



(originally **TRI-University Meson Facility**)

CANADA'S NATIONAL LABORATORY FOR PARTICLE AND NUCLEAR PHYSICS

*Owned and operated as a joint venture by a consortium of Canadian universities
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LABORATOIRE NATIONAL CANADIEN POUR LA RECHERCHE EN PHYSIQUE NUCLÉAIRE ET EN PHYSIQUE DES PARTICULES

*Propriété d'un consortium d'universités canadiennes, géré en co-entreprise à partir d'une contribution administrée par le
Conseil national de recherches Canada*



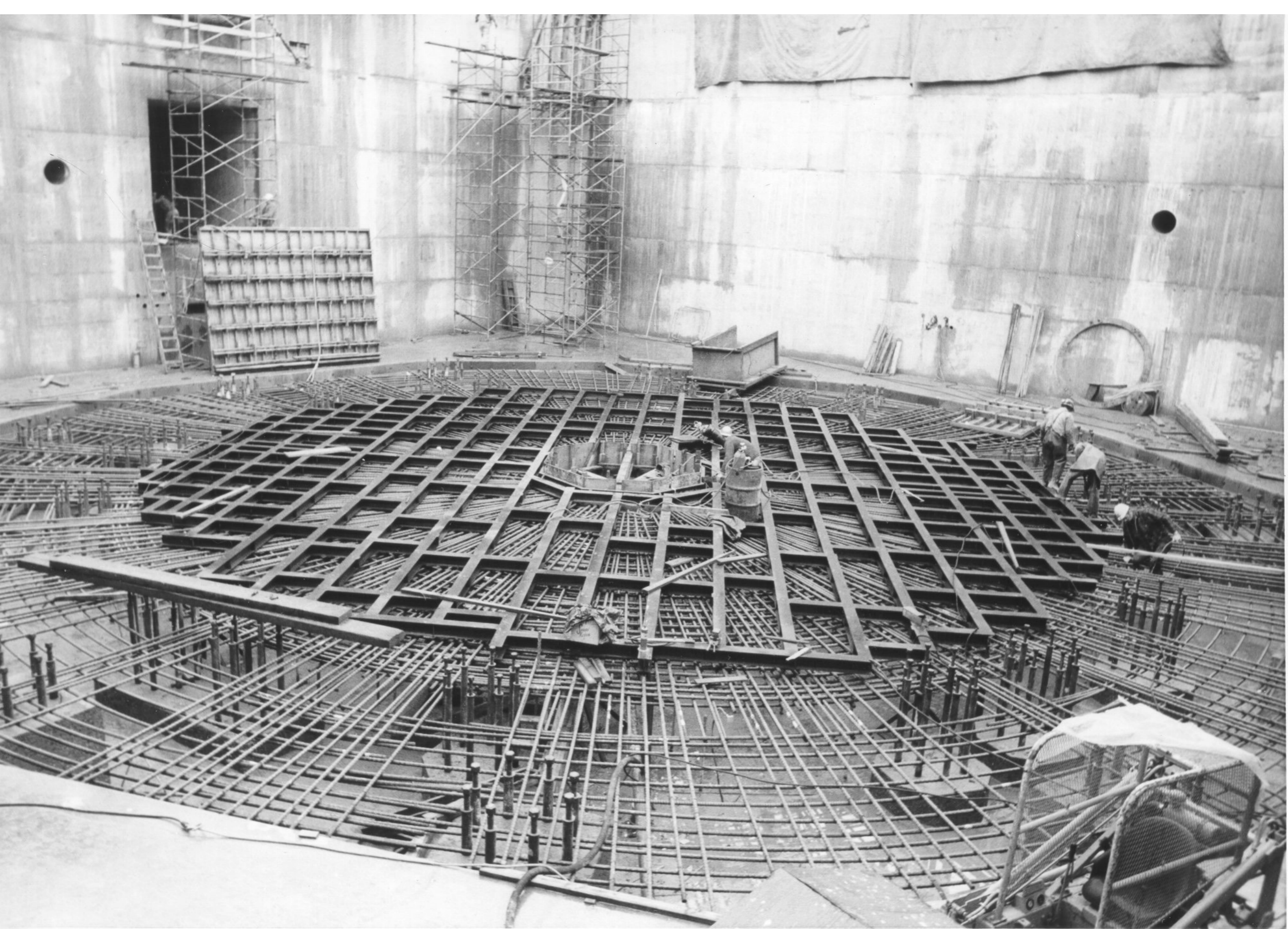


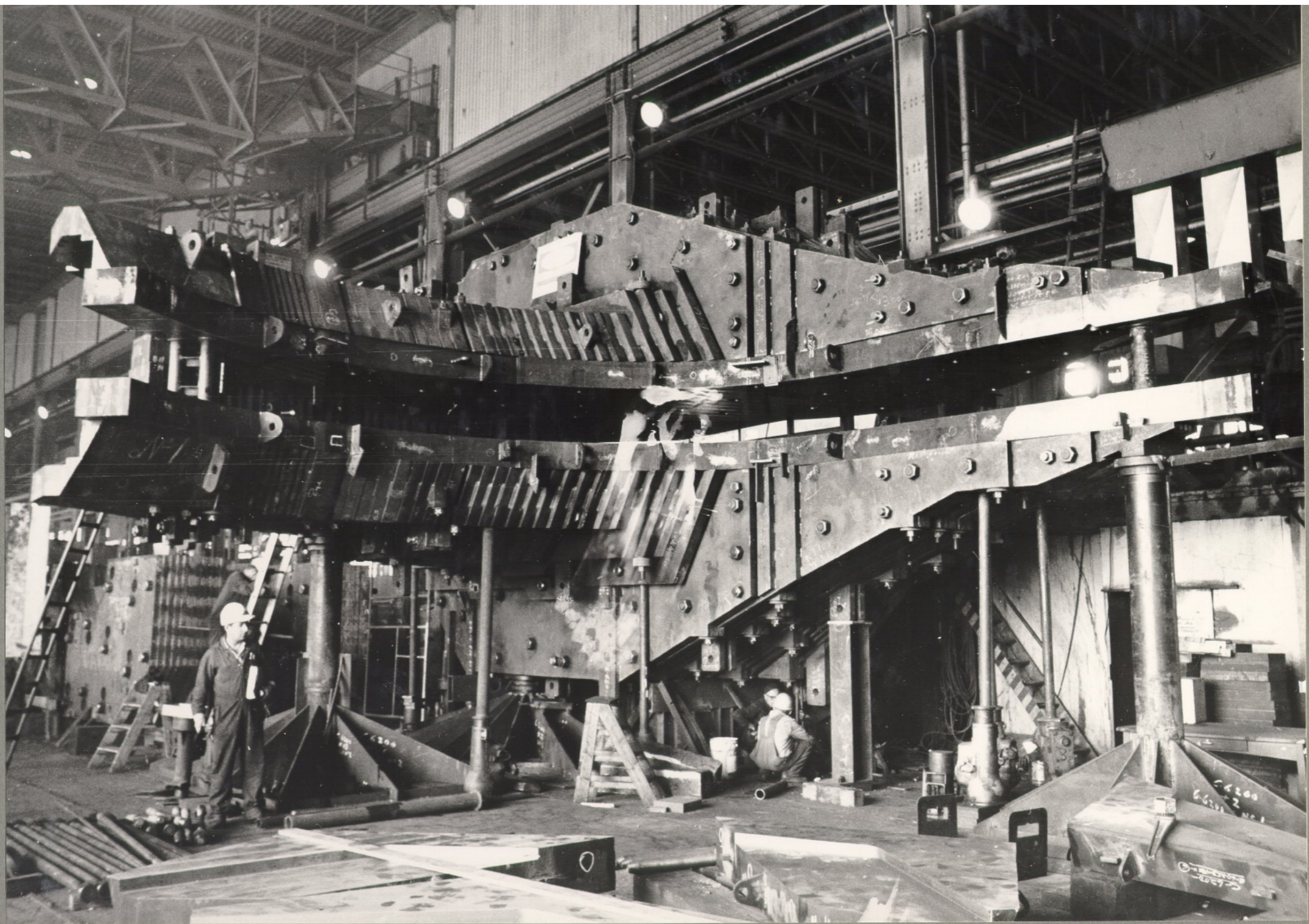




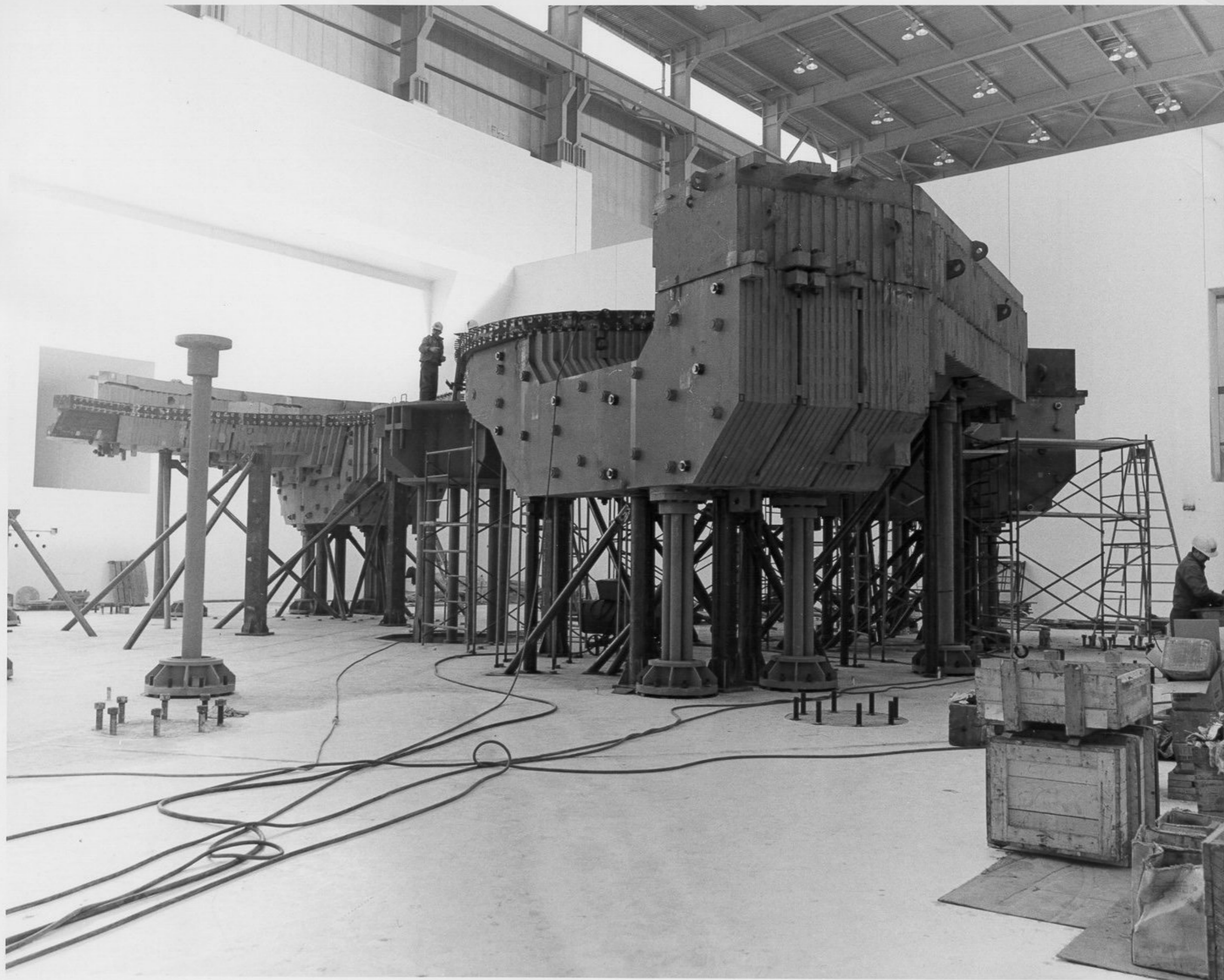
Erecting the Superstructure for the Main Building — March, 1971

(Commonwealth Construction Co. Ltd., Vancouver, B.C.)

