HCC-based LEMC Scenario Progress

Rolland Johnson
Muons, Inc.

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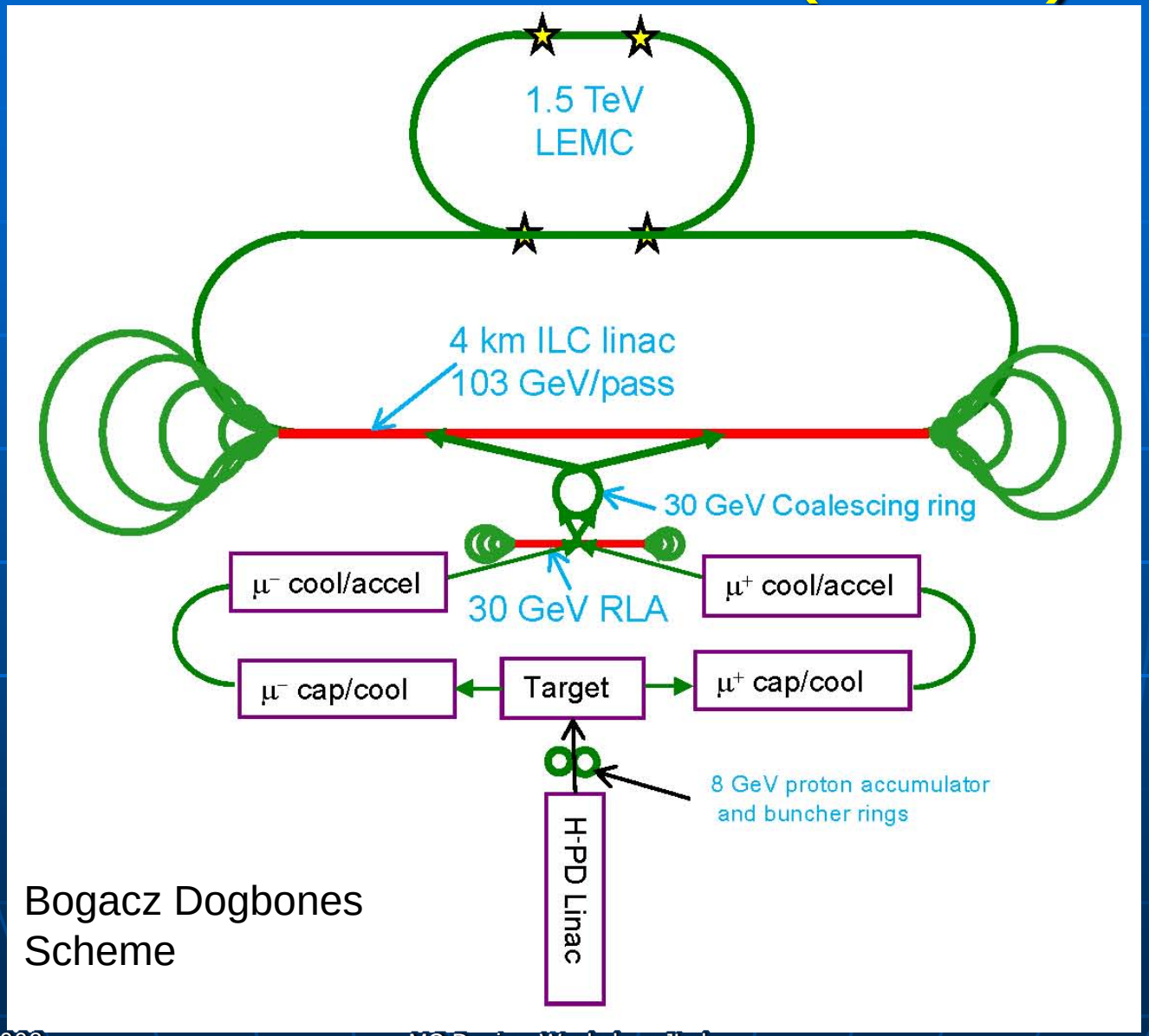
LEMC Scenario (2008)



