

ETAŞ ELEKTRON TEKNOLOJİLERİ A.Ş.

UPHUK-VIII, 5-7 September 2022



www.elektroneteknolojileri.com

Electron Beam Applications for Industry

Dr. Ümit Kaya

07/10/2022-BODRUM

Outline

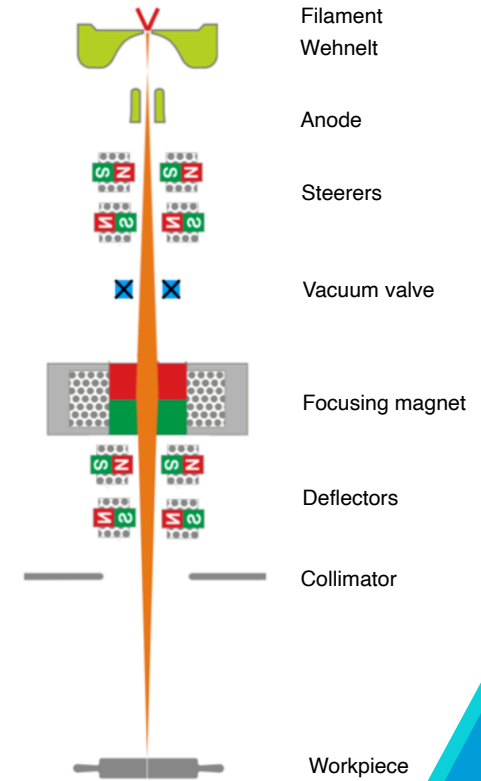
- *Brief introduction to electron beam*
- *Electron beam technology*
- *Electron beam applications*
- *ETAŞ Elektron Teknolojileri Company*
 - *Electron beam welding equipment*
 - *Electron gun development*
 - *Future goals & prospects*

Introduction

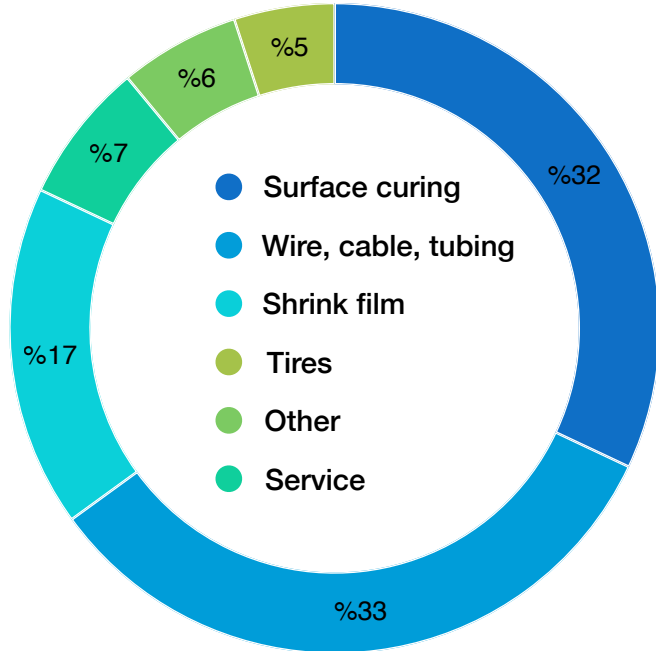
- *Electron beam is being widely used in industry, health and science for various applications.*
 - *The electron beam energy is ranged from keV to TeV.*
 - *Industrial e-beam energy is about 10 keV to 10 MeV*
- *Maximum allowed energy of the electron beam is 10 MeV for industrial usage.*
 - *Higher energies could potentially induce radioactivity in material.*
- *Electron beam is also a source of X-rays*

Electron beam technology

- *Electron gun*
 - *Producing electrons*
 - *Forming the electron beam*
- *Beam transport*
 - *Steering and focusing the electron beam*
 - *Scanning the electron beam*
- *Application specific targetry*
 - *Workpiece manipulation*

