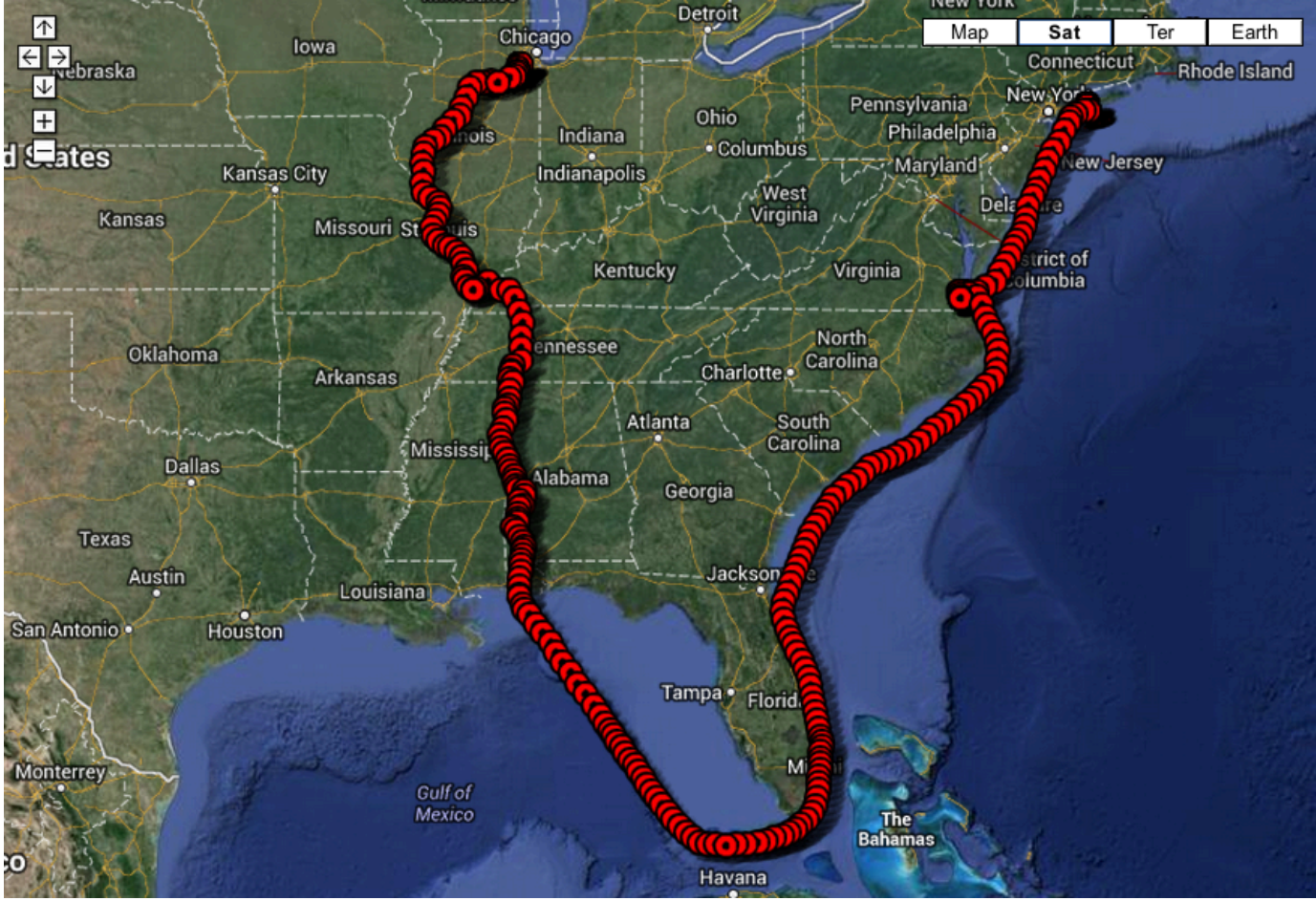


g-2 Update

Brendan Kiburg
Intensity Frontier Department Meeting
July 22nd, 2013

Overview

- The measurement in three slides
- Motivate The Transport
- The Move
- Plans for this week

g-2

$$\vec{\mu} = g \frac{q}{2m} \vec{S}$$

- Dirac theory of point-like elementary spin ½ particle:

