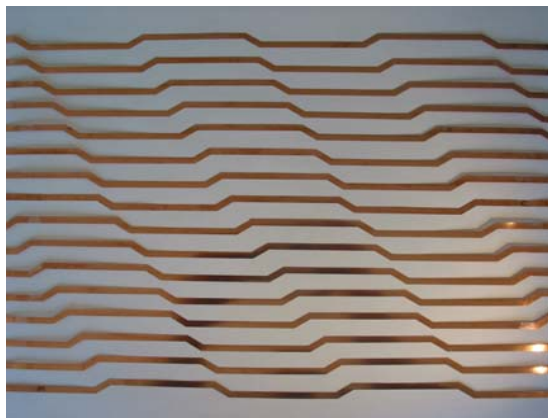


# Meeting customer requirements for ROEBEL cable for ac applications

- ROEBEL cable is a known approach to produce low ac loss, high current conductor/cable
- Conductor exposed to severe mechanical cutting at sharp angles



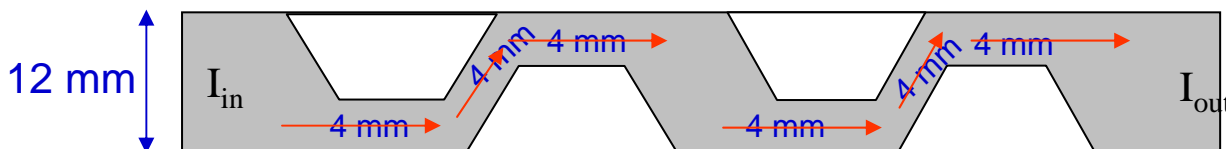
ROEBEL cable made by Forschungszentrum Karlsruhe with SuperPower® 2G HTS Wire

No failure, no delamination

Only 3% loss in current from conductor to ROEBEL cable

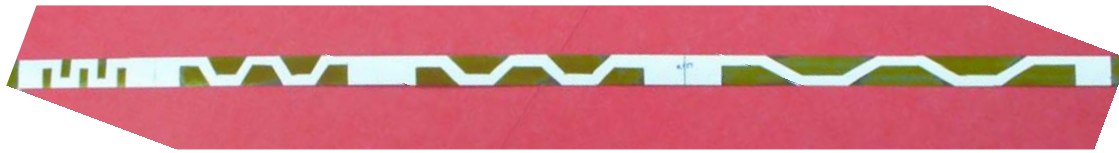
Cable engineering current density = 11,300 A/cm<sup>2</sup>

Degradation in  $I_c$  in a ROEBEL cable can be due to mechanical defects caused by cutting or non-uniformity of current flow across width

