

The Early Days of Proton Therapy

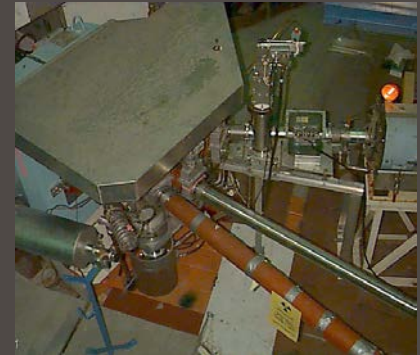
Steps along the way and who contributed

Celebrating 20 years of Treatment

Ewart Blackmore

Accelerating Science for Canada
Un accélérateur de la démarche scientifique canadienne

Owned and operated as a joint venture by a consortium of Canadian universities via a contribution through the National Research Council Canada
Propriété d'un consortium d'universités canadiennes, géré en co-entreprise à partir d'une contribution administrée par le Conseil national de recherches Canada



First Steps TRIUMF 1979-1990

- 1979: Plans for BL2C (65-120 MeV) – John Vincent
- 1980-82: Design, installation of BL2C components - layout
- 1982: First test beams on BL2C with fixed stripping foils - EWB
- 1983-86: Studies on isotope production with cesium (Xe-127) and NaI targets (I-123) - JV & Dave Pearce
- 1987: First beam into BL1B experimental area – neutrons for RBE measurements in collaboration with BCCA – Gabe Lam
- 1988: Protons into BL1B area & Bragg peak measurements on BL2C and BL1B (200 MeV) – JV and EWB
- 1990: BL2C extraction system installed – Dan Gray, Dave Morris

