

Deterministic fabrication of reflective mirrors by FIB

Jining Sun

**Heriot-Watt University, Edinburgh, EH14 4AS,
UK**

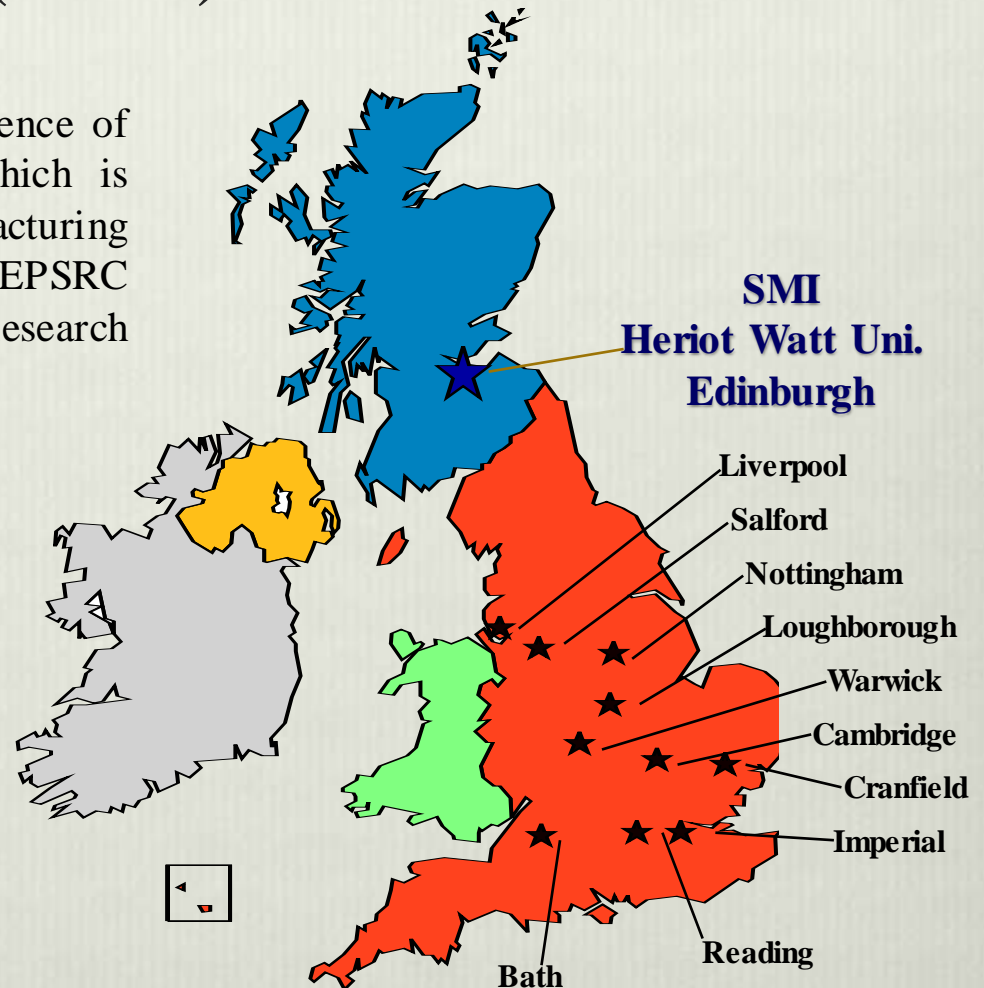
The Scottish Manufacturing Institute (SMI)

The School of Engineering and Physical Science of Heriot-Watt University hosted the SMI, which is within one of the 16 Innovative Manufacturing Research Centres (IMRC) founded by UK EPSRC (Engineering and Physical Sciences Research Council).

