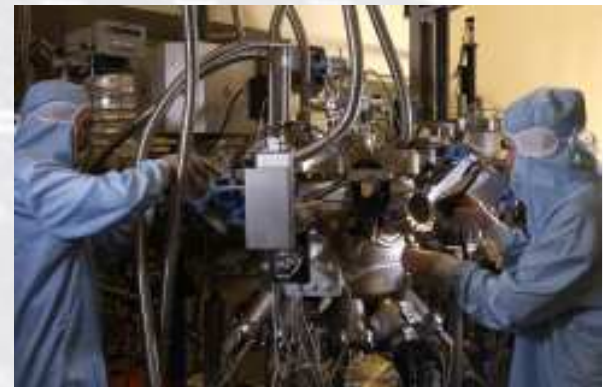
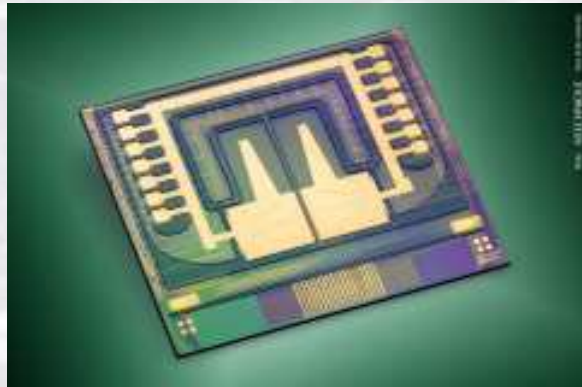


Outgassing of EUV Resist at CEA-Leti



- Aims
- Tool description
- Examples of results
- Issues to discuss

Set up of an EUV outgassing equipment at CEA-Leti

Issues:

Outgassing of resists under EUV light

⇒ contamination of EUV optics

⇒ drop of throughput and lifetime

Outgassing measurement:

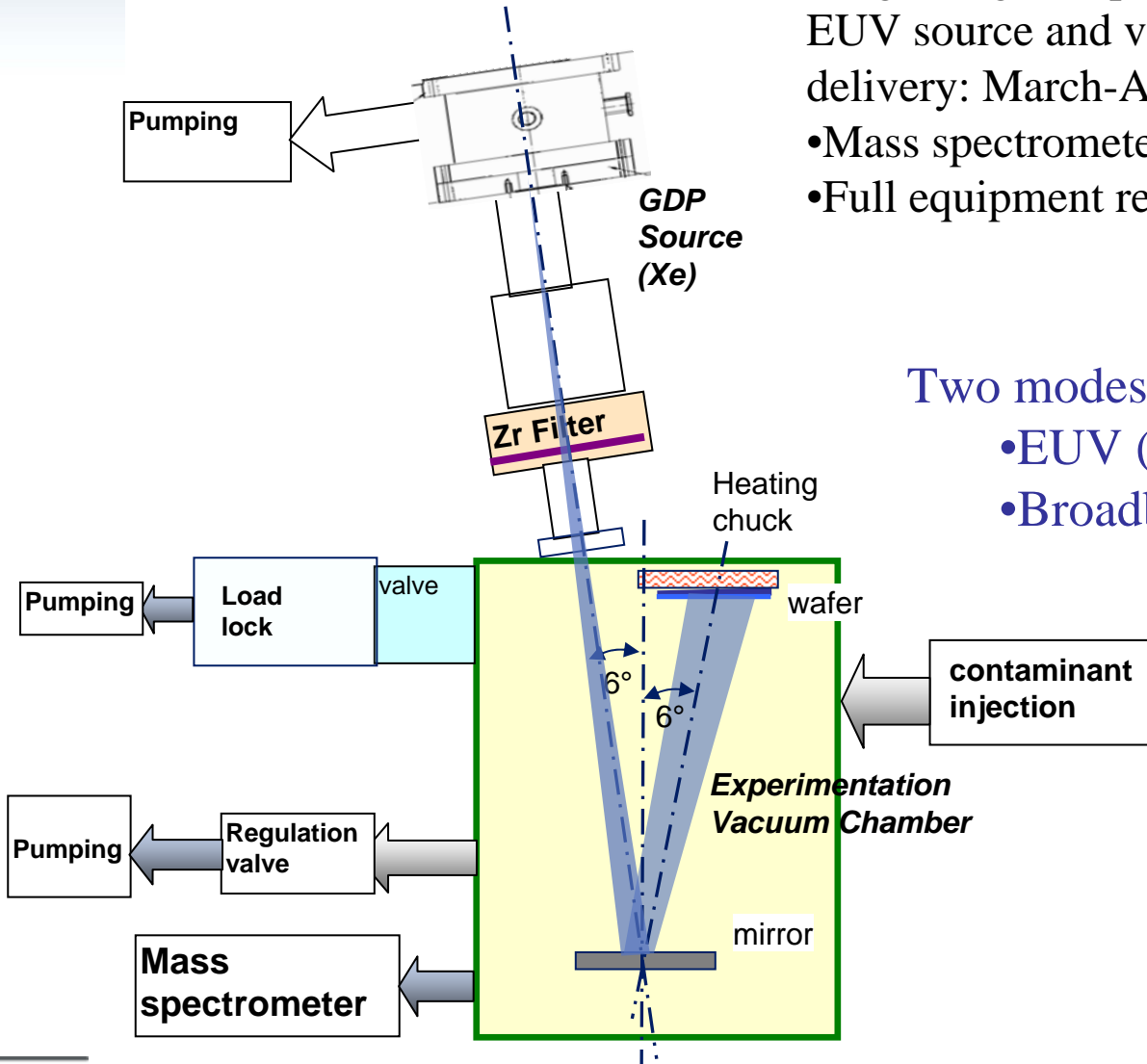
- Screening resist
- Determine dangerous components by intentional contamination
- Study optics contamination

