



VDL Group

Strength through cooperation

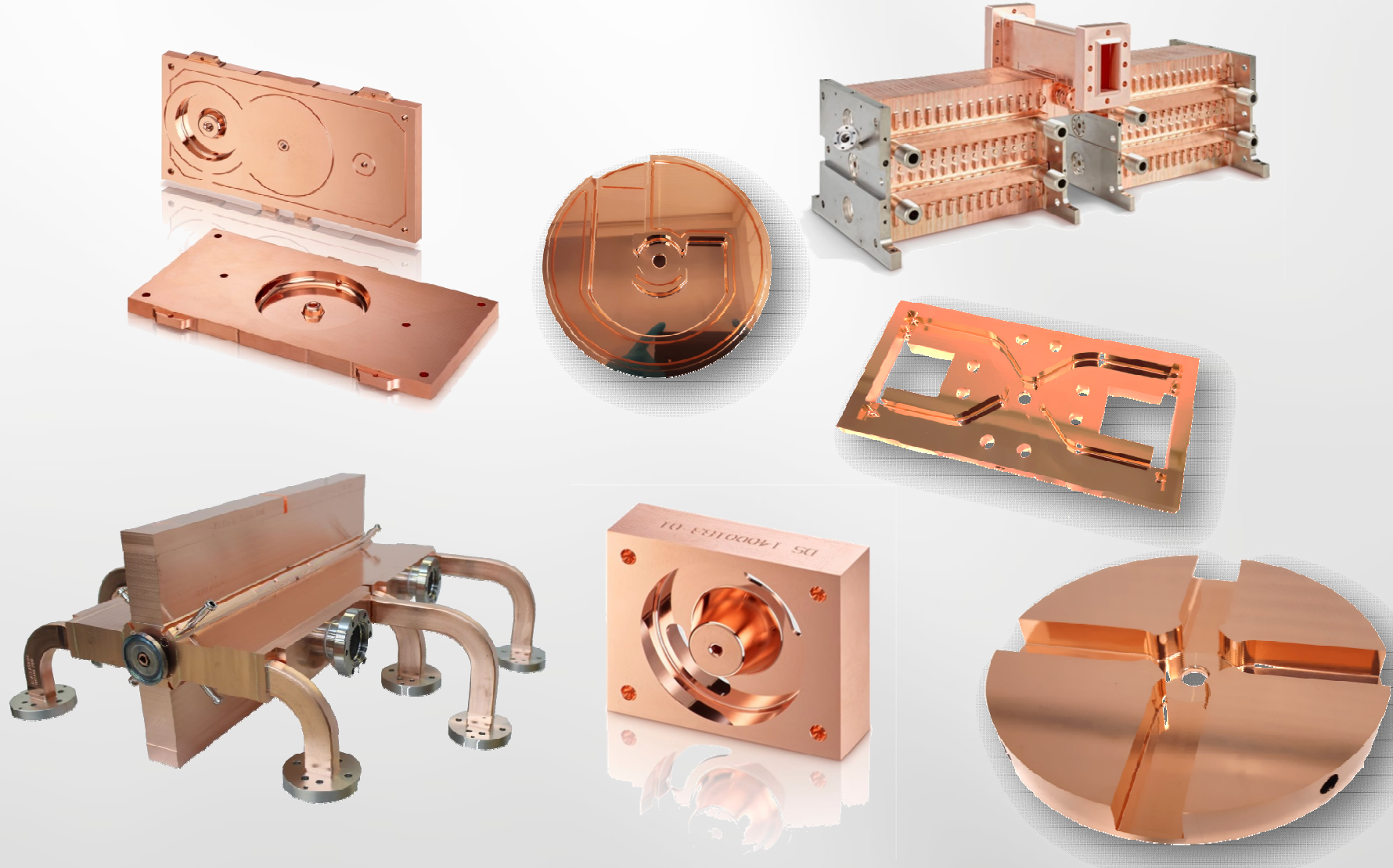
Miranda van den Berg



Courtesy SwissFEL PSI

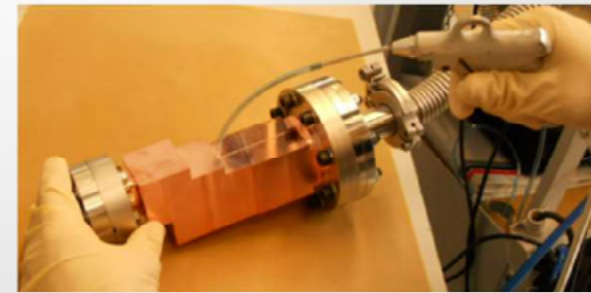
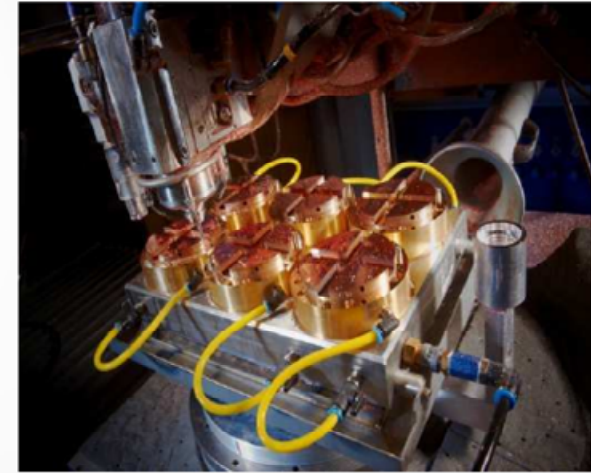
VDL ETG Science and Technology

