

NuMI Beam Tasks

Aesook Byon-Wagner
Fermilab

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MINOS

Beam Tasks

Collaboration Meeting
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ABW - 1

- Detector construction : moving smoothly
 - « production & installation need continue attention
 - « Near electronics & CalDet data taking still have some ways to go
- Remaining places one can “**make a BIG difference**” for the experiment \Rightarrow Tasks in building NuMI Beamline
- Key reasons for significant progresses over last few months
 - « fully staffed engineering
 - « extensive efforts by NuMI project staff (L3 managers & engineers)
 - « tremendous efforts by BSpAG members
 - « additional (~12) Fermilab physicists assigned to beam tasks, and new initiatives by other members of collaborators

However, we are still lacking physicist's effort



Beam Tasks

2-line assessment of areas in beamline technical components

- « Beam Monitoring, Hadron Absorber, Power Supply, Alignment & Infrastructure : **good to excellent shape**
- « Remaining tasks with **a lack of ownership by physicists** are in Primary Beam (WBS 1.1.1) and Neutrino Devices (WBS 1.1.2)

⇒ **Two key areas which will drive neutrino event rate !!**

Components in Primary Beam and Neutrino Devices include active elements which will

- « set the upper limits for the capability of NuMI facility to handle proton intensity
- « have to be robust if we want to minimize down time during operation



Beam Tasks

- These active components are

- « much like active detector components

- * specs include resolution, dynamic range, linearity etc

- * technologies : ionization chambers, scintillator + PMT

- * need intensive testing, calibration technique, commissioning plan etc

- « most cases, similar devices existed and/or used before : but NuMI has

- * higher beam intensity and

⇒ pushing the limits

- * lower beam loss requirements

which make implementations more difficult and

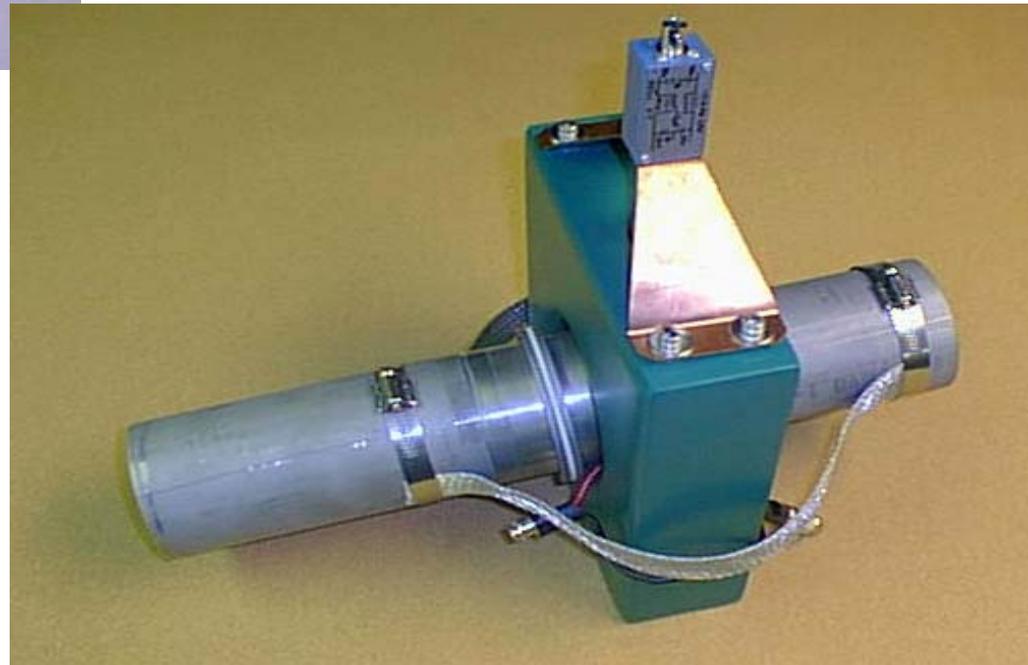
require a lot of careful testing and measurements

- One can complain about not getting enough # of protons but if we do not have a facility which can handle high intensity with a robust operation mode, it will be a mute point