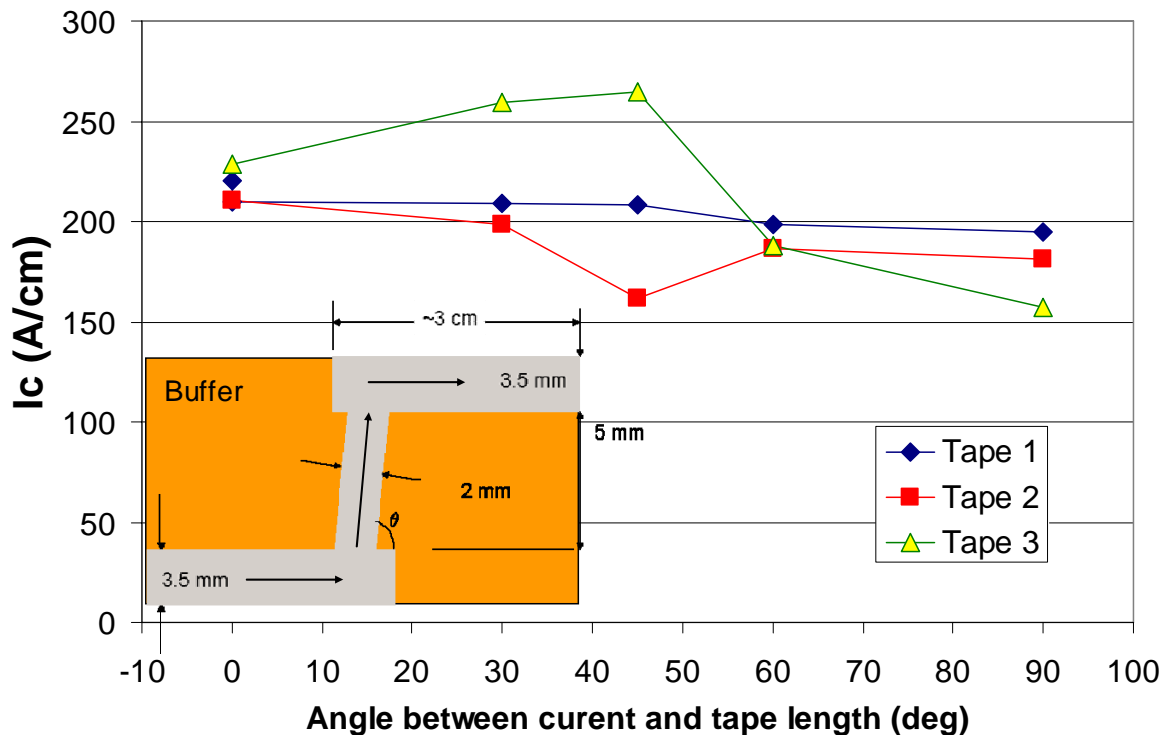


*Useful to separate the two mechanisms and study current flow across width by itself*

# Dependence of $I_c$ with different angles of current flow evaluated for ROEBEL application



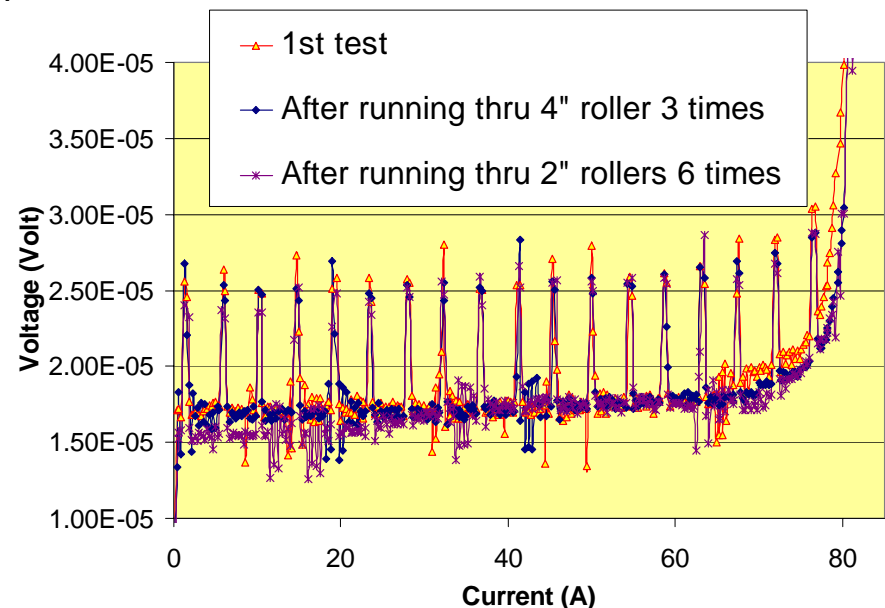
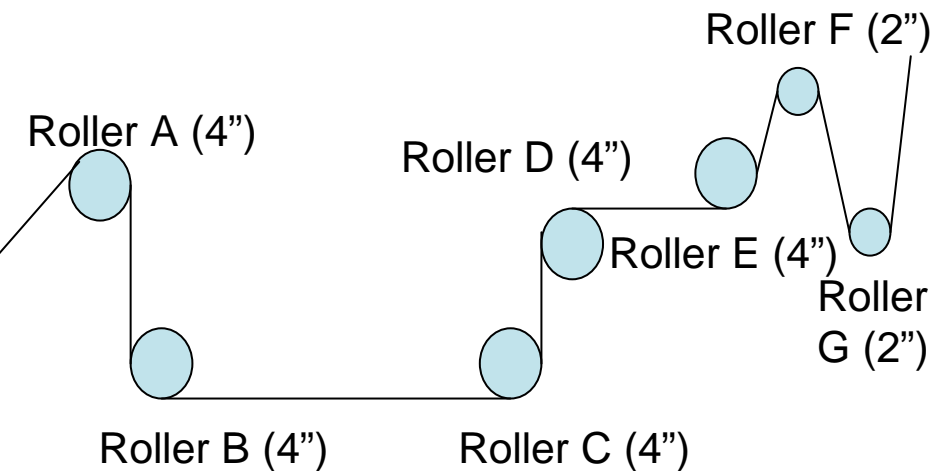
12 mm wide 2G wire patterned in multiple segments for measurements of  $I_c$  at different angles of current flow