Bogacz Dogbones Scheme

HCC-based LEMC Scenario Progress

- Proton Driver - Chuck Ankenbrandt,
- CW Linac PD - Milorad Popovic
- Target
- Pion Capture - Dave Neuffer
- HCC Decay - Cary Yoshikawa
- HCC Magnets - Vladimir Kashikhin, Sasha Zlobin
- HCC RF - Mike Neubauer, Alvin Tollestrup
- HCC Design, sims - Katsuya Yonehara
- HCC EPIC - REMEX - Vasiliy Morozov
- LE RLA
- Coalescing ring
- HE RLA - Alex Bogacz, Dejan Trbojevic
- Collider ring & low β - Vadim Kashikhin
- Experiment Detector - Mary Anne Cummings

Personal excitement over recent progress

- Technology Development
  - Magnets
    - 1st HCC magnets with NbTi built, iterations underway
    - Final HCC magnets using HTS engineered based on HS
    - Two-coil HS about to be built with YBCO
    - Fiber optic quench protection to be experimentally developed
    - High field magnet development funded
  - RF Cavities
    - First SF6 doping studies support models (which imply beam capability)
    - Beam to the MTA soon
    - Dielectric loaded RF to be tested
    - Engineering solutions for HTS HCC with integrated RF
  - RF power
    - Phase and frequency locked magnetron prototype being built

RF System for an HCC

All the critical RF concepts have been suggested for SBIRs at one time or another by Milorad Popvic, Al Moretti, Mohammad Alsharo'a, and Mike Neubauer

Mike Neubauer

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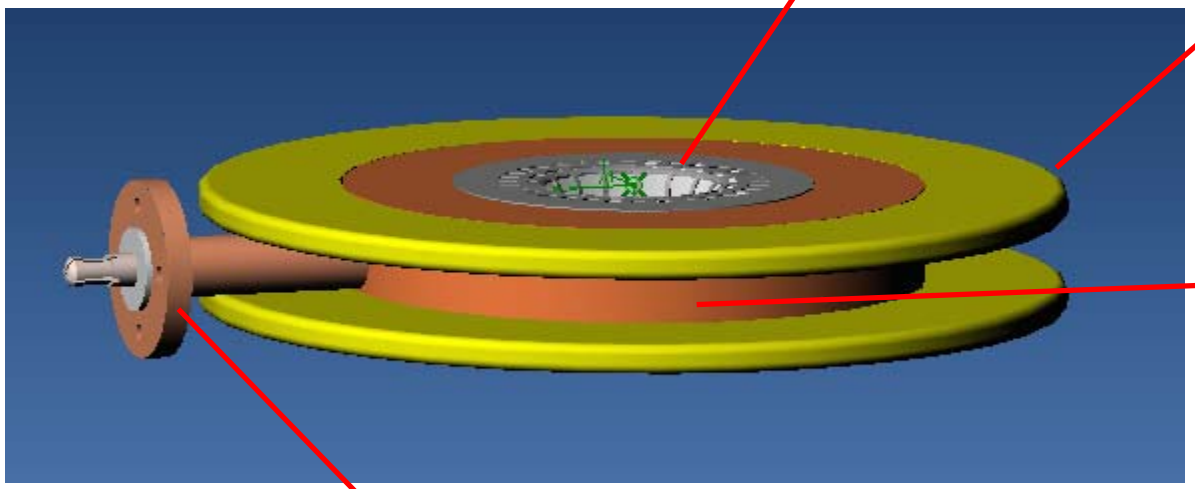
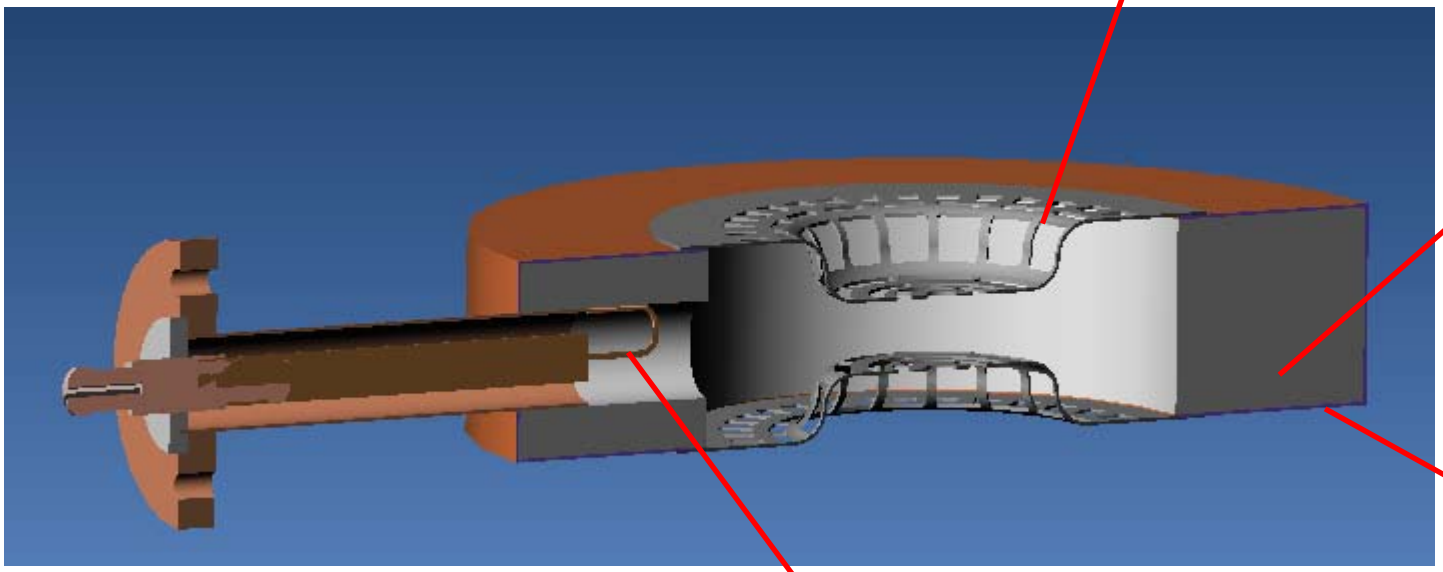
Cavity Module Concept

