



NIKON METROLOGY

Vacuum process improvements at Nikon Metrology

Stephen Fletcher, Andriy Denysov, En

Vacuum Expo

16th October 2014

Confidential

- **Our company and products**
 - **Vacuum in our products**
 - **Our need to improve vacuum cleanliness**
 - **What improvements we have made**
 - **Our future plans**
-

Our company

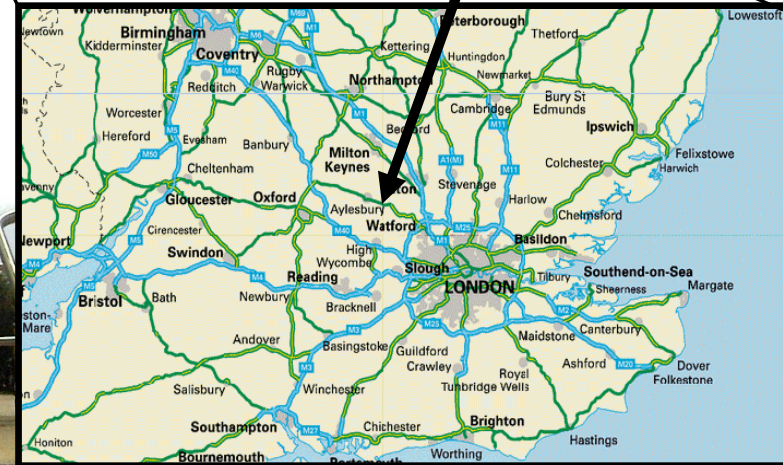
NIKON METROLOGY



Where are we?



**Nikon Metrology X-ray
imaging facility in Tring**



Using **X-TEK** technology
Leading X-ray Technology

Our company

NIKON METROLOGY



Founded as X-Tek Systems in 1986 – over 25 years ago.

Acquired by Nikon Corporation in October 2009.