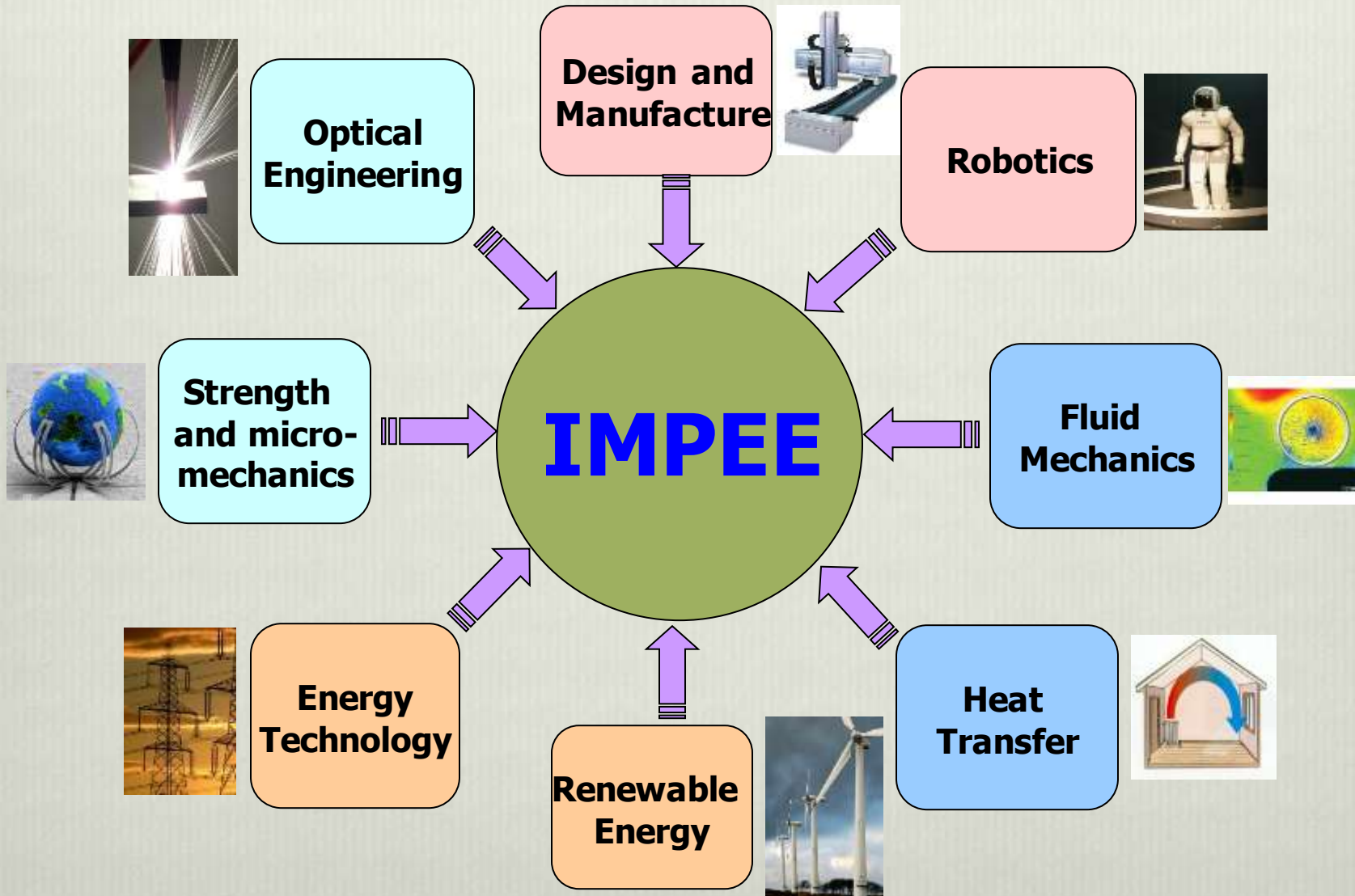
Research Grant

2003 ~ 2007: **£4.2M**

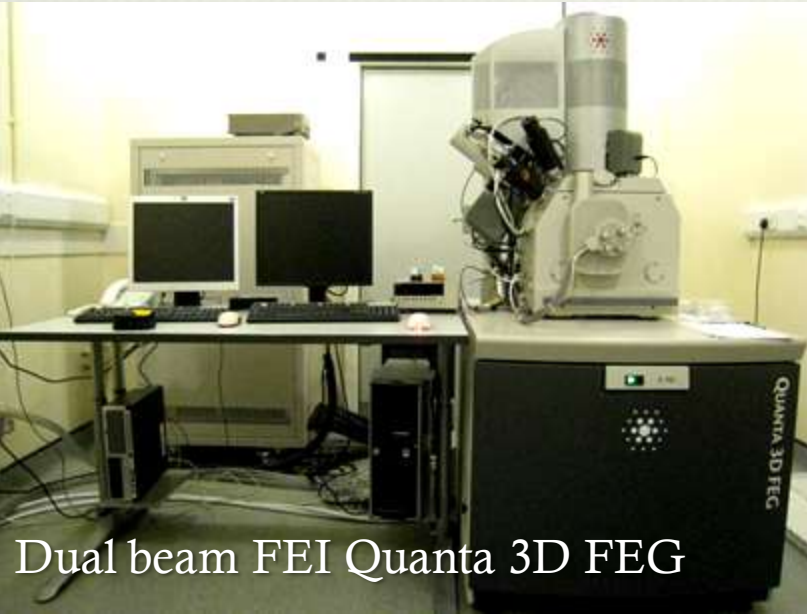
2008 ~ 2013: **£7.2M**



Disciplines in the Institute of Mechanical, Process and Energy Engineering