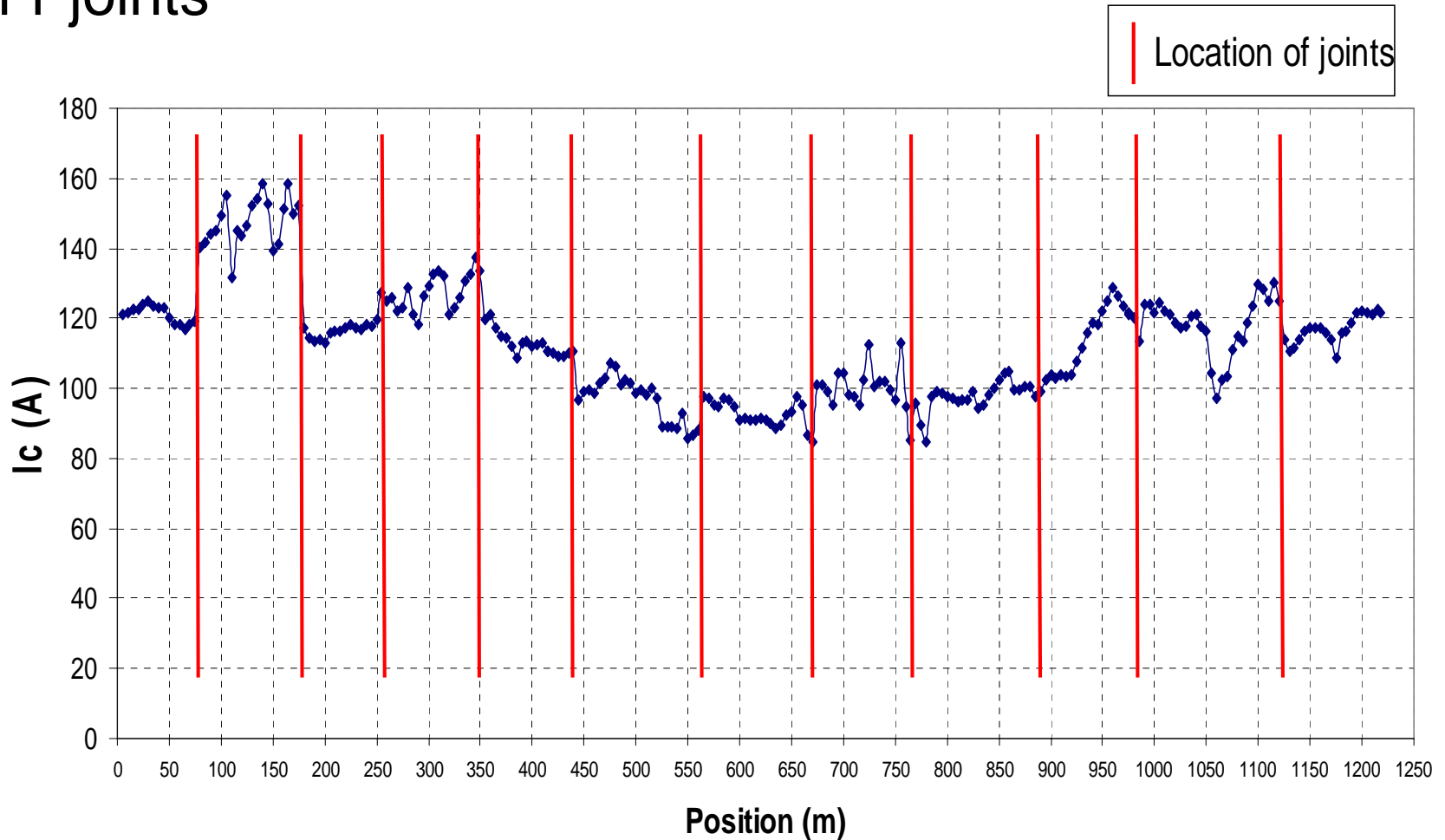
No systematically discernible  $I_c$  reduction in intermediate angles that are employed in ROEBEL conductor fabrication