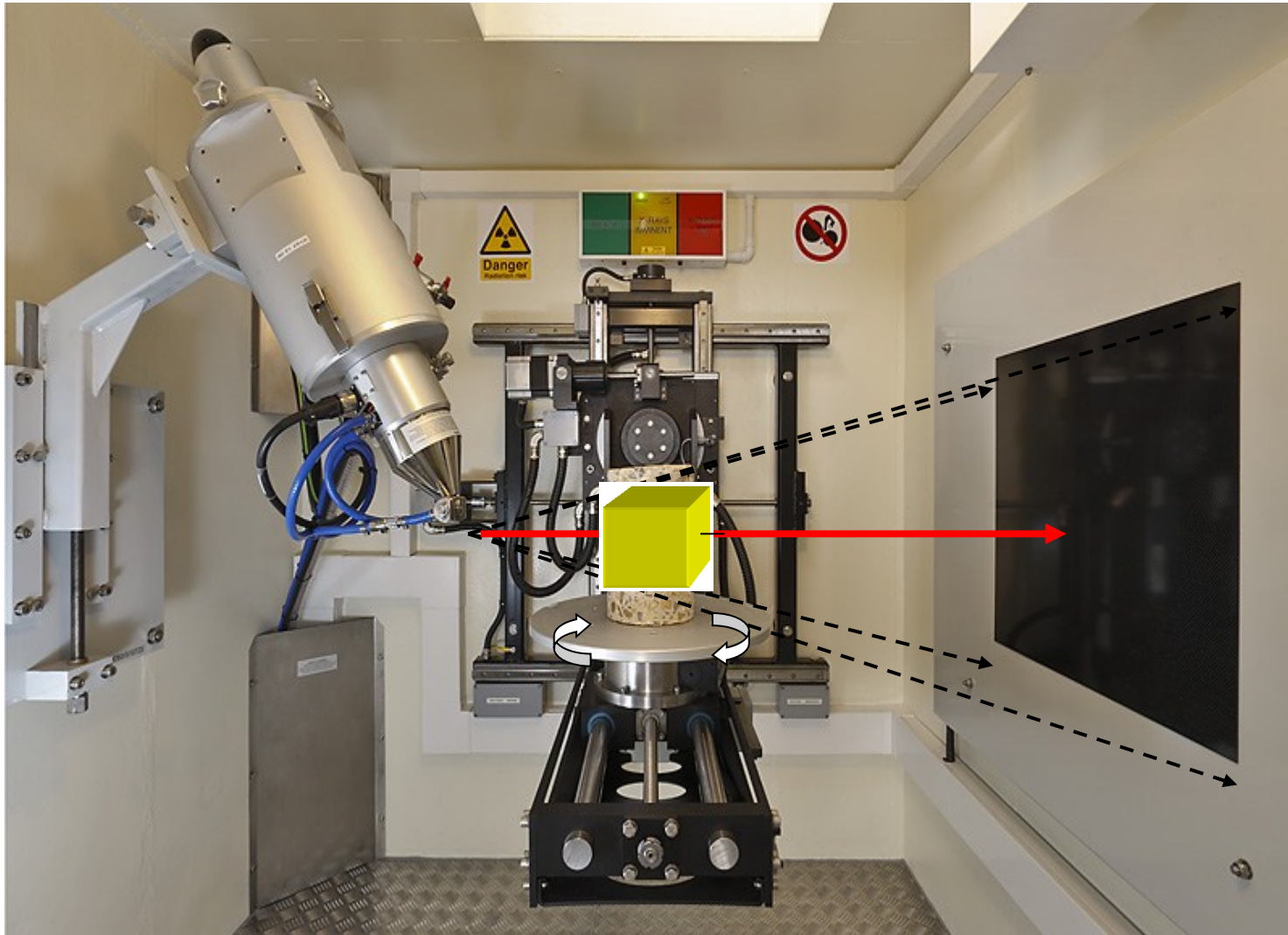
Our products

NIKON METROLOGY



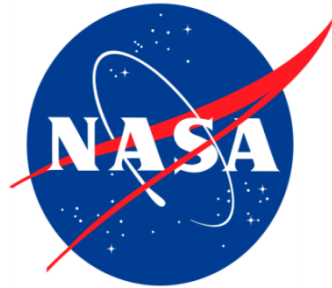
Our products

NIKON METROLOGY



Our customers worldwide

NIKON METROLOGY



Mercedes-Benz



UNIVERSITY OF
CAMBRIDGE

THE UNIVERSITY OF
WARWICK



GlaxoSmithKline



Fraunhofer



AIRBUS

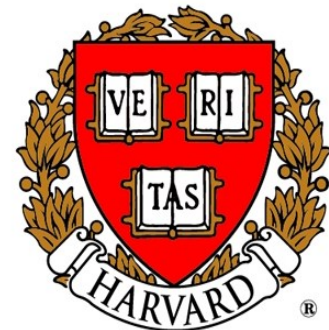


MANCHESTER
1824

The University of Manchester



