



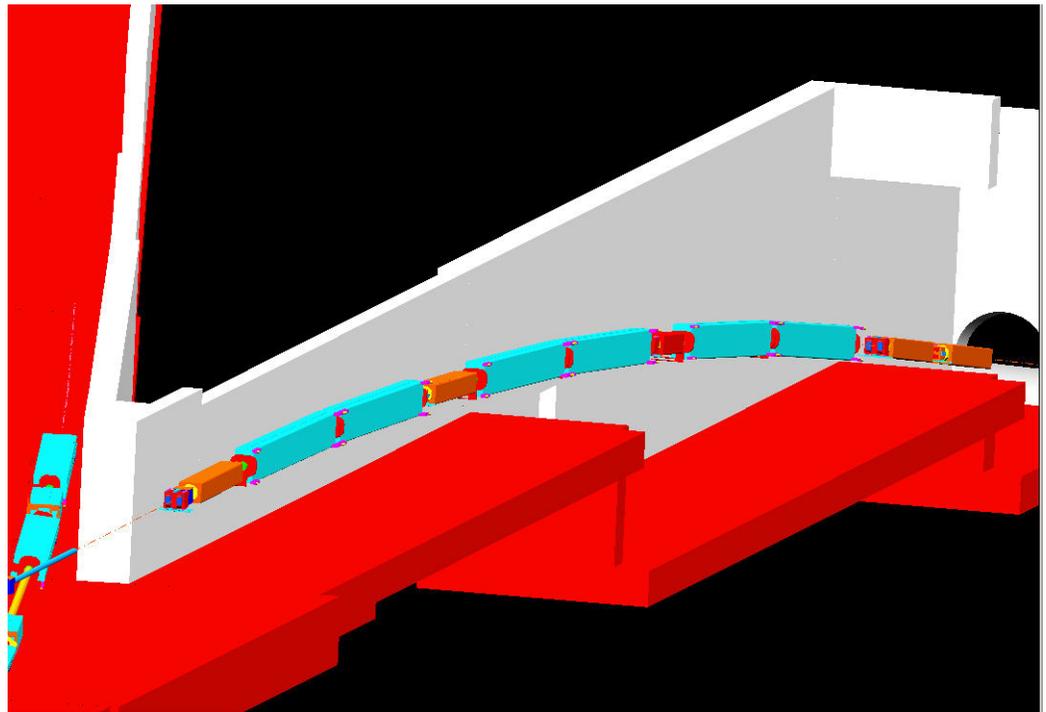
Status of NuMI Upstream Installation

Outline

- Summer/Fall '03 Shutdown Results
 - Kicker region
 - Lambertsons
 - Extraction Channel
 - NuMI Stub
 - Lessons Learned
- Unscheduled Shutdown Plans
- Summer '04 Shutdown
 - Overview
 - Schedule



