

Golem #8 2014 - from #13808 to #18130  
2015 - from #18130 to #20410

Mariánská 2016

Vojtěch Svoboda

## Forecast 2014/2015 → Inventory

- The night of scientists I ✓.
- Training courses: FUMTRAIC IV ✗(administrative problems), GOMTRAIC III (hopefully) ✗(no free energy), SCIWTRAIC V ✓, HUNTRAIC IV ✓, SUMTRAIC@GOLEM VII ✓.  
+EMTRAIC@GOLEM II ✓.
- Remote demos: Padova, TU Denmark, Ahmedabad, Poland.
- IAEA joint experiment ✓.
- Bachelor thesis ? ✓/✗.
- Diploma thesis II completed ✓+III completed.
- Papers: FUSENGDES 2x ✓, AJP .. ? ✗(no free energy) +NF ✓.
- +IAEA TM (Ahmedabad) presentation.
- +Practicum for bachelor level students.
- IAEA TM (Prague) presentation ✓.
- PhD event GOLEM presentation ✓.

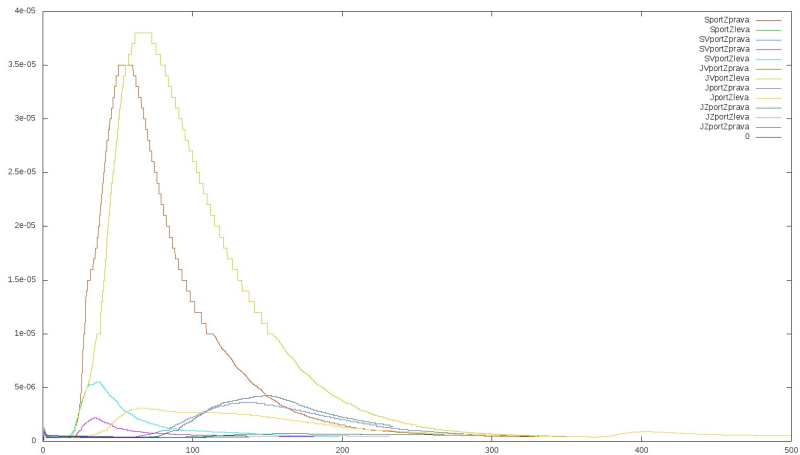
# Dominant "problems"

- SUJB
- Vacuum leakage
- PhD event

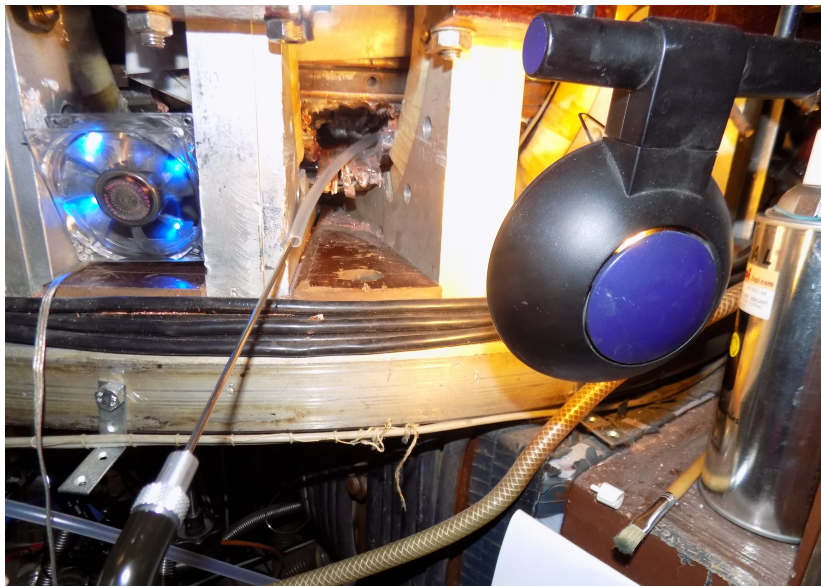
# Outline

- 1 Vacuum Leakage
- 2 AP: Tomography - Viktor Loffelmann
- 3 AP: HXR - Ondrej Ficker + Peter Svihra
- 4 DT: Density measurements - Lukáš Matěna
- 5 DT: Feedback Stabilization - Jindřich Kocman
- 6 Probe measurements in MW plasma
- 7 3D model #3 (Tatiana Okonechnikova)
- 8 Gallery
- 9 Closing