NATURAL
HISTORY
MUSEUM

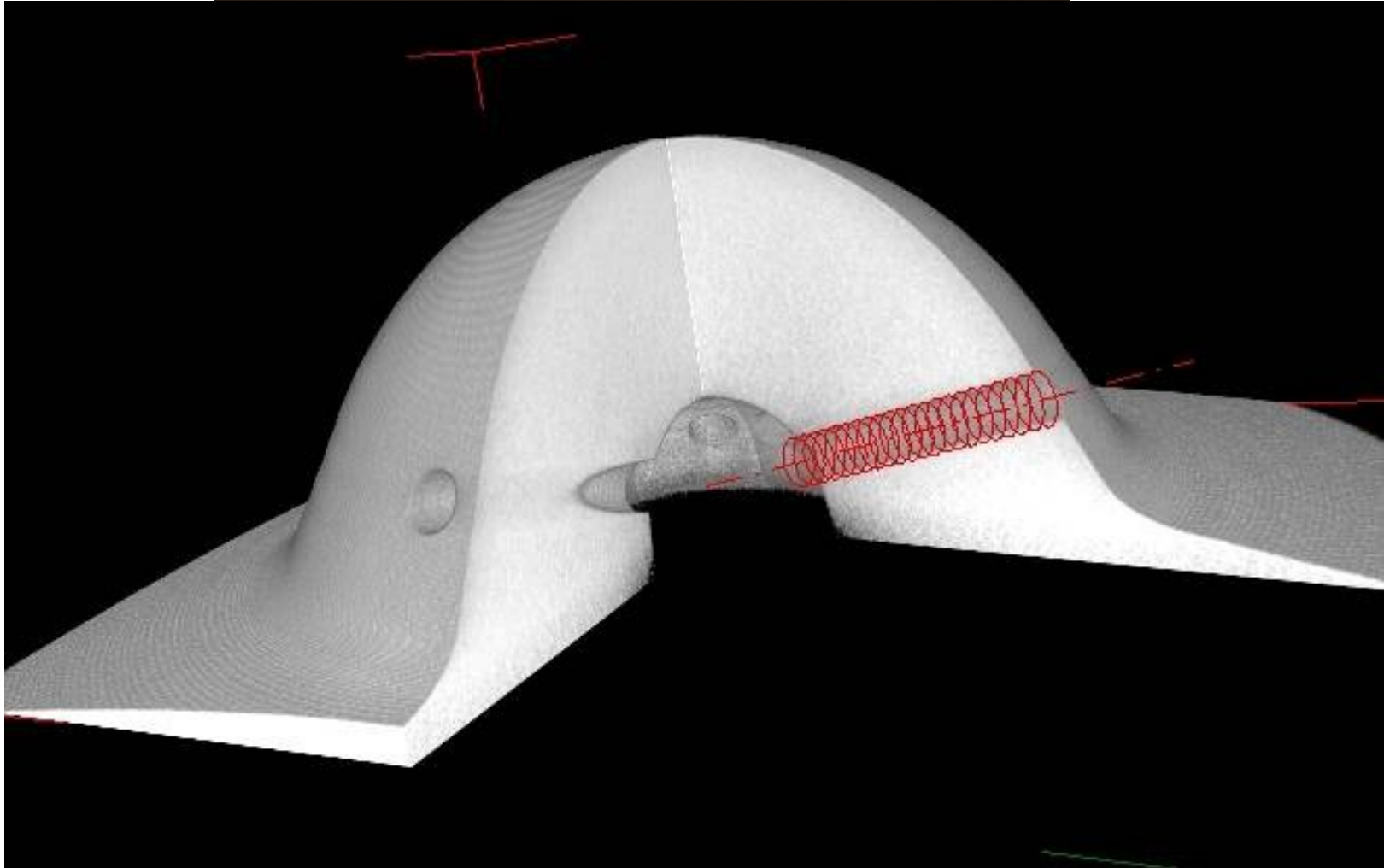


Our products

NIKON METROLOGY

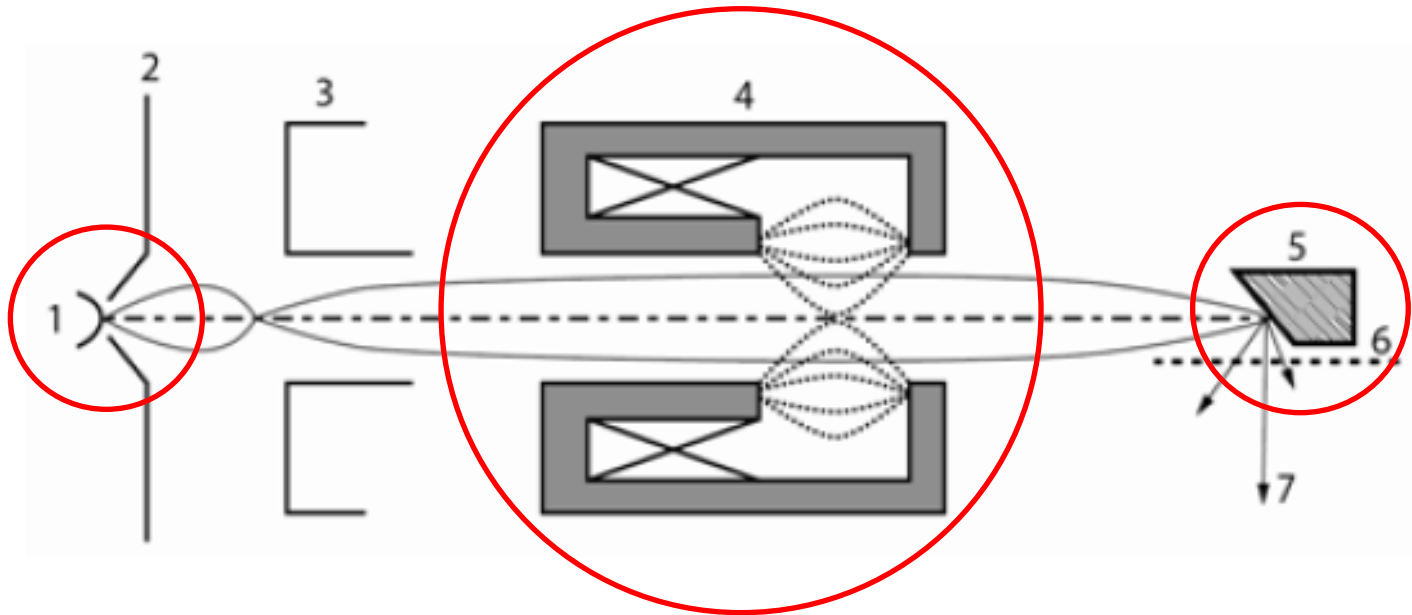


Our customers do CT scans on a wide range of samples, from Archaeology to Zoology



- **Electron beam is extracted from a hot filament (1) in vacuum**
- **Electron beam strikes target (5) to produce x-rays**

1. *Filament*
2. *Cathode assembly*
3. *Anode*