Installation Challenge: NuMI in the Main Injector Tunnel

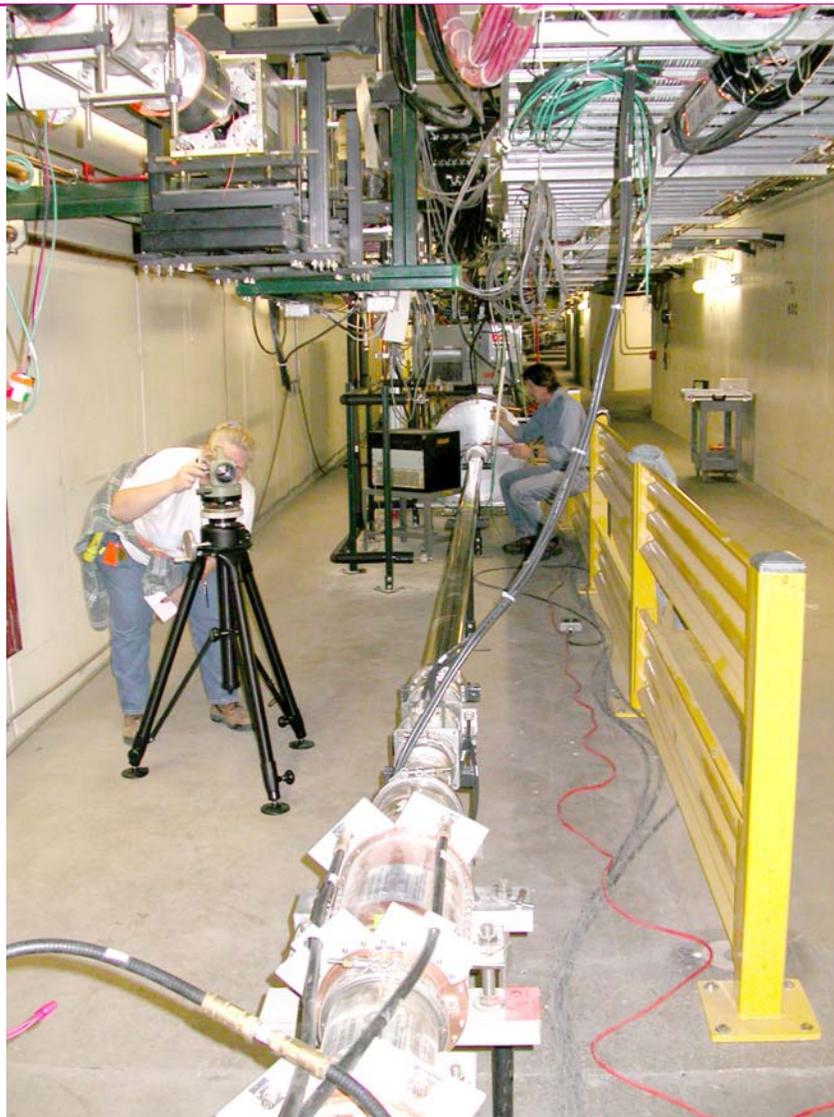


MI ring on bottom,
Recycler on top, NuMI
in the middle
(fit between two accelerators)

NuMI Stub and Extension
(needs cranes, utilities etc.)



NuMI Kicker Region



MI Instrumentation has been successfully moved and under vacuum.

Fluorinert piping installation is complete

Protective guardrail installed



NuMI Lambertsons



- Installed along with C-magnet and Q101
- Lambertsons under vacuum and aligned, bake-out complete
- Electrical hook-up in tunnel complete with properly specified polarities



NuMI Extraction Channel



- 7 Quadrupoles installed
- 6 Dipoles installed
- All displaced utilities have been replaced
- 9 out of 13 magnets rough aligned



NuMI Stub



- 34' (340 tons) concrete wall removed
- Cranes installed; load tested
- 11 magnets installed
- Electrical hook-up complete
- Alignment postponed

