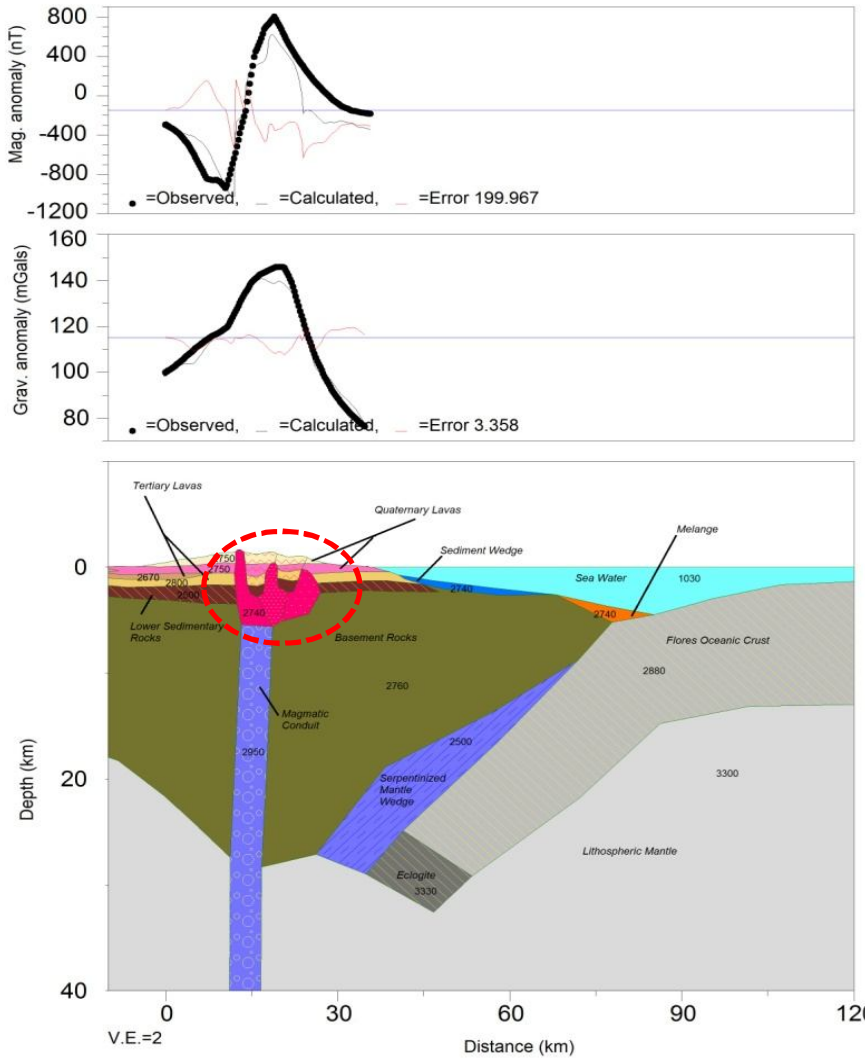


(Zubaidah et al, 2014)

