MRS S C GOULTY
FINANCE & SECRETARIAT (NUCLEAR)1

D/DGSM/CSSE/Sec(Nuc) 5/143

DPA

Defence Procurement Agency
DGSM/CSSE
Defence Procurement Agency,
Ministry of Defence
Rowan 1a, #164
MOD Abbey Wood
Bristol, BS34 8JH

Switchboard: 0117 91 3000

Mr R Evans
6 Birtwhistle House
150 Parnell Road
LONDON
E3 2JY

16 June 1999

Dear Mr Evans

REQUEST FOR DOCUMENTS - PQ 84348

The documents you requested in your letter of 30 May are enclosed. I have had to use two boxes, and have enclosed a copy of this letter in each box. This is Box One of Two.

If you wish to make a complaint that your request for information has not been properly dealt with, you should appeal to The Ministry of Defence, OMD 14, Rm 617, Northumberland House, Northumberland Avenue, London WC2N 5BP. You may at any time register a complaint with the Parliamentary Commissioner for Administration (the Ombudsman) through your Member of Parliament, but the Ombudsman will expect you to have exhausted the internal Ministry of Defence complaints procedure first.

Yours sincerely
Sarah Goulty

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AWE
HUNTING-BRAE

Overview of C16/C15 Facility at AWE(A) HELEN Laser and Support Laboratories

Presented to Term Contract Bid Teams
28th and 29th January 1999
by

Radiation Physics Department

AWE HUNTING-BRAE

Outline

- Introduction
- General Description
- Purpose of Facility
- HELEN Laser
- Support Facilities
- Summary

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Introduction

- Facility C16/C15 contains the HELEN Laser and Operations Support Laboratories
- The HELEN Laser and experimental programme is operated by the Radiation Physics Department within the Directorate of Physics Research
- The HELEN laser is required to support the Warhead Plasma Physics Programme under the Development and Capability Project (Physics)

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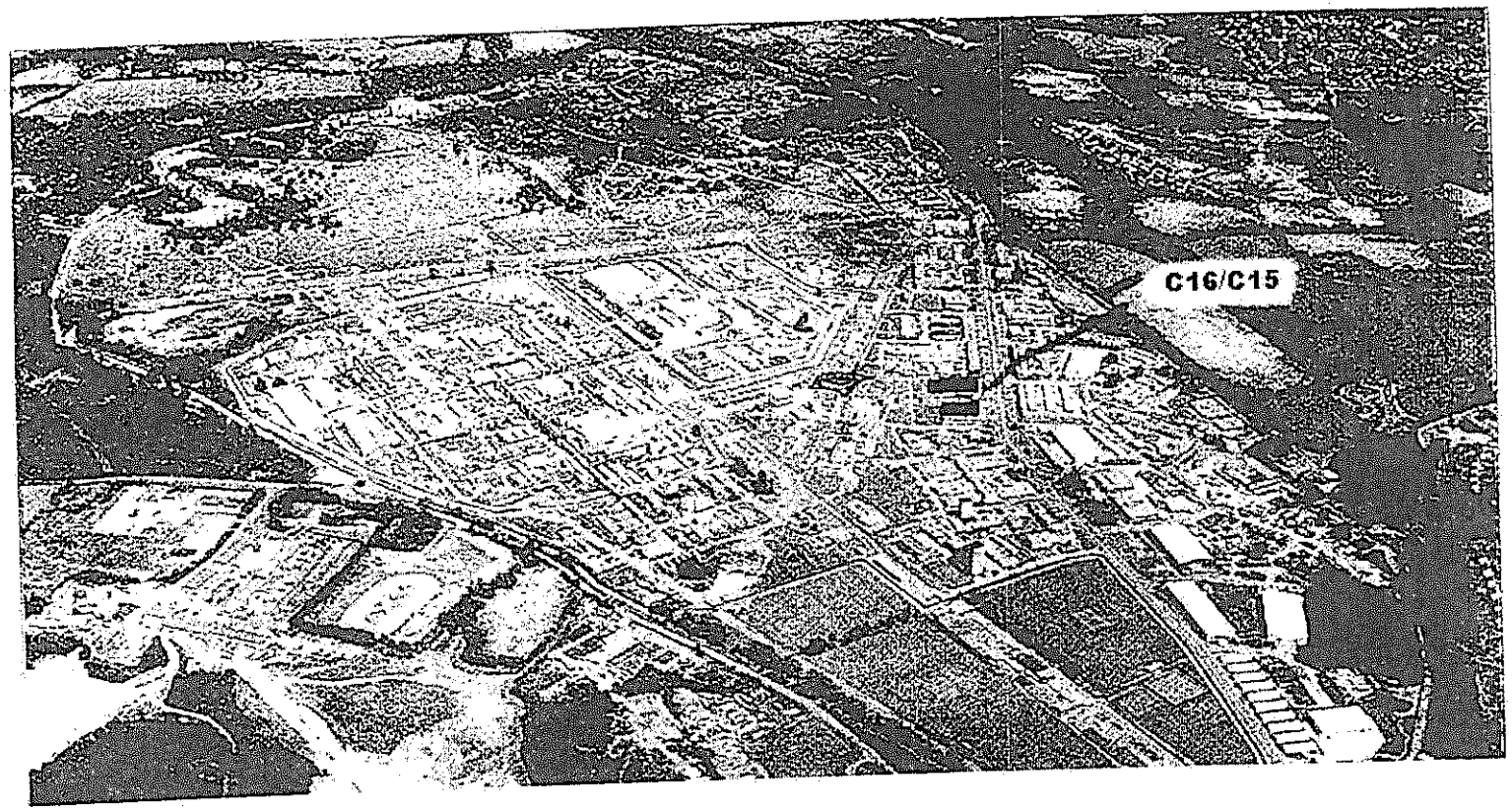
Location of C16/C15



