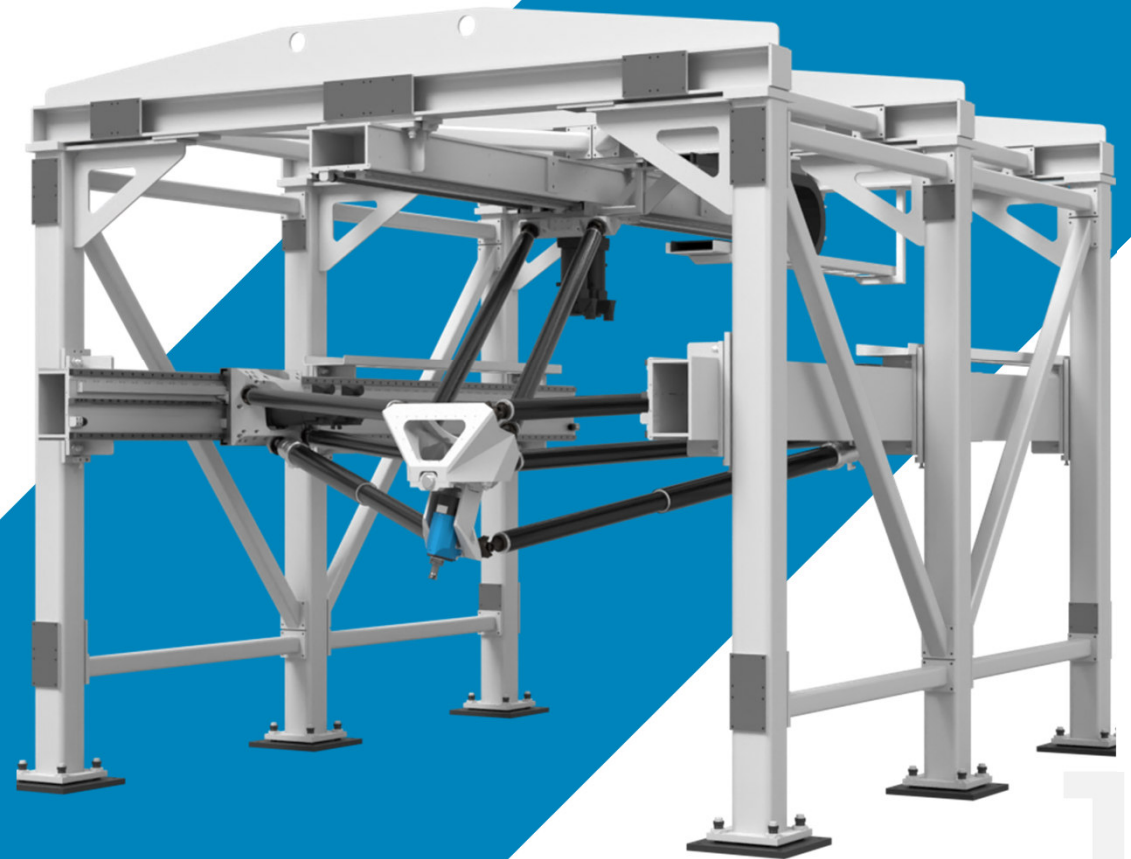


# Product presentation

## Parallel Kinematic Module

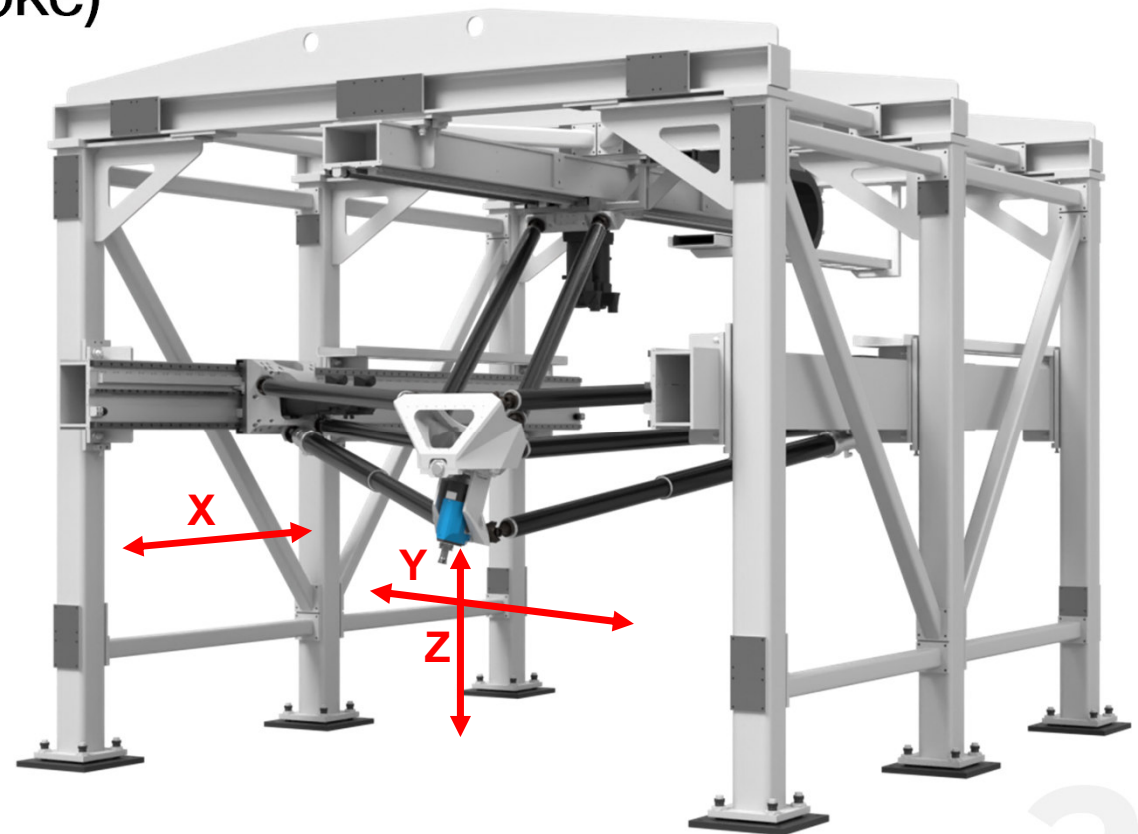
Closing the gap between machine tools and serial  
arm robots



