

APS OPERATIONS: SHUTDOWN PROJECTS JANUARY 22, 2020



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INTRODUCTION

- Cover letter for *Frontiers: Research Highlights 1946-1996* by Alan Schriesheim
- Mentions phrase carved into the façade of the National Archives in Washington, D.C.:

“What is Past is Prologue”

- His reference was, that after 50 years of Argonne National Laboratory’s existence, there was still much more to come.
- Theme very applicable to the APS:
 - August 8, 1996: Key (now Critical) Decision #4 for the APS
 - Not overlooking the outstanding performance of the APS to date, and what it took to get here...
 - ...While looking ahead to operating a next generation machine and user facility taking shape in APS Upgrade.

Dear Colleague,

Here is your copy of *Frontiers*, Argonne's annual review of what we have done so far and what we hope to do in the future.

This issue is special — as special as Argonne's 50th Anniversary. In these pages, we look back to the Laboratory's beginnings in 1946, then come forward to what's happening today, and beyond today into tomorrow. It is a tomorrow that Argonne, and you as part of Argonne, will help shape. From sequencing the human genome, to high-temperature superconductivity, to unlocking the secrets of the atom and the cell, much of what we are doing now could mean a great deal to many people in the years ahead.

Carved into the facade of the National Archives in Washington is this saying: "What Is Past Is Prologue." That also is true of Argonne because, even though what we have accomplished in the past 50 years is massive, it is only an introduction to what is yet to come.

Frontiers is the same annual review we send to people outside the Laboratory. You receive it because it is important for you to know what we tell the world about Argonne. We hope you will want to share this information with your family and friends.

This is also, of course, the last copy of *Frontiers* that you will be getting from me! As I announced in October, I will be stepping down as Director next July, and a new Director will have the pleasure of your company, of your friendship, and of announcing to the world the fruits of your outstanding achievements. As it has been my wife Bea's and my genuine pleasure to work with you, it is now my pleasure to send you your copy of *Frontiers'* 50th Anniversary edition. I hope you enjoy it.

Sincerely,

Alan Schriesheim

Attachment

OPERATED BY THE UNIVERSITY OF CHICAGO FOR THE UNITED STATES DEPARTMENT OF ENERGY



APS HIGH-CURRENT STUDY AT 6 GeV

■ Motivation

- Precisely measure higher-order modes in rf cavities, which will be retained by APS-U
- Provide greater current range for ion instability studies as part of future planned experiments to benchmark ion-instability codes for APS-U
- Provide greater current range for additional accelerator studies at 6 GeV

■ Preparation, Planning, Execution

- Readiness review, staff/user/Lab notifications, local pre-job and RWP briefings
- Large effort to establish rad controlled areas included volunteer “sentinels” for duration of study

■ Results

- Machine trips limited highest current to 245 mA (324 bunches); study was nonetheless very useful for:
 - Understanding beam dynamics at higher current
 - Measuring higher-order modes in rf cavities
 - Performing additional testing of an APS-U BPM