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General Description

- C16 and C15 are two adjoining buildings with a total area of around 4000m^2
- Cat 3 Facility with specific hazards
  - High Energy/Voltage Electrical
  - Lasers
  - X-rays
  - N_2 asphyxiation
  - Power machinery in associated workshops and plant rooms
  - Chemical
- C16 houses the HELEN laser
  - Around 1000m^2 Class 10000 and better clean rooms containing the laser
  - 5 Plant rooms required for the clean areas
  - 2MJ capacitor bank at 20kV to power the laser
- C15 houses support facilities

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Purpose of facility

- An exploding nuclear warhead generates extreme temperatures and pressures - naturally only found in stars
- Design of the warhead requires data on materials properties and physical processes at these extreme conditions
- The Warhead Plasma Physics programme is tasked with determining this data under conditions as near as possible to those generated in a nuclear explosion
- Experiments may be designed to study specific physics issues
- Data yielded from experiments may be used to validate physics packages in warhead design codes
- Lasers are currently the best laboratory tool for generation of the required conditions
- Glass laser technology is most advanced for this application

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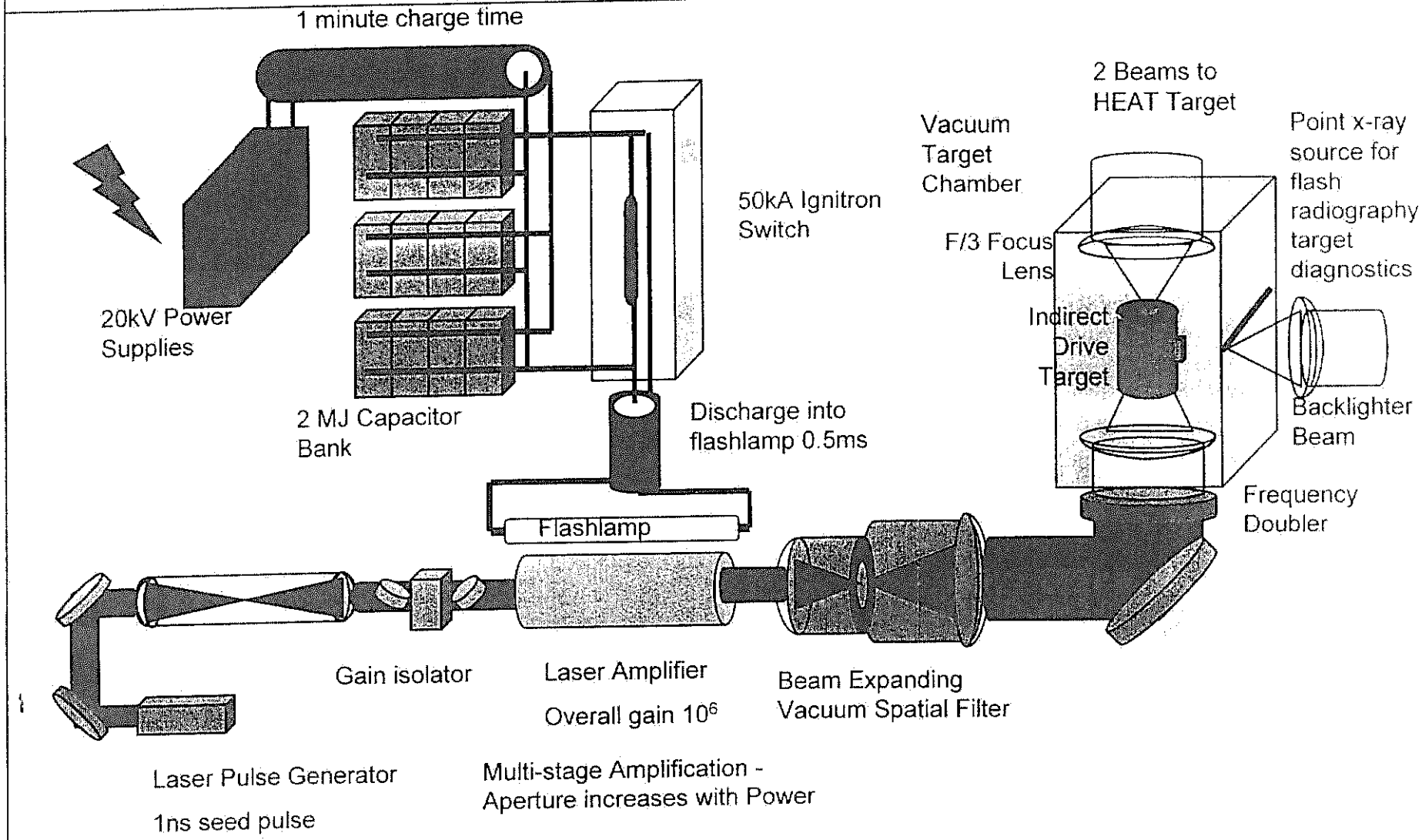
Schematic of HELEN Laser Operation



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Glass Laser System Outline History at AWE