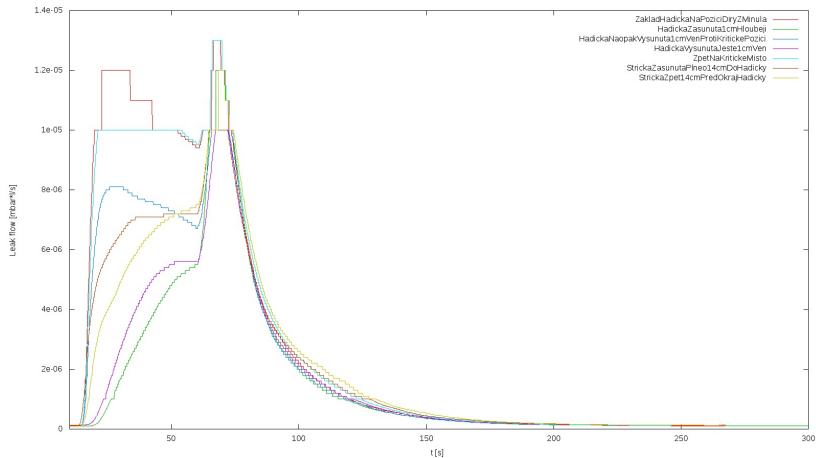
# Toroidal scan



# The hole to shelter



# JV port scan



# Suspicious place





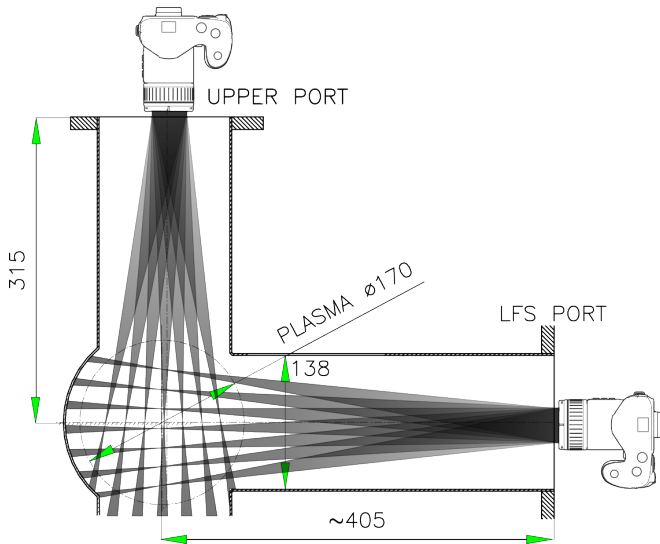
# 01/16 - Dow corning 736 application



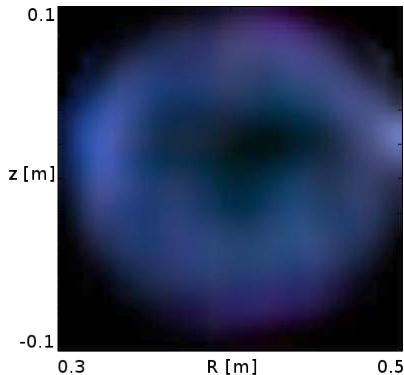
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# Scheme



