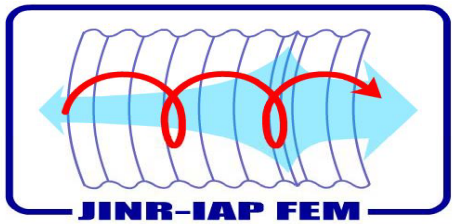

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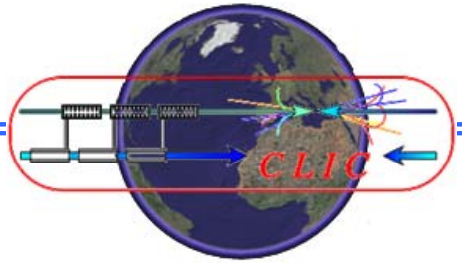

RECENT RESULTS OF JINR-IAP EXPERIMENT ON RF CAVITY HEATING

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Joint Institute for Nuclear Research, Dubna, Russia

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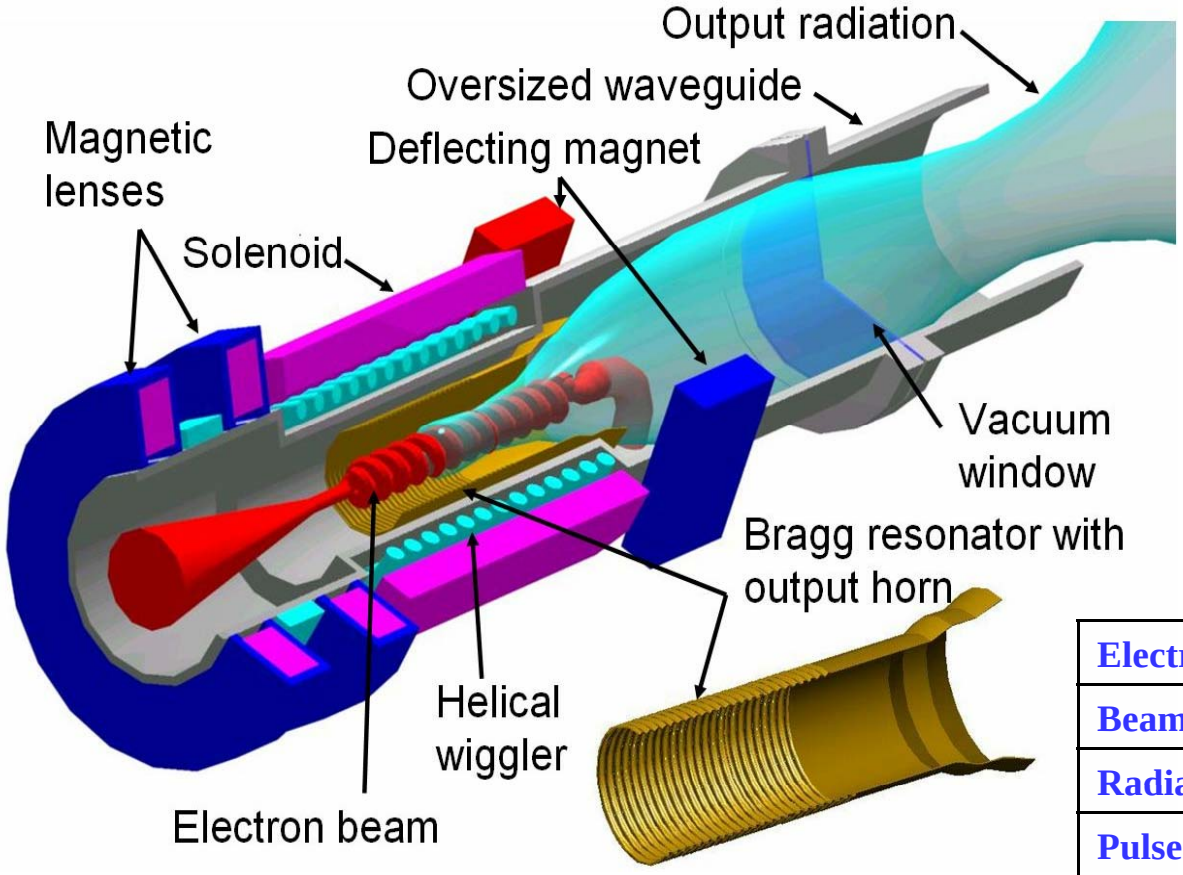

JINR-IAP FEM oscillator with Bragg resonator

Electron energy	**0.8 MeV**
Beam current	**250 A**
Radiation power	**15 – 20 MW**
Pulse length	**180 ns**
Radiation frequency	**30 GHz**
Spectrum width	**< 10 MHz**
Repetition rate	**0.5 – 1 pps**

JINR–IAP FEM

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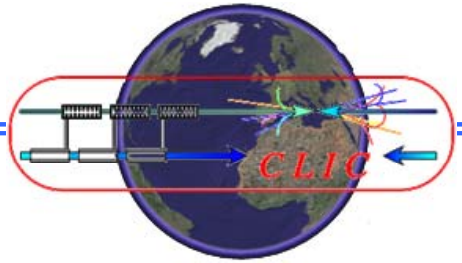

