CAMD's 7.75 T Wiggler

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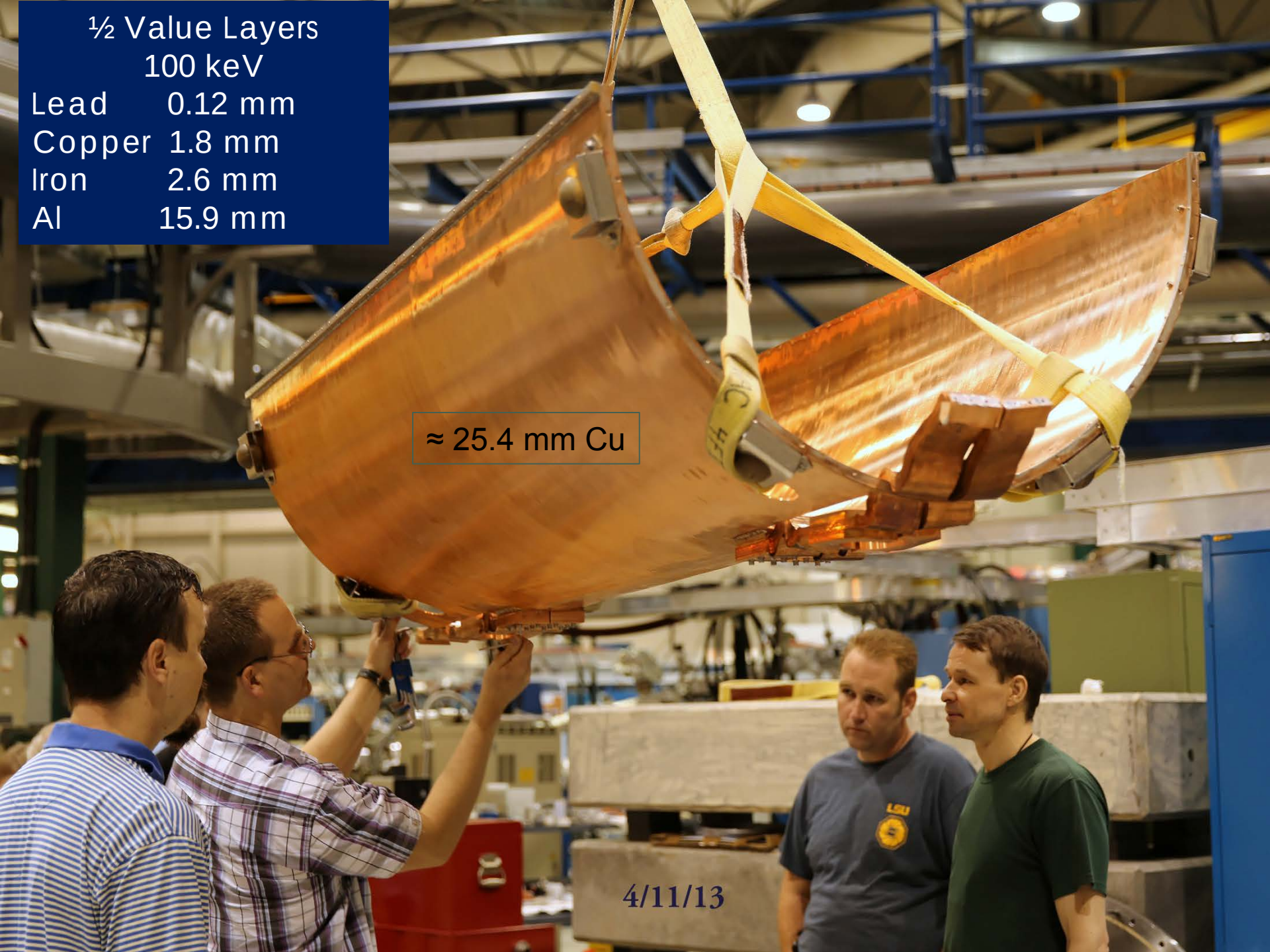
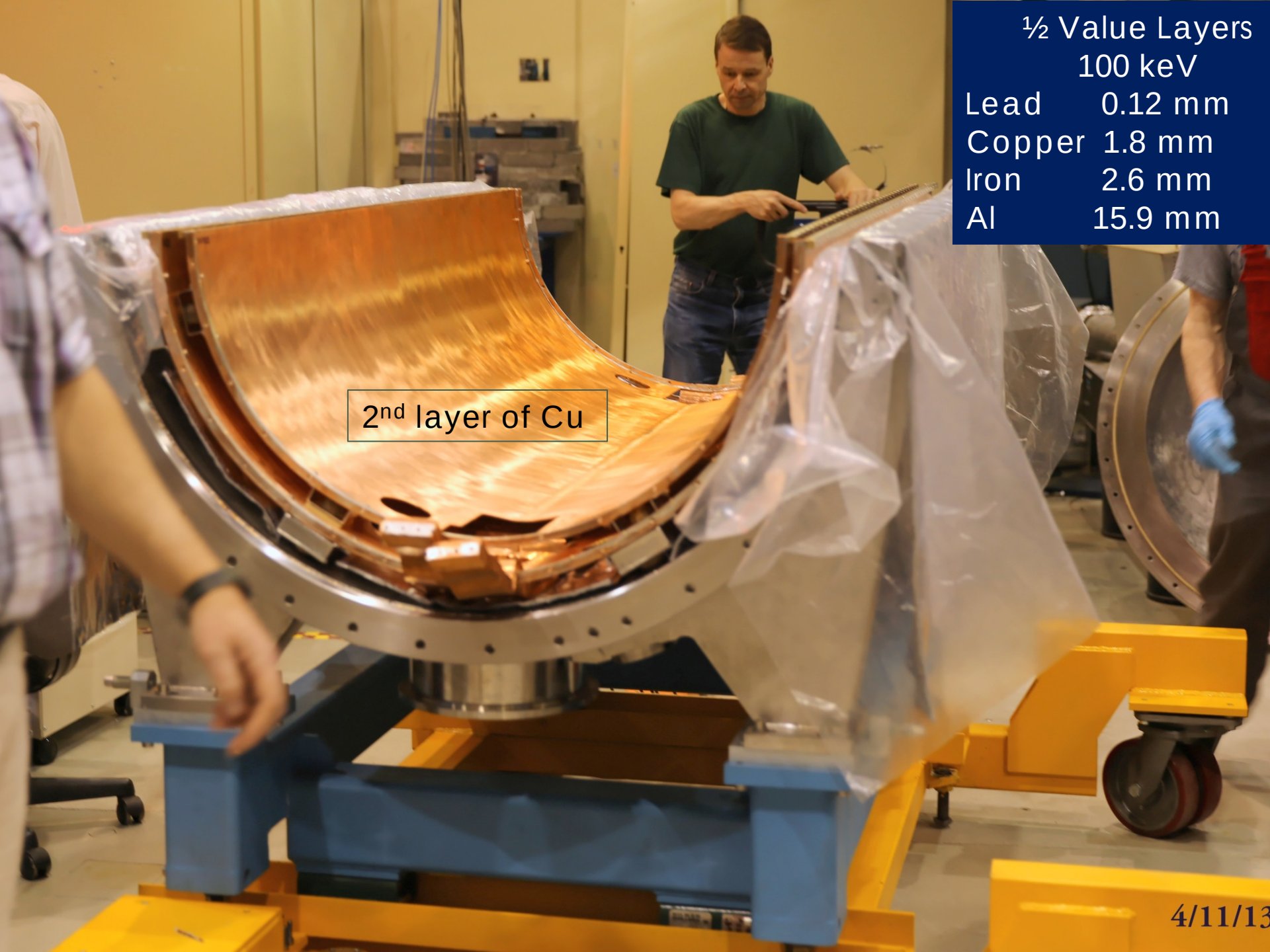
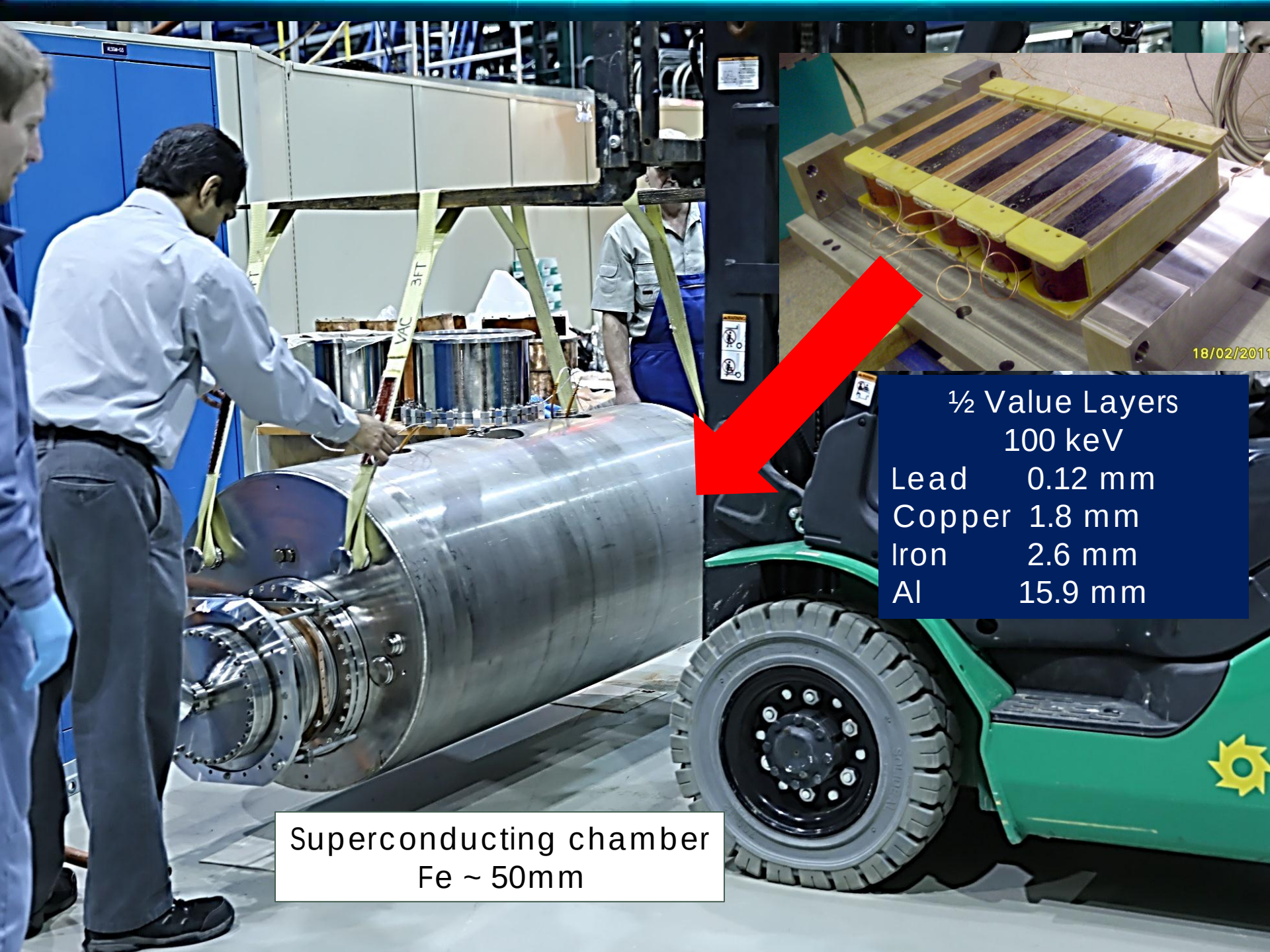
Wiggler Characteristics