Design and Manufacture



Dual beam FEI Quanta 3D FEG



Virtual reality lab

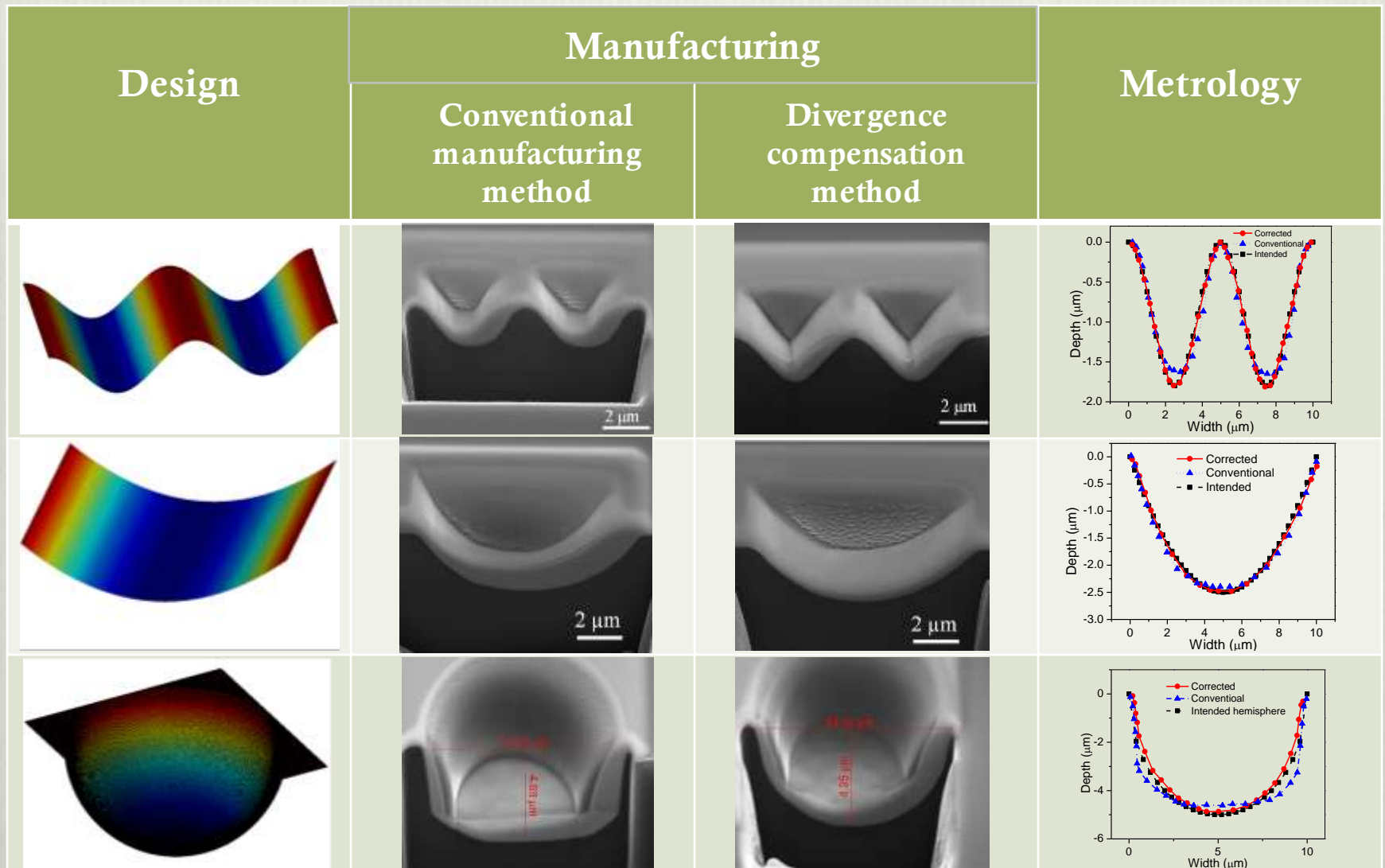


Class 1000 cleanroom for microsystems



