

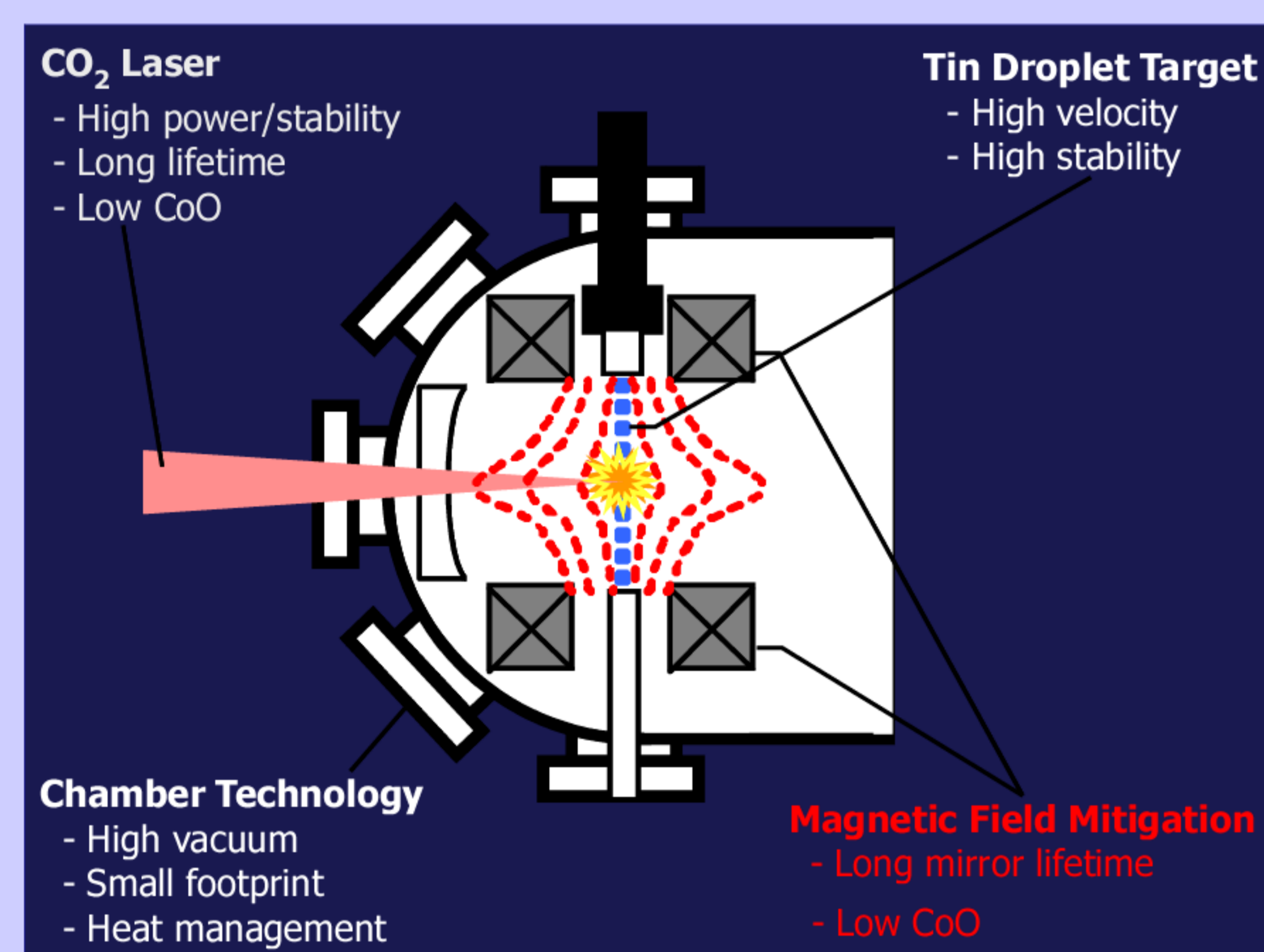
# Characterization of Various Sn Targets with Respect to Debris and Fast Ion Generation