- 1975 — MERLIN Laser 64mm Rod Amps 50GW 100ps 1ω
- 1979 — HELEN Laser Installed 2 beams 150mm Disc Amp
- 1981 — HELEN Laser Start Experiments 1TW 100ps 1ω Total
- 1985-86 — 2nd oscillator and rod amplifier driver
  - 1 heating beam + 1 backlighter beam
  - Point Projection Spectroscopy X ray Diagnostics
  - Second Harmonic Conversion
- 1989 — HELEN re-configured with phosphate glass
  - 2 main beams with 1x208 mm output amplifier per arm
  - expanded beam to 300 mm ϕ
  - new SHG cells and f/3 focusing optics 2 TW 300ps 2ω
  - 1 backlighter beam 180 mm ϕ (β disc amp) 0.4 TW 100ps 2ω
- 1990 — Dual B/L capability - split single beam into 2xD shaped beams
- 1995 — Added 2nd 208 mm Amplifier to each arm - 1 kJ 1ns @ 2ω
- 1996 — New pulse generator
  - based on BEAMLET technology - pulse shaping capability + lower maintenance
- 1996-98 — New control system incorporating hardware timing system, alignment control and diagnostics integration

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Features of Nd^{3+} Doped Glass Lasers

- Optically pumped by Xe flashlamps
- Energy storage medium
- Output wavelength 0f 1054nm is efficiently converted to shorter wavelengths, 527nm, for better plasma coupling
- Master Oscillator Power Amplifier (MOPA) Configuration
  - Master Oscillator generates a low power seed pulse with well defined spatial/temporal characteristics
  - Power Amplifiers provide high fidelity amplification in a multi-stage discrete amplifier system
- Mature Technology
- Ready availability of large volumes of good optical quality doped glass