Geothermal Reservoir
of Sembalun Prospect

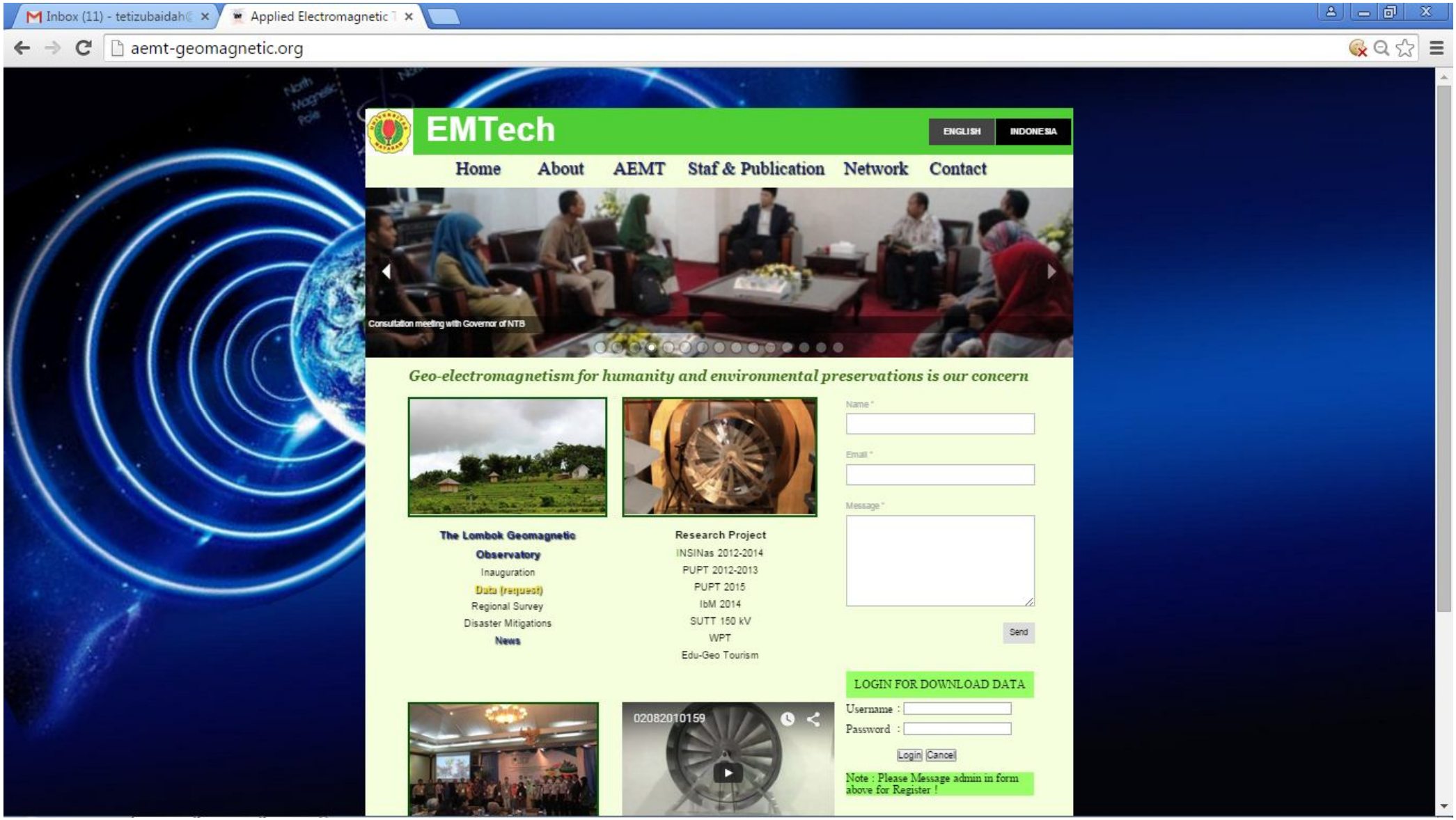
convincing model??
→ need more detailed survey





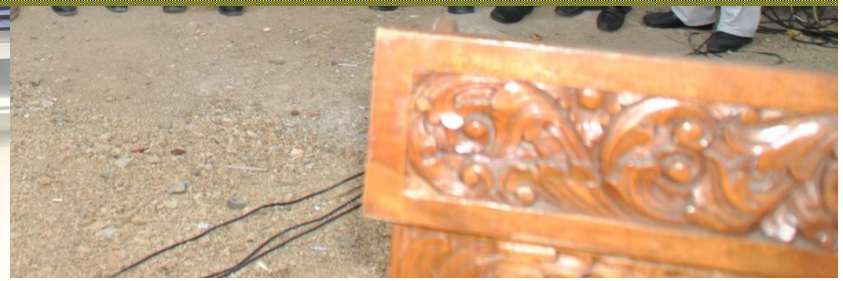
(Zubaidah et al, 2014)

Please visit us



Training for Junior Technicians of LOK

Thank You Very Much for Your Attention



The International Conference on Applied Electromagnetic Technology

1st AEMT, 11 – 15 April 2014