

Muon Accelerator Program Design & Simulations (WBS 2) Monthly Status Review

April 5, 2013

Outline



- D&S Overview
- L2 Manager Updates
- AOB

MAP D&S Overview



- Some highlights:
 - D&S tasks/schedule/milestones/deliverables being incorporated into overall MAP project tracking system
 - High statistics target production runs (Sayed)
 - Chicane coil/shielding studies (Snopok, Souchlas, Weggel)
 - Front End cooling schemes with low B-field (Stratakis)
 - 350 MHz Front End design (Neuffer)
 - Post-merge Guggenheim simulations approaching desired emittances (Stratakis)
 - Study of Palmer half-flip w/ tilted solenoids (Balbekov)
 - Optimized stochastic injection into nuSTORM (Liu)
 - New racetrack FODO for nuSTORM (Bogacz)
 - HF collider D&S: realistic fringe fields in IR mags, multipole errors in IR mags, S-S B-B in linear approx. (Alexahin, Gianfelice-Wendt, Kapin)
 - MARS15 model of HF IR & MDI w/ large aperture Nb₃Sn magnets and SiD lcsim detector (Mokhov, Striganov, Tropin)
 - First results on muon-decay detector backgrounds and heat loads to IRQ (Mokhov, Striganov, Tropin)
 - ICOOL 3.32 released (Berg)
 - Pre-Baseline directory at NERSC

MAP D&S Overview, cont.



- Significant D&S participation at:
 - UCLA Higgs Factory workshop
 - 10th IDS-NF Meeting at RAL and PASI workshop
- Upcoming workshops
 - MIT Frontier Facilities Meeting April 10-11
 - Coordinated MICE & MAP Collaboration Meetings:
 - MICE Meeting: June 17-18 at IIT
 - Joint Day: June 19 at Fermilab
 - MAP Meeting: June 20-22 at Fermilab

L2 MANAGER STATUS REPORTS: DESIGN & SIMULATION (WBS 2)

Monthly L2 Status Report -

WBS: 02.01 – Proton Driver

5 April 2013
Presenter: Keith Gollwitzer



<p><u>Milestone Status (Progress)</u></p> <ul style="list-style-type: none">• In progress: Project X – MAP Task Force Report• To be started: IDS-NF Proton Driver costing study	<p><u>Resource Conflicts, Plan Changes and Issues</u></p> <ul style="list-style-type: none">• Task Force team focused on other topics <p><u>Late Items</u></p> <ul style="list-style-type: none">• Task Force Report
<p><u>Summary of Previous Month</u></p> <ul style="list-style-type: none">• Meeting held with Project X about possible Project X stage 2 for a staged approach for muon accelerators (MASS)	<p><u>Quarterly Plans</u></p> <ul style="list-style-type: none">• Develop Accumulator and Compressor Rings• Develop Compressor Ring extraction line to target for NF• IDS-NF Proton Driver description and costing• Investigate re-use of Project X pulsed linac for muon acceleration
<p><u>Upcoming Work (Next Month)</u></p> <ul style="list-style-type: none">• 2nd iteration of Task Force Report• MAP/Project X Task Force reassembled to look into Project X stage 2 as a proton driver (3 GeV).	

