

# Ultra-Fast Damping Ring Kicker Modulator Development at SLAC

Status update for IWLC2010

C. Burkhardt, A. Krasnykh, R. Larsen, & T. Tang

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# SLAC DR Kicker Modulator R&D

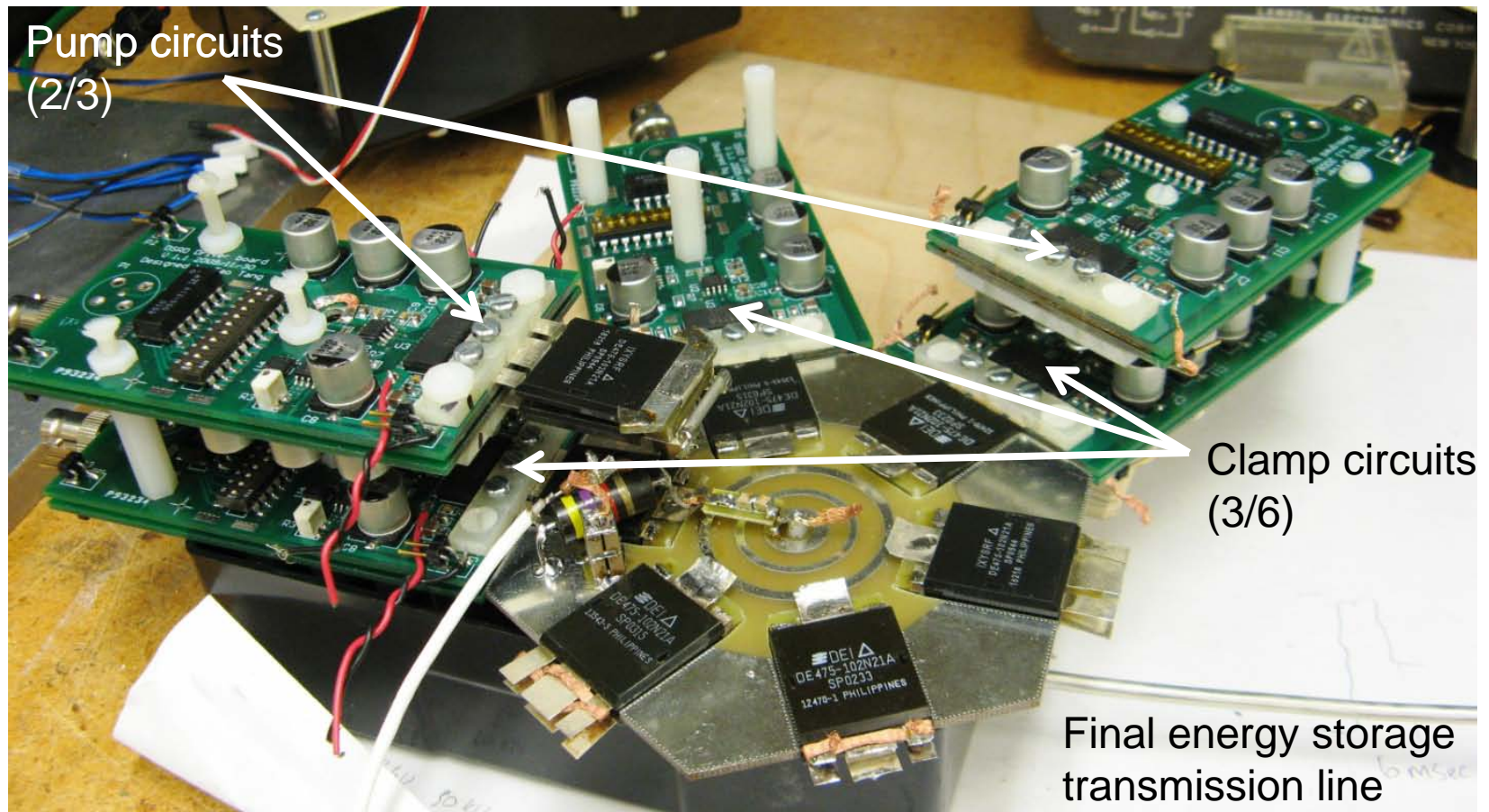
- SLAC program continues to investigate two approaches
  - Adder topologies: array ultra-fast MOSFET switches
  - Opening switch topologies: DSRD switch
- Adder Program
  - Hybrid MOSFET/driver
    - ~1 ns switching time (demonstrated FY08)
    - Improve assembly technique
    - Evaluate thermal stability
  - High bandwidth adder topologies
    - Preservation of pulse fidelity (demonstrated FY09)
    - Extend to ILC parameters
  - Application to FNAL Project X broadband chopper
    - SLAC-FNAL collaboration
    - Partial support for SLAC effort
- Opening Switch Program
  - Functionally similar to DSRD systems marketed by FID GmbH
  - “Open source” design
  - 2-ns prototype demonstrated (FY08)
  - Developing 4-ns modulator for ATF2

