

Centrum Badań i Zastosowań Teraherców

(Center for Terahertz Research and Applications, CENTERA)



Budżet MAB: 39 946 537 zł

Realizacja: wrzesień 2018 – grudzień 2023

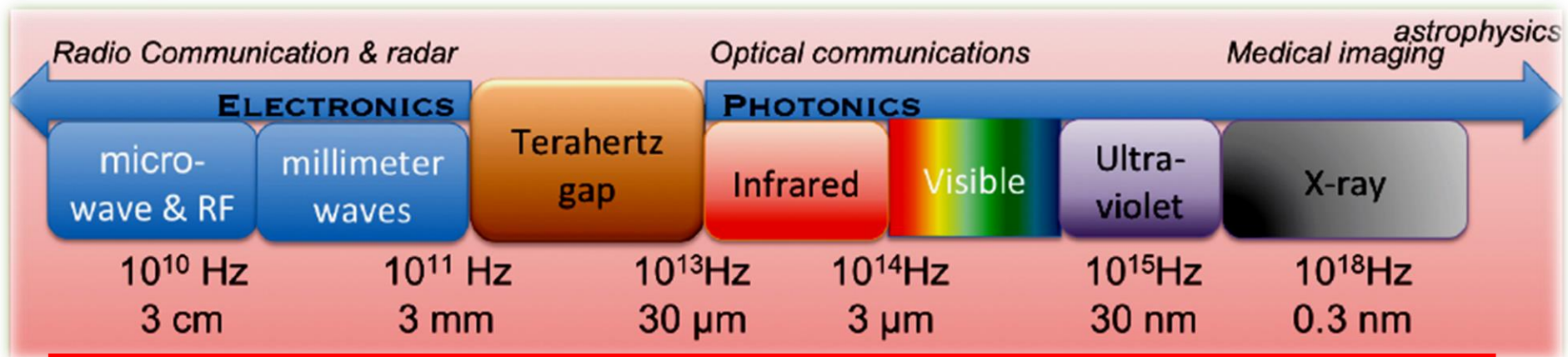
The „Center for Terahertz Research and Applications (CENTERA)” project is carried out within the 'International Research Agendas' programme of the Foundation for Polish Science co-financed by the European Union under the European Regional Development Fund.



INTRODUCTION to TERAHERTZ

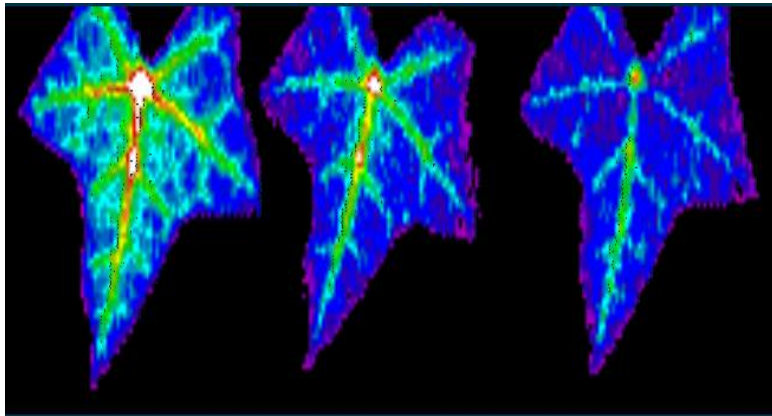
THz Why and Where ?

THz waves propagate in air and penetrate: plastics, paper, clothes, polymers, wood, tooth, bone, dried foods, etc.

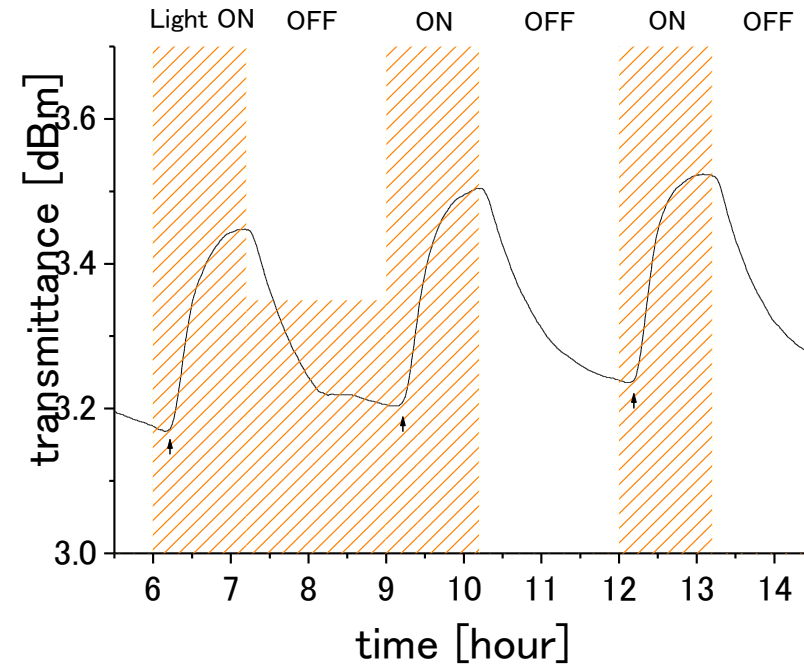


Small Energy of Photons - harmless
Wavelengths – 1THz \sim 300 μ m = 0.3mm - resolution

