

US Collaboration on High Gradient Research

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Warm versus Cold

- Cold Technology chosen for ILC
 - Fundamental limit for SC 50 MV/m
 - $B_{max} \sim 200$ mT for Nb
 ← SC Phase Transition
 - $B_{max}/E_{acc} \sim 4$ achievable

- Warm work at X-Band for NLC, Ku MIT, Ka CLIC
 - Fundamental limit for warm 150+ MV/m
 - $E_{max} \sim 300-400$ M/m
 ← Unknown
 - $E_{max}/E_{acc} \sim 2$ achievable



- ❑ Frequency Scaling
 - Breakdown, and other parameters
- ❑ Geometry
 - Size, Structure, Circuit
- ❑ Materials
 - DC doesn't scale, Composites, Processing
- ❑ Sources
 - High Power at High Frequency
- ❑ Theory and Simulations



- ❑ 5 possible Stations 50-80MW uncompressed
 - Need Infrastructure: Compressors, Windows, Diagnostics
- ❑ Test Structures
 - SLAC, NLC, Others scaled to 11.4 GHz
- ❑ 20-30 GHz Gyrotron
- ❑ Active Pulse Compression
 - Laser triggered bulk effect semiconductor switches
- ❑ 91 GHz GyroKlystron from CCR
- ❑ 30 GHz sources from CERN



- Our 17 GHz HRC Accelerator Lab
 - Upgrade to ~20 Hz for High Power processing

- Breakdown Studies at 17 GHz

- Innovative Structure

- User Facility



- University of Maryland
 - Theory on Breakdown
 - 100/300 MW MIG for Gyrotron Circuits
 - 60 Hz 17.136 GHz Lab for structures

- Argonne National Lab
 - Dielectric 2 Beam Structure
 - X-band Dielectric structure testing
 - Schottky enabled photoemission
 - Atom Probe Tomography, Modeling



- Naval Research Lab
 - Dielectric-loaded accelerating structures
 - High-power active compressors
 - Using plasma switch tubes

- Lawrence Berkeley National Lab
 - POSINST simulation code, secondary emission

- University of Colorado, Boulder
 - Greg Werner (who visited) Dielectric PBG



- Yale

- 34 GHz Omega-P Magnicon Power Combiner
- Number of Experiments: components, structures

- UCLA

- Hybrid Standing/Traveling Wave Photinjector



- Structure, Phase I SBIR
 - Iris Inserts: Stainless/Molybdenum
 - Dual ring power amplifier: Here or UMd

- Source: Choppertron, Phase I SBIR
 - 17-23 GHz
 - With enough beam power, More power than Klystron
 - More phase stability

- New (Old) high gain Klystron tube



- ❑ Lots of Interesting Projects
- ❑ Even more related SBIRs

- ❑ Only new money requests
 - SLAC
 - MIT

- ❑ Look forward to Upgrade, and HRC projects!