MPW specification	
Peak field on axis (Tesla)	7.5
Number of poles	11+4
Pole length (mm)	100
Overall MPW length (m)	2.2
Beam vertical aperture (mm)	15
Magnetic gap (mm)	40
Beam power at 200 mA (kW)	15

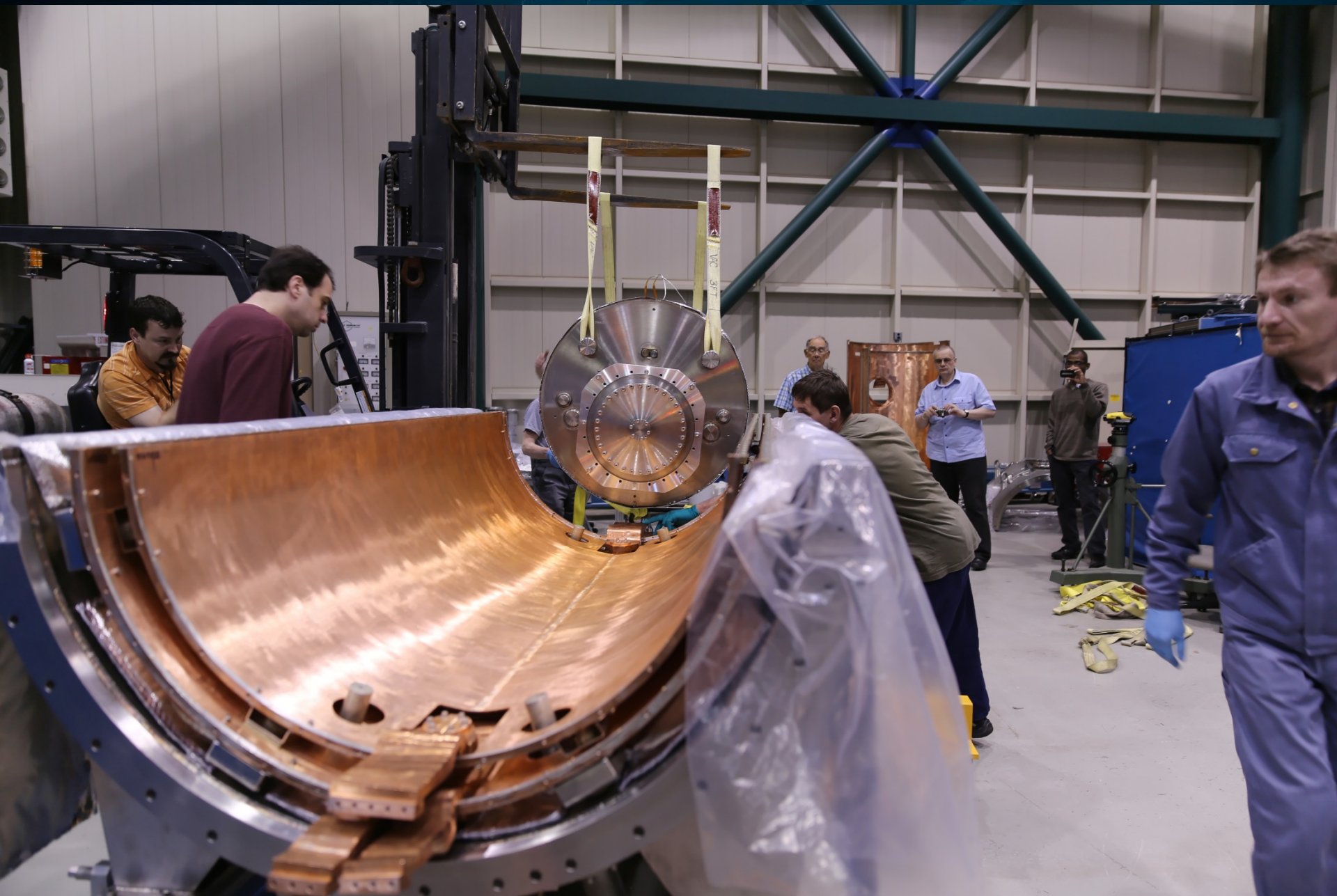
04/12/13 through 04/22/13 – reassembly of wiggler
04/24/13 through 05/06/13 – installation of wiggler
05/06/13 through 05/24/13 – acceptance tests {magnet quenches}
05/24/13 onwards – shield wall rebuild, ring conditioning and commissioning activities