4. *Magnetic lens*
5. *Water or air-cooled reflection target with choice of materials*
6. *Vacuum envelope*
7. *X-rays*

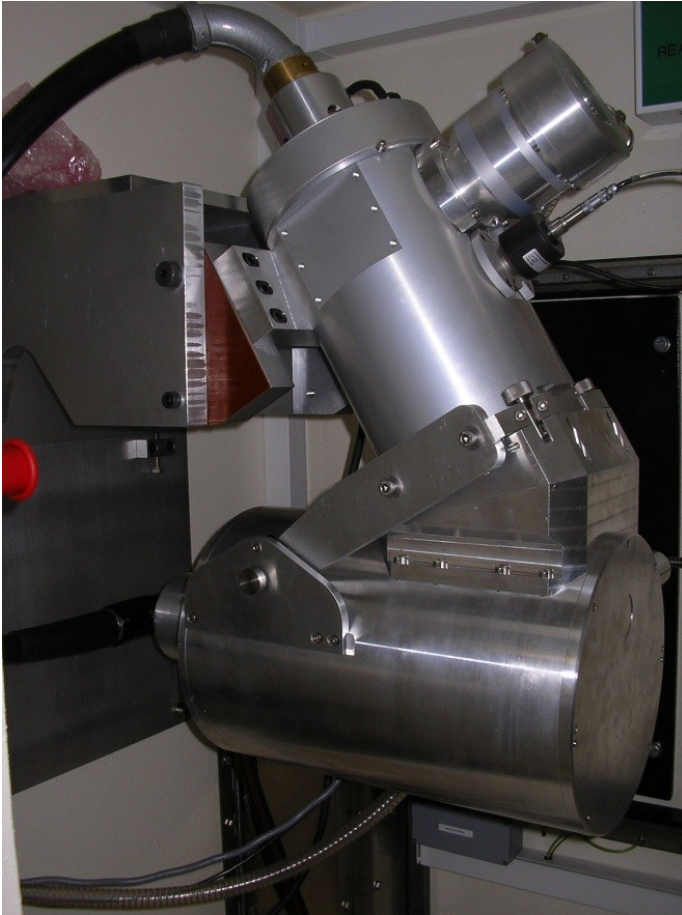


Vacuum in Nikon Metrology products

NIKON METROLOGY



All Nikon Metrology x-ray products feature a demountable micro-focus x-ray source



- A vacuum pressure of 10^{-5} mbar or lower is required for correct function of our electron gun

