CLS Beamline Remote Control Project
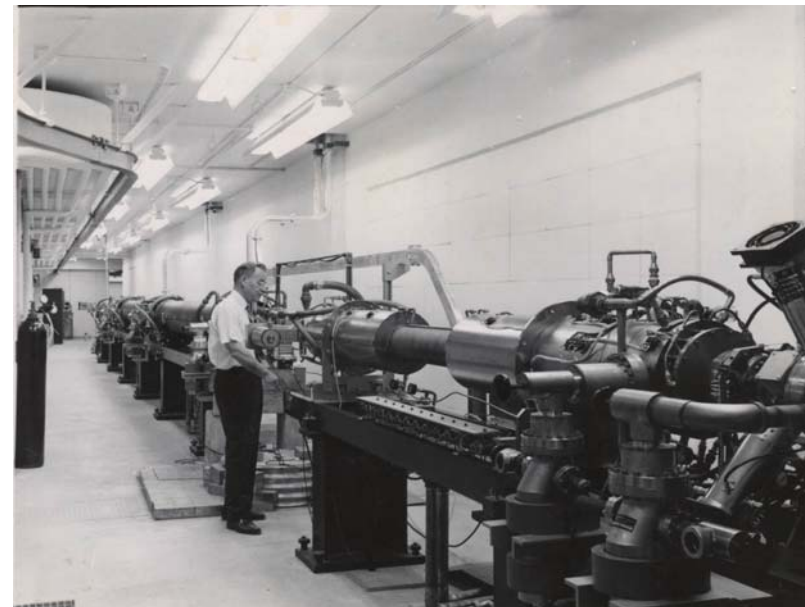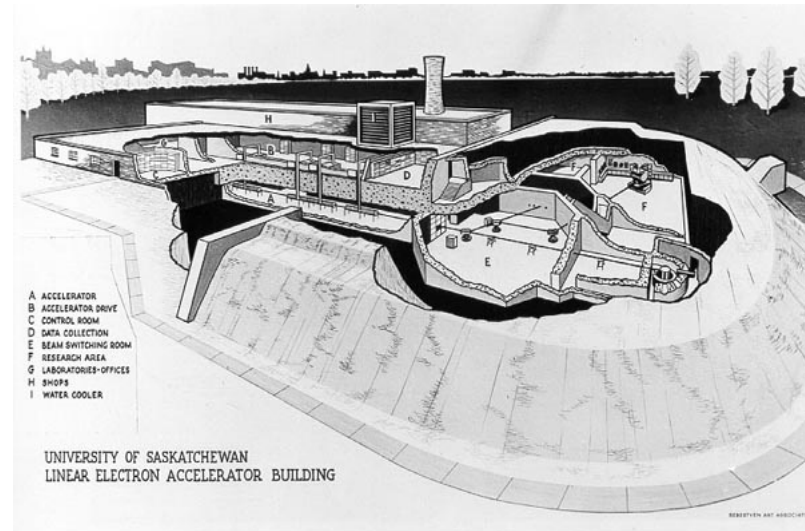

E. Matias
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University of Saskatchewan

- 1964 Saskatchewan Accelerator Lab (SAL) was established for chemistry and nuclear physics research.

University of Saskatchewan Linear Electron Accelerator Building

A ACCELERATOR
B ACCELERATOR DRIVE
C CONTROL ROOM
D DATA COLLECTION
E BEAM SWITCHING ROOM
F RESEARCH AREA
G LABORATORIES-OFFICES
H SHOPS
I WATER COOLER

Background on CLS Accelerator Complex

- 1964 Saskatchewan Accelerator Lab (SAL) was established for chemistry and nuclear physics research.

- 1999 SAL operations were discontinued, and the accelerator was refurbished as an injector for a new 170.88 m storage ring.

SR1 Machine Parameters
2.9 GeV DBA lattice with 12-fold period
Nominal Tune:

$$\nu_x = 10.22$$
$$\nu_y = 3.26$$

E_{loss} per turn: > 0.876 MeV
Bend magnet radiation:

$$\lambda_c = 1.6 \text{ Å}$$
$$E_c = 7.6 \text{ keV}$$

$\varepsilon_x = 18.1$ nm•rad
Damping times:

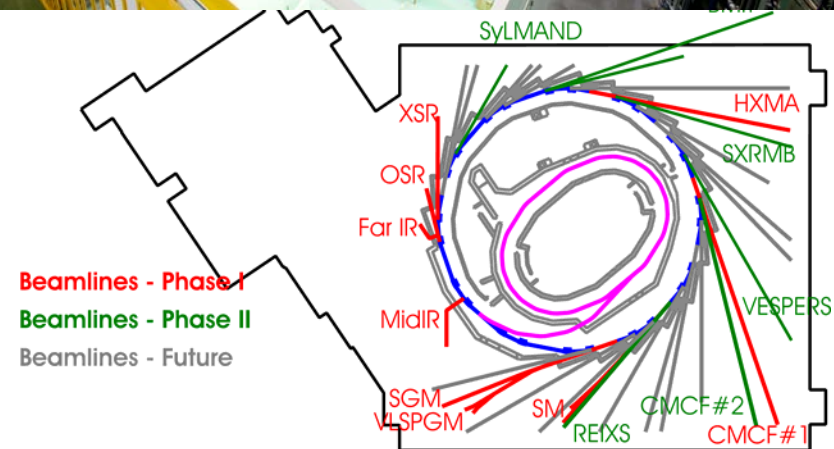$$\tau_x = 2.4 \text{ ms}, \ \tau_y = 3.8 \text{ ms}, \ \tau_E = 2.7 \text{ ms}$$

~10 mm bunch length

Status of CLS Beamlines

- **Phase 1 (commissioning):**
  - Total of 7 scientific and 2 diagnostics beamlines.
- **Phase 2 (funded):**
  - Total of 7 additional beamlines and
  - building expansion for medical imaging.
- **Phase 3 (pre-proposal):**
  - Total of 5+ additional beamlines and
  - building expansion.

Beamlines - Phase I
Beamlines - Phase II
Beamlines - Future

SyLMAND
XSR
OSR
Far IR
MidIR
SGM
VLSPGM
SM
REIXS
HXMA
SXRMB
VESPERS
CMCF#2
CMCF#1

- Common EPICS control system for machine and beamlines
- OPI
  - Scientific Linux with EDM screens
- Scripting
  - Matlab and CERN Root
- IOC
  - RTEMS or Linux
  - using single board computer or
  - industrial PC with fibre optic links
- PLC
  - Telemecanique Momentum
  - Siemens S7/300, S7/400 and S7/400 F
- Relational Database
  - MS-SQL Server
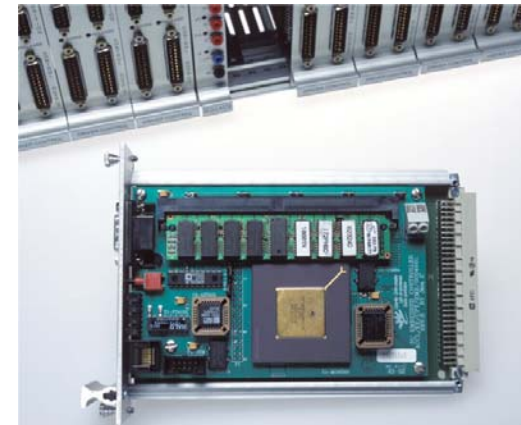
- Facility services users from across Canada.

- User travel time can be up to a day.

- Protein crystallography (PX) and VESPERS beamline users have expressed a strong desire for remote control capability.

- Remote control for PX and VESPERS is feasible.

- Two modes of operation:
  - Direct Remote control
  - Remote queuing and data acquisition with Grid data analysis