Virtual manufacturing

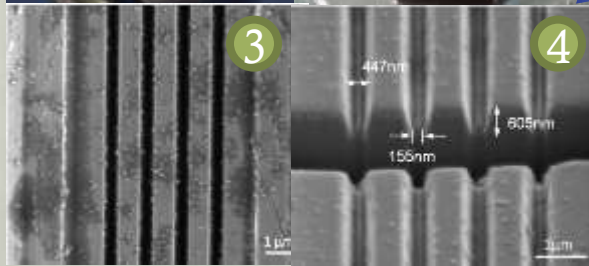
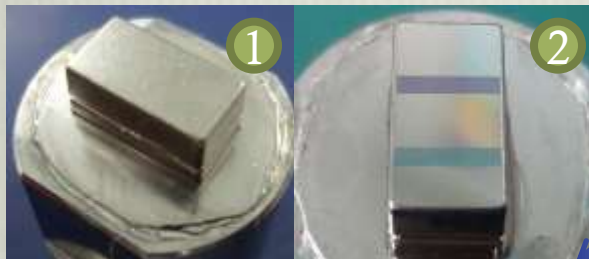
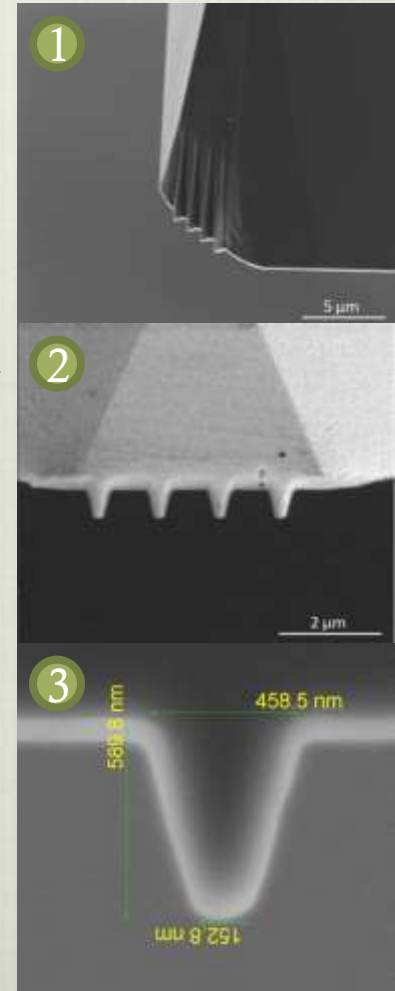
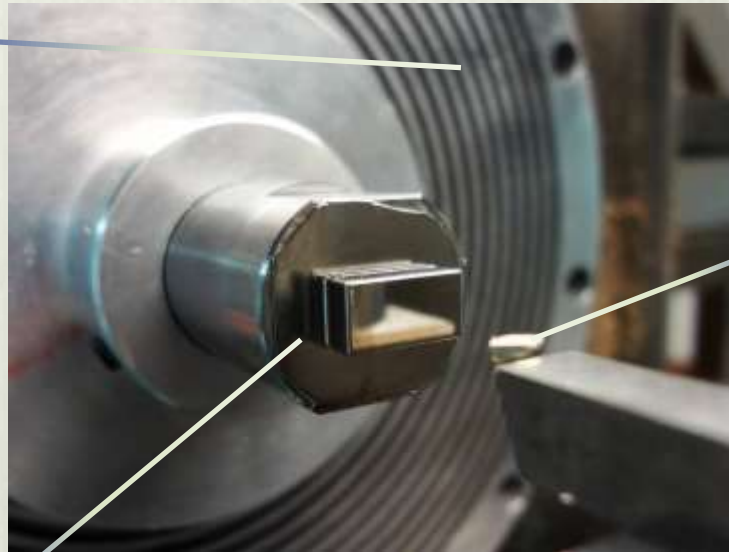
Design → Manufacture