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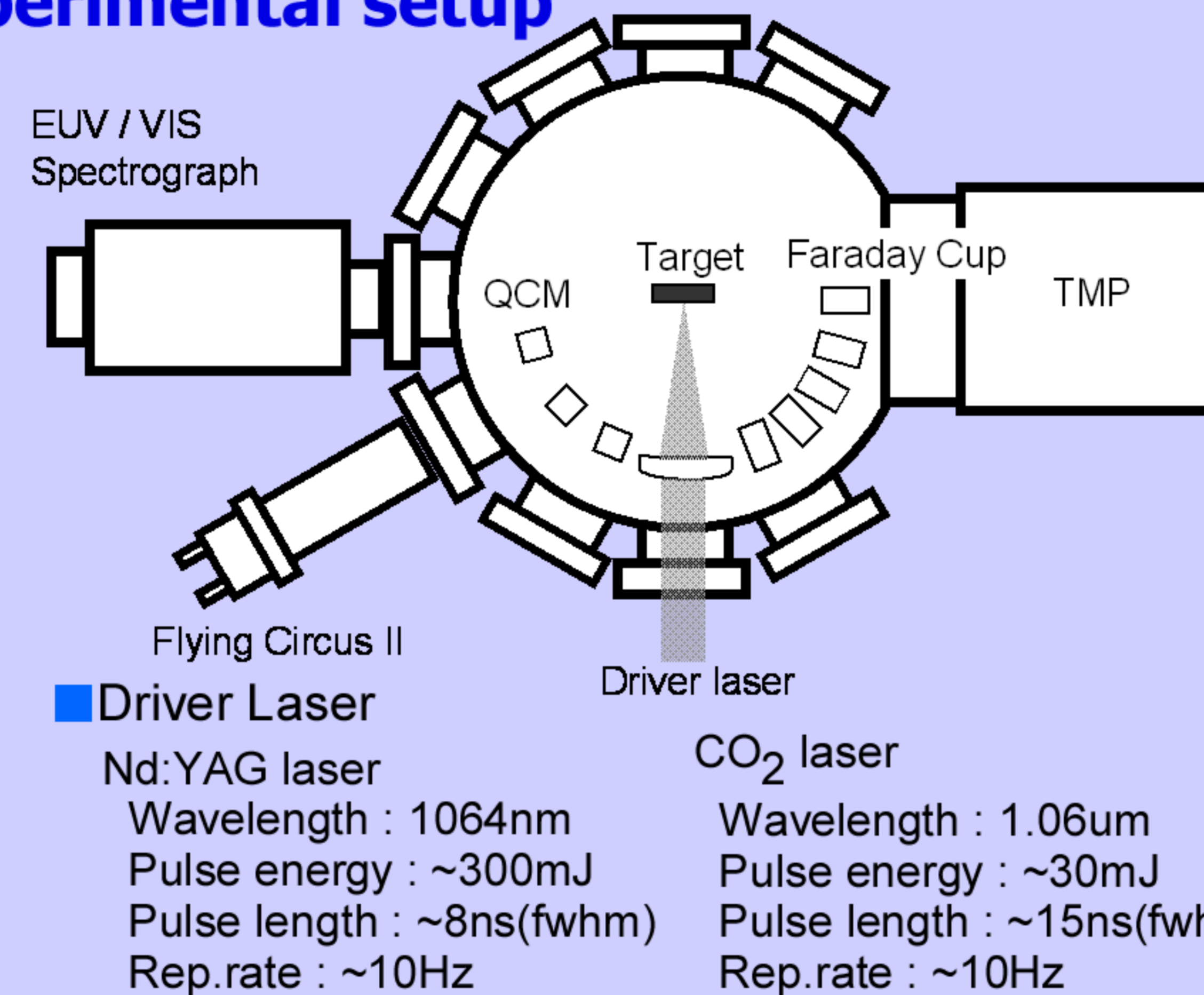
## Abstract