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HELEN Laser Overview

- HELEN Laser
  - 2 Heating Beams
    - 300mm ϕ
    - 1TW at 0.3 ns per arm 2ω
    - 0.5 kJ at 1 ns per arm 2ω
  - 1 Backlighter Beam - split at output
    - 180mm ϕ
    - .4 TW at 0.15 ns 2ω

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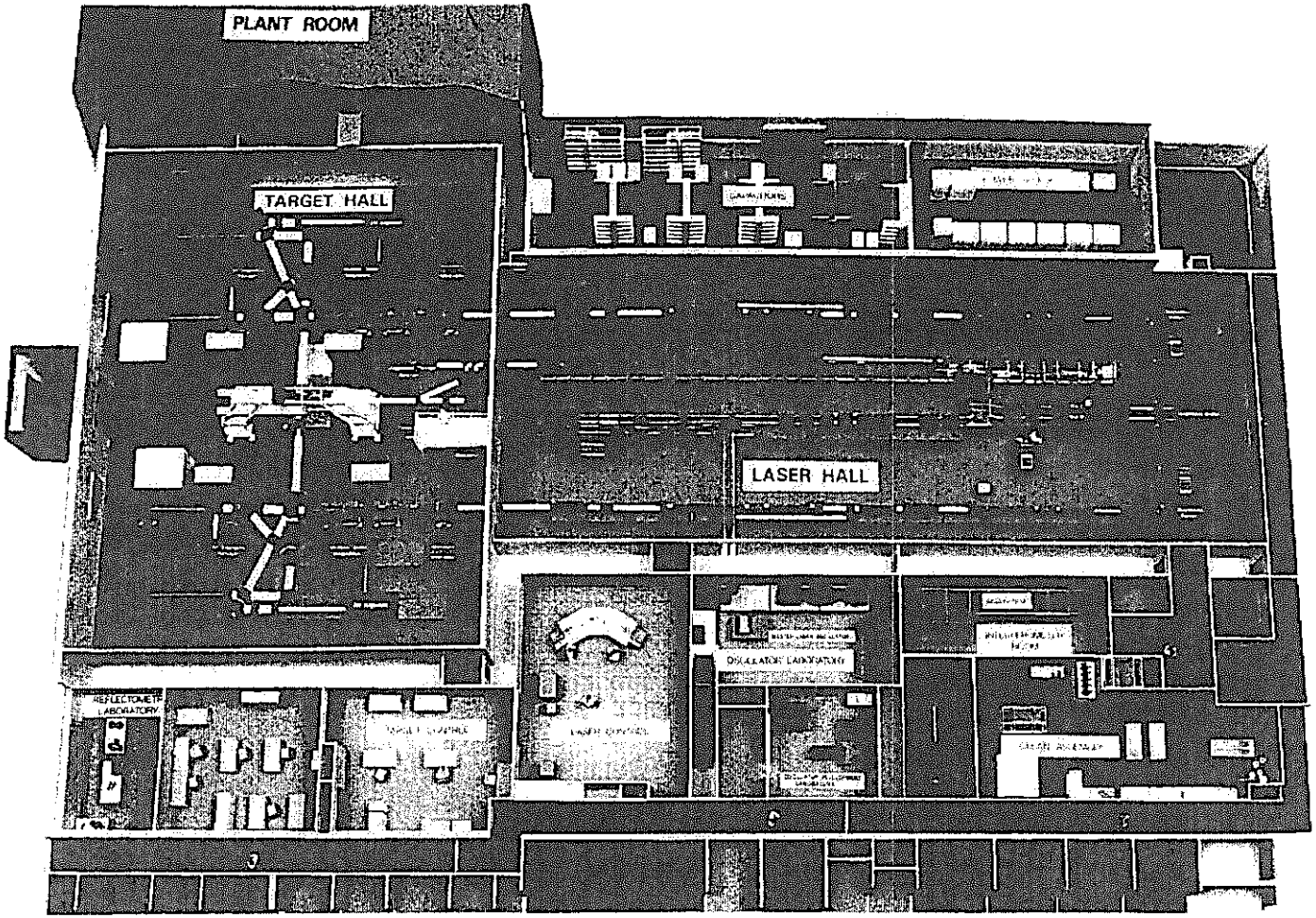
HELEN Laser Facility Layout