# Range of Motion

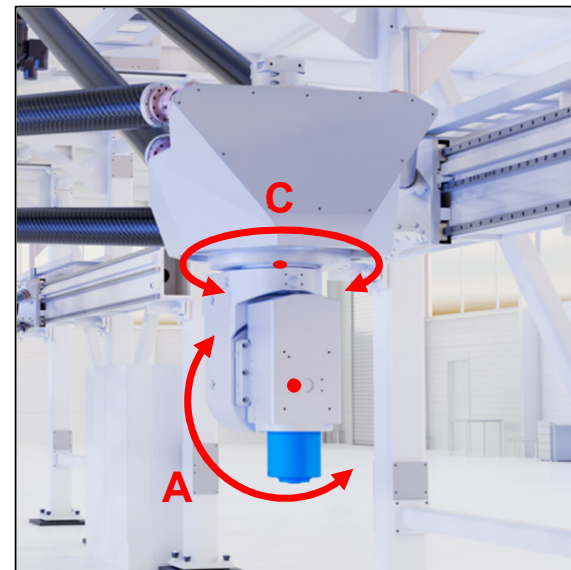
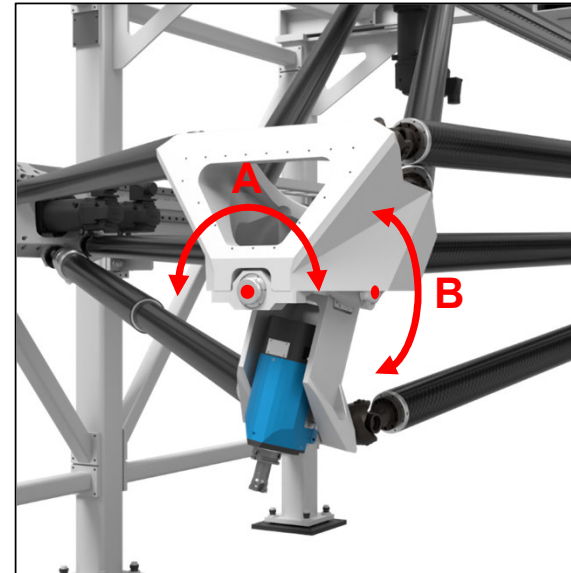
## ➤ Working area (main axis stroke)

- X-axis (lengths)      endless
- Y-axis (width)        up to 3m
- Z-axis (height)      up to 2m

