EUROfusion

PWIE SP-B.4

Reference Coatings for iTER and DEMO

IST activities for 2021: RBS and NRA characterization of selected Be and W reference samples - plans and capabilities
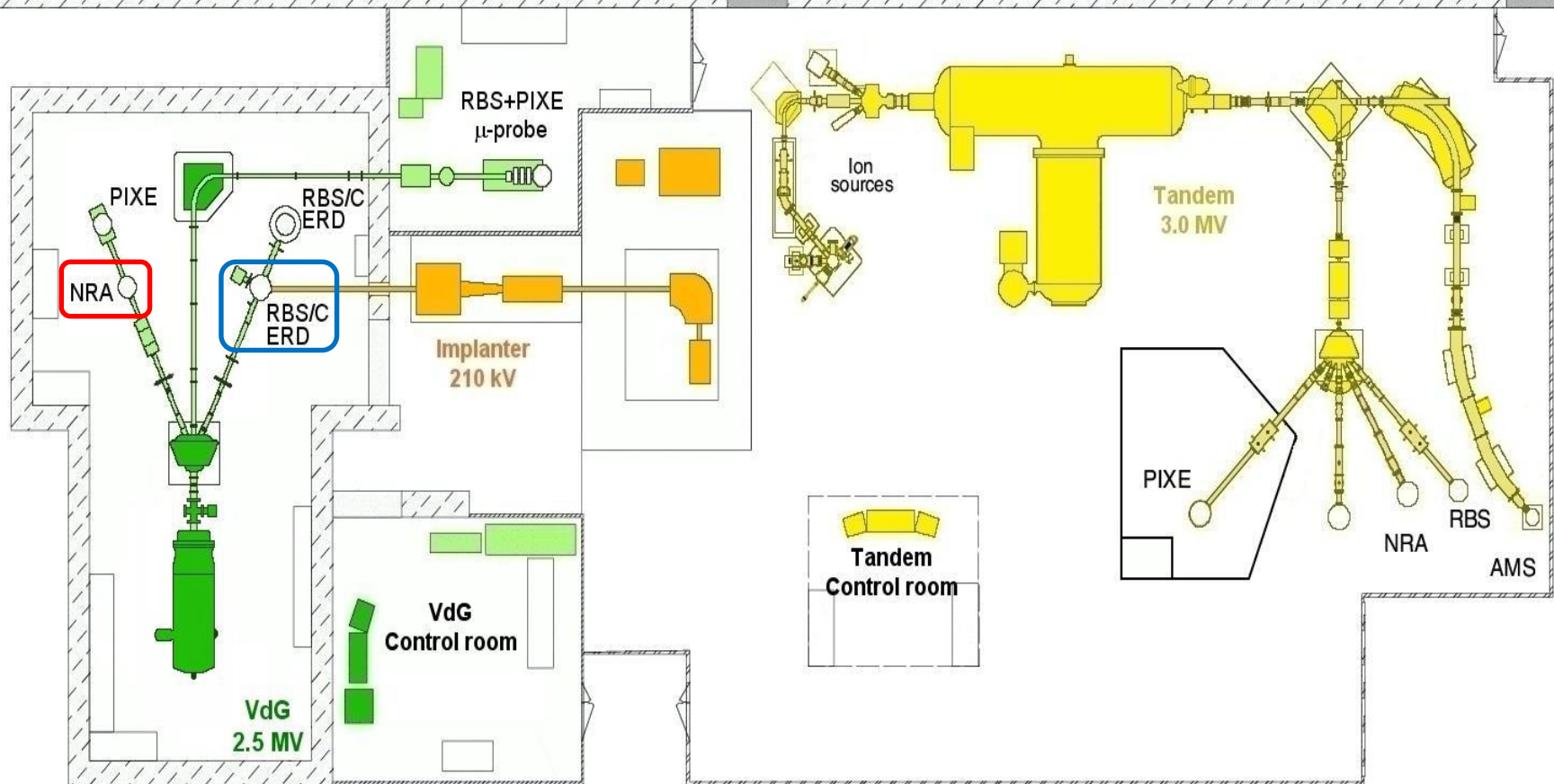
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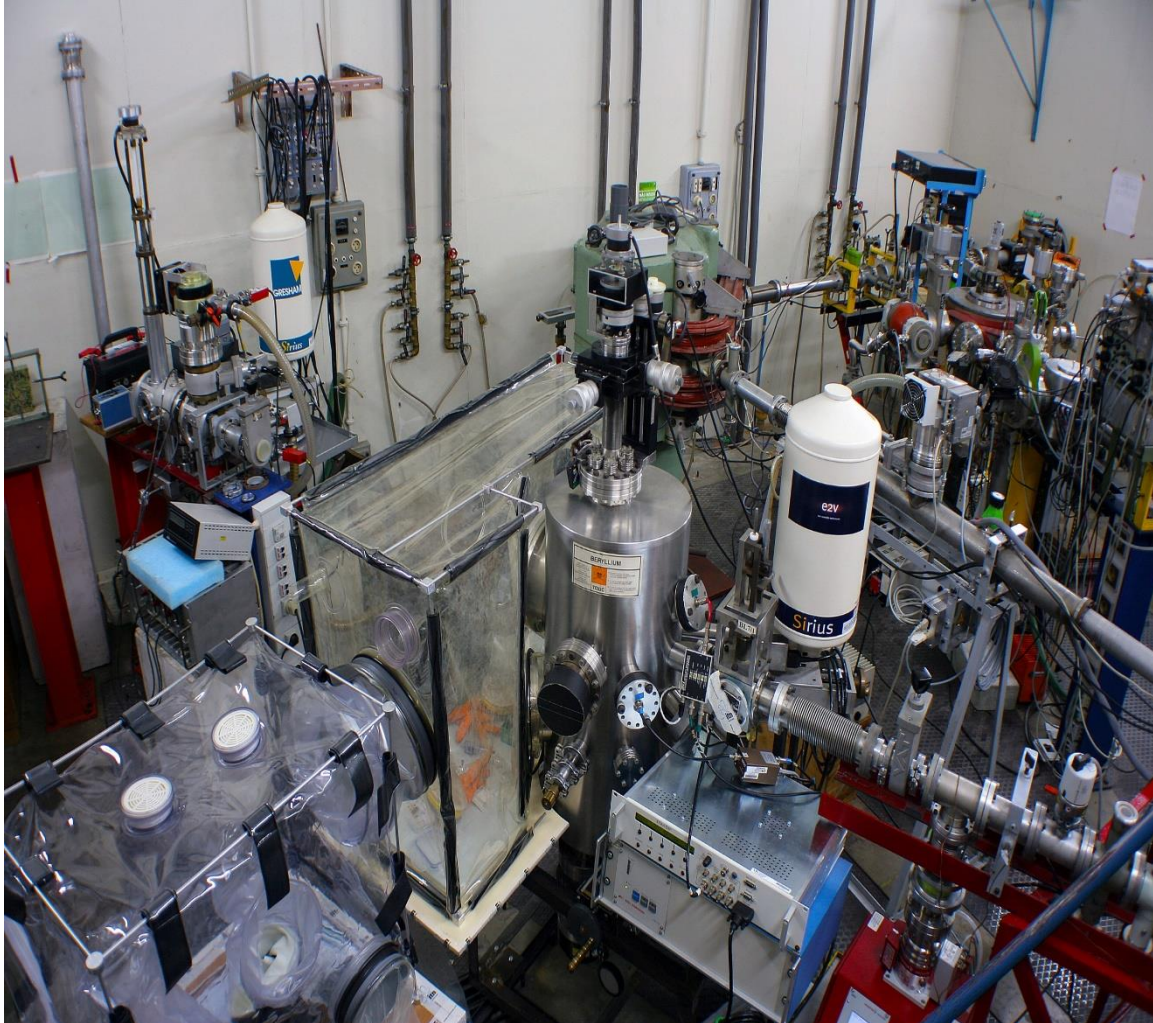# Laboratory layout