# Meeting customer performance requirements for joints: mechanical robustness proven in *Production Mode*

- At ASC 2006, we reported good performance of joints made in test lab.
- A customer required 1,200 m of 2G wire with 11 joints for a coil application. The Ic of entire wire length and resistance of all joints had to be *tested after joining*
- A production operation was developed to make consistently high-quality joints
- Also, the mechanical robustness of joints had to be established since the joined wire had to be moved through 4" and 2" diameter rollers in the 5 m transport Ic measurement rig at a speed up to 400 m/h

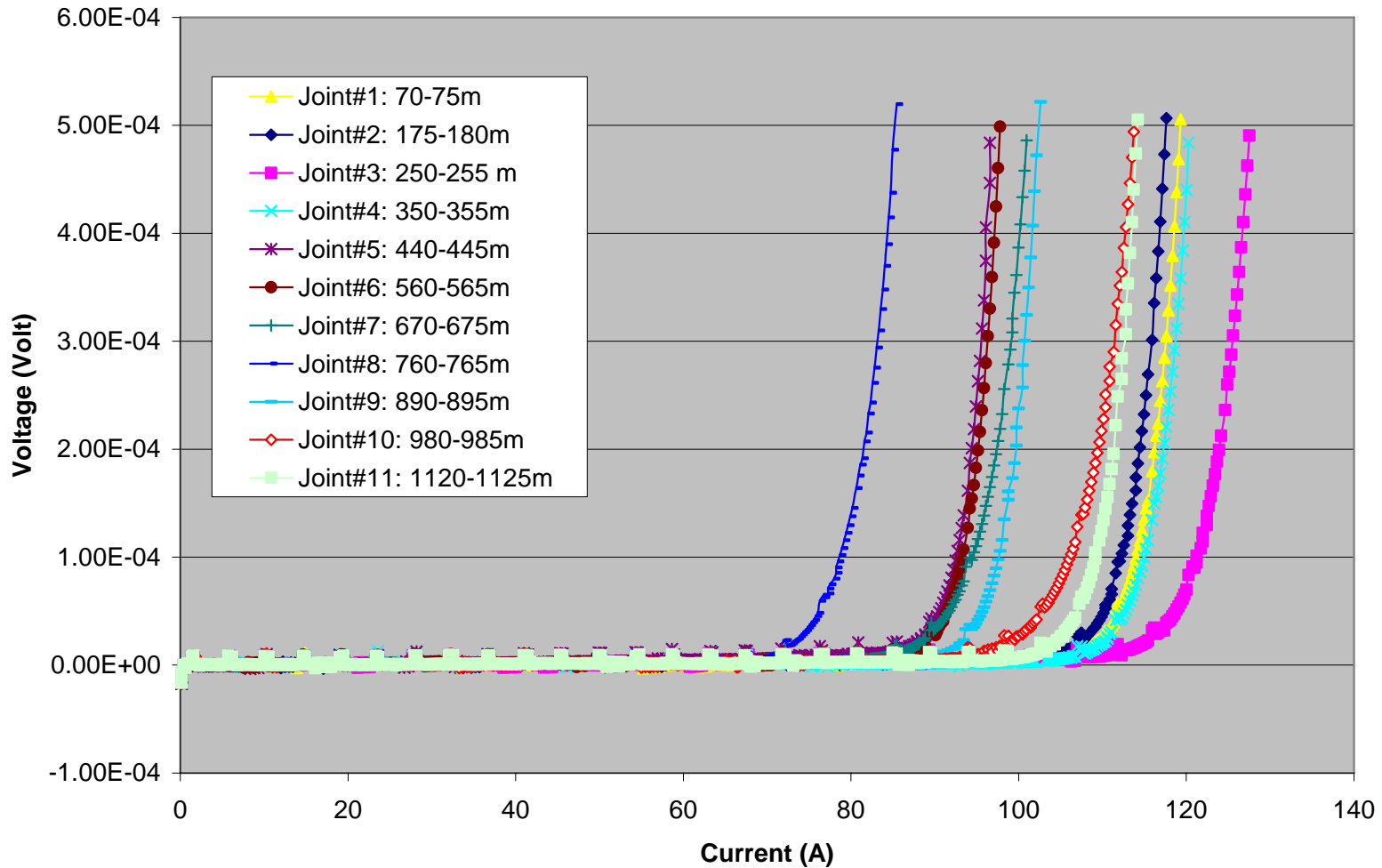


# Ic measured every 5 meters over 1,218 m of wire with 11 joints



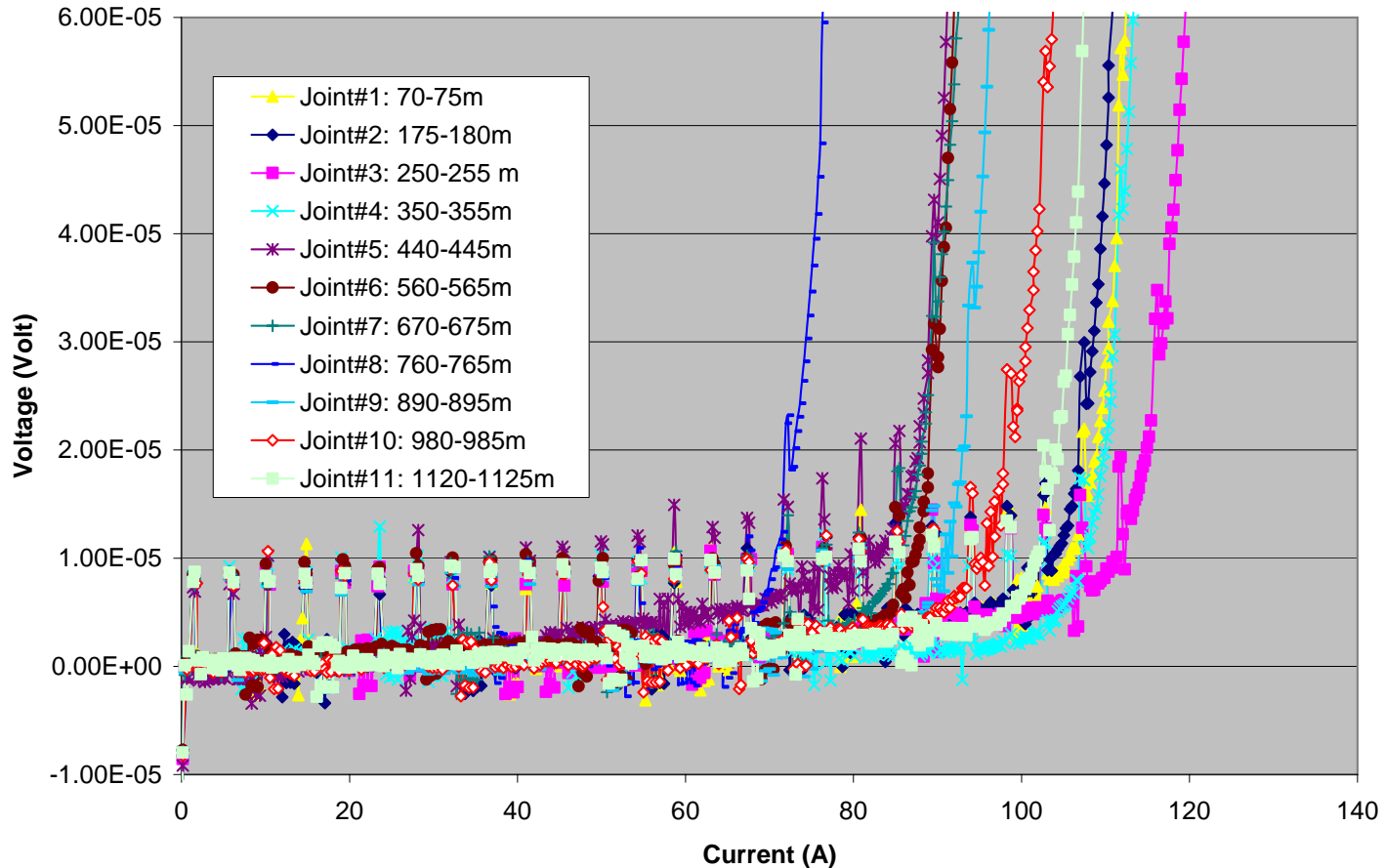
Arrangement of the 12 segments along the length was decided based on communication with customer so that the Ic profile would fit the coil winding requirements