BL2C Proposal 1979

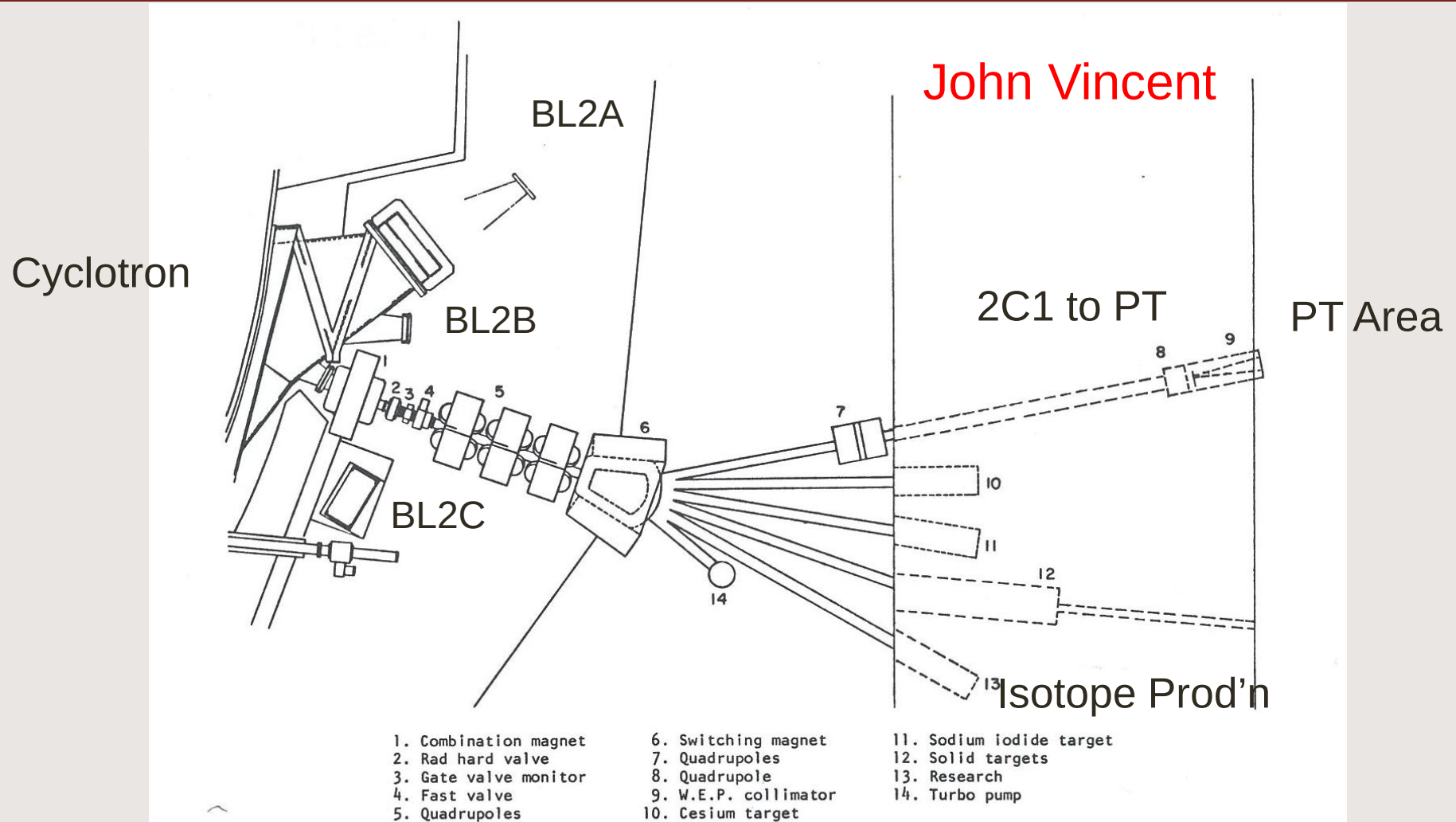


Fig. 109. Proposed layout of beam line 2C inside the vault.

First Bragg Peak Measurements 1988

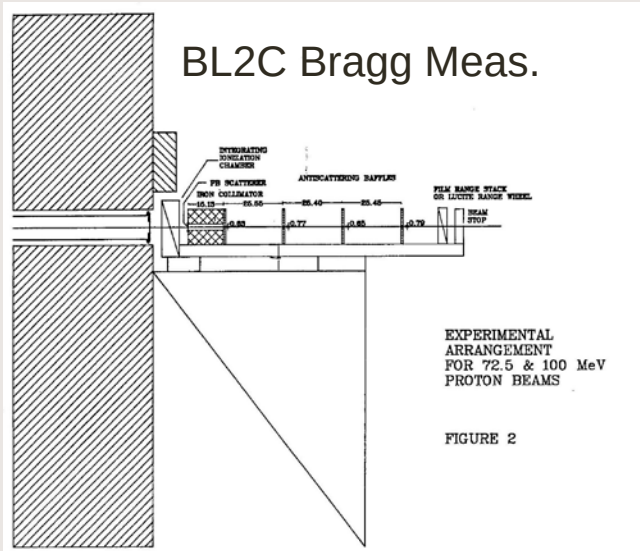
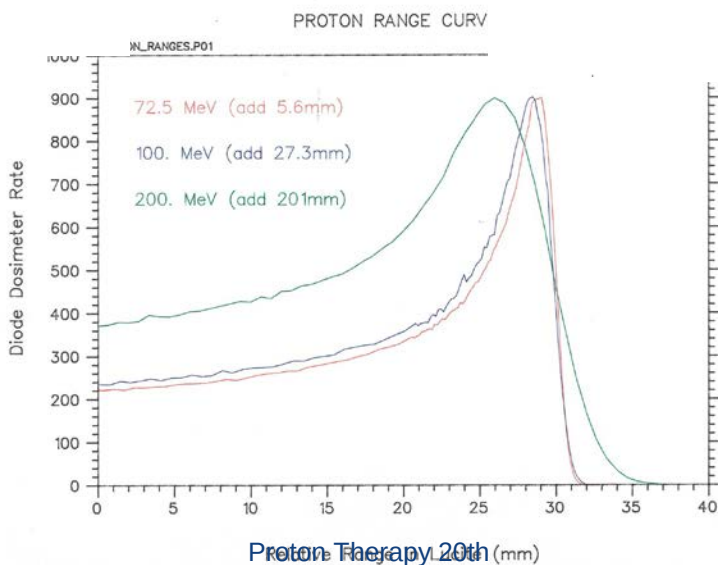
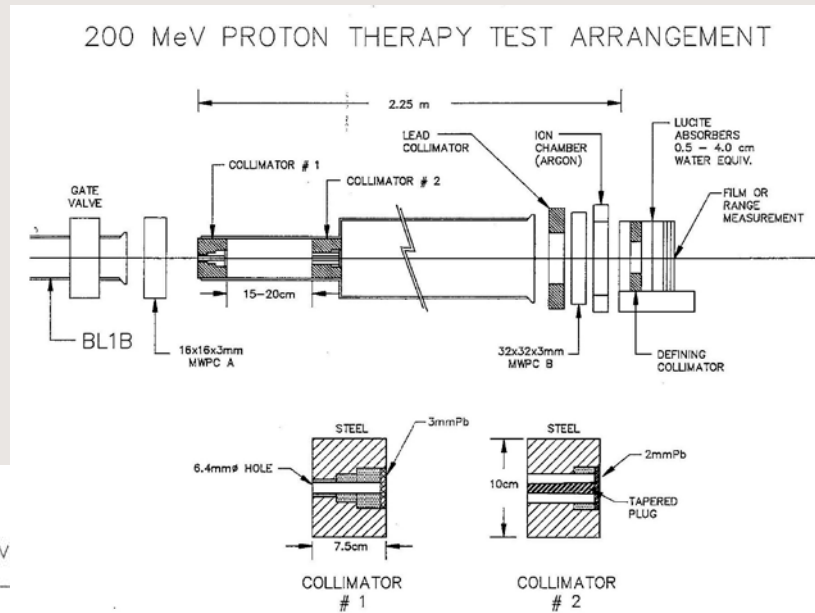


