Presentation to
12th ATF User's Meeting and
ATF Program Advisory Committee
Brookhaven National Laboratory
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# STATUS REPORT ON *LACARA* EXPERIMENT*

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# **LA**SER **C**YCLOTRON **A**UTO-**R**ESONANACE **A**CCELERATOR*

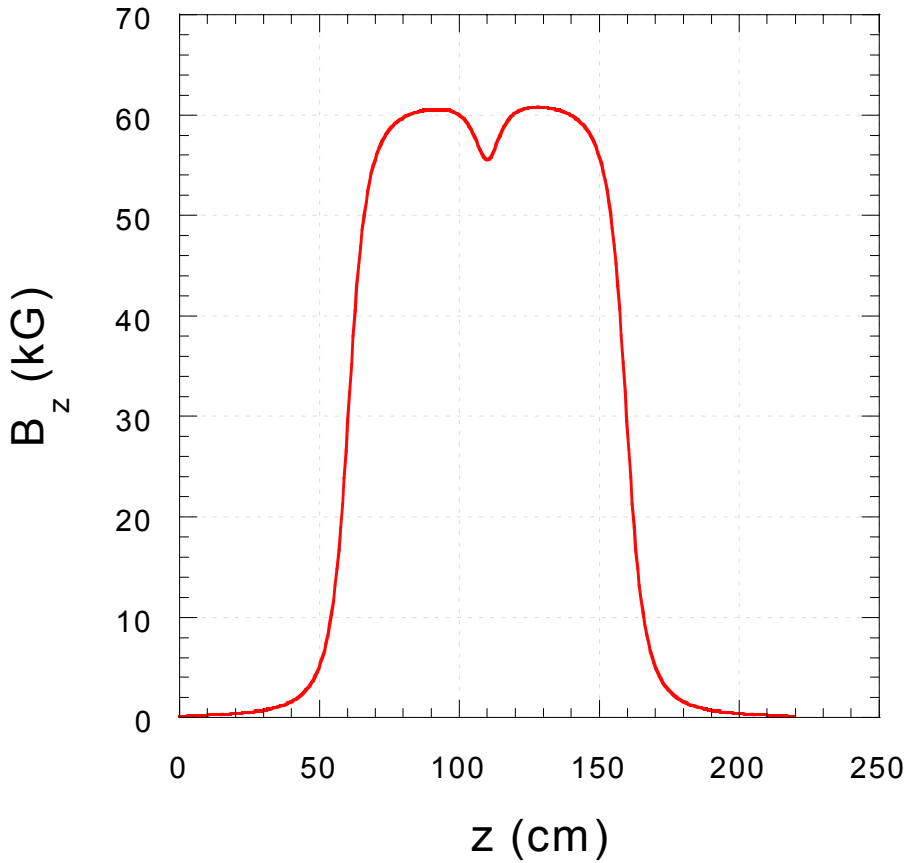
## *LACARA*

Autoresonance condition:

$B_{autores} = B_o [\gamma (1 - \beta)]$,
and $[\gamma (1 - \beta)]$ = const.,
for a plane wave in
uniform-$B_o = m\omega/e$.

On a tight budget:

$B \cong B_1 \pm 5\%$, where $B_1$
is optimized for
energy gain.



# *LACARA Publications*


C. Wang and J. L. Hirshfield, "Laser-driven cyclotron autoresonance accelerator," in *Proc. of the 1999 Particle Accelerator Conf.*, A. Luccio and W. MacKay, eds., p. 3630 (1999).