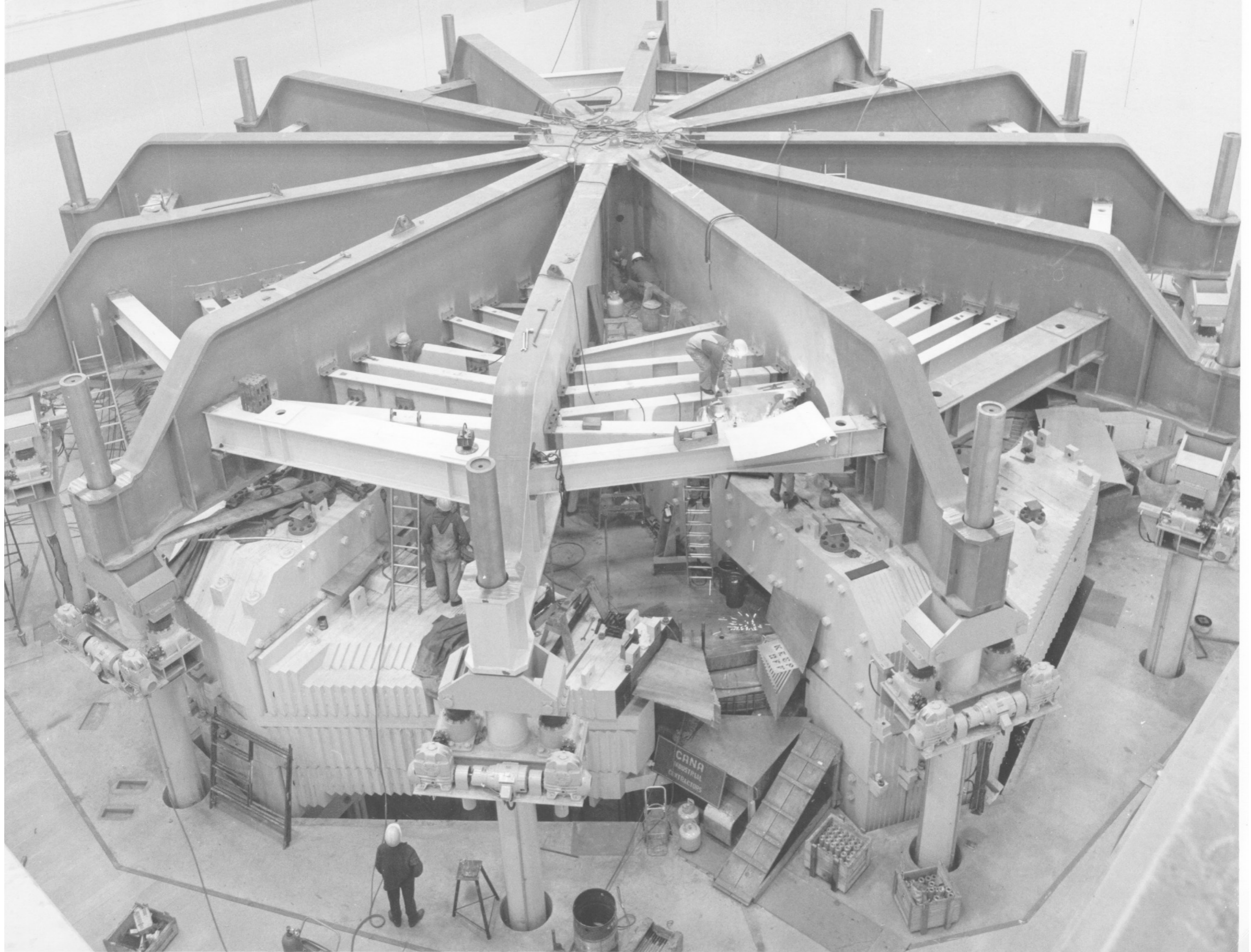


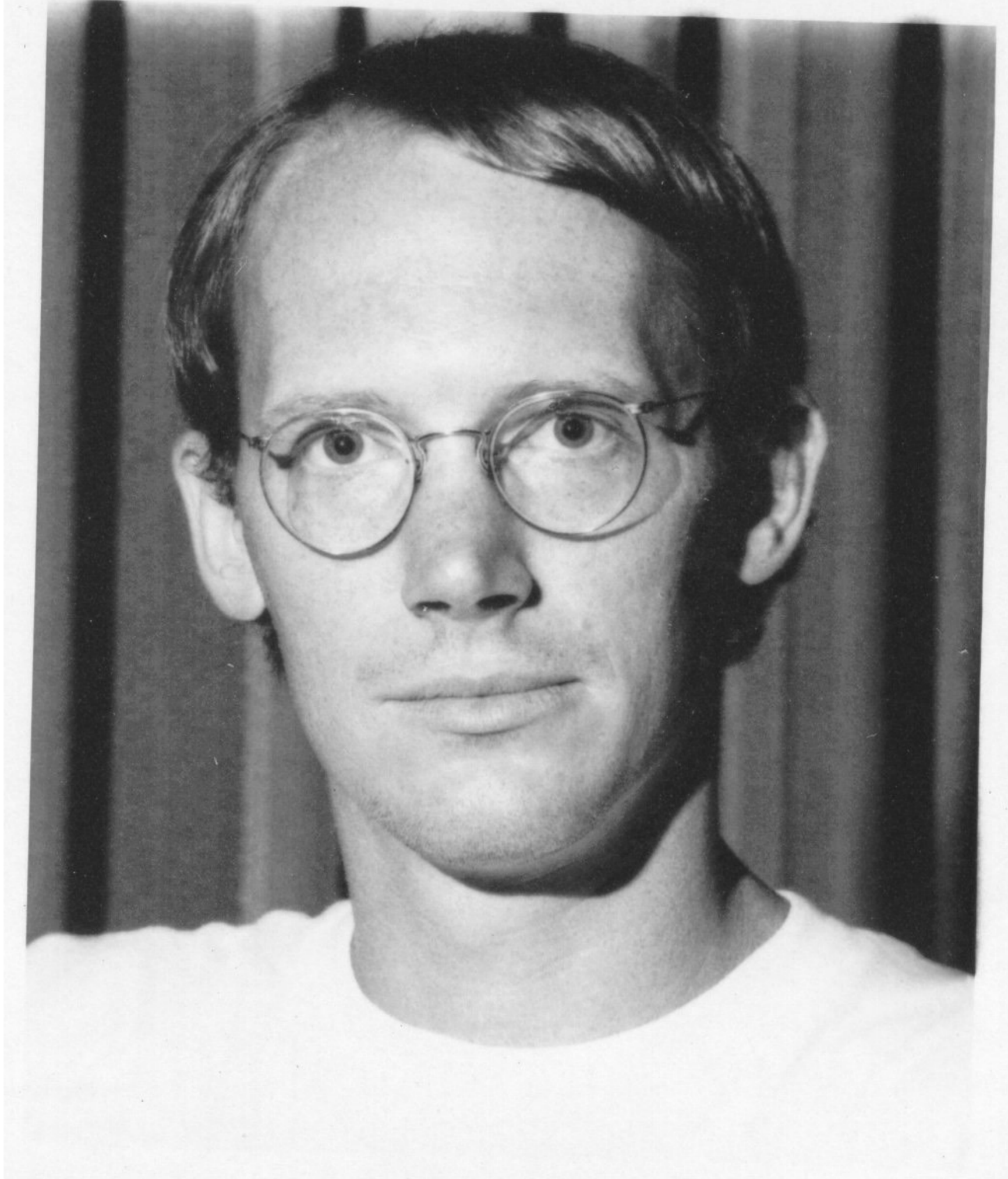