# Tomography



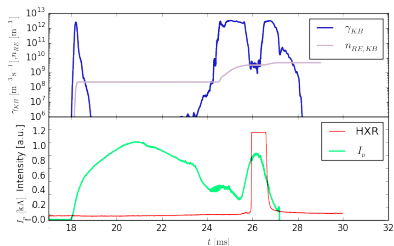
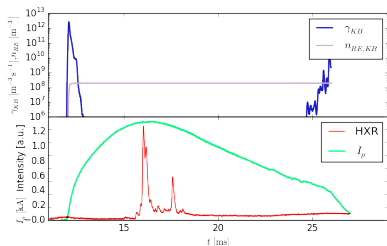
- Tomography is being calculated from the images captured by two fast cameras
- A new algorithm using the Tikhonov regularization has been developed; No assumption about the magnetic flux surfaces is made
- The reconstructions show a hollow profile during the main phase of the discharge
- The reflections from the walls seem to be the main source of artifacts

# Outline

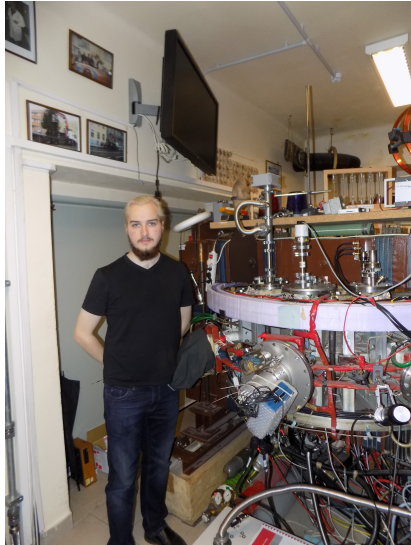
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# Runaway electrons - outvessel

- A new NaI(Tl) scintillation detector with a photomultiplier tube was installed
- Kruskal-Bernstein criterion used for estimating the RE generation rate
- RE generation observed during the breakdown phase as well as during position instabilities
- Plasma recreation observed after the loss of RE (probably due to secondary electrons)



# Runaway electrons - invessel

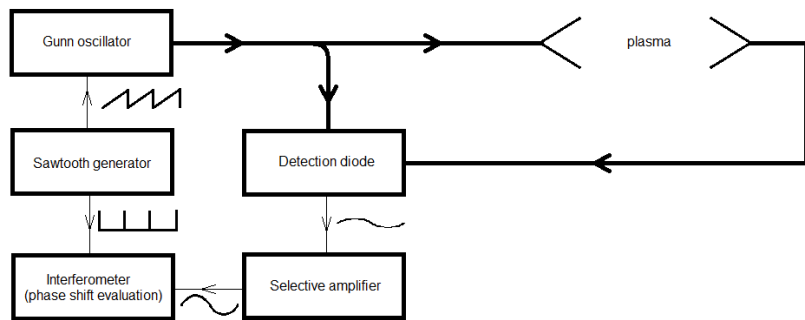


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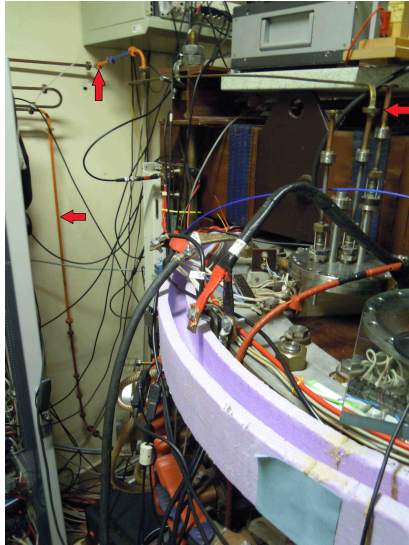
# Interferometer Scheme