# DSRD Program Developments

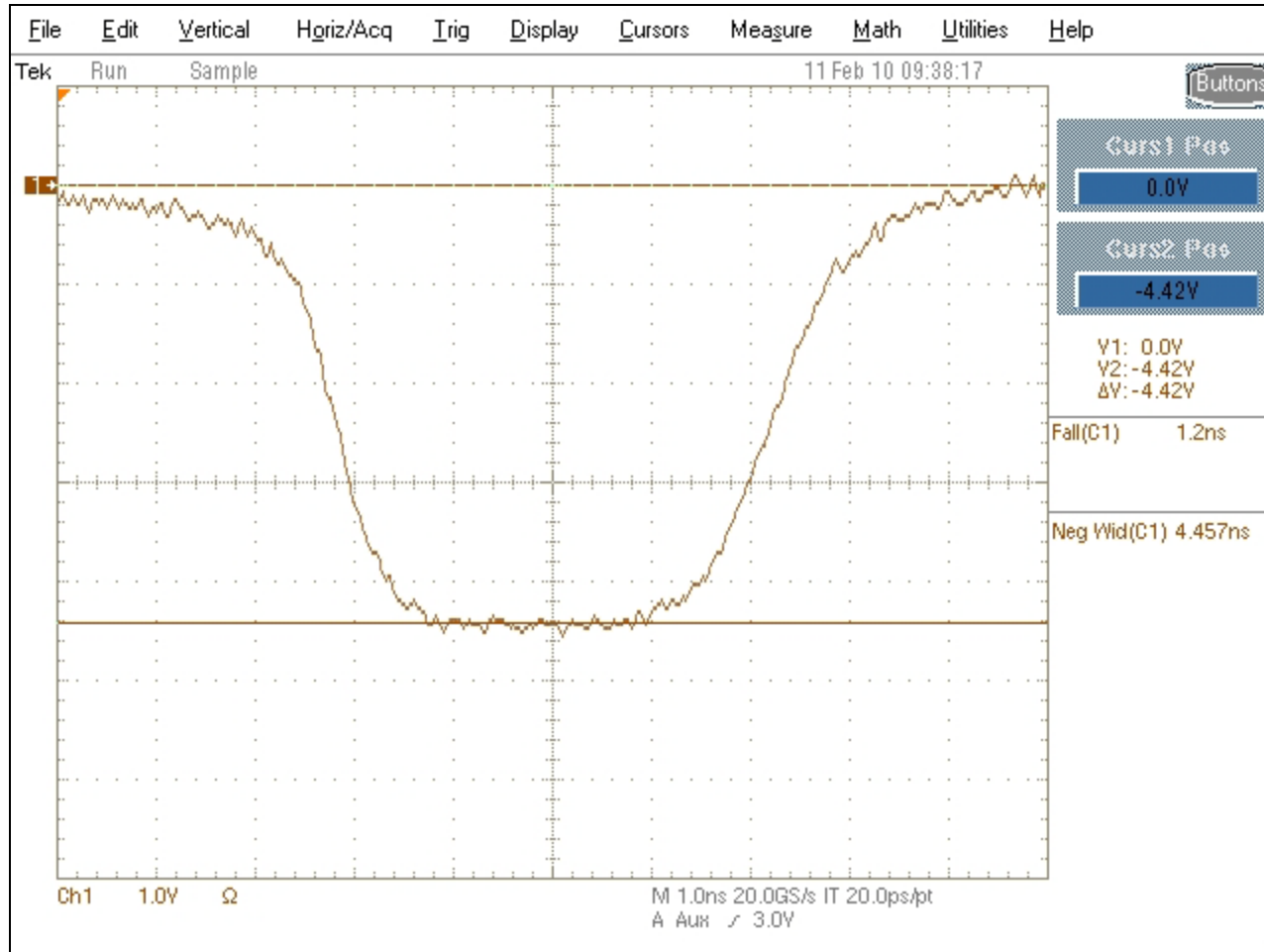
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- Diversified Technologies, Inc. (under USDOE SBIR funding): Floyd Arntz PI
  - Commercialized DSRD production in US (Voltage Multipliers, Inc.: Dennis Kemp, President)
    - Low yields limit commercial viability of diffusion-based fabrication
    - Exploring alternative fabrication based on epitaxial silicon
  - Encountered insurmountable post-pulse issues with SLAC circuit topology
- SLAC developed alternative topology
  - Active clamping to eliminate post-pulse
  - Brass-board testing underway