FIGURE 2



**John Vincent
Ewart Blackmore**

Collaboration with BC Cancer Agency

1979: First patient treated with negative pions on M8 channel

1981: Patient couch installed, cyclotron reliability/intensity issues for 15 fraction treatments.

1990: *Pion therapy at TRIUMF. Treatment results for astrocytoma grades 3 and 4: a pilot study.* [Goodman GB¹](#), [Skarsgard LD](#), [Thompson GB](#), [Harrison R](#), [Lam GK](#), [Lugate C](#).

1994: Last pion patient treated

1997: *Results of randomized trial using pions (2 papers)* based on ~350 patients. **Tom Pickles et al**

Summary: Experiment in radiotherapy, pion flux issues, 15 fraction issues for scheduling and patient accrual.

- but very important for improving cyclotron reliability/intensity
5 year results with pions no better than conventional therapy

Protons much easier to produce than pions!

Collaboration towards Proton Therapy

1988: First meeting of Proton Group Planning Committee
G. Goodman, J. Rootman(Eyes), F. Durity(AVMs)

1988-92: Regular meetings at Cancer Agency: EWB. JV attending

1992: Business plan BCCA to province for tumours of the eye
(uveal melanoma) and neuroradiosurgery (AVMs) – see layout

1992: Woodward's Foundation grants \$500K for eye therapy
using BL2C.

1993; Revised business plan for Eye Therapy only.

Medical: Drs T.Pickles, R.Ma, G.Goodman, K.Paton, L.Skarsgard,
E.El-Khatib, G.Lam, I.Liu

TRIUMF: E.Blackmore, J.Vincent, U.Oelfke, K.Gardey

Monthly meetings at Cancer Agency 1993-1995.