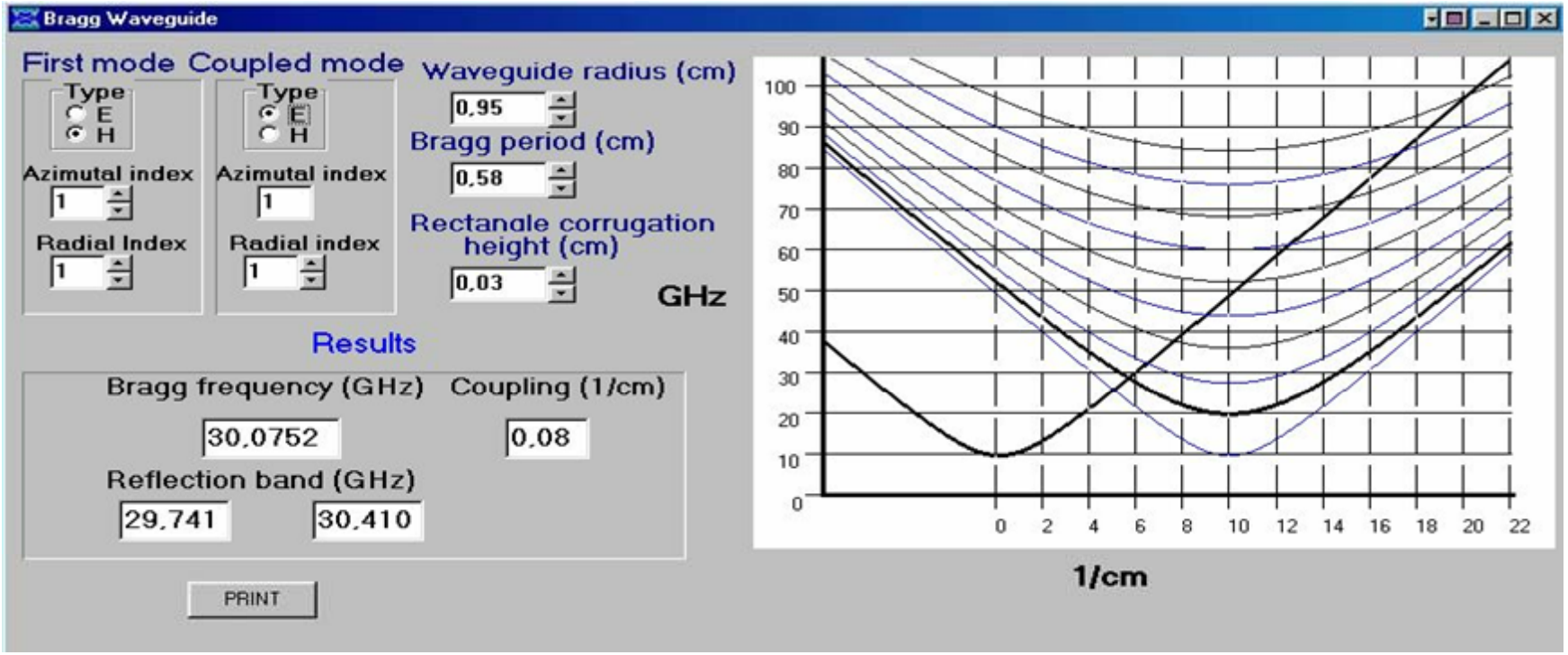

Main parameters and photo of Bragg resonators with shift of corrugation phase

JINR–IAP FEM

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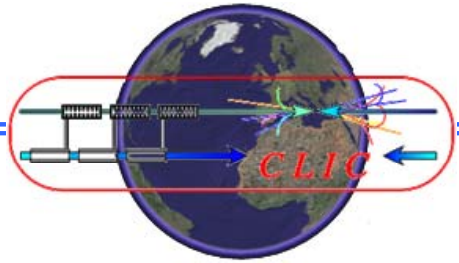
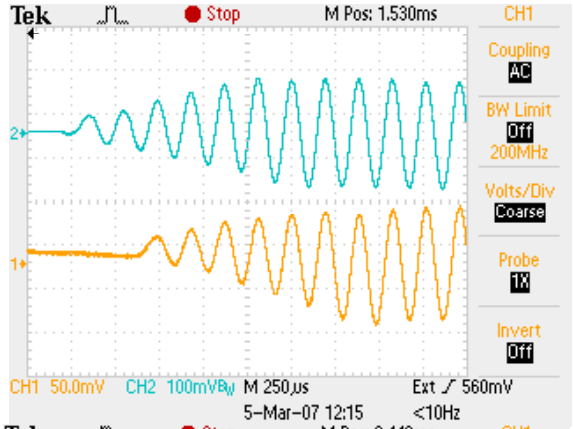
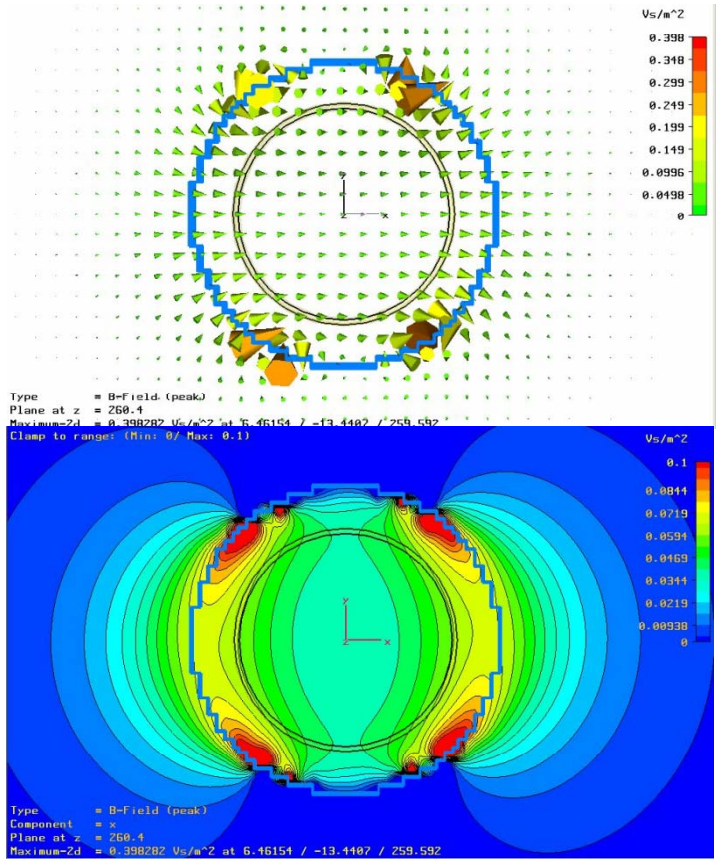
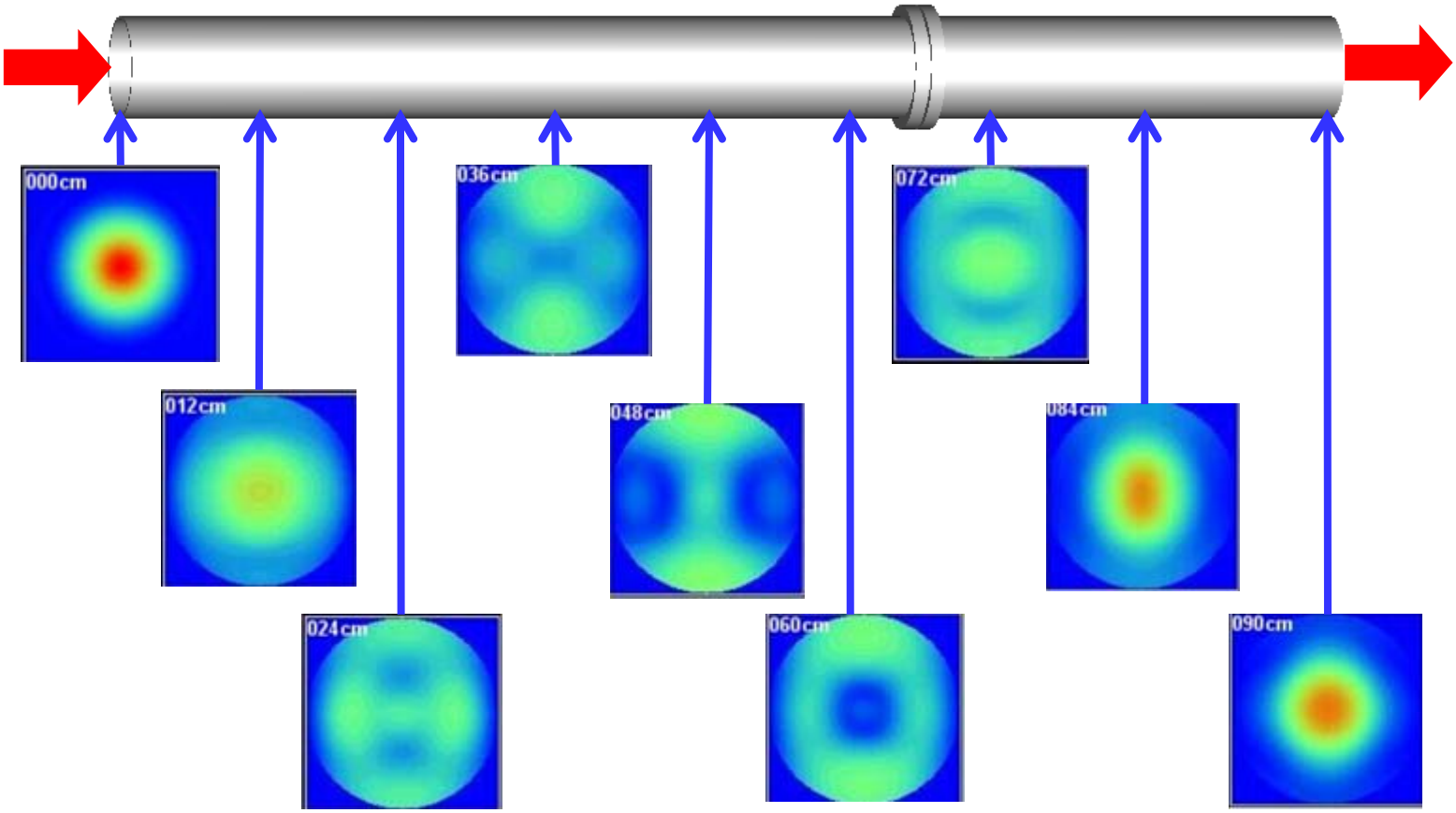




