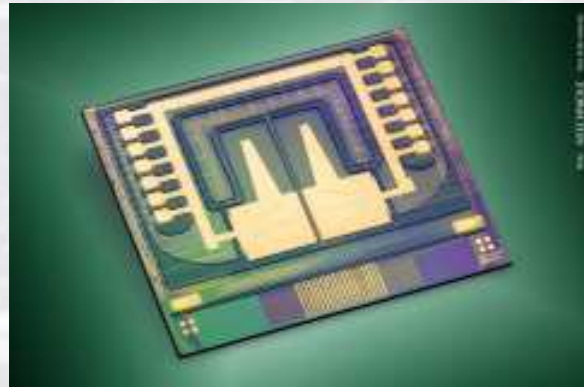


# Outgassing of EUV Resist at CEA-Leti



- 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

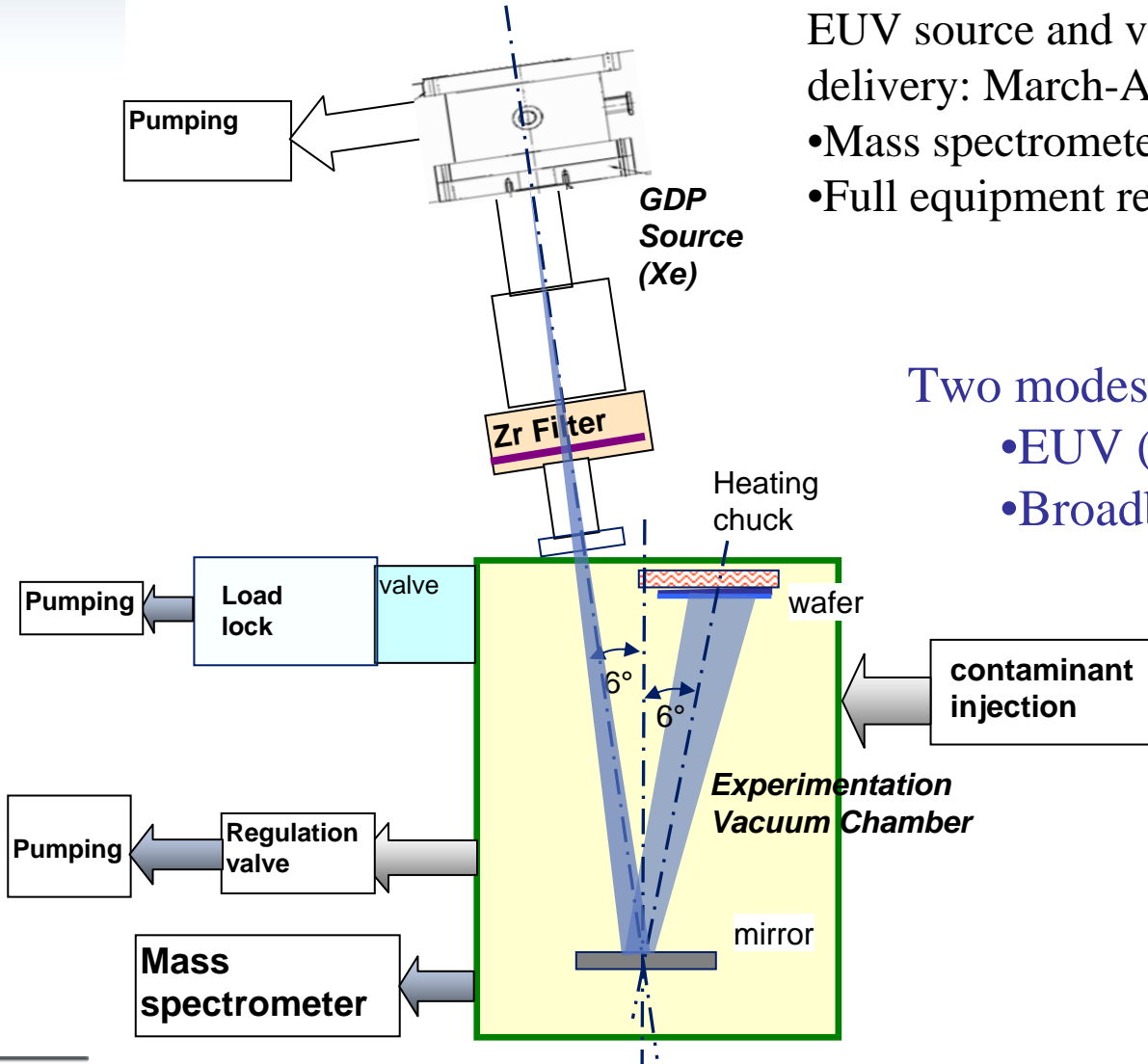