Design of equipment

Outgassing tool planning

EUV source and vacuum chamber forecasted delivery: March-April

- Mass spectrometer ok
- Full equipment ready in June

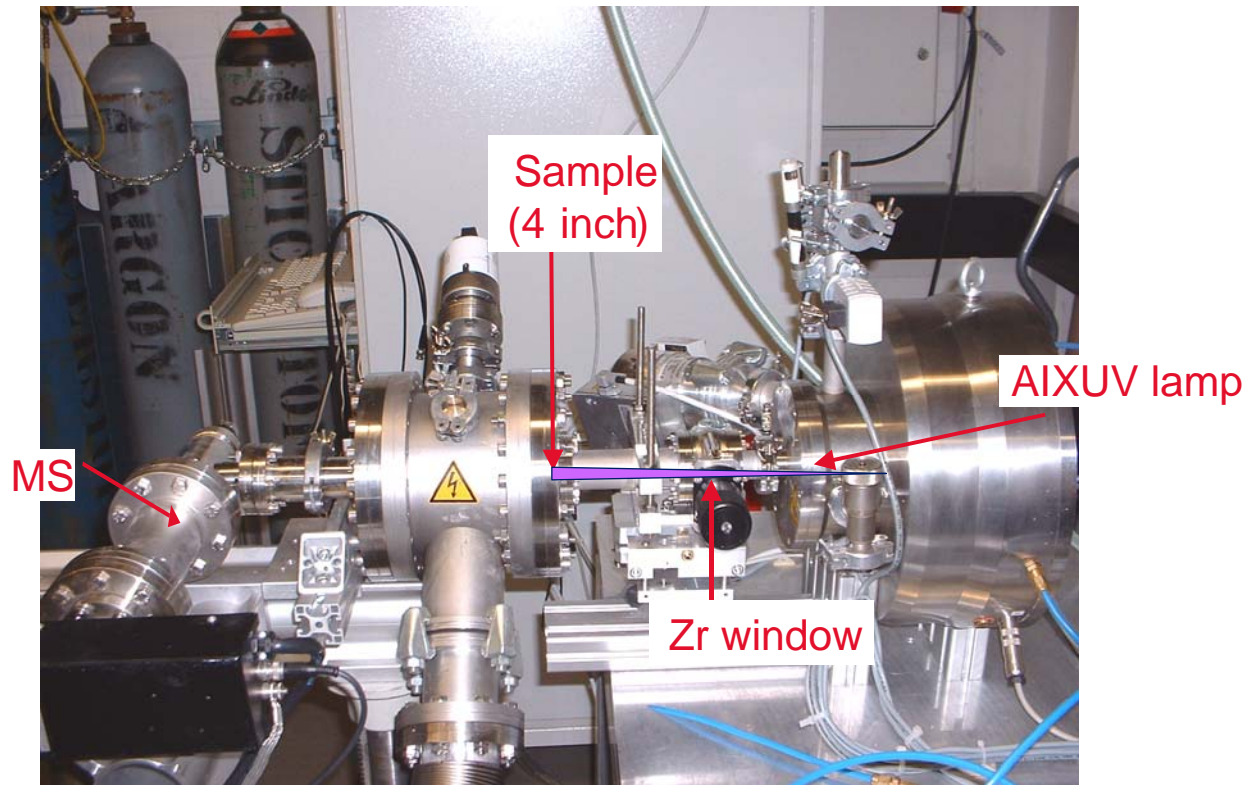


Two modes of operation:

- EUV (with Zr filter and ML mirrors)
- Broadband (Zr filter)

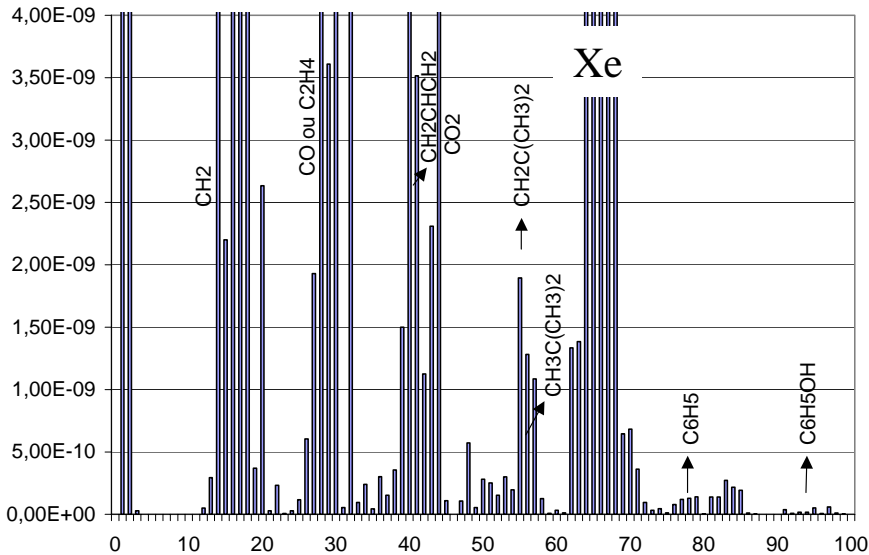
First tests

- Outgassing setup at AIXUV, (Aachen)
- Used to test the lamp on a simplified outgassing configuration
 - Broadband (no ML mirror)