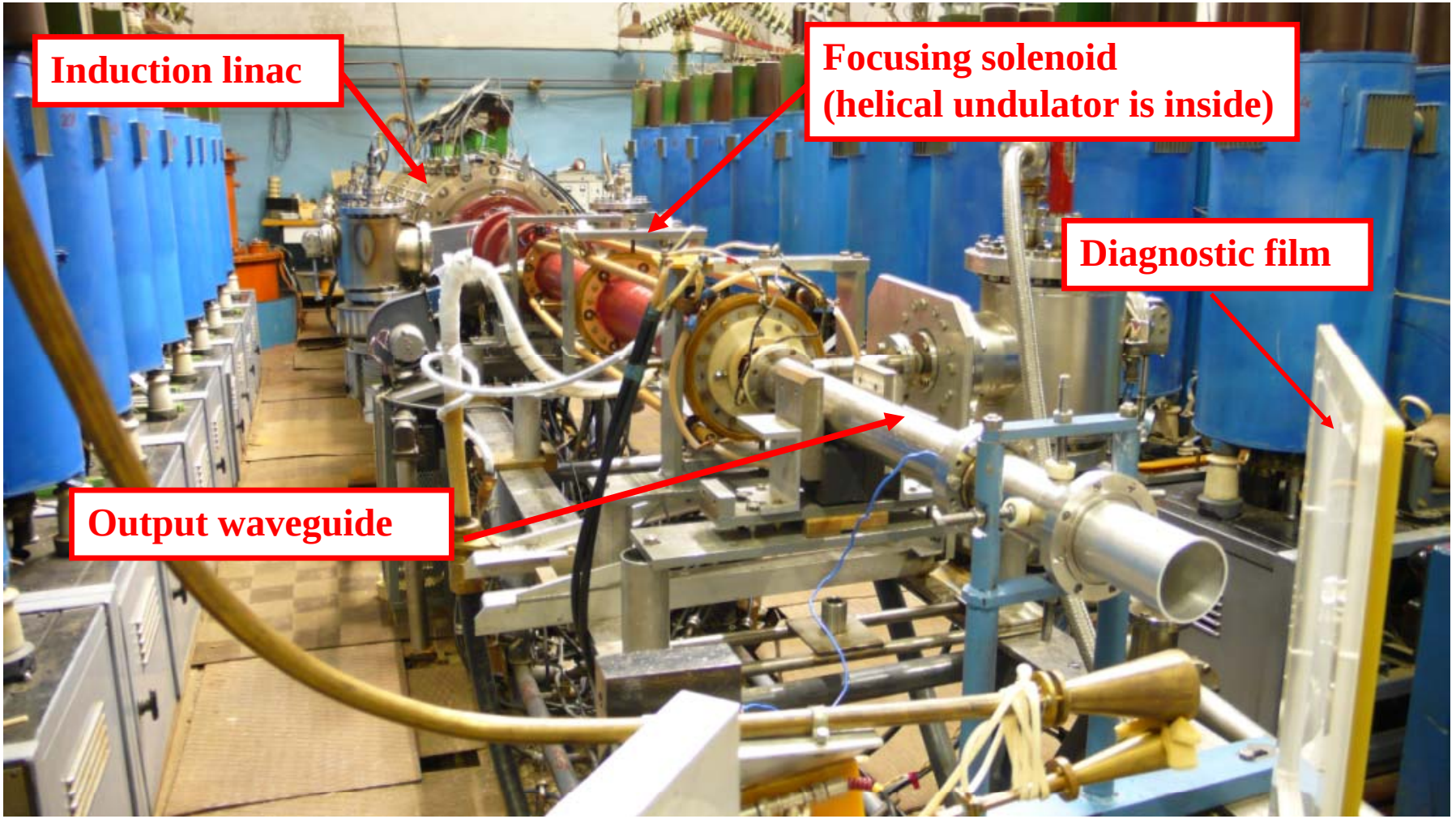


Helical undulator, measured first integral of x- and y-components of magnetic field in adiabatic input and regular part,

simulated transverse field distribution



Wave dynamics in oversized waveguide (Talbot effect): initial Gaussian distribution of the wave repeats itself at distance of 90cm, while it is almost uniform at distance of 70 cm



JINR-IAP FEM oscillator based on induction linac LIU-3000

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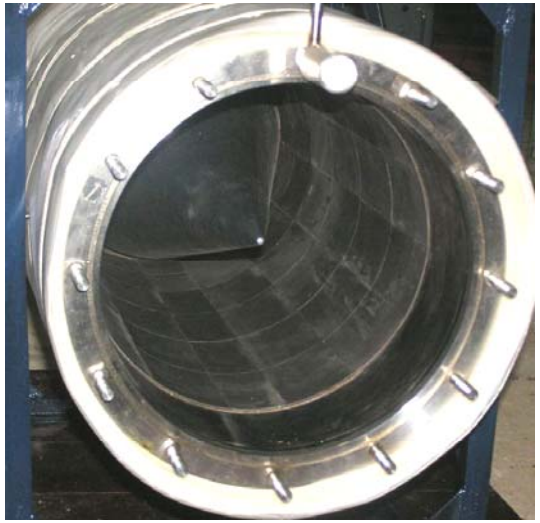
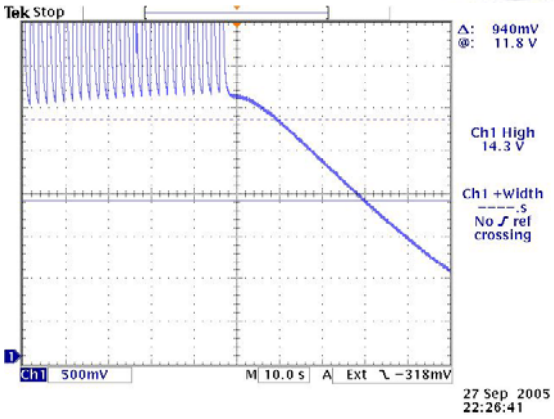
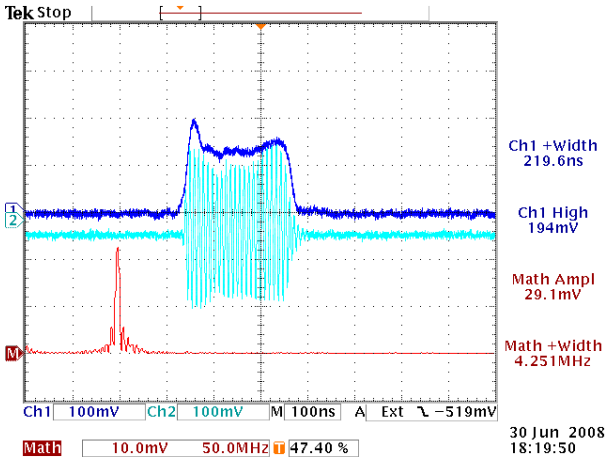