½ Value Layers
100 keV
Lead 0.12 mm
Copper 1.8 mm
Iron 2.6 mm
Al 15.9 mm
≈ 25.4 mm Cu
4/11/13


½ Value Layers
100 keV
Lead 0.12 mm
Copper 1.8 mm
Iron 2.6 mm
Al 15.9 mm
2nd layer of Cu
4/11/13


18/02/2011
½ Value Layers
100 keV
Lead 0.12 mm
Copper 1.8 mm
Iron 2.6 mm
Al 15.9 mm
Superconducting chamber
Fe ~ 50mm

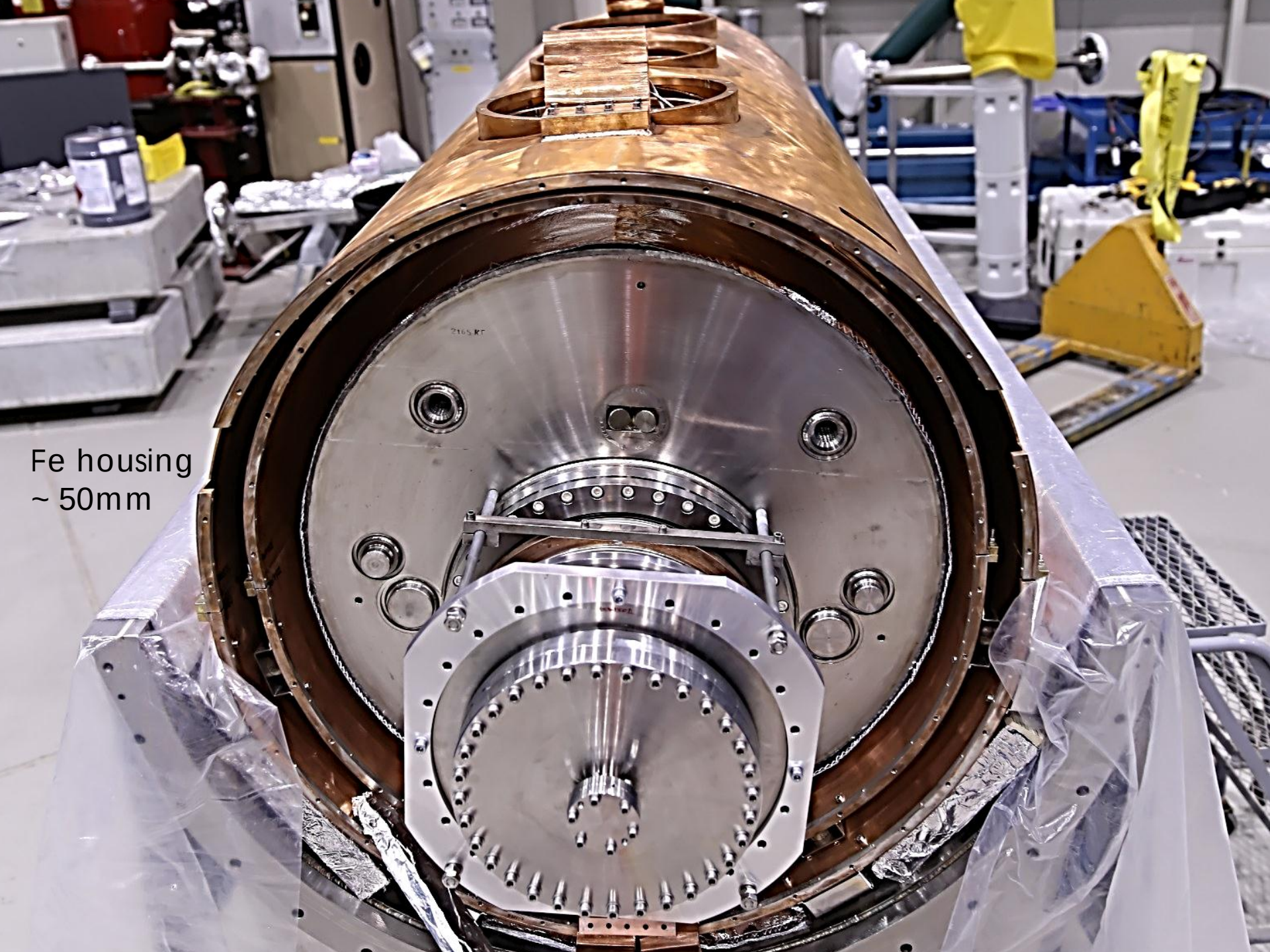

½ Value Layers
100 keV
Lead 0.12 mm
Copper 1.8 mm
Iron 2.6 mm
Al 15.9 mm
≈ ½ Value Layer Al