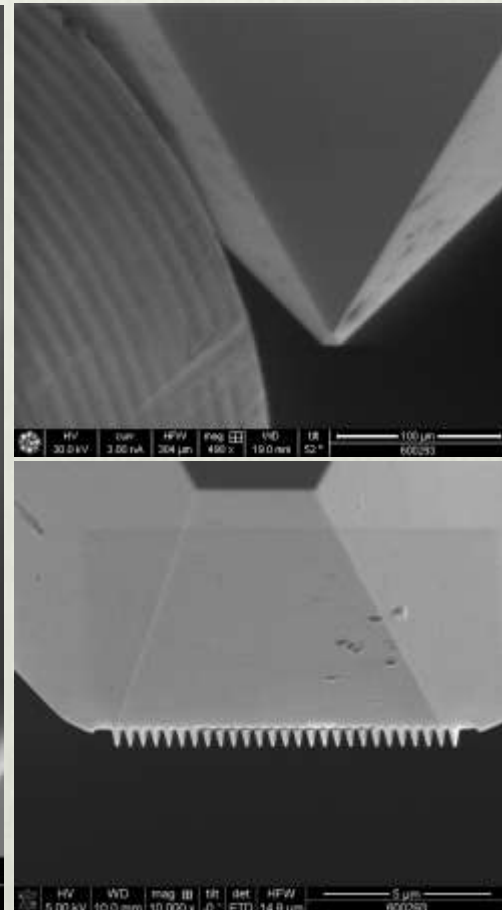
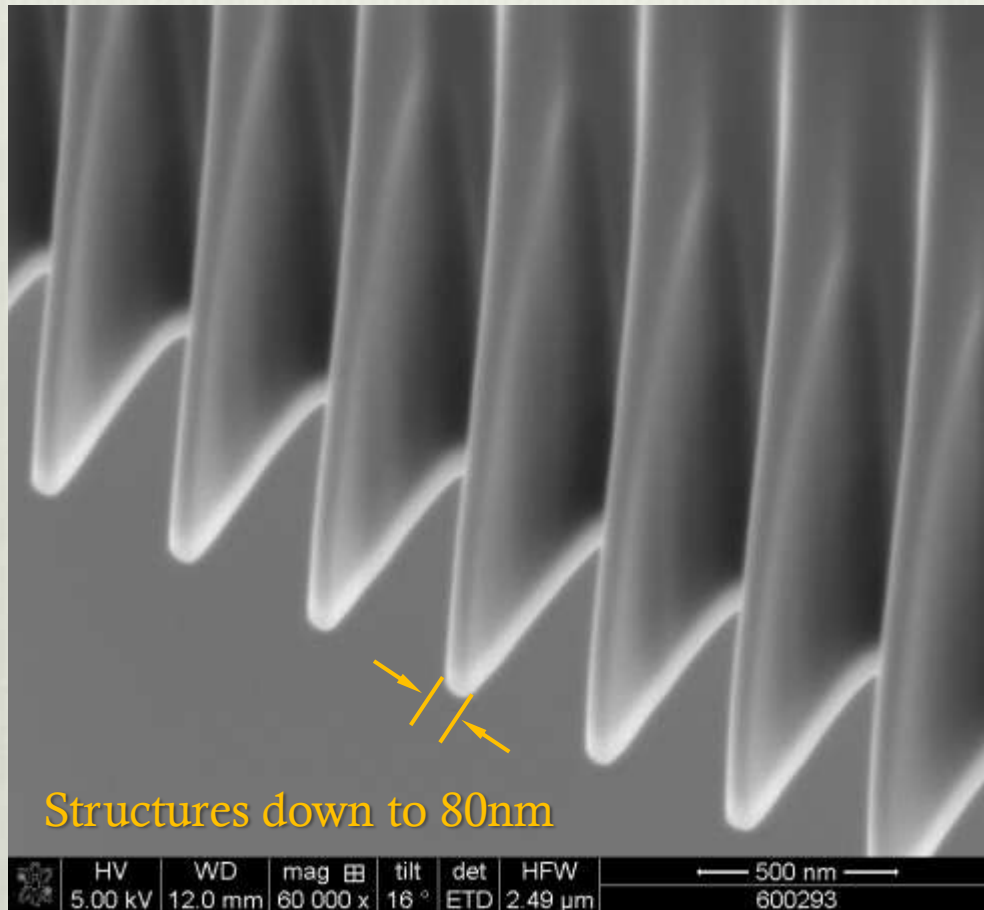
FIB caved diamond cutting tools