  $g \equiv 2$

- $g = 2 + \text{QED} + \text{Weak} + \text{QCD} + \ldots + \text{New Physics}$

- Anomalous magnetic moment: $a_\mu = (g_\mu - 2)/2$

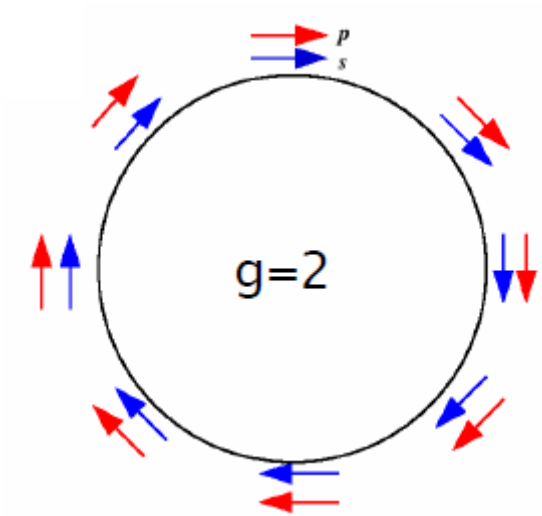
Muons in a storage ring

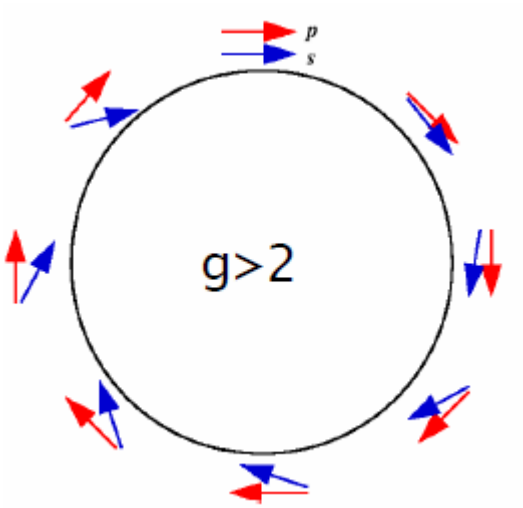
Cyclotron frequency ω_C: $\omega_c = \frac{e}{m\,\gamma} B$

Spin precession frequency ω_S: $\omega_s = \frac{e}{m\,\gamma} B\,(1 + \gamma\, a_\mu)$

