CASE STUDY

University of Chicago
Chicago

Laser experiments in physics labs require a quiet, low velocity discharge airflow design and the consulting engineer delivers

Chicago—The HVAC specification for three new laboratories at the University of Chicago had the typical temperature and humidity requirements required for state-of-the-art laser-based physics research, but there were also some unusual ventilation requirements.

"The research professor didn't want to feel or hear the airflow from the lab's ductwork, because it might affect the laser experiments," said John Phillips, lab manager for the University's new $200 million Gordon Center for Integrative Science.

Adds Peter Pogorski, principal, Ellenzweig, Cambridge, Mass., the project's architecture firm which specializes in the design of scientific, medical research and teaching facilities: "HVAC air system turbulence or a lack of temperature uniformity from disproportionate airflows in these types of physics labs can cause very sophisticated and expensive instruments such as lasers electrons and microscopes to go out of alignment at nanoscale, degrading their precision. The instrumentation can get very hot quickly; it is vulnerable to internal condensation, structural or airborne vibration, and contamination such as dust, so providing a stable lab environment requires sophisticated products, engineering and installation."

While air distribution is a straight-forward mechanical engineering task in most buildings, this project had unique challenges. Providing an airflow discharge velocity that's less than 25-fpm so as not to disrupt the laser and vacuum equipment's sensitivities while simultaneously maintaining strict 70°F (±1°F) temperatures is nearly impossible with conventional HVAC metal duct/register systems. "Temperature swings cause expansion or contraction of laser tables, which in turn change the laser beam and skew research results," said Phillips.

Instead of metal duct, Steve Levin, principal, Bard, Rao + Athanas Consulting Engineers (BR+A), Watertown, Mass., specified fabric air dispersion for the three labs where the laser-based physics research is conducted. "Just sound waves from a person's voice or a gentle draft from an HVAC duct can skew electron microscopy scans," noted Phillips, "so airflow must be very subtle with no noise or turbulence."

The Cylindrical model of the LabSox Series of fabric air dispersion designed specially for the strict airflow requirements of laboratories was manufactured by DuctSox Corp., Dubuque, Iowa. The LabSox series offers a variety of low-throw fabrics where air is dispersed gently and evenly at low fpm's versus typical metal duct/registers systems, which create too many drafts even after test and balance refinements.

"...Just sound waves from a person's voice or a gentle draft from an HVAC duct can skew electron microscopy scans"

While mechanical contractor, F.E. Moran Inc., Northbrook, Ill., completed the entire buildings HVAC work, Kirby Sheet Metal Works, Chicago, was the build-to-suit contractor after a newly-hired researcher needed more stringent HVAC performance in three generically designed labs. Thus, fabric duct's flexibility served another purpose of easing the installation, which given the predominance of existing utility piping, would have been difficult with the rigidity of conventional metal duct, according to Robert Simek, project manager, Kirby Sheet Metal Works.

Each lab has two 12-foot-long runs with diameters ranging between nine and 12-inches. They are suspended by H-Track suspension systems, which minimize sway. Air Products Equipment Co., Elk Grove Village, Ill., was the manufacturer's representative that assisted with sizing, permeability and other factory engineered features of the fabric duct.

Unlike metal duct when it needs cleaning, fabric duct is easily unassembled. Therefore, the University of Chicago's maintenance staff will commercially launder the fabric duct if and when Phillips sees the need for cleaning it.

"It seems many physicists would be happy with a Space Shuttle on earth where there's zero gravity and zero atmosphere, but until that happens, it looks like fabric duct is excellent for laboratories that require minimum turbulence and noise combined with even air dispersion," said Ellenzweig's Pogorski.

DuctSox Corporation
4343 Chavenelle Rd
Dubuque, IA 52002

Phone: 563-588 5300
Toll-free: 866-382-8769
Fax: 563-588-5330

ductsox.com

DUCTSOX®
Redefining Air Dispersion