- ## Collaboration between:
  - Canadian Light Source, Inc. U of S (Project Lead)
  - IBM Canada
  - University of Western Ontario
  - University of Alberta
  - BigBangwidth
- ## Project funding by:
  - CANARIE, with additional funding from CLS, IBM, UWO and BigBangwidth.
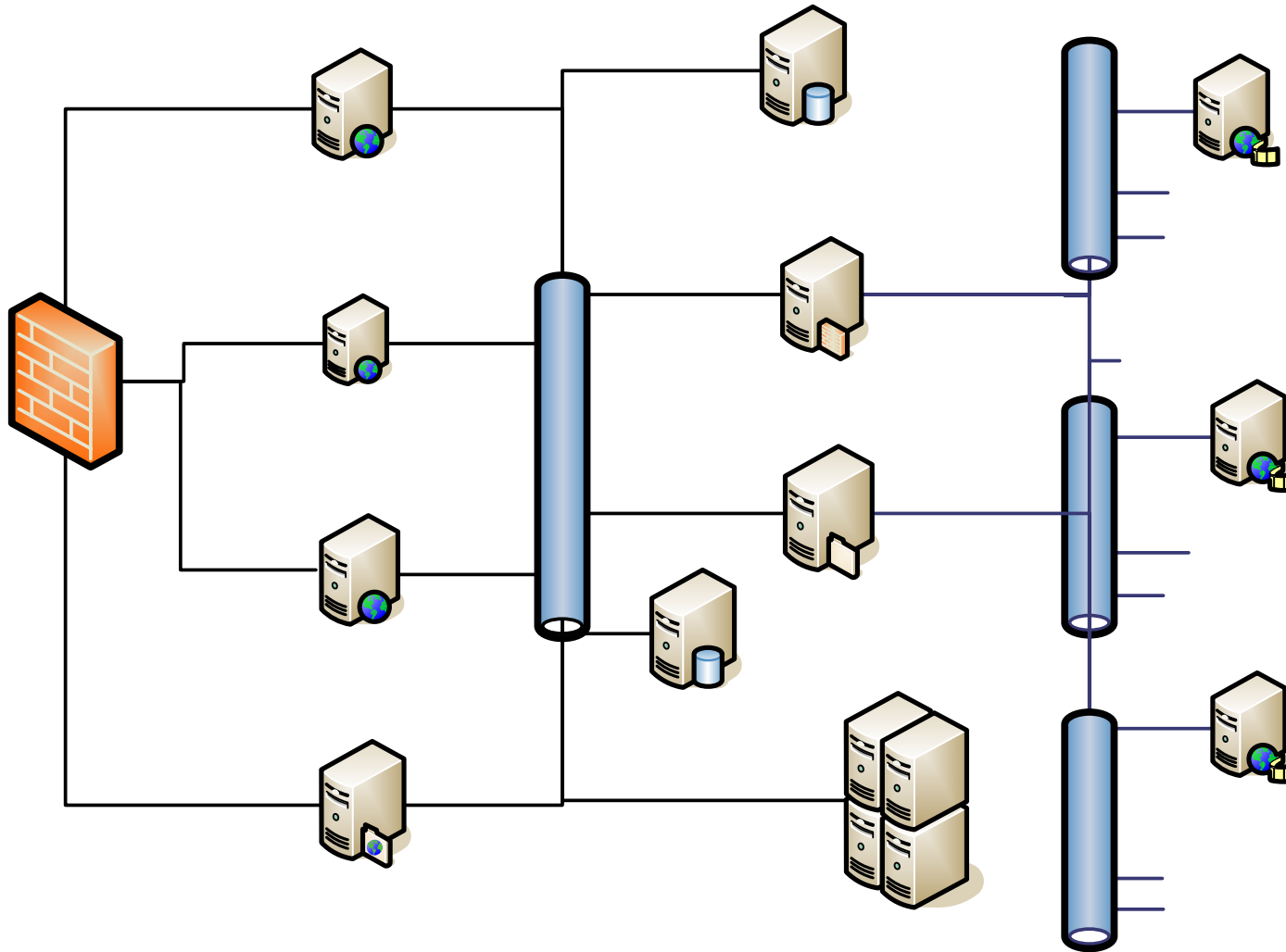
- **IBM Rational WebSphere Studio Application Developer**
  - offers creation tools, editors, wizards, templates, and code generators based on SOA and WSDL
- **IBM WebSphere Process Choreographer**
  - Business Process Execution Language for Web Services (BPEL)
  - A process is a directed graph that starts with an Input node and ends with an Output node. A process itself is described in WSDL. Its input and output are described as WSDL messages.
  - A process can contain many activities. An activity can be the invocation of an EJB, a Java class, a service or another process. A process can also be event-driven.
- **IBM WebSphere Portal**
 - Web server with collaboration tools.

- EPICS Web Service
  - CLS requires an interface to EPICS.
  - Based on SOA, and WSDL specifications.
  - DIXI Server from DESY is a possible starting point.

  - EPICS Web service will be open source.

Web Services Description Language

WSDL normally defines web services portType, message, type, and binding.

-      <portType>   The operations performed by the web service. This defines the functions of interfaces provides by the web service.

-      <message>   The messages used by the web service. The messages are used to define the parameters used by the web service.

-      <types>   The data types used by the web service. Defines the data types that are used by the web service. Note, XML schema is used to define the data types for | cross-platform portability reasons.

-      <binding>   The binding element defines the message format and protocol details used for each port.