Agriculture and Food Industry

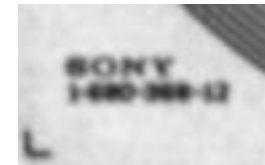
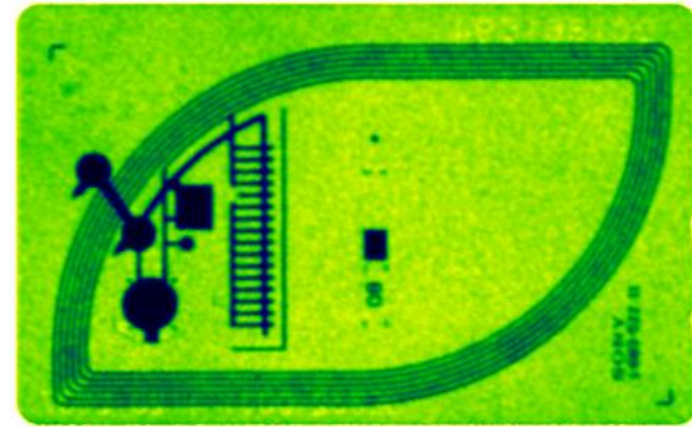


Water contents of plants



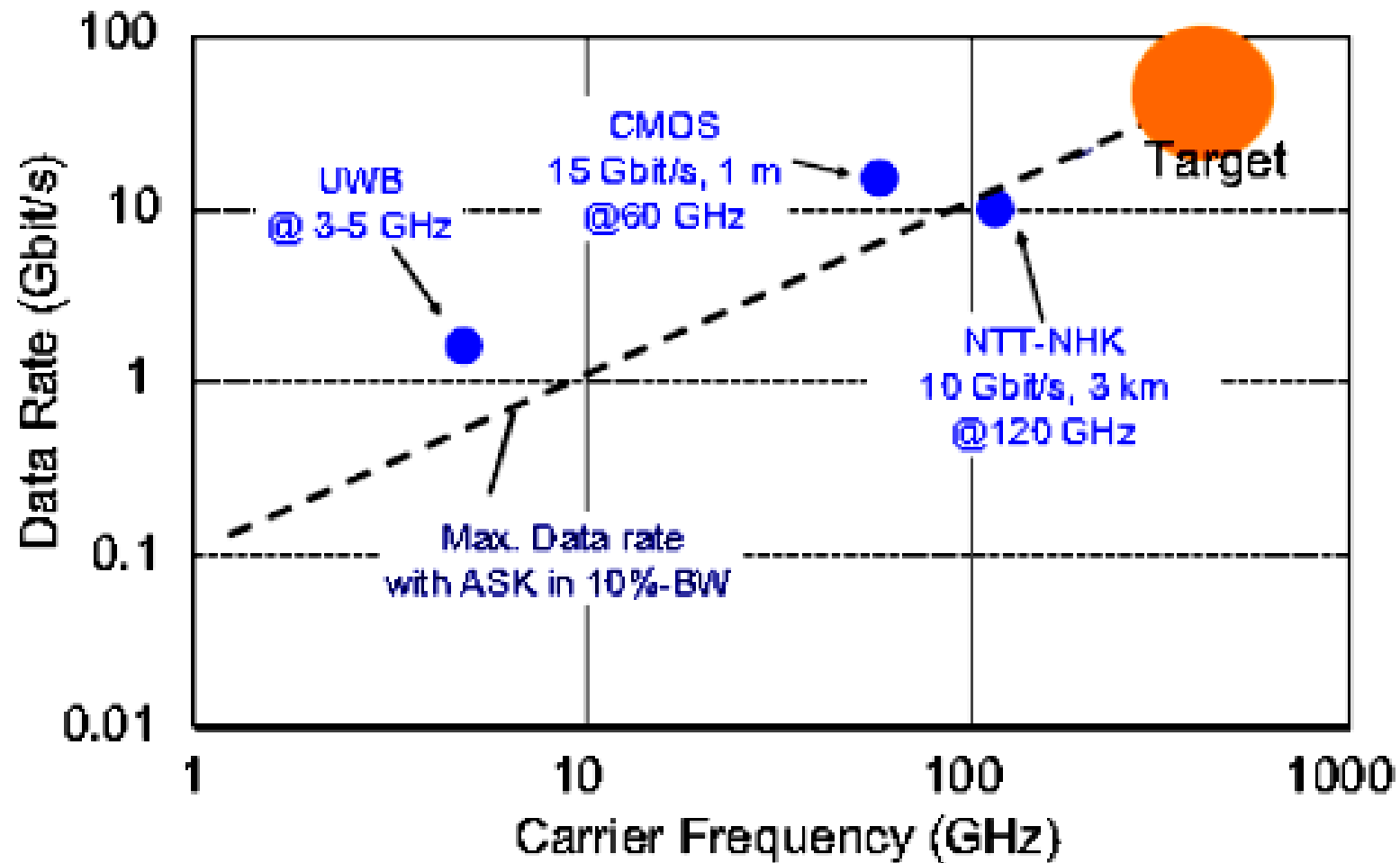
Monitoring of plants – transmission 0.75THz