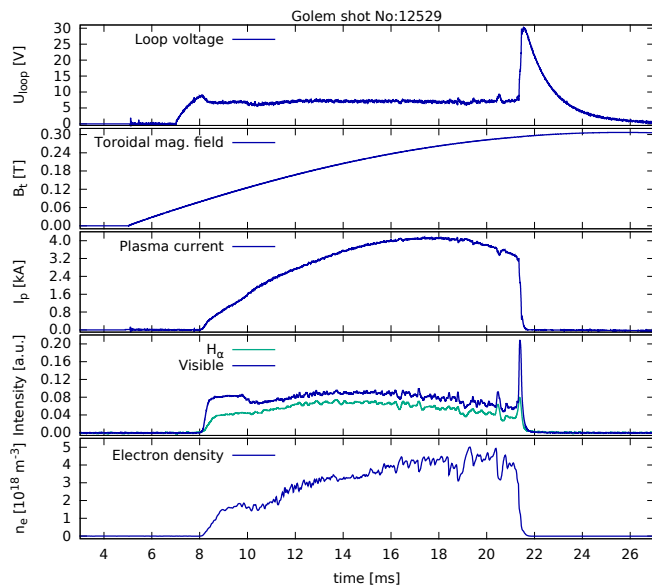
# Photo of the interferometer



# Dispersion line



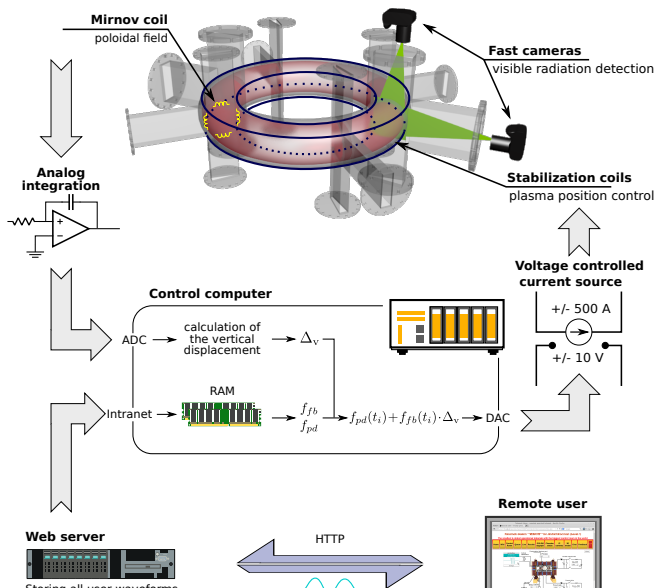
# Text book plasma #12529



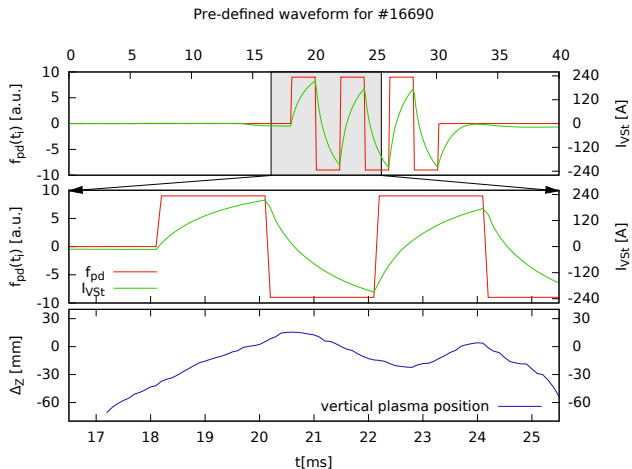
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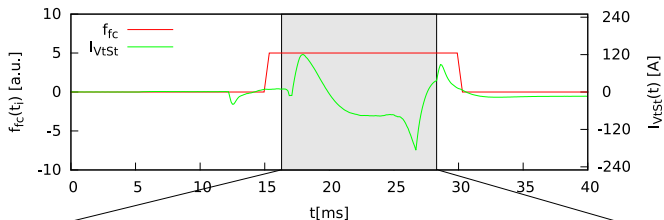
# Pre-defined waveform - off-line stabilization



# Feedback coefficient waveform - on-line stabilization



Feedback coefficient waveform & stabilization current for #16853



16.3

t [ms]

28.3



# Web control room -level2

Tokamak Golem - remotely operated tokamak - Mozilla Firefox

Firefox Tokamak Golem - remotely operat...