Upstream End of NuMI Stub



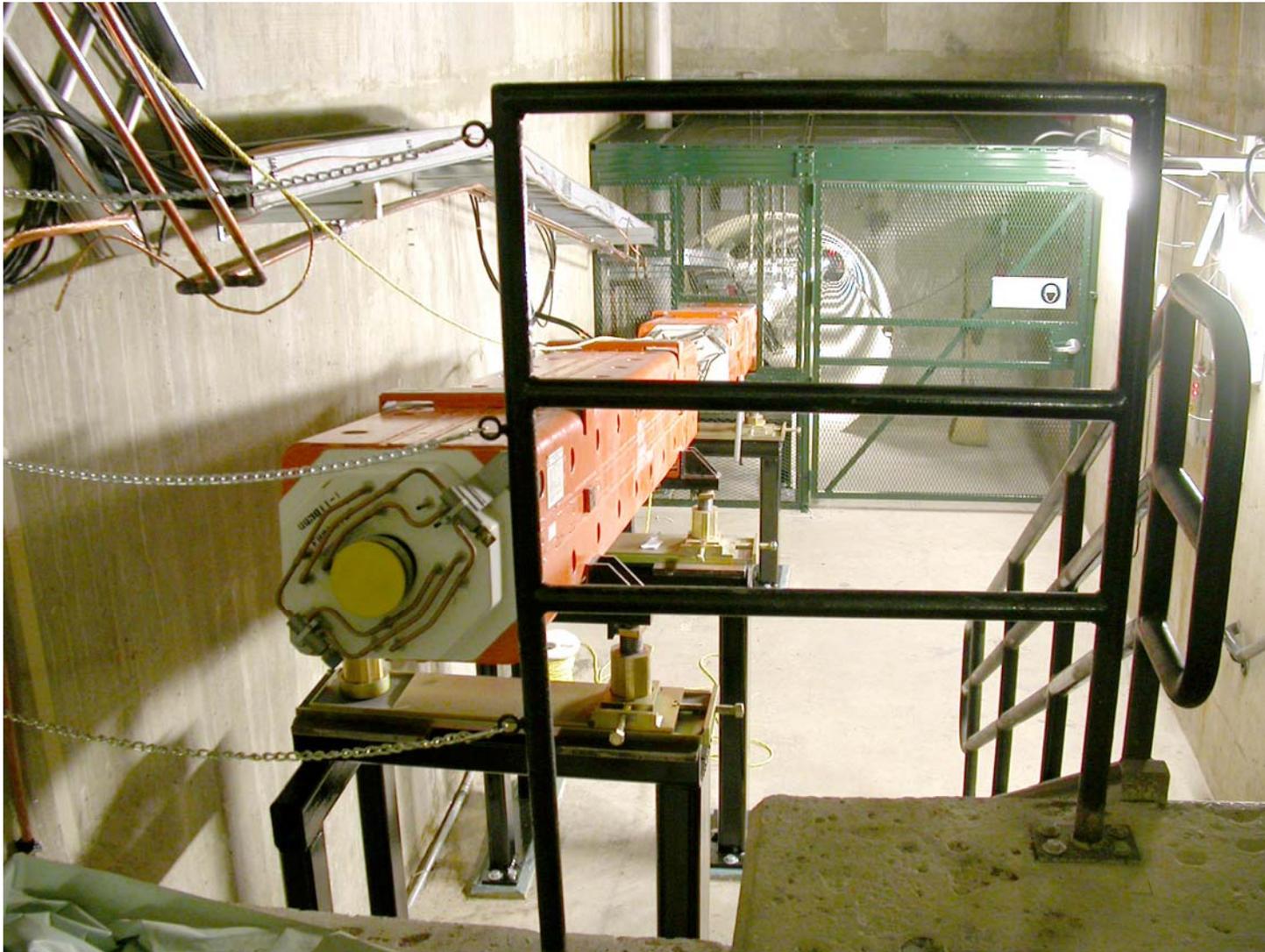
NuMI Stub Downstream Before & After

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Peter's Porch





Lessons Learned

- We will continue to insist on a safe work area. We conducted daily safety walkthrus during the shutdown.
- We are now diligent in tracking engineering safety reviews so they are completed on time.
- We need dedicated engineering oversight in the tunnel to avoid delays and cost overruns.
- We need to have better QA on parts to make sure they are all there, fit, and work properly.
- It is useful to pay attention to the ramifications of equipment failure during the installation process



Unscheduled Shutdowns

- NuMI needs to do work during unscheduled shutdowns to assure that it meets its schedule goals.
- The highest priority task is installation & testing of magnetic shielding of the Recycler from the fringe fields of the NuMI EPB dipoles.
 - « LCW magnet connections - 3 shifts
 - « LCW startup & commissioning - 2-3 shifts
 - « Installation of modular steel shielding pieces - 10 shifts
 - « Magnet & PS prep - 5 shifts
 - « Magnetic field measurements in tunnel - 2 shifts
 - « Initial Recycler beam tests - 2 shifts



Unscheduled Shutdowns

- What happens if we don't get enough unscheduled shutdown time to install and test recycler shielding?
 - « NuMI may wish to request additional shutdown time prior to the scheduled shutdown in order to have sufficient beam study time to test the shielding. We at least need a test on our first two magnet shields.
 - « Required in order to allow for design modifications, if necessary, to be implemented during the '04 shutdown; otherwise NuMI's turn on schedule would be at risk.



Unscheduled Shutdown Work

- Other unscheduled shutdown work includes:
 - « Rough alignment of 14 magnets in xover and stub.
 - « Vacuum work
 - « Cable pulls
- All work is prioritized by the following method
 - « High - must be completed before '04 shutdown
 - « Medium - could be done during the Summer Shutdown, but would require an extension to the 8 weeks required.
 - « Low - originally scheduled for the Summer Shutdown, but could be done earlier