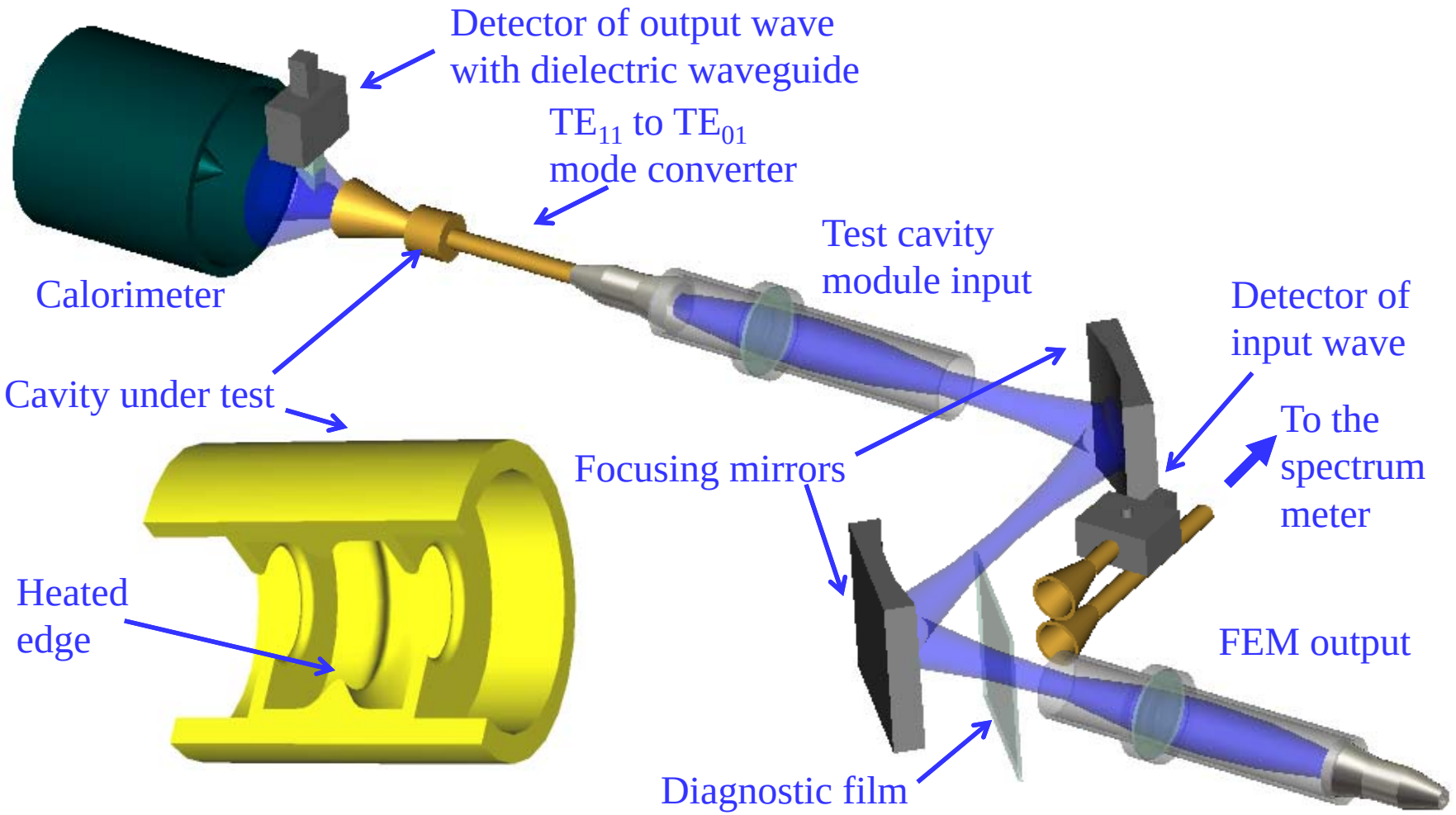


Typical output parameters of FEM radiation.
Pulse energy 2.2J

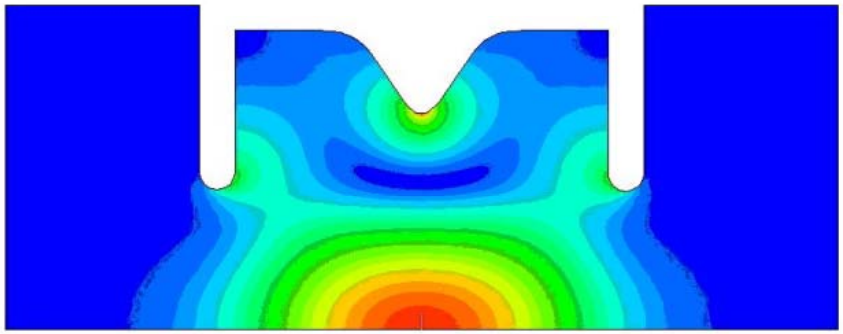
Calorimeter and heterodyne spectrum meter.