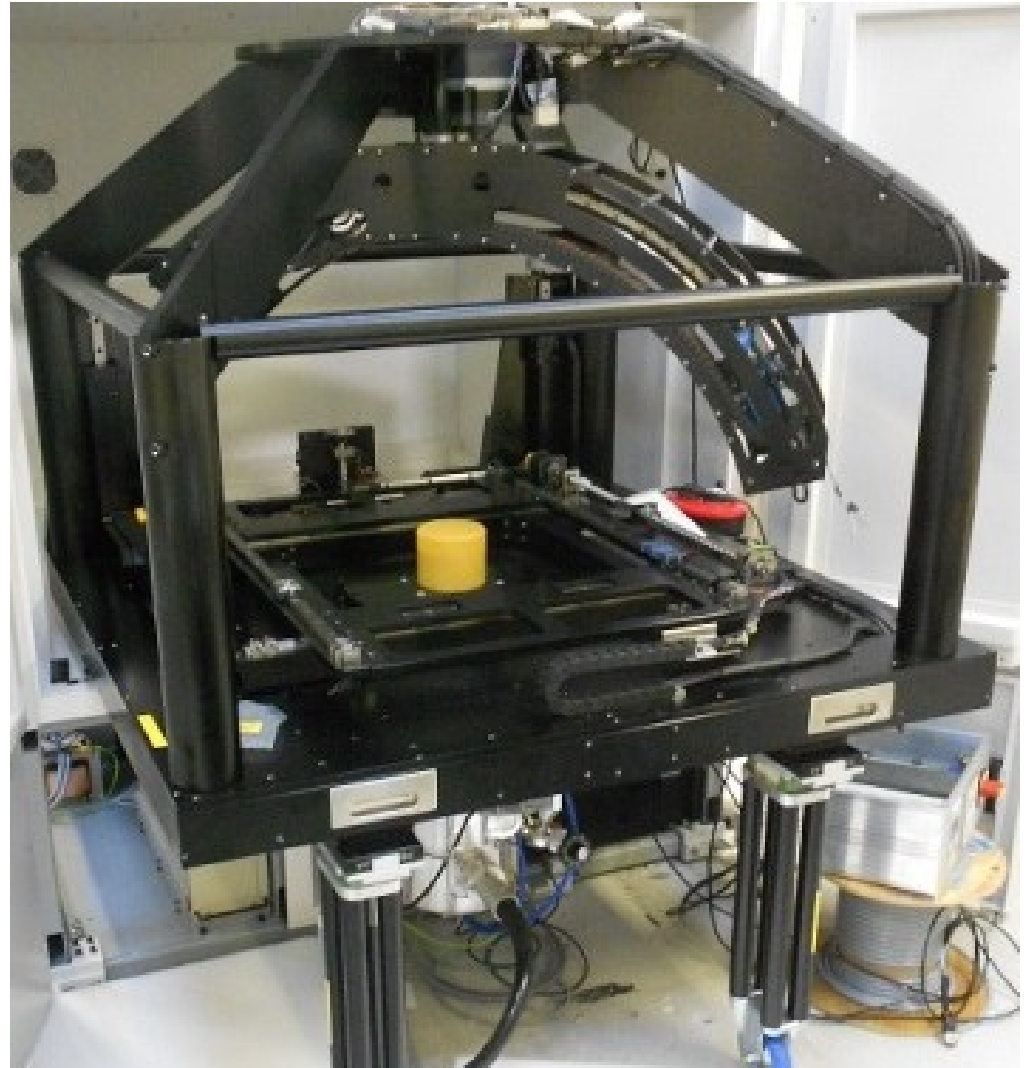


- **Our customers can replace the filament**



Why improve?

- Our Nano-focus x-ray tube requires 10^{-8} mbar
- We must improve our existing facilities



Why improve?

- **Improved cleanliness could benefit existing products**



- **We read CLEANING FOR VACUUM SERVICE**

R.J. Reid, CLRC Daresbury Laboratory, Warrington WA4 4AD, UK

- **We asked Science & Technologies Facilities Council to provide cleaning services to speed up our research**



**Science & Technology
Facilities Council**

**Assessment of STFC
cleaned source**

**Implement our own
improvements**

STFC cleaned components

- Component washing tailored to material type

100 k Pa	Hot water wash Swab or wash with detergent
100 Pa	Wash in hot aqueous detergent
10^{-4} Pa	Ultrasonic wash in aqueous detergent Rinse with hot demineralised water
10^{-7} Pa	Ultrasonic wash in hot solvent Vapour wash in solvent vapour Rinse with hot demineralised water Vacuum bake to 250°C