Monthly L2 Status Report -

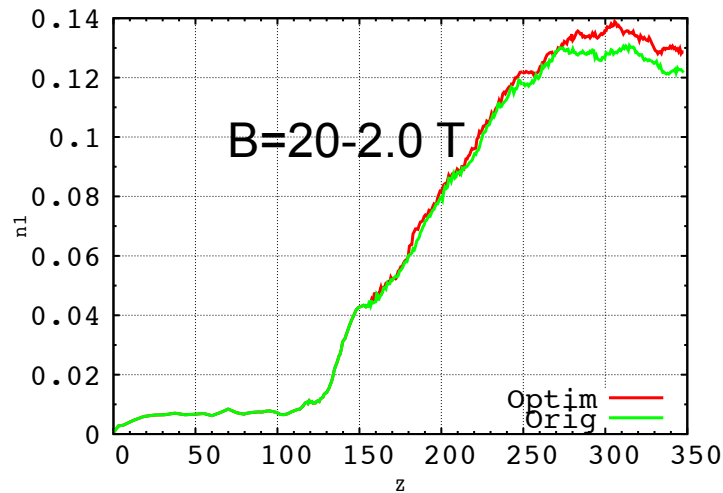
WBS: 02.02

5 April 2013
Presenter: Diktys Stratakis

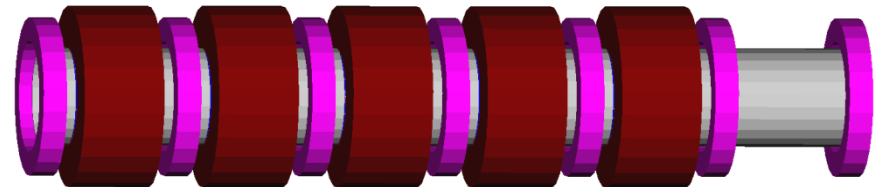


<p><u>Milestone Status (Progress)</u></p> <p>Current Activities</p> <ul style="list-style-type: none">• Decay Channel Chicane Work(Rogers, Neuffer, Snopok)• Capture Taper (Sayed)• Update Cooling Channel (Stratakis)• Front End Element Alignment (Prior)• Optimization Algorithms (Sayed, Ryne, Qiang)	<p><u>Resource Conflicts, Plan Changes and Issues</u></p> <p><u>Late Items</u></p>
<p><u>Summary of Previous Month</u></p> <ul style="list-style-type: none">• Multivariable optimization studies (Qiang, Sayed)• Chicane coil/shielding studies (Snopok,Souchlas,Weggel)• ICOOL v.332 has been released (Berg): new random generator• Generation of high statistics particle distributions (Sayed)• Benchmark of ICOOL/G4Beamline (Rogers/ Stratakis)• Simulation of FE Engineering constraints (Stratakis)	<p><u>Quarterly Plans</u></p> <ul style="list-style-type: none">• Decay Channel – Evaluate coil/Shielding scenario• Capture Taper – Determine optimal peak/end fields• Update cooling channel• Front End element alignment -determine alignment sensitivities• Optimization algorithms – Optimize Front End phase rotator and cooling channel parameters
<p><u>Upcoming Work (Next Month)</u></p> <ul style="list-style-type: none">• Advance chicane coil/shielding studies (Snopok,Souchlas,Weggel, Neuffer)• Multi-variable optimization at NERSC (Qiang,Sayed)• Integration of MPI- ICOOL into the ICOOL source code.• High statistics FE simulations (Sayed, Stratakis)	

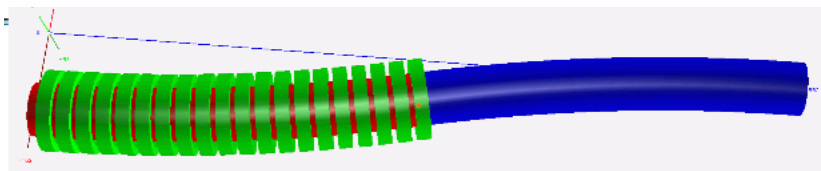
- Multivariable Optimization (Sayed)



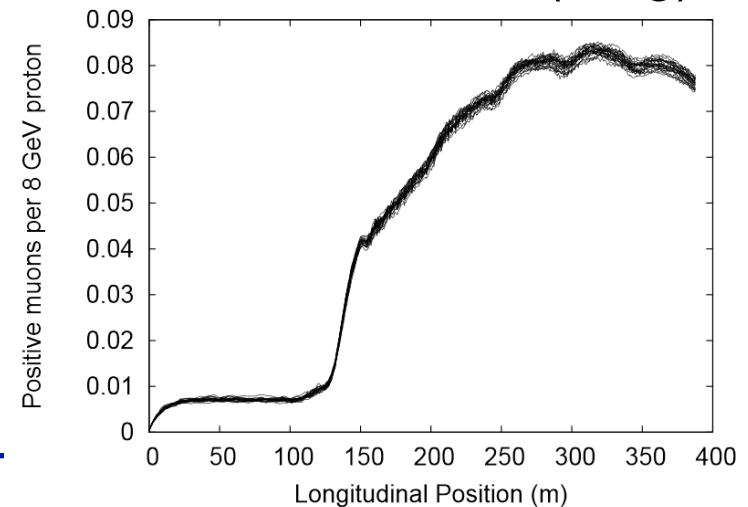
- New FE Baseline Cooler (Stratakis)