□ JET chamber - EBS, RBS, NRA, PIXE, from small samples to tiles

□ RBS/C, ERD chamber - EBS, RBS, NRA, Be-based, W-based,
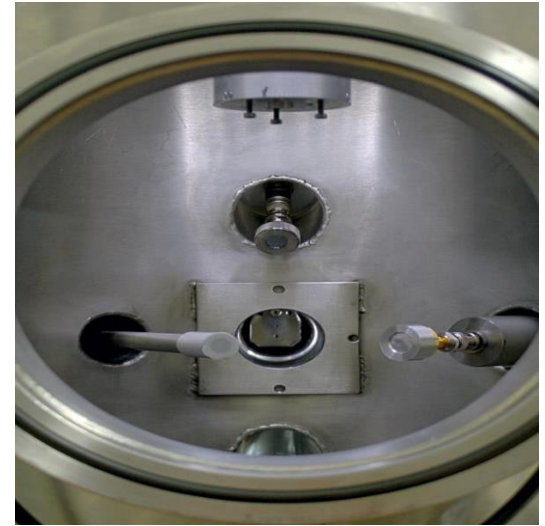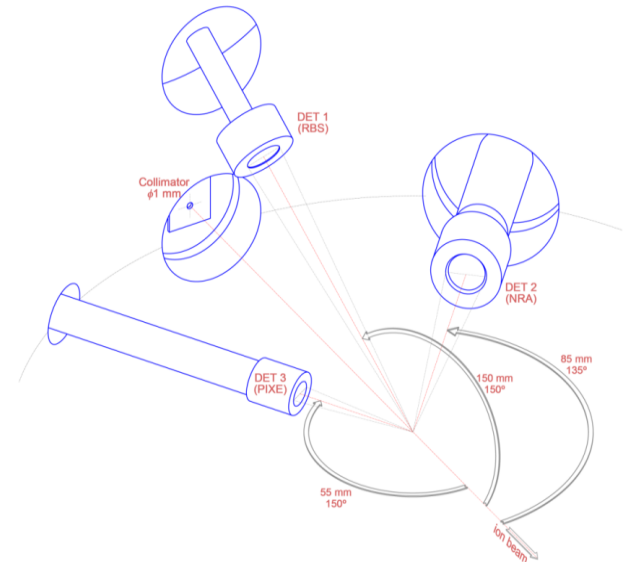   small samples, good adhesion
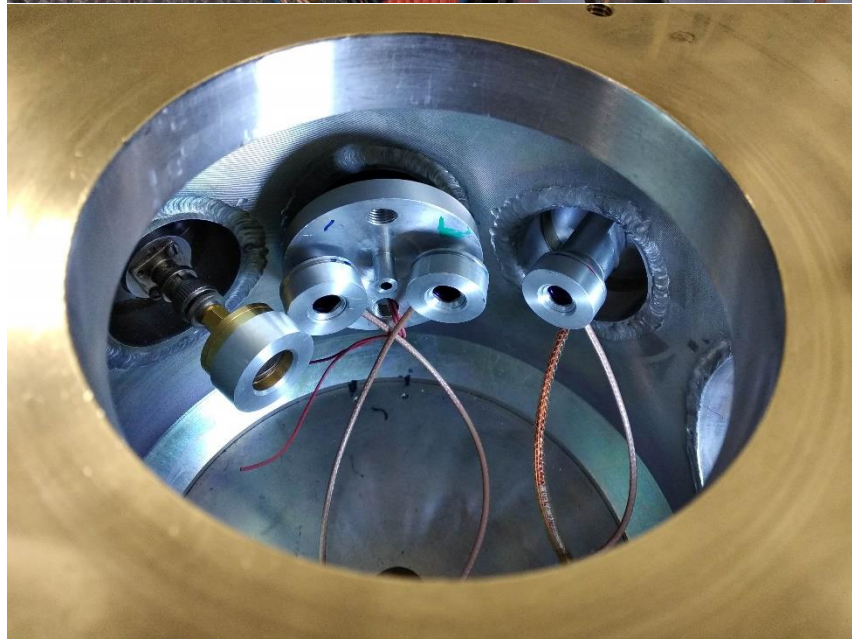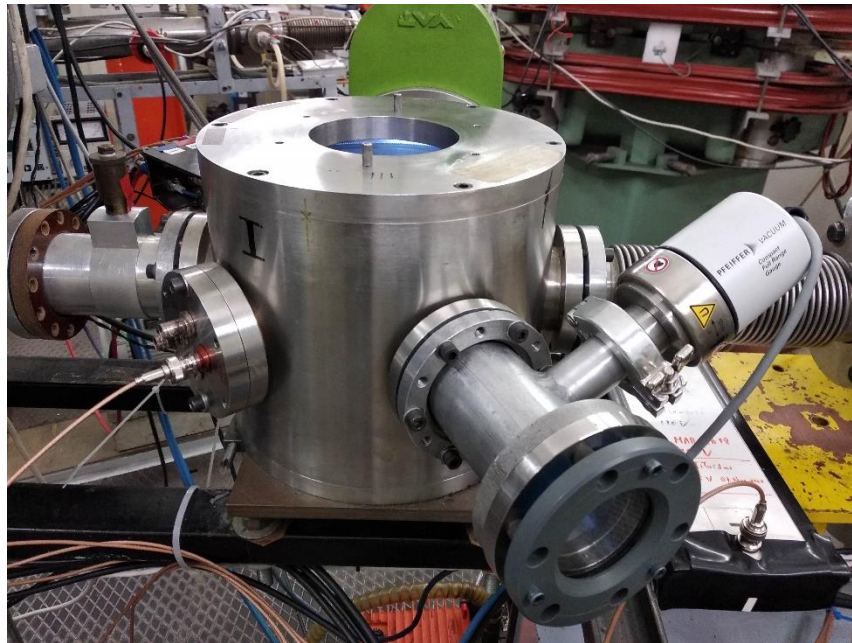
JET line