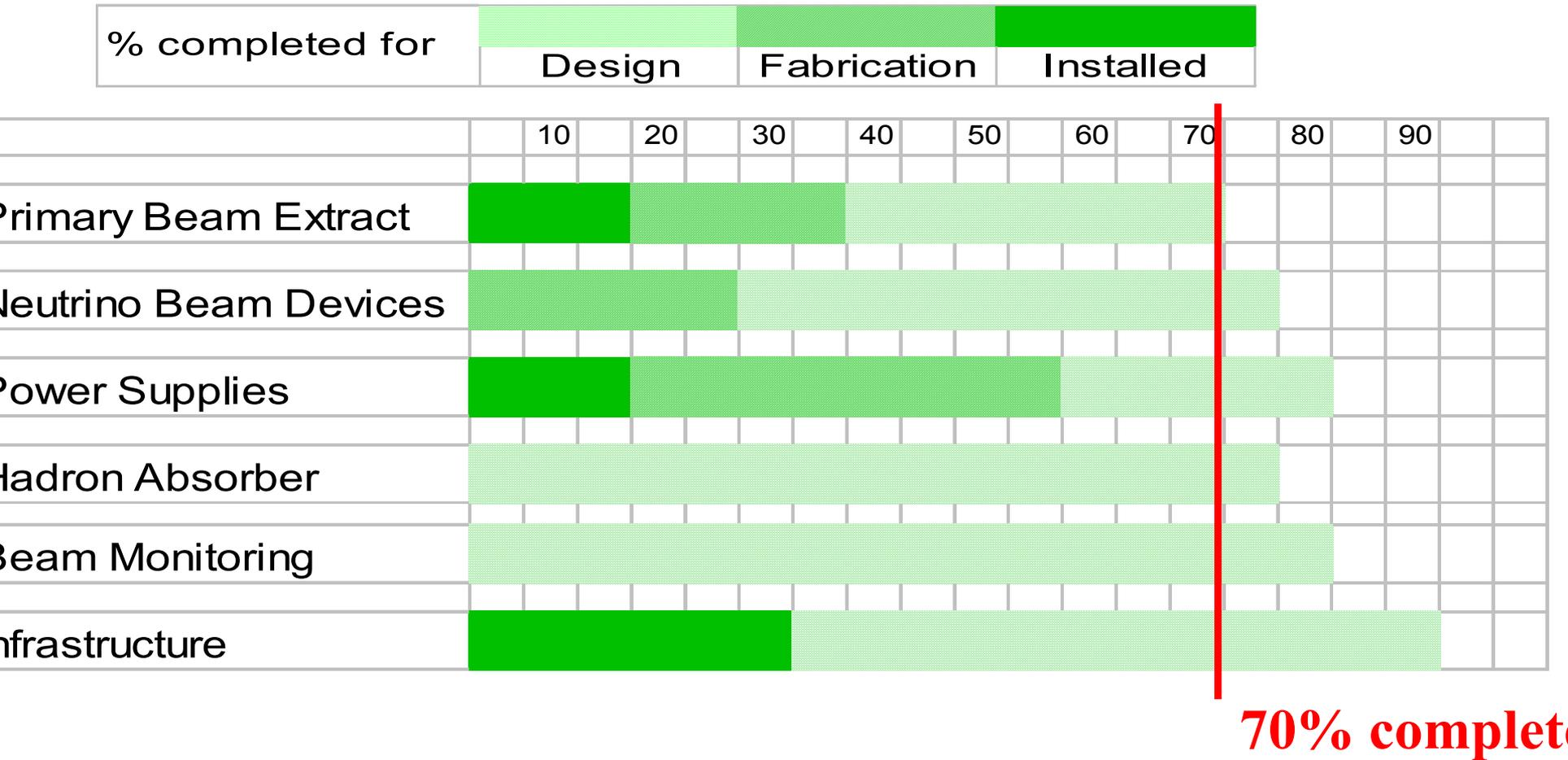
Beam Loss Monitor

Toroid





Status of NuMI Technical Components



Designs are all in good progress but still a lot to do on construction testing, fabrication, installation and commissioning



Primary Beam - Tasks & issues

(Sam Childress, Craig Moore)

• Nail down input parameters from Main Injector : P150 program

« Progress reported in Alberto's talk

« Goals are to

- * Measure beam profile & tail during transfer
- * Study beam loss and stability
- * Measure beam signals (ionization profile monitor, RF signals)
- * Test prototype beam extraction permit system
- * Study magnet power supply stability requirements

« **Very high priority** : needed as soon as possible in order to

- * finalize beam optics design and instrumentation configuration
- * specify division of beam extraction permit & radiation safety system

« Will be a long term program

- * Testing ground for various instrumentation
- * Training ground for NuMI beam operation



