PPPL
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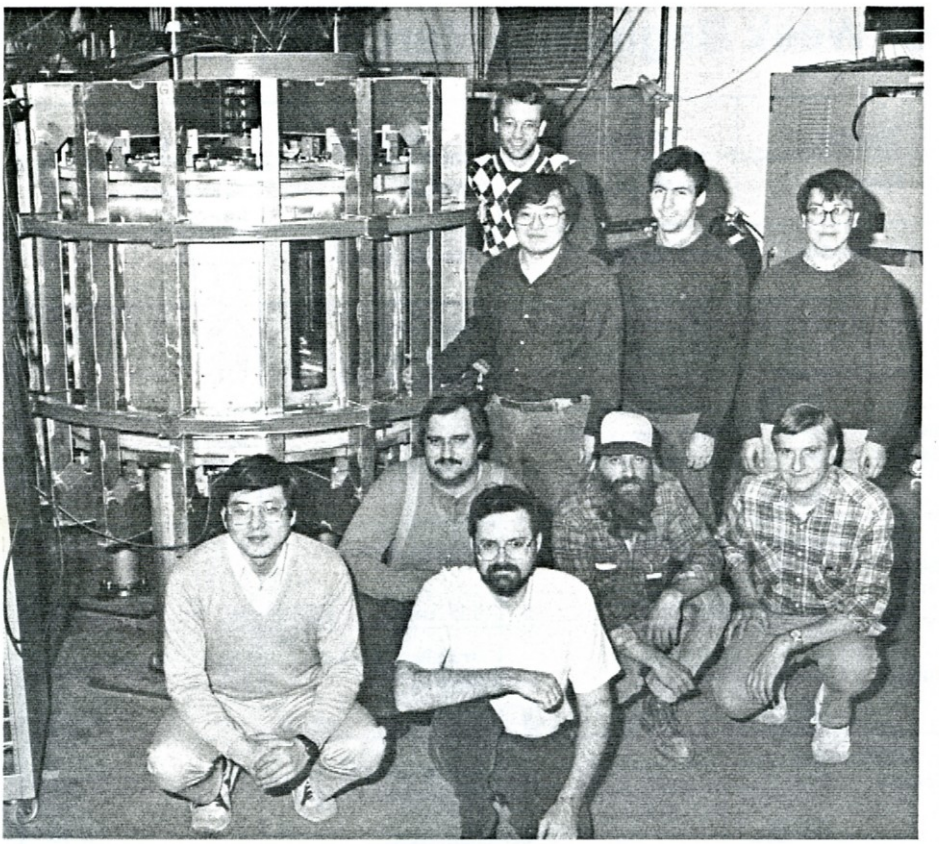
CDX-U Produces First Plasma: Meets DOE's Milestone for Start Up



The CDX-U device, shown in the upper left-hand corner of the photo, replaces the CDX device, which ended experimental operation on January 2 of this year. In little more than six weeks, the CDX was dismantled and in its place the CDX-U assembled. PPPL staff responsible for the project are, in the back row, left to right, graduate students Cary Forest, Yong-Seok Hwang, Ted Jones, and Won Ho Choe; in the middle row, left to right, Tech Shop technician Tom Signs and CDX-U technicians Jim Taylor and Bill Kineyko; in the foreground, left to right, CDX-U Project Head Masa Ono and physicist Glenn Greene. Others who have contributed to the project include engineer Phil Heitzenroeder, who consulted on the machine design and fabrication techniques, and physicists Doug Darrow and Tom Stix.

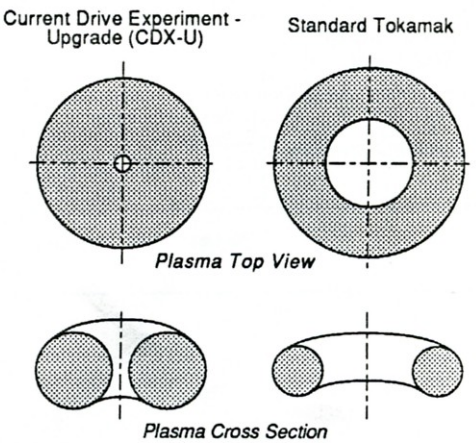
by Carol A. Phillips

The Current-Drive Experiment-Upgrade (CDX-U) achieved first plasma on February 15, successfully meeting its U.S. Department of Energy milestone for start up.