Unscheduled Shutdowns Work List

Short Shutdown Task List

| Task | Skill Set | No. of people (keys) required | *Priority | Minimum time required | Total Time required | Earliest start date for project | Comments |
|---|--|--------------------------------------|-----------|-----------------------|---------------------|---------------------------------|--|
| MECHANICAL | | | | | | | |
| EPB Dipole Shielding | Mechanical Technicians | 6 (8) | High | 1 shift | 10 shifts | 15-Mar-04 | Also requires 1 physicist and 1 engineer. Installation of shielding around 2 magnets will require 3-8 hour shifts. A total of 6 magnets require this shielding |
| Modify LCW Valve Mounts | Mechanical Technicians | 2 (3) | High | 1 shift | 1 shift | December '03 | Needed to put a few shut off valves in a visible position |
| Install LCW Hoses | Mechanical Technicians | 2 (3) | High | 1/2 shift | 2 shifts | January '04 | Needed before the LCW system can be filled |
| Fill LCW System | Mechanical Technicians | 3 (4) | High | 2 shifts | 2 shifts | March '04 | Need above jobs and MCC in MI-62 |
| Install Vacuum Cans on ends of 12 inch pipe | Mech Tec + Welder | 2 (3) | Medium | 1/2 shift | 3 shifts | January '04 | Need access to the carrier Tunnel |
| Install Ion pumps and spools in NuMI Stub | Mech Tec + Welder | 2 (3) | Medium | 1/2 shift | 2 shifts | March '04 | Can be done in several accesses |
| Install Ion pumps and spools in the extraction Area | Mech Tec + Welder | 2 (3) | Medium | 1/2 shift | 2 shifts | March '04 | Can be done in several accesses |
| Build and Install long vacuum pipe spools around Q106, Q107, Q108 | Mech Tec + Welder | 2 (3) | Low | 1 shift | 2 shifts | March '04 | Can be done in several accesses |
| ELECTRICAL | | | | | | | |
| Flag Cleanup | Electrical Techs | 2 (3) | High | 1 shift | 5 shifts | February '04 | This task includes plating of the flags, measuring for the jumpers to be installed, and installing them. |
| CABLING | | | | | | | |
| Install Klixon Cables in MI Enclosure | Electricians | 2 Electricians in Enclosure (3 keys) | Medium | 2 shifts | 3 Shifts | January 6, 2004 | Medium Priority |
| Verify Continuity of Installed Cables to Magnets | Fermilab Technical Staff or Electricians | 2 Electricians in Enclosure (3 keys) | Medium | 1 shift | 2 Shifts | January 6, 2004 | Medium Priority. Can Effectively Be Accomplished During an 8 Hour Controlled Access |
| Install Interconnecting High Voltage Leads for Loss Monitors | Electricians | 2 Electricians in Enclosure (3 keys) | Low | 2 shifts | 3 Shifts | February 16, 2004 | Low Priority. May Want to Install Cables pre-terminated. Need to Investigate with Gianni. |
| SURVEYING | | | | | | | |
| Rough Align Q-103 | surveyors | 3 (4) | Medium | 0.5 shift | 0.5 shift | November-03 | MI-60 Extraction Channel |
| Rough Align Q104-107 | surveyors | 3 (4) | Medium | 1 shift | 1.5 shifts | November-03 | 4 Magnets in MI-60 Crossover AP150 line |
| Rough Align Q108-112 | surveyors + | 3 (4) | Medium | 1 shift | 3.0 shifts | November-03 | 11 magnets in NuMI stub area |
| Adjust Q108-112 | tech technicia | 1 | Medium | 1 shift | 3.0 shifts | November-03 | adjust above magnets |
| *Priority | | | | | | | |
| High - must be completed before the Summer Shutdown or earlier (we want to test the shielding before the Summer Shutdown.) | | | | | | | |
| Medium - could be done during the Summer Shutdown, but would require an extension to the 8 weeks required. | | | | | | | |
| Low - originally scheduled for the Summer Shutdown, but could be done earlier. | | | | | | | |



'04 Shutdown Preparations

- Current start date is August 23rd
- NuMI requires an estimated 8 weeks. Not currently considered to be driving shutdown length
- Goal is to come out of shutdown ready for beam
- We have a preliminary schedule which includes all the work. Will begin bottoms-up schedule soon
- Discussions with AD groups have begun informally; formally expected within the next few months
- Significant work ongoing to make sure components are ready



'04 Shutdown - Major Installation Tasks

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- Extraction kickers
- Trim Magnets
- Vacuum & Instrumentation
- Final Alignment
- Equipment checkout, testing



'04 Shutdown Schedule (Preliminary)