Larmor + Thomas precession

$$\omega_a = \omega_S - \omega_C = e/m\ \mathbf{a_\mu}\ B$$



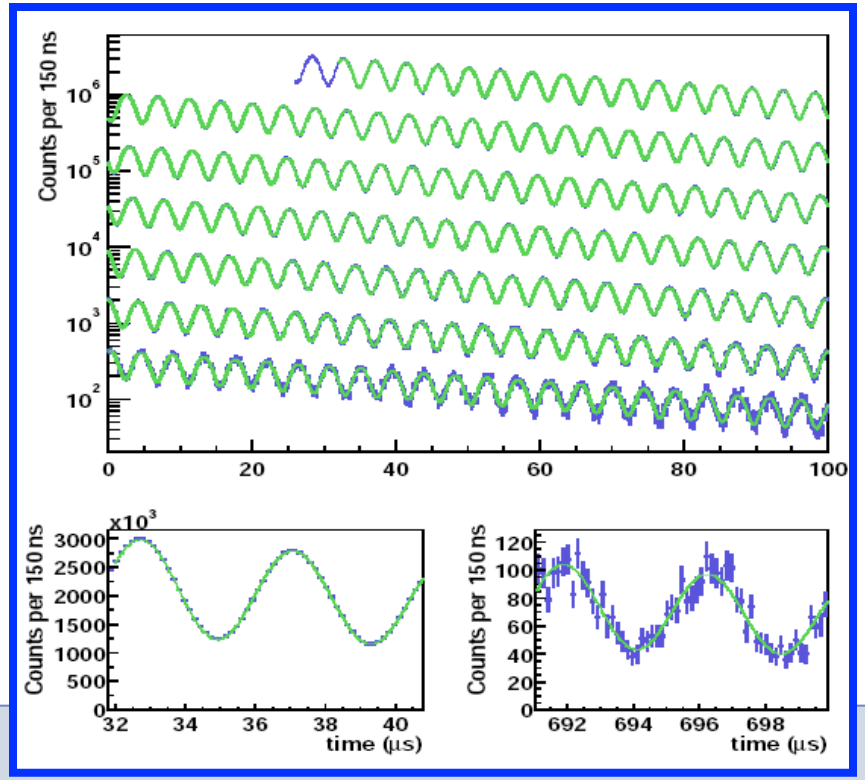


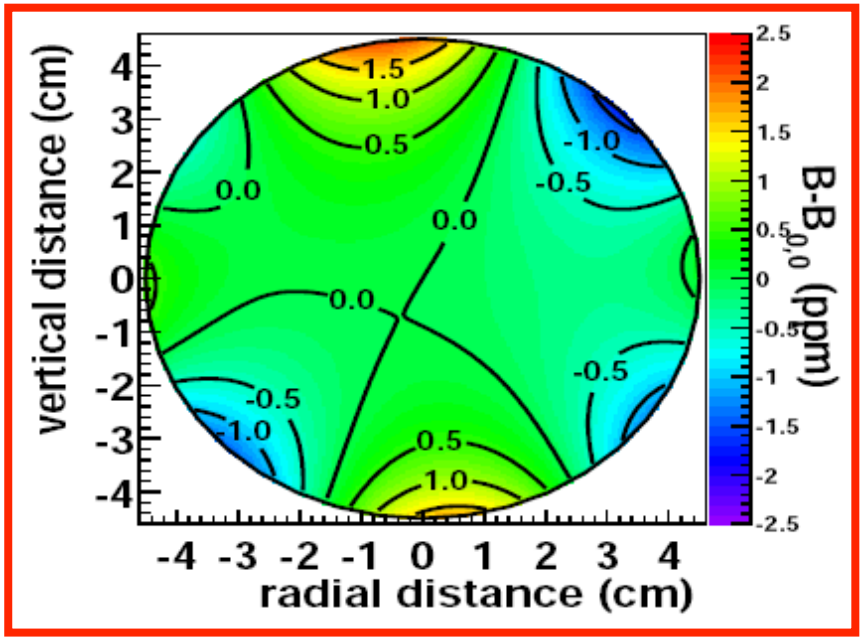
The Measurement

$$\omega_a = e/m\ a_\mu\ B$$

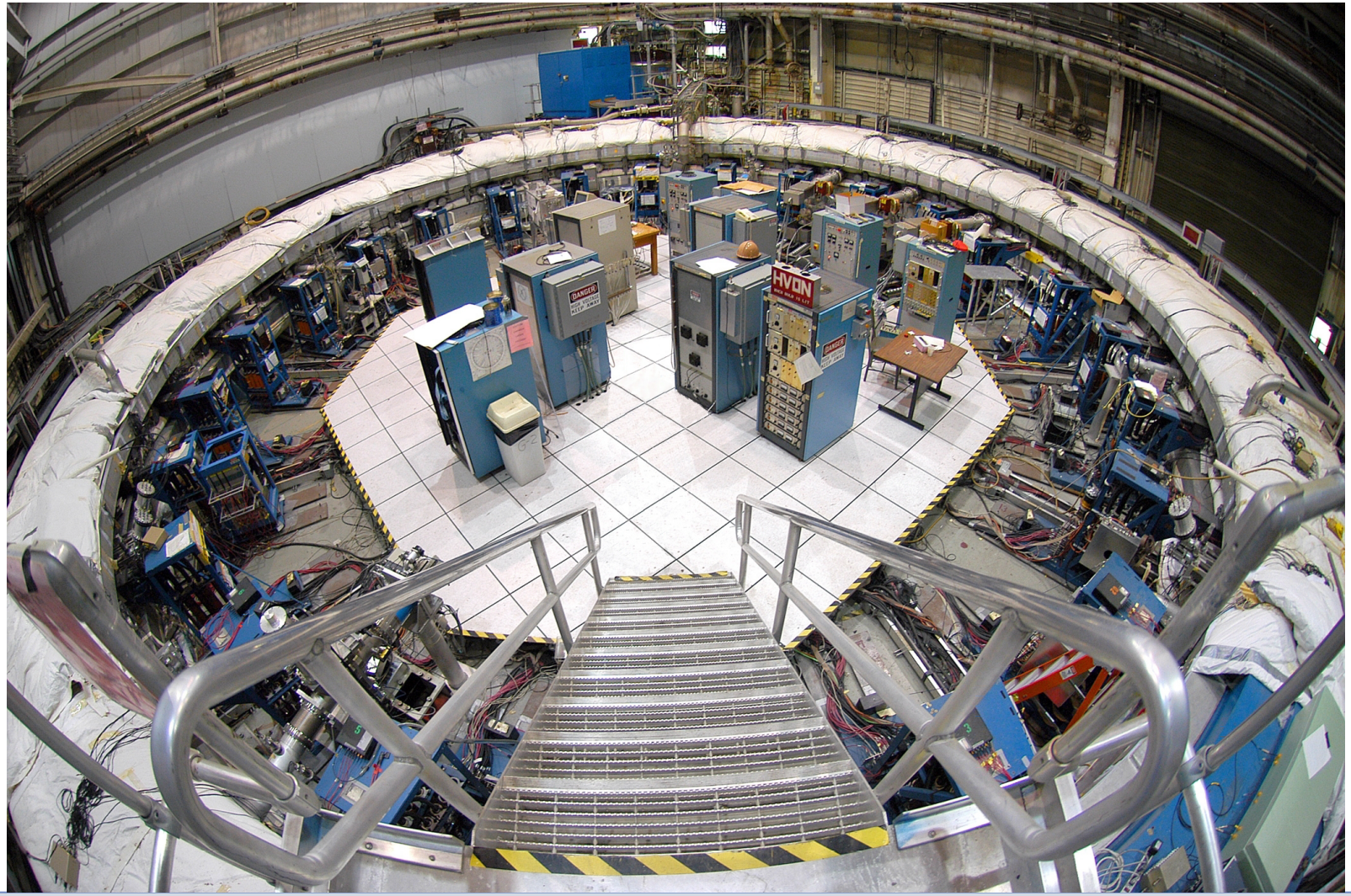
Measuring the anomalous moment a_μ requires both