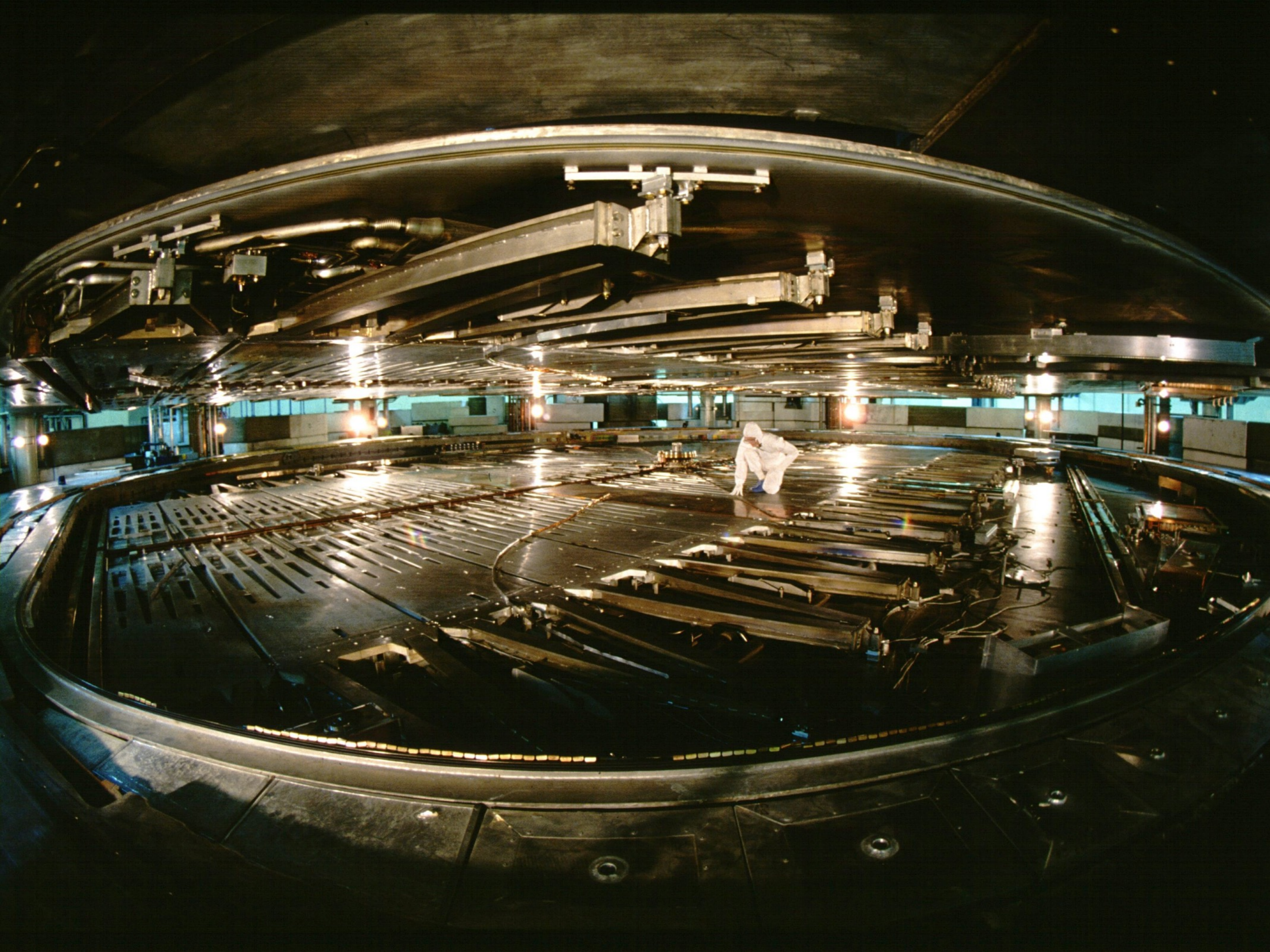
*First Magnet Sector Assembled at Davie Shipyards, Quebec
— June, 1971*











