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Redesign of EAEA Plasma Focus Device-1

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ABSTRACT

- Egyptian Atomic Energy Authority – Plasma Focus device 1 (EAEA-PF1) was successfully redesigned in terms of its electrode system material and dimensions, insulator shape and the energy storage bank to investigate the best plasma focus action.
- A simple-to-perform technique was applied to investigate the distribution of the azimuthal magnetic field induction and the induced magnetic force acting on the plasma current sheath.
- The redesigned device can be efficiently used in many important applications including Controlled Fusion and working as Neutron and X-ray Source.

BACKGROUND

- Plasma Focus (PF) devices are considered as one of the most effective sources of pulsed neutron emission which is relevant for controlled fusion.
- Using deuterium as the filling gas, fast neutrons with energy of around 2.5 MeV and energetic protons with the energy of around 3 MeV are produced from PF devices [1].
- A passive radioactive source of fast neutrons with similar energy emits continuously, causing inconveniences in handling and storing. In turn, PF generators do not have activation problems for storage and handling [2].
- PF devices have the advantage of the ability to operate with some other types of gases or gas mixtures which makes it a generator of a pure x-ray radiation (not accompanied by the neutrons) [3].
- Redesigning the device was the **first step** to be able to use it in these applications.
- X-ray and Neutron yield had to be improved to make the device applicable in these applications which couldn't be done without modifying the device.

