



At the Luminosity Frontier

Fermilab's Main Injector with the Antiproton Recycler gives the Tevatron Collider a tenfold increase in luminosity.



**Main Injector/
Recycler Tunnel**

Upper green permanent magnets form the Antiproton Recycler Ring. Below are the Main Injector and the low conductivity cooling water system for the Main Injector.

Secretary of Energy Bill Richardson (left) and Speaker of the House Dennis Hastert turned the keys to the Main Injector to help dedicate Fermilab's newest accelerator on June 1, 1999.



Tevatron Luminosity Evolution

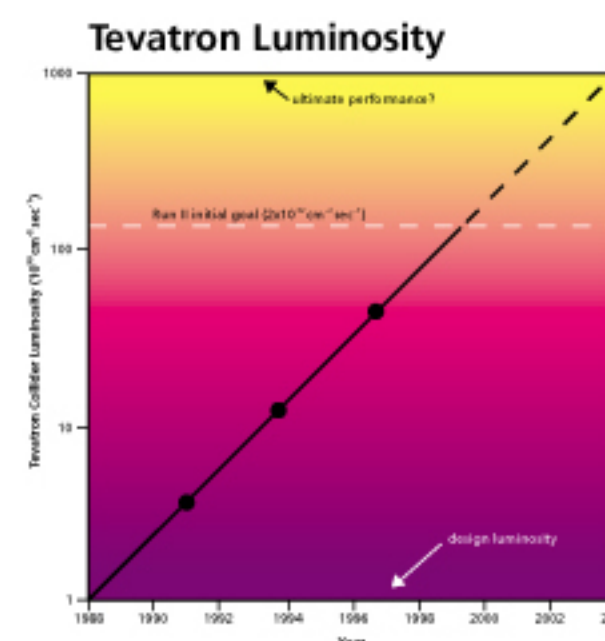
| | 1989 | 1A (1992-93) | 1B (1993-95) | II (1999-)* | II (1999-)** |
|---------------------------------|----------|-------------------------------|---------------|--|------------------------|
| Protons/bunch | 7.00E+10 | 1.20E+11 | 2.32E+11 | 2.70E+11 | 2.70E+11 |
| Pbars/bunch | 2.90E+10 | 3.10E+10 | 5.50E+10 | 7.00E+10 | 2.55E+10 |
| Proton emittance | 25 | 20 | 23 | 20 | 20 |
| Pbar emittance | 18 | 12 | 13 | 15 | 15 |
| Beta @ IP | 0.55 | 0.35 | 0.35 | 0.35 | 0.35 |
| Energy | 900 | 900 | 900 | 1000 | 1000 |
| Bunches | 6 | 6 | 6 | 36 | 99 |
| Bunch length (rms) | 0.65 | 0.55 | 0.6 | 0.38 | 0.38 |
| Form Factor | 0.71 | 0.62 | 0.59 | 0.73 | 0.73 |
| Typical Luminosity | 1.6E+30 | 5.4E+30 | 1.6E+31 | 2.0E+32 | 2.0E+32 |
| Best Luminosity | 2.1E+30 | 9.2E+30 | 2.5E+31 | NA | NA |
| Integrated Luminosity | 0.3 | 1.1 | 3.2 | 40.0 | 40.0 |
| Bunch Spacing | 3000 | 3000 | 3000 | 396 | 132 |
| Interactions/crossing (@ 45 mb) | 0.25 | 0.85 | 2.48 | 5.19 | 1.89 |
| Antiproton tune shift | 0.025 | 0.009 | 0.015 | 0.020 | 0.020 |
| Proton tune shift | 0.014 | 0.004 | 0.006 | 0.007 | 0.002 |
| What's New? | | Separators, Pbar Improvements | Linac Upgrade | Main Injector, Recycler, Pbar Improvements | 132 nsec bunch spacing |

*Initial run conditions **With 132 nsec bunch spacing

Beam parameters comparing Tevatron Collider Run 1b (ended 1996) and Collider Run II, (beginning 2000) after completion of the Main Injector and Recycler Ring. Average luminosity (integrated luminosity per week) will increase by over an order of magnitude.



The Fermilab community pitched in to complete the \$260 million Main Injector on time and under budget.



The Tevatron collider peak luminosity history. The luminosity in Run I began already above design luminosity and has grown since at the rate of a factor of two every 18 months.