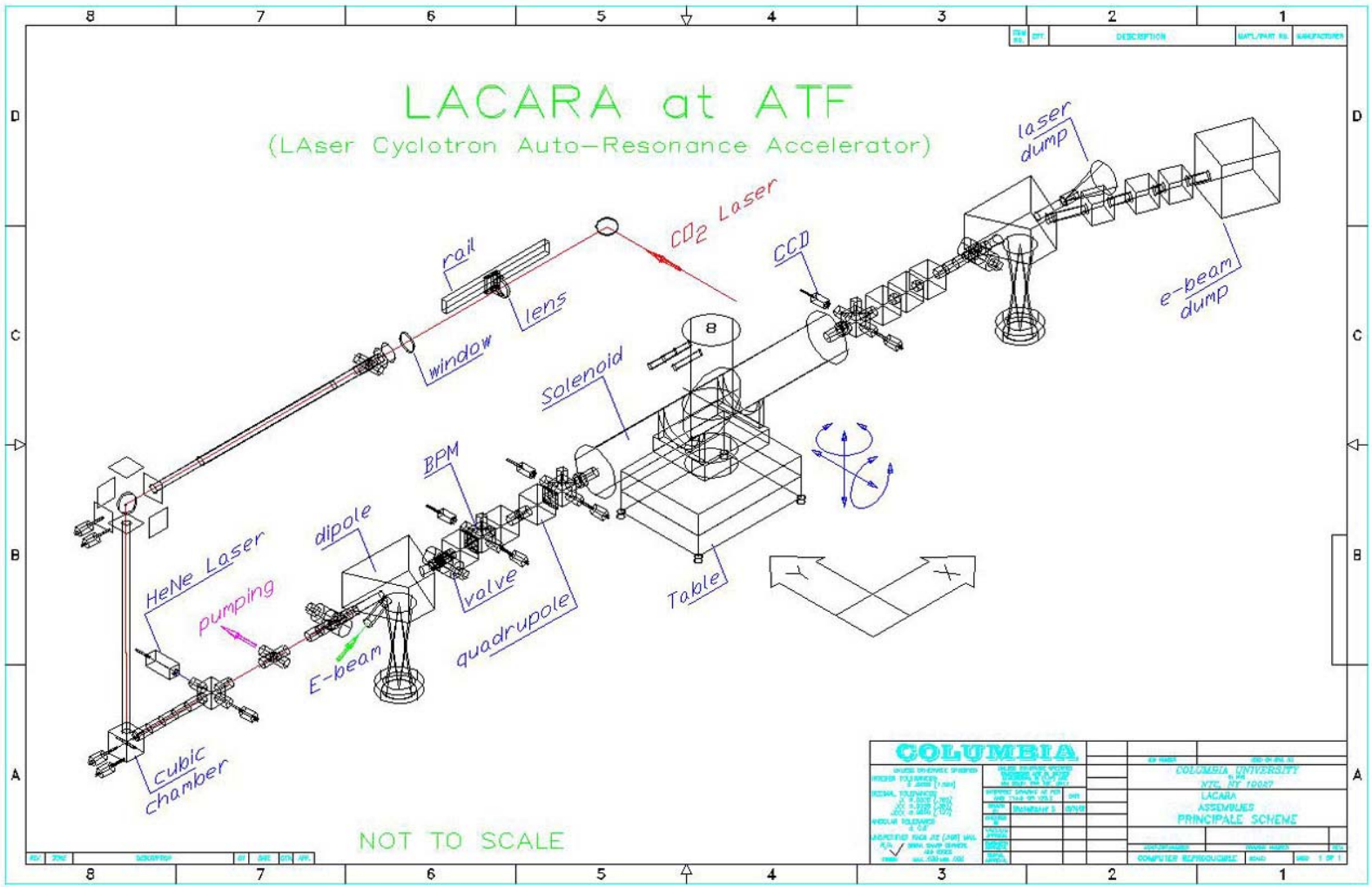
J. L. Hirshfield and Changbiao Wang, “Laser-driven electron cyclotron autoresonance accelerator with production of an optically chopped electron beam,” *Phys. Rev.* E **61**, 7252 (2000).

J. L. Hirshfield and C. Wang, “Laser-driven cyclotron autoresonance accelerator,” in *Advanced Accelerator Concepts*, edited by P. L. Colestock and S. Kelley, AIP Conf. Proc. **569**, 326 (AIP, New York, 2001).

C. Wang, J. L. Hirshfield, and T. C. Marshall, “Creation of femtosecond sheet-like bunches for driving optical-scale dielectric slab accelerator structures,” in *Proc. of the 2001 Particle Accelerator Conf.*, June 18-22, Chicago, Illinois, P. Lucas and S. Webber, eds. (IEEE, NJ, 2001), p. 4035.

