

**Technical Programme**

Monday 3 <sup>rd</sup> Dec 2007	Tuesday 4 <sup>th</sup> Dec 2007
<p><b>10.00</b> Coffee on arrival</p> <p><b>10.30</b> Welcome- Dr Henny Spaan, euspen Vice President</p> <p><b>10.35</b> Opening Address- Prof. Pat Mckeown</p> <p><b>“Historical Background to Thermal Effects in Precision Systems”</b></p> <p><b>11.00</b> <b>Session A: Thermal design strategies and principles</b></p> <p><b>12.30</b> Lunch</p> <p><b>13.30</b> <b>Session B: Compensation methods for thermal deflections</b></p> <p><b>15.30</b> Coffee break + posters</p> <p><b>16:00</b> <b>Session C: Modelling of thermal effects</b></p> <p><b>Close 18.00</b></p>	<p><b>09:00</b> <b>Session D: Measurement of temperature and corresponding deflections</b></p> <p><b>10.30</b> Coffee break + posters</p> <p><b>11.00</b> <b>Session D: Measurement of temperature and corresponding deflections</b></p> <p><b>12:30</b> Lunch</p> <p><b>13:30</b> <b>Session E: Experience and lessons learned</b></p> <p><b>15.30</b> Closing Remarks</p> <p><b>15.35</b> Close</p>

**Monday 3<sup>rd</sup> December:**

Page No.

10:00	<b>Coffee</b> on arrival	
10:30	<b>Welcome</b> – Dr Henny Spaan, euspen Vice President	
10:35	<b>Opening address</b> – Prof. Pat Mckeown	
	<b>“Historical Background to Thermal Effects in Precision Systems”</b>	
	<b>Session A: Thermal design strategies and principles</b>	
11:00	<b>OA.1</b> - Thermal expansion compensation for radiation exposed astronomic instrument in cryogenic environment. M. Teuwen, H. Janssen, R. Geurink Janssen Precision Engineering B.V., The Netherlands.	1
11:30	<b>OA.2</b> - Immersion lithography wafer table deformation control at nanometer level under transient thermal conditions with significant thermal loads J. Jacobs <sup>1</sup> , F. van der Meulen <sup>1</sup> , J. Ottens <sup>1</sup> , D. van Abeelen <sup>1</sup> & H. Versteijnen <sup>2</sup> <sup>1</sup> ASML, the Netherlands <sup>2</sup> Mecal, the Netherlands	4
12:00	<b>OA.3</b> - Design of the spindle bearing housing on the basis of thermo-elastic effect S-M. Kim and S-K. Lee Dept.Mechatronics, Gwangju Korea	5
12:30	<b>Lunch</b>	

Proceedings of the Topical Meeting: Thermal Effects in Precision Systems – Maastricht- December 2007

	Page No.		Page No.
		<b>Session B: Compensation methods for thermal deflections</b>	
13:30	8	<b>OB.1</b> - Measurement and control of 3D volumetric positioning errors with thermal deflections O. Svoboda <sup>1</sup> and C. Wang <sup>2</sup> <sup>1</sup> Research Center of Manufacturing Technology Czech Technical University in Prague, Czech Republic <sup>2</sup> Optodyne, Inc.,	
14:00	13	<b>OB.2</b> - An uncertainty model for thermal effects on axial depth of cut in micro milling G. Bissacco, H.N. Hansen, L. De Chiffre Department of Manufacturing Engineering and Management, Technical University of Denmark, Denmark.	
14:30	16	<b>OB.3</b> - Thermal transfer function based control method of a machine tool cooling system P. Bárta, O. Horejš, J. Hornych, J. Vyroubal Research Center for Manufacturing Technology at Czech Technical University in Prague, Czech Republic	
15:00	19	<b>OB.4</b> - Thermal compensation method for machine tools B. Denkena, K-H. Scharschmidt Leibniz Universität Hannover, Institute of Production Engineering and Machine Tools, Germany	
15:30		<b>Coffee break + posters</b>	
		<b>Session C: Modelling of thermal effects</b>	
16:00	22	<b>OC.1</b> - Thermal effects in a hybrid kinematics Institute of Production Engineering and Machine Tools B. Denkena, H-C. Möhring Leibniz University of Hannover	
16:30		<b>OC.2</b> – Thermal dynamics and active control of an optical reference cavity for space applications E. Canuto, J. Ospina and A. Ripa Politecnico di Torino	26
17:00		<b>OC.3</b> - Towards thermo-mechanical system modelling S. Box Philips Applied Technologies, Eindhoven, The Netherlands	29
17:30		<b>OC.4</b> - Thermal transient analysis of complex systems using structured lumped mass models J.C.G. van der Sanden, T.A.M. Ruijl Philips Applied Technologies, The Netherlands	32
18:00		<b>Day 1 - Close</b>	
<b>Tuesday 4<sup>th</sup> December:</b>			
<b>Session D: Measurement of temperature and corresponding deflections</b>			
09:00		<b>OD.1</b> - Thermal metrology for precision engineering J. Flügge, R. Schödel Physikalisch Technische Bundesanstalt, Germany	36
09:30		<b>OD.2</b> - Model and experiment on stage drift in a transmission electron microscope T. van den Oetelaar FEI Company, the Netherlands	
10:00		<b>OD.3</b> - Novel techniques based on FBG optical fibre sensors for real-time compensation of thermal errors of high precision machine tools P. Bosetti <sup>1</sup> , A. Merlo <sup>2</sup> , D. Ricciardi <sup>2</sup> & F. Meo <sup>3</sup> <sup>1</sup> Università di Trento, Italy <sup>2</sup> Ce.S.I. Centro Studi Industriali, Italy <sup>3</sup> FIDIA, Italy	39