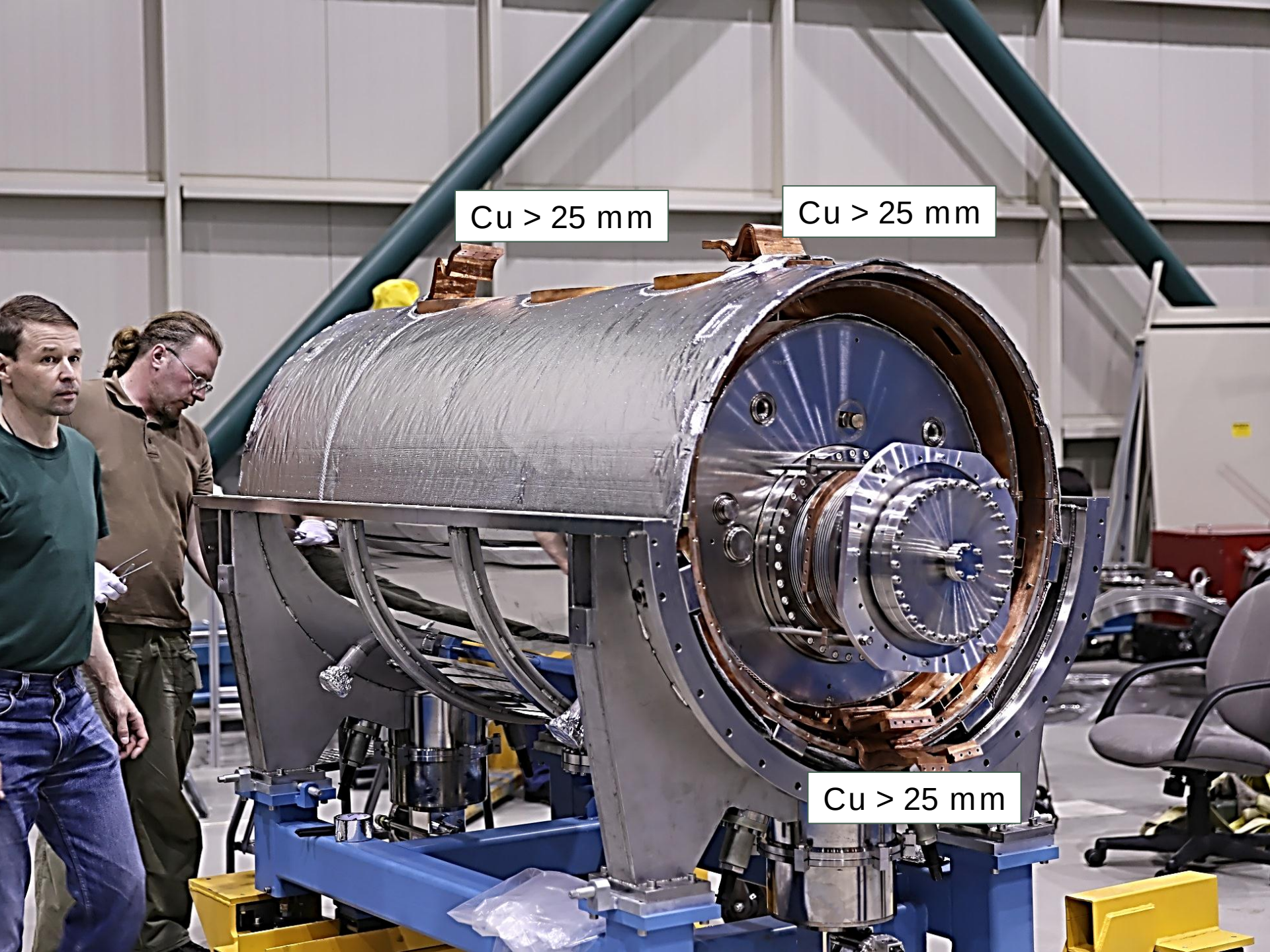


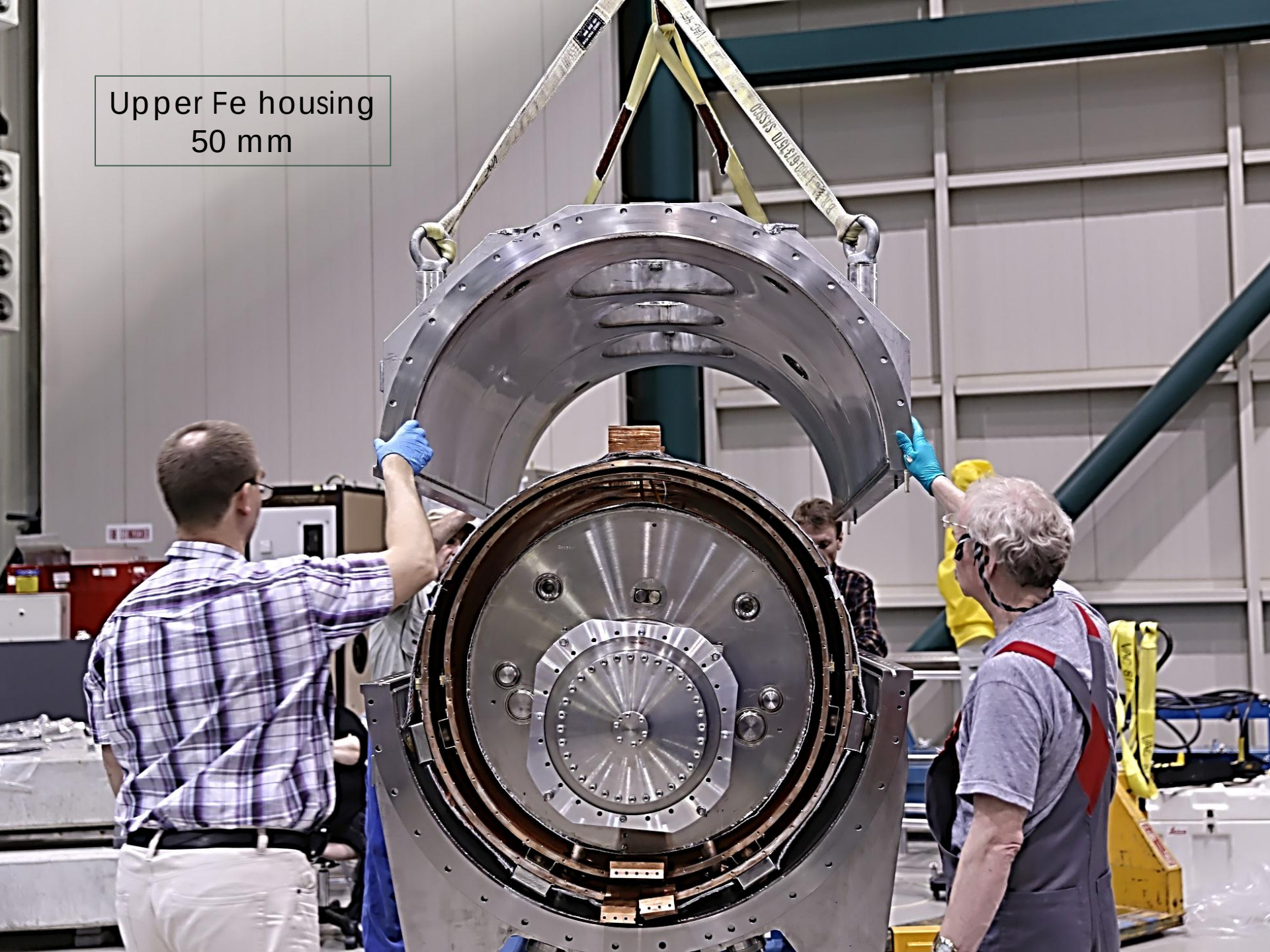

Bottom Half of Wiggler

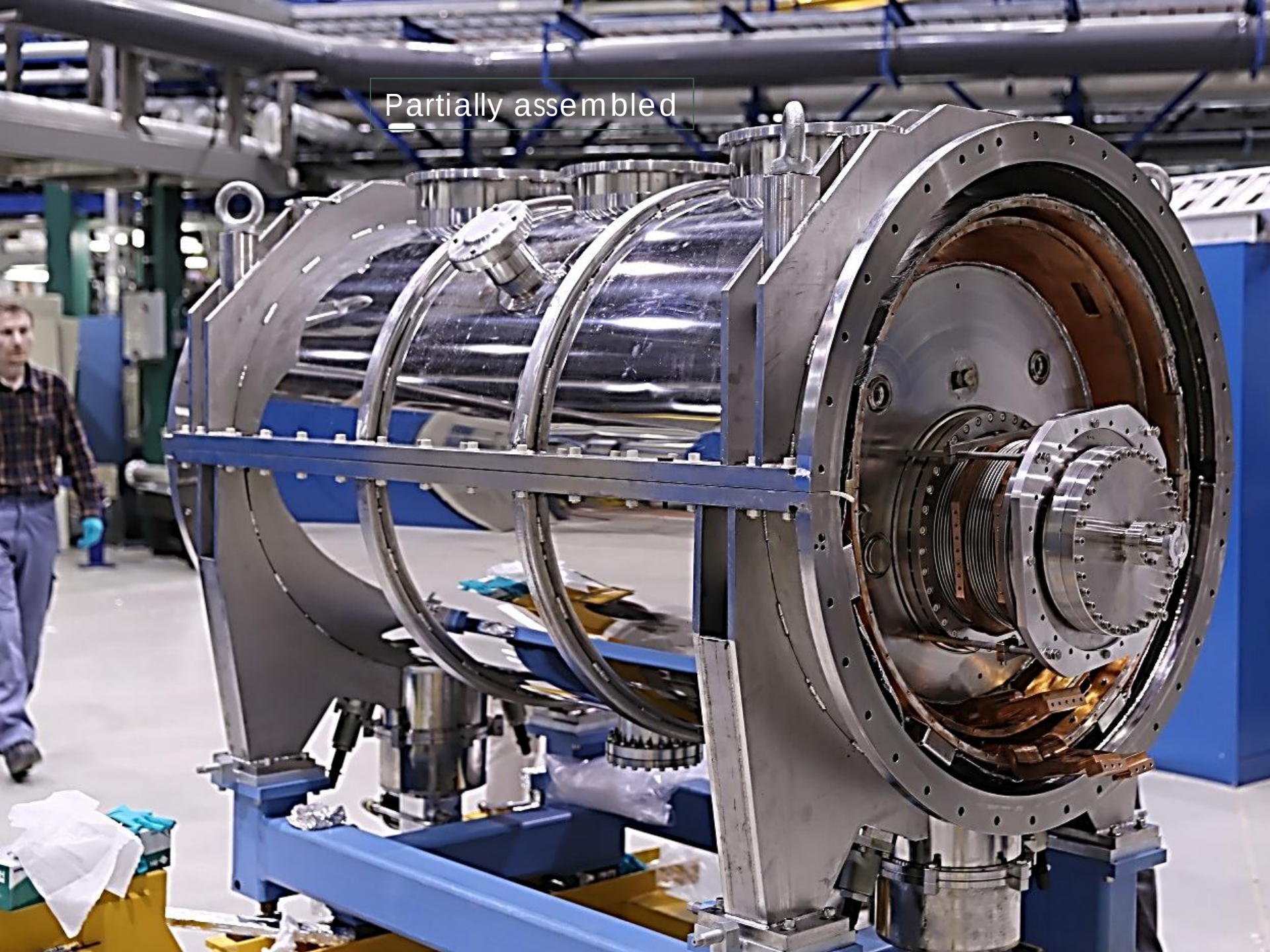

1st top half of Cu shield


2nd half of upper Cu shield
(cryoprotection)