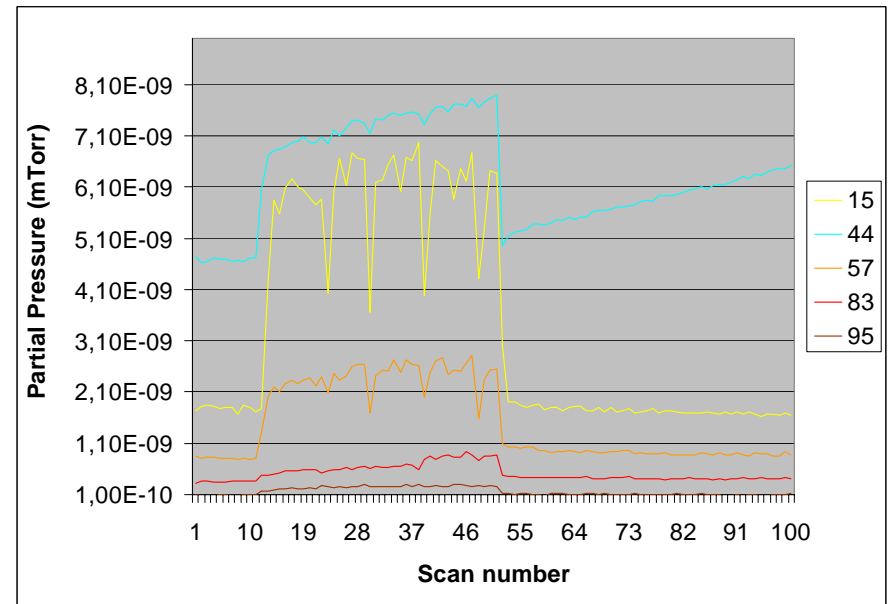
Mass detection

All masses
But takes a long time




Dynamic detection

On a few masses



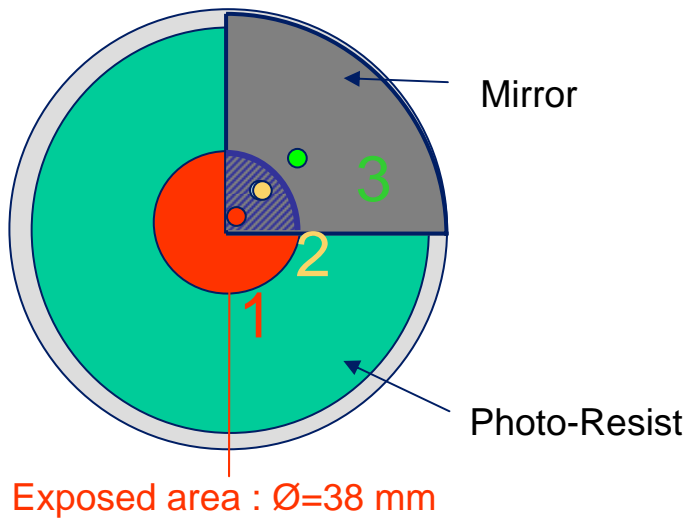
- Pressure measurement range = $[10^{-11}-10^{-6}]$ mBar
- Mass spectrometer theoretical sensibility = 10^{-14} mBar
- Typical vacuum level before source ignition = 10^{-6} mBar
- Typical vacuum level after source ignition = $2 \cdot 10^{-5}$ mBar
- 4 CAR resists tested

Resist	Type	PEB T°	Total ΔP (mBar)
A	Polymethacrylate	110°C	$1,28 \cdot 10^{-6}$
B	ESCAP type	130°C	$4,5 \cdot 10^{-7}$
C	248nm type	130°C	$1,1 \cdot 10^{-6}$
D	ESCAP type	125°C	$9,3 \cdot 10^{-7}$

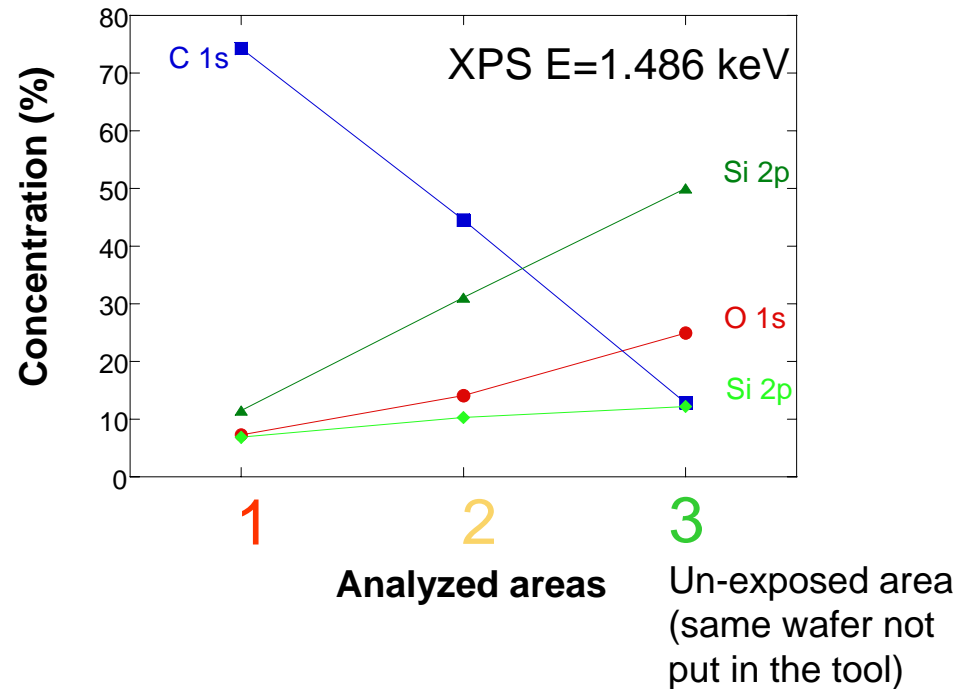
- Power of the source : 100 mW/cm² in Broadband ; 6 mW/cm² at 13.5 nm
 - What is measured is gas partial pressure
 - Not easy to know what are the outgassing species:
 - Resist formulation not known
 - Several species can have the same mass
 - Peaks due to Xe pollute the spectra
 - Xe⁺(132) ; Xe²⁺(66) ; Xe³⁺(44)
 - Many isotopes
-  Isolate as much as possible source from experimentation chamber

Optics contamination

EUV broadband exposure during 22H
 EUV power density = 104.4 mW/cm²
 Integrated Power density = 8.3 kJ/cm²



XPS characterization



Issues to be discussed and common actions

- comparison of results on same chemical products, resists,