The CDX-U is the latest in a series of small tokamak devices, including ACT (Advanced Torus Concepts), ACT-1, and CDX (Current Drive Experiment), that have operated since the summer of 1979. The main physics goals for CDX-U are to investigate the physics of steady-state current drive in plasmas and to develop a method to produce steady-state currents in future tokamak fusion reactors. Steady-state currents, that is, continuous currents, could be used to maintain plasmas for longer times. The device will also be used to study plasma transport properties — what causes plasma particles and heat to escape — and how plasma transport is affected by plasma fluctuations, radial electric fields, and plasma aspect ratio (how skinny or fat the plasma is).

Two types of plasma current drive will be studied in CDX-U: direct current (dc) helicity injection current drive and transport driven current drive. In dc-helicity injection, a high-current, low-energy electron beam is injected along the magnetic field at the edge of the plasma and the current is carried into the plasma center. Transport current drive is a natural current in the plasma. It is driven by the plasma flowing outward from the plasma interior.

The CDX-U device is unique among existing tokamaks in that the "doughnut hole" or center core formed by the inner toroidal field (TF) coils is very small, about 6 inches as compared to 40 inches for standard-sized tokamaks. The closeness of the coils causes the toroidal fields near the plasma's inner edge to be much higher than those on its outer edge. In CDX-U plasmas, the ratio of the high field region to the low field region can vary by up to a factor of 6 (sometimes called the mirror ratio); in a



The CDX-U device differs from other present-day tokamaks in that the size of its "doughnut hole" is very small: 6 inches as compared to 40 inches for standard-sized tokamaks. Nevertheless, 160-turn water-cooled toroidal-field coils surround the vacuum vessel.

(continued)

typical tokamak, such as PLT and TFTR, the difference is only about 2. Therefore, the CDX-U can be used to investigate tokamak plasma properties in a wide range of mirror ratios.

Another unique feature of the CDX-U is its physical flexibility. The device can literally be taken apart and put back together in about three weeks, allowing physicists to change the machine configuration to meet the physics needs of the magnetic fusion program. Additionally, it has a large number of diagnostic ports for measuring plasma properties and, because of its relatively small size and the nature of its research objectives, it is also well-suited for graduate student training and thesis experiments: PPPL graduate students actively participated in its design and construction, and also in the planning of its physics programs.

Volunteer work you can do laying down. Give blood on March 22, 9:00 a.m. to 2:00 p.m., at the Emergency Services Unit Firehouse. Call extension 2272 to schedule an appointment.

Cafeteria Menu for Week Beginning March 19, 1990

Item	Monday	Tuesday	Wednesday	Thursday	Friday
Soup #1 ($.90)	Chicken Noodle	Navy Bean	French Onion	Lentil	Fisherman's Chowder
Soup #2 ($.90)	New England Clam Chowder	Chicken Noodle	Navy Bean	French Onion	Lentil
Entree #1	Southern Fried Chicken w/Veg. $2.65	Chopped Tenderloin w/Sauteed Onions & Whipped Potatoes $2.70	Vegetable Quiche w/French Fries $2.45	Spaghetti w/Meatballs & Garlic Bread $2.65	Catch of the Day w/Veg. $2.85
Entree #2	Beef Burgundy over Noodles $2.85	Baked Manicotti w/Garlic Bread $2.65	Herb Marinated Chicken w/Rice $2.75	Baked Lasagna w/Garlic Bread $2.85	Stuffed Cabbage w/Veg. $2.60
Dieter's Special	Broiled Chicken w/Veg. & Roll 287 cal. $2.65	Broiled, Chopped Tenderloin w/Veg. & Roll 328 cal. $2.70	Baked Fish w/Veg. & Roll 342 cal. $2.85	Tomato Surprise 335 cal. $2.10	Broiled Fish w/Veg. & Roll 342 cal. $2.85
Hot Sandwich	Cheeseburger w/French Fries $1.95	Grilled Swiss w/Tomato $1.50	Hot Dog w/Kraut $1.45	**Grilled Turkey Reuben*** **$2.35**	Cheese Steak w/Grench Fries $2.45
Cold Sandwich	Great Dane $2.39	Egg Salad w/Lettuce & Tomato $1.75	Tuna, American Cheese, Bacon on Whole Wheat $2.39	Genoa Salami & Provolone Hoagie $1.95	Bacon, Lettuce, & Tomato $1.95
Salad by the Ounce (18¢ per ounce)	Spinach Salad	Danish Cucumber	Pasta Salad	Claremont Salad	Garden Salad
Breakfast Specials	2 Eggs, Cheese, Sausage on Kaiser Roll, Small Coffee $1.93	2 Eggs, 2 Bacon, Toast, Small Coffee $1.90	3 French Toast, 2 Bacon, Small Coffee $1.93	Ham & Cheese Omelet, Toast, Small Coffee $1.95	3 Pancakes, 2 Bacon, Small Coffee $1.93

***Note:** **New items are noted in bold print.**

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