The MTA Experimental Plan

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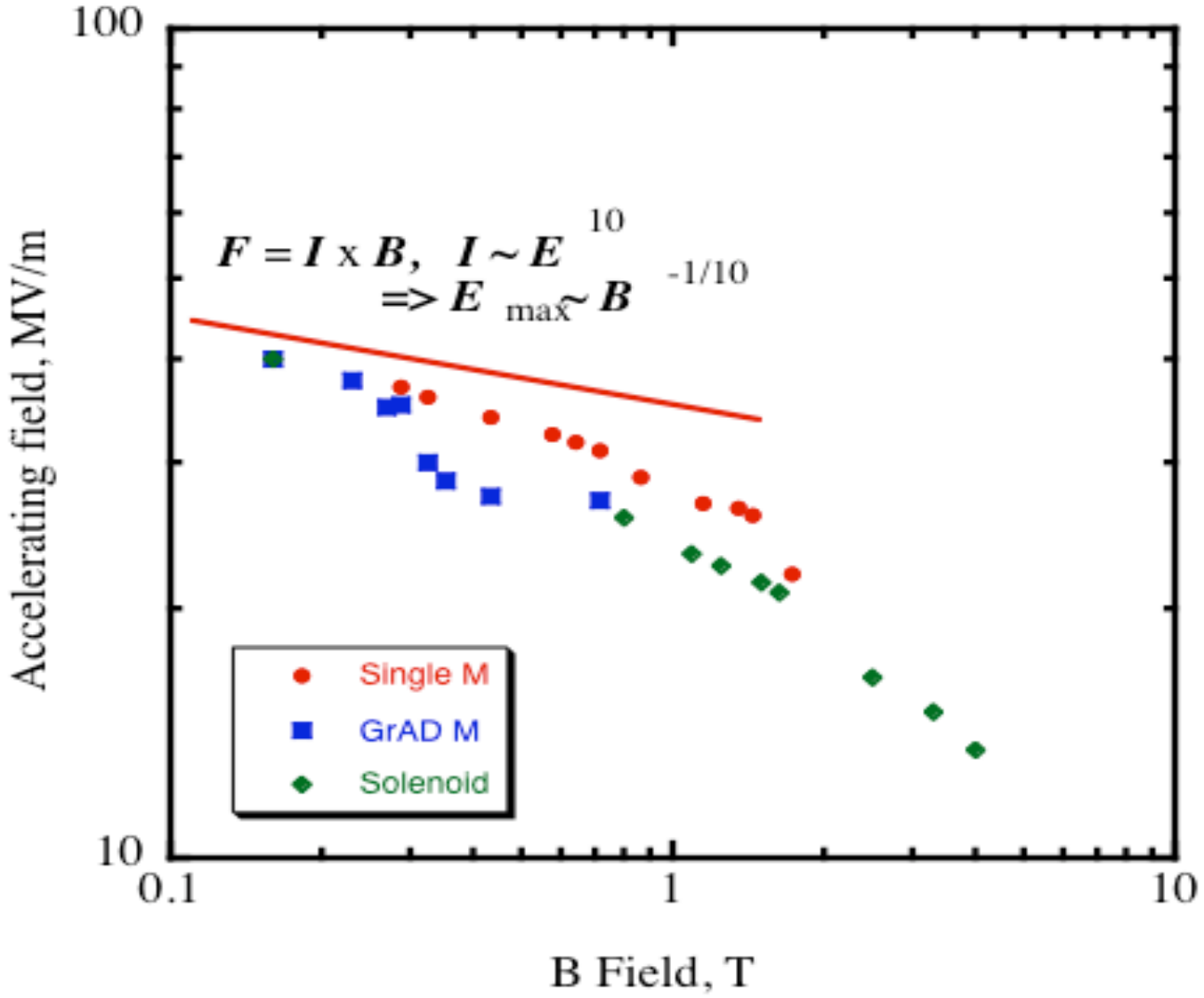
MuCool Meeting
Jan. 7, '05

MICE and the Muon Collaboration need to know:

- Can we operate reliably at 8 – 15 MV/m with a ~5 T field ?
- Can we reduce field emission backgrounds with high work function materials ?
- Will coatings of these materials stick to the copper ?
- Can they be applied to a large, expensive (and fragile) cavity ?
- Can we defeat the magnetic field effects by reducing field emission ?

- Will high intensity beams change things ?
- Can high pressure gas reduce breakdown ?
- Can Materials Science techniques reduce breakdown ?

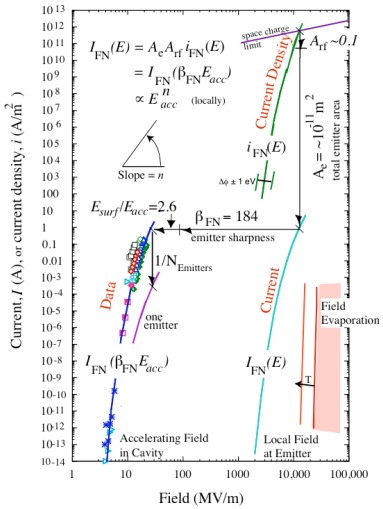
Understanding magnetic effects may be the highest priority.