| ID | Task Name | Duration | Start | Aug 22, '04 | Aug 29, '04 | Sep 5, '04 | Sep 12, '04 | Sep 19, '04 | Sep 26, '04 | Oct 3, '04 | Oct 10, '04 | Oct 17, '04 | Oct 24, '04 |
|----|---|----------------|--------------------|-------------|-------------|------------|-------------|-------------|-------------|------------|-------------|-------------|-------------|
| | | | | 8/22 | 8/29 | 9/5 | 9/12 | 9/19 | 9/26 | 10/3 | 10/10 | 10/17 | 10/24 |
| 1 | Kicker Installation | 15 days | Mon 8/23/04 | | | | | | | | | | |
| 2 | Re-locate MI Instrumentation from NuMI Kicker Region (MI602) | 2 days | Mon 8/23/04 | | | | | | | | | | |
| 3 | Install Kicker Magnet Stands | 1 day | Wed 8/25/04 | | | | | | | | | | |
| 4 | Install Kicker Magnets | 3 days | Thu 8/26/04 | | | | | | | | | | |
| 5 | Rough Align Kicker Magnets | 2 days | Tue 8/31/04 | | | | | | | | | | |
| 6 | Connect fluorinert cooling system | 2 days | Thu 9/2/04 | | | | | | | | | | |
| 7 | Terminate and connect Kicker Cables | 2 days | Mon 9/6/04 | | | | | | | | | | |
| 8 | Connect Kicker vacuum | 2 days | Wed 9/8/04 | | | | | | | | | | |
| 9 | Polarity check of Kicker Magnet | 1 day | Fri 9/10/04 | | | | | | | | | | |
| 10 | Trim Magnet Installation | 18 days | Mon 8/30/04 | | | | | | | | | | |
| 11 | Install Trim Magnet Stands | 4 days | Mon 8/30/04 | | | | | | | | | | |
| 12 | Install Trim Magnets | 4 days | Fri 9/3/04 | | | | | | | | | | |
| 13 | Install SY 200 turn bump magnet | 2 days | Thu 9/9/04 | | | | | | | | | | |
| 14 | Electrical connections to trim magnets & 200 turn bump | 2 days | Mon 9/13/04 | | | | | | | | | | |
| 15 | LCW connections | 2 days | Wed 9/15/04 | | | | | | | | | | |
| 16 | Field direction checks (all magnets) | 1 day | Fri 9/17/04 | | | | | | | | | | |
| 17 | Rough Align Trim Magnets | 3 days | Mon 9/20/04 | | | | | | | | | | |
| 18 | Instrumentation Installation | 27 days | Mon 8/30/04 | | | | | | | | | | |
| 19 | Install Instrumentation & vacuum stands in MI | 5 days | Mon 8/30/04 | | | | | | | | | | |
| 20 | Install Instrumentation & vacuum stands in NuMI Stub | 5 days | Mon 9/6/04 | | | | | | | | | | |
| 21 | Install Instrumentation & vacuum pipe (BPM's, Multiwires, toroid) | 10 days | Mon 9/6/04 | | | | | | | | | | |
| 22 | Install loss monitors | 2 days | Mon 9/20/04 | | | | | | | | | | |
| 23 | Rough align Instrumentation & vacuum pipe | 7 days | Mon 9/20/04 | | | | | | | | | | |
| 24 | Install vacuum pumps and stands | 2 days | Wed 9/29/04 | | | | | | | | | | |
| 25 | Pump down and Commission Vacuum System | 3 days | Fri 10/1/04 | | | | | | | | | | |
| 26 | Terminate and connect Cables (Instrumentation, vacuum, LCW, etc.) | 4 days | Wed 9/29/04 | | | | | | | | | | |
| 27 | Electrical Work | 5 days | Mon 8/23/04 | | | | | | | | | | |
| 28 | Pull Remaining Cables (Instr., TLM, vacuum, LCW, etc.) | 5 days | Mon 8/23/04 | | | | | | | | | | |
| 29 | Final Preparations for Beam | 8 days | Wed 10/6/04 | | | | | | | | | | |
| 30 | Subsystem checkout | 5 days | Wed 10/6/04 | | | | | | | | | | |
| 31 | Final alignment of magnets and instrumentation MI through NuMI stub | 5 days | Wed 10/6/04 | | | | | | | | | | |
| 32 | Beamline Testing | 5 days | Mon 10/11/04 | | | | | | | | | | |
| 33 | Ready for commissioning with beam | 1 day | Mon 10/18/04 | | | | | | | | | | |



'04 Shutdown Risks

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- Multiwires expected to arrive just in time
 - Will we get the time to install the magnetic shielding? Will it work? If not, may need redesign and more shutdown time to refit in the tunnel.
 - Other tasks which did not get done on short shutdowns



Conclusion

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- The NuMI part of the Summer '03 shutdown was an unqualified success.
 - All major tasks were completed safely and on time.
 - We have had many small bumps in the road which have been mitigated by an excellent team working in the tunnel
 - There are some important lessons learned that will help us for our future installation tasks.
 - We are now prepared to take advantage of any access time AD gives us.
 - We have a preliminary '04 shutdown schedule from which to begin integrating into other AD work.
 - Safety always has the priority over schedule.