- Updating the chicane ROOT-based geometry (Snopok)



- ICOOOL-v3.32 Release (Berg)



Monthly L2 Status Report -

WBS: 02.03 Cooling

5 April 2013
Presenter: Tom Roberts



<p><u>Milestone Status (Progress)</u></p>	<p><u>Resource Conflicts, Plan Changes and Issues</u></p> <ul style="list-style-type: none">• Need funding for Missing Physics Processes• Need engineering study on Guggenheim final stages <p><u>Late Items</u></p> <ul style="list-style-type: none">• Missing Physics Processes
<p><u>Summary of Previous Month</u></p> <ul style="list-style-type: none">• EPIC: Continuing...• HCC: On hold this past month• Guggenheim: Continuing; 13 stages of rings simulated• Half-flip w/ tilted solenoids• Physics Processes: Ongoing... msc maxStep code started	<p><u>Quarterly Plans</u></p> <ul style="list-style-type: none">• 6D Baseline Selection<ul style="list-style-type: none">– Need some preparatory work– (Basically on hold awaiting the other 6D D&S tasks)• Guggenheim D&S• HCC D&S• FOFO Snake D&S• Auxiliary components• Final Cooling D&S• Missing Physics Processes
<p><u>Upcoming Work (Next Month)</u></p> <ul style="list-style-type: none">• Guggenheim D&S (Stratakis et al)• HCC D&S (Yoshikawa et al)• Rectilinear RFOFO with tilted solenoids (Balbekov)• Final Cooling D&S (Palmer)• Physics Processes: plasma effects, others, ...	

Monthly L2 Status Report -

WBS: 02.04 – D&S Acceleration

05 April 2013
Presenter: J. Scott Berg



<p><u>Milestone Status (Progress)</u></p> <ul style="list-style-type: none">• MAD designs for NF Linac & RLAs, transfer line Linac to RLA1• IDS-NF RDR Linac/RLA section: not begun• Just beginning Higgs factory acceleration chain	<p><u>Resource Conflicts, Plan Changes and Issues</u></p> <ul style="list-style-type: none">• Some messing around with baseline frequencies and acceleration plan, related to MASS. Will know more next month.
<p><u>Summary of Previous Month</u></p> <ul style="list-style-type: none">• Finalizing IDS-NF design• Work with UK engineering on IDS-NF design	<p><u>Late Items</u></p> <ul style="list-style-type: none">• Lattice files for neutrino factory acceleration available
<p><u>Upcoming Work (Next Month)</u></p> <ul style="list-style-type: none">• Calculations to support FFAG-based acceleration chain design• Finalize transfer lines and matching for IDS-NF lattices• Deliver lattice files for neutrino factory acceleration	<p><u>Quarterly Plans</u></p> <ul style="list-style-type: none">• Q3-4: Setting up Higgs factory FFAG calculations• Q3-4: IDS-NF RDR Linac/RLA section

Monthly L2 Status Report -

WBS: 02 05 Collider Ring Design

05 April 2013
Presenter: Y. Alexahin



<p><u>Milestone Status (Progress)</u></p> <ul style="list-style-type: none">• Higgs Factory (HF) design with account of detector protection from backgrounds – getting ready for 2nd iteration.• Study of effects of field imperfections in wide-aperture IR magnets on beam dynamics in Higgs Factory – ~ half done.• Longitudinal dynamics studies in Higgs Factory with account of beam-beam forces and wake-fields – not started yet• Upgrade of the 3TEV collider lattice with combined-function magnets – on hold	<p><u>Resource Conflicts, Plan Changes and Issues</u></p> <ul style="list-style-type: none">• H/Z Factory instead of Higgs Factory ?
<p><u>Summary of Previous Month</u></p> <ul style="list-style-type: none">• Simulation study started of the effects of fringe fields with realistic profile in the HF IR magnets.• Beam dynamics simulations in HF with account of multipole errors in IR magnets performed: DA ~ physical aperture.• Strong-strong beam-beam effect in long bunches studied in linear approximation for HF upgrade parameters: no problem found.	<p><u>Late Items</u></p> <p><u>Quarterly Plans</u></p> <ul style="list-style-type: none">• Update of the Higgs Factory collider lattice design based on the detector background simulations.• Correction of the effects of field imperfections in wide-aperture IR magnets on beam dynamics in HF.• Self-consistent longitudinal dynamics simulations for HF
<p><u>Upcoming Work (Next Month)</u></p> <ul style="list-style-type: none">• Continued work on the HF collider lattice design.• Continued study of the effects of fringe fields in wide-aperture IR quadrupoles of the HF and their correction.	