CANARIE CA*net^4
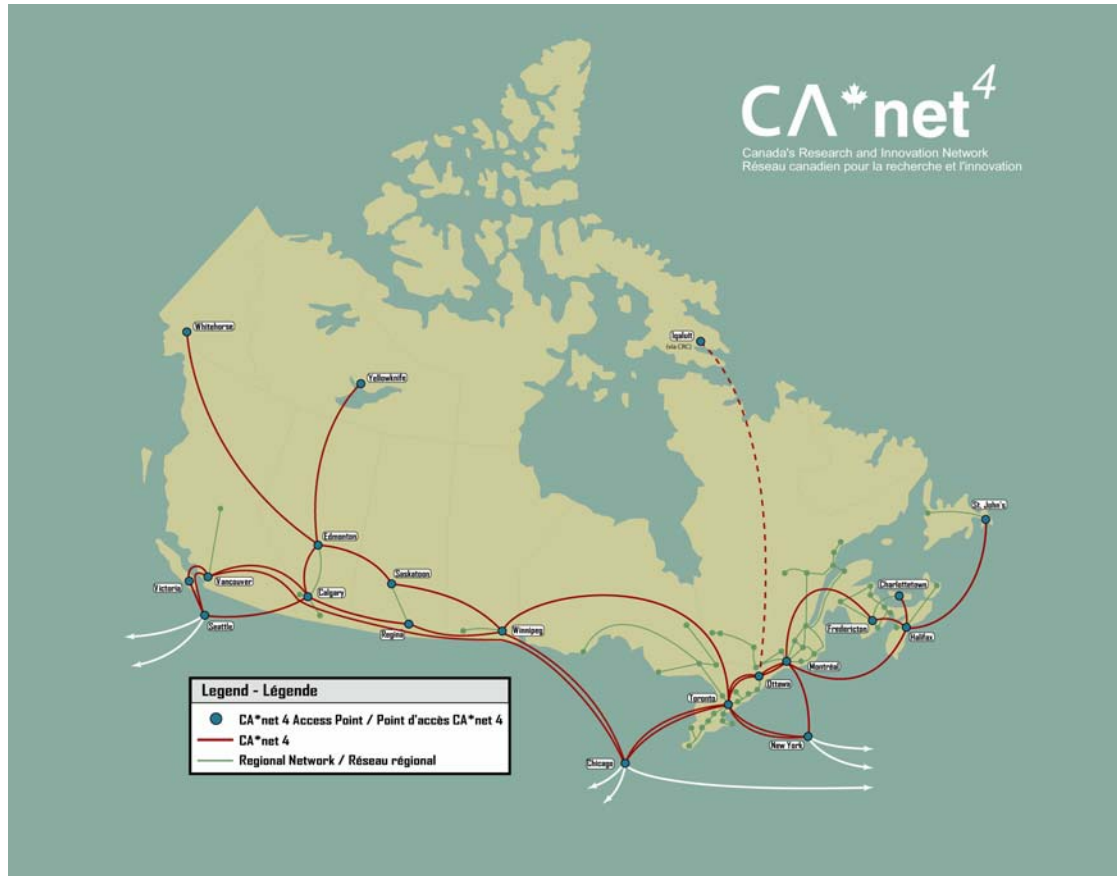
- CA*Net^4 using User Configurable Light Paths (UCLP), dedicated connections are available between CLS and Canadian Universities with shared international links

- **UCLP Connections:**
  - University of Alberta
  - University of Calgary
  - Simon Fraser University
  - University of Toronto
  - McGill University
  - University of Western Ontario
  - University of British Columbia
  - National Research Council Montreal (BRI)
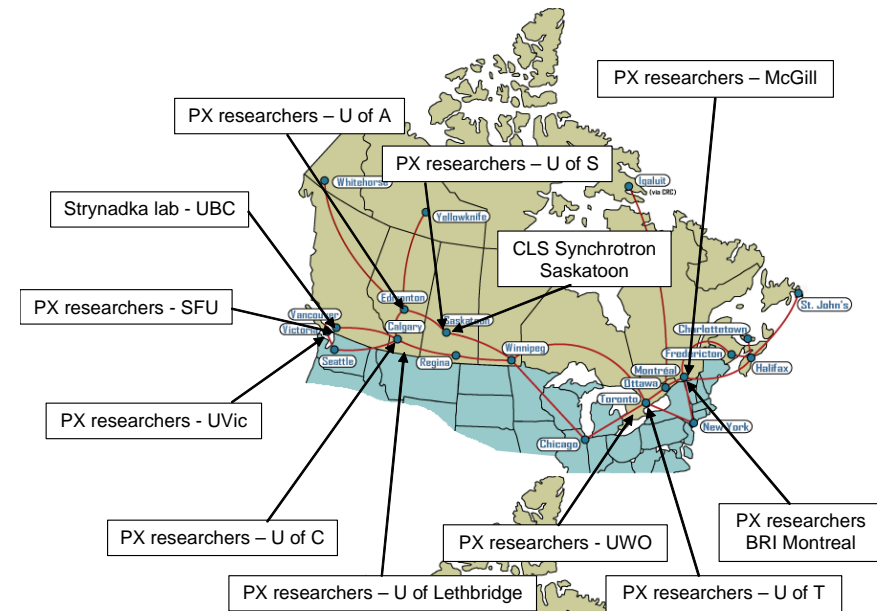
  System using BigBangwidth 1 or 10 Gigabit Light Path Accelerator Technology