Quality control



Wireless communication

“data rate x10= carrier frequency “

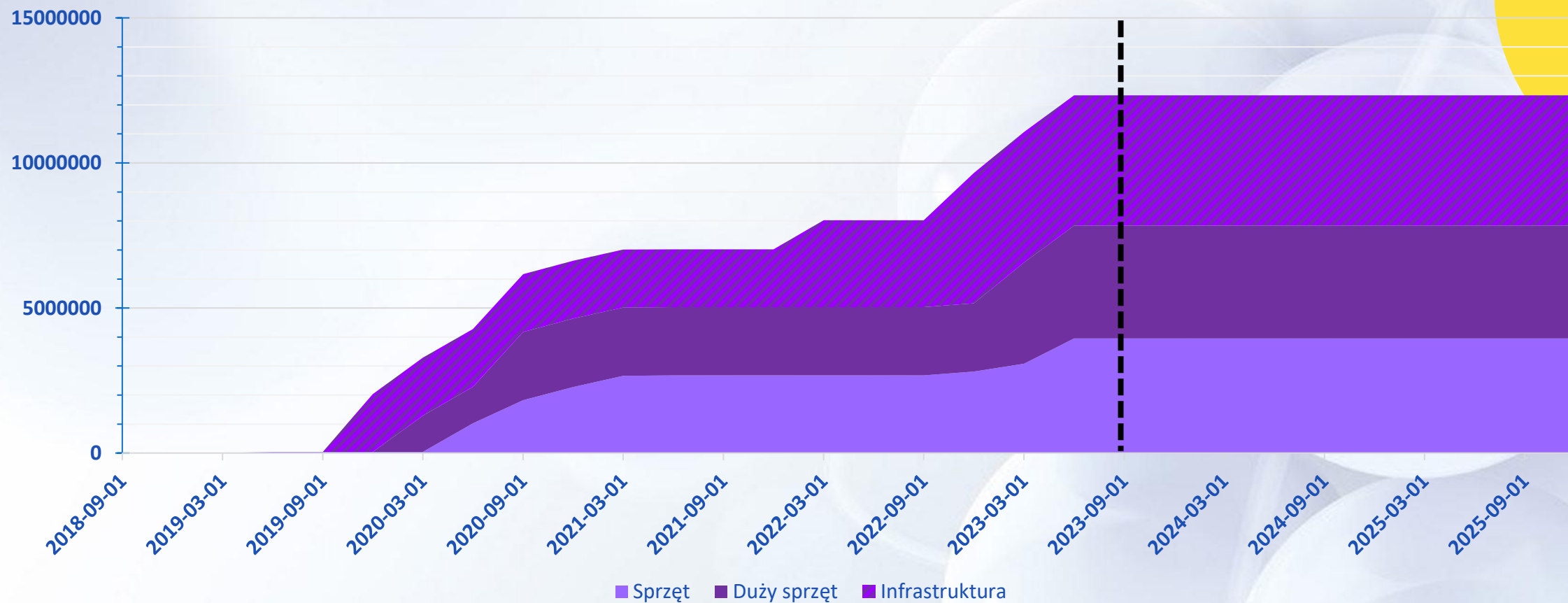




CENTERA in NUMBERS

CENTERA – Equipment

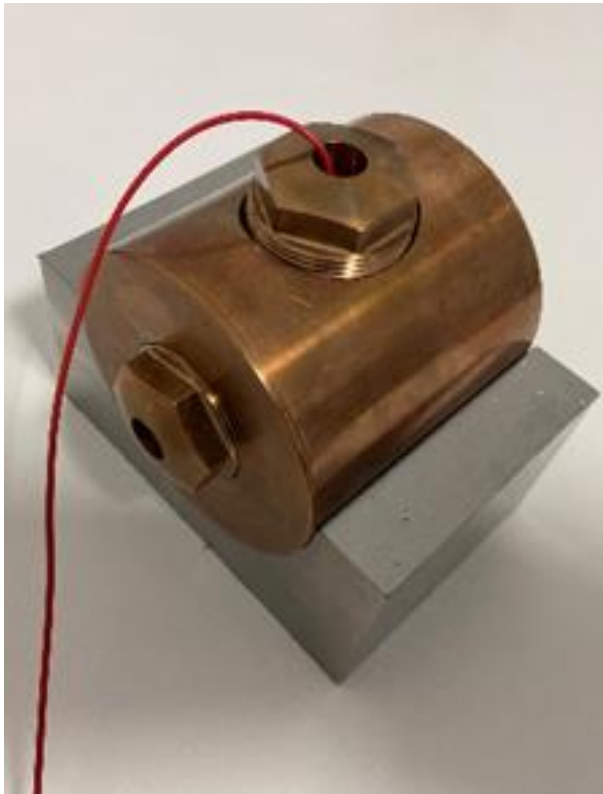
Inwestycje (zł) - skumulowane (dokonane | zamierzone) .



