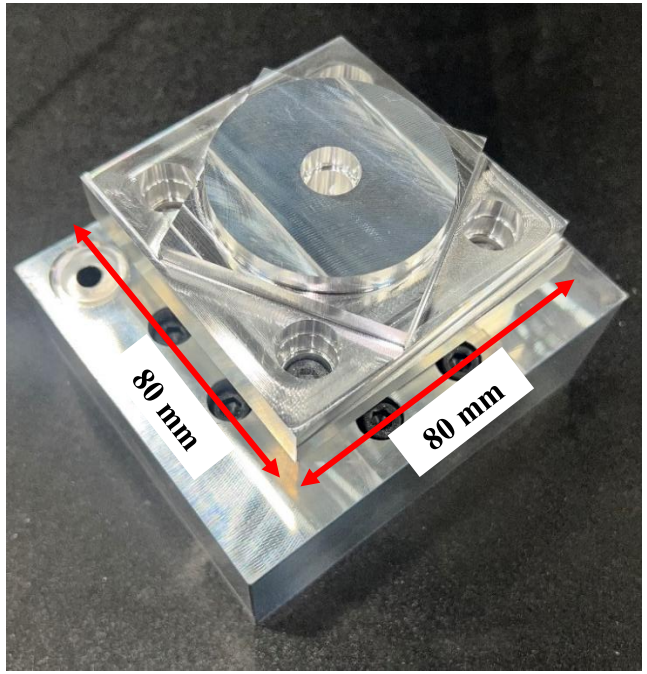
Circle diamond square cutting test

- Purpose of test
  - Standardized method to evaluate positioning, contouring, and interpolation accuracy
  - Used to assess squareness, roundness, and straightness
- Machining Parameters
  - Tool: 6.35 mm 3-flute bull nose endmill with zirconium nitride coating
  - Axial depth of cut: 6 mm
  - Radial depth of cut 0.508 mm
  - Feed rate: 1200 mm/min
  - Spindle speed: 19,200 rpm



ISO 10791-7, M1_80

Cutting test results

- Parts measured using ZEISS Duramax coordinate measuring machine (CMM)
  - Over 10 points measured per feature
- Desktop CNC mill compared versus same cutting test on Haas VF4
- Desktop CNC mill struggled to meet ISO tolerances of 5-15 µm deviation
  - Sufficient accuracy for educational purposes
  - Average deviation of 20 µm from the Haas VF4 results

Object	Characteristic	Tolerance [mm]	**Desktop machine** [mm]	**Haas VF-4** [mm]
Central hole	Perpendicularity: C-A	0.010	0.030	0.006
	Cylindricity: C		0.015	0.021
Square	Straightness: B	0.005	0.008	0.002
	Straightness: F		0.011	0.004
	Straightness: G		0.006	0.003
	Straightness: H		0.006	0.002
	Perpendicularity: H-B	0.010	0.041	0.023
	Perpendicularity: F-B		0.062	0.005
	Parallelism: G-B		0.021	0.019
Diamond	Straightness: K	0.005	0.016	0.002
	Straightness: L		0.018	0.002
	Straightness: M		0.015	0.003
	Straightness: N		0.022	0.003
	Angularity: K-B	0.010	0.023	0.003
	Angularity: L-B		0.036	0.007
	Angularity: M-B		0.026	0.003
	Angularity: N-B		0.025	0.004
Circle	Roundness: P	0.015	0.031	0.010
	Concentricity: P-C	0.025	0.015	0.002
Sloping faces	Straightness: I	0.005	0.012	0.011
	Straightness: J		0.011	0.002
	Angularity: I-B	0.010	0.014	0.016
	Angularity: J-B		0.057	0.007
Bored holes	Position: D1-C	0.050	0.078	0.008
	Position: D2-C		0.027	0.003
	Position: D3-C		0.054	0.007
	Position: D4-C		0.037	0.007
	Concentricity: E1-D1	0.020	0.048	0.007
	Concentricity: E2-D2		0.014	0.002
	Concentricity: E3-D3		0.036	0.003
	Concentricity: E4-D4		0.011	0.007