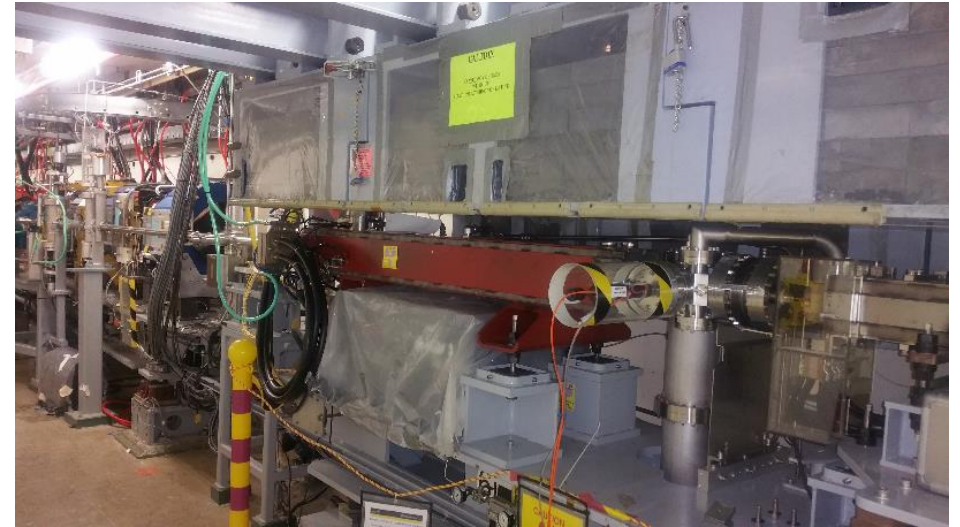


Main Control Room during the 6-GeV, 300-mA studies

Photos courtesy Michael Borland

SECTOR 39 INJECTION SEPTUM MAGNET (S:IS1) INSTALLATION

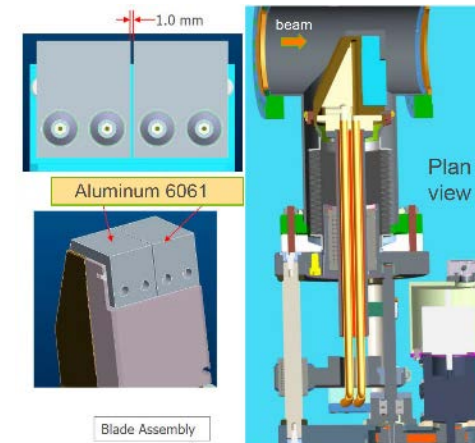
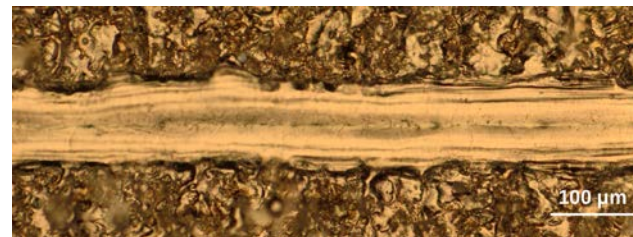
- Motivation
 - Return refurbished injection septum magnet to service
- Preparation, Planning, Execution
 - Refurbishment began immediately after removing from service in late Sept. 2019, observed by Health Physics
 - Coordination and assistance from NWM and Central Shops for machining of end pack in Bldg 367 and re-welding
 - New beam chamber fabricated, new coil installed, new end pack and fixture fabricated
 - Work control document (WCD), readiness review, pre-job briefs, lessons learned from prior replacements
- Results
 - Preliminary electrical and pulse testing on bench and in-tunnel have gone well
 - Installation completed on time and ahead of schedule, including additional adjustment for improved alignment



Upstream and downstream views of S:IS1 injection septum magnet Photos courtesy Cassandra Hayden

SECTOR 37 HORIZONTAL COLLIMATOR (SCRAPER) STUDIES

- Motivation
 - Advance understanding of material damage from electron beam strikes; previous test showed beam strikes can damage Al6061 and Ti₆Al₄V (90% Ti, 6% Al, 4% V)
 - Assess effect of multiple beam strikes at the same location
- Preparation, Planning, Execution
 - WCD, readiness review, pre-job briefs, lessons learned from prior replacements
- Results
 - Address feasibility and requirements for APS-U whole-beam-dump
 - Provide data for simulation benchmarking and information of interest to other accelerator projects



Plan view of scraper assembly (left), as-installed in S37 (top) and scraper hardware (above)
Photos courtesy John Zientek

SECTOR 25 GAS INJECTION FOR ION INSTABILITY STUDIES

■ Motivation

- Ion instability not observed in APS storage ring, but a serious concern for APS-U
- Particle tracking simulations used to predict instability in APS-U and help develop mitigations
- Plan to create a local pressure bump (N_2 , up to 1000 nTorr) in Sector 25 straight to study resulting instability and help validate simulation
- Front end, dual undulators, vacuum chamber installed in April/May shutdown, removing test window

■ Preparation, Planning, Execution

- Considered first-of-a kind experiment enacting a conservative approach
- New WCD; design readiness, radiation safety, commissioning reviews; status meetings for preparation and planning among many other activities
- Hazards identified and mitigated, primarily potential radiological hazard
- Significant bench testing in Bldg 382 and *in situ* testing completed successfully

■ Results

- Pending; experiment to take place on Jan. 29 at 6 PM



Nitrogen source and control cabinet located on SR mezzanine (left)

Gas injection apparatus installed in ante-chamber of short vacuum chamber in Sector 25 (below)

Downstream view of gas injection installation (bottom, left)

Photos courtesy John Hoyt