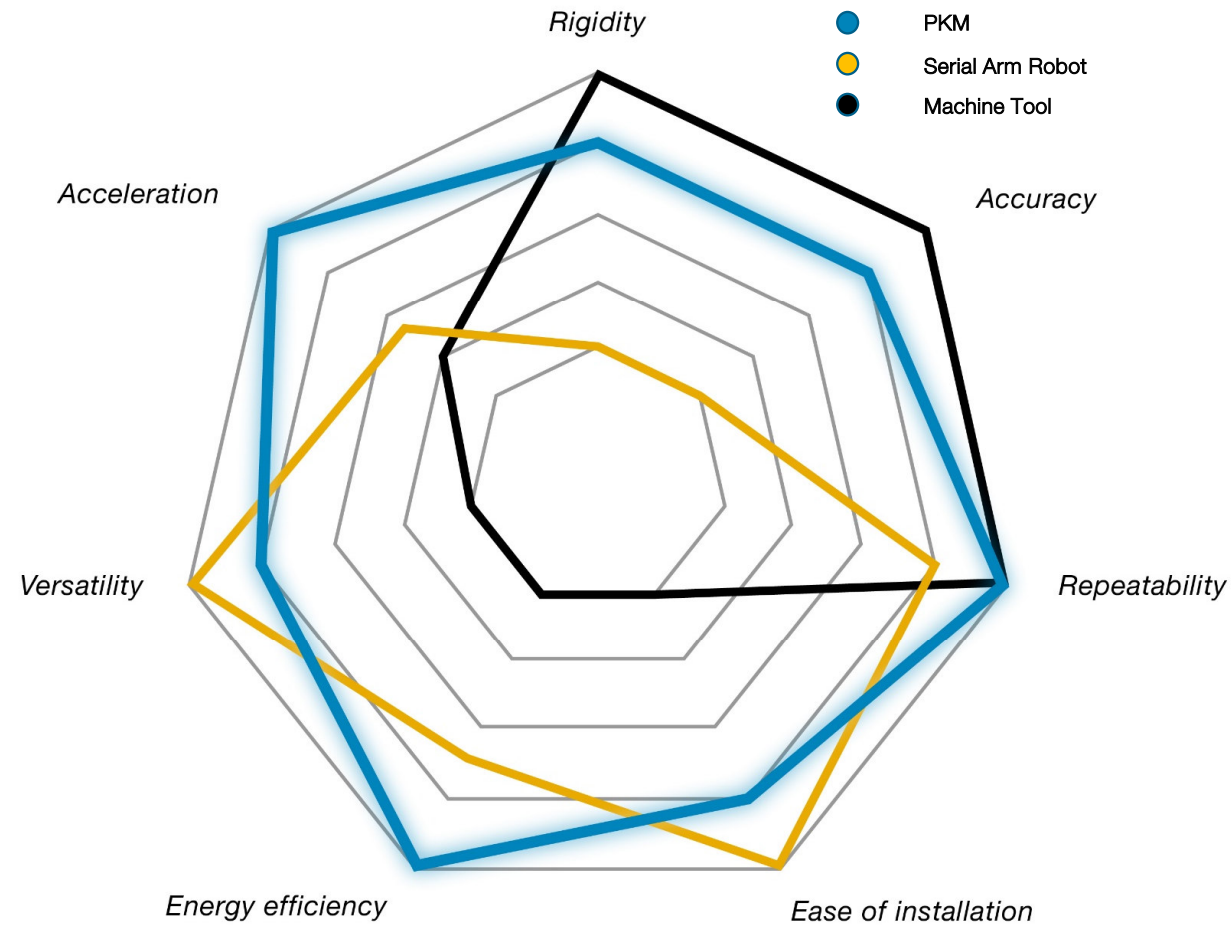


# Range of Motion

- PKM-*st* (A-B-axis head)
  - A-axis:  $\pm 50^\circ$
  - B-axis:  $\pm 50^\circ$
- PKM-*hv* (A-C-axis head)
  - A-axis:  $\pm 120^\circ$
  - C-axis:  $\pm 360^\circ$
- Spindle drive for both heads
  - Up to 20kW



# Comparison of systems



# USP 1

- Energy efficient
  - Designed to reach the maximum stiffness with lowest weight
  - Up to 20 times less moving mass compared to classic machine tools



# USP 2

- Fast and dynamic
  - Tool center point velocity up to 170m/min
  - Tool center point acceleration up to 2,5G depending on application carrier (2,5G up to 40kg)