- Single pill-box cavities are made that are aligned to create an HCC.
- Each Cavity has it's on set of magnet coils at 50% fill factor

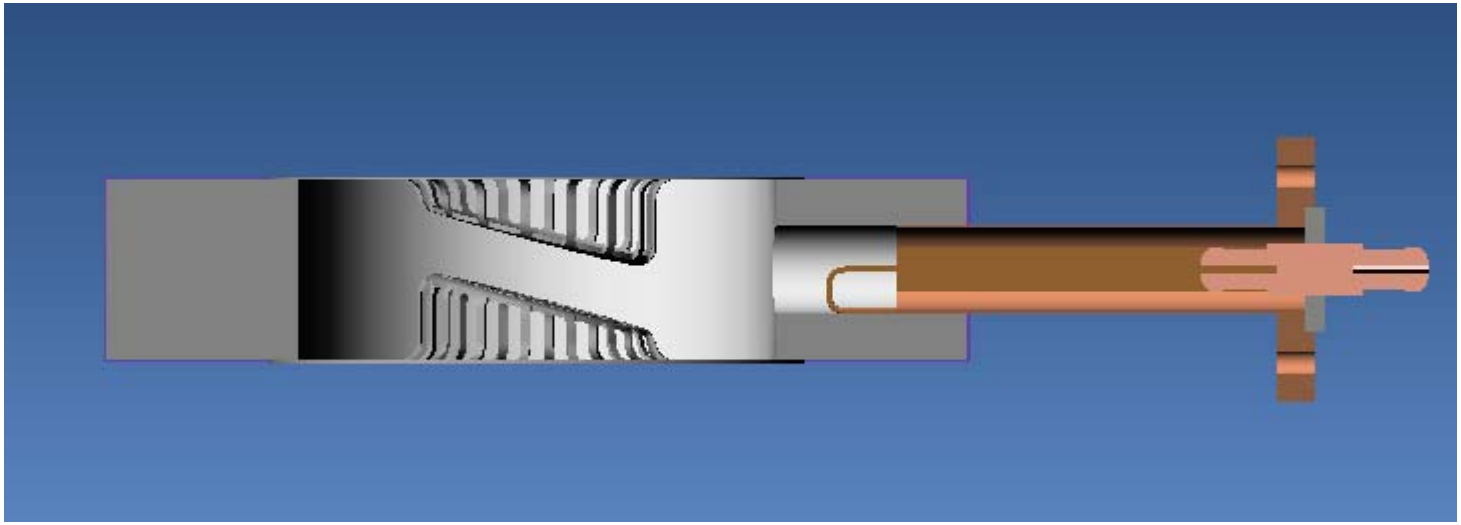


Cavity Detail

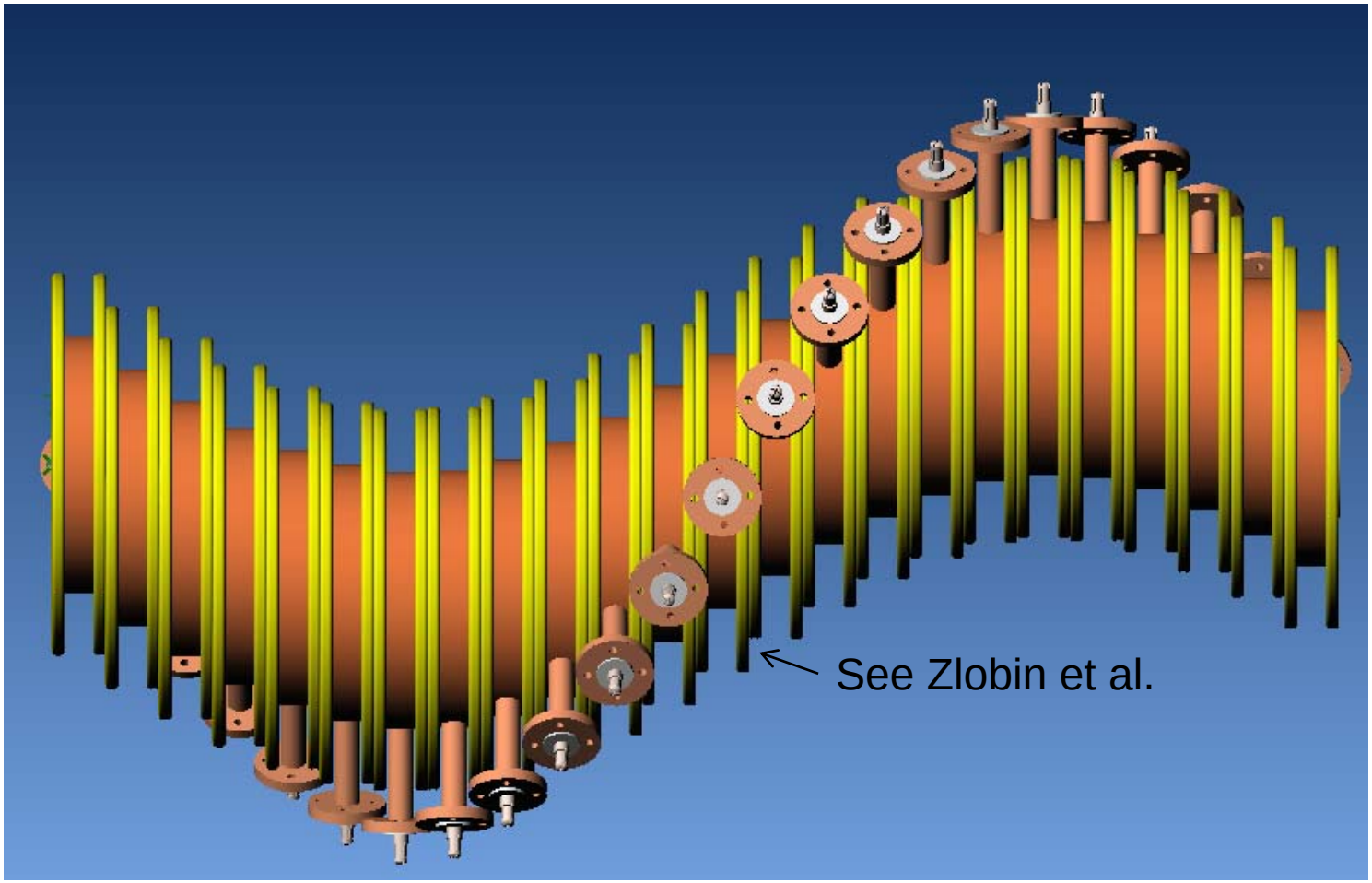


Cavity Detail showing angled grid

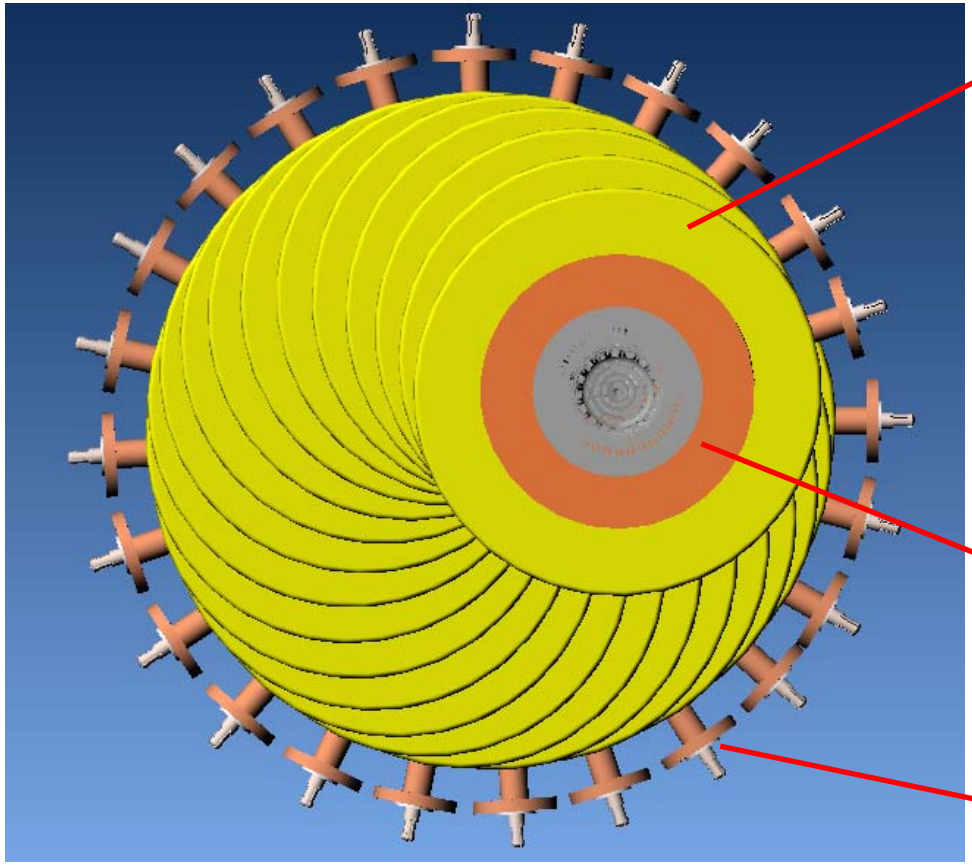
- Angled Grid at HCC angle



Complete HCC---Single Period



This is a 24 cavity per period 400 MHz design



Magnet Coil

- Approximate Diameter at the coax flange is 40”

Pill box Cavity

Coax Feed per cavity

Personal excitement over recent progress (cntd)

- Simulations, Models, and Inventions
  - New HCC simulations show impressive 6-D cooling
    - More conservative frequencies and apertures – 10^{34} still looking good
  - Parametric-resonance Ionization Cooling – key to LEMC!
    - Epicyclic PIC invention seems to overcome fringe field and D problems
    - G4Beamline model working, ready for development
    - New person (Vasiliy Morozov) dedicated to solving this problem
  - Ramping RLA Magnets to enable more RF cavity traversals
    - variations on and extensions to U Miss concept