1. the spin precession frequency ω_a
2. the magnetic field **B**

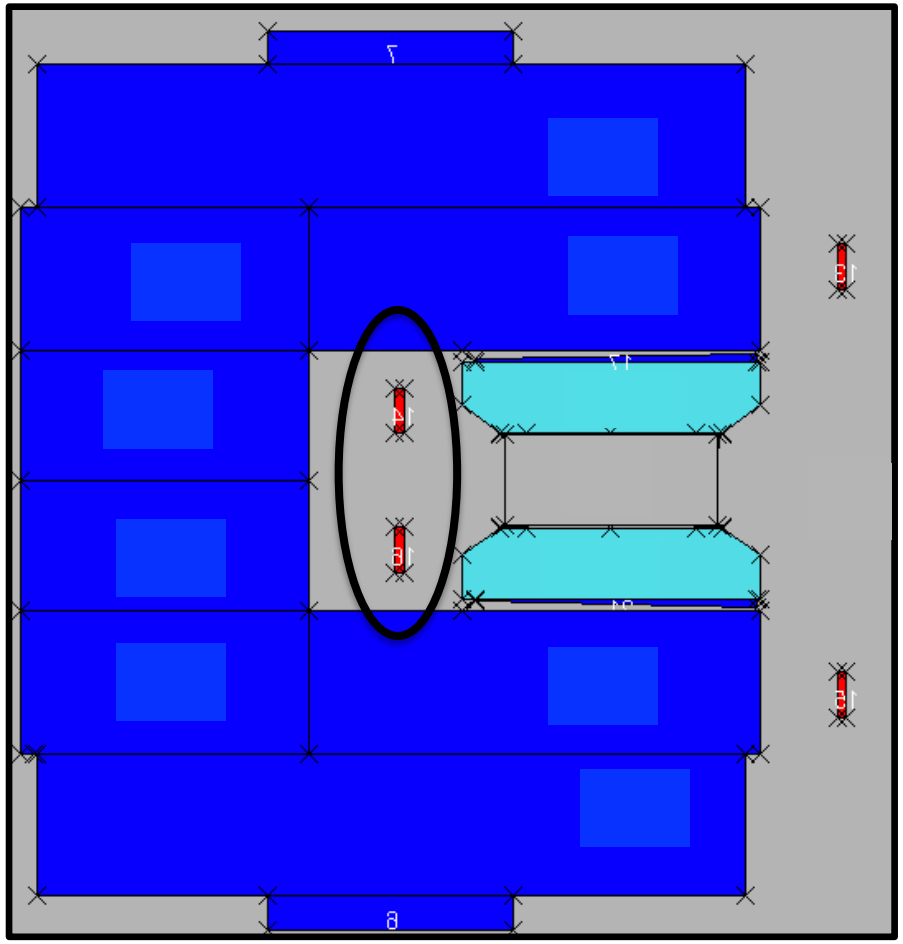




The Hall at Brookhaven



Producing the Magnetic Field



Ring center

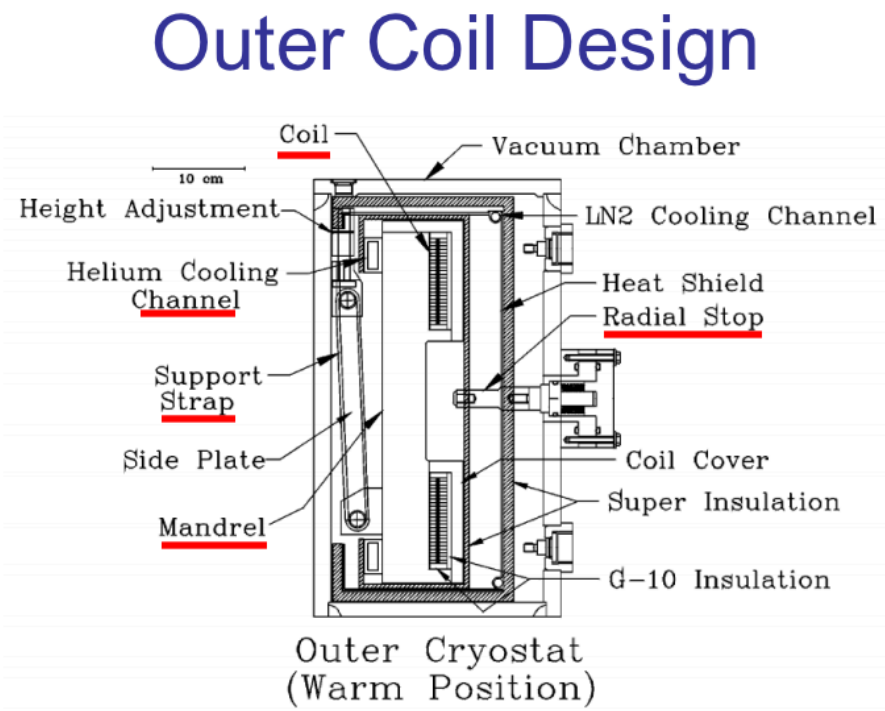
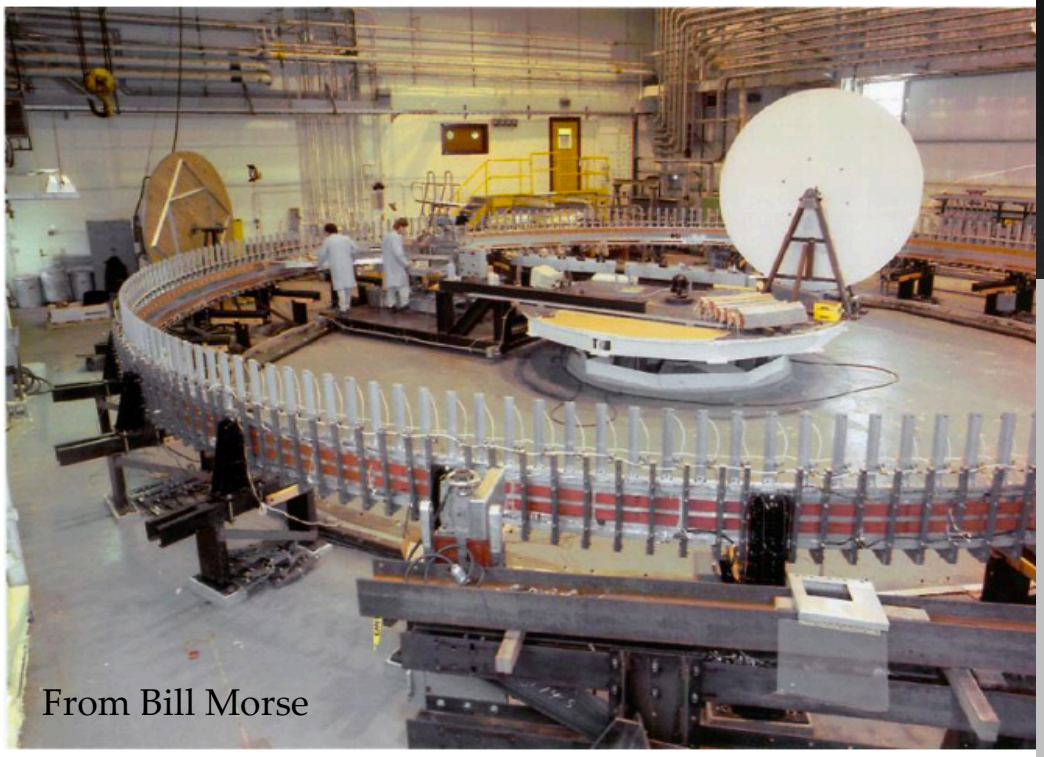
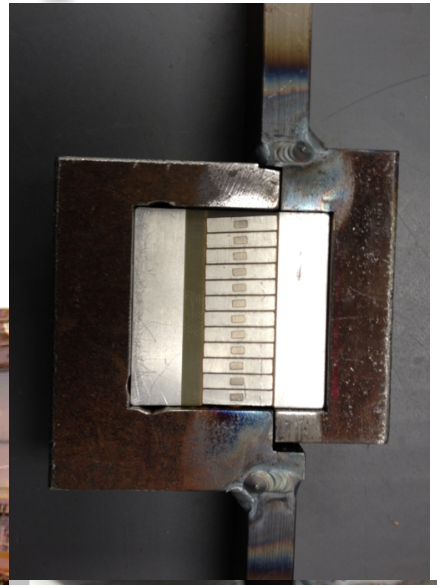


