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STUDY IN OPTICAL SYSTEMS FOR LASER ISOTOPE SEPARATION

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MASTER

FINAL REPORT

STUDY IN OPTICAL SYSTEMS
FOR LASER ISOTOPE SEPARATION
(LLNL P.O. #3881405)

Prepared for:

LASER ISOTOPE SEPARATION PROJECT
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NOTICE

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BACKGROUND

As a part of LLNL's Laser Isotope Separation project, ORA has been supplying optical design, analysis, and tolerancing support since September 1983 under Purchase Order 3881405. LLNL has chosen to close the referenced Purchase Order as of 4/16/84 with a slight (10%) under-expenditure and pursue appropriate additional effort by ORA under the LLNL BEAR activity, which started 4/84. This report will summarize the tasks worked on during this period. A list of the tasks is given below:

<u>TASK</u>	<u>NAME</u>	<u>STATUS</u>
001R	Dye Chain/Dye Telescopes	In Work
002R	Venus-Mars Telescope	Done
003R	RM108 - Second Bravais Telescope	Done
004R	RM108 - First Bravais Telescope	Done
005R	Triton Beam Delivery System	Done
006R	RM108 Bravais Telescope Component Drawings	Done
007R	CVL Relay Telescopes	Done
008R	Triton Beam Delivery System - Revision #1	Done
009R	White Cell - Laser Pulse Stretcher	In Work
010R	CVL Optical Chain Wavefront and Alignment Effects	On Hold
011R	Dye Relay Telescope #1 - Sapphire Design	In Work
012R	Five Relay Dye Chain Design and Tolerancing	In Work

An overview of these tasks grouped by area is given below with task designations given as appropriate.

TRITON BEAM DELIVERY OPTICS

Numerous tasks dealt with process beam delivery from the output of the power dye amplifier on the Venus table to the process chamber in Triton. Design tasks and data delivered included:

- (1) Beam expanders for the dye amplifier output (red and yellow) (002R).
- (2) An achromatic relay telescope whose input was the near field image at the Venus table dichroic and output at the entrance of the Mars telescope (002R).
- (3) Beam shaping and relaying telescopes for the Triton table (005R, 008R). The input to these telescopes was the output of the Triton telescope and the output of the system was to the process chamber. Different anamorphic ratios for the output beam were desired and achieved with design data being delivered.

Analysis tasks included analysis of the Mars/Triton telescope combination (008R).

DYE CHAIN RELAY (RM 108) OPTICS

Three relay telescopes were designed for each of the red and yellow beams using fused silica as the lens material (001R). Several tolerance studies were undertaken using the performance criteria of system collimation and magnification. Different sets of compensating parameters, axial movement of the central element and axial movement of all elements, were analyzed. Subsystem alignment procedures were developed involving lateral displacement of the telescopes to change slit image position and rotation of the telescopes to affect beam steering.

Design for the relay telescope between the first and second amplifiers using sapphire as the element material was accomplished and design data delivered (011R).

CVL BEAM DELIVERY

Effort was expended in two areas:

- (1) Analysis and tolerancing of near 1:1 relay telescopes which relayed the CVL beam overlap point to the center of the second dye amplifier cell (007R). Both upper and lower telescopes were analyzed for both green and yellow beams. Component drawings were delivered.
- (2) Design revision, analysis and tolerancing of anamorphic Bravais telescopes for both the first and second dye amplifiers (003R, 004R). Designs were presented for both green and yellow beams. Component drawings were delivered (006R).

OPTICAL DELAY LINE (WHITE CELL)

A design for a 16 pass white cell to be used in the CVL chain was analyzed and toleranced in support of a group at the Union Carbide Corporation working for LLNL (009R). A similar task was done for a 16 pass Herriott cell.

DOCUMENTATION

Various technical data was provided over the duration of this study. Among them were the following:

1) Progress reports dated -

4 Oct 1983
9 Nov 1983
12 Dec 1983

2) Letter Reports dated -

17 Oct 1983	Amp 2 Bravais system analysis
10 Nov 1983	Amp 1 Bravais system analysis
7 Dec 1983	Amp 1 and 2 Component Drawings

3) Undated technical data packages

One copy of all technical data provided to LLNL by ORA was given to John Taylor of the LIS group.

FUTURE TASKS

Tasks which have been defined but not started under this contract include design and subsystem tolerancing of a five relay dye chain (012R) and analysis and tolerancing of the CVL chain from oscillator to dye amplifier cell including thermal effects (010R).