T. C. Marshall, C. Wang, and J. L. Hirshfield, “Femtosecond planar electron source for driving micron-scale dielectric wake filed accelerator,” *Phys. Rev. Special Topics-Accelerators and Beams* **PRST-AB 4**, 121301 (2001).

# Layout of LACARA at ATF



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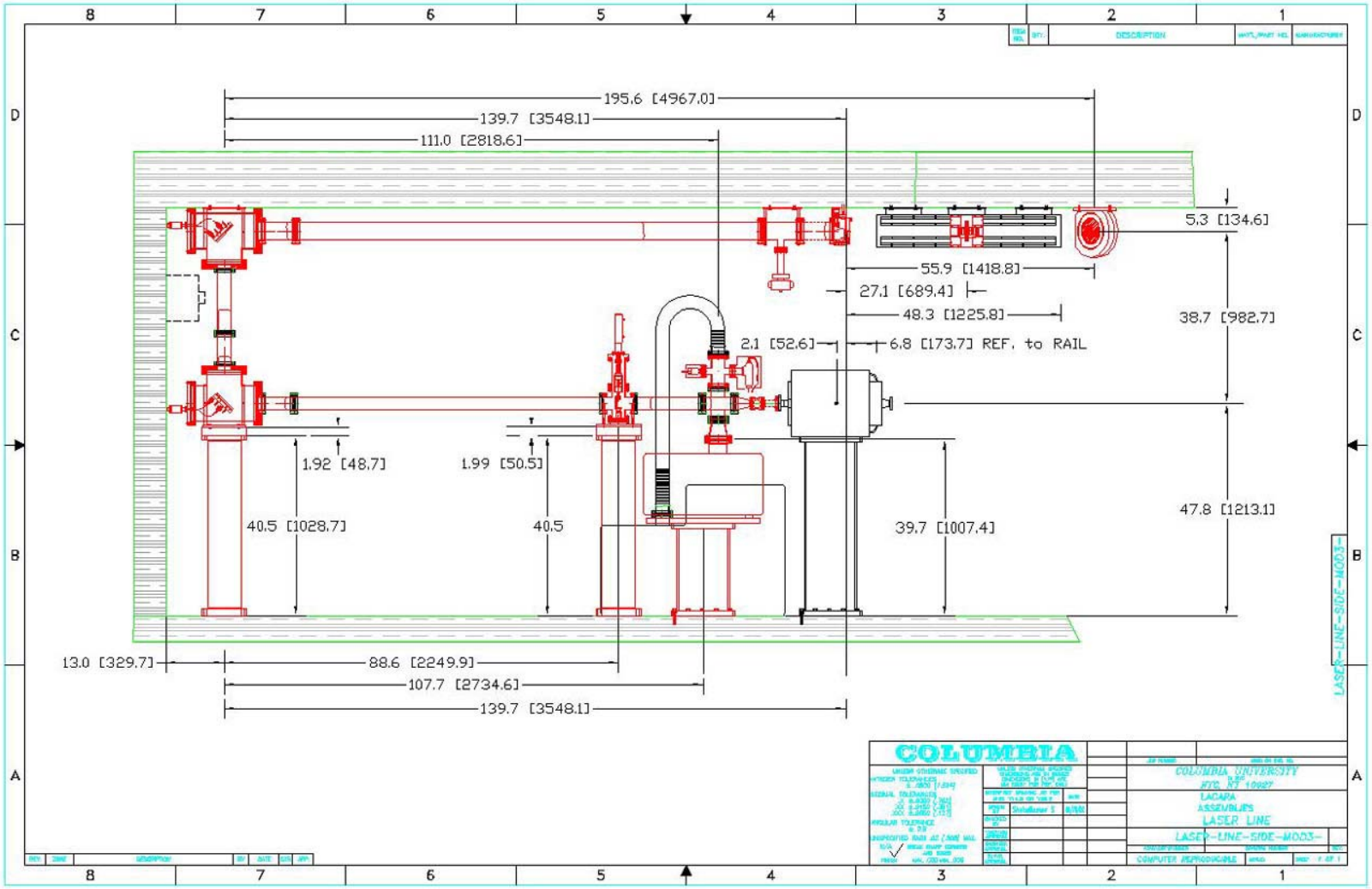
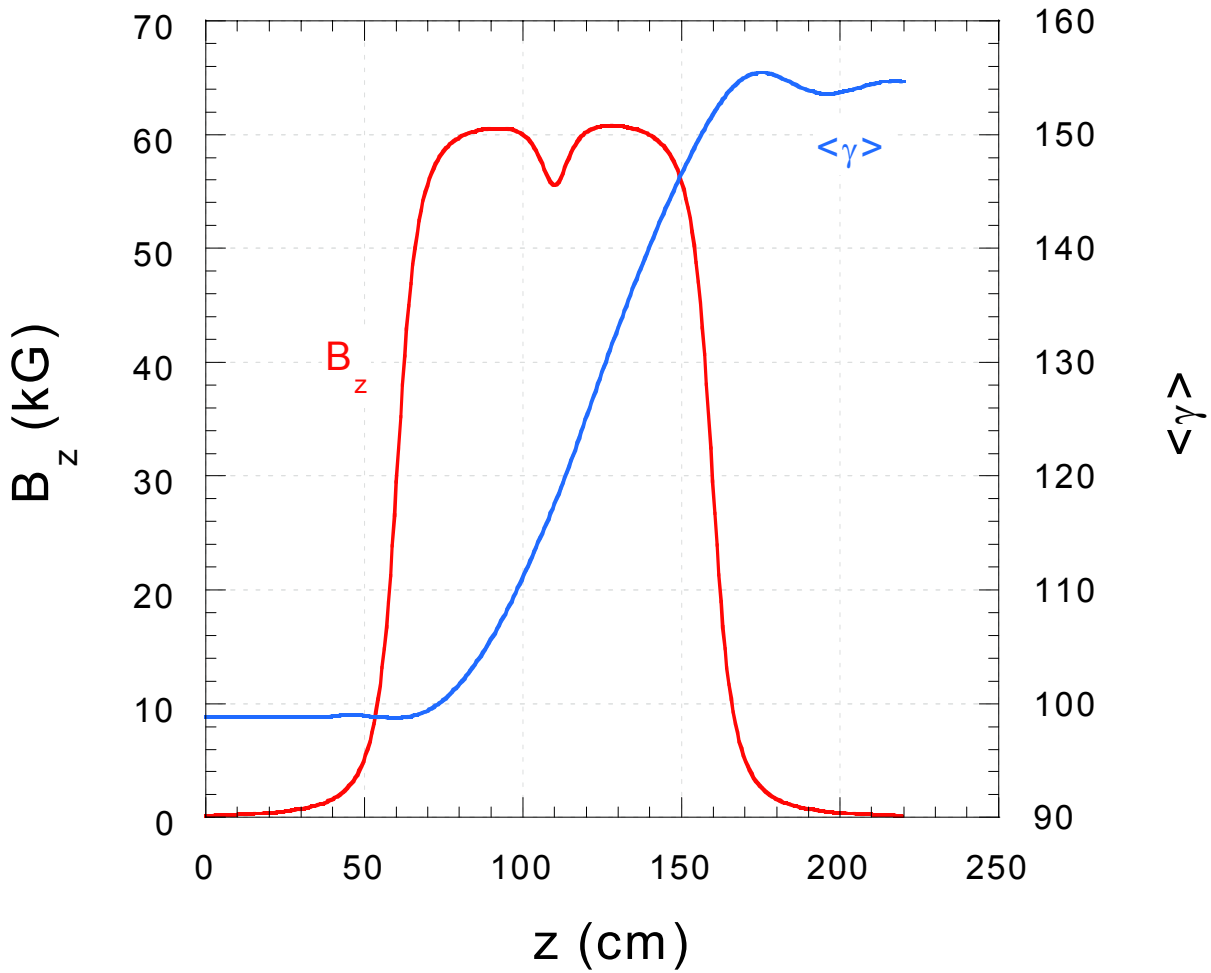



