

B4 - Development of microsystem enhanced machine tool structures for lightweight and accuracy optimized (LEG²O) frames – Challenge

▶ Motivation

- ▶ Development of an innovative concept for machine tool frames capable of adapting to continuously varying production tasks, - requirements and - locations
- ▶ Provision of advanced functionalities of the single modules, e.g. identification, communication and distributed sensing as key requirements for hardware concept

▶ Challenge

- ▶ Fusion of microsystem technology (MST) based systems with machine tool (MT) components
- ▶ Alignment of use times of MST and MT components considering effects of aging, failure and innovation cycles

▶ Sustainability aspect

- ▶ Reconfigurable machine tool structures, allowing for a more intensive, effective use of equipment
- ▶ Flexibility and mobility of production systems through moderate module sizes
- ▶ Exchange, upgrade or repair depending on technical condition and market demands
- ▶ Implementation of EcoDesign strategies for electronics development

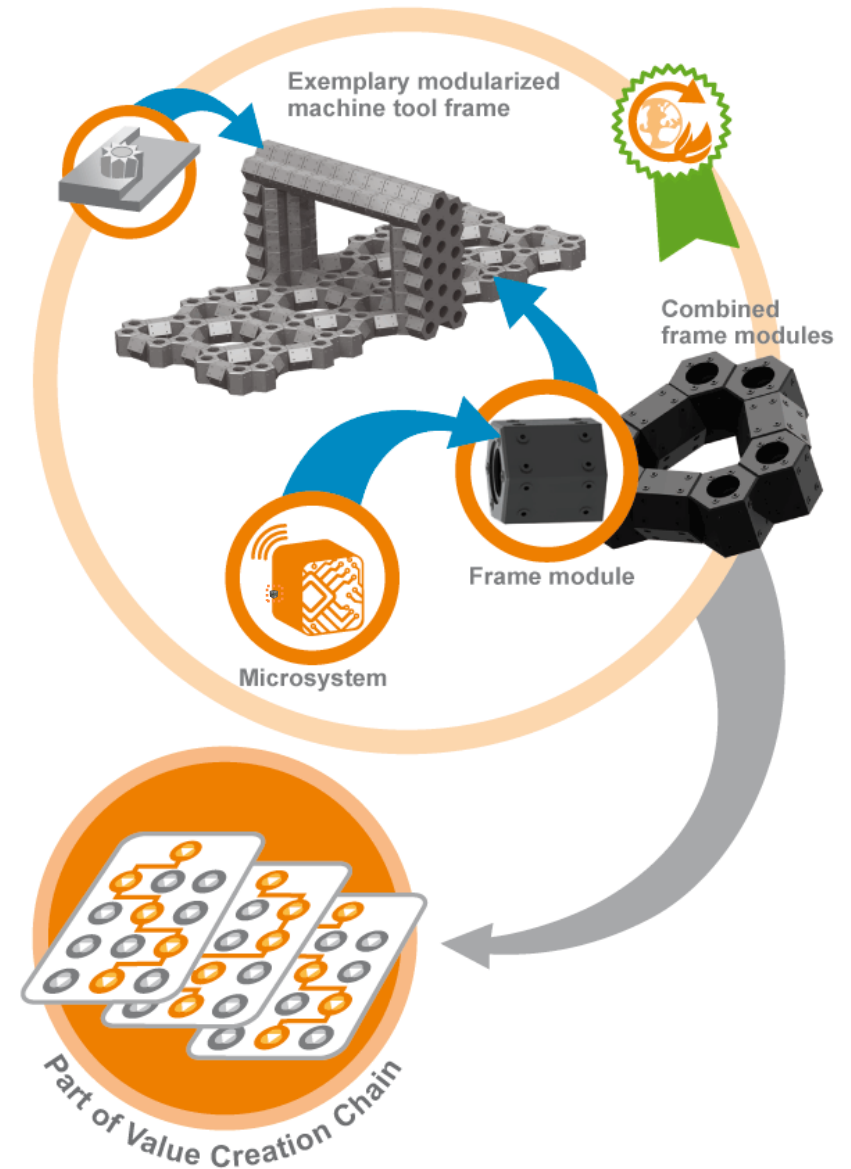
B4 LEG²O – Approach

▶ Concept

- ▶ Replacement of conventional monolithic frames by lightweight, accuracy optimized and reusable frame modules
- ▶ Active and passive modules to compensate thermally and mechanically induced or structural deformations
- ▶ Microsystem technologies to provide enhanced functionalities

▶ Value creation

- ▶ Flexibility with respect to application scenario
- ▶ Cost reduction along with environmental improvements through more intensive and/or prolonged use times of equipment
- ▶ New perspectives with respect to mobility, scalability and mutability of production systems



B4 LEG²O – Results 2012

- ▶ **Microsystem technology concept**
 - ▶ Prototypical sensor system setup for first evaluation of measurement concepts and energy saving potentials
 - ▶ Provision of data from distributed sensor nodes via central PC, using webserver as interface for MST/MT
 - ▶ Investigation of environmental impacts of wireless sensors using indicators for toxicity and resource scarcity
- ▶ **Machine tool concept**
 - ▶ Modules must be easy to manufacture and guarantee a repeatable and easy assembly
 - ▶ Low module weight → transportability
 - ▶ Thermal, static and dynamic properties similar to monolithic frame properties
 - ▶ Side length of 200.0 mm and plate thickness of 10.0 mm
 - ▶ Honeycomb structure is favorable design

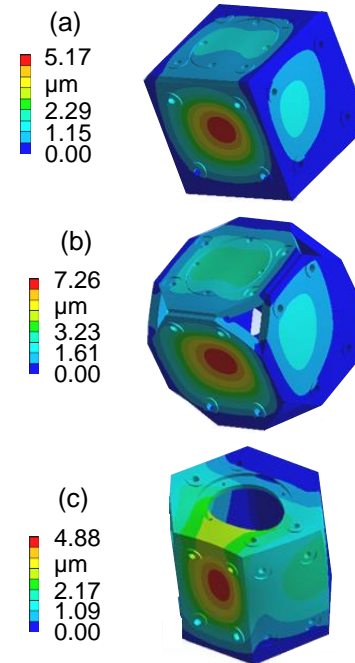


Table to assess design concepts

	Regular cube	Light-weight cube	Hexagon-comb
Weight	- 22.5 kg	+ 19.5 kg	++ 18.8 kg
Welding	-	+	-
Machinability	+	++	-
Stiffness	+	-	++
Fill damping material	+	-	+

Deflection simulation results (a) regular cube, (b) lightweight cube (c) honeycomb