Proceedings of the Topical Meeting: Thermal Effects in Precision Systems – Maastricht- December 2007

	Page No.		Page No.
10:30		<b>Coffee break + posters</b>	
11:00		<b>OD.4</b> - Thermografic temperature measurement on the tool and workpiece during milling M. Graf von der Schulenburg, E. Uhlmann Institute for Machine Tools and Factory Management, Technische Universität Berlin, Germany	42
11:30		<b>OD.5</b> - Measurement and analysis of thermal errors in precision machine tools with a new multi lateration system C. Brecher, C. Baum, T. Gerrath, C. Wenzel Fraunhofer Institute for Production Technology IPT, Germany	
12:00		<b>OD.6</b> - Thermal behaviour of high tech ball screws I.C. Riemenschneider, T. Blaschun, J. Edler Institute Of Production Engineering, Technical. University Graz, Austria	45
12:30		<b>Lunch</b>	
		<b>Session E: Experience and lessons learned</b>	
13:30		<b>OE.1</b> - Measurement methods for efficient thermal assessment and error compensation S. Fletcher, A.P. Longstaff and A. Myers University of Huddersfield, United Kingdom.	48
14:00		<b>OE.2</b> - Thermal deflection of thermo rolls – in situ measurement J. Toiva Helsinki University of Technology, Finland	51
14:30		<b>OE.3</b> - Recent experiences with active temperature control of large machines D E. Luttrell Moore Tool Company, USA	55
15:00		<b>OE.4</b> - Thermal control of a high energy density ultra precision machine P. Morantz <sup>1*</sup> , E. Gould <sup>2</sup> , R. Collins <sup>1</sup> , X. Tonnellier <sup>1</sup> , P. Shore <sup>1</sup> <sup>1</sup> Cranfield University, UK <sup>2</sup> 3D Evolution, UK	
15:30		<b>Closing Remarks</b>	
15:30		<b>Day 2 - Close</b>	
		<b>Posters</b>	
		<b>P1</b> - Flexible compensation of thermal errors A.P. Longstaff, S. Fletcher and A. Myers University of Huddersfield, United Kingdom	57
		<b>P2</b> - Compensation of thermal errors on machine tools T. Blaschun, H. Harreiter, I.C. Riemenschneider, E. Eckerstorfer Institute Of Production Engineering, Technical. University Graz, Austria	60
		<b>P3</b> – Thermistor calibration oriented to differential temperature measurements E. Canuto, J. Ospina and A. Ripa Politecnico di Torino	63
		<b>P4</b> - Thermal deflection of paper machine rolls - balancing E. Porkka, J. Pirttiniemi Helsinki University of Technology, Finland	66

Proceedings of the Topical Meeting: Thermal Effects in Precision Systems – Maastricht- December 2007

	Page No.
<b>P5</b> - Shape deviation of molded glass lenses caused by shrinkage F. Klocke, O. Dambon, H. Sarikaya, G. Pongs, A. Grüntzig Fraunhofer Institute for Production Technology IPT	70
<b>P6</b> - Investigations in the definition of mold die materials for high molding temperatures F. Klocke, O. Dambon, H. Sarikaya, G. Pongs Fraunhofer Institute for Production Technology IPT	73