

**PACKAGE ID** - 000391AL0II00 RAY

**KWIC TITLE** - Ray Tracing 3-D Optical Systems

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**LIMITATION CODE** -UNL                   **AUDIENCE CODE** - UNL

**COMPLETION DATE** - 05/01/1990   **PUBLICATION DATE** - 05/01/1990

**DESCRIPTION** - RAY is a ray tracing program written to analyze general three dimensional systems of refracting and reflecting surfaces, which can be quadric, aspheric, and toric. The image plane is found by determining the closest intercept of two rays in image space. This image may be real or virtual and, in general, the position of the image plane depends upon the choice of the two rays in object space. For any traced ray, the 4x4 ray matrix may be computed and information about the nature of the image provided. Fans of rays may be traced and their loci at the image plane or at any surface plotted and listed. Ray fans may be multiple circuits in azimuth at different polar angles which fill a solid angle. The image plane may be moved and the current and minimum RMS spot diameters or the image plane position where the smallest spot occurs can be found. A gray scale or color image of the focal spot or far field intensity distribution may be displayed upon which linear line outs with arbitrary direction, width, and end points may be taken. Circular line outs with arbitrary center and maximum radius may also be taken. The image plane may be moved to obtain a succession of images. It can also be easily moved to the position where the RMS spot size is smallest. Substantial editing capabilities are available for modifying the optical system.

**PACKAGE CONTENTS** - NESC Note; Software Abstract; User's Manual;

**SOURCE CODE INCLUDED?** - Yes

**MEDIA QUANTITY** - 3 3.5 Diskettes

**METHOD OF SOLUTION** - One cannot trace a ray until the image plane has been found, and one cannot find the 4x4 ray matrix until a ray has been traced. The image plane is found by specifying two reference rays and one axis ray. It is normal to the axis ray and has its origin at the midpoint of the perpendicular line segment joining the two reference rays. Both the starting points and starting directions of these rays may be arbitrarily specified. However, one almost always wishes all the starting points to be at the object space origin. For either refraction or reflection ray tracing, the ray is first extended from its intercept point on the preceding surface to its intercept point on the next surface. Once a ray has been traced, the 4x4 matrix for the ray can be computed by basic arithmetic operations upon quantities computed during the ray trace.

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**COMPUTER** - APPLE II

**OPERATING SYSTEMS** - Apple System 4.2 or later

**PROGRAMMING LANGUAGES** - Absoft FORTRAN/020 v2.4

**SOFTWARE LIMITATIONS** - Maximum of 10 surfaces, this is a program parameter which may be changed by recompiling.

**SOURCE CODE AVAILABLE (Y/N)** - Y

**RELATED SOFTWARE** - RAYMTX is a ray matrix optics code for axisymmetric optical systems with spherical refracting and reflecting surfaces.

**OTHER PROG/OPER SYS INFO** - Release included is designed for Apple Macintosh II implementation.

**HARDWARE REQS** - 4 Mbytes with 68020, 68030, or 68040 CPU and 68881 or 68882 FPU for the Macintosh II version.

**REFERENCES** - Donald W. Phillion, Analysis of Three Dimensional Optical Systems Consisting of Quadric, Aspheric, and Toric Reflecting and Refracting Surfaces, LLNL Memorandum, May 30, 1989; RAY, NESC No. 9470, RAY Flexible Disk Cartridge Descriptions, National Energy Software Center Note 91-13, November 14,1990.

**ABSTRACT STATUS** - Abstract first distributed November 1990. Apple Macintosh version submitted June 1989, March 1990, and May 1990.

**SUBJECT CLASS CODE** - W

**KEYWORDS** -

COMPUTER PROGRAM DOCUMENTATION  
R CODES  
OPTICAL SYSTEMS  
IMAGES  
THREE-DIMENSIONAL CALCULATIONS  
REFLECTION  
REFRACTION

**EDB SUBJECT CATEGORIES** -  
990200 661300

**SPONSOR** - DOE/DP

**PACKAGE TYPE** - SCREENED