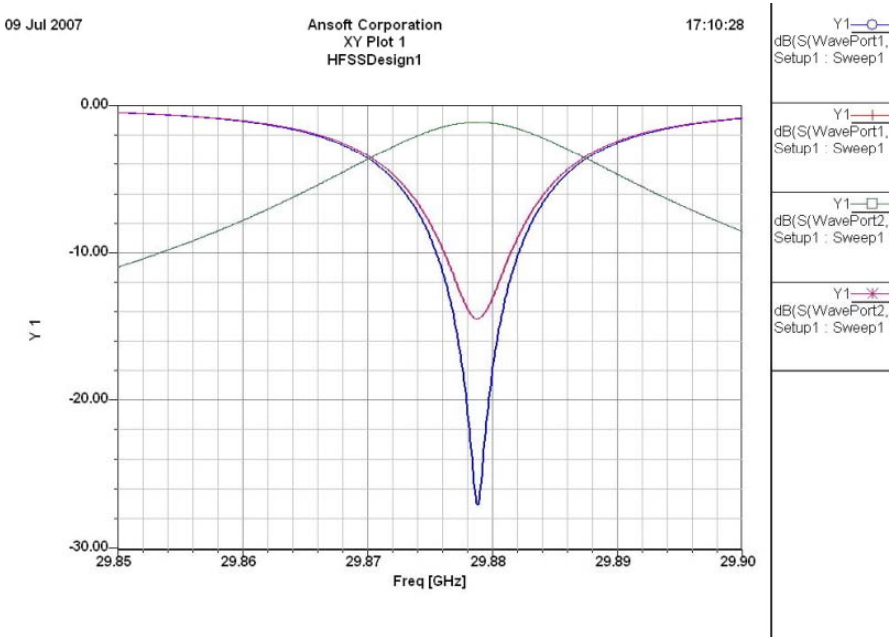


Optimal output parameters of FEM radiation



Layout of the experiment on 30 GHz copper cavity heating

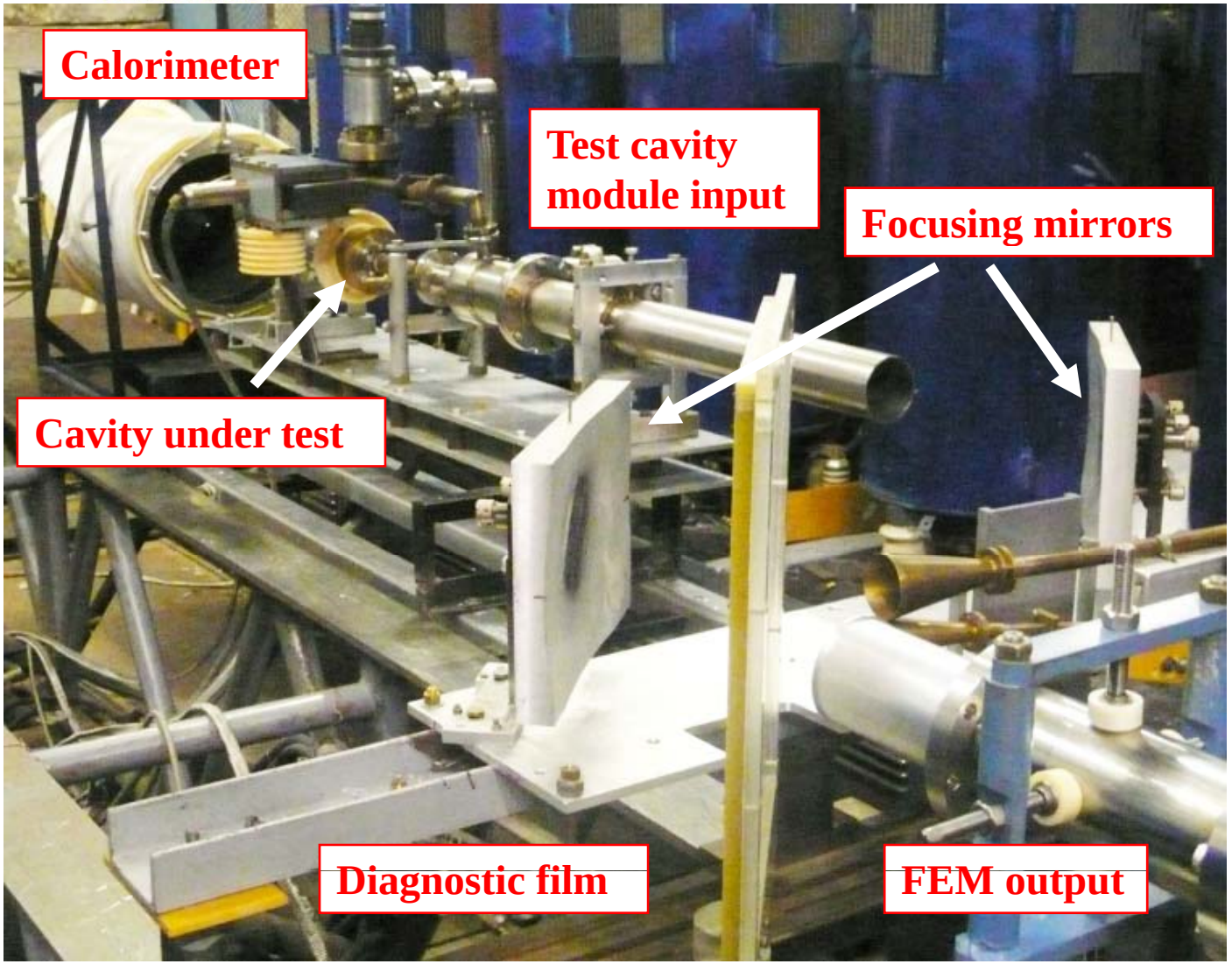




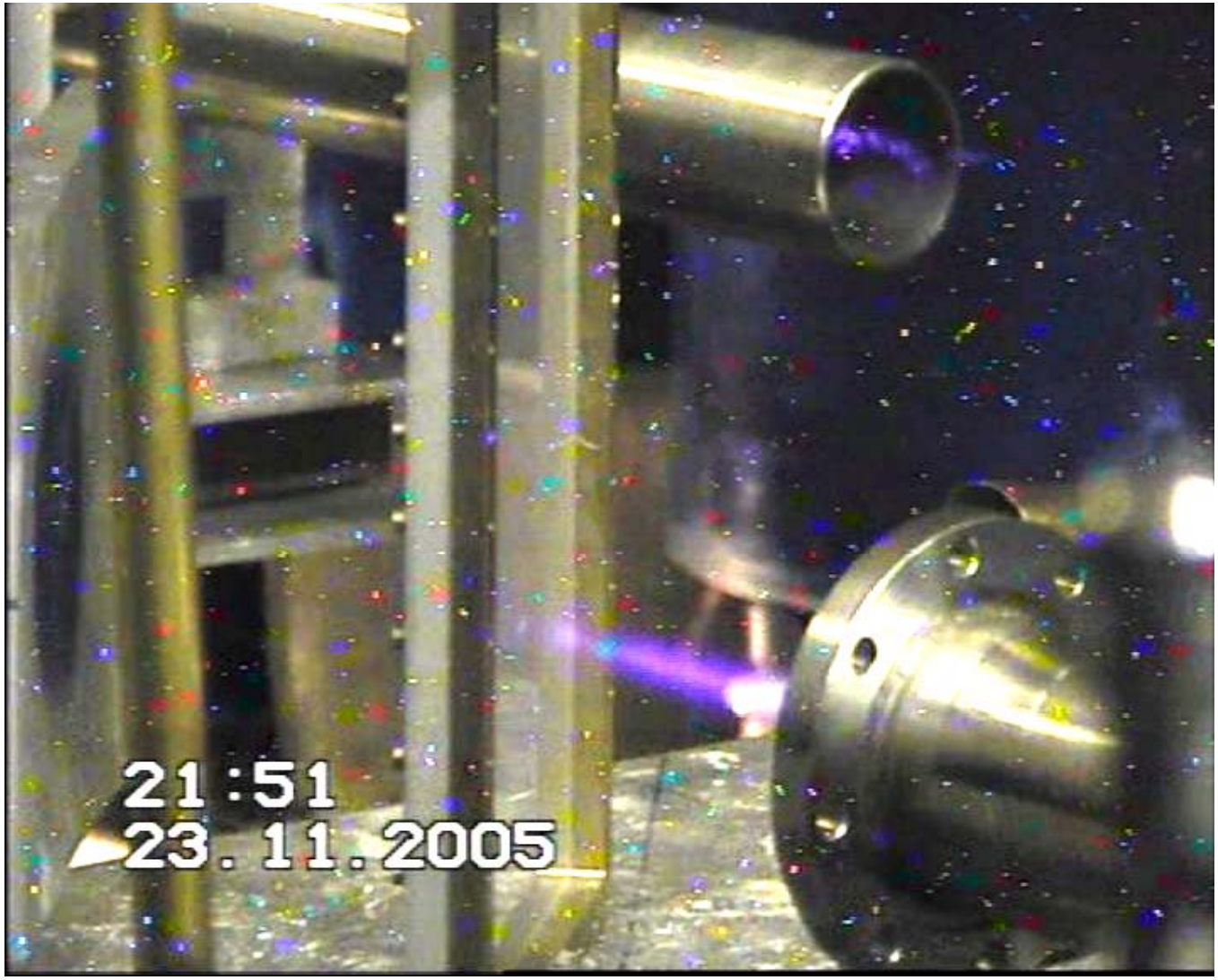
Test cavity with sharp edges and quality factor about 1500.
Frequency - 29,8788 GHz
Quality factor - 1500.
H z,max - 2,05 MA/m when Win = 25MW

Improved test cavity with Q-factor about 1500

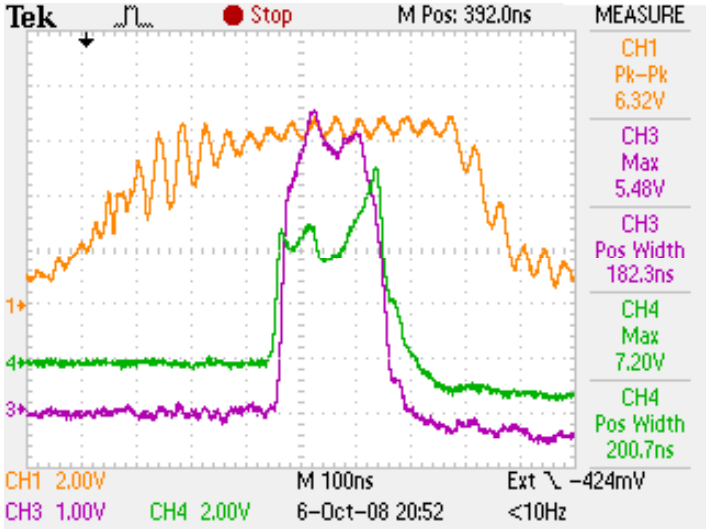
Details of test cavity – vacuum box, central ring and input diaphragm