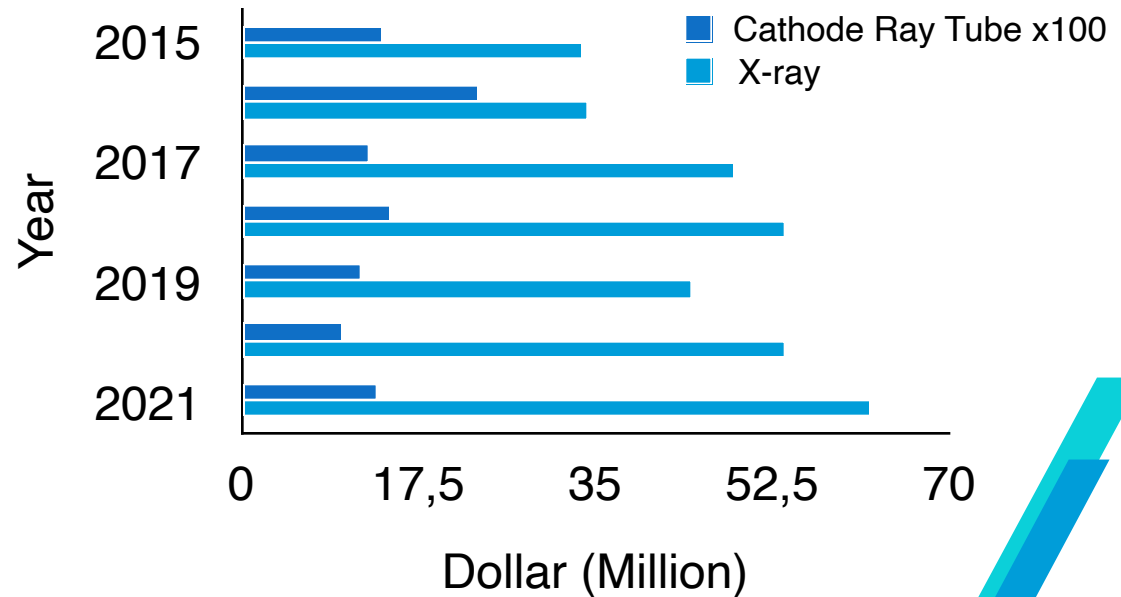


Electron beam applications



50 billion dollar market @ 2011, IAEA

Turkey Import Values



Electron beam applications

Additive manufacturing

Melting

Cladding

Evaporating

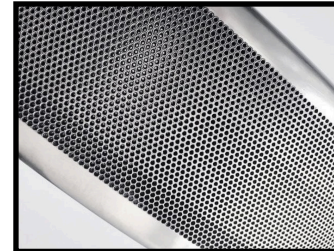
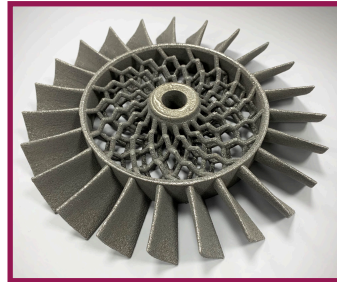
Shaping

Micro-machining

Lithography

Therapy

Material improvement



Welding

Cross-linking

Sterilization

X-ray production

Hardening

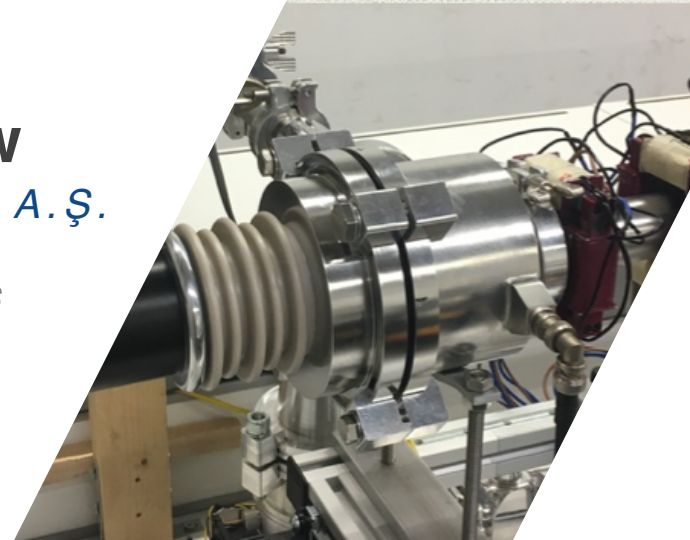
Flue gas cleaning

Liquid cleaning

Company overview

ETAŞ Elektron Teknolojileri A.Ş.