- Space
- Astronomy
- Accelerators



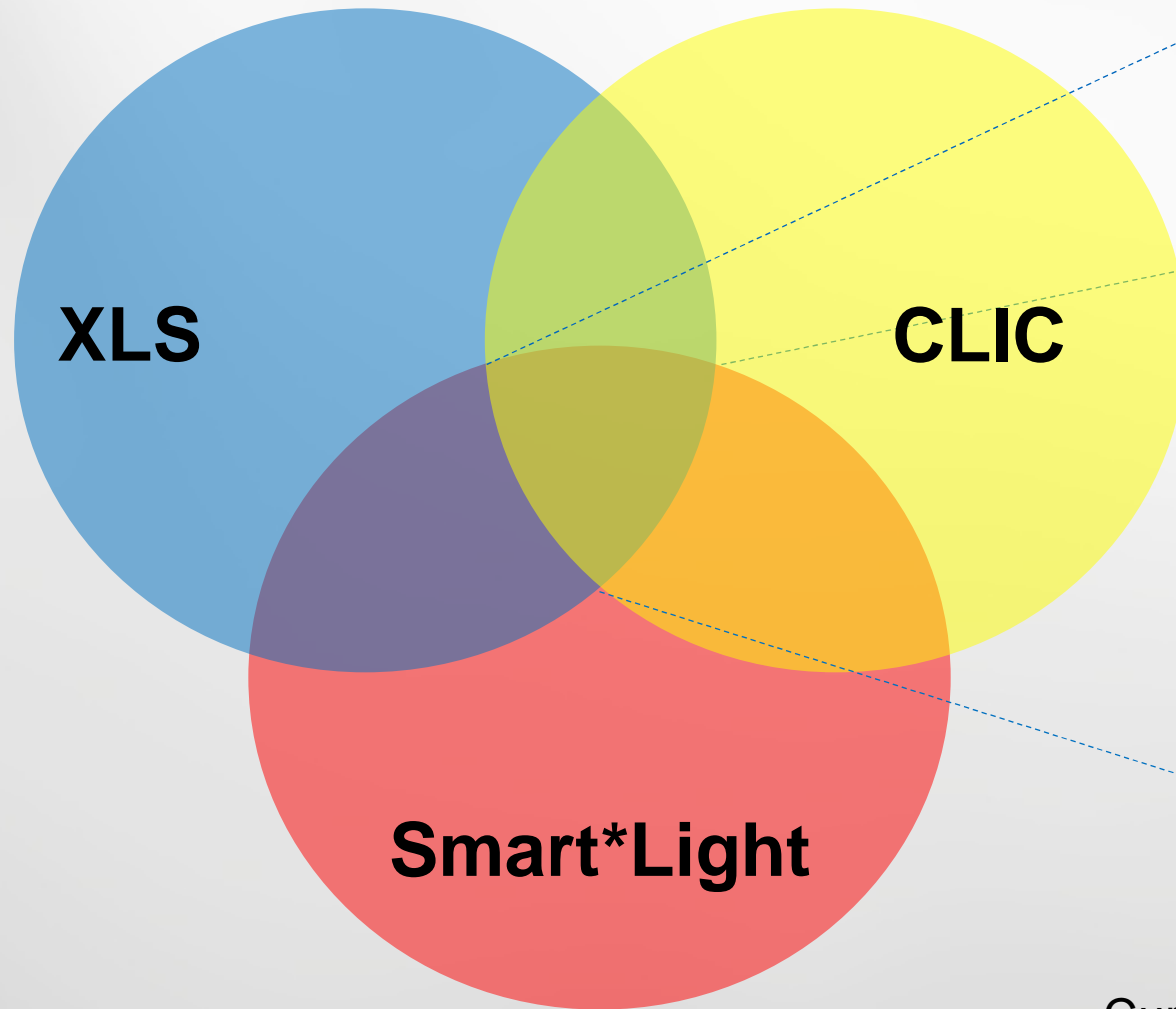
Most relevant competences are in-house

- High Precision Machining (HPT)
- Ultra High Precision Machining (UPT)
- Metrology
- Sheet Metal
- Welding/Vacuum Brazing
- Vacuum Technology
- Clean room assembly
- Electromagnetic technology
- Functional frames
- Complex Assemblies
- Cleaning
- Functional qualification
- Engineering
- Industrialization & Redesign



Synergy

Multiple X-band projects



- X-band
- Normal conducting
- High gradient
- Cu-OFE
- Brazing

- Linac
- Pulse-compressor
- Pumping ports
- Bi-couplers

Current: Copper components and their (sub)assemblies
Future: High power tested modules and systems

Current academic projects fuel commercial projects

VDL involvement

- **Smart*Light**

- System design
- Manufacturability
- Business development

- **CERN CLIC**

- “Technical Questionnaire for Industrialization study of CLIC 380 GeV accelerating structures production”