## Outgassing tool planning

EUV source and vacuum chamber forecasted delivery: March-April

- Mass spectrometer ok
- Full equipment ready in June

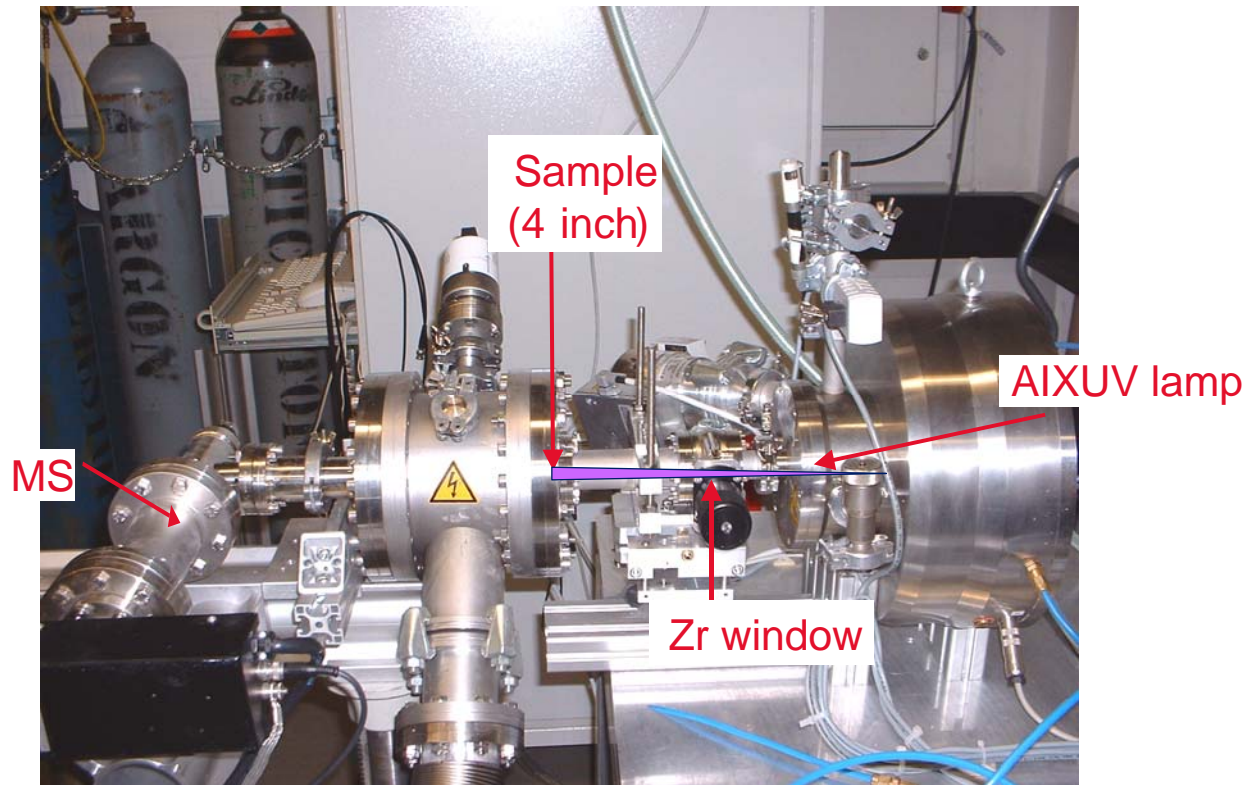
## Two modes of operation:

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



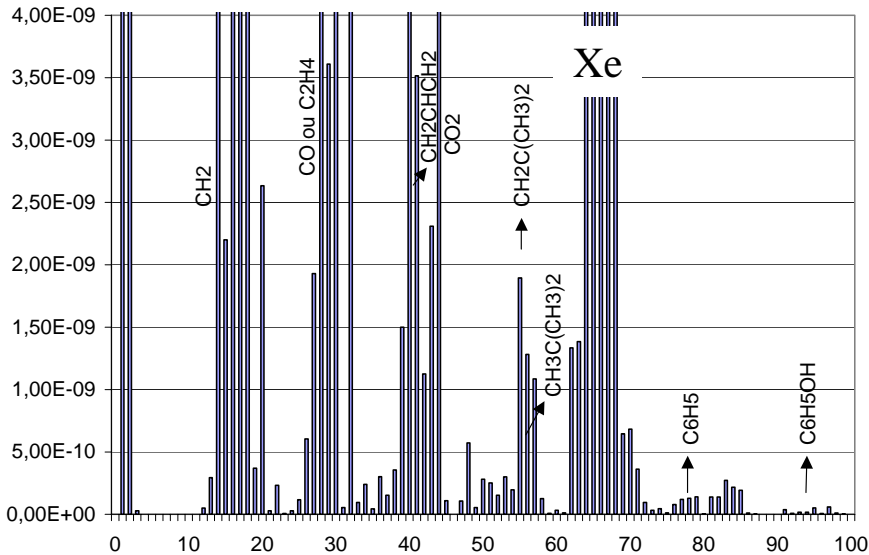
# First tests

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



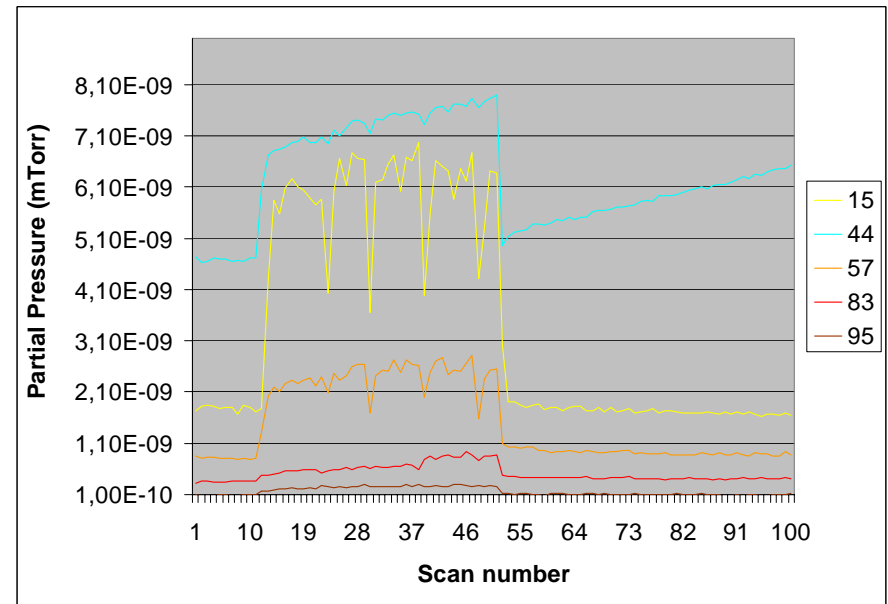
## Mass detection

All masses  
But takes a long time




## Dynamic detection

On a few masses



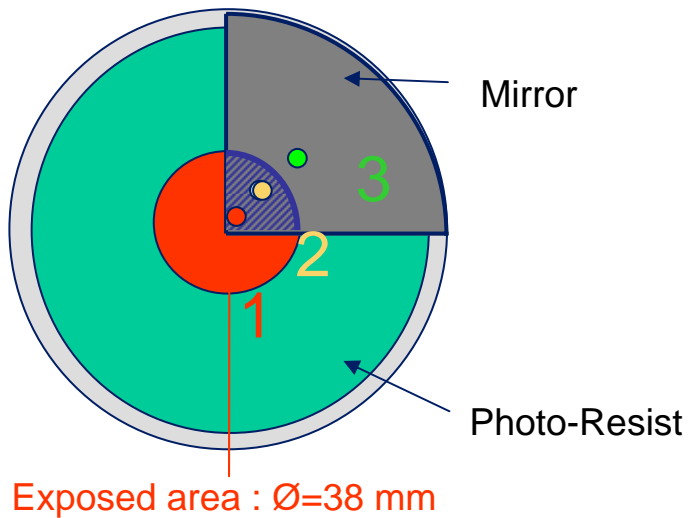
- Pressure measurement range =  $[10^{-11}-10^{-6}]$  mBar
- Mass spectrometer theoretical sensibility =  $10^{-14}$  mBar
- Typical vacuum level before source ignition =  $10^{-6}$  mBar
- Typical vacuum level after source ignition =  $2 \cdot 10^{-5}$  mBar
- 4 CAR resists tested

Resist	Type	PEB T°	Total $\Delta P$ (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	$9,3 \cdot 10^{-7}$