Experimental chamber

Detector geometry

RBS/C, ERD chamber

Detectors

- **1 Si(Li) detector / for NRA**
    - **Active area / 200 mm²**
    - **Active thickness / 2 mm**
    - **Absorber foil**
        71900 x 10^{15} at/cm² Mylar ($C_{10}O_4H_8$)
    - **Solid angle / 35 msr**
    - **Reaction angle / +140⁰**

- **3 Si pin-photodiode / for RBS, EBS**
    - **Active thickness   / 0.3 mm**
    - **Solid angles   / 8.8 msr, 11.7 msr, 11.7 msr**
    - **Scattering angles / -140⁰,   -165⁰,   +165⁰**

Table 1. List of Be-based coatings deposited on W plates at CT and up to 400 °C.

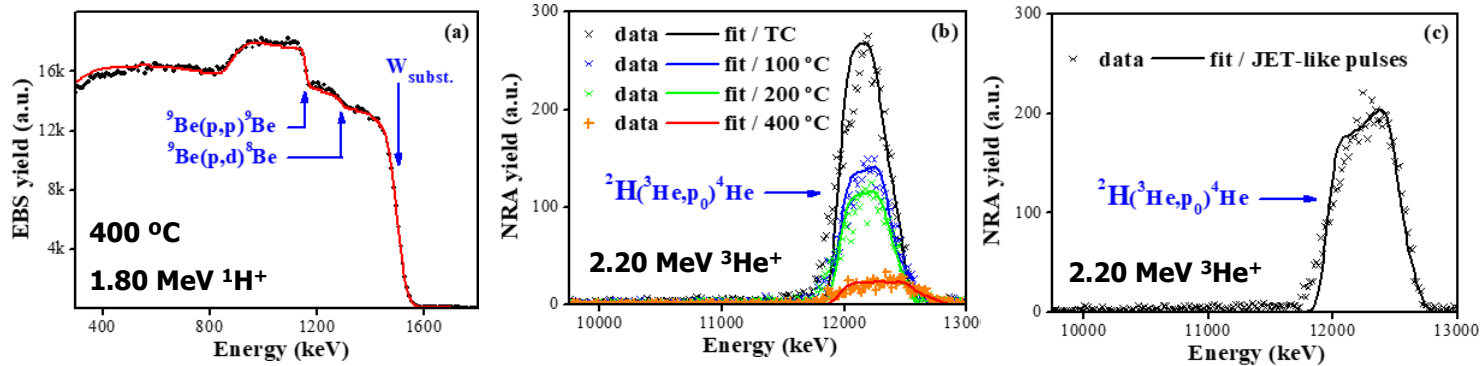| Reference	Nominal composition	Nominal thickness (μm)	Substrate temperature (°C)
60190516_1_2	Be+D(10%)	5	Chamber Temp. (CT)
60190520_1_2	Be+D(5%)	5	Chamber Temp. (CT)
60190523_1_2	Be+D(5%)	5	400
60190527_1_2	Be+D(10%)	5	200
60190528_1_2	Be+D(5%)	5	100
60190607_1_2	Be+D(10%)	5	JET-like pulses

WP PFC 2019

Table 2. Selected Be-based coatings.