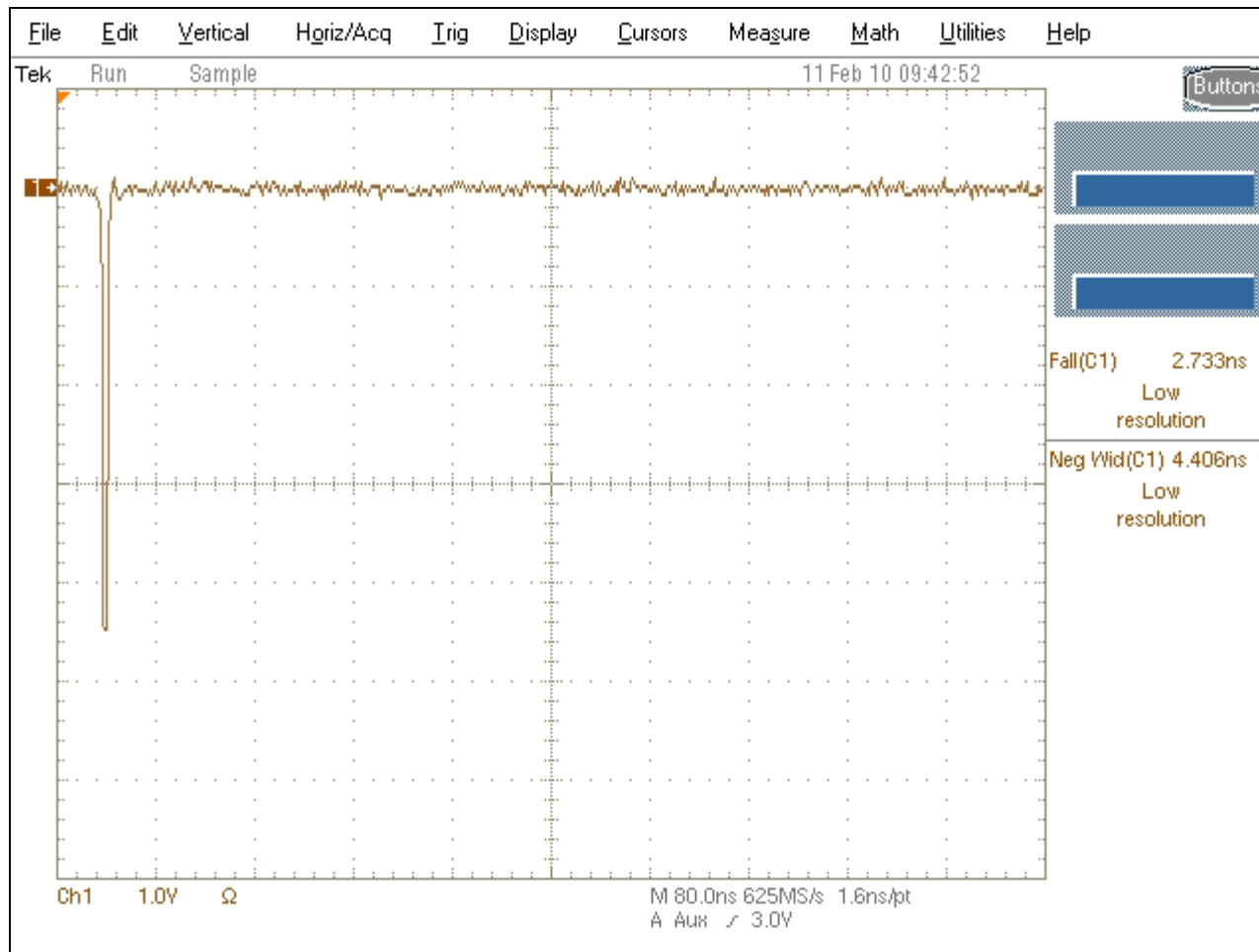
# Partially Assembled DSRD Circuit



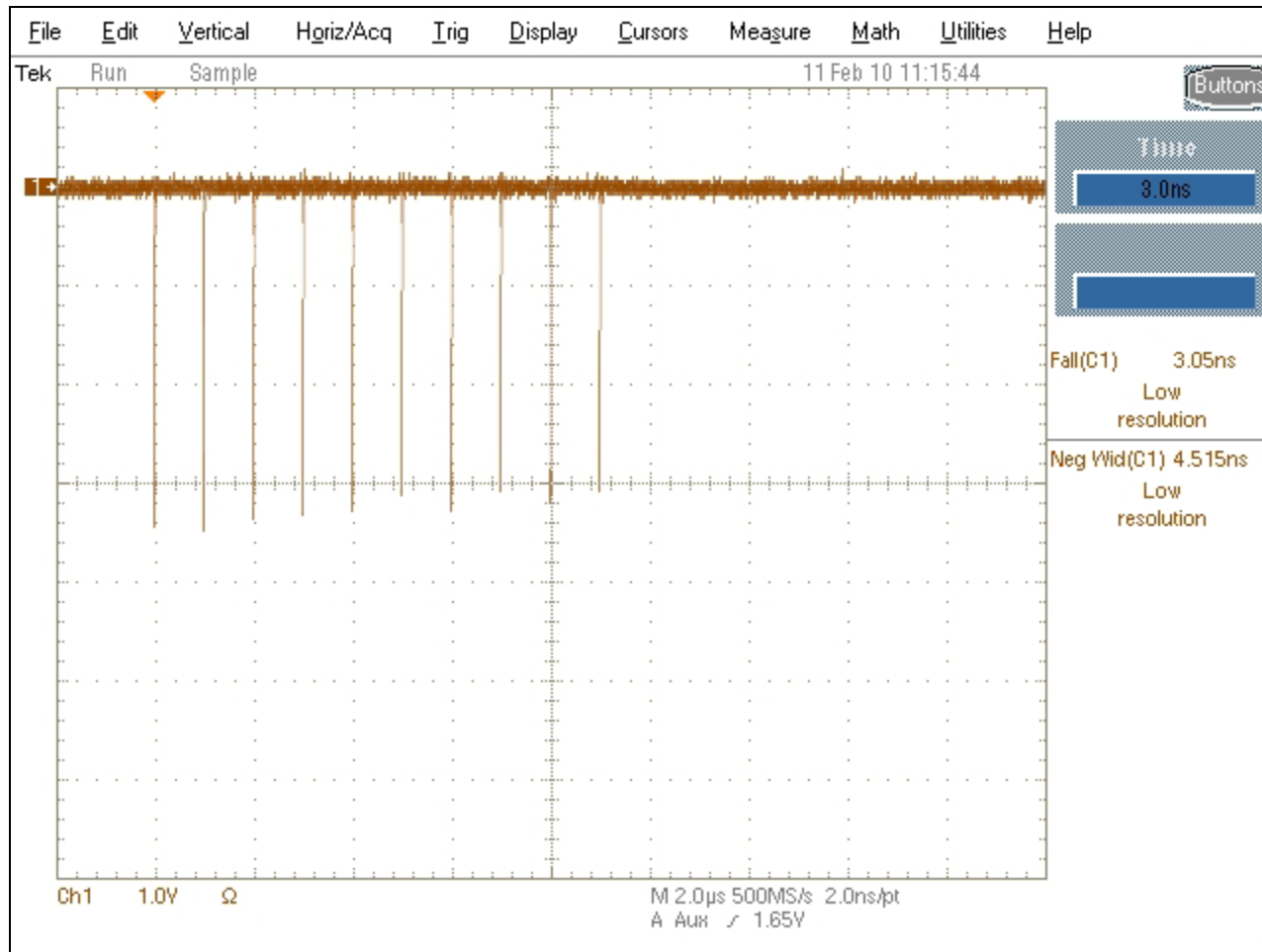
# Reduced Width (2 ns) Output Waveform



# Output Waveform: No Post-pulse



# Output Waveform: 1 MHz Pulse Train





# Development Plan

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- FET-Adder
  - 2<sup>nd</sup> Generation MOSFET/driver (FY11)
    - Partial support from FNAL Project X
  - Full scale adder (FY12)
- DSRD-Opening Switch
  - Full scale prototype (FY11-Q1)
  - Demonstration modulator (FY11-Q2)
  - ATF2 Testing (FY11)