We evaluated Sn debris generated from a CO<sub>2</sub> laser (10.6um) and a Nd:YAG laser (1064nm) plasma. Experiments were performed with bulk Sn-plates (t=1mm) and freestanding Sn-foils (t=15um). Quartz Crystal Microbalances (QCM) were used for debris analysis. We observed a drastically lower deposition for the CO<sub>2</sub> laser driven plasma compared with the Nd:YAG laser plasma. In addition, several Sn coated targets with different Sn thickness were investigated for the CO<sub>2</sub> drive laser with respect to the generated plasma debris. In general, a 100nm Sn coated glass target generated more debris than the solid Sn target. Especially, we observed for the Sn-plate target that the deposition rate is smaller than the erosion (sputter) rate caused by the plasma ions.

## Concept of EUV Light source



## Experimental setup



- Target  
Solid Sn-plate/foil, Sn coated glass/copper
- Electromagnet  
Magnetic field : 0 ~ 1.1T (center)  
Coil spacing : 50mm
- Chamber pressure : 10<sup>-2</sup>~10<sup>-3</sup>Pa
- Evaluation  
EUV energy : Flying Circus II  
Debris (deposition / erosion)  
: Quartz Crystal Microbalance  
: Si, Mo/Si witness plate  
Fast Ion : Faraday Cup

## Conclusion

■ Basic evaluation of debris and ion generation from a Sn plate irradiated with a CO<sub>2</sub> laser and a Nd:YAG laser was performed with several QCMs and Faraday cups.

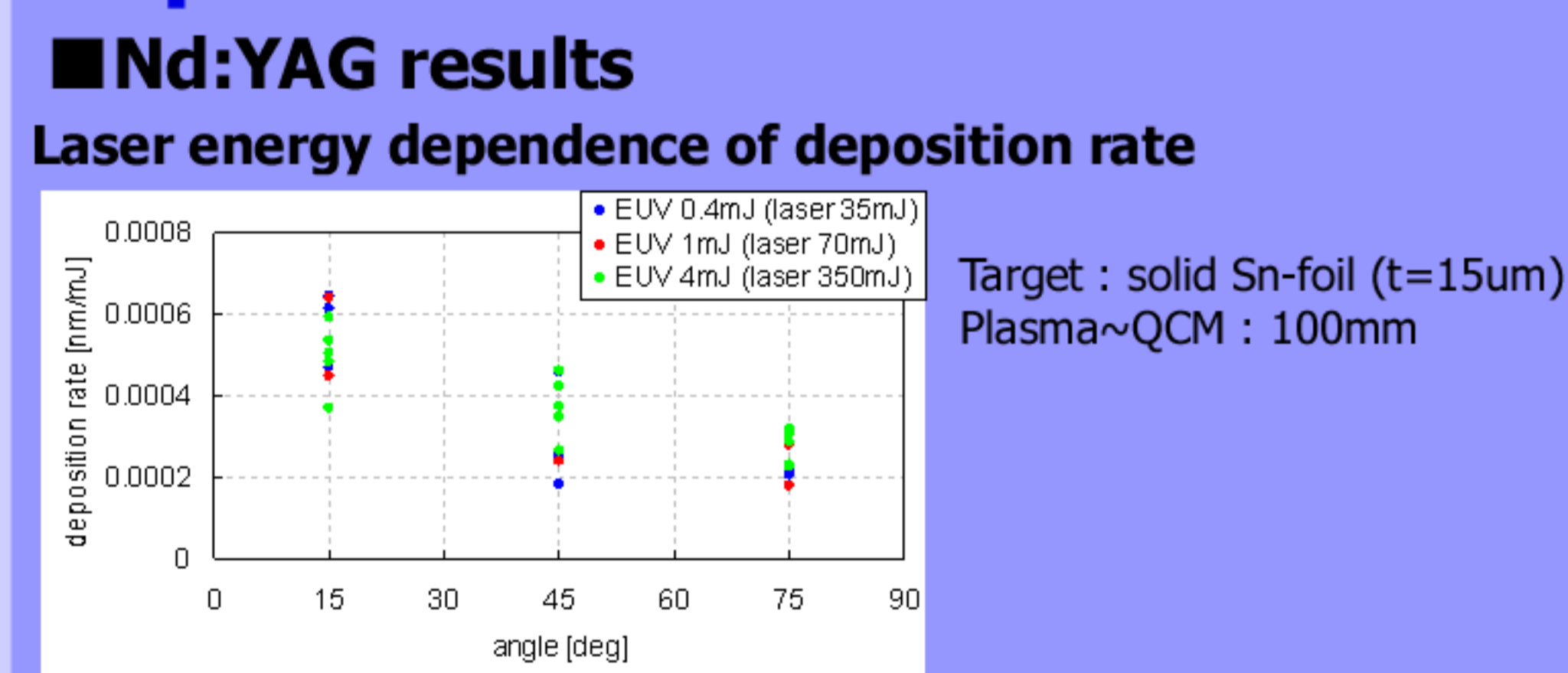
→ We observed erosion for the CO<sub>2</sub> drive laser and deposition for the Nd:YAG drive laser. A largely different amount of molten debris is the reason for this observation.