Fe housing
~ 50mm


Cu > 25 mm
Cu > 25 mm
Cu > 25 mm


Upper Fe housing
50 mm


Partially assembled


Bellows
Cu block


LN2 port
assembly

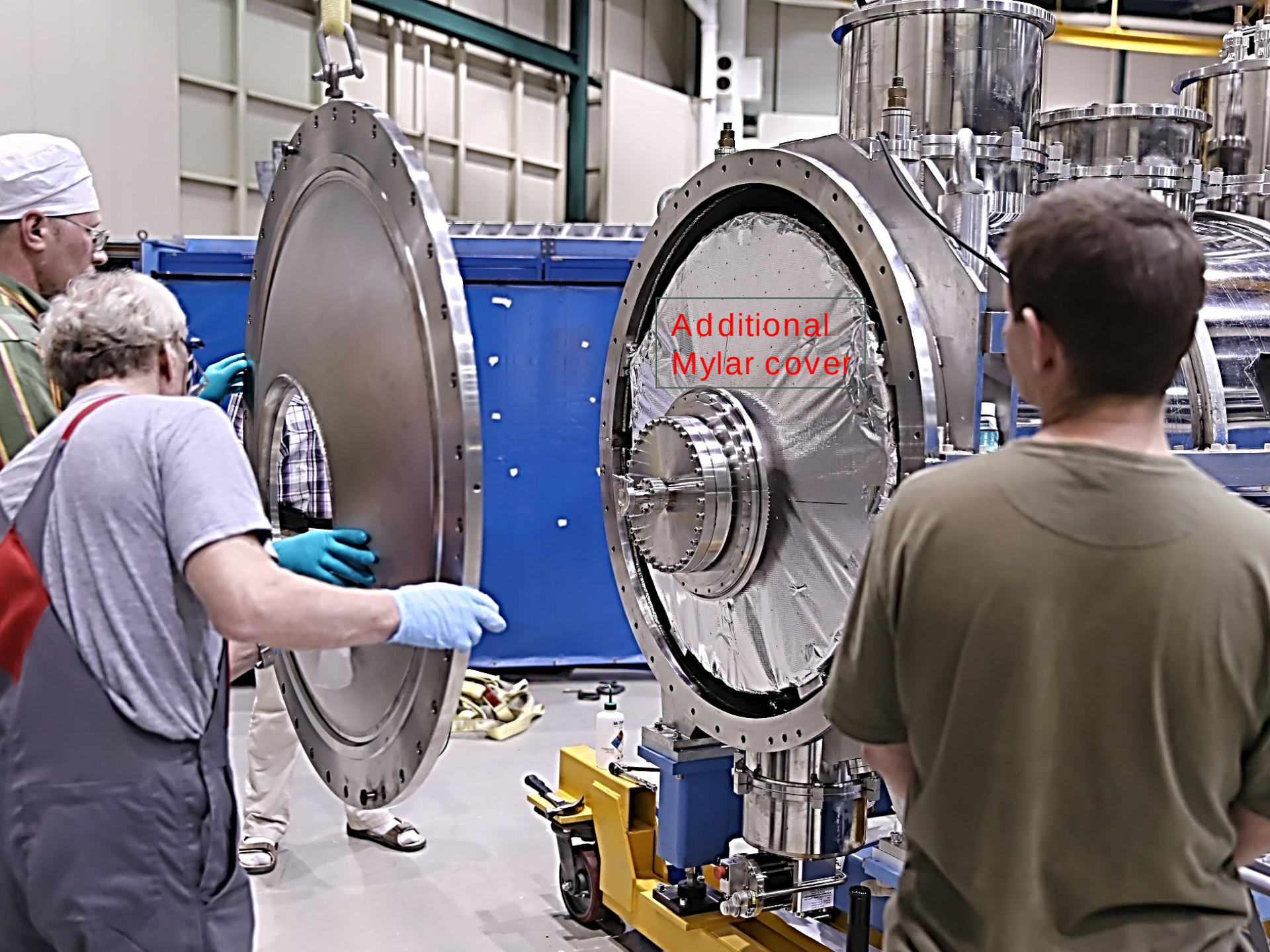

Cryogenic-tolerant
Glue for EE

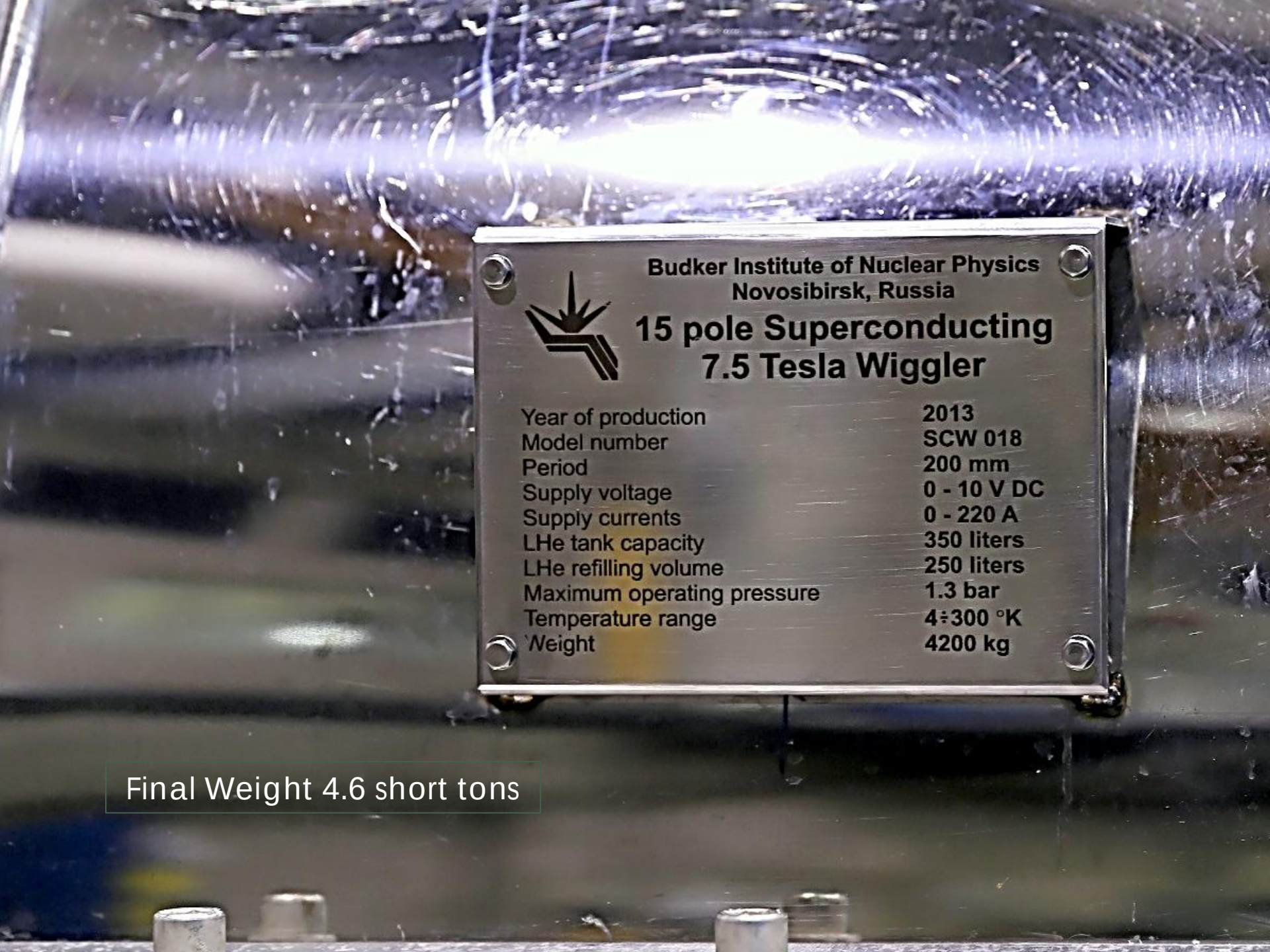

Cooling shield
for assembly
KIMTECH
Kimwipes
KIMTECH
SCIENCE
Delicate Task Wipers
Essuie-tout pour tâches délicates
Paños para tareas delicadas