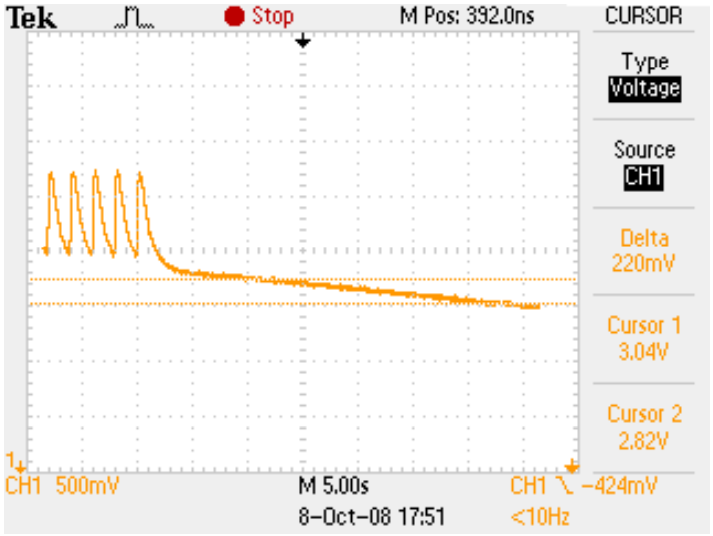
Overview of experimental setup



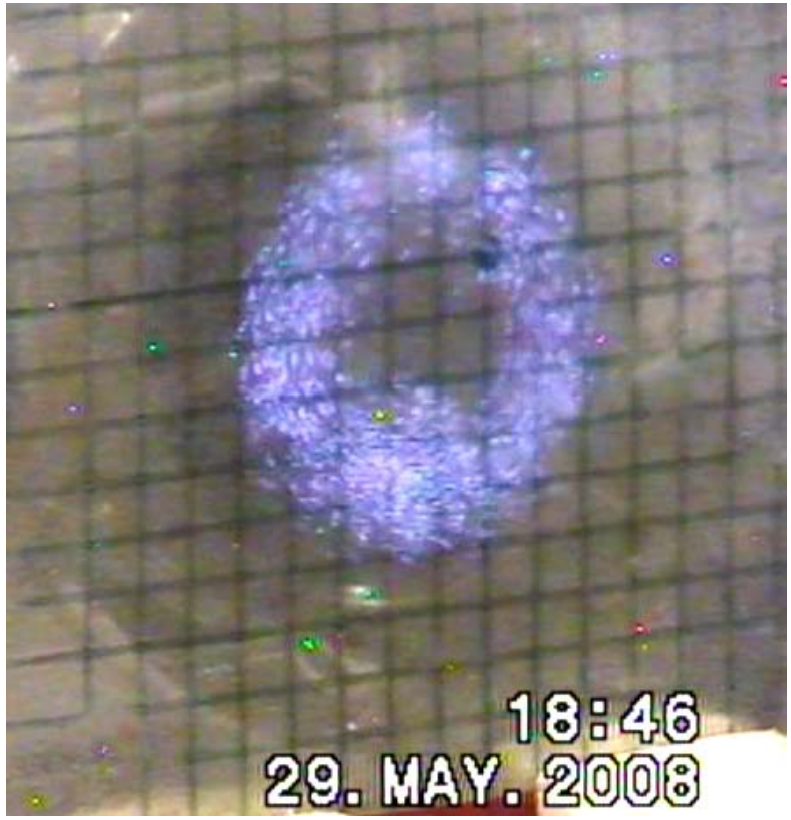
Air breakdown at the FEM output waveguide and at the input of test cavity module



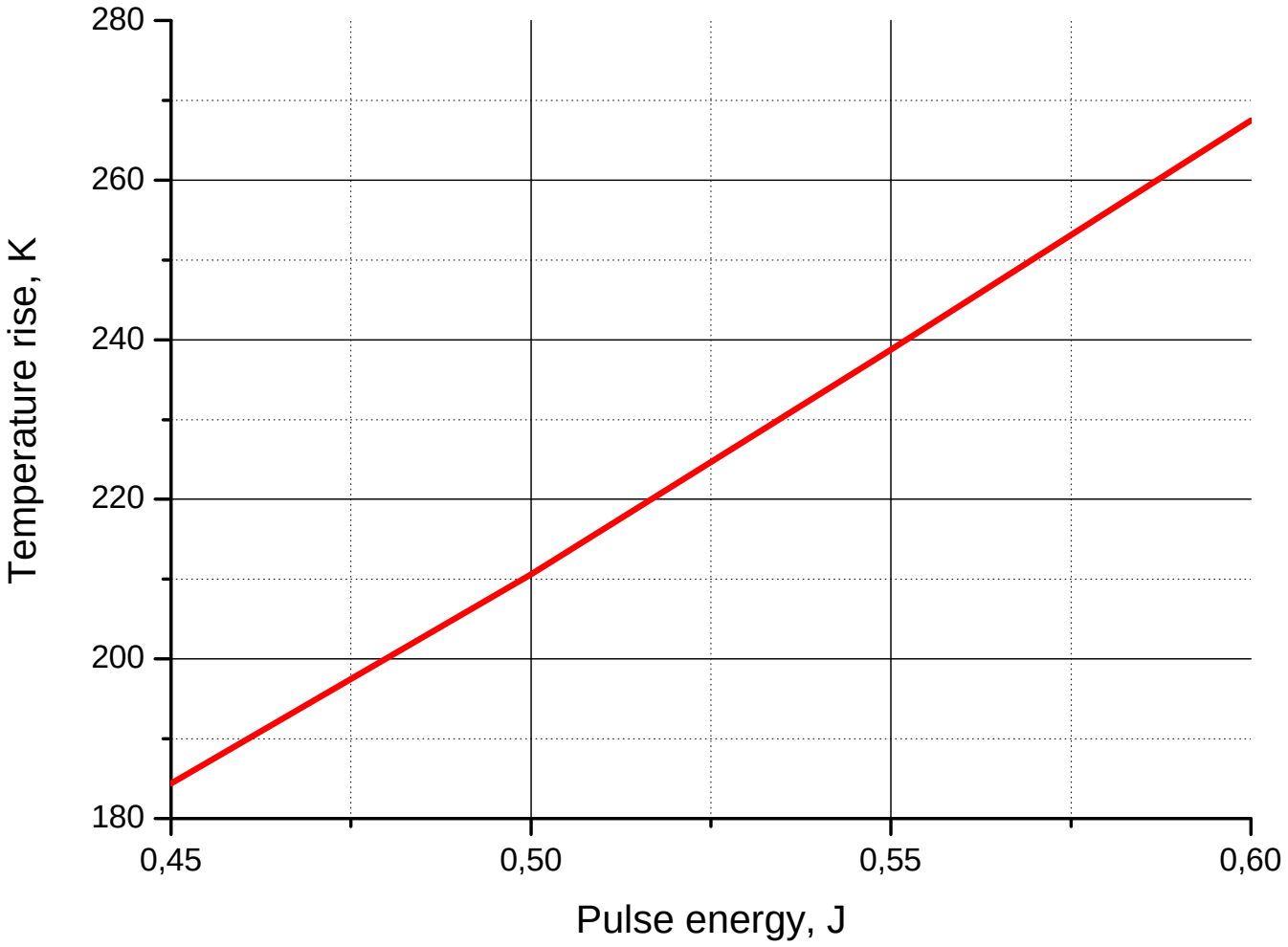
RF power behind the FEM (green trace) and after the test cavity (violet trace) , pulse duration is about 180 ns