golem.fjfi.cvut.cz/roperation/tasks/STUDENTS/0413jindrichKocman/Level\_1/index.php

## Tokamak Golem \*\*REMOTE\*\* for JindrichKocman (Level 1)

The smallest & oldest operational tokamak with the biggest control room in the world

Home Wiki Control Room Queue Live Results GOLEM dygraph Chamber status IP cameras 3D model Chat Feedback Level 1

predefine feedback combination  
change

Vertical stabilization

Preionization (electron gun)  
Preion OFF

Toroidal magnetic field  
 $U_B$  [V] 800 2kV

Primary current  
TCD [us] 5000  
 $U_{CD}$  [V] 400 2kV

Vacuum stand  
PWG [mPa] 16  
GAS handling  
Working Gas  
H2 Hydrogen

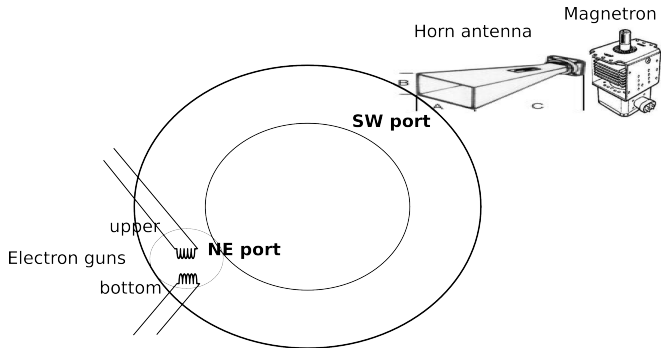
Discharge comment

Place the discharge setup into the queue

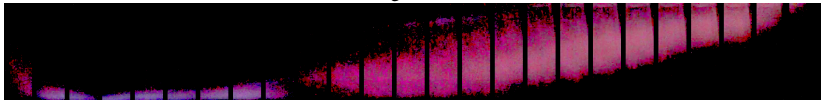
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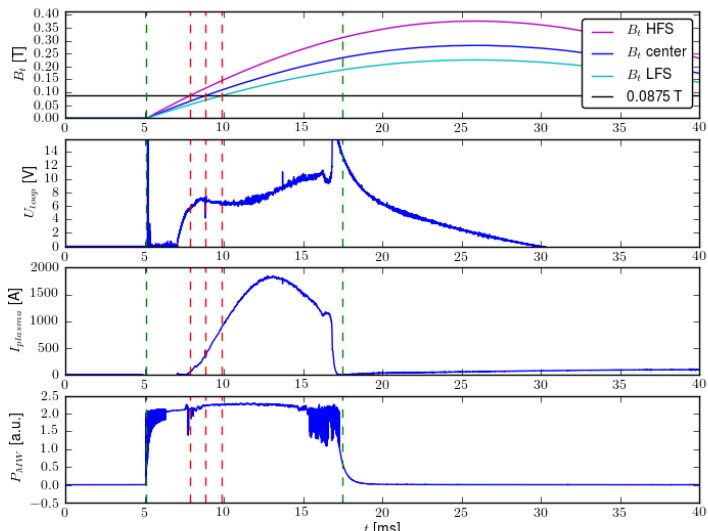
# Microwave plasma investigation



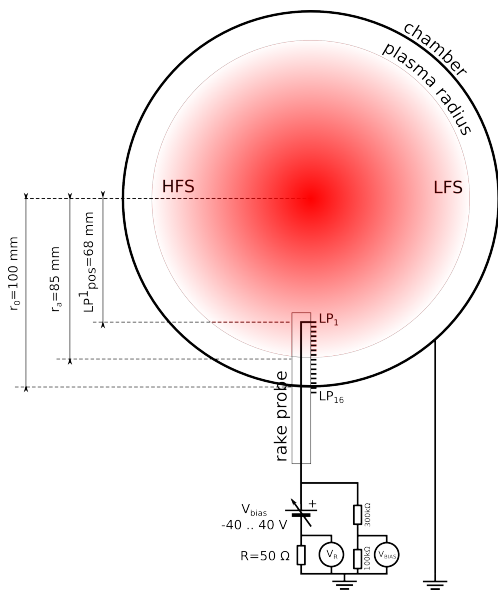
$$B_{RES} = 2\pi f_M \frac{m_e}{e}, f_M = 2.45 \text{ GHz}$$



