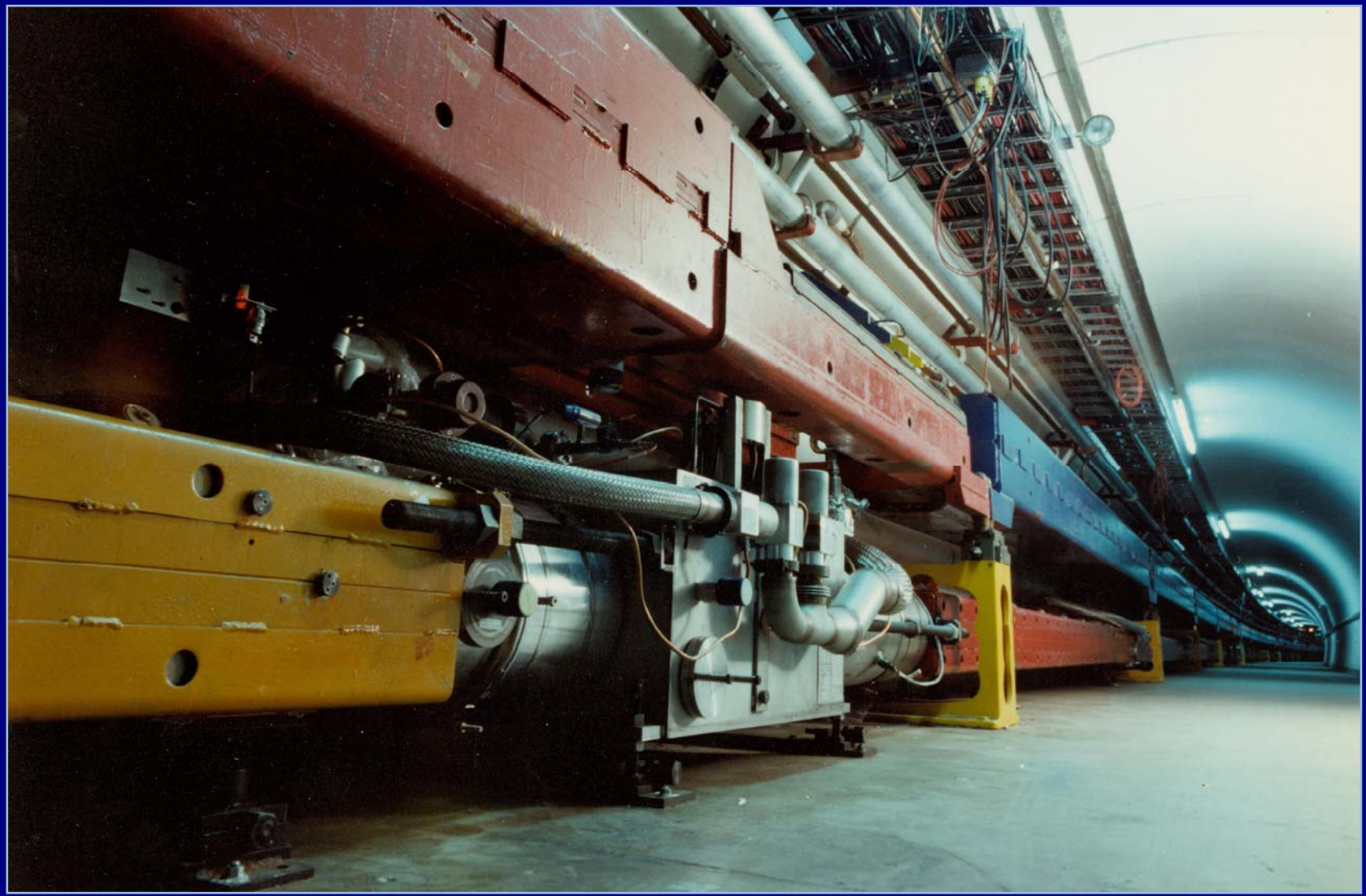
Tevatron Tunnel



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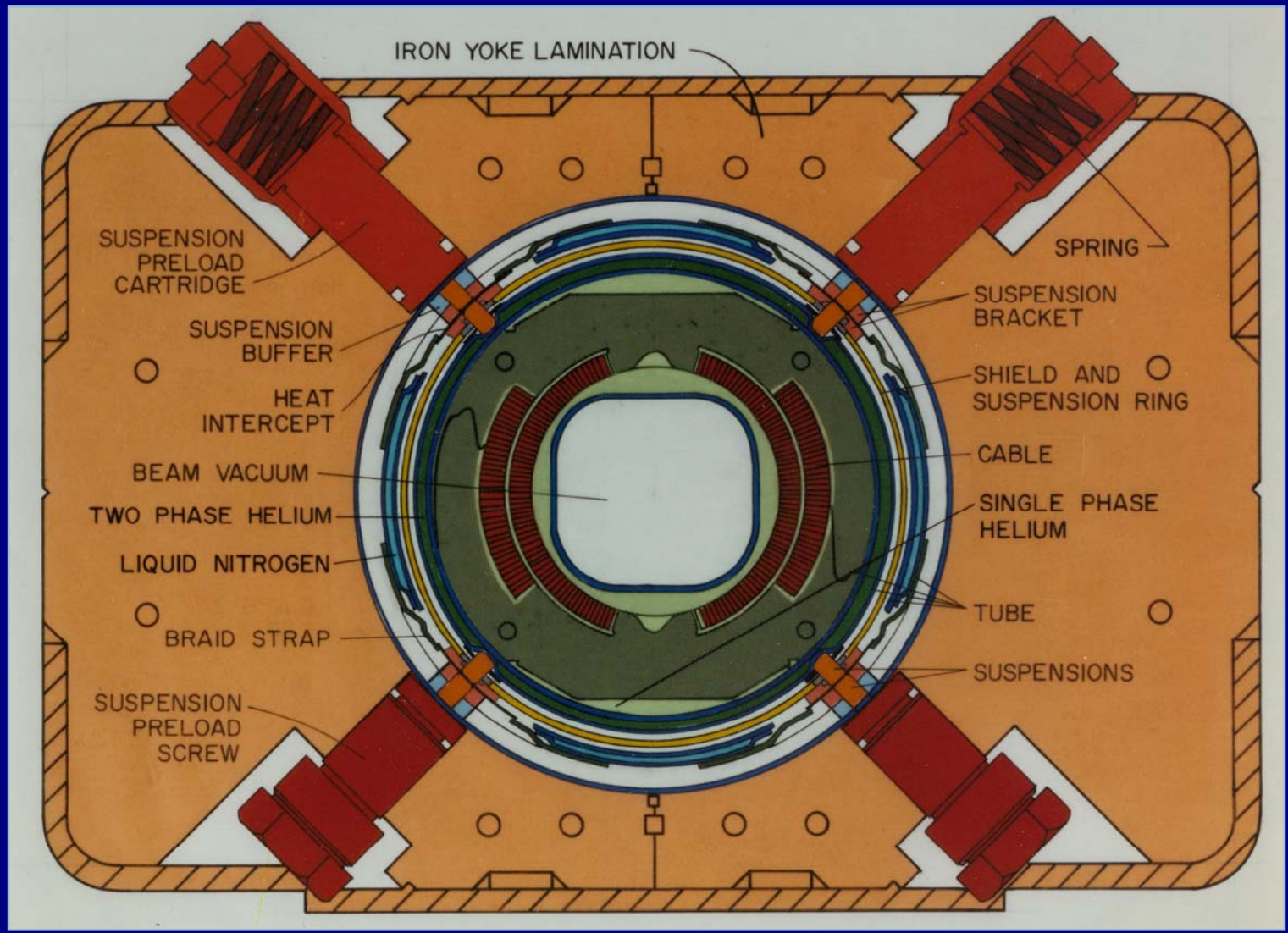
Tevatron Dipole Cross Section



Tevatron Satellite Refrigerator

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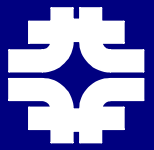

Progression of Cryogenic Design

1. Tunnel geometry
2. Warm iron magnet design
3. High heat load and pressure drop
4. Distribute refrigeration over short distances
5. 24 distributed 1 kW satellite refrigerators
6. Reciprocating expanders

2005 Labor Usage (FTE)

Cryogenic Department 2005 Labor Usage	
Tevatron	
Operations	15.0
Maintenance	9.0
Projects	
Run II	7.8
A0 Photoinjector	0.1
SRF	9.5
PD	0.1
MuCool	2.5
Other	
Paid Time Off	8.0
Administration	4.0
Total	56.0

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Comparison of Cryogenic Operations in Large Accelerators

	CEBAF[1]	RHIC[2,3]	HERA[1]	Tevatron[2]
Operators (Lab)	1	11	11	13
Operators (Contractor)	0	0	7	0
Operations Support Staff	1	3	1	2
Number of Refrigerators	3	1	3	25

Notes:

1. Data from 1996
2. Data from 2005
3. Cryogenic system originally designed for ISABELLE and CBA

Comparison of Helium Losses in Large Accelerators

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	CEBAF[1]	RHIC[2,3]	HERA[1]	Tevatron[2]
Number of Refrigerators	3	1	3	25
Recover Quench Gas	NA	Yes	Yes	No
Losses (scf/day)	11,700	12,000	2,800	30,000
Losses per Refrigerator (scf/day)	3,900	12,000	933	1,200
Sensitivity to power outage < 1 hour	Low	Medium	Medium	Very high

Notes:
scf = standard cubic feet
1. Data from 1996
2. Data from 2005
3. Cryogenic system originally designed for ISABELLE and CBA