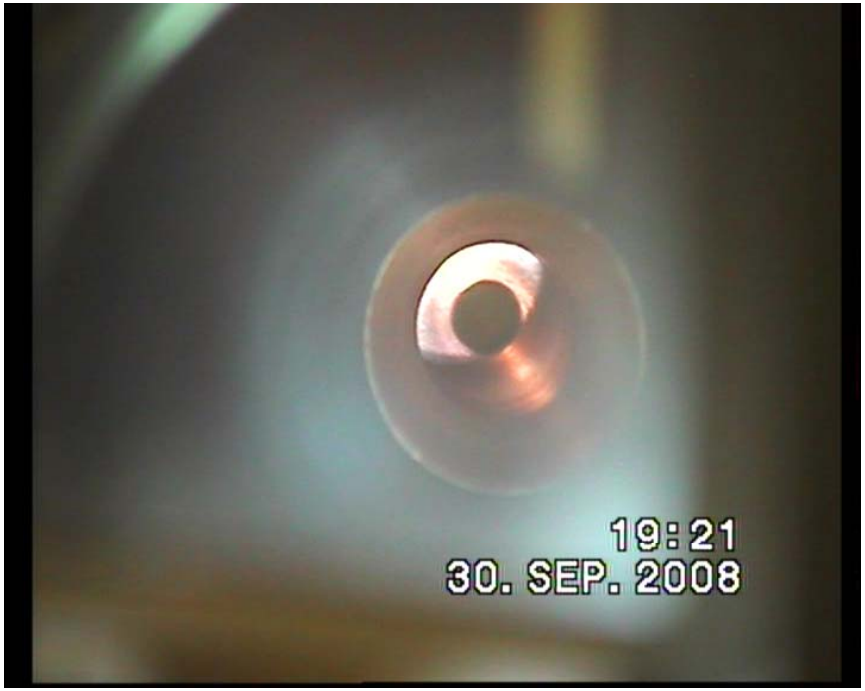
Pulse energy after test cavity is 0.5 J

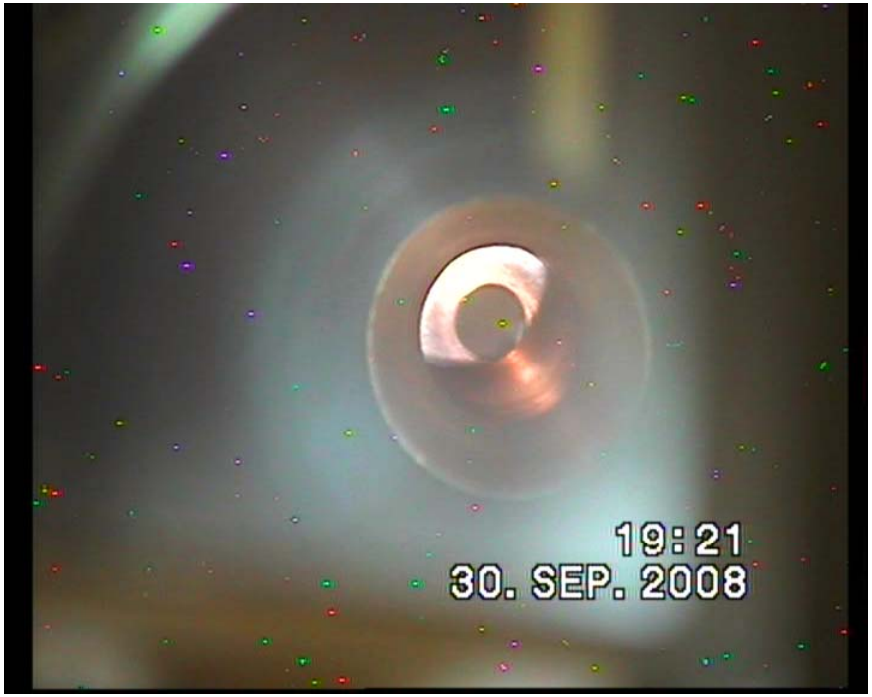


Wavebeam visualisation after the test cavity (TE_{01} mode)



Correlation between pulsed heating and measured energy of radiation after the test cavity at pulse duration of 180ns





Output diaphragm of test cavity between pulses (left) and during the pulse (right) – no evidences of inner breakdown while the wall temperature rise was 200º-220º

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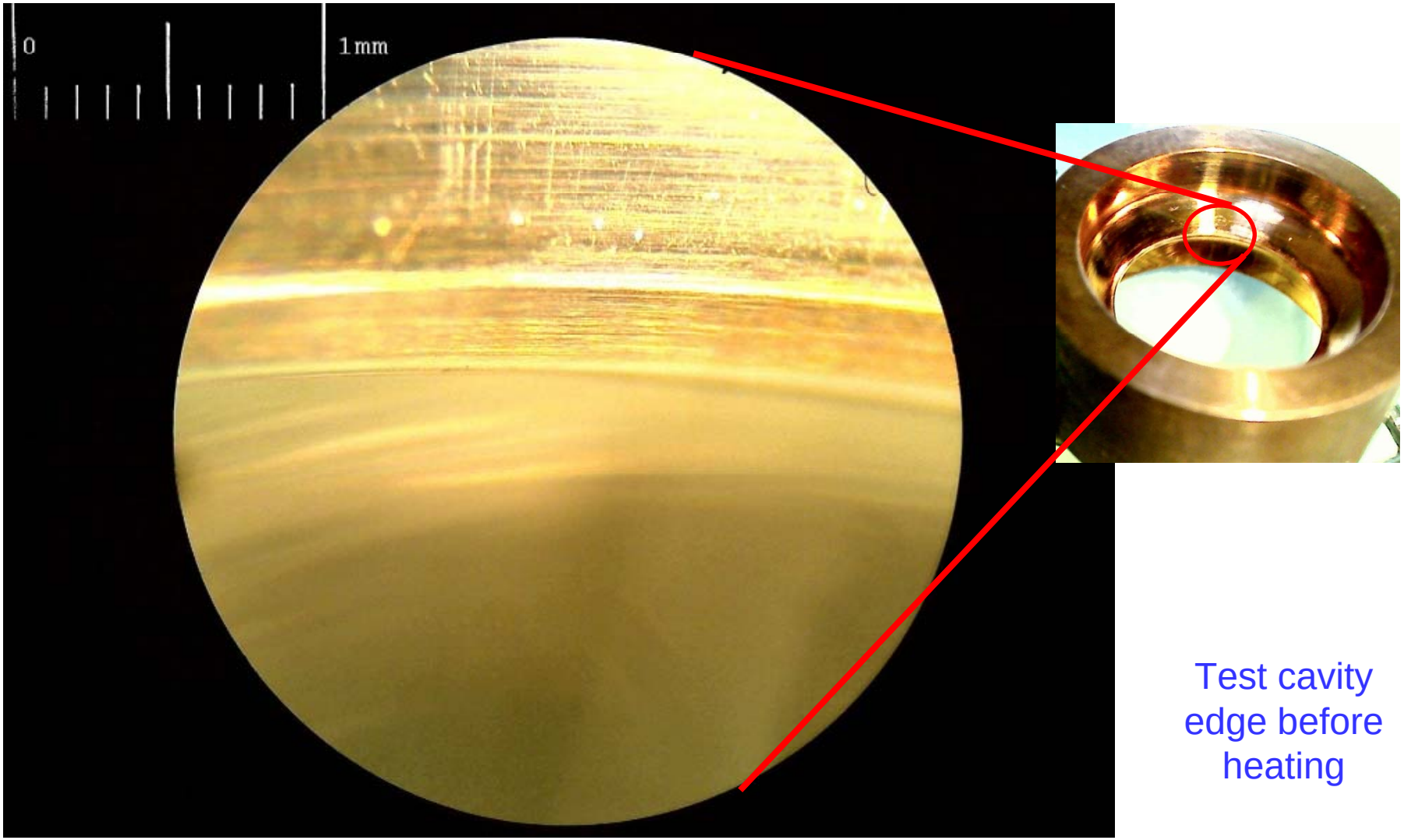