Fig. 8. A cross-section of the outer coil and cryostat assembly at the location of a radial stop.

The delicate requirements

- Largest SC coil by factor 10 in 1990s
- Continuous winding around 50 ft diameter
- Transporting much more cost effective than rebuilding


From Bill Morse



Shear tests + caculations divided by a safety factor set the deflection spec. (3mm out of plane / twisting)

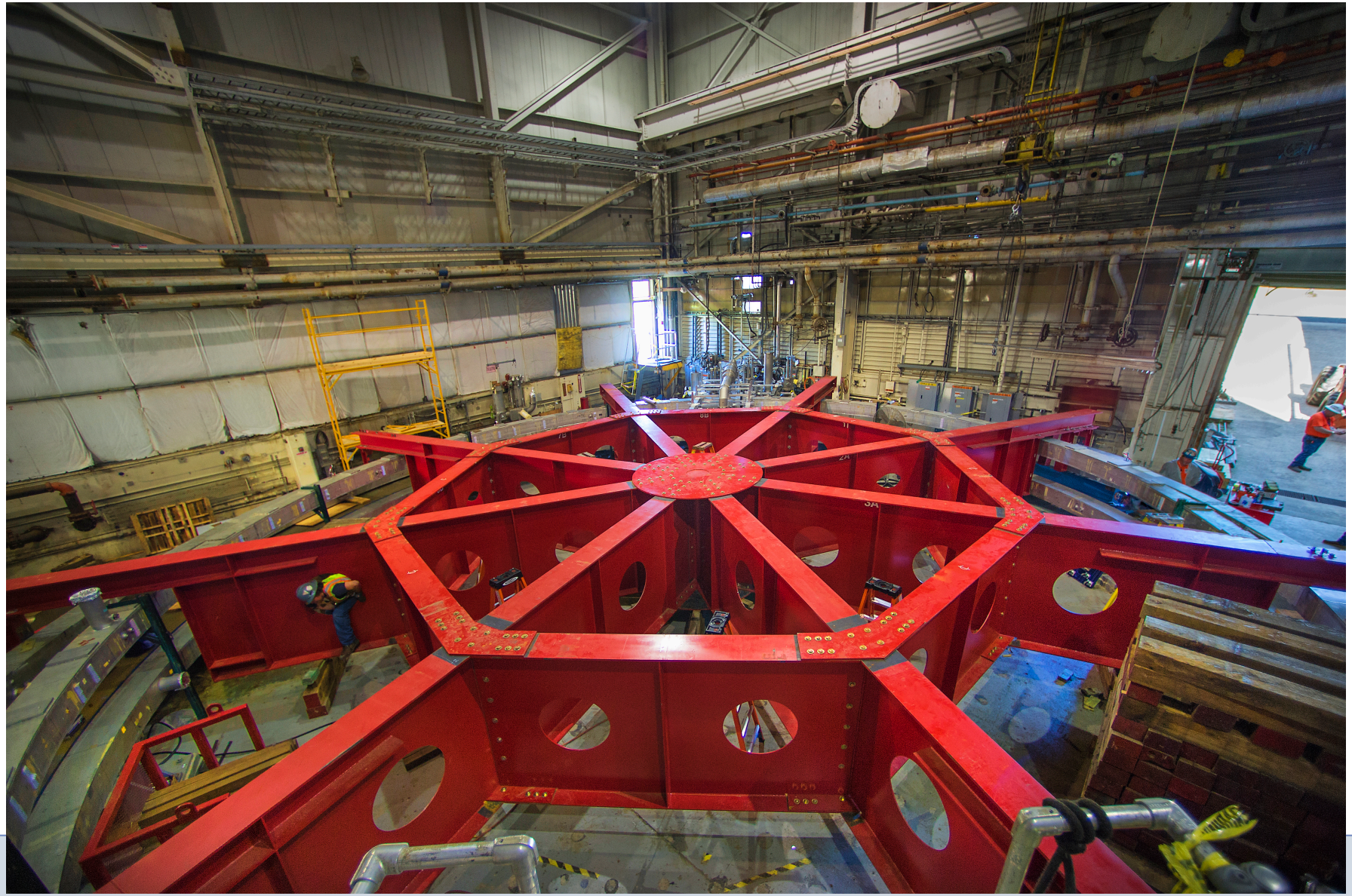
Wave analysis to understand forces endured at sea