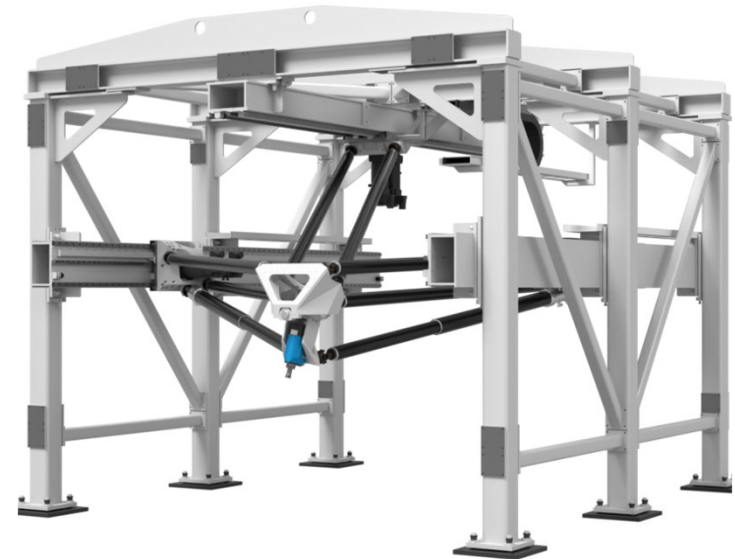
# USP 3

- High precision
  - Backlash free
    - Master-Slave drives
    - Cardan joints without backlash
  - Initial volumetric calibration by laser tracker
  - In machine compensation triggered by CNC program (TCP probe and a ball at the edges of workspace)



# USP 3

- High precision
  - Tool center point stiffness is at least 10 times higher compared to serial robots (serial robots ~  $0,5\text{N}/\mu\text{m}$ )





# USP 3

- High precision
  - Positioning repeatability up to 5µm
  - Tool path accuracy in the entire working area up to 0,04mm without process forces
  - The resulting total tool path accuracy depends on the tool path accuracy and the process forces



# USP 3

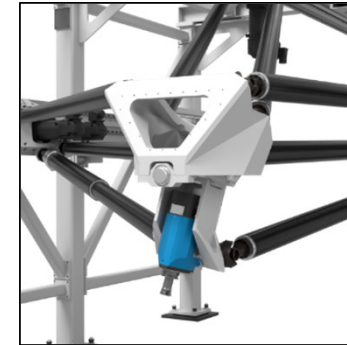
- High precision
  - Option: static tool path optimization based on CNC program process force prediction
  - Option: dynamic tool path optimization based on active process force detection



# USP 4

## ➤ High flexibility

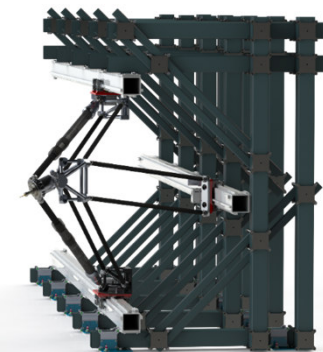
- Application carrier for 5-axis processes
- PKM *st* (sigma tau)
  - Telescopic links allow universal tool platform
    - Allow tool versatility
  - High stiffness
    - Increased accuracy even at higher feed rates
  - Minimum moving mass
    - Rapid movement for reduced cycle time
- PKM *hv* (horizontal-/vertical head)
  - High tool agility
    - Allows machining of hard to reach areas or even obstructed surfaces.



# USP 4

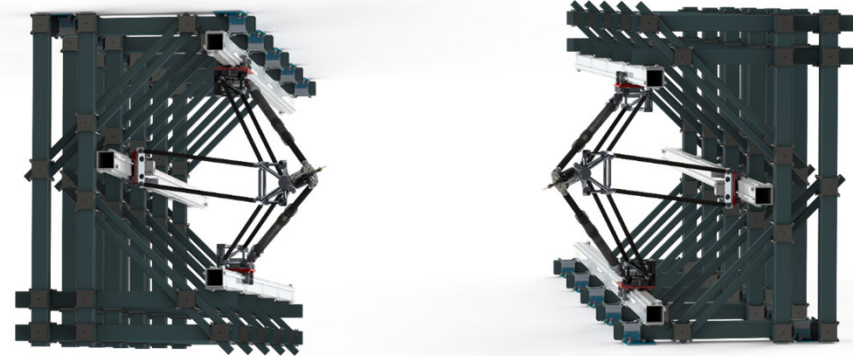
## ➤ High flexibility

- Robot can be mounted vertically, horizontally or at each other angle
- Links and traverses length can be adjusted



# USP 4

- High flexibility
  - Several robots can work in parallel on one workpiece (from the top, from the side)



# USP 4

- High flexibility
- Multiple robots can be mounted serial on the same traverses



# USP 5

- Only a few spare-parts are required for basic robot
  - rack and pinion
  - gearbox
  - joints
  - direct measuring system
  - 5-axis Application carrier specific parts



# Tool change

- Options:
  - Tool rack
  - Pick up magazine
  - Chain magazine
  - Robot based tool arena





# Additional facts

- Maximum moved weight of PKM
  - Up to 500kg in the high force configuration with reduced dynamic
- Maximum process force of PKM
  - Up to 15kN in the high force configuration



# Additional facts

- CNC Control Software
  - Cognibotics, based on Beckhoffs platform
  - Specific software applications that make the PKM unique
- Drives
  - Regenerative Bosch drive technology