The Lorentz Force

$$\vec{F} = q (\vec{E} + \vec{v} \times \vec{B})$$

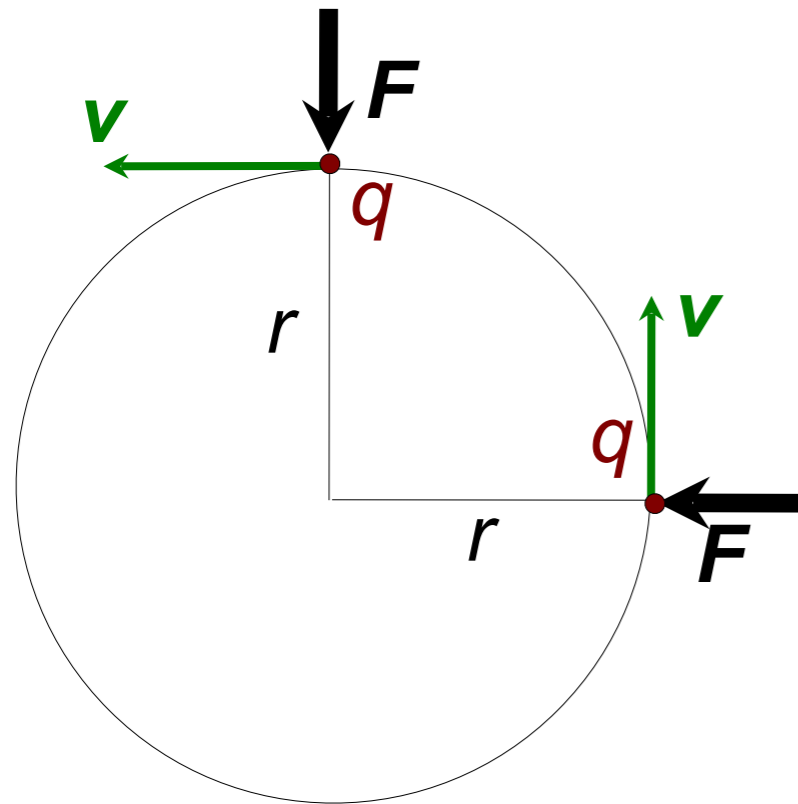
There are lots of applications of the Lorentz force, as you might expect. (After all, **force** is what we need to do some **work!**) We will look at:

- **Circulating Charges**: when \vec{v} is perpendicular to \vec{B} we get a force \vec{F} that is perpendicular to both. This produces **uniform circular motion**.
Cyclotrons: $p = qBr$ where p = momentum and r = orbit radius.
Magnetic Mirrors: Magnetic forces **do no work**. Spiral paths reflect.
- **Velocity Selectors**: when \vec{v} is perpendicular to both \vec{E} and \vec{B} we can adjust the ratio until $E/B = v$ so $F = 0$. If p is known, so is m .
- **Hall Effect**: charges moving down a conductor through a perpendicular magnetic field get swept sideways until a voltage builds up.
- **Rail Guns**: discharge a capacitor to make a huge current pulse....

The Cyclotron

When \mathbf{v} is perpendicular to \mathbf{B} we get a force \mathbf{F} that is perpendicular to both. This is the familiar criterion for **uniform circular motion**. Recall

$$mv^2/r = qvB \text{ or } p = qBr \text{ where } p = mv.$$



Since $\mathbf{v} = r\boldsymbol{\omega}$ we have $m r \boldsymbol{\omega} = qB r$

or

$$\boldsymbol{\omega} = qB/m = \text{constant.}$$

If the frequency of the charged particle orbit is constant, we can apply an accelerating voltage to the particles that reverses direction every half-orbit so that it is always in the right direction to make the particles go faster. This is what we call a **cyclotron**.