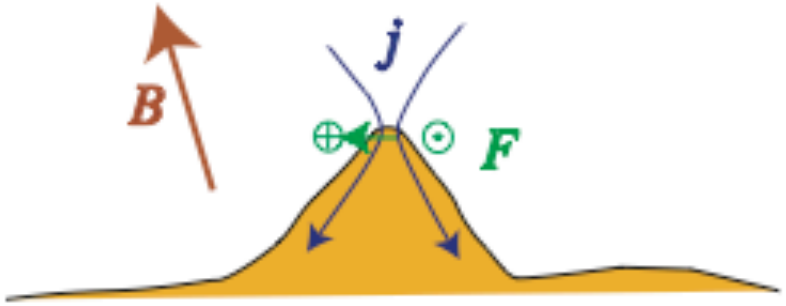
Magnetic Fields: the "Moretti Effect"

- The current densities produced by emitters are enormous.

  Lab G data showed that emitters produce:
  - 0.1 mA currents
  - 10^{10} – 10^{11} A/m^2 current densities
  - These are produced in sharp impacts a few 100 ps long.



- Geometry requires that currents flow in a variety of different directions in emitters.



- We are already within a factor of ~two of where we want to run, and we should be able to reduce the field emission currents by a large factor.

- We have to prove this.

The Muon Collaboration rf program

Experimental

- Muon Test Area at Fermilab
  Tests of cavities at 805 and 201 MHz with magnetic field

- Atom probe experiments at Northwestern
  Materials studies relevant to Muon cooling, breakdown and SCRF

Modeling

- Model breakdown process, at Argonne.

Muon Test Area Experimental Program

- 805 MHz cavity
  - Curved windows (the flat ones were unstable)
  - Button tests of different materials (damage in different materials)
  - Magnetic field studies (we need to operate at 5T)
  - High pressure cavities (high pressures may be good)

- 201 MHz cavity
  - Conditioning and breakdown studies (needed for MICE)
  - Magnetic field studies (Can we reach 16 MV/m?)

- Surface modification and control (Can we do better?)

RF in the MTA: the plan

- Document underway (last edit Dec 21, 8 pages so far)
  Drafts are circulating, things change.

- Loose ends:
  Gridded window
  NAI detector
  How close to mount the cavities
  Windows on the 201 MHz vacuum plate
  Quench safety with the 201 MHz cavity
  Do they still make Polaroid Film?
  Status of mounts, windows, controls. etc.
  Interfacing with Muons Inc.

- Final operating priorities

- Need to schedule Rickard Sandstrom for a productive visit.

The Surface Studies Program at Northwestern: next week

- Modifying a 3DAP to systematically study coatings.
- Construction underway
- Some results expected for PAC'05 in May.
- Collaboration with Linear Collider SCRF R&D group at Fermilab.
- Talk by David Seidman Jan 13, after our MC Meeting.
- Meeting will be a new day to accommodate Seidman, Seminar, and SCRF

Jan 13, Thursday 1:30

Modeling of Breakdown, at Argonne, to be announced

- We have a new paper

PHYSICAL REVIEW SPECIAL TOPICS - ACCELERATORS AND BEAMS 7, 122001 (2004)

New mechanism of cluster-field evaporation in rf breakdown

Z. Insepov, J. H. Norem, and A. Hassanein
Argonne National Laboratory, 9700 South Cass Avenue, Argonne, Illinois 60439, USA
(Received 26 April 2004; published 22 December 2004)

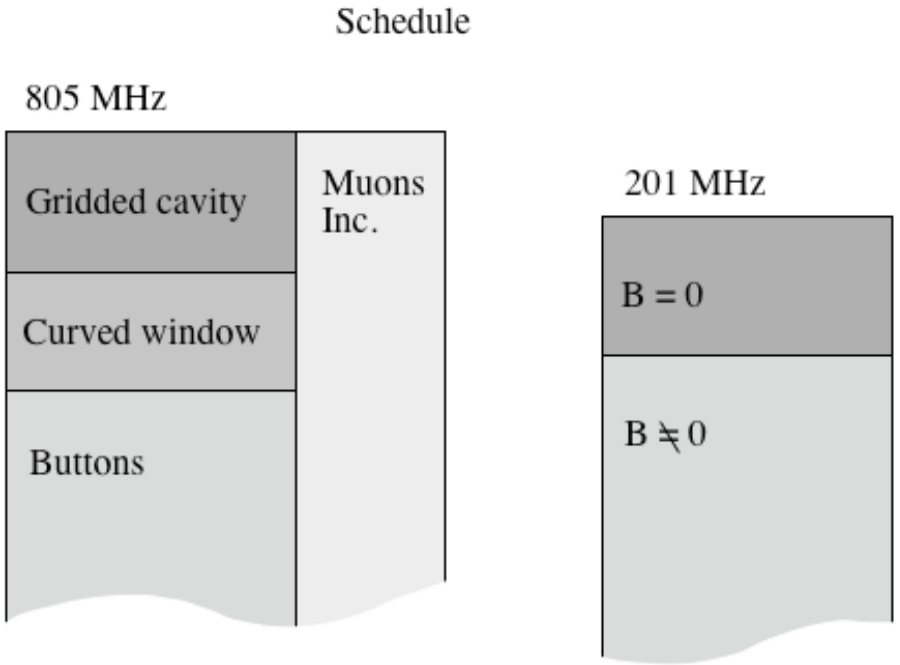
. . . but little funding.

Experiments and schedule

- Experiments
  - Measure background rates during conditioning with B field
  - Quantify damage
  - Measure Production distribution of dark current
  - Study Different materials

- Geometries
  - 805 MHz pillbox
    - Aluminum grid ??
    - Be windows
    - Sample insertion
  - 201 MHz pillbox
  - High pressure cavity
  - (Open Cell cavity ?)

- Schedule at right.
  - Starts around Mar 1
  - Moves at a deliberate pace.



Summary

- The main outlines of the MTA program are defined.
- We need to settle a few details.
- Materials science and modeling will be discussed later.