

Design & Simulation Overview

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R & D goals for this FY

1. contribute material and help prepare IDS-NF IDR (8/10)
2. prepare Initial Configuration Document for Front End (0)
3. prepare Initial Configuration Document for NF μ acceleration (0)
4. prepare parameter list for muon collider (8)
5. investigate ways to mitigate radiation in front end beam channel (2)
6. improve realism of tapered Guggenheim channel simulations (3)
7. prepare detailed work plan for the RCS (1)
8. study effects of fringe fields on collider ring (5)
9. estimate collider ring impedance (1)
10. make preliminary design of 3 TeV collider ring (5)
11. make preliminary design of detector cone (5)

- we have prepared several documents in response to the DOE Review
 - detailed RF parameter list for muon collider (Bob)
 - validation document for G4beamline (Tom)
- many contributions to IDS-NF IDR (Scott et al)
 - proton driver, target, front end, acceleration
- new 30 T solution is close to goal for final cooling (Bob)
 - should help improve the credibility for a muon collider

- minimal resources available for this right now
- have plans for what needs to be studied
 - 4 MW power upgrade for Project X
 - accumulator & compression rings
 - trombone & funnel optics
- we need a small group dedicated to this ASAP
 - ~2 full-time people at Fermilab under Keith's direction
- asked for a postdoc in FY11 MAP supplemental request
- highest priority for new resources next fiscal year

- responsibility for target work switched this year to Technology Development
- still a subject of great interest for D&S
 - interface between proton driver and front end has important influence on ultimate machine performance
- collaboration between D&S and TD will continue as appropriate
 - e.g. contributions to redesign of 20 T capture magnet system

- lot of work was done for NF IDR
 - new shorter front end channel
- major issues now
 - incorporate solution to RF in magnetic field into simulations
 - shielding beam channel solenoids from radiation from target
 - could have significant cost implications
 - Chris Rogers has taken lead on mitigation studies
 - hopefully {Dave, Juan, Pavel} will contribute also
- need MAP Initial Configuration Document this year

- continuing to optimize and improve realism of cooling simulations
 - HCC channel using 201, 402, 805 MHz
 - tapered Guggenheim channel
 - charge separation at higher momentum
 - more efficient 6D bunch merging scheme
 - final cooling channel using 30 T solenoids
 - better simulations of properties of EPIC lattice
- major issues now
 - incorporate solution to RF in magnetic field in simulations
 - varying levels of detail in the simulations
 - missing pieces in the cooling chain

Cooling “focus”

- there are still many different cooling ideas being studied
- MAP proposal calls for cooling **downselection** next year
 - people have ~1 more year to show their ideas are relevant to MAP
 - need to show where the cooling system can be used
 - need to make realistic simulations of performance with expected beam parameters, fringe fields, windows, etc.
 - need to make detailed list of technical parameters fields, gradients, dimensions, kickers, etc. ...
- support is likely to continue only for the baseline design and perhaps one backup design

- small group has made good progress
- lot of work on low-energy accelerators was done for IDS-NF IDR
- a new high energy accelerator sequence was proposed with higher overall transmission
- major issues now
 - get self-consistent set of lattice files for NF acceleration
 - do basic design work for the Rapid Cycling Synchrotron (RCS)
 - new postdocs allocated for BNL and Mississippi should start work on RCS

- small group & visitors continues to make significant progress
- presently working on
 - analysis of fringe fields and multipole effects & correction
 - design of beta* tuning scheme for 1.5 TeV collider
 - simulate beam-beam effect
 - estimating ring impedance
 - preliminary design of 3 TeV collider
- additional help available from PBL SBIR on open-midplane dipole issues

- small group & visitors continues to make significant progress
- presently working on
 - full simulations of detector background
 - improve simulation tools to meet detector community requirements
 - evaluation if physics goals can be achieved
 - build realistic 3D model of IR lattice elements compatible with specs
 - develop SC magnet protection system
- additional help available from Muons Inc. SBIR on detector backgrounds

This meeting

- Rob Ryne outlined a number of interesting possibilities for enhancing our computing efforts
- we need to examine possible topics that could utilize SciDAC work
 - Collider group starting collaboration on beam-beam simulations
 - multi-parameter optimization
 - space charge
 - people doing computer simulations should think about whether these types of tool could help them
- new standard program is needed for emittance calculations
- several suggestions for improvement were made
 - Pavel agreed to look into this

- DOE review suggested that we have beam dynamics workshops
- bring in outside experts on topics of mutual interest
- possibly this could bring in some new collaborators
- mini-workshops can sometimes be very useful
 - e.g. Workshop on Solenoid Capture at BNL in December
- some suggested topics
 - collective effects in μ interactions in absorbers
 - pulsed systems, e.g. induction linacs, fast kickers
 - wakefields in muon colliders
 - getting $\beta^* \sim 1$ cm in a collider ring
 - limits on gradients for low frequency RF
- volunteers for organizing one of these workshops appreciated

R & D goals for FY12

1. establish viable proton driver working group
2. incorporate solution to RF in magnetic field problem into our simulations
3. front end reoptimization including radiation mitigation scheme
4. simulate 6D bunch-merging scheme in greater detail
5. decide criteria to be used for the cooling downselection
6. finish assessment of missing physics needed in G4beamline
7. prepare Initial Configuration Document for cooling
8. do basic design & lattice studies for RCS
9. design collimation scheme, BPM & corrector arrangement for 1.5 TeV collider ring
10. prepare Initial Configuration Document for collider ring
11. first self-consistent MDI design for a 3 TeV collider