Precitech Freeform 700



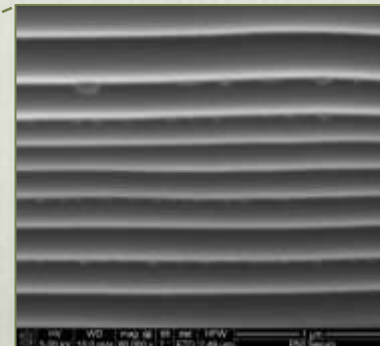
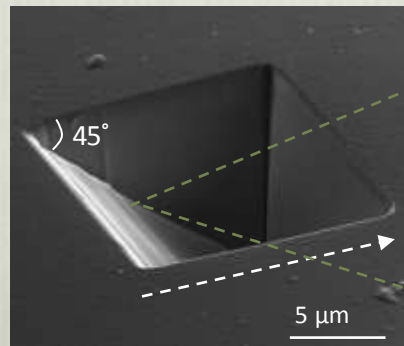
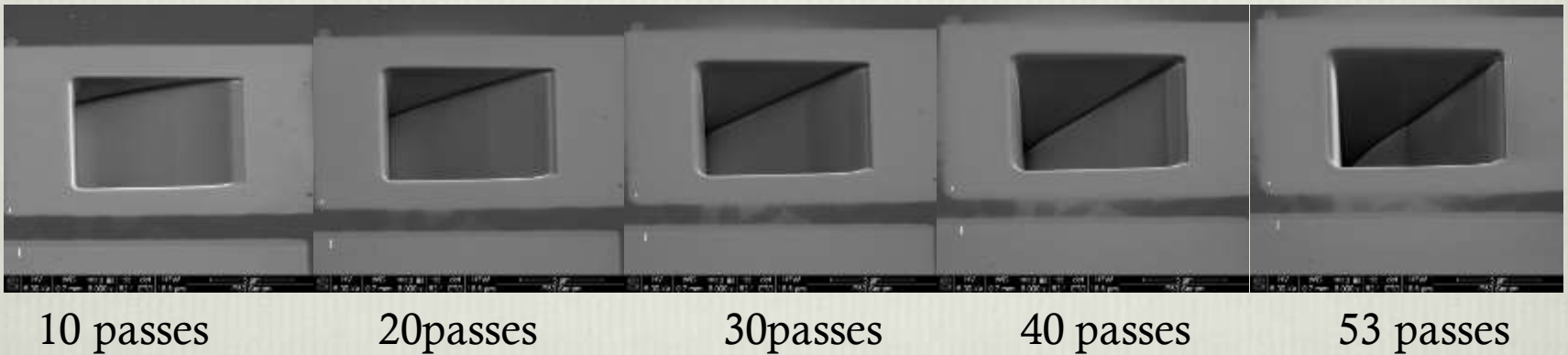
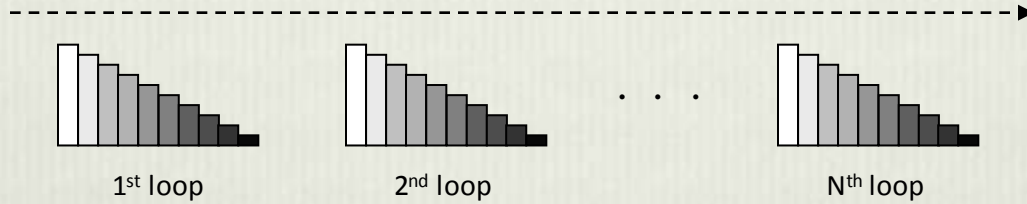
FIB caved diamond cutting tools