Early Plans for Proton Therapy

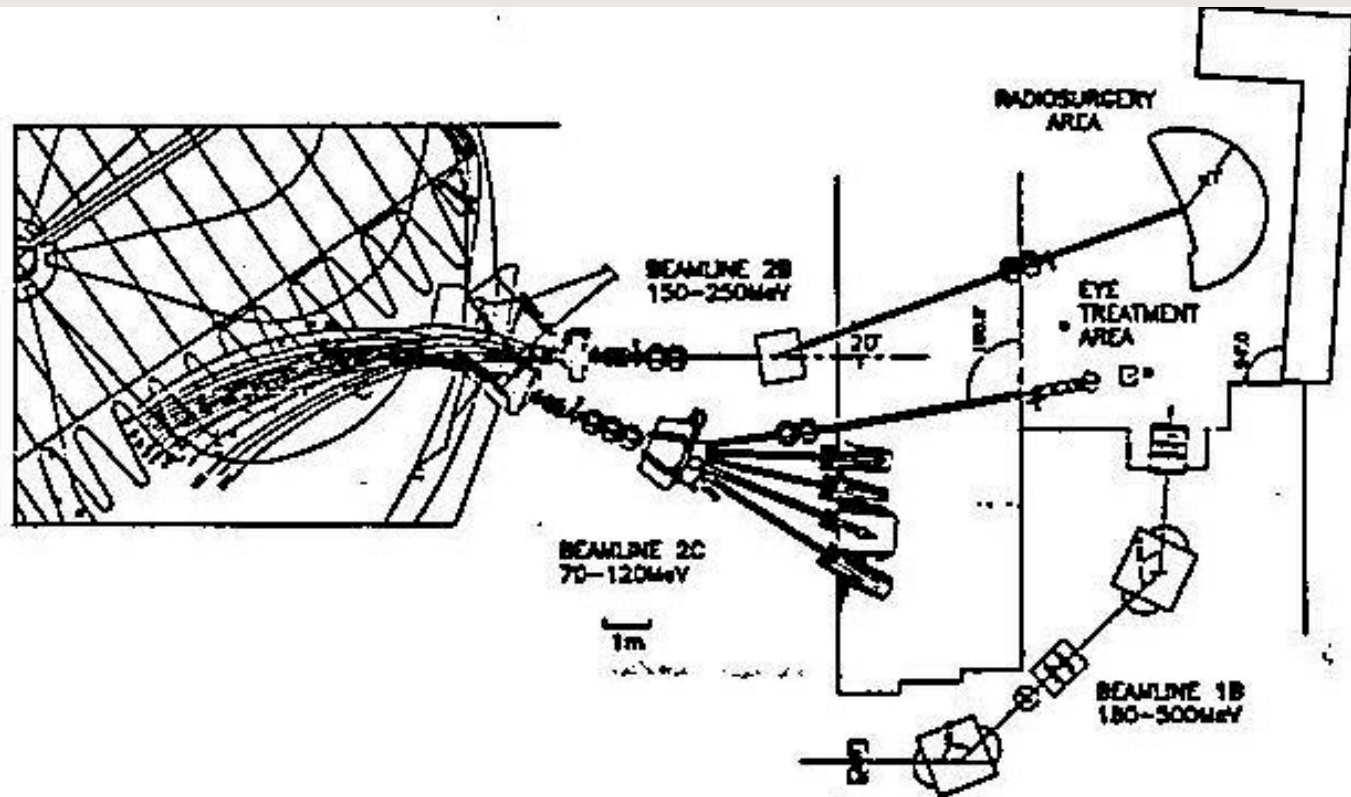


Fig. 122. Layout of proton therapy facility in present BL1B area.

Proposal to Woodward's Foundation for Eye Therapy

The capital cost estimates for 1991 for this program include construction of a facility at TRIUMF to allow treatment of patients including an eye chair, radiography facilities and satellite viewing stations. The capital costs are broken down as follows.

TABLE 5

PROPOSED CAPITAL COSTS	
Beam delivery equipment	\$50,000
Alignment equipment	100,000
Eye chair	115,000
Controls and instrumentation	50,000
Building/area modification	100,000
Treatment planning	25,000
Contingency	60,000
	500,000