Handling cleaned parts

- **Cleaned components must only be handled by gloved hands**
 - **Keep handling to a minimum**
 - **No re-work of components**
 - **No solvents**
 - **No o ring grease**
 - **Use a clean room to keep dust out**
-

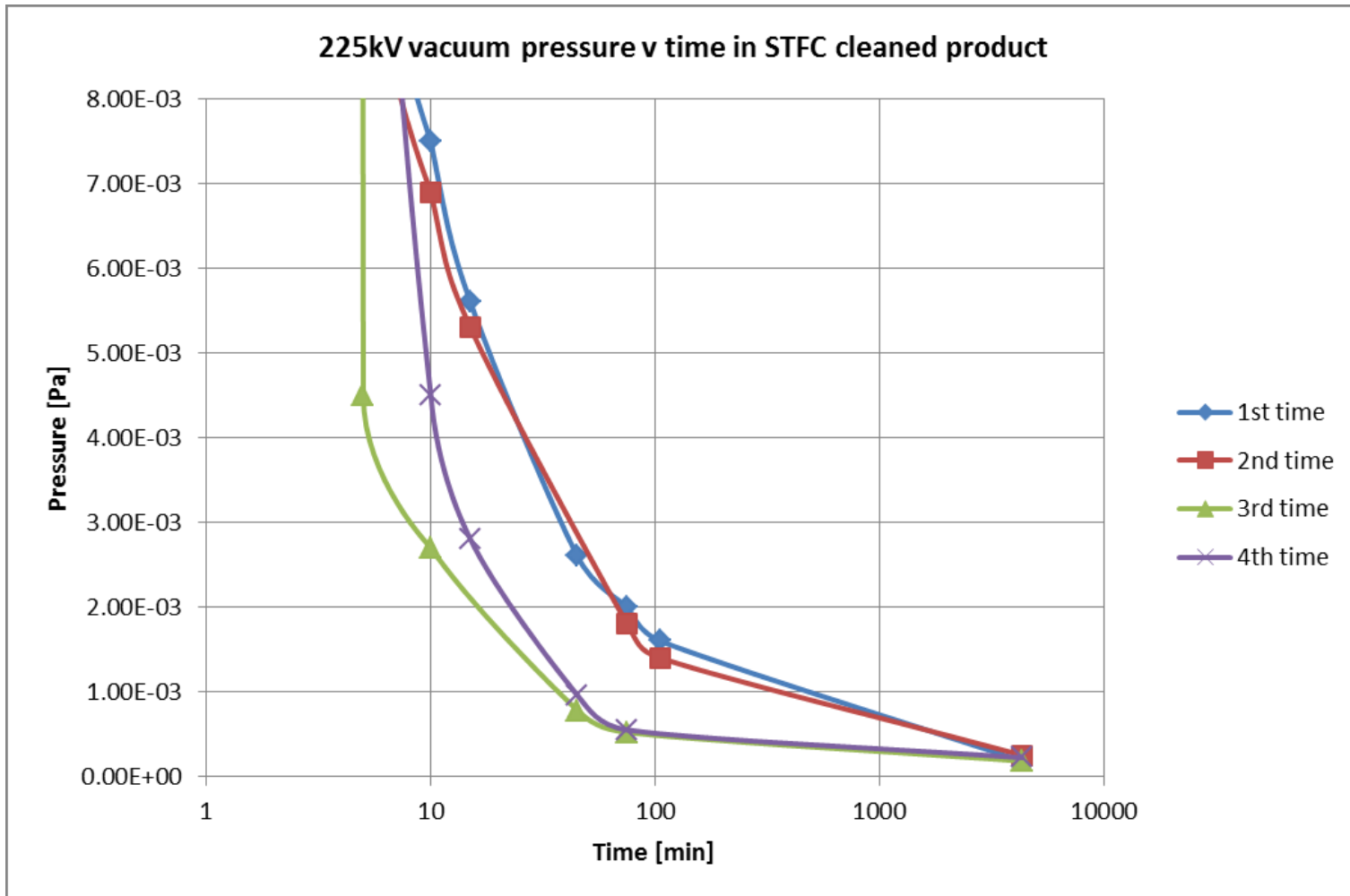