- **XLS**

- **WP4.2: Industrialisation**



Comparable/overlapping development involvement

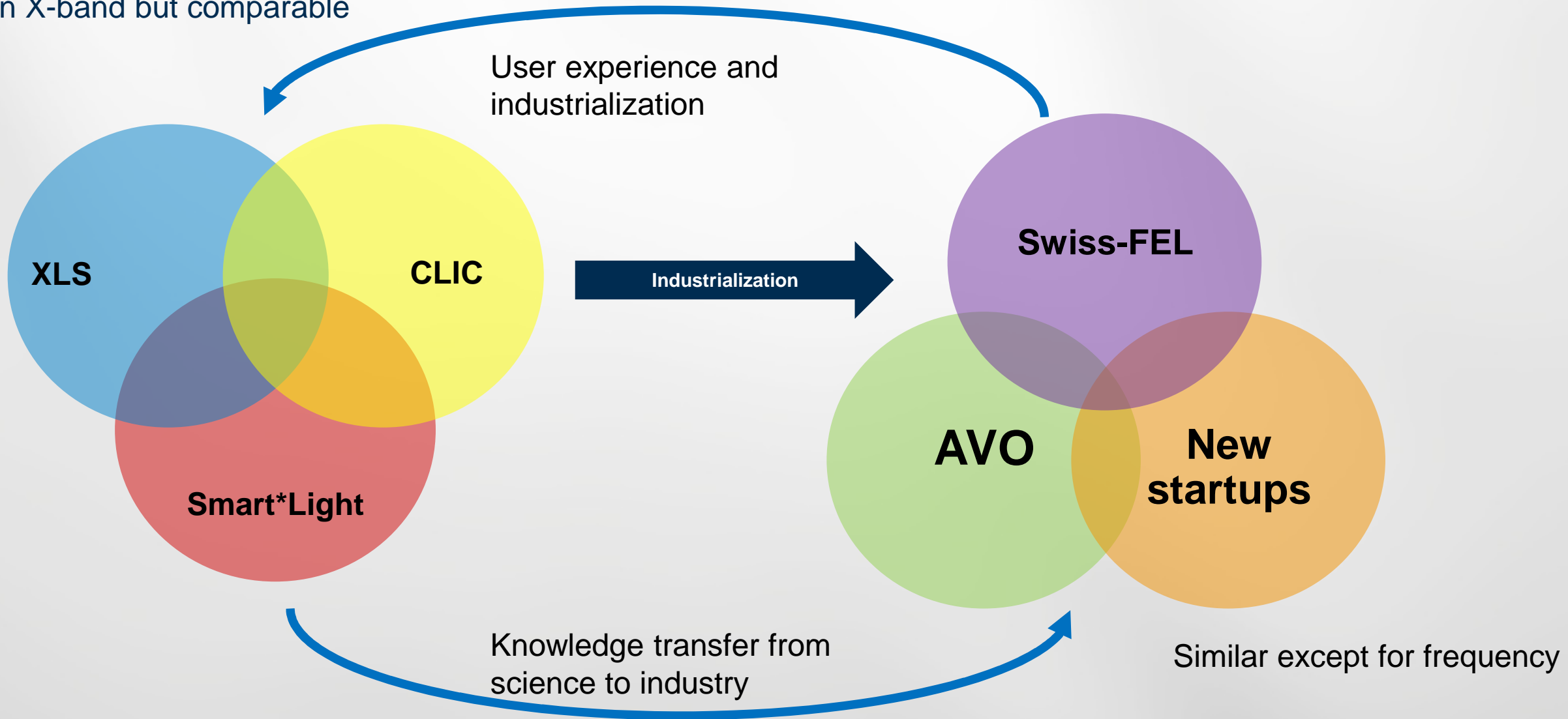
→ VDL to combine as much as possible

→ Projects to benefit from gained knowledge

→ Faster route to standardization in X-band technology

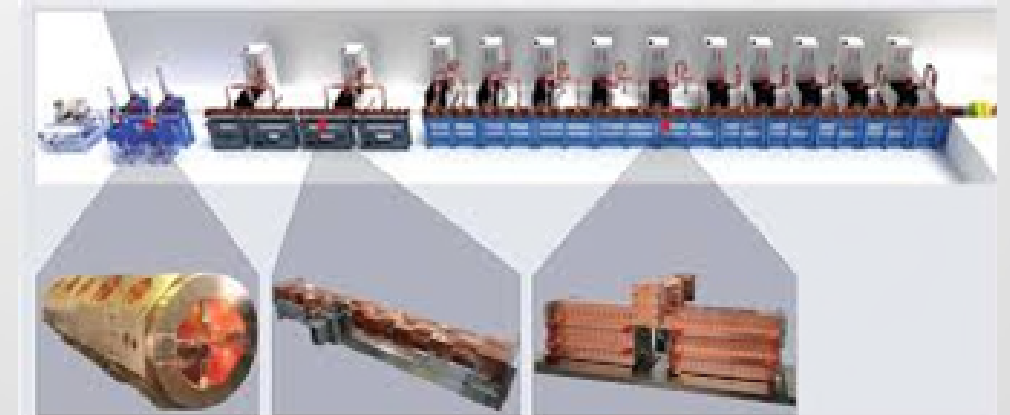