Purchases Outside

- Eye chair - Benchmark
- X-ray equipment - Toshiba
- Room modifications

Rest done by TRIUMF

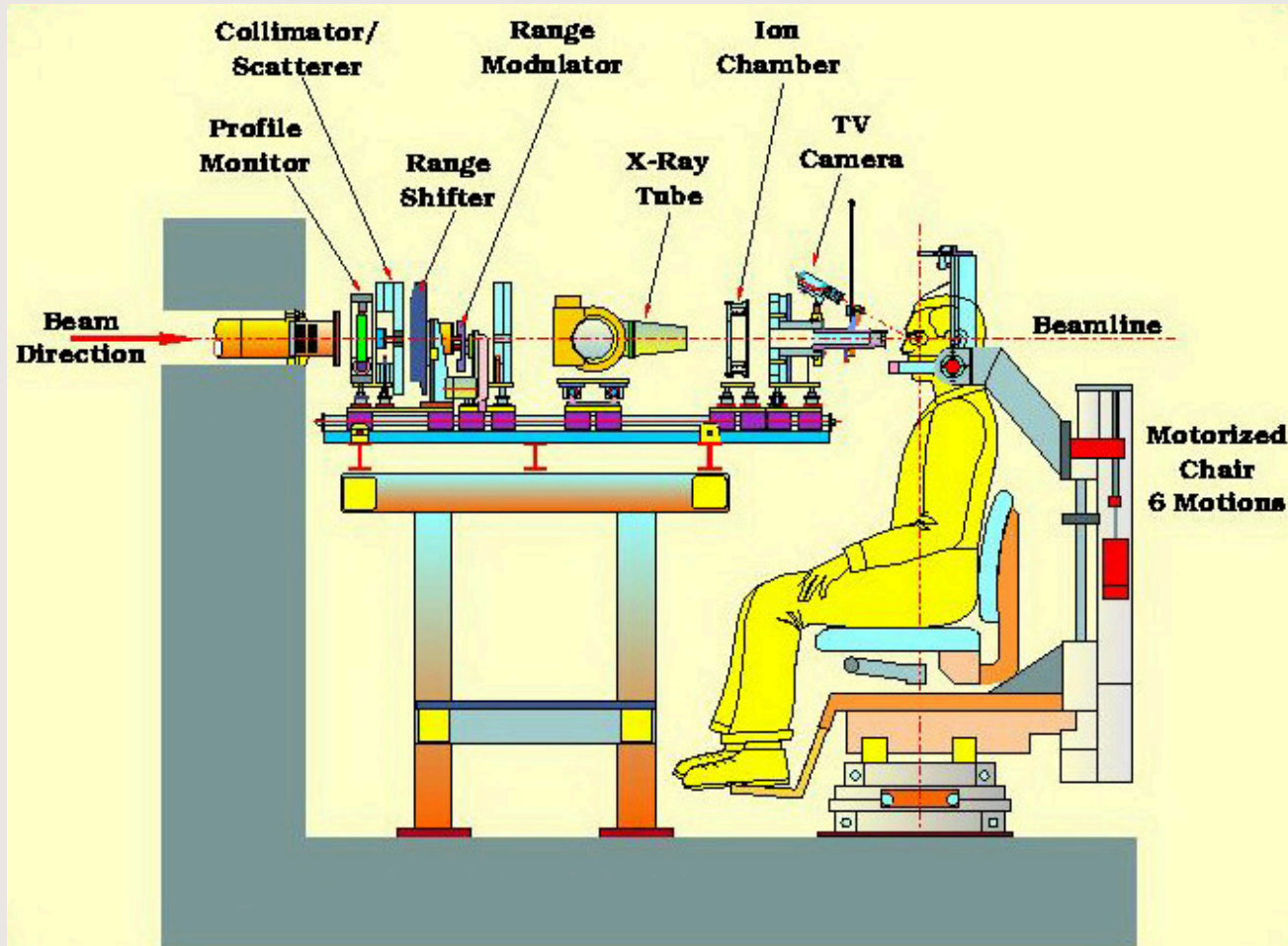
EWB visited Harvard, PSI, Clatterbridge (UK) to learn about Eye Therapy techniques & equipment

Assumptions

- Land, building maintenance, hydro, etc. will be assumed by TRIUMF.
- Building of the beam-handling components would be done by existing staff as outside contracting could increase cost by a factor of 3.
- Estimate for materials or purchased parts only. Assumes TRIUMF will provide design office, electronic and machine shop free of charge. Complete outside contracting could increase cost by a factor of 3.