# I-V curves of the 11 sections containing the joints



All 11 joints show smooth transition at their respective  $I_c$

# Excellent resistance measured in all joints

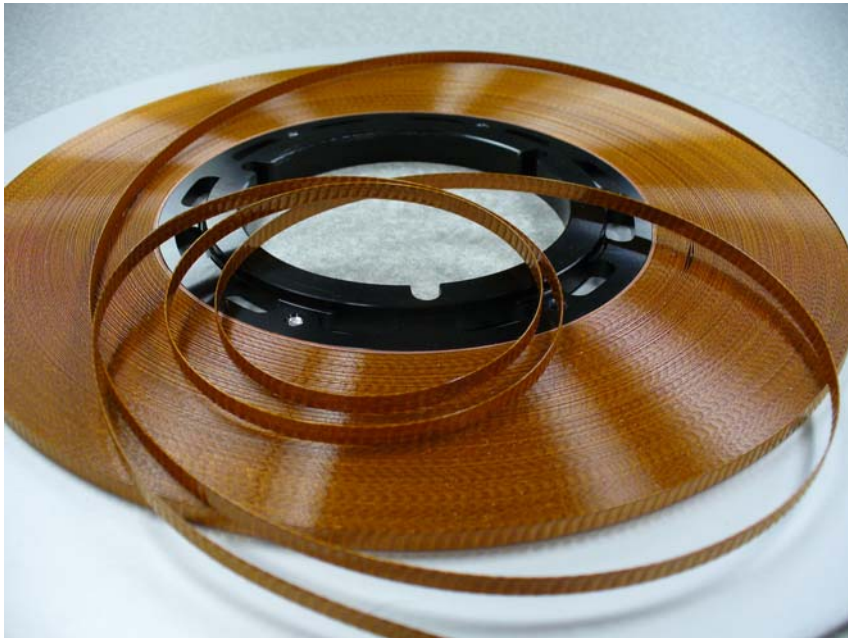


All but one of the joints showed a resistance around **33 nΩ**, One joint showed a resistance of 100 nΩ, still within limit



# Customer-driven development of insulated wire

- Several customers, primarily for coil applications, required insulated 2G wire
- After evaluating a number of vendors, we procured a system for in-house fabrication of insulated wire
- System in place and being used for both 12 and 4 mm wide wire



- Preliminary test showed no breakdown at 1000 V with 0.0025 mm polyimide film
- Deliveries of insulated wire already being made.