LHe recompression
LHe port


Steel Cover
Mylar layer


First
End Piece

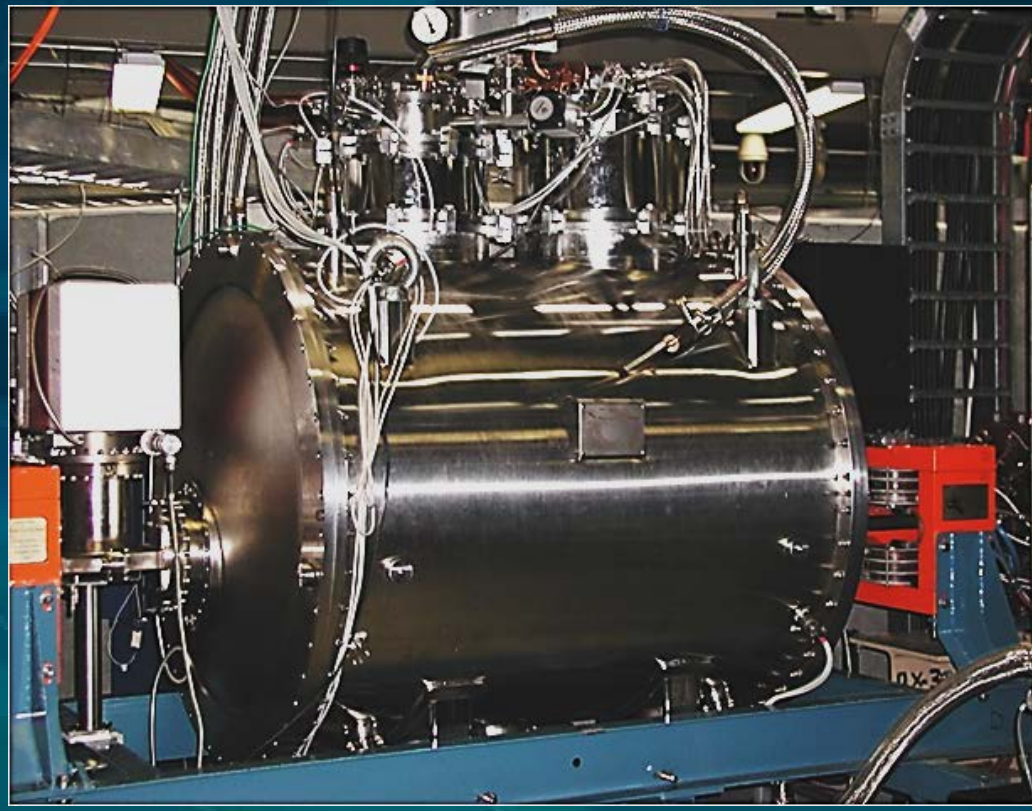

Additional
Mylar cover

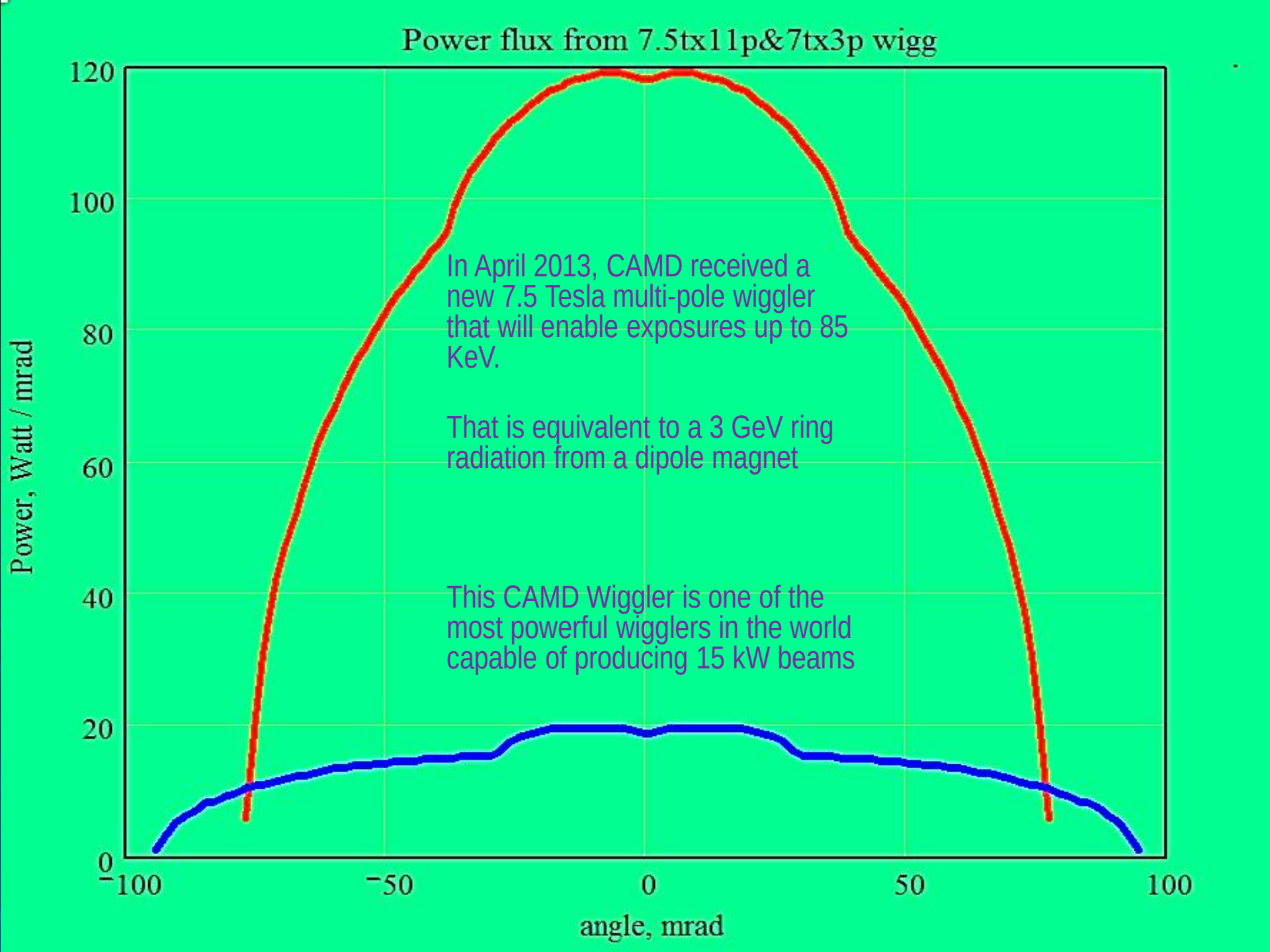


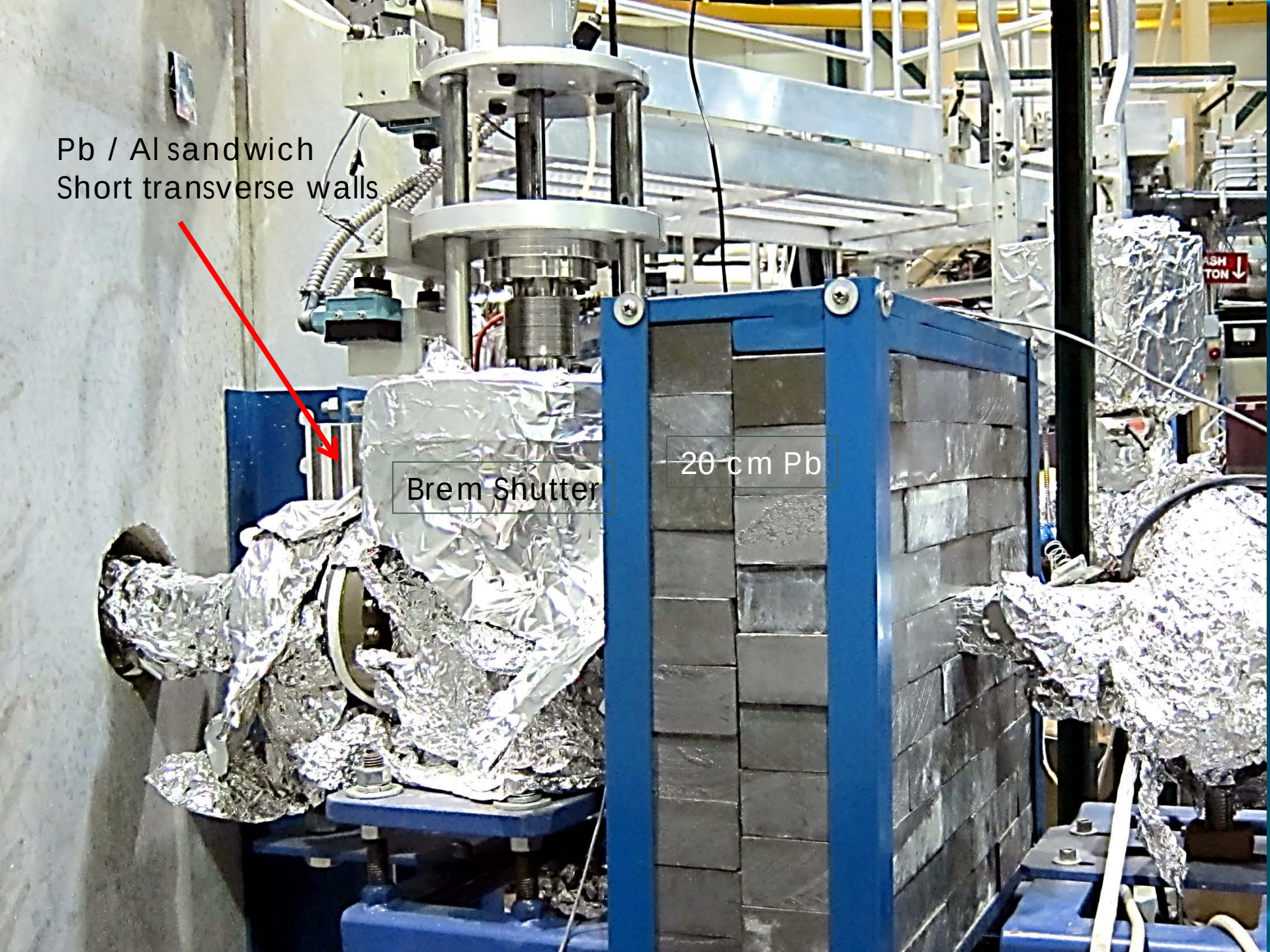
Final Weight 4.6 short tons

Wave-Length Shifter

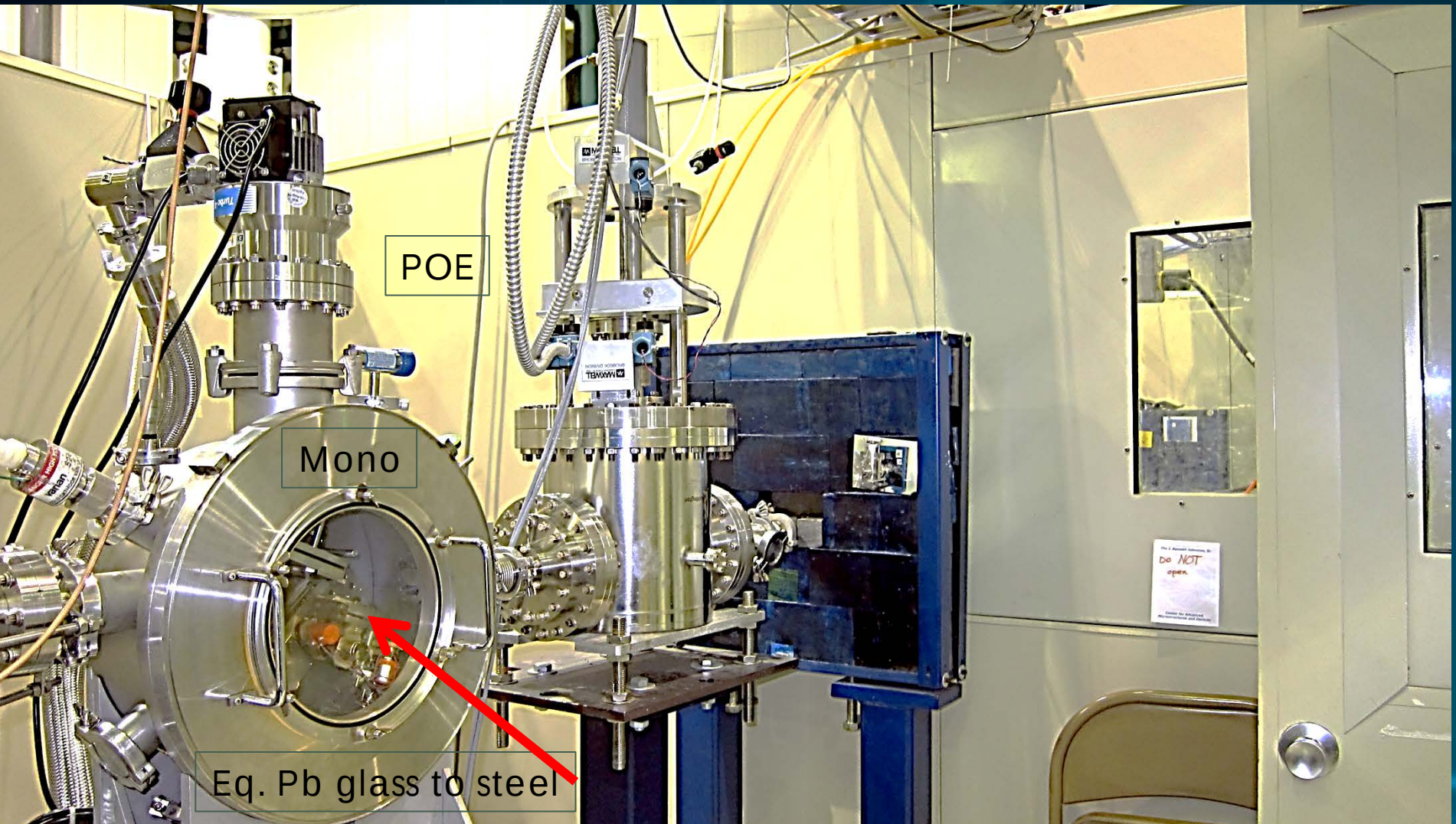
- 7T wave-length shifter
- Helium cryostat was installed in 2009.
- Losses are on the order of 1% per day when the insertion device is being ramped.
- Unlike the new wiggler, this device is on during injection and ramp.




Power flux from 7.5tx11p&7tx3p wigg
120
100
80
60
40
20
0
Power, Watt / mrad
−100
−50
0
50
100
angle, mrad
In April 2013, CAMD received a new 7.5 Tesla multi-pole wiggler that will enable exposures up to 85 KeV.
That is equivalent to a 3 GeV ring radiation from a dipole magnet
This CAMD Wiggler is one of the most powerful wigglers in the world capable of producing 15 kW beams


Pb / Al sandwich
Short transverse walls
Brem Shutter
20 cm Pb

Backside of 1st Brem Shutter 15mm Pb



Bremsstrahlung Dose Calc. for CAMD Wiggler.