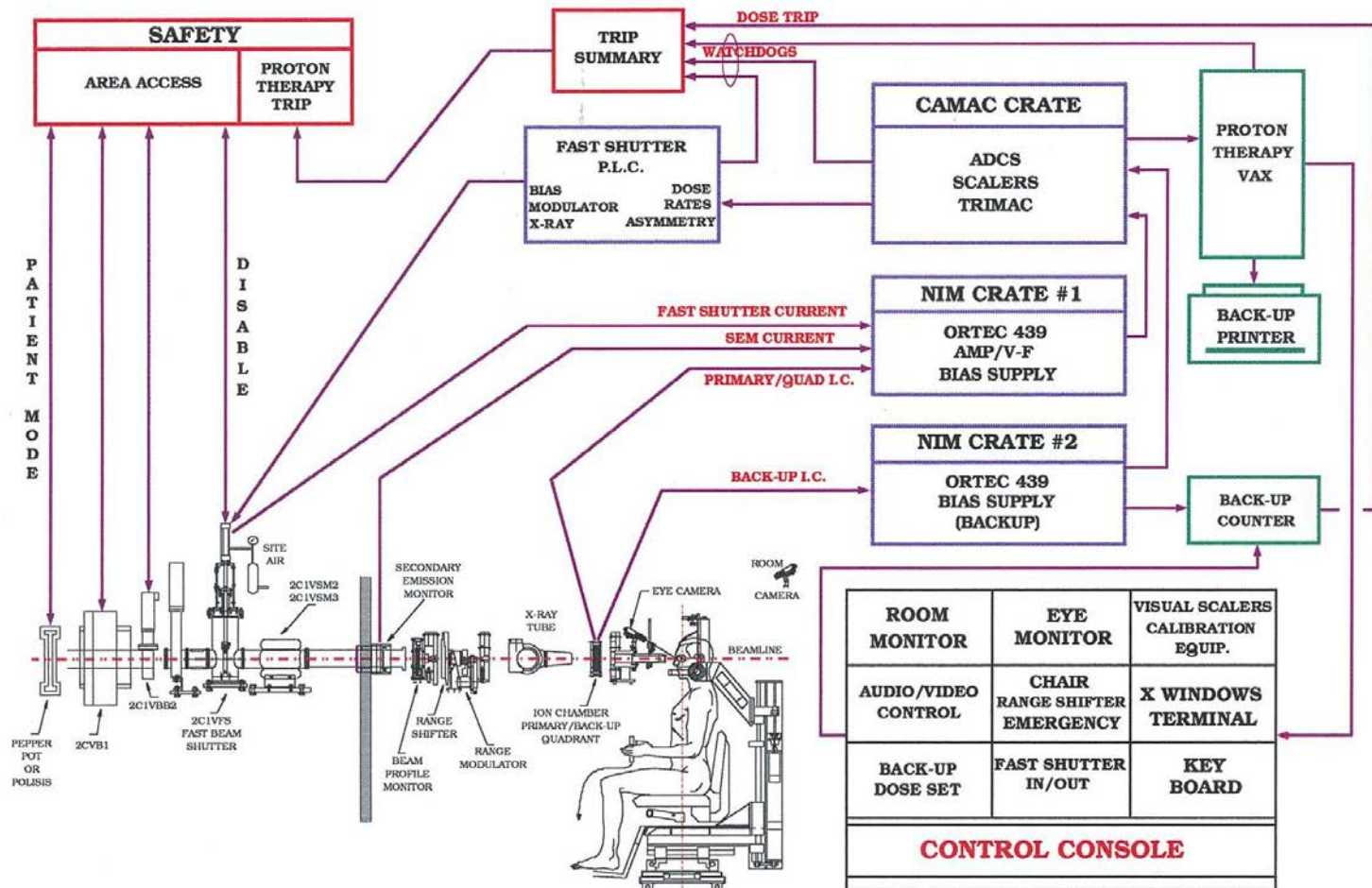
Design Phase 1993-1994

During the last years of the KAON PDS



Design Phase 1993-1994

PROTON THERAPY CONTROL SYSTEM



TRIUMF PT Team

Overall coordination – EWB

Mechanical design & ass'y: F. Cifarelli, E. Knight + Machine Shop

Fast Shutter, profile monitor: D. Gray, B. Rawnsley

ISIS pepperpot: R. Ruegg

Ion chambers: W. Faszler, P. Vincent, C. Lim

Modulators & Range Shifter: EWB, U. Oelfke, K. Gardey

Controls hardware, software, cameras, console: B. Evans, P. Bennett, R. Moore, J. Nelson, D. Morris, B. Roberts

Operator Interface software: M. Mouat, T. Kadantseva, E. Klassen

Room modifications: H. Mertes

Safety hardware & overview: J. Drozdoff, L. Moritz, I. Thorson

Control room operations & BL2C coordination: A. Hurst, M. Stenning, J. Vincent, D. Pearce.