Yale/Omega-P Beam Physics
Collaboration

# *Parameters for LACARA at ATF*

| | |
|---|---|
| laser wavelength $\lambda$ | 10.6 μm ($CO_2$) |
| laser power | 800 GW |
| laser waist radius $w_o$ | 1.16 mm |
| Rayleigh length | 39.88 cm |
| initial beam energy | 50 MeV |
| initial energy spread | 0 |
| initial rms emittance | $1.5 \times 10^{-3}$ mm-mrad |
| $\sigma_x = \sigma_y$ | 28 μm |
| final beam energy | 78.5 MeV |
| final rms energy spread | 4.05 MeV (5.1%) |

# *Predicted mean energy gain in LACARA*

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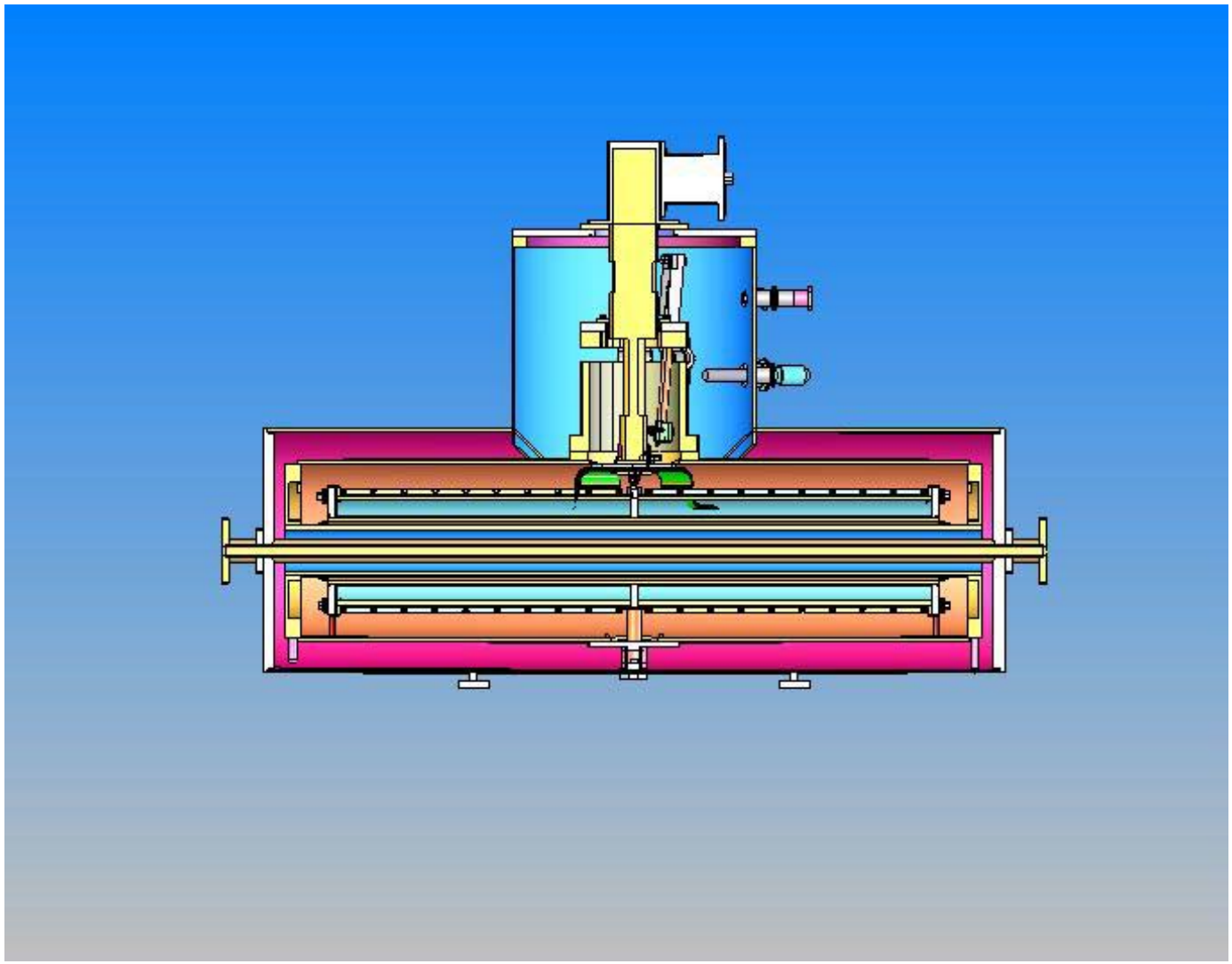
# *Cutaway drawing of LACARA dry cryomagnet*