Test cavity edge before heating

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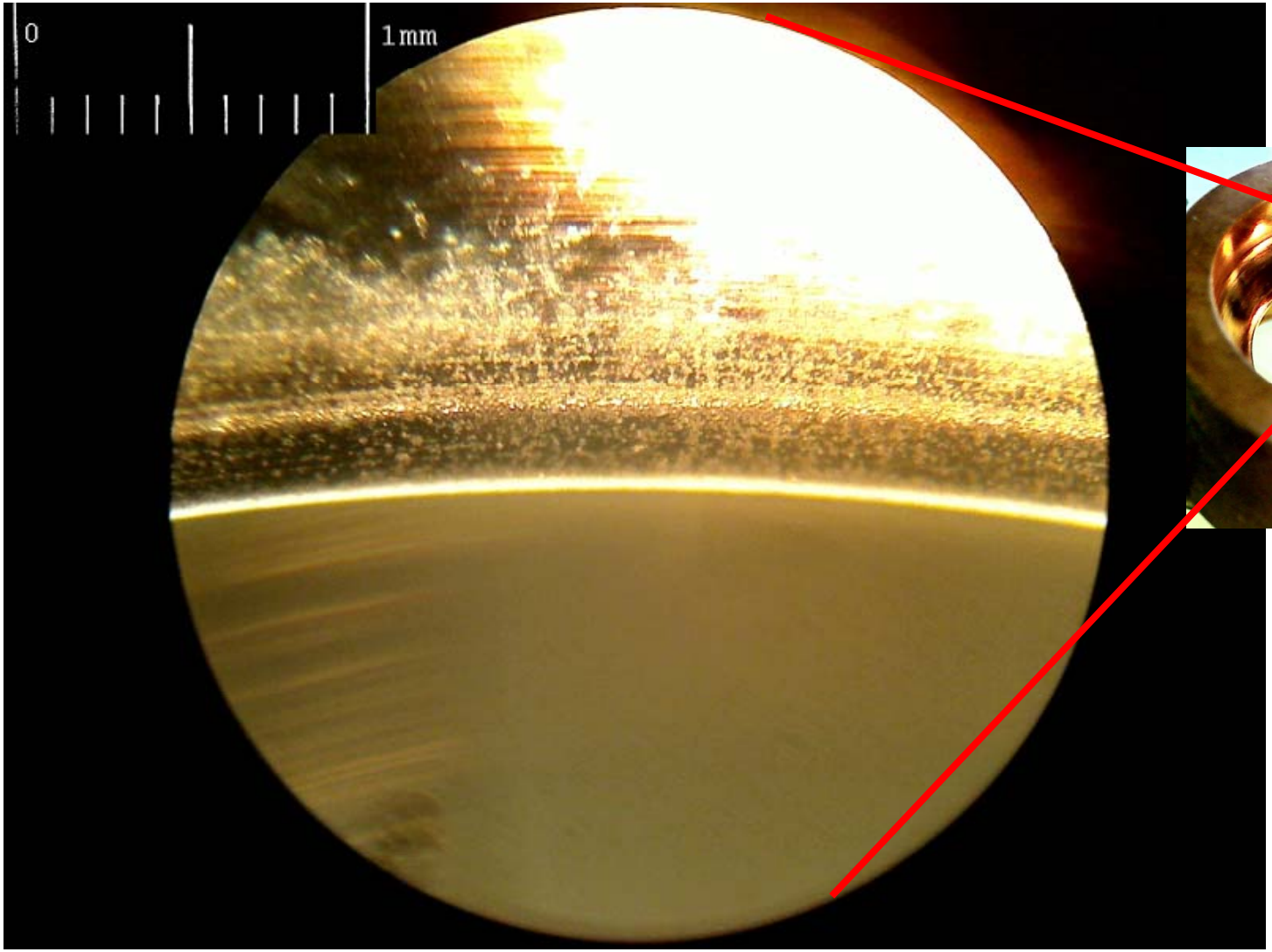
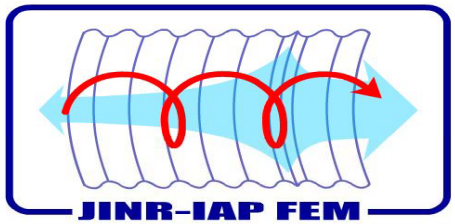


Test cavity edge after $3*10^4$ pulses at pulse heating of 200º - 220º



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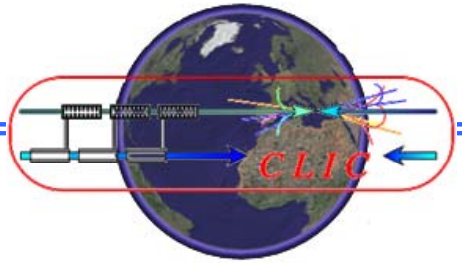
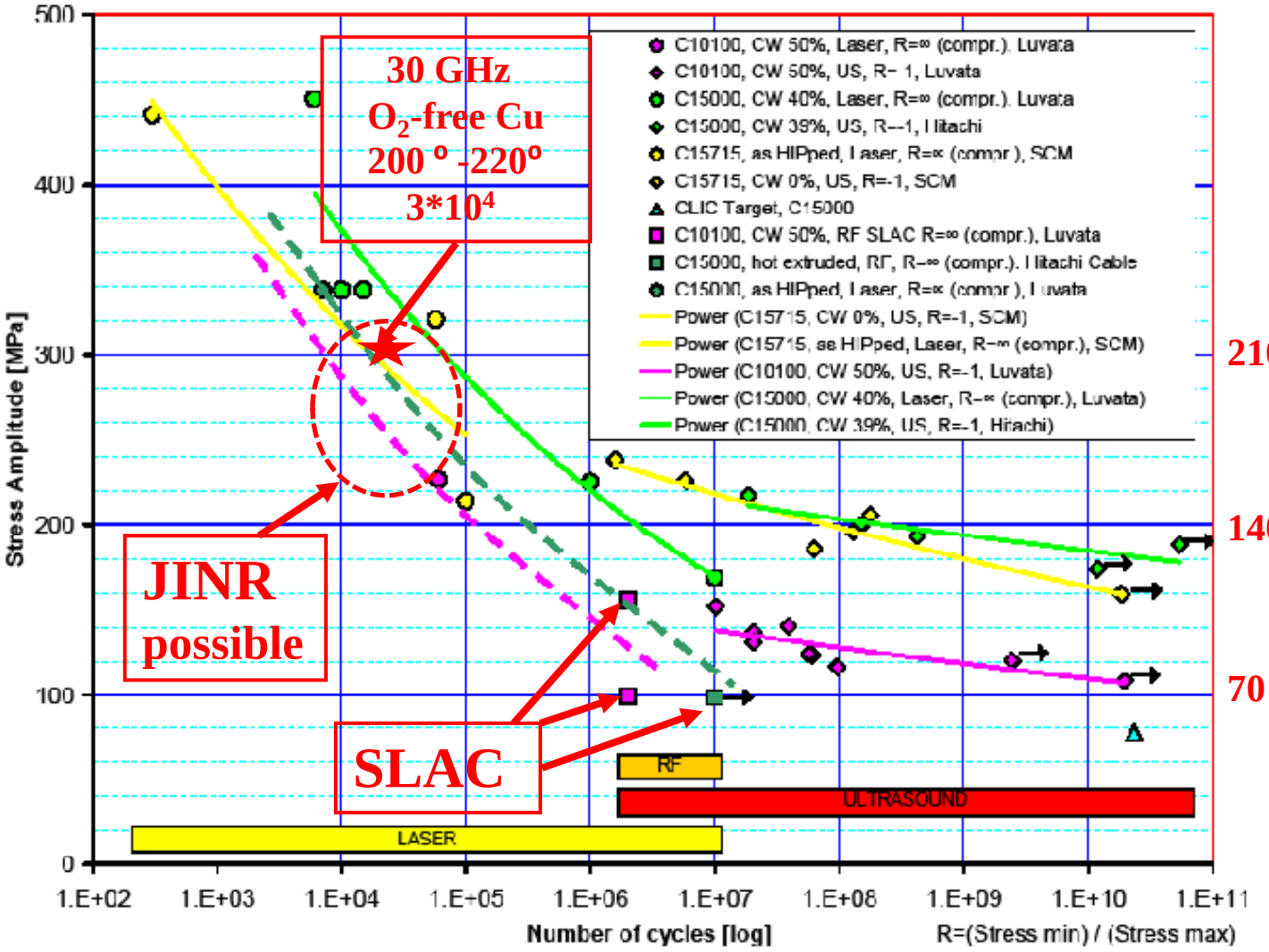


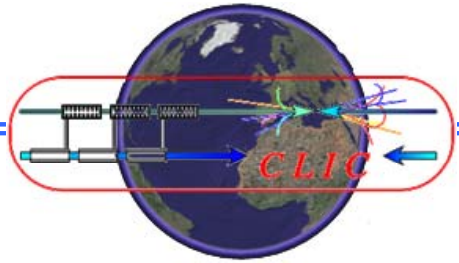


210 º

140 º

70 º

Parameters possible for JINR-IAP experiment (using picture of Samuli Heikkinen, CLIC meeting 22 February 2008)



CONCLUSION

- Facility for experiments on damage of cavity wall due to pulse heating has been created by JINR-IAP collaboration using 30 GHz free-electron maser with output power of 20 MW, pulse duration of 180 ns and repetition rate up to 1 pps.
- First full-scale experiment shows that the oxygen-free copper has been damaged after $3*10^4$ pulses when temperature rise was 200^0-220^0. This result corresponds rather well to the CERN experimental results with surface heating by optical laser.
- The facility is now ready for experiments with pulse heating from 150^o up to 220^o and pulses number up to 10^5, each experiment will take from few days up to one month.
- Comparison of damage character with similar experiments in SLAC can be useful for investigation of parameter influence such as pulse duration and RF frequency.
- Parameters region rather far from SLAC experiment seems to be useful for results extrapolation to the design parameters of CLIC accelerating structure.