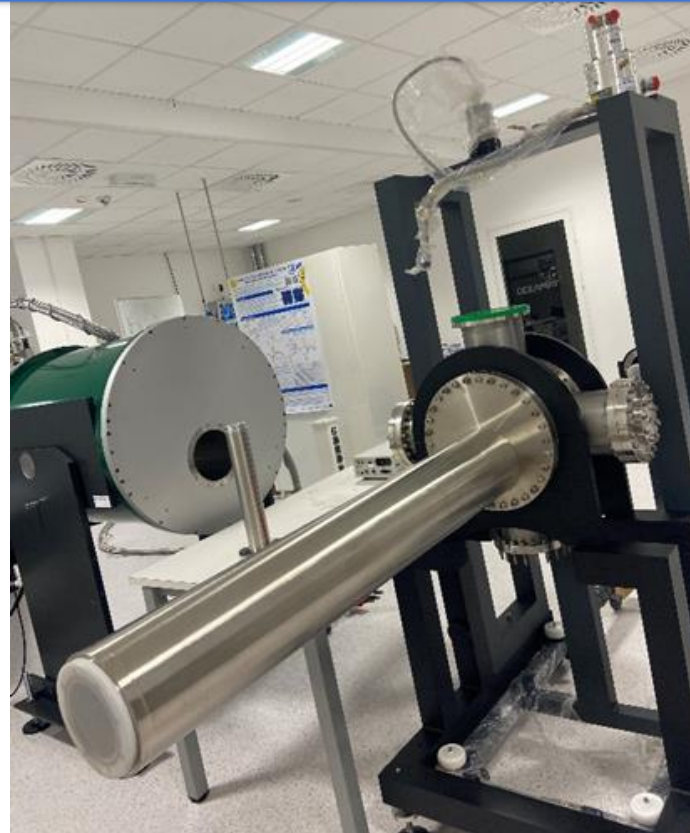
CENTERA 7.5+1.7=9.2 M€ + equipment 1.9 M€ (+ other grants 1.6 M€)