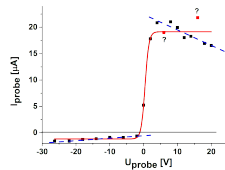
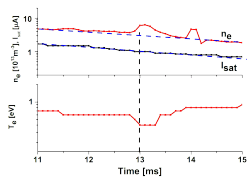
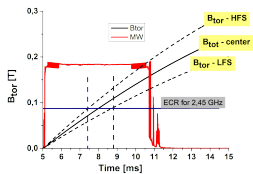
# Sustained breakdown conditions (for "ever")



# Experimental setup



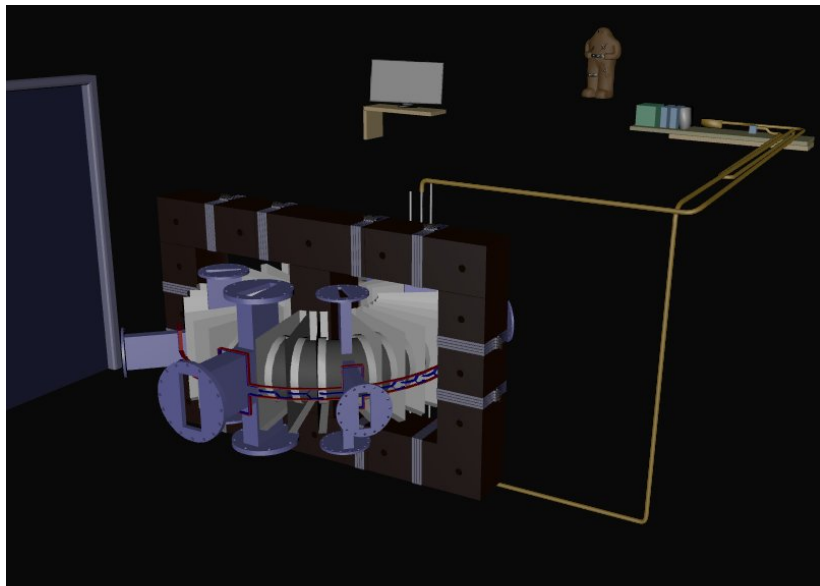
# Results



# Outline

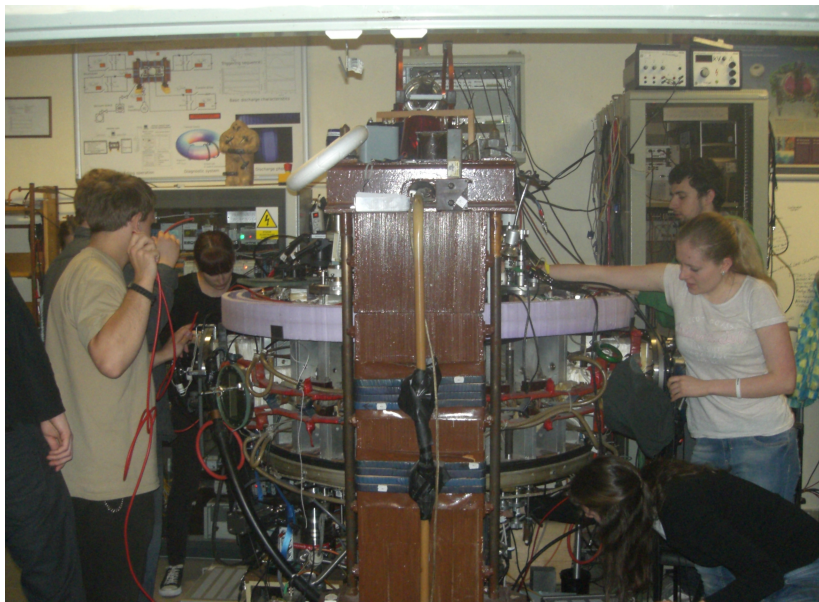
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# X3DOM