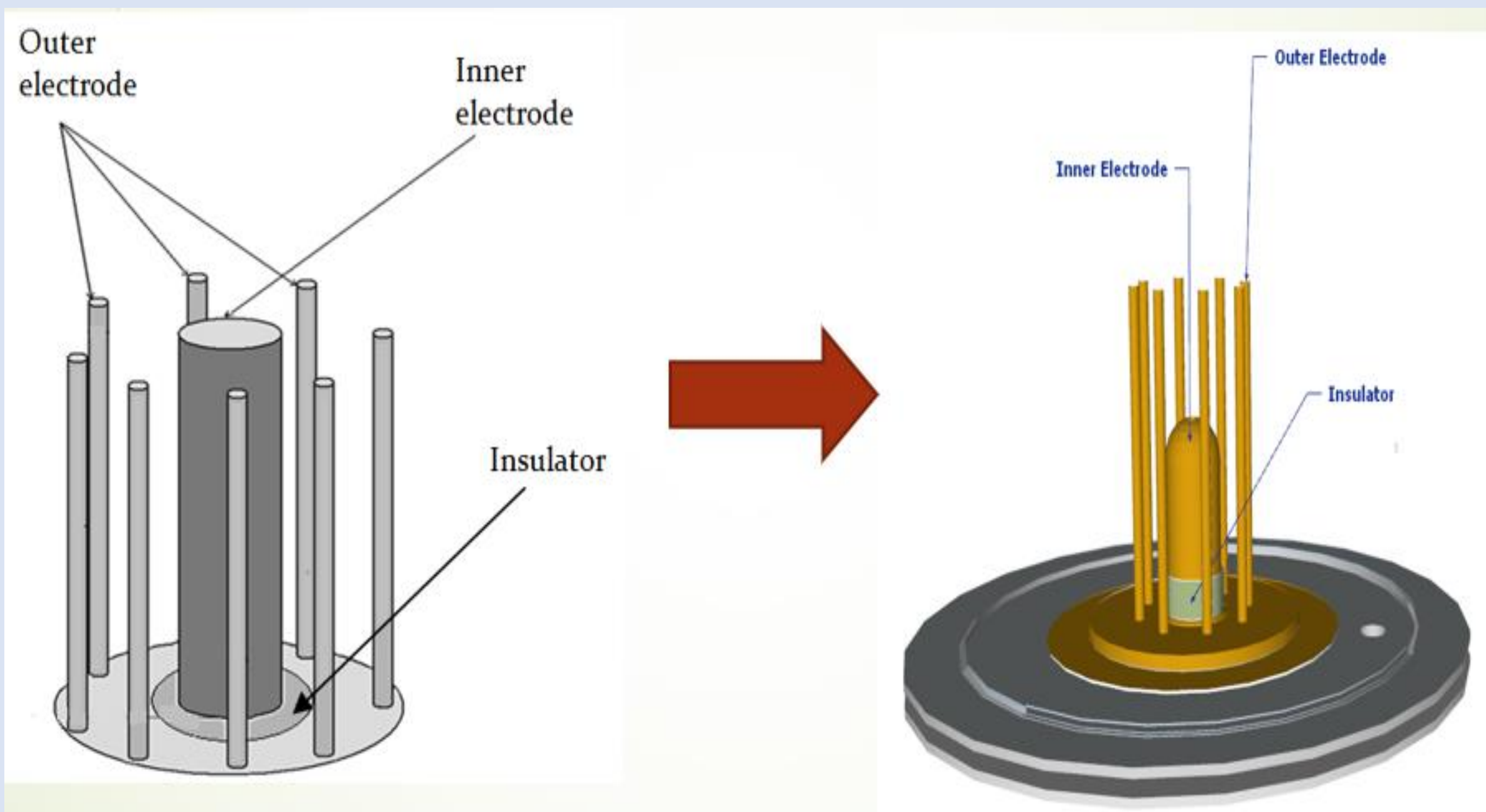
CHALLENGES

1- Redesigning the device.
EAEA-PF1 had to be redesigned in such a way that it's focusing action is enhanced so that the X-ray and Neutron yield are increased.

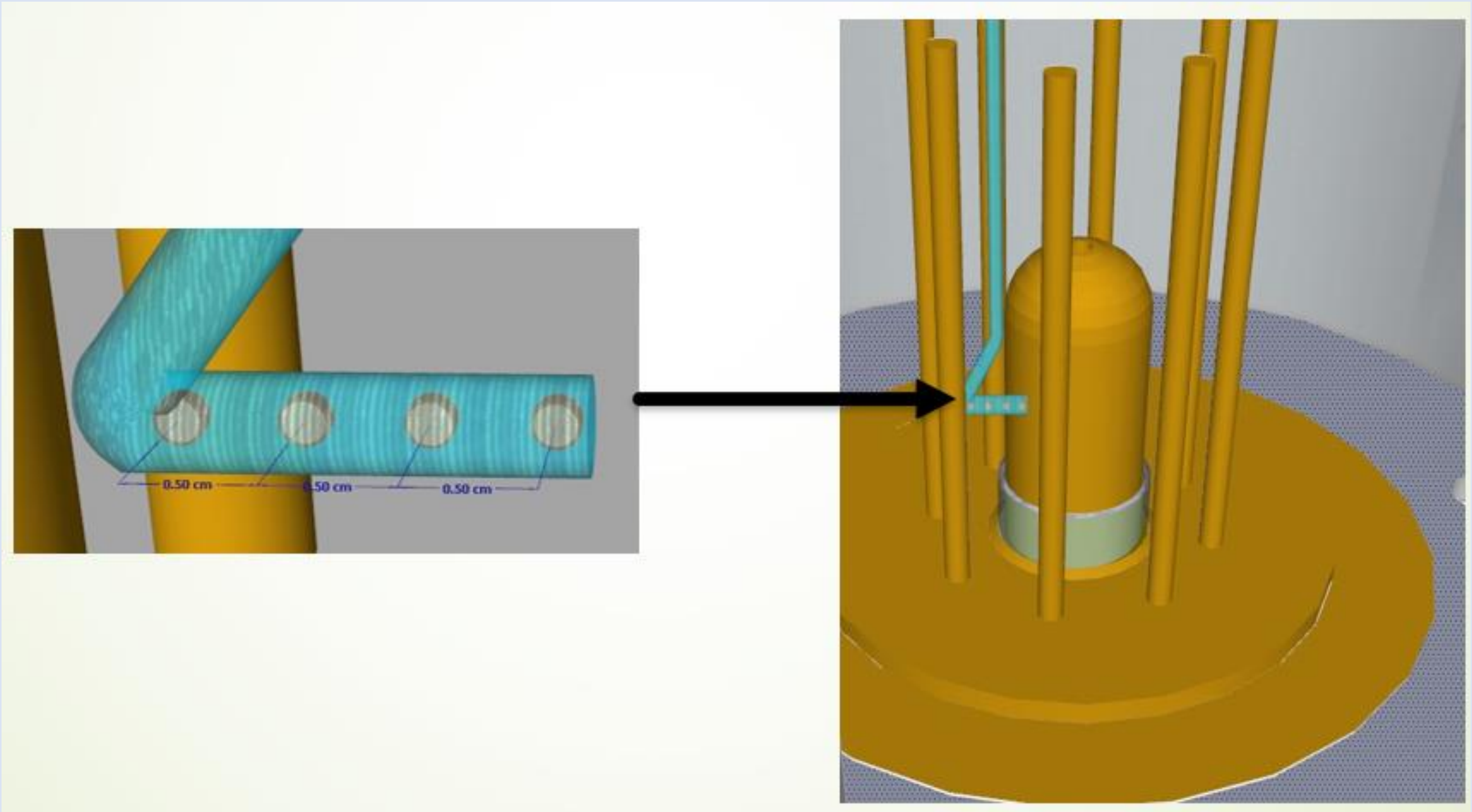
2- Characteristics of PF action after modification.
Ch/s of PF were investigated by measuring some parameters such as voltage spike amplitude, area of voltage spike and full width at half maximum time.