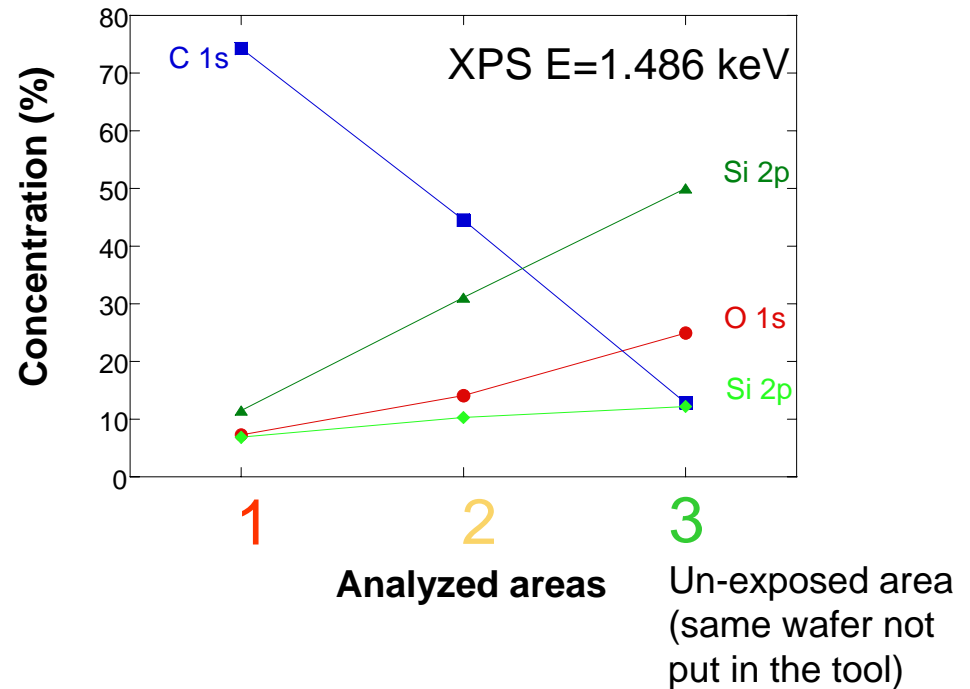
- Power of the source : 100 mW/cm<sup>2</sup> in Broadband ; 6 mW/cm<sup>2</sup> at 13.5 nm
  - What is measured is gas partial pressure
  - Not easy to know what are the outgassing species:
    - Resist formulation not known
    - Several species can have the same mass
  - Peaks due to Xe pollute the spectra
    - Xe<sup>+</sup>(132) ; Xe<sup>2+</sup>(66) ; Xe<sup>3+</sup>(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/cm<sup>2</sup>  
 Integrated Power density = 8.3 kJ/cm<sup>2</sup>



## XPS characterization



Issues to be discussed and common actions

- comparison of results on same chemical products, resists,