Preparing the solution at Brookhaven

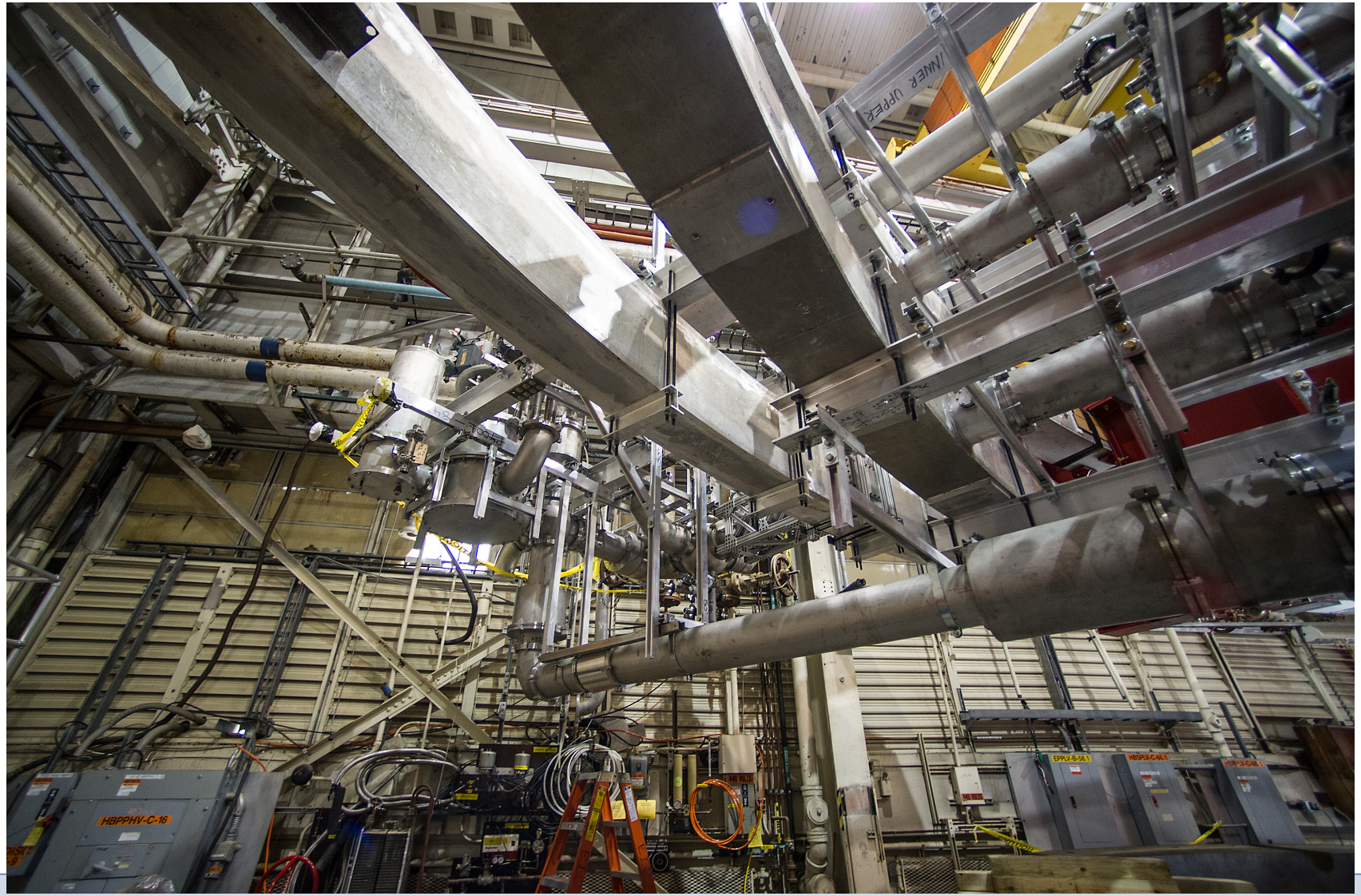
- Rigid structure to fix ring
- Three point mount