■ Several Sn coated targets with different Sn thickness were investigated with respect to the generated debris for the CO<sub>2</sub> laser.

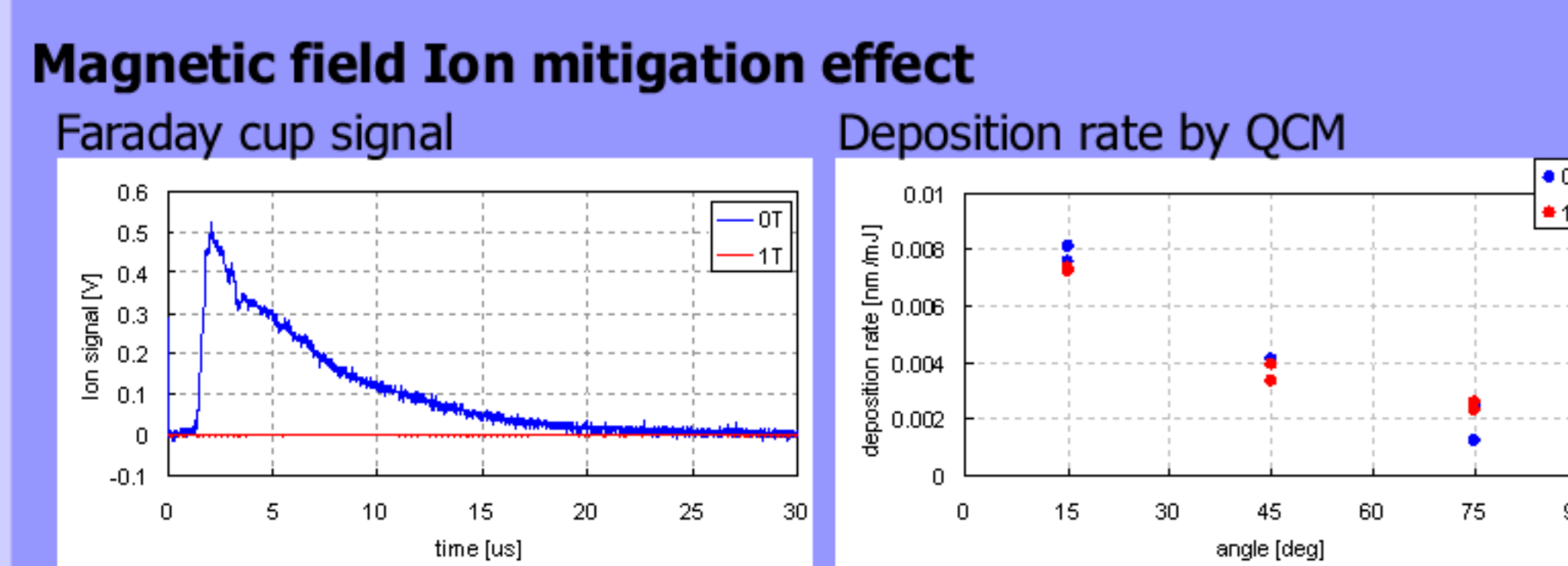
→ We confirmed a mass limiting effect by the evaluation of these Sn targets. The main difference was observed between the bulk Sn target and the coated Sn targets. Especially, the measured deposition for a 100nm Sn coated glass target is larger than for the bulk Sn target.