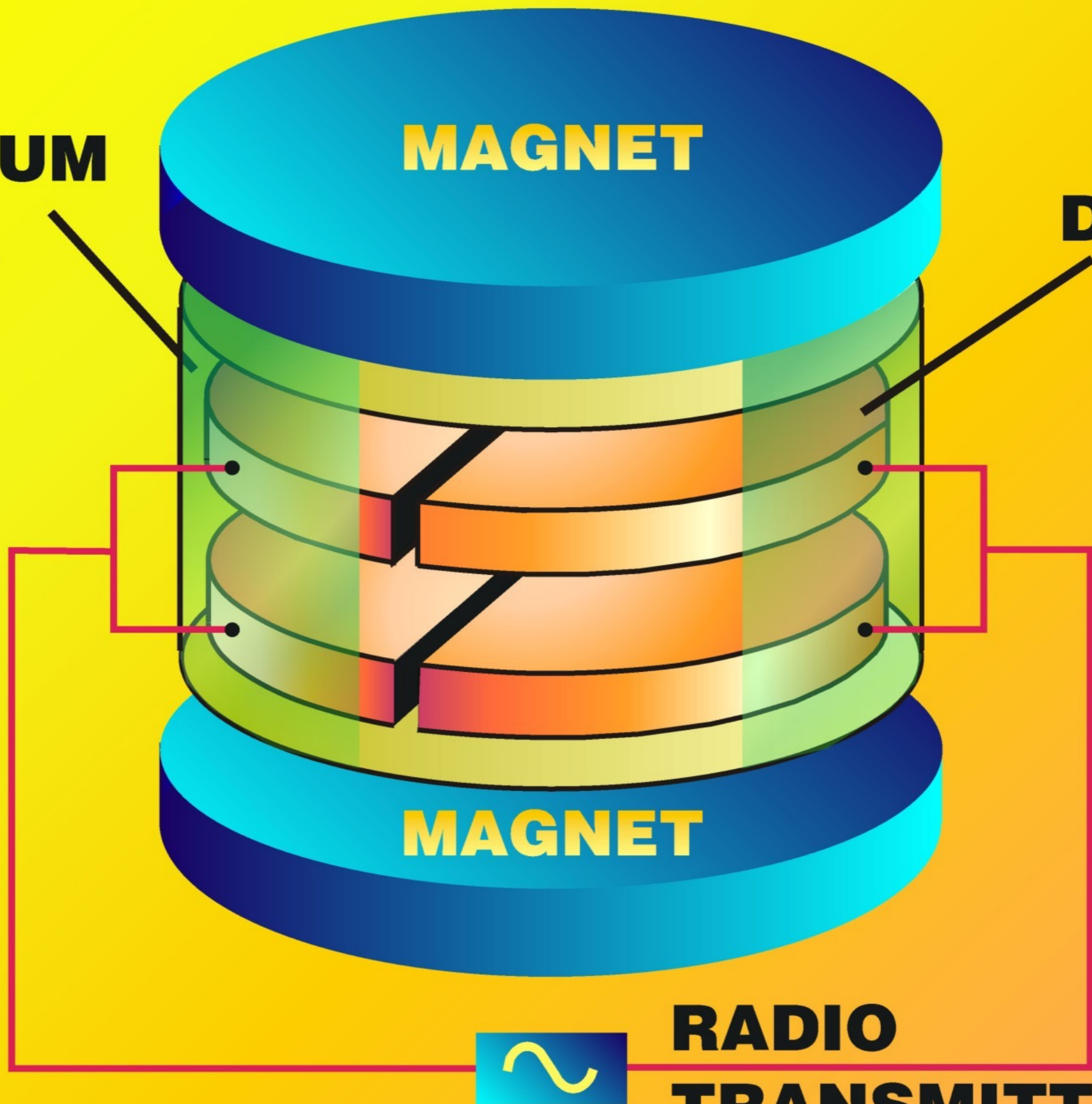
**VACUUM
TANK**

MAGNET

DEE

MAGNET

**RADIO
TRANSMITTER**



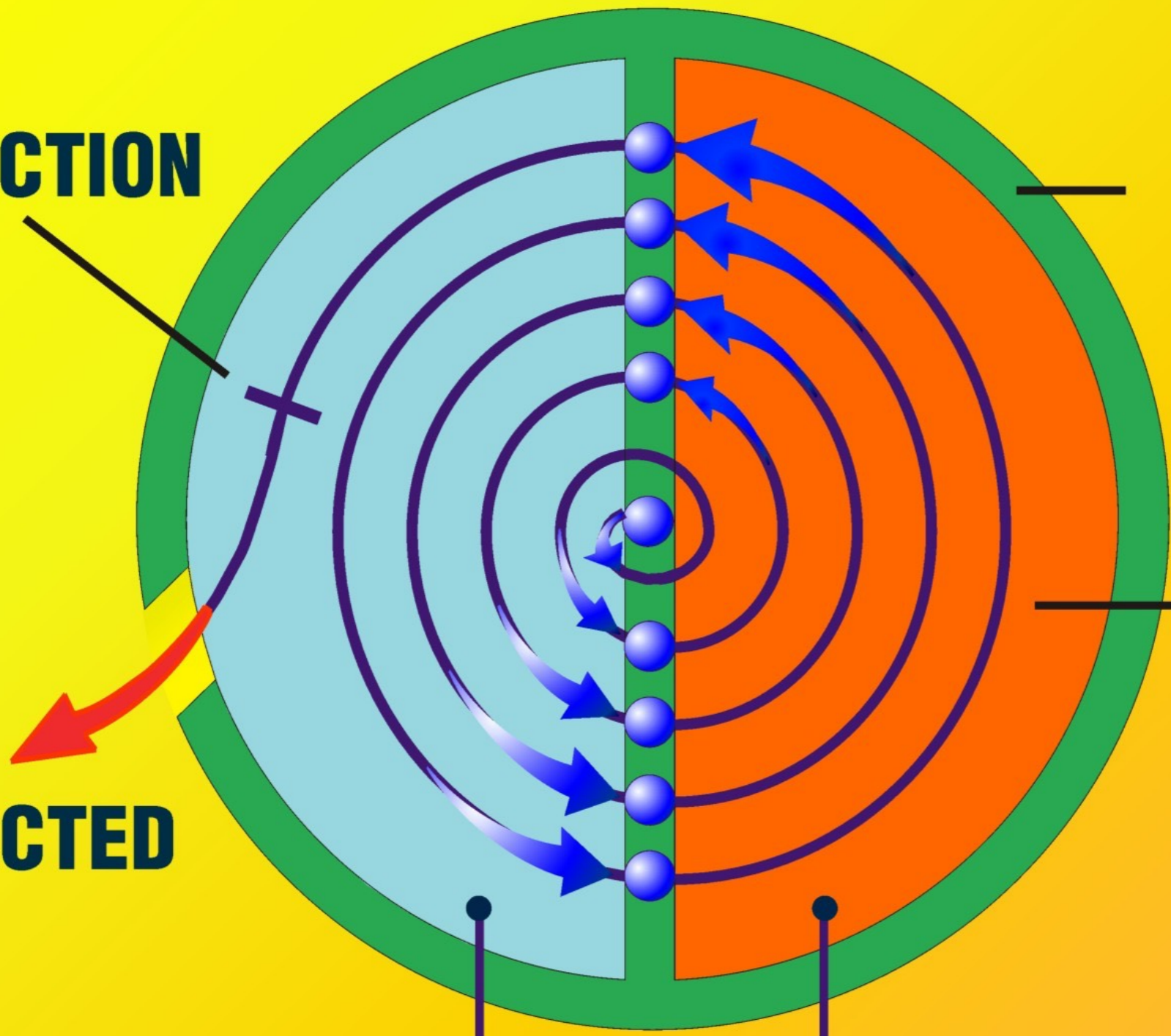
**EXTRACTION
FOIL**

**MAGNET AND
VACUUM
TANK**

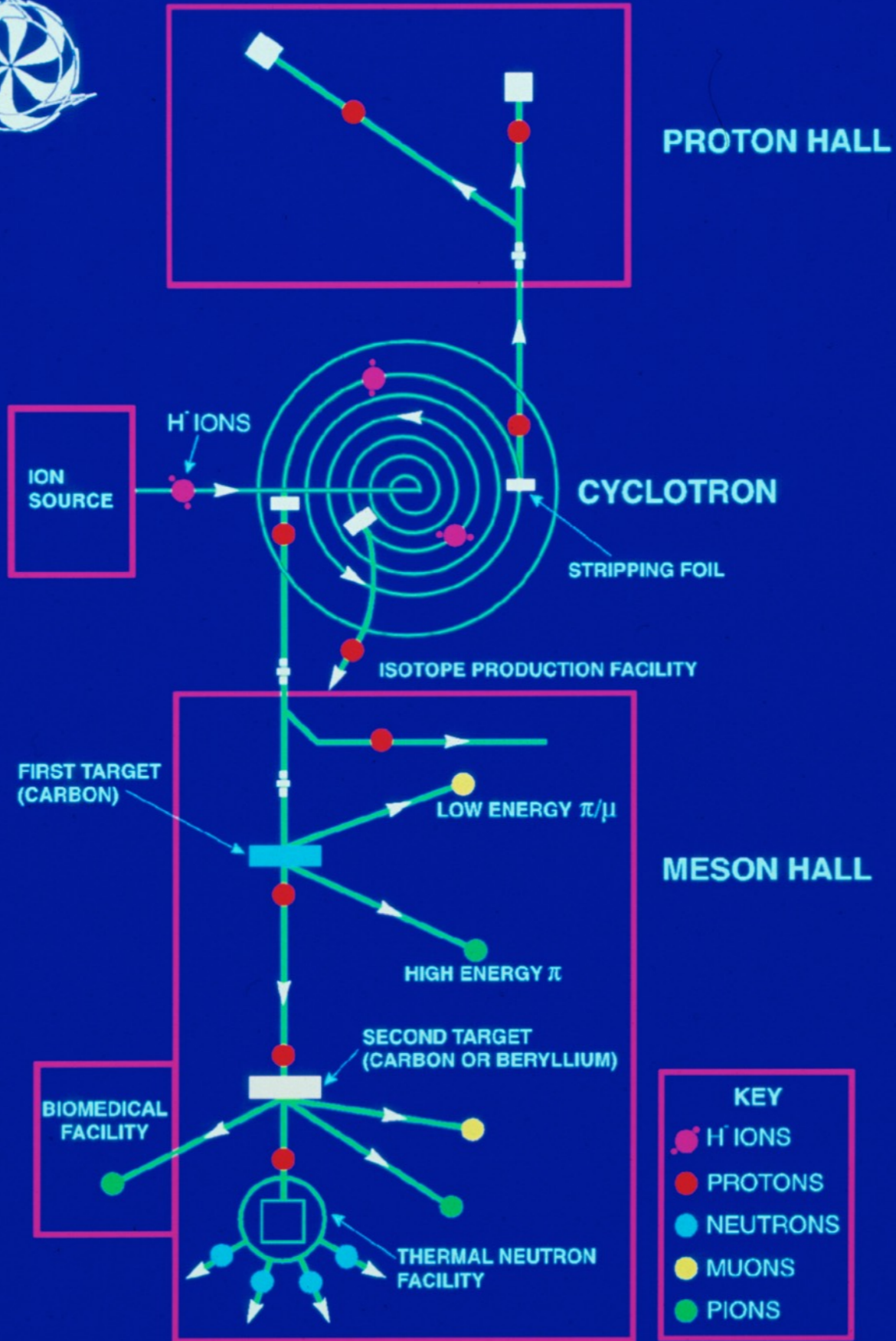
DEE