# Highlight 2014/2015 - HANDS ON TOKAMAK (Bachelor level students)



- SUJB

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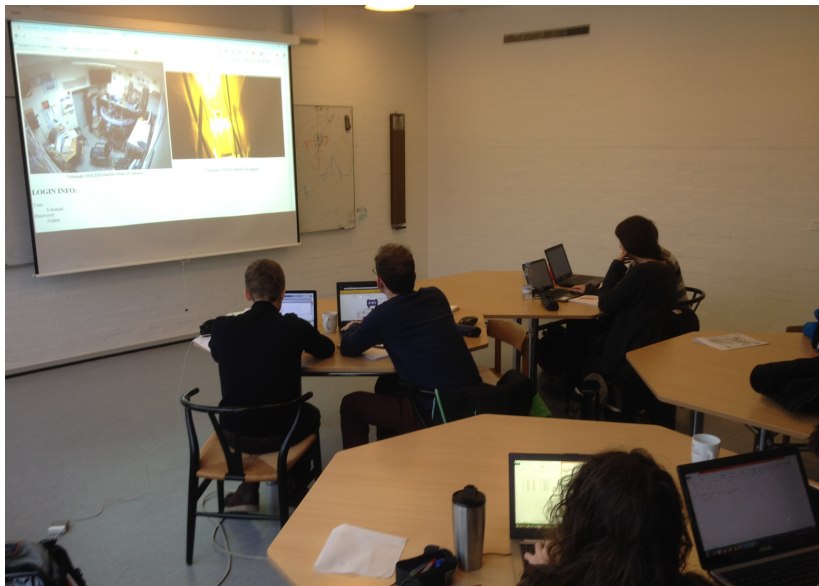
# Remote from Grenoble



# Remote from Belgrade



# Remote from Kobenhavn



# Remote from Eindhoven



# R.J.E.Jaspers letter

**TU/e**

Technische Universiteit  
**Eindhoven**  
University of Technology

Faculty of Applied Physics  
Science and Technology of Nuclear  
Fusion

P.O. Box 513, 5600 MB Eindhoven  
The Netherlands  
Internal address: Flux 5.116  
[www.phys.tue.nl/fusion](http://www.phys.tue.nl/fusion)

Ing. Vojtěch Svoboda, CSc.  
KF JFJI ČVUT  
Břehová 7  
115 19 PRAGUE 1  
Czech Republic

**Date:**  
2015-12-16

**Contact:**  
Dr. R.J.E. Jaspers  
T: (+31) 40-2472253  
[r.j.e.jaspers@tue.nl](mailto:r.j.e.jaspers@tue.nl)

Dear Vojtech,

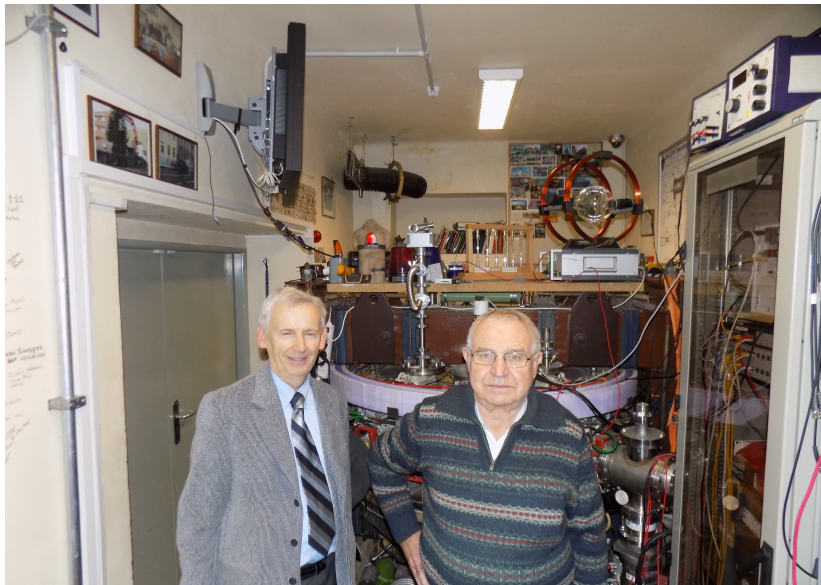
Please find here the fee we have to pay to be able to make real fusion science with our students!  
As judged from their enthusiasms (maybe you can read that from their faces in the enclosed pictures), this is a very good investment!