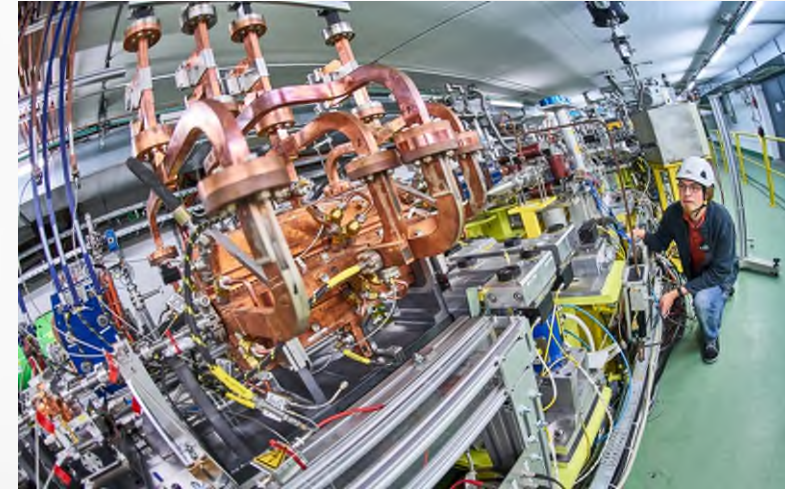
Spin-offs

Non X-band but comparable



Requests to industry from spin-offs and start-ups

- Manufacturability
- Standardization → Modular design
- Series production on module level → system integrator
- Testing
- Cost optimization
- Business development