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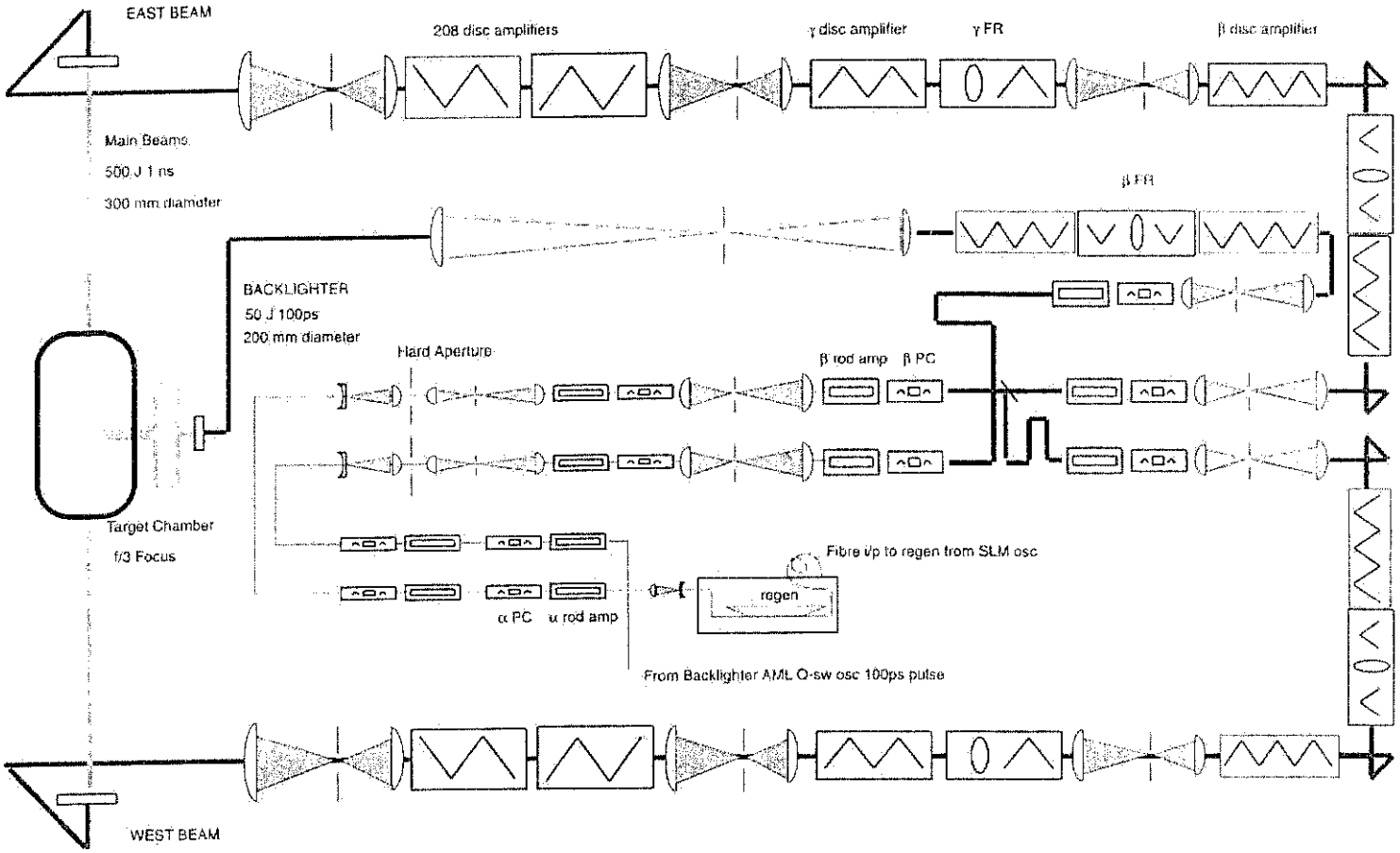
HELEN Laser Schematic