Building Unique Laboratory

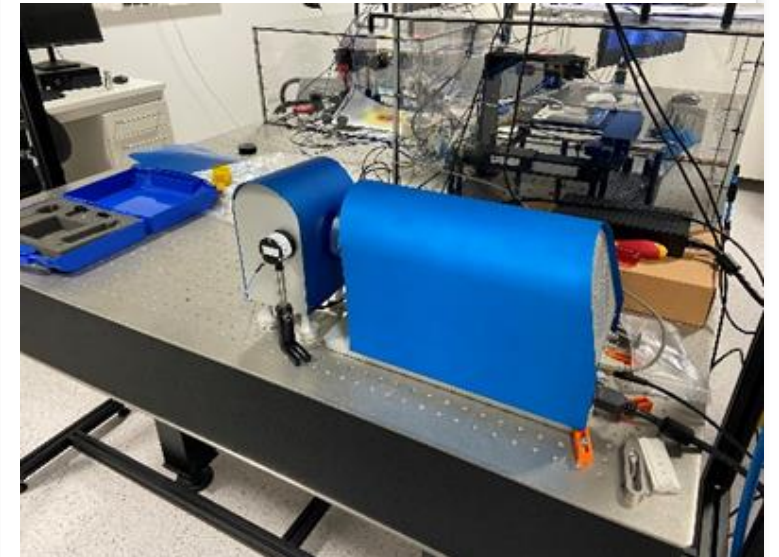
Optyczna komora
wysokociśnieniowa



9T Magnes nadprzewodzący

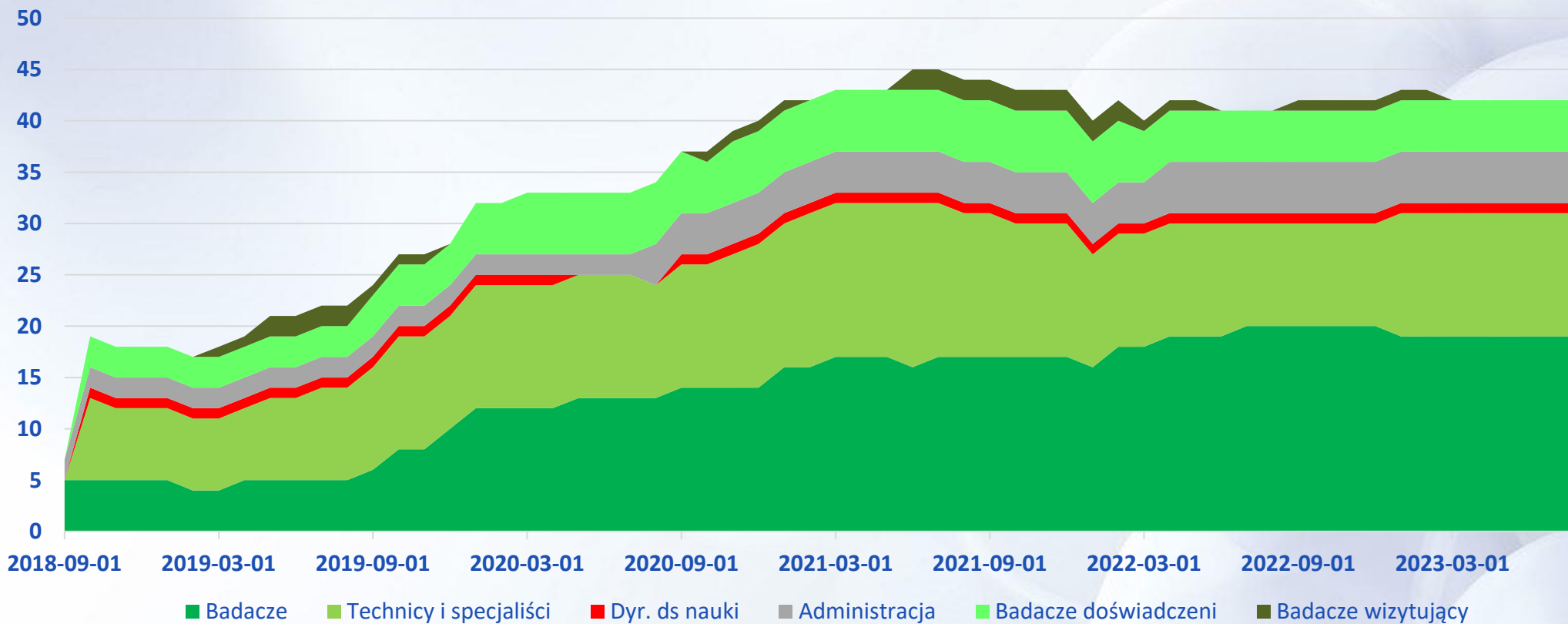


THz Kwantowe Lasery
Kaskadowe



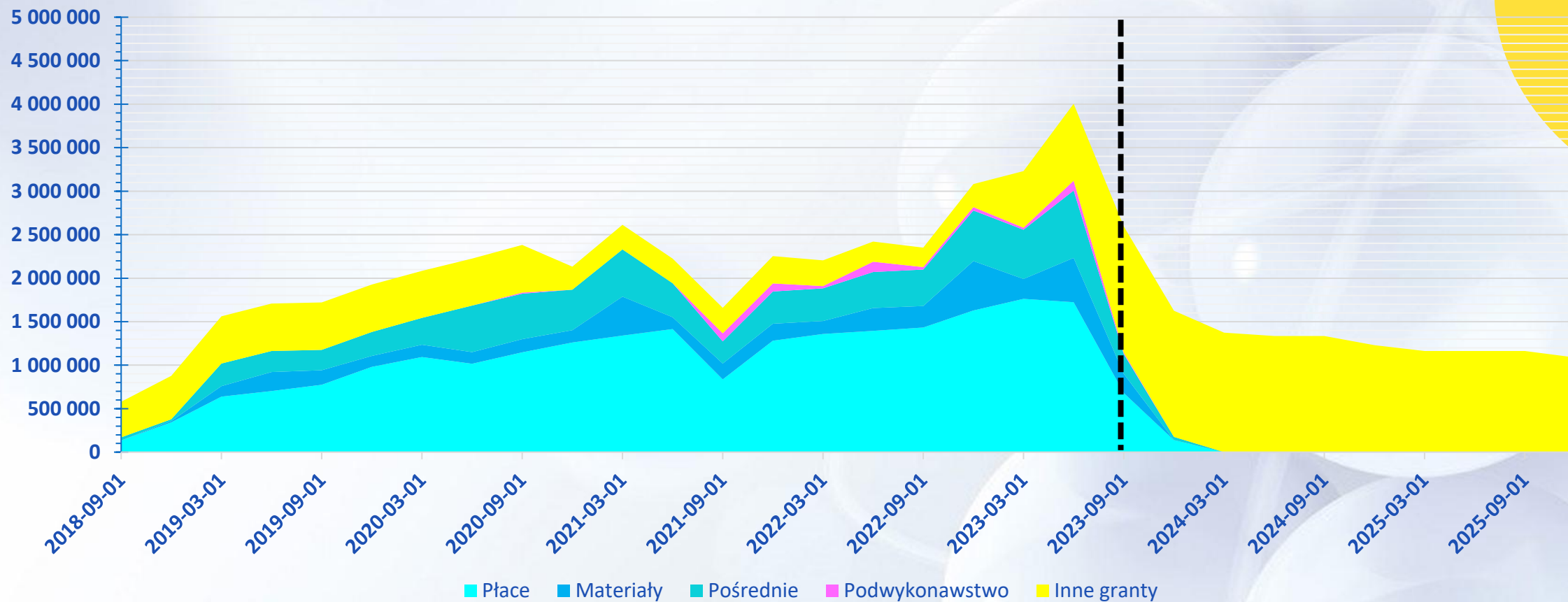
CENTERA – personel

Personel miesięczny stan (przeszły | planowany)