Cross and vertical supports

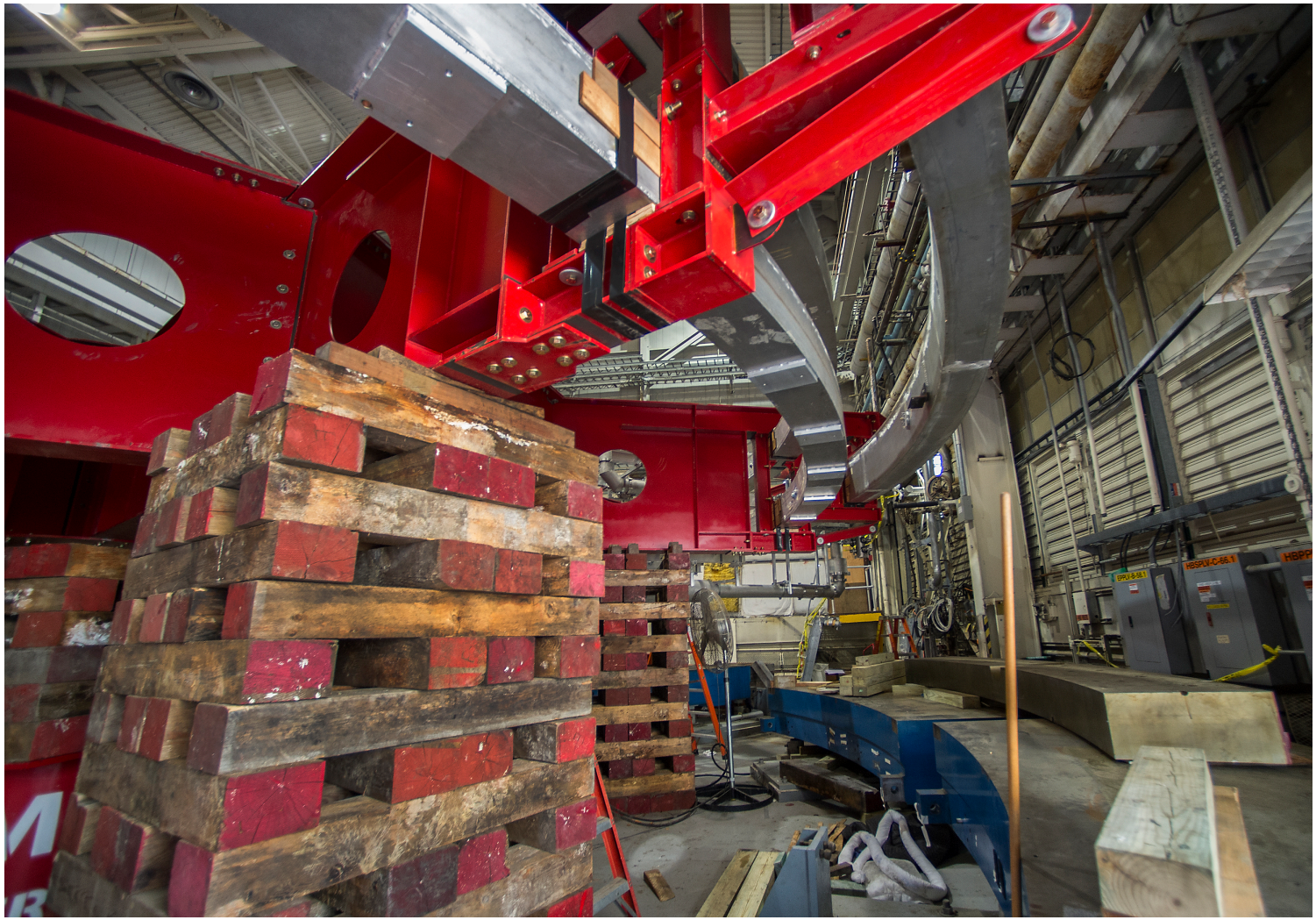
Fixture in place



View of Interconnects



Elevated



Leaving the Brookhaven Hall

Leaving the Brookhaven Hall

Not a spaceship

Ready for the transport

Shrink wrap

- Protect from sea and debris
- Flowing Nitrogen Gas

Trailer shipped to BNL

Trailer Assembled

Ready to roll

Homeward Bound

Homeward Bound

Tree trimmers on call

Rolling Roadblocks

Night transport on public roads

Craned off of the trailer

And onto the barge

Three point mount

Bon voyage! A seaworthy magnet on June 25

Transporting the ring to Fermilab

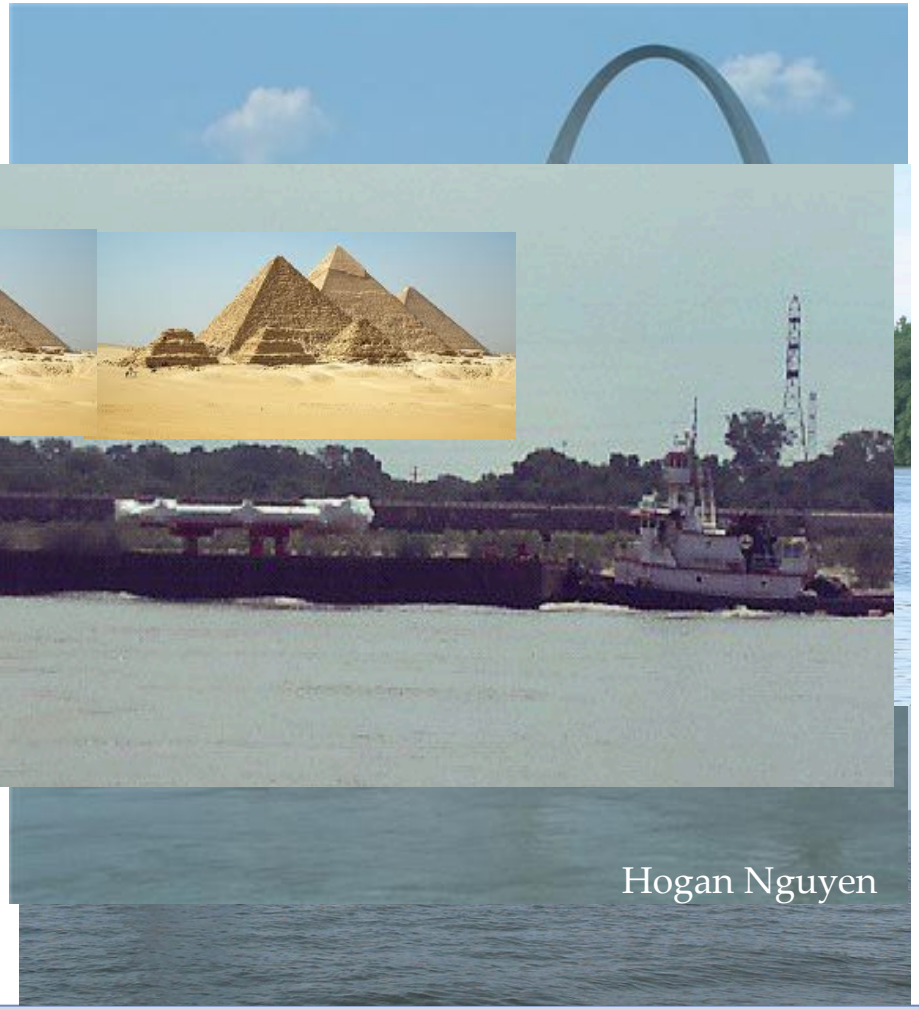
Movie credit: Volodya Tishchenko (BNL)