▪ Assessment of STFC cleaned x-ray gun

**Vacuum
pressure**

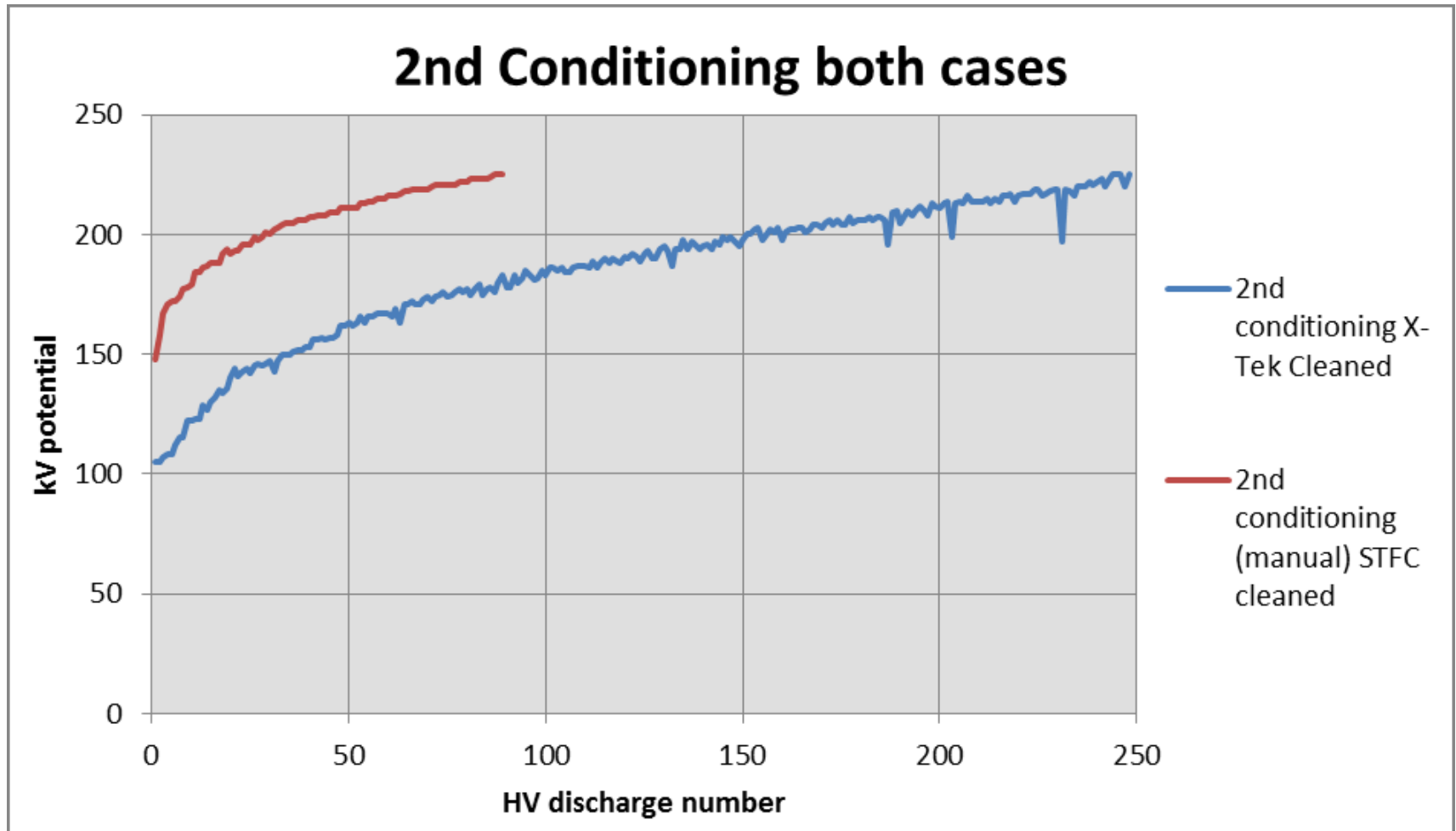
**High Voltage
stability**

**Cathode
lifetime**

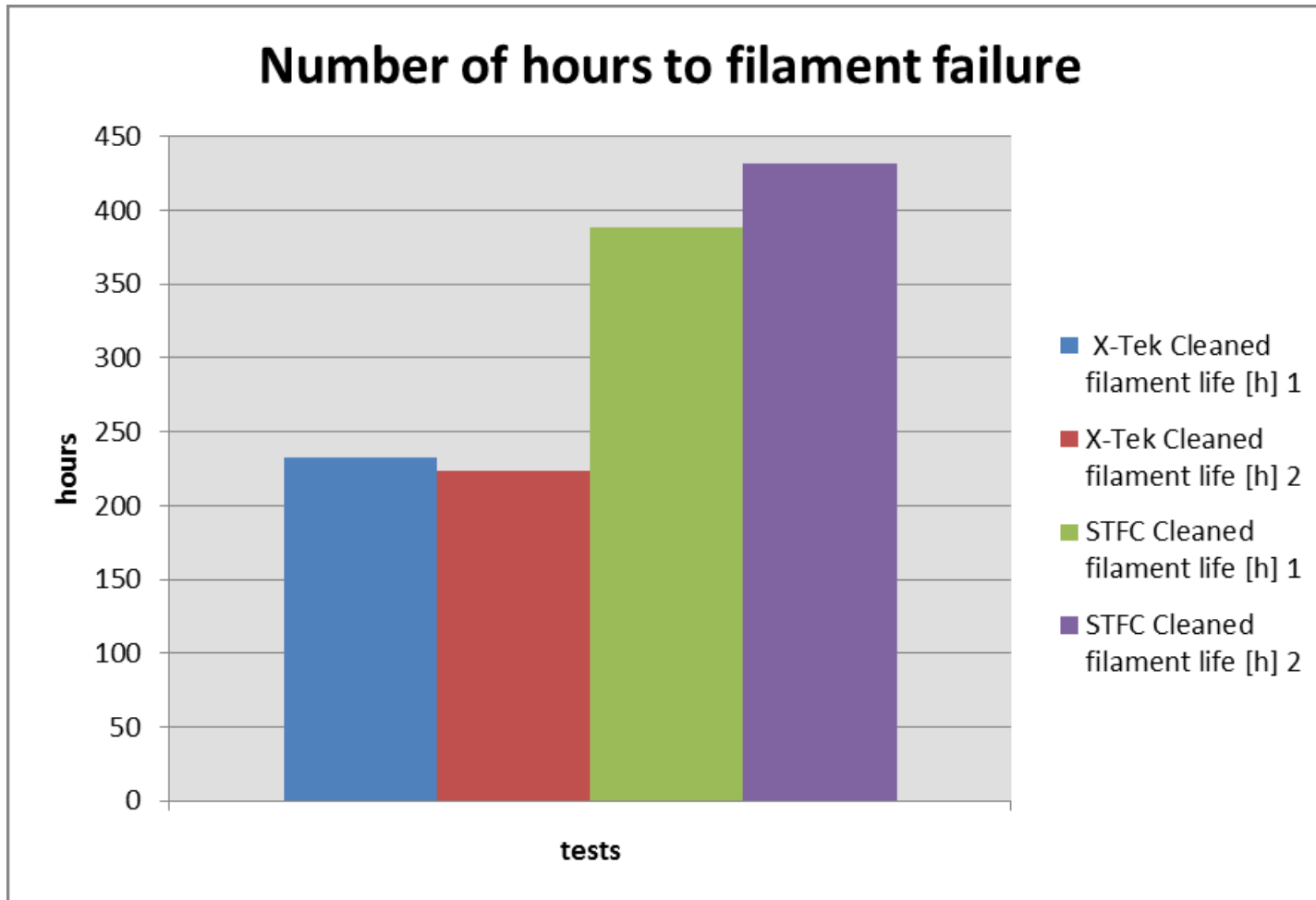
Vacuum pressure



High Voltage stability



Cathode lifetime



Build nano focus cleaning facility

- Material specific washing processes
 - Vacuum bake out oven
 - Use RGA
 - Nitrogen purge
 - Install clean room for dust control
 - Design out unsuitable vacuum materials
-



Thank you for your attention



Stephen Fletcher, Andriy Denysov, Engineering, Tring, UK

www.nikonmetrology.com

NIKON CORPORATION