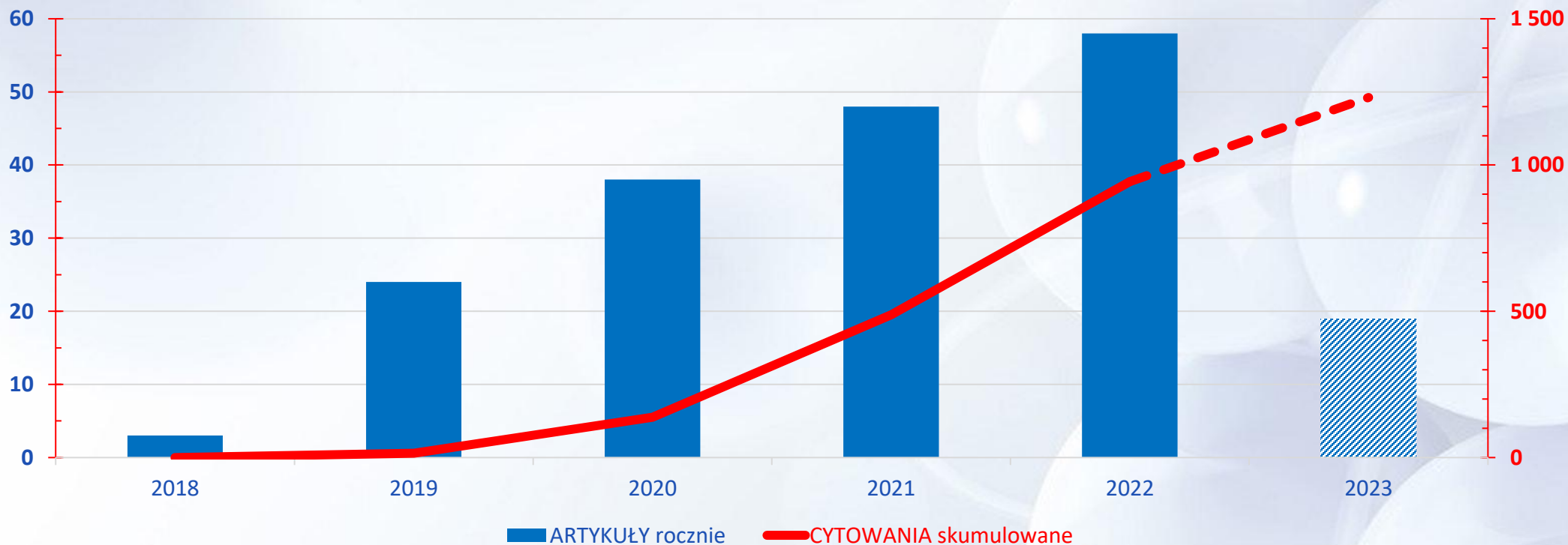
CENTERA - FUNDING

Wydatki bieżące (zł) kwartalnie (dokonane | zamierzone) .



Laboratoria CENTERA – dorobek naukowy

PUBLIKACJE JCR afiliowane do CENTERA



Pełna lista: <https://centera.eu/publications> (UWAGA! dane za 2023 są jeszcze niekompletne)



Example of Scientific Achievement

PLASMA WAVES & Me

PLASMA WAVES THz DETECTOR SUCCESS & 30 YEAR OLD AMPLIFIER CHALLENGE



PLASMA WAVE THz ELECTRONICS
(DYAKONOV & SHUR)