Primary Beam - Tasks & issues

(Sam Childress, Craig Moore)

P150 Program - continue

- « Activities: develop test program, prepare hardware devices & software, take data (shifts!), analyze data
- « Working group : Alberto, Brajesh, D Jensen, Gordon, Valeri, Christos
[need 2~3 more people]

Primary Beam Instrumentation

- « basic devices
 - * Beam Position Monitor (BPM), Multi-wire Profile Monitor, Toroid
 - * Beam Loss Monitor (BLM), Total Loss Monitor (TLM), Intensity monitorexist but “pushing the limits” for specs on high intensity & low beam loss
- « Require a lot of careful testing and measurements
- « Activities : participate on finalizing specs & system design, development and testing of prototypes
- « Working group : Sam, Jensen, Valeri
[need 2~3 more people]



Neutrino Devices - Tasks & issues

(Jim Hylan)

• Target, Baffle & mounting module

- « Specification, design, fabrication, testing, installation & commissioning
 - * Study & specify motion requirement, reliability, radiation hardness, thermal specs for target, baffle as well as their motion space frame
- « Work on system integration : cooling, controls, instrumentation
 - * Ex: interface with beam extraction permit system
- « Number of hands-on hardware tasks
- « Working group : Bernstein, IHEP group plus FNAL engineers

[need 1~2 more people]

• Horn

- « Prototype & Production horn testing
 - * field measurement
 - * other performance measurements such as Bdot, temperature, water conductivity, vibration ⇒ number of hands-on hardware tasks



Neutrino Devices - Tasks & issues

(Jim Hlyen)

- « Setup a permanent DAQ & control interface system for testing
- « Work on system integration : cooling, controls, instrumentation
- « Working group : Frank Nezzrick, **Bob Wagner**

[need 1~2 more people]

• Instrumentation in Target Hall

- « Design, prototype, test, fabricate & commission instrumentation required in target hall area - around target, horns, and target pile
 - * Horn fiducial cross-hair, Target Budal monitor, drive and position monitors for modules, thermocouples, cameras for hot horn handling
 - * Harsh environment : have to address radiation hardness, temperature dependence, cooling, reliability and stability of devices
- « Work on system integration : connecting to controls system
- « Working group : Adam Para, **Rich Talaga**

[need 2~3 more people]



Software - Tasks & issues

(Peter Lucas)

- Application and Controls Program (software) Peter Lucas
 - « Application programs for primary beam transfer
 - * Control & monitoring software for magnet and power supply
 - * Control & monitoring software for Beam Extraction Permit System
 - « Application programs for rest of NuMI complex
 - « associated with Target and Horn control & monitoring
 - « monitoring of radiation level in various areas and monitoring system for ground water
 - « Control & monitoring software for system infrastructure (similar to MINOS DCS system)
- Database for Beam Instrumentation and monitoring ???
 - « Leader for this effort needed
 - « Compile list of database entries to produce specification for NuMI Beam instrumentation database architecture
 - « Develop database architecture which can interface with application programs as well as MINOS database



Other integration related activities

(Bruce or Aesook)

- **Ground water protection**
 - « Drives proton intensity limit for NuMI facility
 - « Evaluate and finalize numbers
 - « Working group : Doug Michael [need 2~3 more people]

- **Commissioning plan**
 - « Drives many of “motion” requirement specs
 - « Need a “Baseline” plan as soon as possible
 - « Working group : Para, Debbie, Messier, Kopp, Hylan,

- **Beam related accident conditions**
 - « Compile and evaluate various scenarios
 - « Give starting points for what will & will-not be allowed as operating points or conditions
 - « Working group : Bernstein & Co



Other integration related activities

(Bruce or Aesook)

- MARS and Beam Simulation tasks
 - « Constant demands to answer specific design questions
 - « Demands will continue over the duration of experiment on
 - * Beam simulation: Physics analysis for systematics
 - * MARS: Evaluations of “allowed” operating conditions
 - « For MARS, need **owners for specific areas**
 - * Primary beamline
 - * Target hall
 - * Decay pipe & absorber hall
 - « Working Group : Messier (Beam Simulation) & Gina (MARS)
- Target Hall Integration
 - « Review plans & drawings : Dave Ayres
- Installation in NuMI Stub area :



Summary

- A lot to do - especially by physicists
- You can **make a BIG difference**
 - « Talk to people listed more about details of tasks
 - « Take a piece, big or small, as yours (or your groups')
- We have a challenging schedule to meet
 - « Will not be possible without your active participation