Reference	Nominal comp. (at.%)	Nominal thickness. (μm)	Substrate	Substrate temp. (°C)
60200211_3_3	Be+D(5)+Ne(2.5)	5	W	Not heated
60200129_1_1	Be+D(5)+Ne(2.5)	5	W	100
60200130_1_2	Be+D(5)+Ne(2.5)	5	W	400

WP PFC 2020
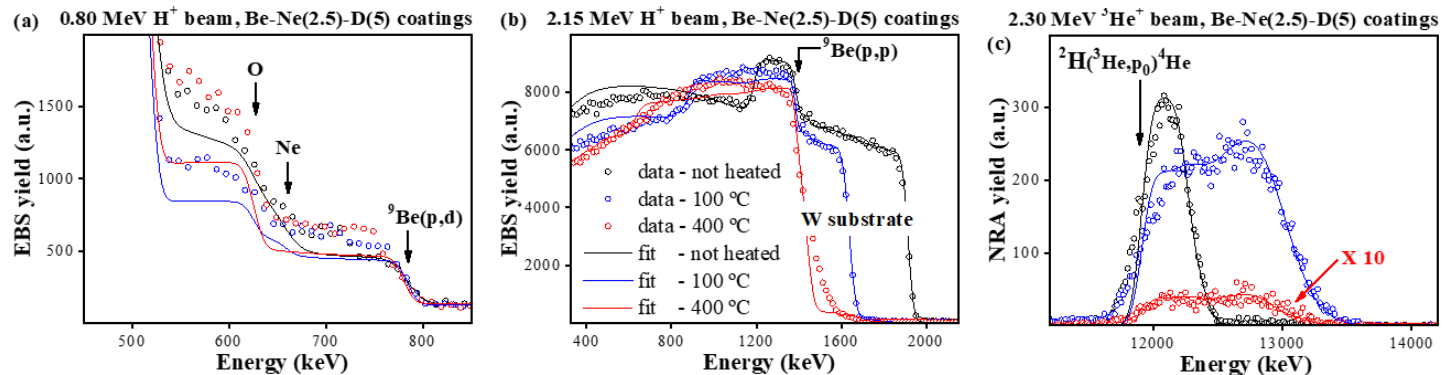
Case study: Helium load on W-O coatings (ENEA)

Coating	Description	Nominal thickness (μm)
WFW536	compact W-O	>1.0
WFW549	porous W-O	>1.0

Ion beam	Ion implanted fluence
150 keV ^{4}He$^+$	2×10^{17} ion/cm^2
100 keV ^{4}He$^+$	2×10^{17} ion/cm^2
50 keV ^{4}He$^+$	1×10^{17} ion/cm^2
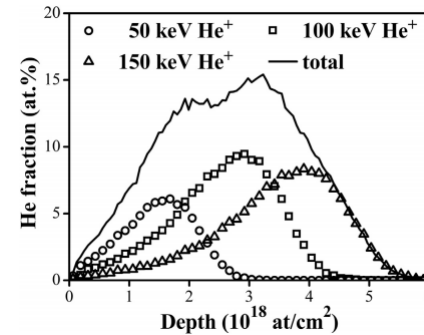
Ion implantation

SRIM simulation for W:O (37:62)
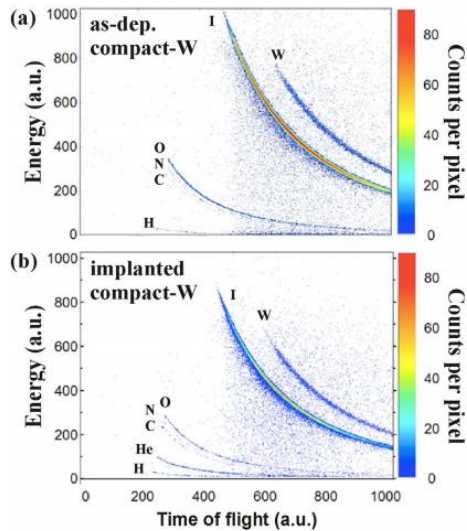
TOF-ERDA (RBI) compact W-O