3- Finding an alternative to measure magnetic forces cheaply.
Magnetic probes technique was used

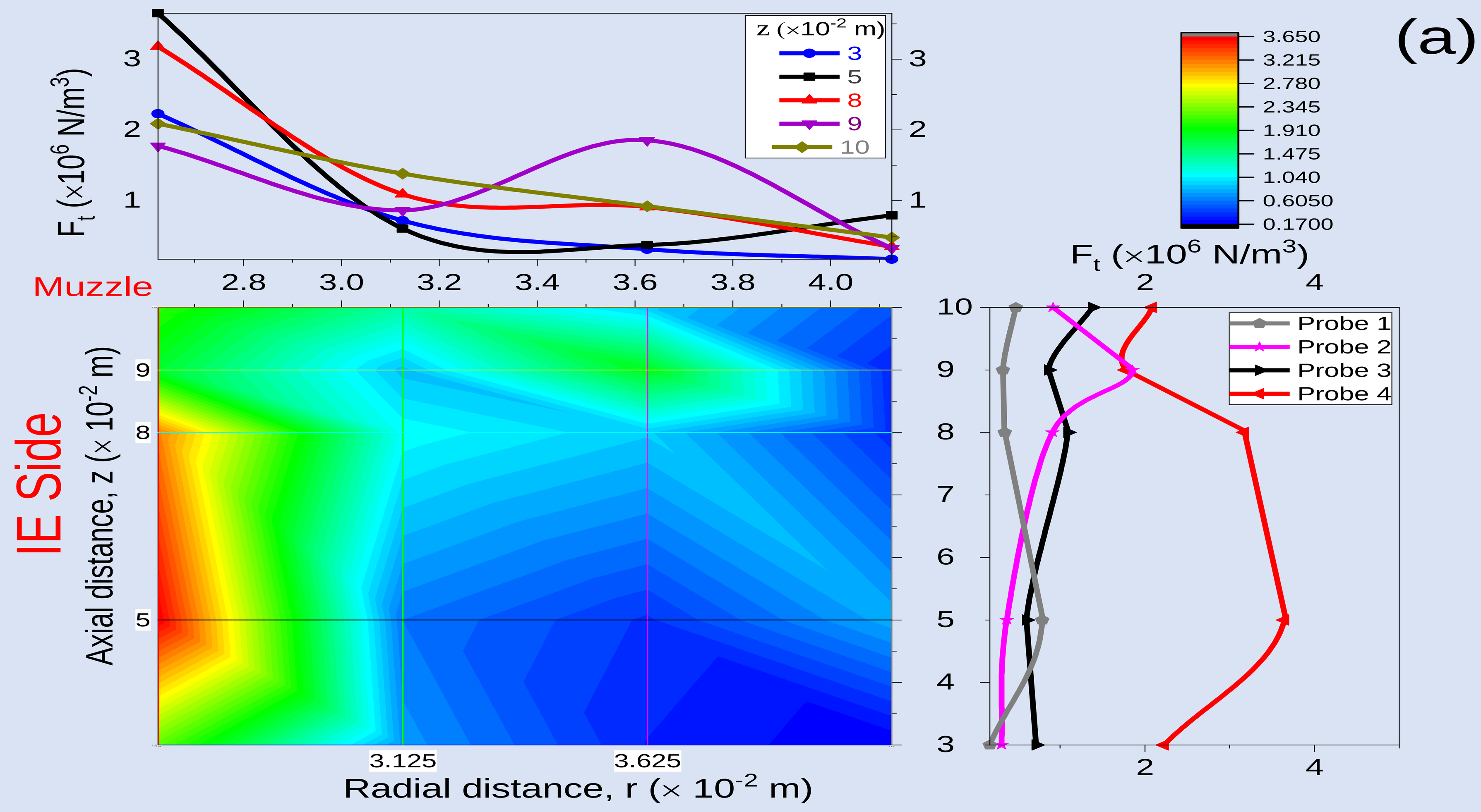
4- Measuring the X-ray yield.
The is the next step in the near future.



Electrode system



Magnetic Probes Assembly



Total Magnetic Force [4]

CONCLUSION

- **EAEA-PF1 was successfully redesigned.**
- **Optimum PF Formation Conditions were investigated.**
- **A simple, lab-made, cheap technique was used efficiently instead of expensive fast time-resolved camera or laser shadowgraphy.**

Future Work

- The idea of tapered electrode proved to be very efficient way to increase the X-ray yield. Thus, this idea will be applied in the near future and the X-ray yield will be measured after tapering the anode.
- Studying the ability of using the device as neutron source and measure the neutron yield in each case.

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