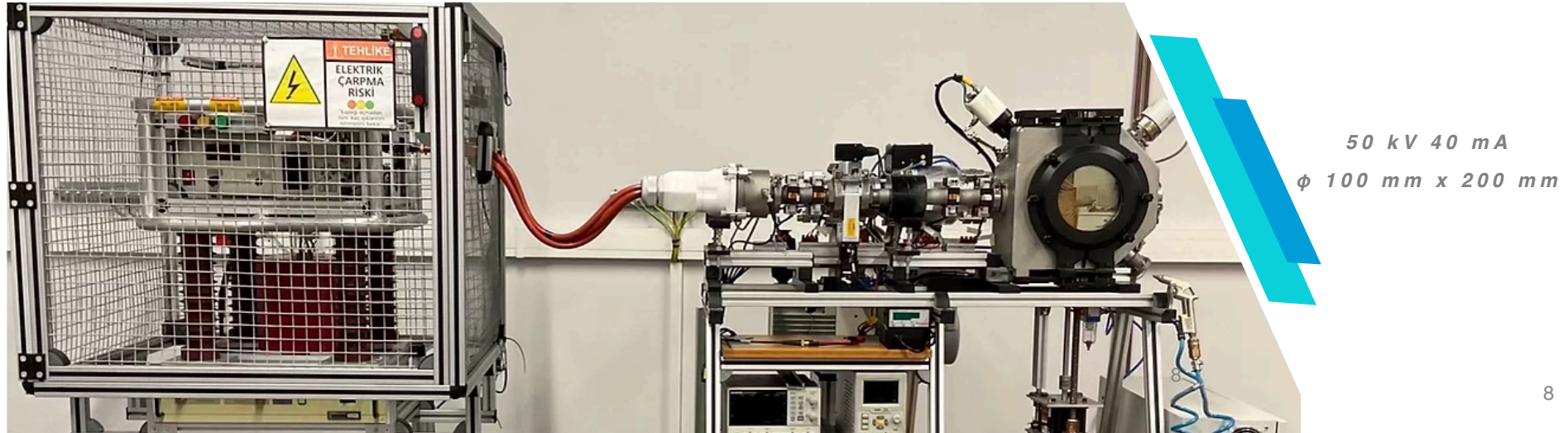
- *The company was founded by 4 physicists in Q4 of 2021.*
- *ETAŞ has 5 employees.*
 - *1 physicist*
 - *2 mechanical engineers*
 - *2 electrical engineers*
- *Fields of activity*
 - *Electron guns*
 - *Electron beam processing*
 - *RF power generators/amplifiers*
 - *X-ray generators*



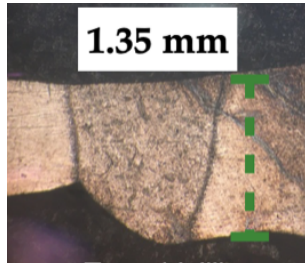
Electron beam welding machine



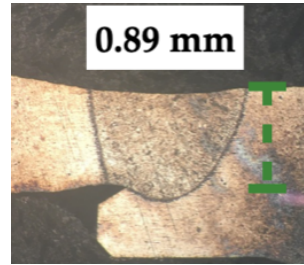
- *Welding of different melting material*
- *Deep and thin welding*
- *Low heat input and distortion*
- *Clean welding in vacuum*
- *Automation*
- *Welding of complex geometry*
- *High efficiency (single turn - narrow region (HAZ))*
- *High positioning accuracy*
- *High welding speed*
- *No filler*