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# *LACARA* magnet design parameters*

| | | | |
|---|---|---|---|
| design field | 6.0 T | total turns | 30,597 + |
| winding id | 4.46” | 30,713 = | 61,310 |
| winding od | 6.40” | wire length | 87,157 ft |
| winding length | 38.5” | | (16.5 miles) |
| split gap width | 0.5” | inductance | ~60 Hy |
| wire diameter | 2.6 mm | charging rate | 5-6 A/hr |

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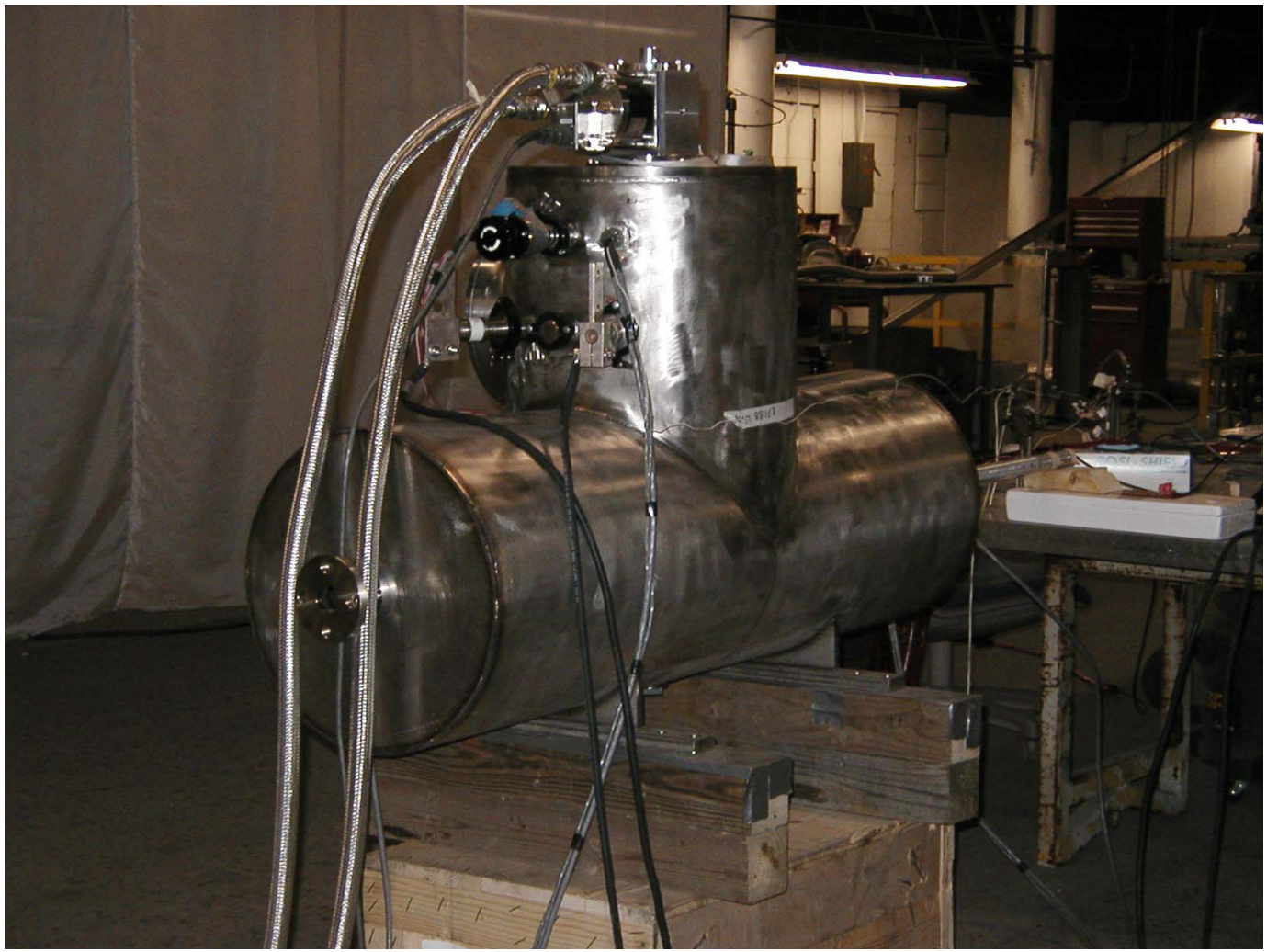
**designer:*