Personal excitement over recent progress (cntd)

- New Synergies
  - Project-X heeding MC and NF needs
    - Contributing to: H^- Source, laser stripping, magnetron, couplers,
  - Mu2e experiment P-X upgrade uses muon cooling techniques,
    - Favorable reviews, but still awaiting Fermilab response to "MANX following MICE" and "Mu2e Upgrade" proposals
    - My lesson – need to have at least two competitors
  - Homeland Security
    - Muons for Special Nuclear Material (SNM) detection
  - Advanced Research Project Administration – Energy (ARPA-E)
    - Accelerator-Driven Subcritical (ADS) Power Generation, and Nuclear Waste Disposal (ATW)
    - Can ARPA-E help fund and expedite more powerful Project-X, to make sure MC and NF needs are met?

Ultimate Goal: High-Energy High-Luminosity Muon Colliders

- precision lepton machines at the energy frontier
- achieved in physics-motivated stages that require developing inventions and technology, e.g.
  - high-power 8-GeV H^- Linac (CW with AR & BRs)
  - stopping muon beams (HCC, EEXwHomogeneous absorber)
  - neutrino factory (HCC with HPRF, RLA in CW Proj-X)
  - Z' factory (low Luminosity collider, HE RLA)
  - Higgs factory (extreme cooling, low beta, super-detectors)
  - Energy-frontier muon collider (more cooling, lower beta)

Muons, Inc. Status

7 New Phase I awards.
- HOM Absorbers (Cornell),
- Quasi-isochronous Decay Channels (Fermilab),
- DC Gun Insulators (JLab),
- H-minus Ion Source (SNS),
- High-power Coaxial Couplers (JLab),
- High-field YBCO Magnets (FSU),
- Phase and Frequency-locked Magnetrons for SRF (Fermilab)

2 New Phase II awards:
- Fiber Optics for HTS (FSU)
- Pulsed RLAs (JLab)

2 Phase II awards continued
- HCC Magnets (Fermilab)
- Stopping muon beams (ODU)

3 Contracts :
- Fermilab to help with Project-X development
- PNNL to help develop a photon beam concept for Homeland Security
- ANL-UC ps counter development

21 New SBIR-STTR Proposals submitted

1 DTRA proposal with Hampton U announced soon

BES

Dudnikov.Stockli 15b ORNL 15 b High Brightness Sources of Negative Hydrogen Ions
Rol Danilov 16d ORNL Laser Stripping for H^- Injection
Mike-Nasiri 14d ANL Adjustable High Power Coax RF Coupler

NP

Dudnikov-Zhang 45e JLab Highly Polarized Ion Sources
Mike-Rimmer 45c- JLab Novel Crab Cavity RF Design
Mike Milorad 45a FNAL Compact, Tunable RF Cavities
Mike Milorad 45a FNAL Dielectric Loaded RF Cavities
Tom Dan 45d IIT Particle Refrigerator

HEP

MACC Hedin NIU 61a Integrated Low Beta Region Muon Collider Detector Design
Rol Justin NCSU 62a YBCO Roebel Cable for High-field Low-loss Accelerator Magnets
Rol SlavaD 64b JLab Epicyclic channels for PIC
Tom Dan 64g IIT Advanced Multi-Program GUI for Accelerator Modeling
Kahn Hedin 64g NIU Simulation of Accelerator Based Backgrounds in a Muon Collider
Kahn Palmer 63f BNL High Gradient Final Focusing Quadrupoles for Lepton Colliders
Abrams Hauptman 64a ISU Gas-Cherenkov Calorimeter for High Intensity Beams
Abrams Frisch 64b UC Fast Time-of-Flight System for Muon Cooling Experiments
Mike-Moretti 65c FNAL RF Pulse Compressors for Muon Beams
Rol Dan IIT 65a Gridded-Wire Windows for High Pressure RF Cavities
Rol-Zeke 65a Buckyball Dopants for High Pressure RF Cavities

FES

Mike-Kwan LBNL 68a High Currently Density Lithium Ion Source
Rol Justin NCSU 66c Fiber Optics Sensors for Cable-Wound SC Magnets for Fusion