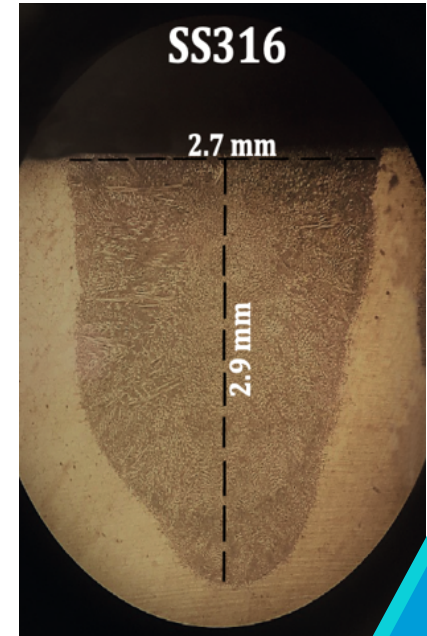
Electron beam welding



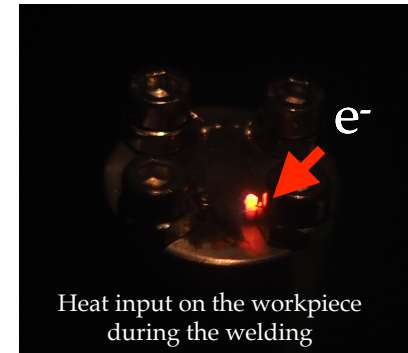
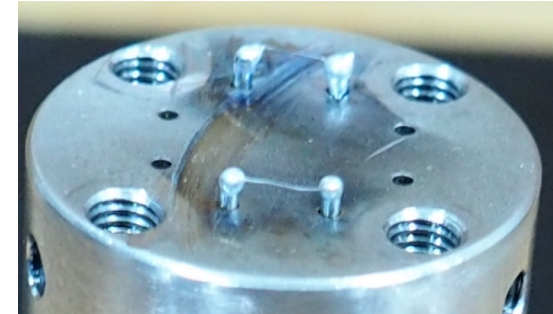
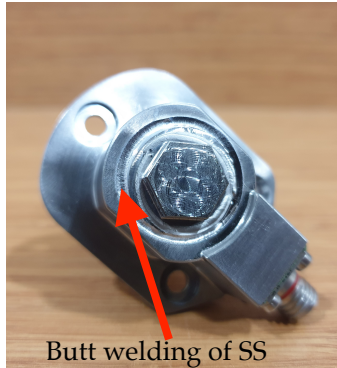
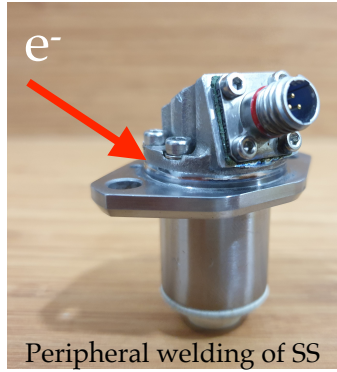
Full penetration



Partial penetration



Electron beam welding



Ongoing projects

Electron guns



DGET

- 30 kV, 100 μ A
- W cathode



SEM

OGET

- 60 kV, 10 mA
- W cathode



EBW/X-ray source

YGET

- 150 kV, 25 mA
- Dispenser & LaB₆ cathode options

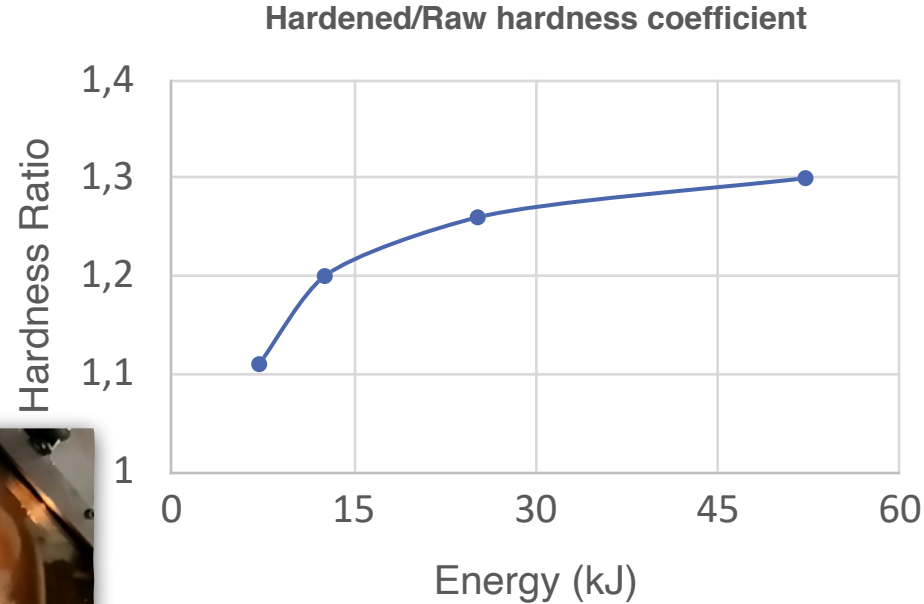
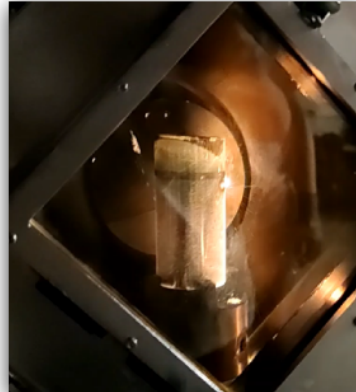