■ In the future, more sensitive surface analysis has to be done in order to confirm the increased mirror lifetime expectation.

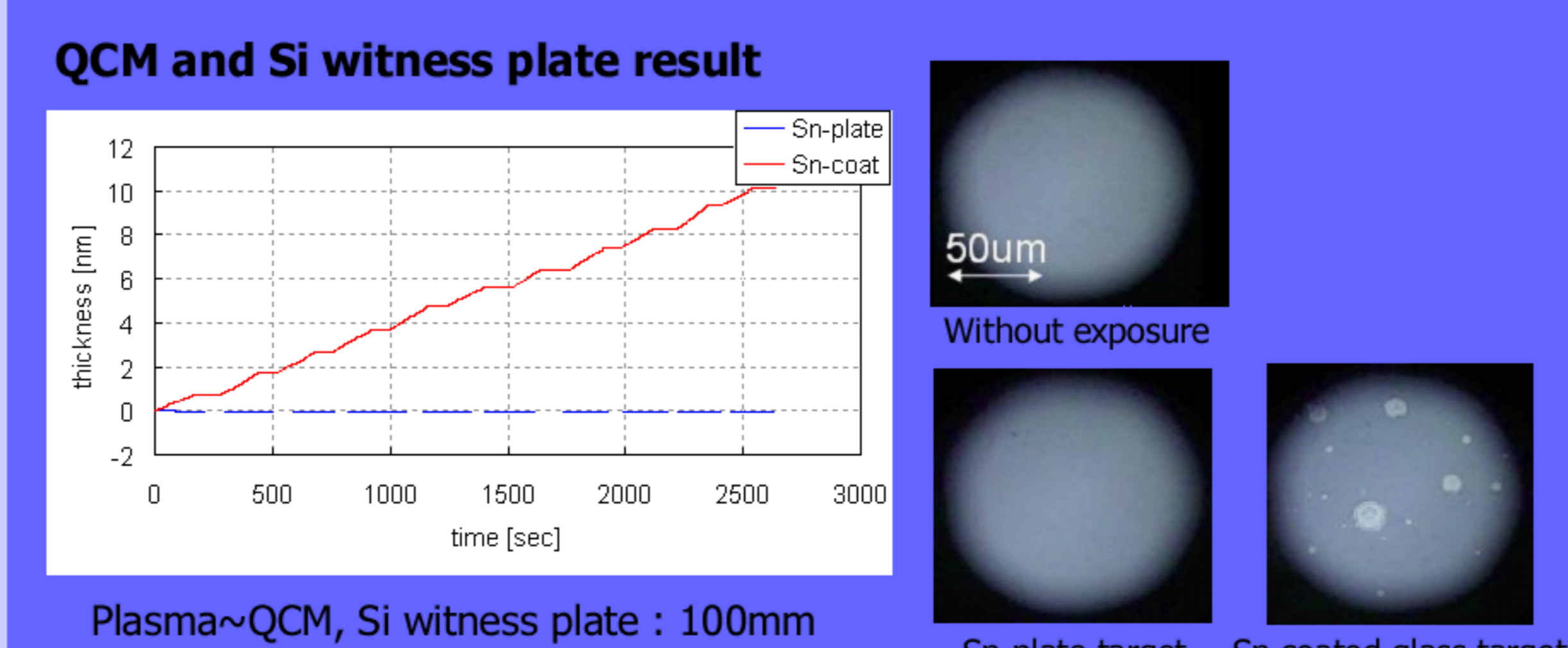