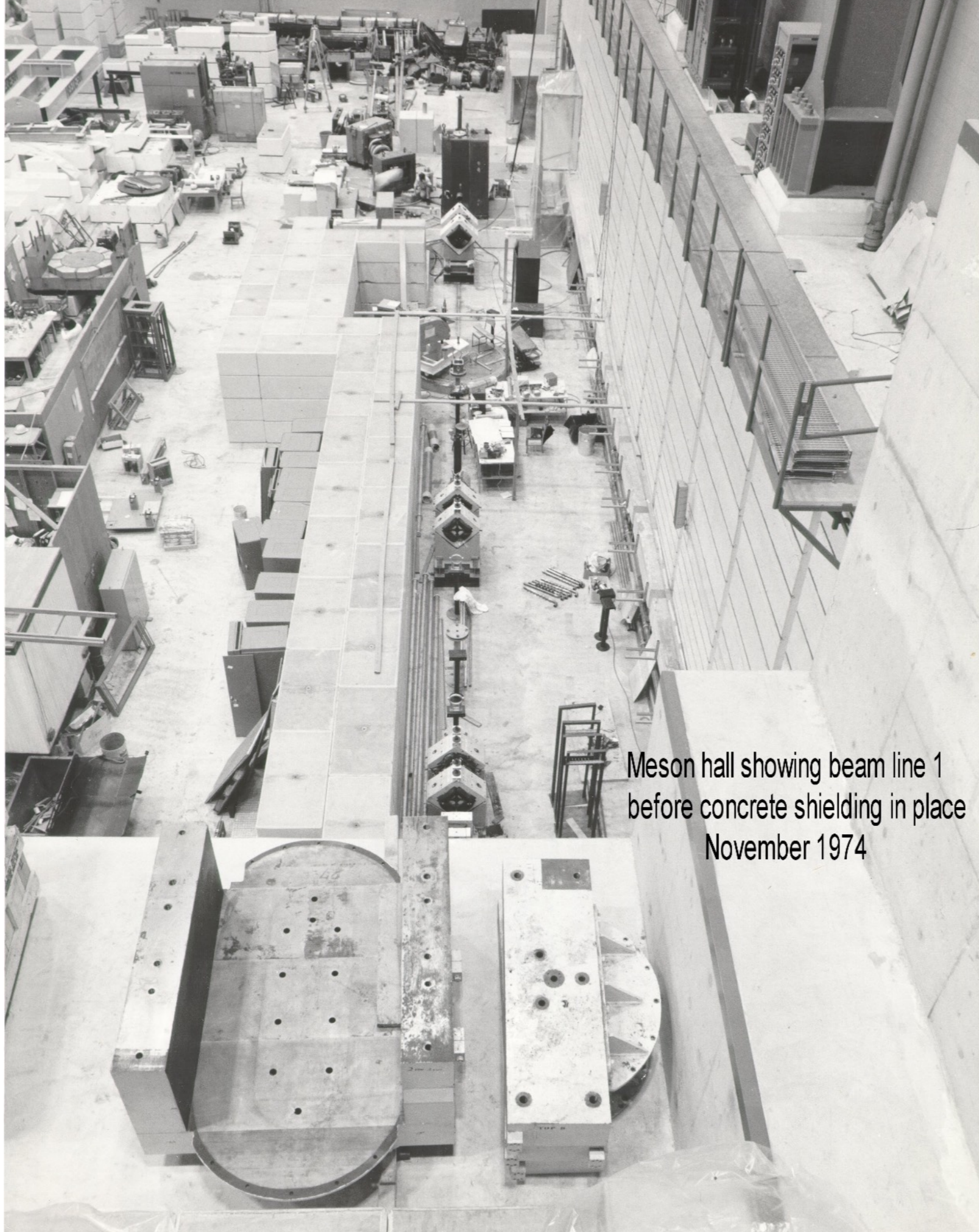
**EXTRACTED
BEAM**

**RADIO
TRANSMITTER**









Meson hall showing beam line 1
before concrete shielding in place
November 1974



Mike Pearce



Jess Brewer



Ken Kendall

M9

M20

T2

M8