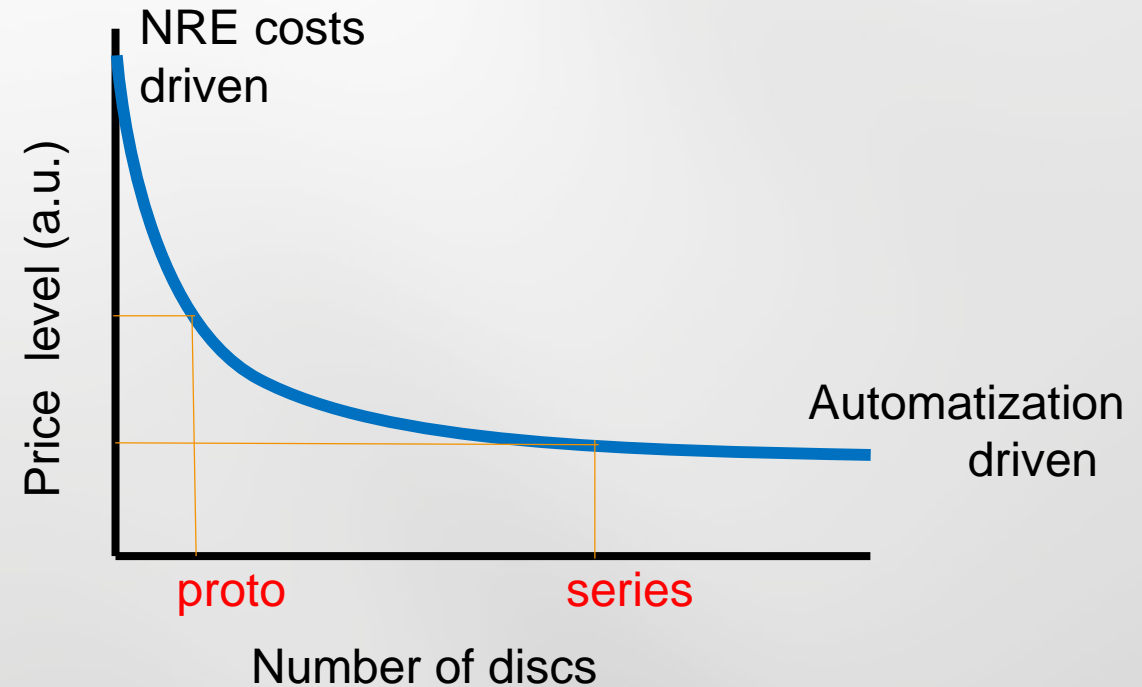
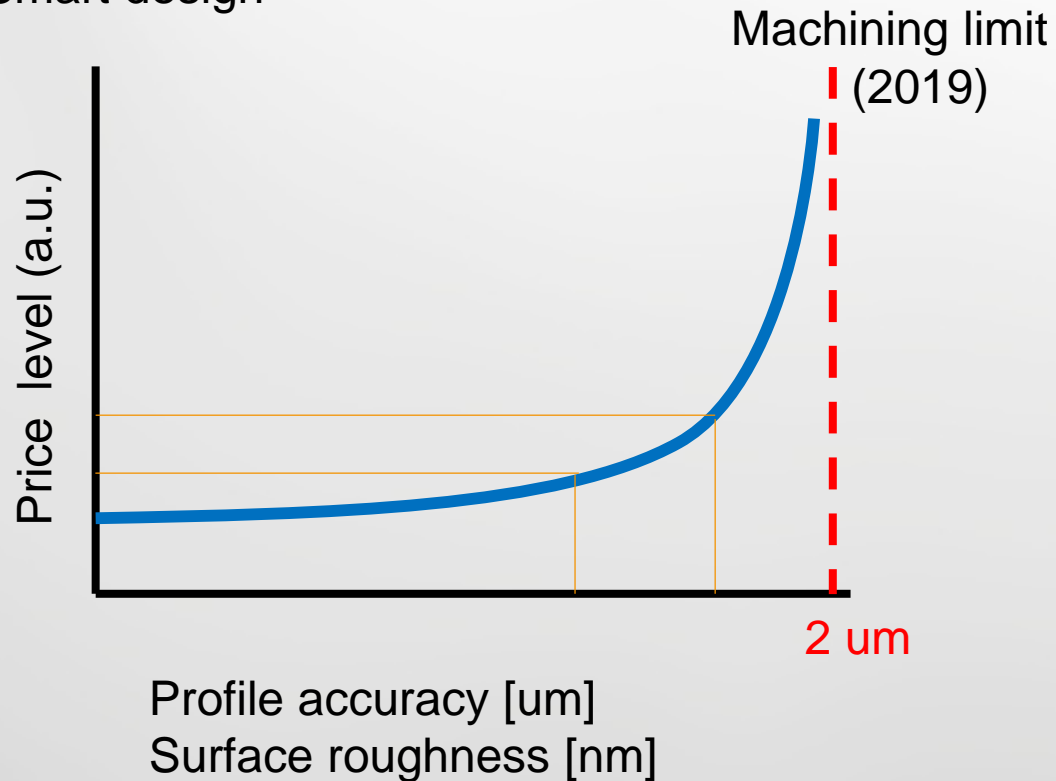


Contribution to XLS;WP 4.2 Industrialization

- Investigate design of mono-parts i.e. check manufacturability, industrialization
- Assembly breakdown of brazed sub-assemblies
- Cost driver breakdown of entire RF-section
- All limited to functional RF parts i.e. **accelerator**, pulse-compressor, bi-couplers, pumping ports, splitters

Cost drivers mono-parts

- Percentage of dimensional control i.e. 3D CMM time
- Material e.g. type, treatment and batch size
- Shape/profile accuracy and surface roughness
- Size of production volume
- Smart design



Cost drivers accelerator assembly

- Assembly accuracy and procedure i.e. **manual stacking** (CLIC) v.s. **robot** (SwissFEL)



- Industrial maturity of joining technique i.e. **bonding** v.s. **brazing**
- Dimensional control i.e. CMM time
- RF-tuning i.e. **cavity-by-cavity tuning** (CLIC) v.s. **accelerator stack tuning** (SwissFEL)
- RF conditioning