*Peter Hwang, Advanced Cryogenics Engr.*

*manufacturer:*

*CVIP (Cyrogenics, Vacuum, Instrumentation, Piping)*

# *Photo of LACARA dry cryomagnet*



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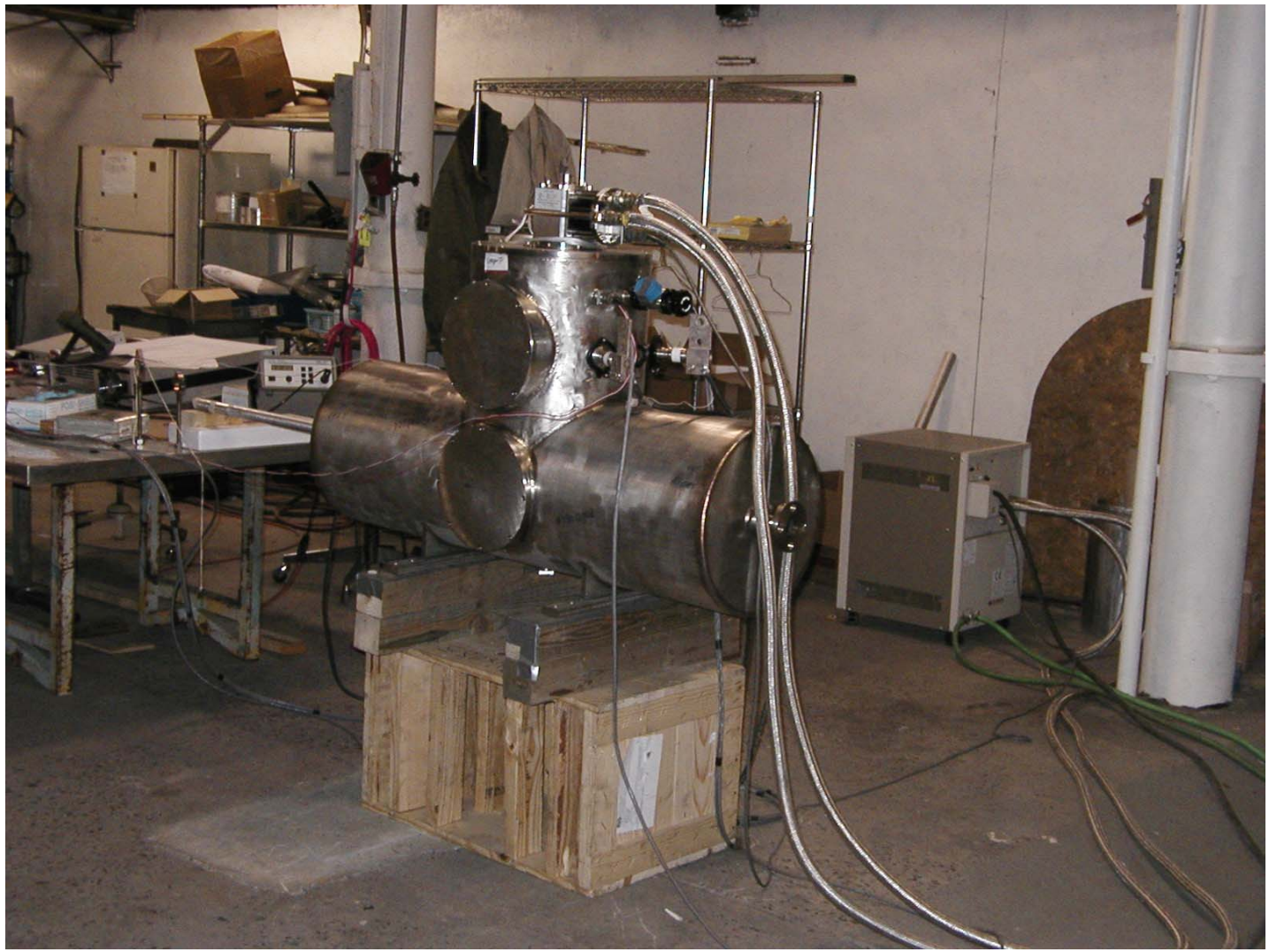