PLASMA WAVE THz DETECTORS

GATE – POTENTIAL U



$$f_p = \frac{1}{4L} \sqrt{\frac{eU}{m^*}} \sim (0-7) \text{ THz}$$



STARTUP



PhD, University of Warsaw

Grenoble

Toulouse

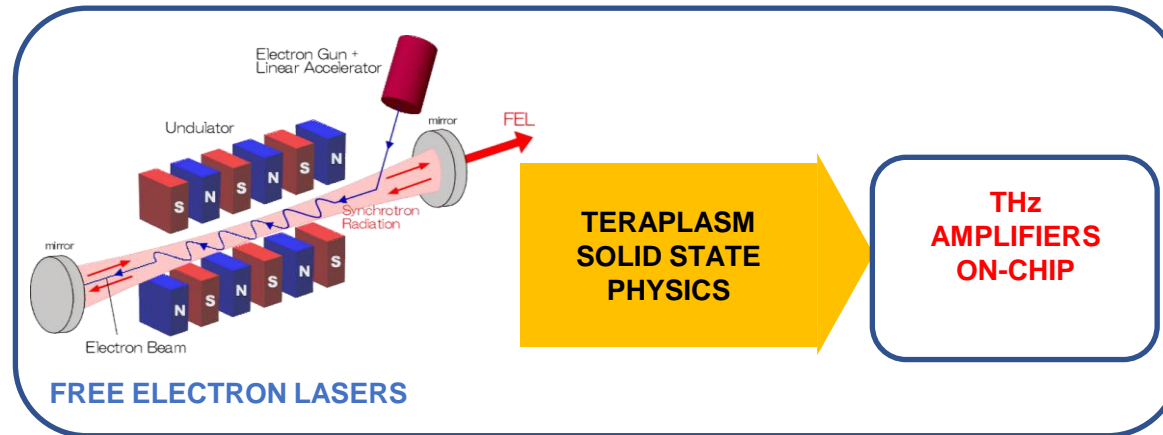
USA + JAPAN

Founder of CENTERA Labs, Warsaw

University of Montpellier

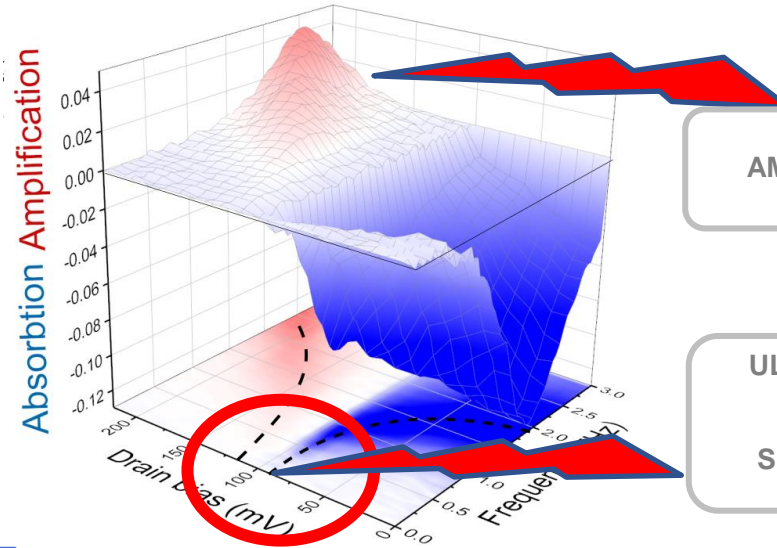
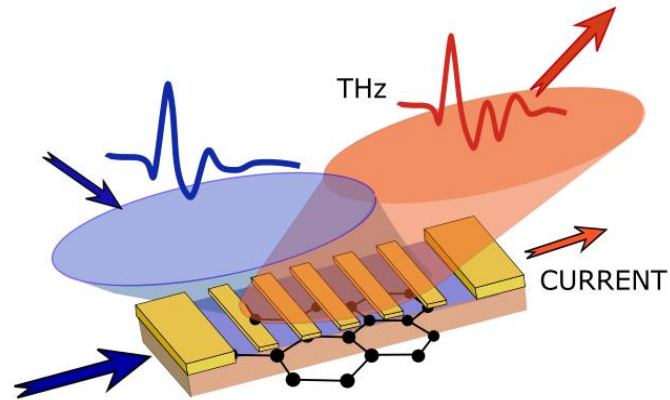
TOWARDS ON-CHIP PLASMONIC AMPLIFIERS OF TERAHERTZ (THz) RADIATION (TERAPLASM)

WOJCIECH KNAP – CENTERA LABORATORIES – WARSAW - POLAND



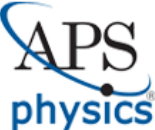
BREAK-THROUGH RESULTS

PLASMONIC THz AMPLIFICATION (STARTING POINT)



AMPLIFICATION?

ULTRA STRONG DOPPLER?
SILENCE GAP?


 The first observation of energy transfer from DC current to plasmons, leading to THz amplification at **ROOM TEMPERATURE**
Physical Review X–July 6, 2020

KEY CHALLENGES!

N°1) FIND PHYSICS BEHIND...PRX RESULTS

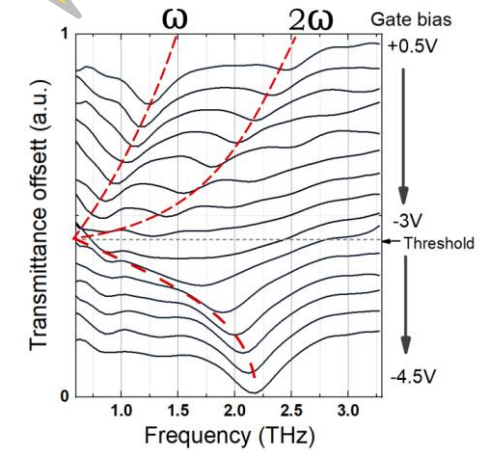
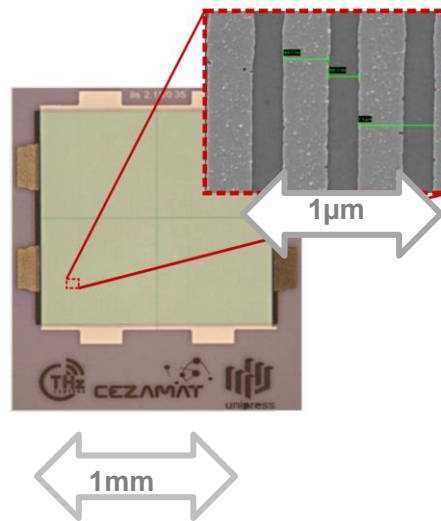
N°2) EXPLORE NEW PHENOMENA...

IMPLEMENTATION CENTRA LABS – STRONG POINTS

WHY NOW - AFTER 30 YEARS OF RESEARCH - PLASMA AMPLIFIERS CAN BECOME A REALITY?



**NANOTECHNOLOGY HUB
& THz LABORATORY**

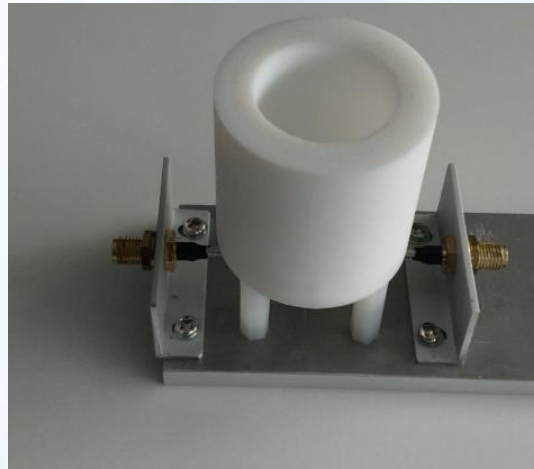


**PRX – October 5
2023**

Example of THz Demonstrators



- 1) grubość – thickness
- 2) jakość – quality
- 3) wilgotność – humidity
- 4) czystość – purity