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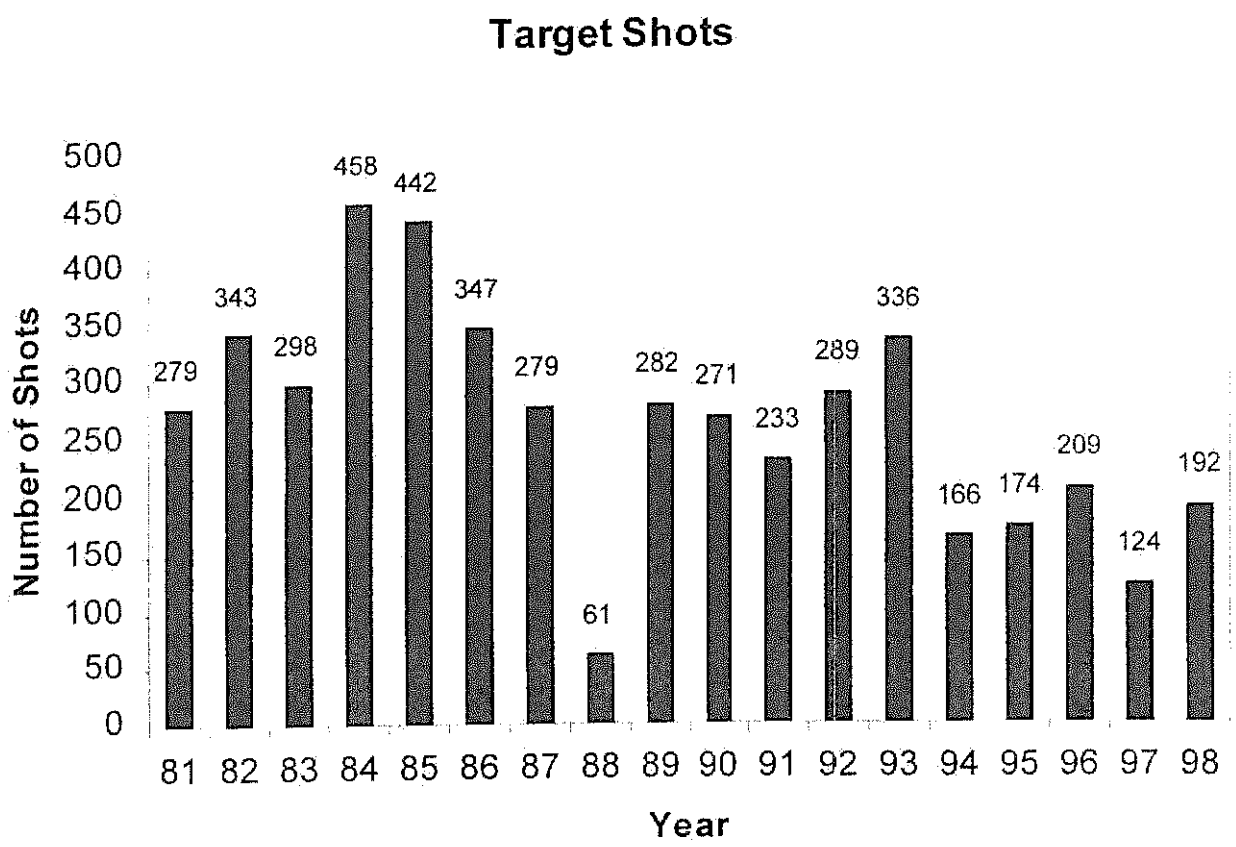
HELEN Laser Lifetime Target Shots



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Safety Management

- Engineering Controls
  - Door Interlocks etc
  - Castell Keys
  - Access Restrictions (Card Access)
  - Evacuate areas at shot time
- Administrative Controls
  - NII Licensed Site
    - Work Instructions
    - Risk Assessments
    - Competent Person Register/On the Job Training
    - Appointed Persons (Electrical)
    - Regular Audits
    - Change Controls
- PPE
- Be safe but also demonstrate that we are safe

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Support Facilities

- Clean Room
- Optical Workshop
- Sol-gel Coating Facility
  - Spin
  - Dip
  - Meniscus
- Photometry Lab
- Laser Damage Lab
- Amplifier Test Lab
  - ssg tests

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Summary

- C16/C15 houses the HELEN laser and support laboratories
- HELEN is a multi-beam solid state laser producing powers >1TW in a 1ns at 527nm
- The laser is focused onto small targets for physics studies of matter at extreme temperatures, densities and pressures under controlled laboratory conditions