EBW/TEM

- Beam scanning and focusing system
- Beam diagnostic system
- Control system

Ongoing projects & goals

- *New projects with e-gun*
 - *Surface processing with e-beam*
 - *X-ray generator*
 - *RF power generator/amp. (magnetron/ TWT)*
 - *...*
- *In house production*
 - *vacuum gauge*
 - *beam diagnostic equipments*
 - *...*



30% surface hardening has been achieved in SS-304 material (depth ~400 μ m).

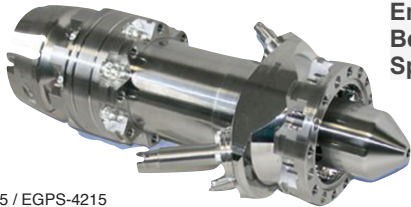
Products

EBW

- Serve to the domestic industry with EBW - now
- Promote our domestic EBW machine to the market

E-guns

- With the appropriate marketing strategy in e-guns, it is possible to compete with foreign companies.
- Opportunities are being explored in the geography where Turkey is active.



EMG-4215 / EGPS-4215

Energy Range: 1 keV to 30 keV
Beam Current: 1 nA to 5 mA
Spot Size: 0.5 mm to 25 mm



EGH-8100 / EGPS-8100

Energy Range: 1 keV to 100 keV
Beam Current: 10 nA to 1 mA
Spot Size: 3 mm to 100 mm