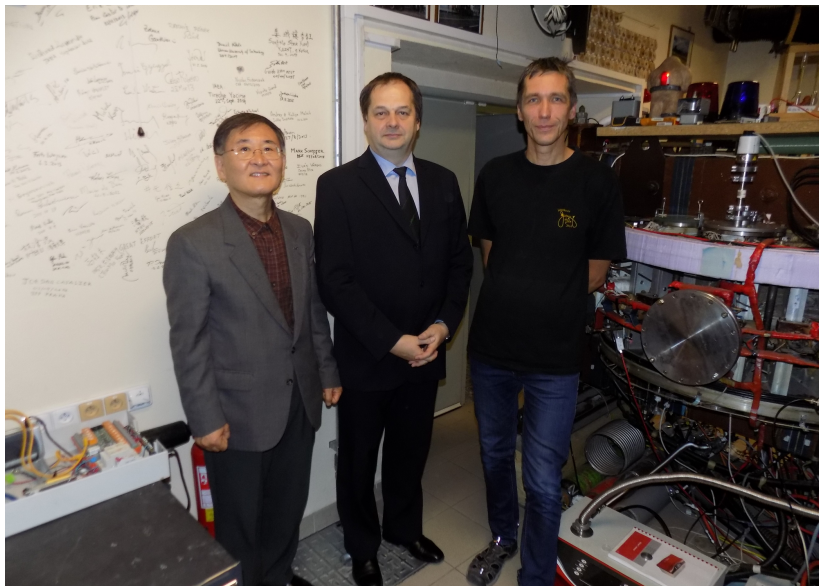
So thanks for all your efforts and I am sure it will not be the last time I will use this opportunity.



prof. Moos







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# Forecast 2016

- The Night of Scientists III.
- FUMTRAIC IV, SCIWTRAIC@GOLEM VI, HUNTRAIC V, SUMTRAIC@GOLEM VIII, EMTRAIC@GOLEM III.
- GOMTRAIC ?? (3 days)
- Bachelor thesis ?
- Diploma thesis IV cont.
- papers in FUSENGDES, AJP .. ?
- AP: MartinM, MatusC, OndraG, KatkaJ, PeterS, MiroslavS, RichardD, AdamS, BorL, JakV, VojtM → Marianska 2017.

# Summary

It is a student's project.

- Electron density measurement achieved!
- Stabilization (on the horizon)!
- Education ✓, Science ✓/✗
- Vacuum problem (a hole in the vessel?). Historical copper shell prevents easy repair.
- New (HTS support?) vessel in consideration.

43<sup>th</sup> EPS @ ?? (Belgie??)

KDO CHCE JECT? Za peníze z SGS

Nabídka pro nejproduktivnějšího.

Fee: Abstrakt (02), Poster (07), Sborník (06)

# Acknowledgement

## Acknowledgement

The financial support by FUSENET, MSM 6840770039, MSM 6840770014 and A1581, SGS SGS11/131/OHK4/2T/14 is acknowledged.

Special thanks to the GOLEM team (students, teachers, technicians)

**Ondrej Grover**, Jindrich Kocman, Lukas Matena, **Michal Odstrcil**, Tomas Odstrcil, **Honza Stockel**, **Gabriel Vondrasek**,  
Frantisek Zacek.



Thank you for your attention