- $\frac{3.0 \times 10^{-4}}{\Pi \times X_o} \quad \frac{E^2}{0.511^2} \quad \frac{I \times \mathcal{g}}{L\,(L+1)}$ Rindi and Tromba, 1993

- X_o = radiation length of air @ 10^{-9} torr = 2.34×10^{16}
- $\mathcal{g}$ = effective length in meters (8 meters)
- I = beam current in e/s
- E = electron beam energy in MeV [1300]
- This yields a primary Bremsstrahlung dose rate of :
- 0.57 mSv/hour

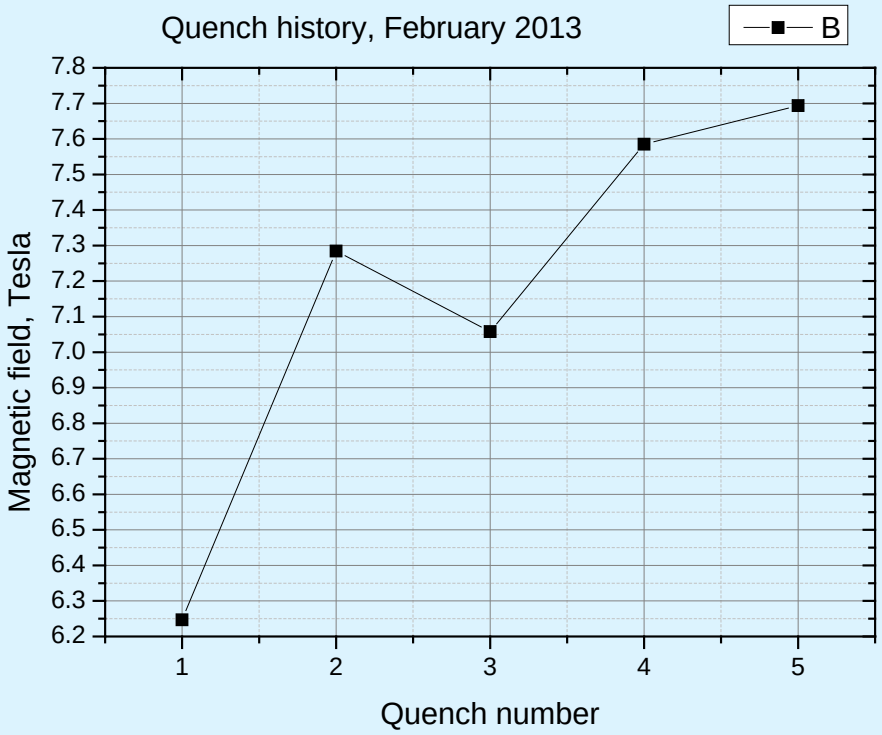
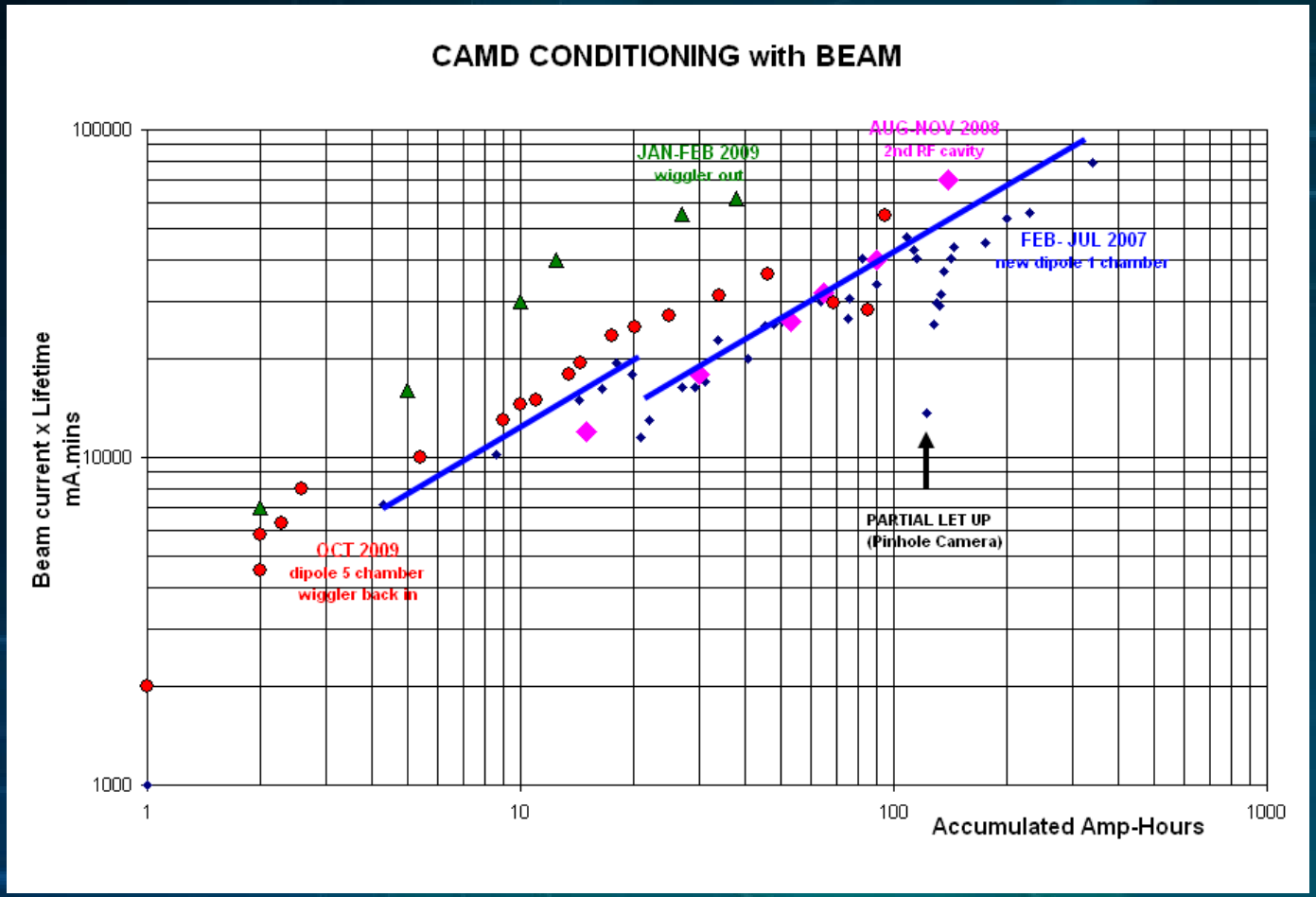


Figure 15 Quench history of MPW for LSU CAMD during FAT, February 2013. Quench number 3 was made after short time between second quench.

Beam Lifetime after a Vacuum Incursion



The beam lifetime plateaus after approx 120 Amp-hrs accumulated. Nowadays that takes 4-5 months.

Health Physics Issues

- Poor Vacuum will contribute to overall dose [ring open]
- Lack of Pumping – will contribute to Gas Bremsstrahlung dose
- Virgin Metal [4.6 tons]
- First attempt at running both RF cavities – one will not permit even a single electron to orbit
- First attempt at running both insertion devices - simultaneously
- Construction of 3 new beamlines and re-positioning of two others [shielding, Laue Mono,
- Re-measure all alignments prior to commissioning anything – remote monitoring only
- Ascertaining that 15 kW beam is strategically confined within a narrow window of phase space –RIS modification necessary. Movement of other RIS elements in ring to accommodate MPW
- Large Linac beam during injection might be difficult to thread through 2nd wiggler with minimal spacing between the poles.
- Add additional radiation monitors [received on 5/3/13] – install, test and implement new system