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LLNL-TR-747223

Advanced High Power mm-Wave Microwave Devices Final Report CRADA No. TC-0287-92

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Disclaimer

This work performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under Contract DE-AC52-07NA27344.

Advanced High Power mm-Wave Microwave Devices

Project Accomplishments Summary (Attachment II)
CRADA No. TC-0287-92

Date: September 25, 1997 Revision:

A. Parties

The project was a relationship between the Lawrence Livermore National Laboratory (LLNL) and Varian Associates, Inc./Communication and Power Industries (CPI), Inc.

University of California
Lawrence Livermore National Laboratory
7000 East Avenue, L-795
Livermore, CA 94550

CPI, Inc.
811 Hanson Way
Palo Alto, CA 94304

B. Background

Lawrence Livermore National Laboratory collaborated with CPI (formerly a part of Varian Associates, Inc.) in the field of microwave devices for energy and defense applications. Varian is a world leader in high-average-power microwave devices in the millimeter regime and has been the market leader in North America and Europe. These microwave devices are presently used in the heating of plasmas in magnetic fusion energy and material processing applications. This research agreement was designed to improve existing devices through detailed component computer modeling and to develop designs for the next-generation microwave devices.

C. Description

The purpose of this CRADA was to improve existing high-average-power microwave devices and develop the next generation microwave devices for energy and defense applications.

A Free Electron Maser was under test at the FOM Institute (Rijnhuizen) Netherlands with the goal of producing a 1MW-long pulse to CW microwave output in the range 130GHz to 250GHz. The DC acceleration and beam transport system is eventually to be used in a depressed collector configuration requiring 99.8% beam transmission in order that the high voltage 2MV supply be required only to supply 20 milliamps of body current. A relativistic version of the Herrmann optical theory originally developed for microwave tube beams was used to take into account thermal electrons far out on the gaussian distribution tail that can translate into beam current well outside the ideal beam edge. This theory was applied to the FOM beamline design and predicts that the beam envelope containing 99.8% of the current can be successfully transported to the undulator for a wide range of assumed eminence values.

D. Expected Economic Impact

Advances in millimeter-wave technology resulting from this CRADA will help CPI develop improved microwave sources.

E. Benefits to DOE

The results of this CRADA will provide DOE with capabilities to develop improved millimeter-wave sources and allow the development and benchmarking of simulation codes.

F. Industry Area

Microwave device industry.

G. Project Status

The simulation codes developed in this CRADA were used to assist CPI in developing microwave device technology. The codes were successfully used to model microwave components and subsystems for high-power millimeter-wave devices, such as free electron masers.

H. LLNL Point of Contact for Project Information

Clifford C. Shang
P.O. Box 808, L-153
Livermore, CA 94551
PH:(510) 422-6174
FX: (510) 423-5080

I. Company Size and Point(s) of Contact

Company Size: >500 employees
Point of Contact: Tony Tomlin, PH: (650) 424-6984, FX: (650) 846-3276

J. Project Examples

A report entitled, *Design and Characterization of the DC Acceleration and Transport System Required for the 1 MW Free Electron Maser Experiment,* was produced.

K. Release of Information

I certify that all information contained in this report is accurate and releasable to the best of my knowledge.

Karena McKinley 4/22/99

Karena McKinley, Director
Industrial Partnerships
and Commercialization

Date

RELEASE OF INFORMATION

I have reviewed the attached Project Accomplishment Summary prepared by Lawrence Livermore National Laboratory and agree that the information about our CRADA may be released for external distribution.

Glen A. Huffman 1-20-99

~~Troy~~ Tomlin GLEN HUFFMAN
CPI, Inc.

Date