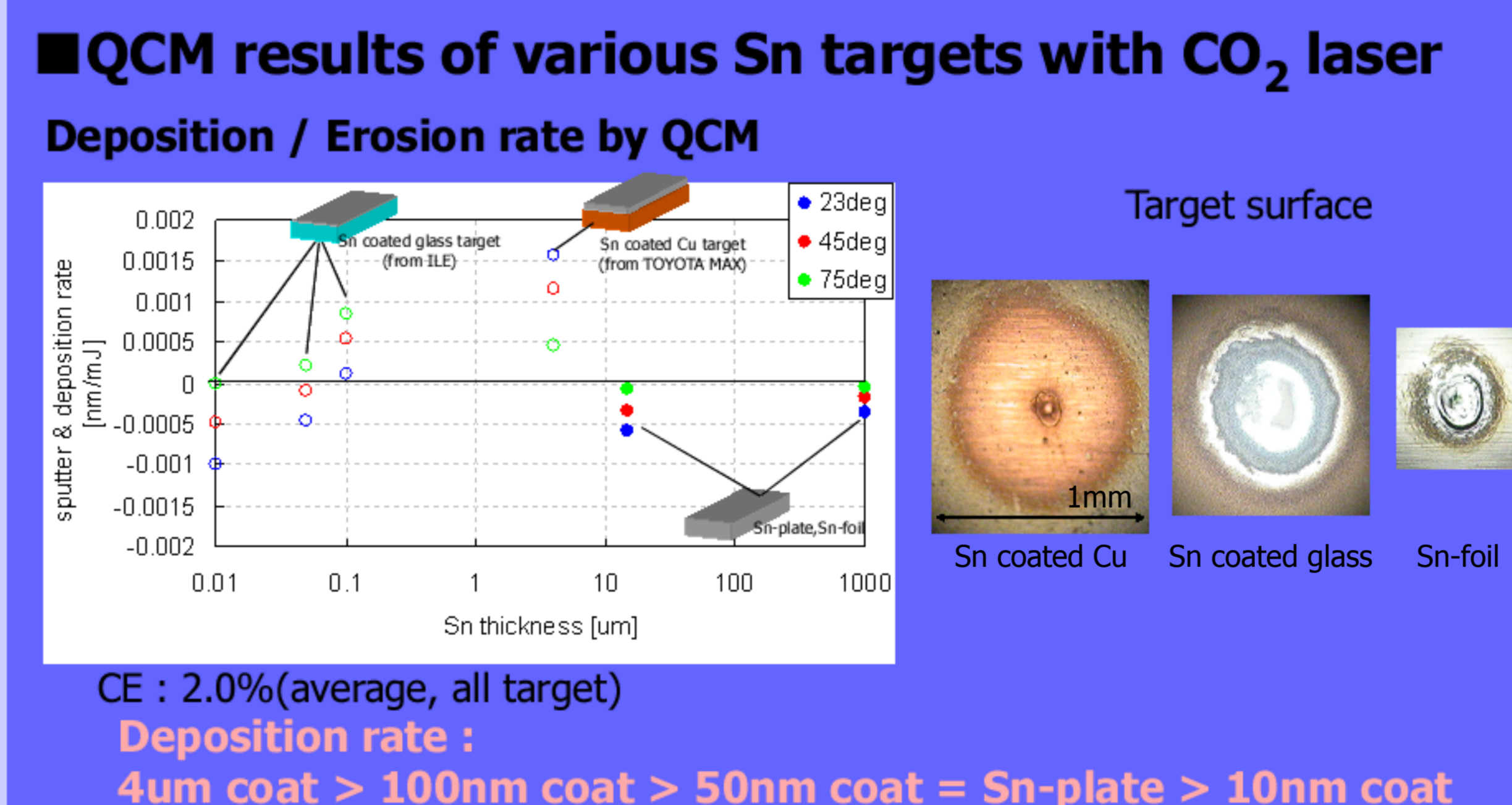
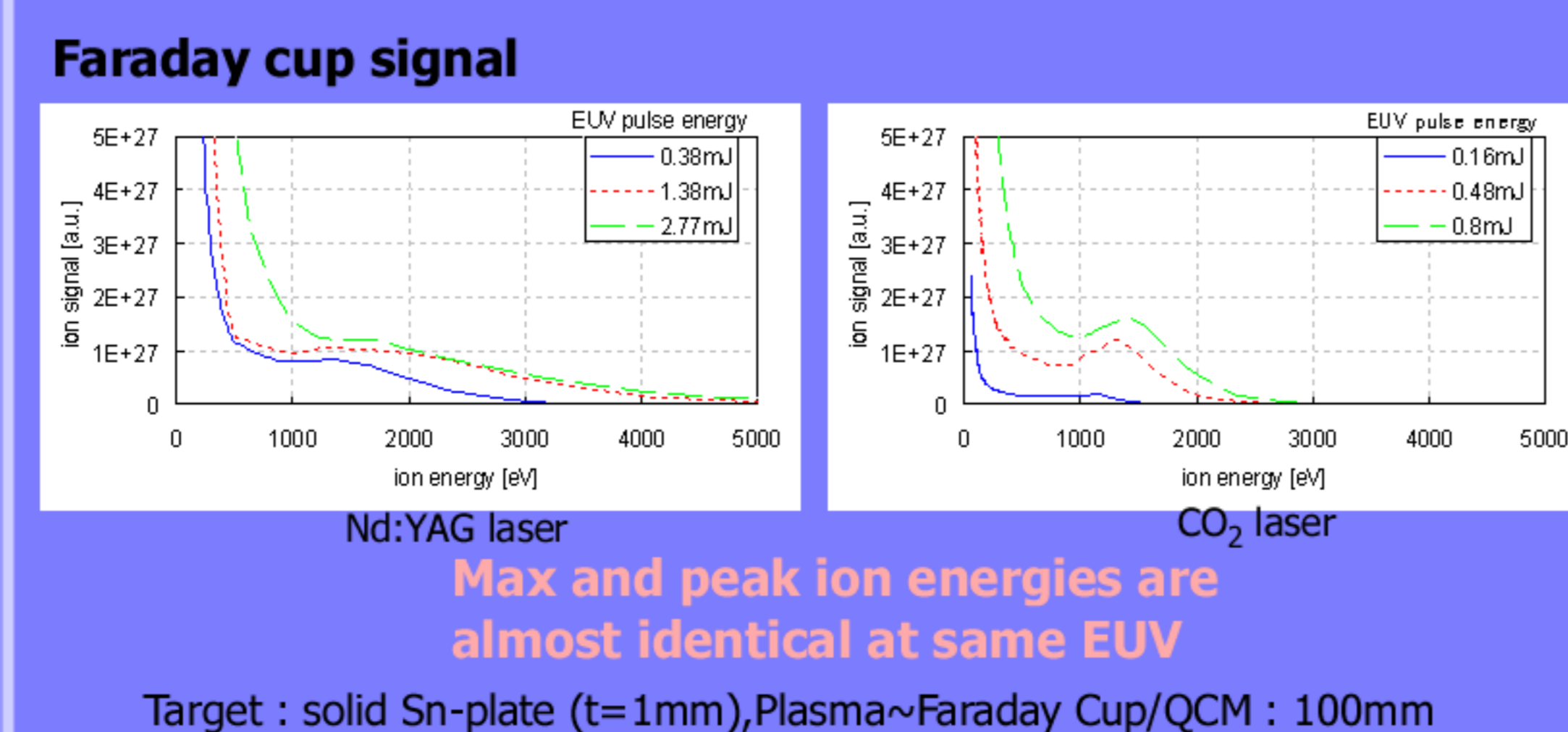
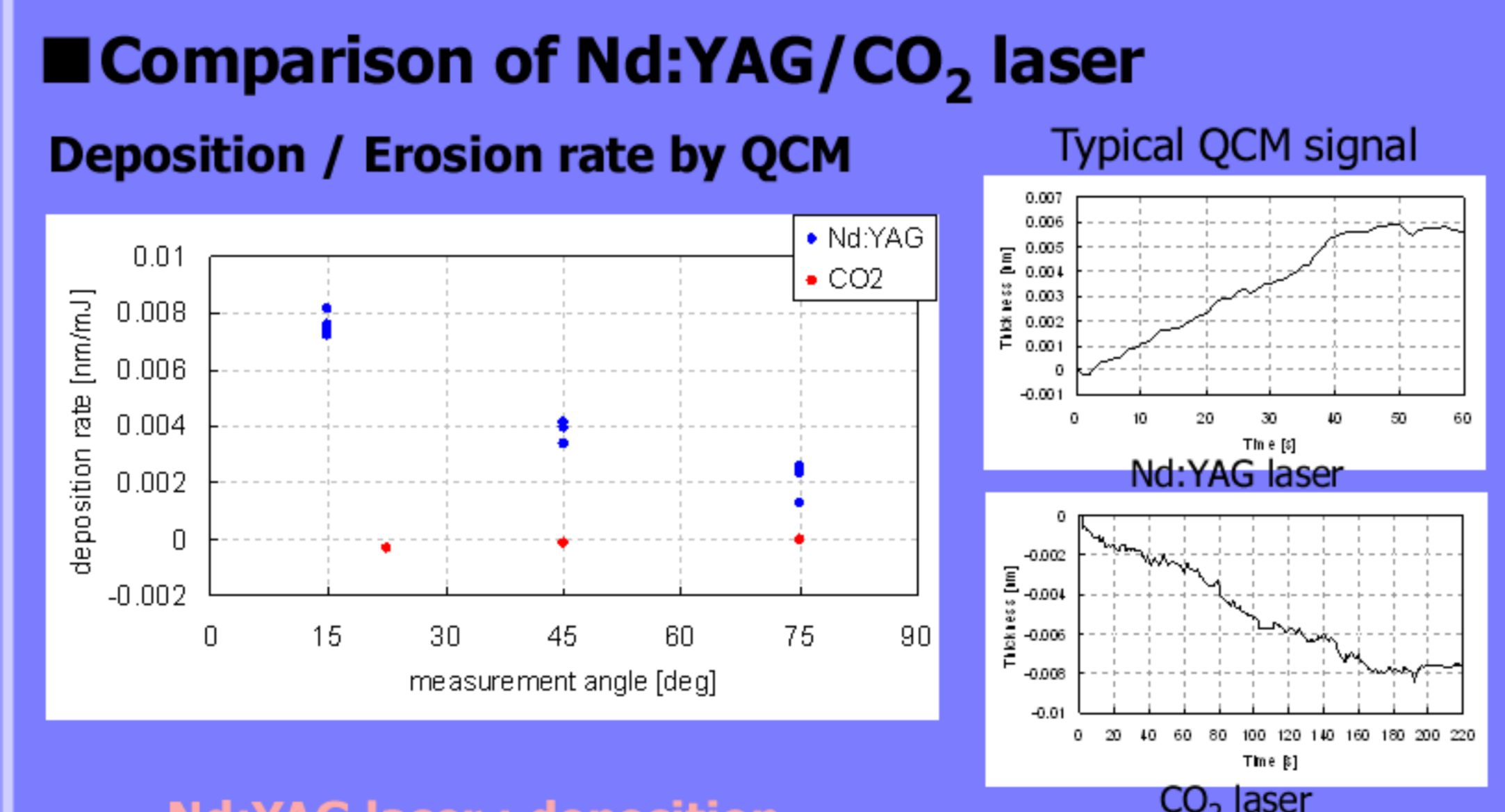
## Experimental Results



Deposition rate is constant (EUV pulse energy:0.4-4mJ)  
 Deposition rate = Deposition thickness/EUV pulse energy(2%BW 2nsr)[nm/mJ]



**Ion deposition below 1%**  
 The ion signal decreased below Faraday cup detection limit (about 3 orders) with a magnetic field of 1T. (See Faraday cup signal)  
 On the other hand, the QCM signal does not change. (See deposition rate)



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