EBS / RBS porous W-O

Coating	Description	Nominal thickness (μm)
WFW600	porous W-O	>1.0
WFW624	porous W-N-O	>1.0

Ion beam	Ion implanted fluence
150 keV D_2^+	2×10^{17} ion/cm^2
100 keV D_2^+	2×10^{17} ion/cm^2
50 keV D_2^+	1×10^{17} ion/cm^2

WFW600

NRA
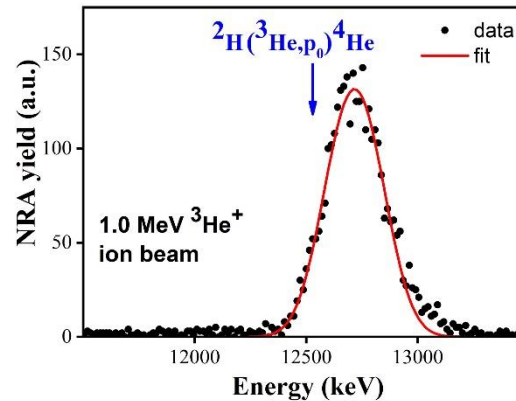
SIMS (VTT)
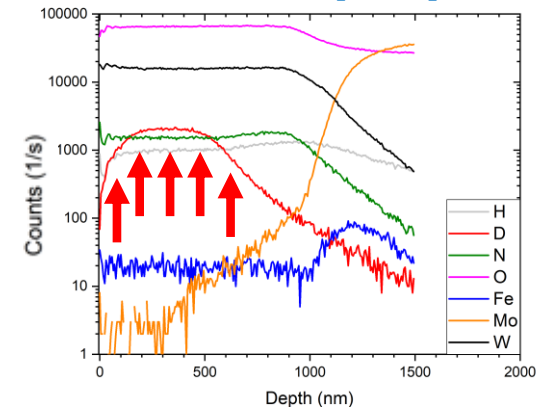
compatible results:

EBS/RBS/NRA (IST)
TOF-ERDA (RBI)
SIMS (VTT)

NRA

SIMS (VTT)

WFW624

Summary
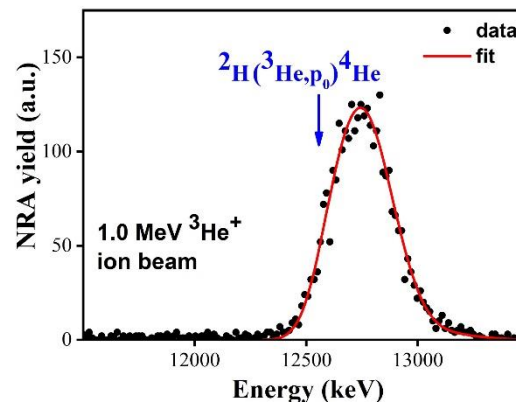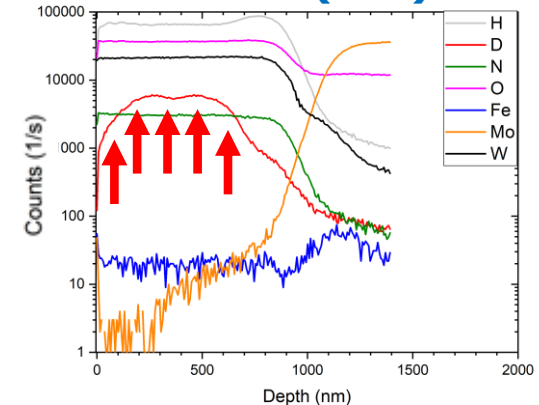
Within the PWIE of the European Fusion programme IST will contribute with Ion Beam Studies of Be-based and W-based reference samples.

Besides EBS, RBS and NRA, IBA analysis at IST may easily include PIXE and PIGE.

Additional ion implantation experiments (^{1}H, ^{2}H, ^{4}He ...) are commonly performed.