Monthly L2 Status Report -

WBS: 02.06 - Machine-Detector Interface

5 April 2013
Presenter: Nikolai Mokhov



<p><u>Milestone Status (Progress)</u></p> <ul style="list-style-type: none">• Developments of physics and geometry modules of MARS15 for adequate modeling of heat loads in SC magnets and backgrounds in HF and MC detectors• MARS model of HF IR with large-aperture magnets, MDI and lcsim detector is up and running.	<p><u>Resource Conflicts, Plan Changes and Issues</u></p> <ul style="list-style-type: none">• Still can't run MARS on NERSC machines.
<p><u>Summary of Previous Month</u></p> <ul style="list-style-type: none">• MARS15 model of Muon Collider HF IR and MDI with large aperture Nb₃Sn magnets and SiD lcsim detector built.• First results on muon-decay detector backgrounds and heat loads to IRQ calculated.• MDI configurations studied – although with some encouraging outcome - revealed the difficulties in background suppression for the HF muon decay source term.• First SC magnet protection scheme was tested.	<p><u>Late Items</u></p>
<p><u>Upcoming Work (Next Month)</u></p> <ul style="list-style-type: none">• Optimization of nozzle and other MDI components for better suppression of detector backgrounds.• Optimization of magnet protection scheme.• Prepare production runs for background files to feed the lcsim detector simulations.	<p><u>Quarterly Plans</u></p> <ul style="list-style-type: none">• Q3: Optimization of HF magnet protection system and MDI. Production MARS runs to feed the detector studies. With this source, launch full detector simulations.

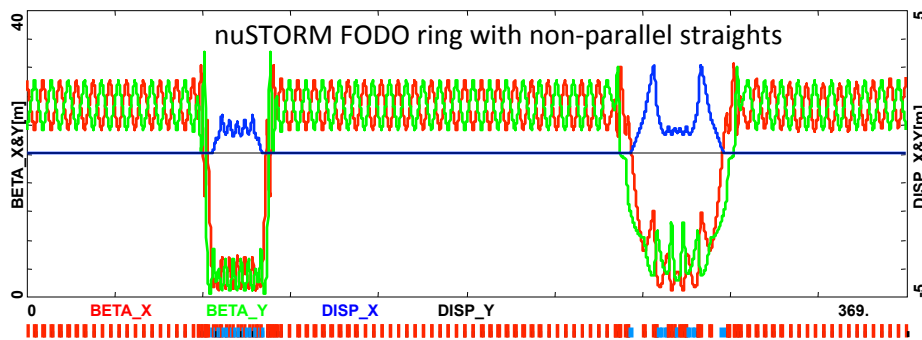
Monthly L2 Status Report -

WBS: 02 07 Decay Rings

5 April 2013
Presenter: Alex Bogacz



Milestone Status (Progress)



Summary of Previous Month

- A. Liu – Optimized stochastic injection into nuSTORM ring, presented at the CERN nuSTORM Workshop last week.
- A. Bogacz – New racetrack FODO design with non parallel straights for nuSTORM, presented at the CERN nuSTORM Workshop last week.
- J. Pasternak - The main ongoing activity is to design the injection system for 10 GeV NF decay ring, to be presented at 10-th IDS Plenary Mtg at RAL this week.

Upcoming Work (Next Month)

- A. Liu – nuSTORM Dynamic Aperture studies with G4BL for the new ring with non-parallel straights.
- D. Kelliher - Feasibility study of injecting both positive and negative muons into the ring will be explored from the injection timing point of view.

Resource Conflicts, Plan Changes and Issues

Late Items

Quarterly Plans

- Large acceptance ring design for ν STORM
 - Pursue both FODO and FFAG Racetrack designs
 - Continue lattice optimization and Dynamic Aperture study for both designs
- Ring design for NF
 - Finalize 10 GeV ring design for IDS-NF
 - Finalize injection into the ring for both charge species
 - Adapt 10 GeV ring design (IDS-NF) for 4 GeV L3NF at Fermilab

AOB



- Are there any other issues for today's discussion
- Questions?
- Comments?