ES&H Expertise Helps Get to the Top

Poster for “Top Turns Ten” Celebration
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The Tevatron, as the probe used to discover the top quark, posed two unique technological challenges solved with the help of ES&H expertise

A. The need to monitor beam loss to minimize quenches and reduce downtime

B. The need to mitigate the oxygen deficient hazard (ODH) posed by large inventory of Tevatron cryogens (LN_2 and LHe)

A. Monitoring Beam Loss to Minimize Quenches

In May 1981, Robert Shafer of the “Energy Doubler” project recruited ion chamber experts Larry Coulson, Tom Anderson, Fred Krueger, and John Larson of the Safety Section (now the ES&H Section) to design, test, build, and install a Beam Loss Monitor (BLM) system for the Tevatron.

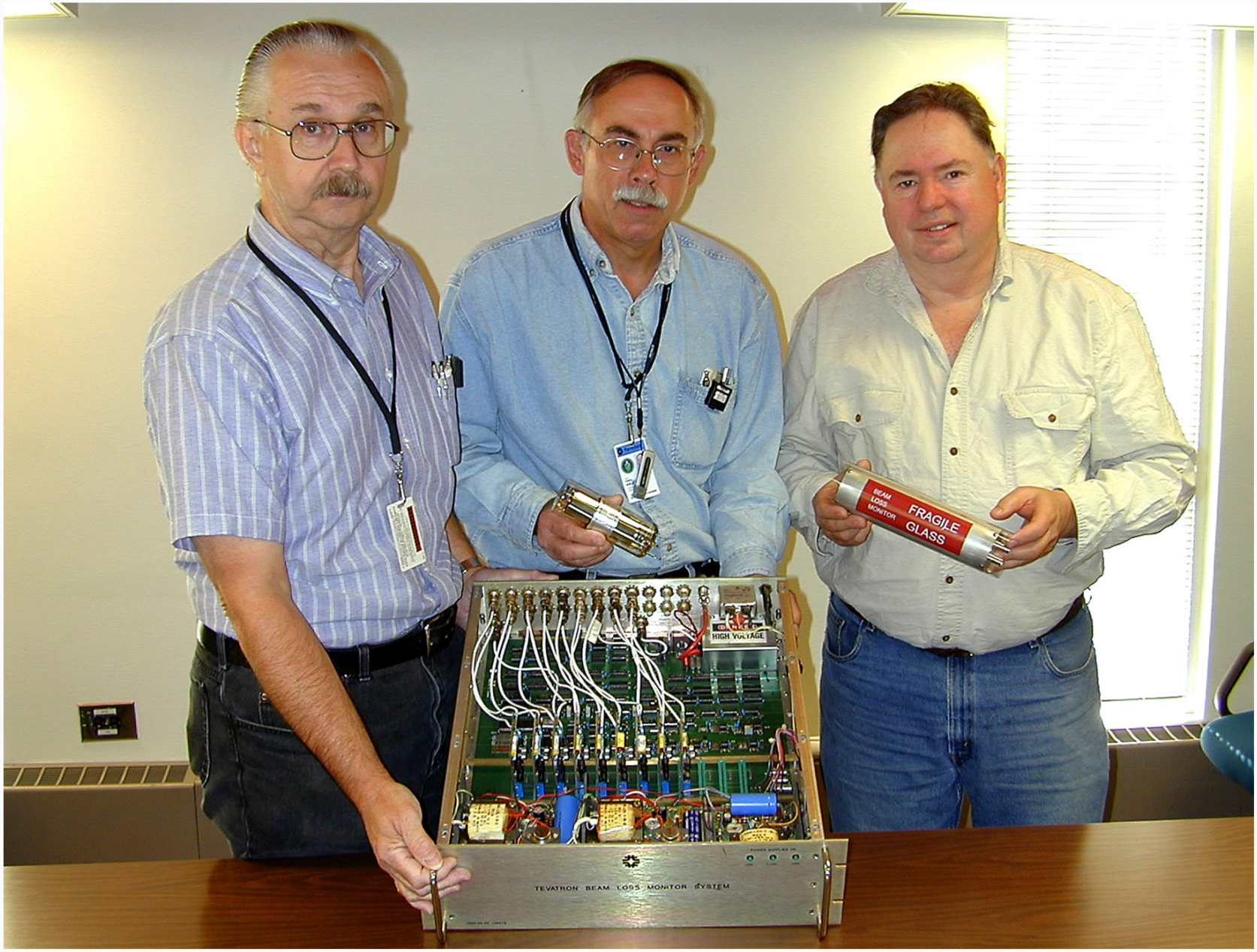
This included both the ion chambers and the readout electronics.

The ion chambers were tested using large gamma-ray sources, Argonne National Laboratory’s pulsed electron linac, and radiation fields available in various Fermilab beam areas.

The electronics chassis was designed to provide a fast abort signal and interface to the controls system to provide real time beam loss data. Each chassis could support up to 12 BLM ion chambers.

This system was introduced into other beam areas and has continued to be utilized to the present. The remaining ES&H instrumentation team members who participated continue to provide support for calibrating the ion chambers and consultations, when needed.

Tevatron Beam Loss Monitor (BLM) Ion Chambers
(Assembled and Disassembled)



L to R: John Larson, Fred Krueger, & Tom Anderson with BLM Parts

B. Mitigating the ODH Hazard Posed by the Tevatron

Early on it was recognized that the use of individual "ODH" monitors was necessary to alert personnel to oxygen depletion if the cryogens were vented. Butch Hartman of the Safety Section (now the ES&H Section) was enlisted to find a reliable, cost-effective solution.

In April 1981, use of a commercial instrument built to Fermilab specifications, the Lumidor LP-COM-30, began. Problems were found in actual use:

The power switch was easily broken and the belt clip was difficult to use.
The detector was sensitive to its orientation.
The battery charging system was unreliable and the 12 hr lifetime was too short.

During 1983-1984, Hartman designed a new, second generation monitor:

The above problems were all corrected.
The instrument is smaller and lighter than its predecessor.
The instrument can operate for 1 year on a single battery and is always "on".

To the present day, the "Micro2" Fermilab-designed ODH monitor continues to be used as the standard personal ODH monitor.

Left: The Original ODH Monitor in Use at Fermilab
Right: The Second Generation Fermilab ODH Monitor

Butch Hartman Holds a Second Generation Fermilab ODH Monitor

Examples of more “ordinary” contributions of ES&H personnel to this monumental scientific discovery:

Support for CDF’s unique source driver system.

Support for the safe fabrication of the D0 depleted uranium calorimeters.

Provision of high quality and reliable “Chipmunk” and “Scarecrow” radiation monitors providing safety with a negligible contribution to downtime.

Analysis services used to calibrate accelerator beam intensity monitors.

Participation in measurements of radiation fields near the collision vertices by both CDF and D0 to understand “backgrounds” and radiation damage.

Consulting services on radiation physics, industrial hygiene, occupational safety, fire protection, and environmental protection topics.

Guidance and support for successful and timely completion of safety documents and reviews in an era of intensive scrutiny of safety programs.