Summer students: R. Van Varsveld

Main Challenge – Getting AECB Approval

- System commissioned and ready for patient treatment by December 1994
- Dosimetry checked, beam profiles checked
- RBE measurement using V79 cells & mouse feet
- Treatment planning software EYEPLAN and patient alignment checked.
- TRIUMF TSAC approved Safety Analysis Report but AECB wanted more reviews.
- February 1995: External Expert Review Dr. L. Verhey
- April 1995: Structured Peer Review (control system)
- May 30, 1995: AECB grants Proton Therapy Operating Licence.

BC Cancer Agency/Ophthalmology Team

Eye Care Centre/UBC: Dr. Katherine Paton, Dr. Jack Rootman

Oncologists: Dr. Tom Pickles, Dr. Roy Ma

Medical Physics: Dick Kornelson, Gabe Lam, Ellen El Khatib, Cheryl Duzenli, William Kwa, Richard Lee, Conrad Yuen

Physics Ass't: Ivan Liu, Vince Strgar

Radiotherapy Technologists: Chris Alexander, Pat Ho, Sarah Conibear

TRIUMF: Ewart Blackmore, Conny Hoehr (since ~2009)

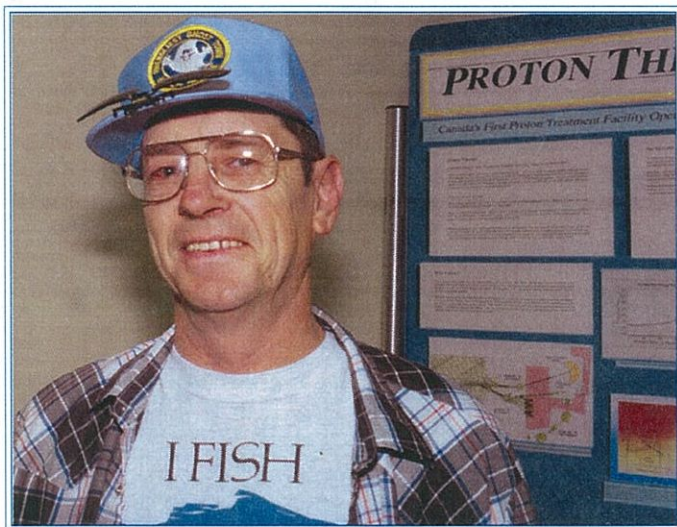
Typically 5-9 present at TRIUMF for each treatment

First Patient August 21-25 1995

PRESENT:

Dr. T. Pickles
Dr. E. Blackmore
Dr. R. Ma
Dr. K. Paton
Dr. U. Oelfke
Dr. C. Duzenli
Chris Alexander

Dr. J. Vincent
Dr. L. Skarsgard
Dr. G. Lam
Mr. K. Gardey
Mr. I. Lui
Bob Harrison



The first patient, Mr. Lorne Scott, immediately after proton treatment to his right eye at TRIUMF in August 1995.

DATE

Monday, July 31	Clip insertion
Tuesday, August 8	Simulation 8:00 a.m. at TRIUMF
Thursday, August 10	Planning 8:30 a.m. at TRIUMF
Thursday, August 17	Final measurements, if needed
Friday, August 18	
Saturday, August 19	
Sunday, August 20	Final Simulation
Monday, August 21	First fraction
Tuesday, August 22	Second fraction
Thursday, August 24	Third fraction
Friday, August 25	Fourth fraction

Thank you!

Merci

TRIUMF: Alberta | British Columbia |
Calgary | Carleton | Guelph | Manitoba |
McGill | McMaster | Montréal | Northern
British Columbia | Queen's | Regina |
Saint Mary's | Simon Fraser | Toronto |
Victoria | Western | Winnipeg | York