Changing Tugboats in Mobile Bay July 12

Ocean Tug: Trident

River Tug: Miss Katie

Tombigbee to the Mississippi



The Illinois Waterway

Passing under anti-carp field

Locks

Panorama at the locks

Inspiring to see the public interest

- Tugboat captain told us there have been crowds at every lock along the river system

- There were rings chasers on boats

- Many opportunities to inform the public about our work

Arriving at Lemont Saturday

Tying up

Preparing to unload Sunday

Up in the air

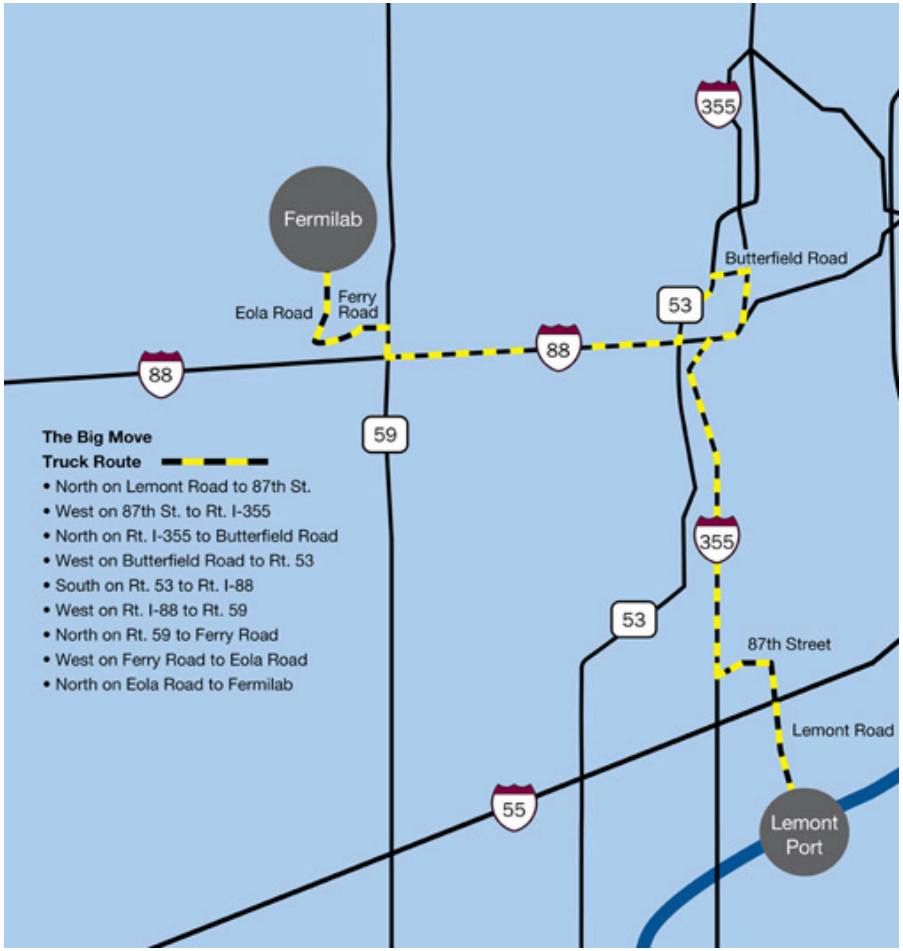
Muon g-2

Back on the trailer

Media Coverage

This Week

- **Tuesday 9pm**: Lemont to Bolingbrook
- **Wed 9am – 5pm** : Public outreach event at Costco (87th street and I-355 in Bolingbrook)
- **Wed 11:30 pm**: I-355 to Rt 56 to Rt 53
- **Thurs 9am – 5pm** : Public outreach event at Hidden Lake Forest Preserve (near Rts 56/53)
- **Thurs 11 pm**: I-88 → Rt 59 → Ferry → Eola → FNAL
- **Fri 5:30 pm**: Public event at Wilson Hall



Thanks to all the photographers (credited and uncredited)

- Reidar Hahn
- Hogan Nguyen
- Darin Clifton
- Adam Lyon
- Peter Winter
- Volodya Tishchenko

- And many more