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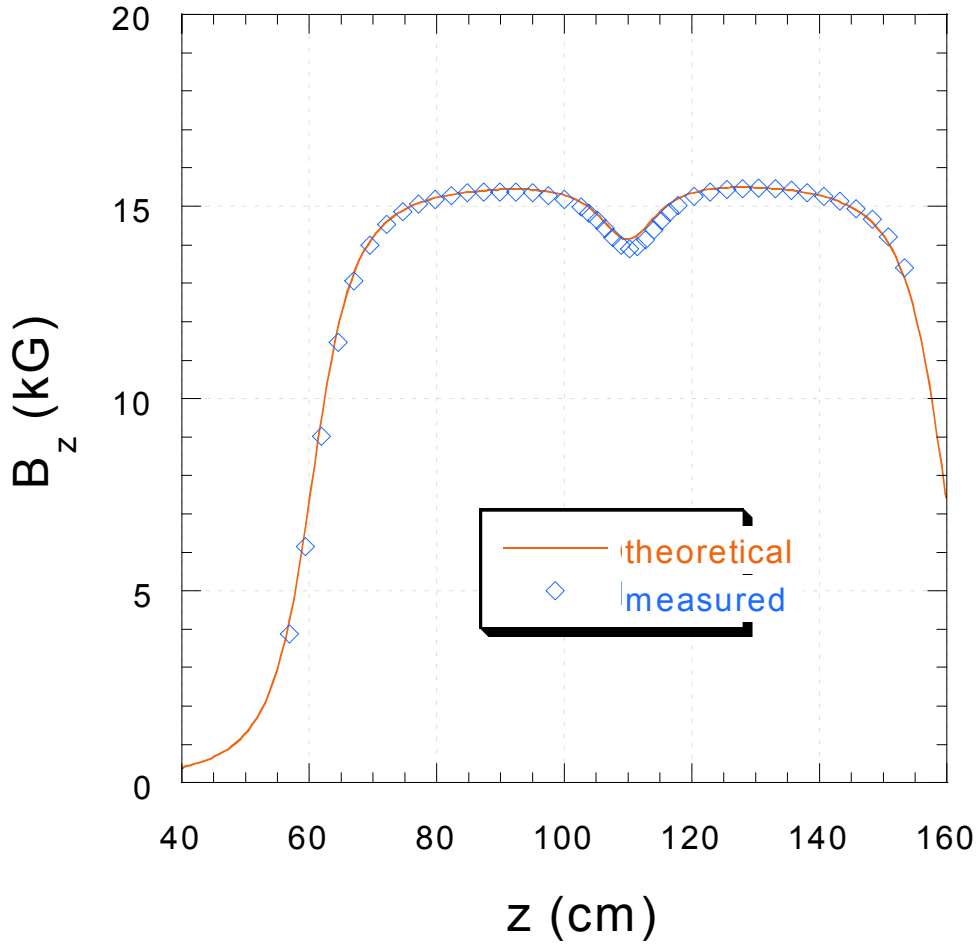
# *Magnetic field profile: ◊ measured, ----- calculated at 20 A. Design current = 76.5 A.*

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