Challenges

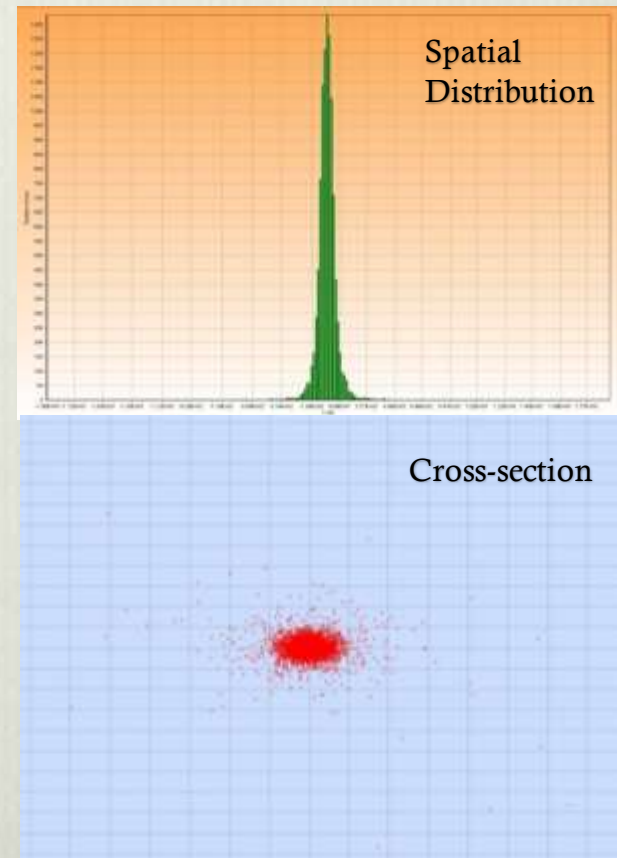
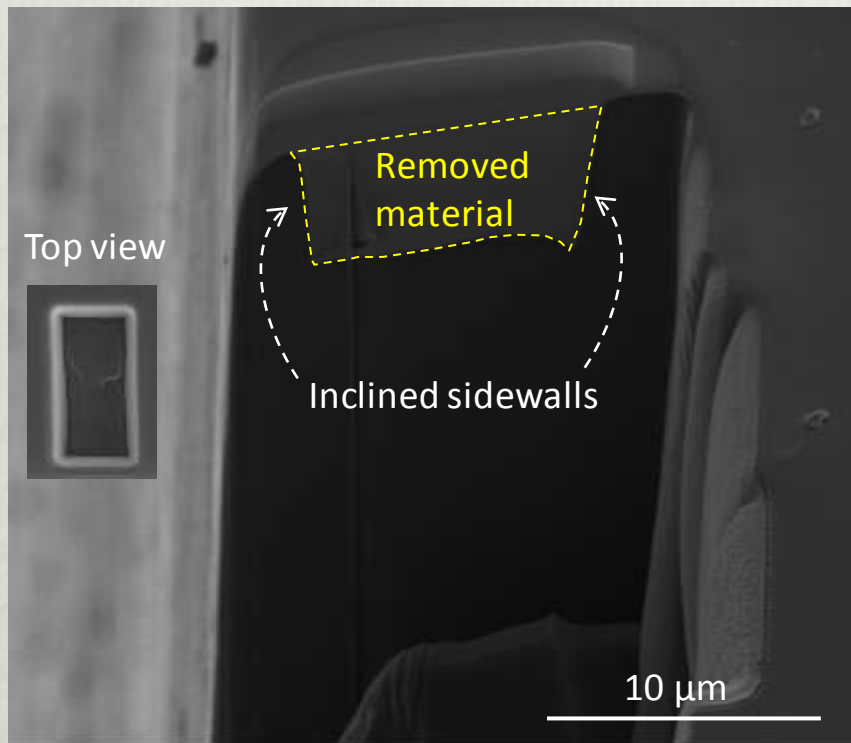
- ❖ Angular dependence of sputter yield
- ❖ Gaussian beam distribution (overlap & beam skirt effect)
- ❖ Redeposition effect

FIB 3D machining



Ripples on the mirror

FIB 3D machining



Polishing