BL1A

500 MeV

High
Energy
Proton

Primary
Production
Target

Carbon or
Beryllium
Nuclei

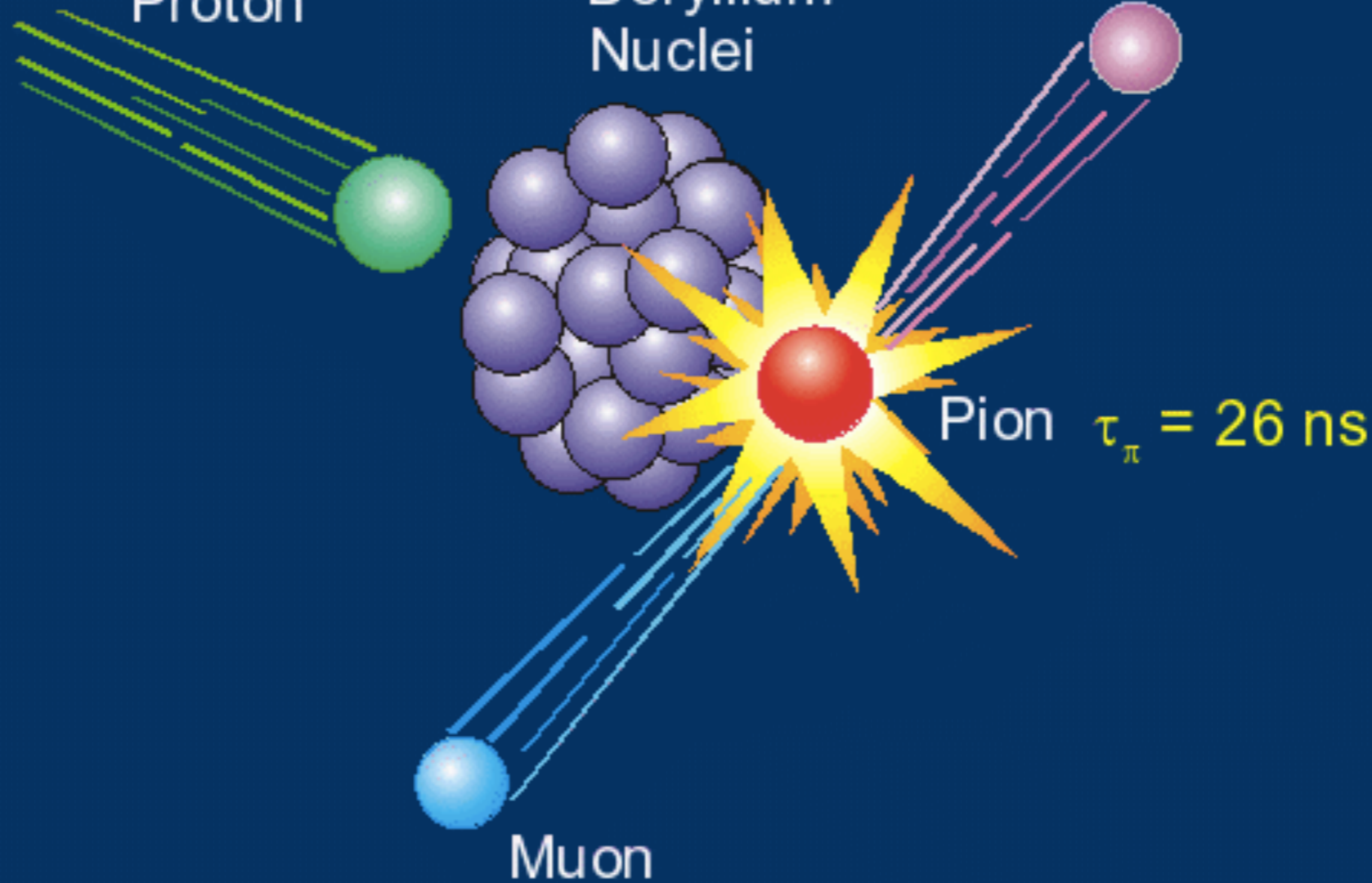
Neutrino

Pion $\tau_{\pi} = 26 \text{ ns}$

Muon

4.1 MeV

$\tau_{\mu} = 2.2 \mu\text{s}$



History

of

μSR