

THE ADVANCED PHOTON SOURCE UPGRADE (APSU) STRAIGHT SECTION VACUUM SYSTEMS FIRST ARTICLE FABRICATION

Megan Szubert AES Mechanical Engineering, Ethan Anliker AES Mechanical Engineering, Grace Avellar AES Mechanical Engineering, Jason Lerch AES Mechanical Engineering
Advanced Photon Source at Argonne National Laboratory

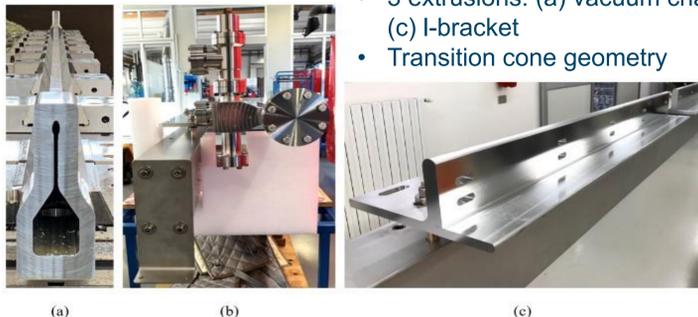
INTRODUCTION

The APSU includes 40 straight sections, 35 of which will be outfitted with Superconducting Undulators (SCUs) or Hybrid-Permanent Magnetic Undulators (HPMUs). The vacuum systems for these devices have unique fabrication challenges, but all first article (FA) components have been produced successfully. The Insertion Device Vacuum Chamber (IDVC), used in HPMU sectors, is produced by SAES Rial Vacuum (Parma, Italy). The SCU vacuum system components are produced by two vendors, Cinel Instruments (Venice, Italy) and Anderson Dahlen (Ramsey, MN, USA).



INSERTION DEVICE VACUUM CHAMBER

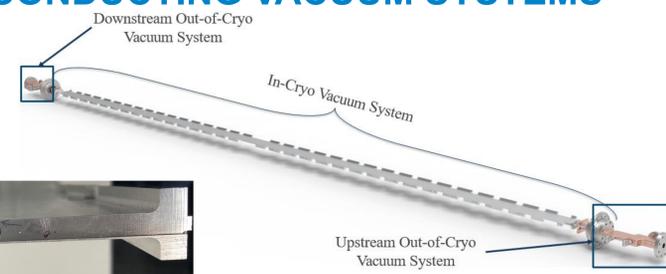
- 3 extrusions: (a) vacuum chamber, (b) strongback, & (c) I-bracket
- Transition cone geometry



LONG LEAD TIME ITEMS



SUPERCONDUCTING VACUUM SYSTEMS



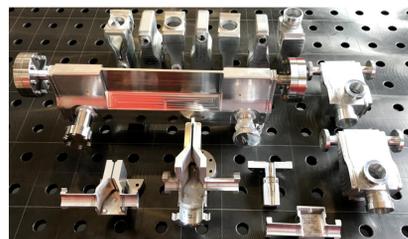
- 1 extrusion for the majority length of the vacuum system
- 400-micron thick wall on either side of aperture (prototyping completed by local company), proven by first article

PROCUREMENT

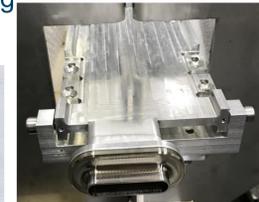
- Competitive Bid, including fabrication of the chamber and supports, functional testing, vacuum certification— Awarded to SAES Rial Vacuum in 2019
- Collaborate with the vendor to solve manufacturing issues – transition cone
- In-Cryo system sole-sourced to domestic vendor Anderson Dahlen (AD) (Ramsey, MN)
 - Benefits oversight and compatibility with other SCU components
 - Fabrication split into 3 Purchase Orders: (1) Best effort chamber machining, (2) Supplemental components, & (3) Final weldment
- Out-of-Cryo Chambers competitively bid, awarded to Cinel Instruments

FIRST ARTICLE (FA) FABRICATION

- Characterization of extrusions and aperture prior to machining the thin-wall feature
- Hold point of weld samples and first article -- SRV worked to improve weld processes
- FA delivered December 2020



- In-Cryo FA weldment delivered October 2020
 - Machine thin-wall chamber for "best effort" and achieve specification
 - Bi-metal long lead time and thermal shock testing
 - External vendor to complete brazing
- Out-of-Cryo FA delivered June 2020

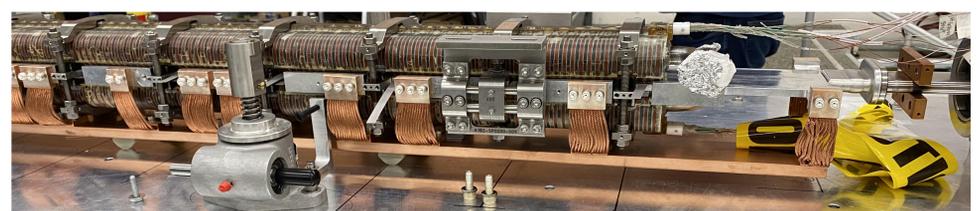
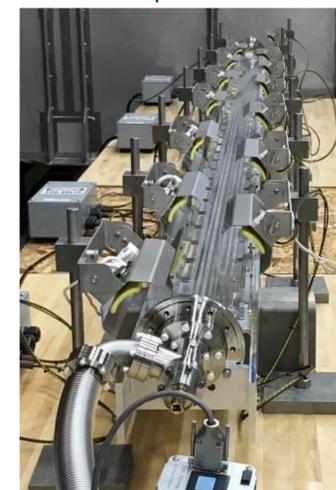


2ND ARTICLE & PRODUCTION

- 2nd Article IDVC estimated completion August 2021
 - Weld development to meet Class A & B welds adhering to AWS D17.1
 - Add water channel feature beginning with the 2nd article
- Production includes 39 additional units
 - Fabricate, weld, vacuum test 2 chambers a week until contract end
 - Estimated completion date January 2021



- In-Cryo 2nd Inline Article Estimated Completion October 2021
 - Additional scope is an unwelded chamber and supplemental components
 - Canted Production Estimated completion June 2022
- Out-of-Cryo Production & Support Units completed January 2021



CONCLUSION

The APSU straight section vacuum systems have gone through the FA fabrication process, proving the validity of the designs, and allowing functional testing to be performed prior to full-scale production. Functional tests from each of the vendors, in addition to onsite testing, has resulted in confidence that the production units will arrive onsite, ready for installation.



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