Terahertz Silicon Electronics

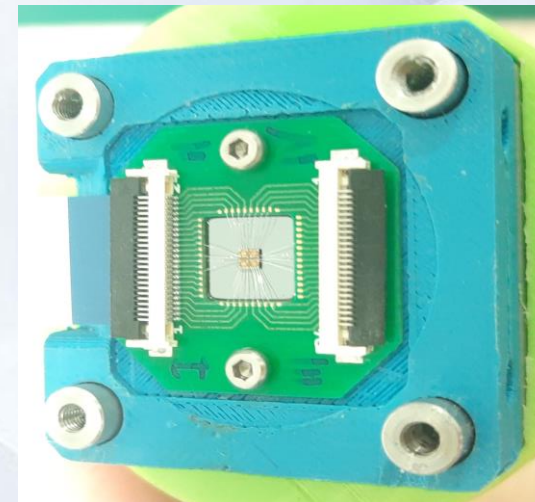
Rozmiar: 35cm x 35cm

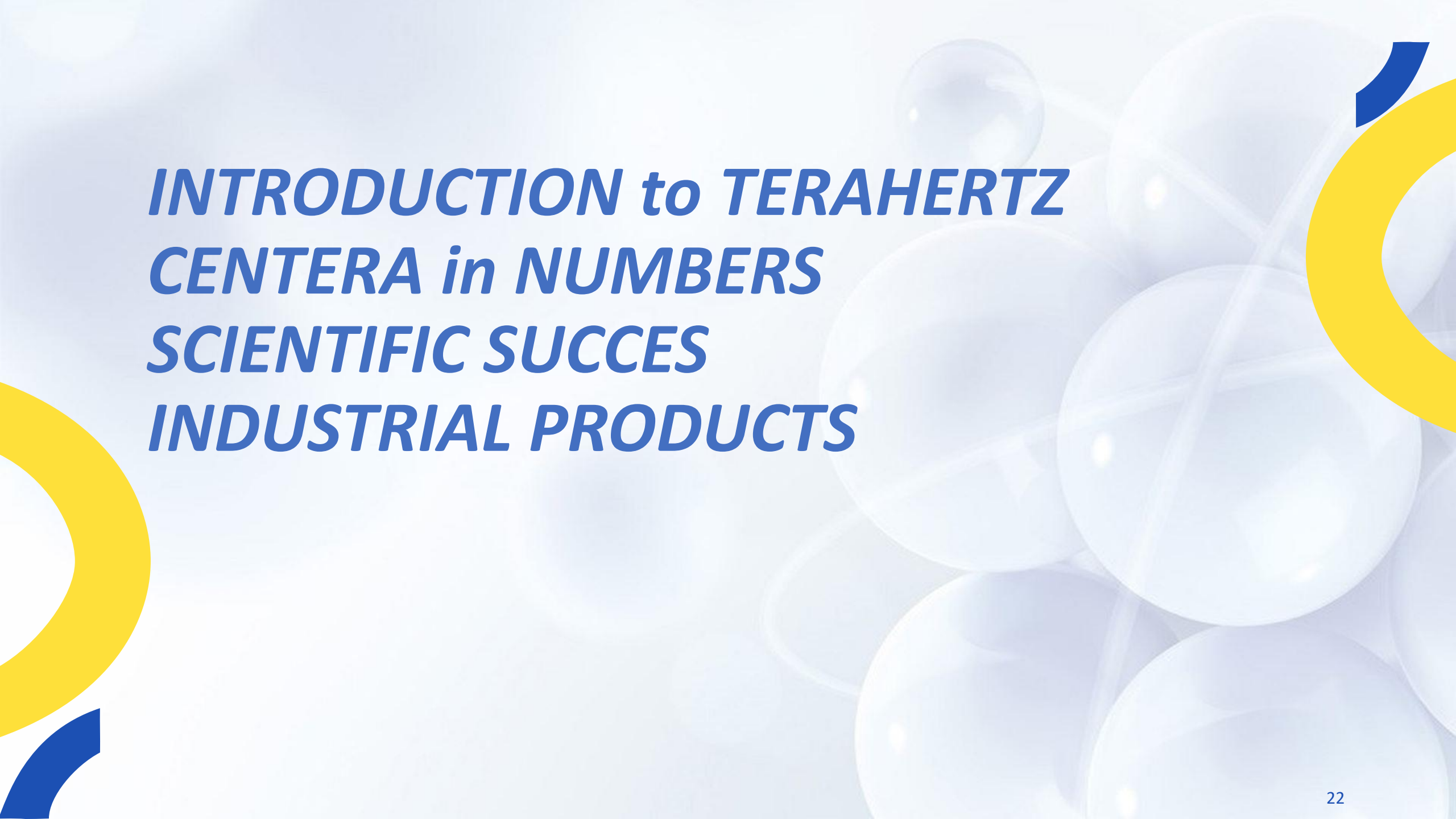
Cena: 120 000 PLN



Rozmiar: 35mm x 35mm (X10)

Cena: 1200 PLN (x100)





***INTRODUCTION to TERAHERTZ
CENTERA in NUMBERS
SCIENTIFIC SUCCES
INDUSTRIAL PRODUCTS***

WHY NOW ???

- nanotechnology available , ideas well established

WHY in POLAND ???

-concentration in time and place of material technology +processing+ experimental and theoretical physics

Thank YOU