Starting price Basic System - options not included: \$64,600

Starting price Basic System - options not included: \$110,500

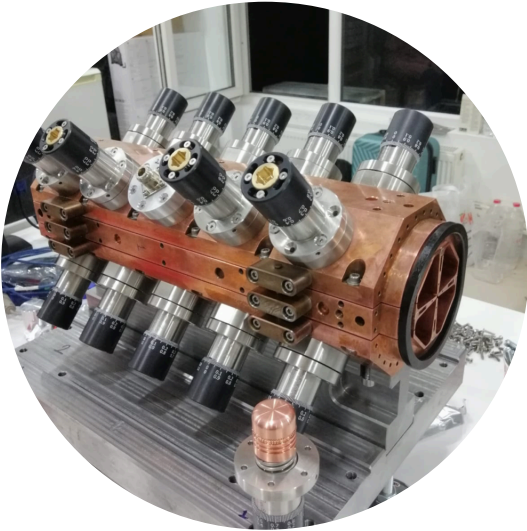
φ 100 mm x 150 mm



60 kV 33 mA

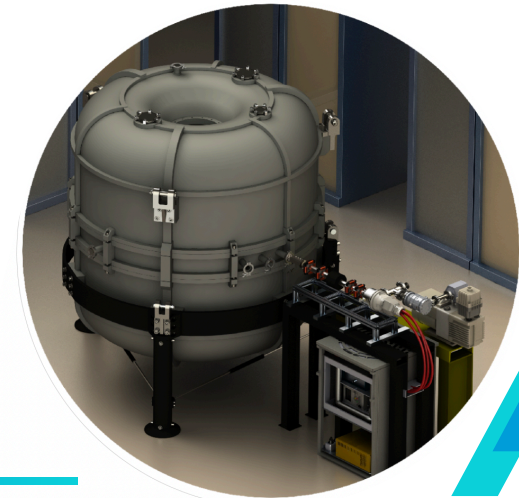
265kEuro @ 09/2019

Partnerships



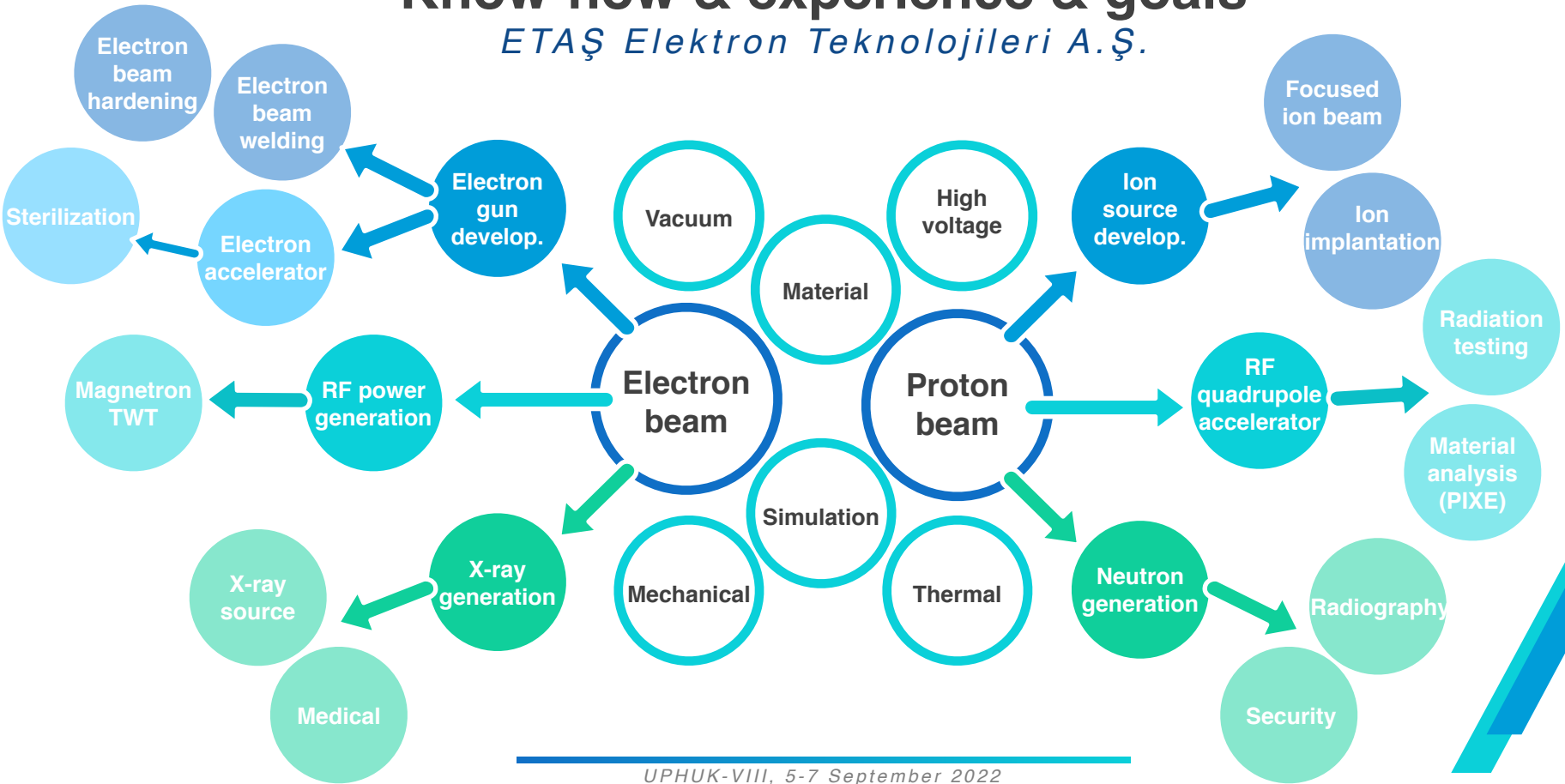
- *Proton linac project - KAHVELab*
 - *800 MHz: The highest frequency RFQ*
 - *2.45 GHz magnetron & RF transmission line*
 - *2 MeV, <1 m: The shortest RFQ*
 - *Domestic design and production*
 - *PIXE application*

- *Electron accelerator (Rhodotron) project - KAHVELab*
 - *MeV e- beam*
 - *R&D studies are going on*
 - *Meetings with potential users are going on*
 - *Medical sterilization - izmir*
 - *Tiers cross-linking - istanbul*



Know-how & experience & goals

ETAŞ Elektron Teknolojileri A.Ş.



- *Although ETAŞ is newly established, it will commercialize the products of our total 40 years experience in the domestic design and production of particle accelerators.*
- *Over time, not only will our product portfolio expand, but our team will also grow to be able to provide technical services that our country needs in particle accelerator and related technologies such as RF, vacuum and simulation etc.*

Thank you!