a Compressor Rotor Passage Using the Laser Doppler Velocimeter," ASME JOURNAL OF ENGINEERING FOR POWER, Vol. 95, Apr. 1973, p. 91.

7 Walker, D. A., Williams, M. C., and House, R. D., "Intrablade Velocity Measurements in a Transonic Fan Utilizing a Laser Doppler Velocimeter," *Minnesota Symp. on Laser Anemometry*, University of Minnesota, Minneapolis, Oct. 22–24, 1975.

8 Wisler, D. C., "Shock Wave and Flow Velocity Measurements in a High Speed Fan Rotor Using the Laser Velocimeter," ASME Paper No. 76-GT-49.

9 Schodl, R., "Laser Dual-Beam Method for Flow Measurements in Turbomachines," ASME Paper No. 74-GT-157.

10 Weyer, H. B., and Schodl, R., "Unsteady Flow Measurements in Turbomachines," *Modern Methods of Testing Rotating Components of Turbomachines*, AGARD-AG-207, 1975.

11 Schodl, R., "On the Extension of the Range of Applicability of LDA by Means of the Laser-Dual-Focus (L2F)-Technique," LDA-Symp. 1975, Technical University of Denmark, Copenhagen, Aug. 25–28, 1975.

12 Rotta, J. C., "Turbulente Strömungen," *Teibner Verlag*, Stuttgart, 1972, pp. 13–62.

13 Strinning, P. E., and Dunker, R. J., "Aerodynamic- and Blade-Design of a Transonic Axial Compressor Stage" (in German), DFVLR, Institute for Air Breathing Engines, Internal Report No. IB-352-75/7, 1975, p. 87.

14 Dunker, R., Schodl, R. and Weyer, H. B., "Fortschritte in der Turbomaschinen-forschung durch ein neues optisches Meβverfahren für Strömungsvektoren," *Zeitschrift für Flugwissenschaft* ZfW 24, Heft 1, 1976, pp. 17–25.

15 Eckardt, D., "Detailed Flow Investigations Within a High Speed Centrifugal Compressor Impeller," ASME Paper No. 76-FE-13, 1976.

16 Dunker, R., and Strinning, P., "Flow Velocity Measurements Inside of a Transonic Axial Compressor Rotor by Means of an Optical Technique and Compared with Blade-to-Blade Calculations," *3rd International Symposium on Air Breathing Engines*, Munich, Proceedings, DGLR-Fachbuch No. 6, Mar. 7–12, 1976, pp. 217–232.

17 Wu, C. H., "A General Theory of Three-Dimensional Flow in Subsonic and Supersonic Turbomachines of Axial, Radial and Mixed Flow Types," NACA TN 2604, 1952.

18 Marsh, H., "A Digital Computer Program for the Through-Flow Fluid Mechanics in an Arbitrary Turbomachine Using a Matrix Method," NGTE Report R 282, 1966; also Aero. Res. Counc. R&M 3509, 1968.

19 Davis, W. R., and Millar, D. A. J., "Axial Flow Compressor Analysis Using a Matrix Method," revision, Carleton University ME/A 73-1, Feb. 1973.

20 Horlock, J. H., and Marsh, H., "Flow Models for Turbomachines," *I. Mech. E., Jnl. Mech. Eng. Sci.*, Vol. 13, No. 5, 1971.

21 Marsh, H., "Through-Flow Calculations in Axial Turbomachinery: Technical Point of View," Contribution to the 47th AGARD-Meeting on Through-Flow Calculation in Axial Turbomachinery, Cologne, No. 2, May 20–21, 1976, p. 17.

22 Novak, R. A., and Hearsey, R. M., "A Nearly Three-Dimensional Intrablade Computing System for Turbomachinery—Part I: General Description," ASME Paper No. 76-FE-19, 1976.

23 Bosman, C., and El-Shaorawic, M. A. I., "Quasi-Three-Dimensional Numerical Solution of Flow in Turbomachines," ASME Paper No. 76-FE-23, 1976.

24 Thompkins, W. T., and Oliver, D. A., "Three-Dimensional Flow Calculation for a Transonic Compressor Rotor," Contribution to the 47th AGARD Meeting on Through-Flow Calculation in Axial Turbomachinery, Cologne, May 20–21, 1976.

DISCUSSION

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The authors are to be congratulated for this excellent experimental work developed at DFVLR.

It appears from the experimental setup that the laser beams follow a radial path and, therefore, no radial components of velocity can be measured. A discussion by the authors would be welcome on the way this lack of information on the radial velocities affects the accuracy of velocities and, in particular, of flow angles.

With regard to the comparison with through-flow methods, the authors stress the important problem of the distribution of losses and flow turning through the blade. Clearly, the linear distribution doesn't seem to reproduce correctly the measured data inside the blade region, and it would be interesting to know if other assumptions have been tested and, if so, what the results were.

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