HIGH POWER MEGASONIC CLEANING in the CMP Application

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Agenda

- Company Overview
- Megasonic Technology Review
- CMP Application and Results
- Trends:
  - Chemistry & Physics
  - Batch -vs - Single Wafer
- Summary

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Company Overview

- 6 year old - privately held corporation
- Superior technology - Bonding
  - High Speed Electronics
  - High Power RF
- Patents issued and applied for
- Customer Base (70+ units in the field)
- 9000sq/Ft in Campbell, Calif. (Class 10 cleanroom)

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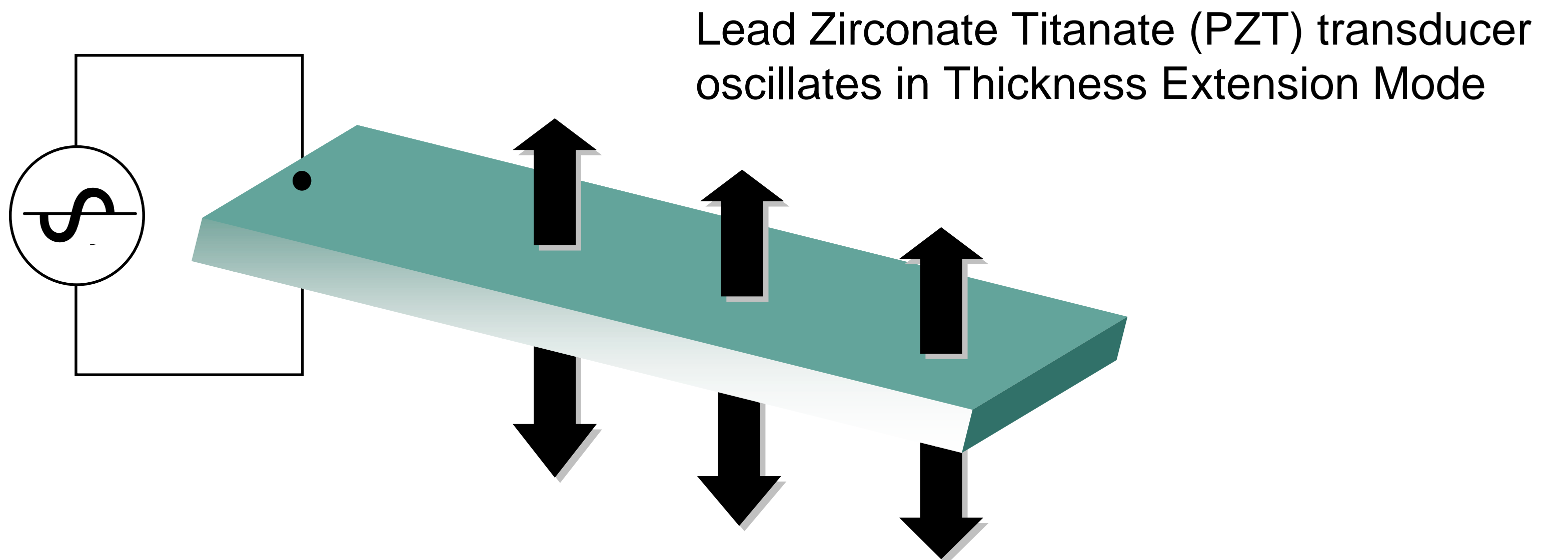
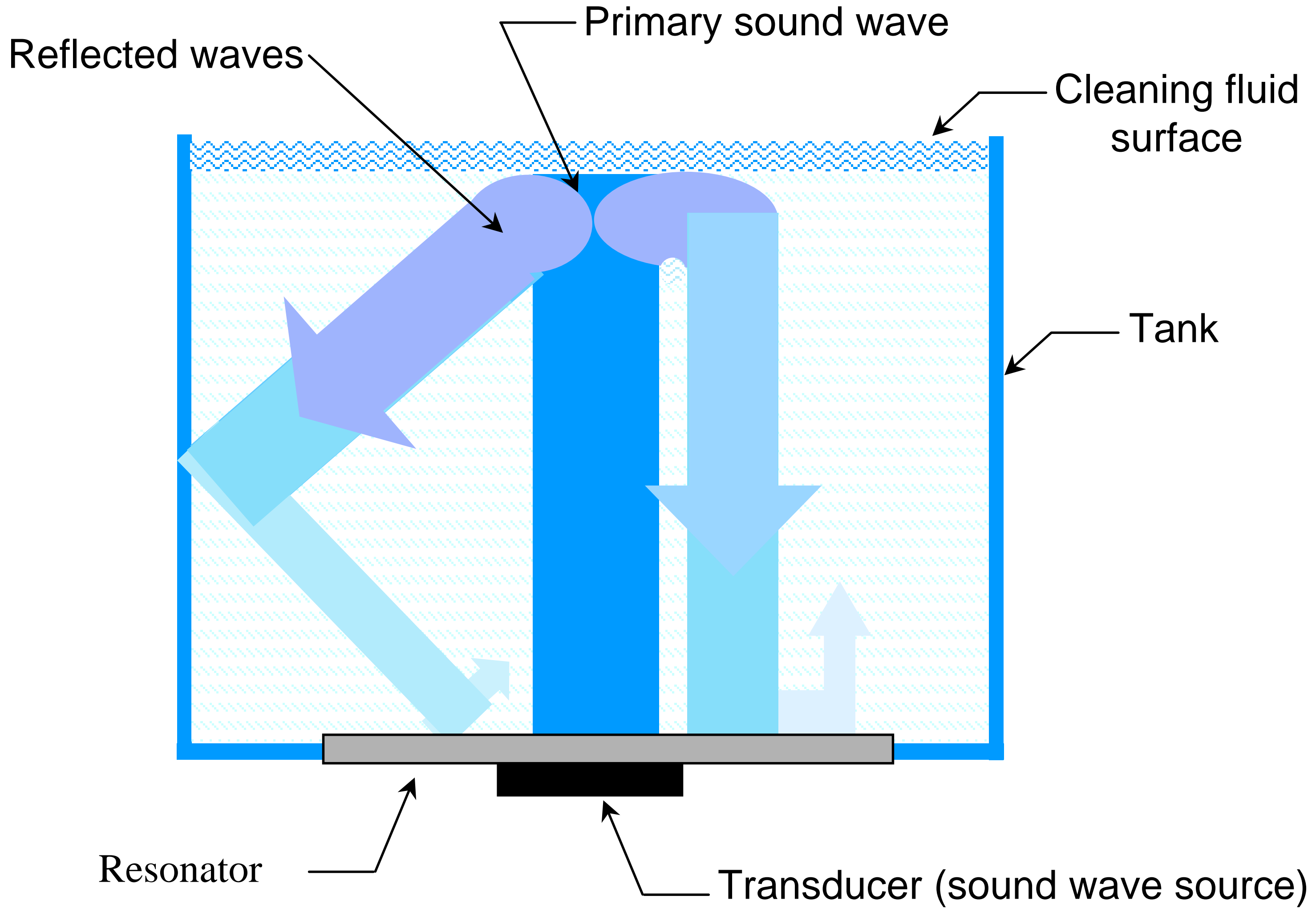
Technology

- What is Megasonics?
  - **Megasonic** cleaning uses high-frequency acoustic energy to generate pressure waves in a liquid bath.



Continuous Wave Megasonics



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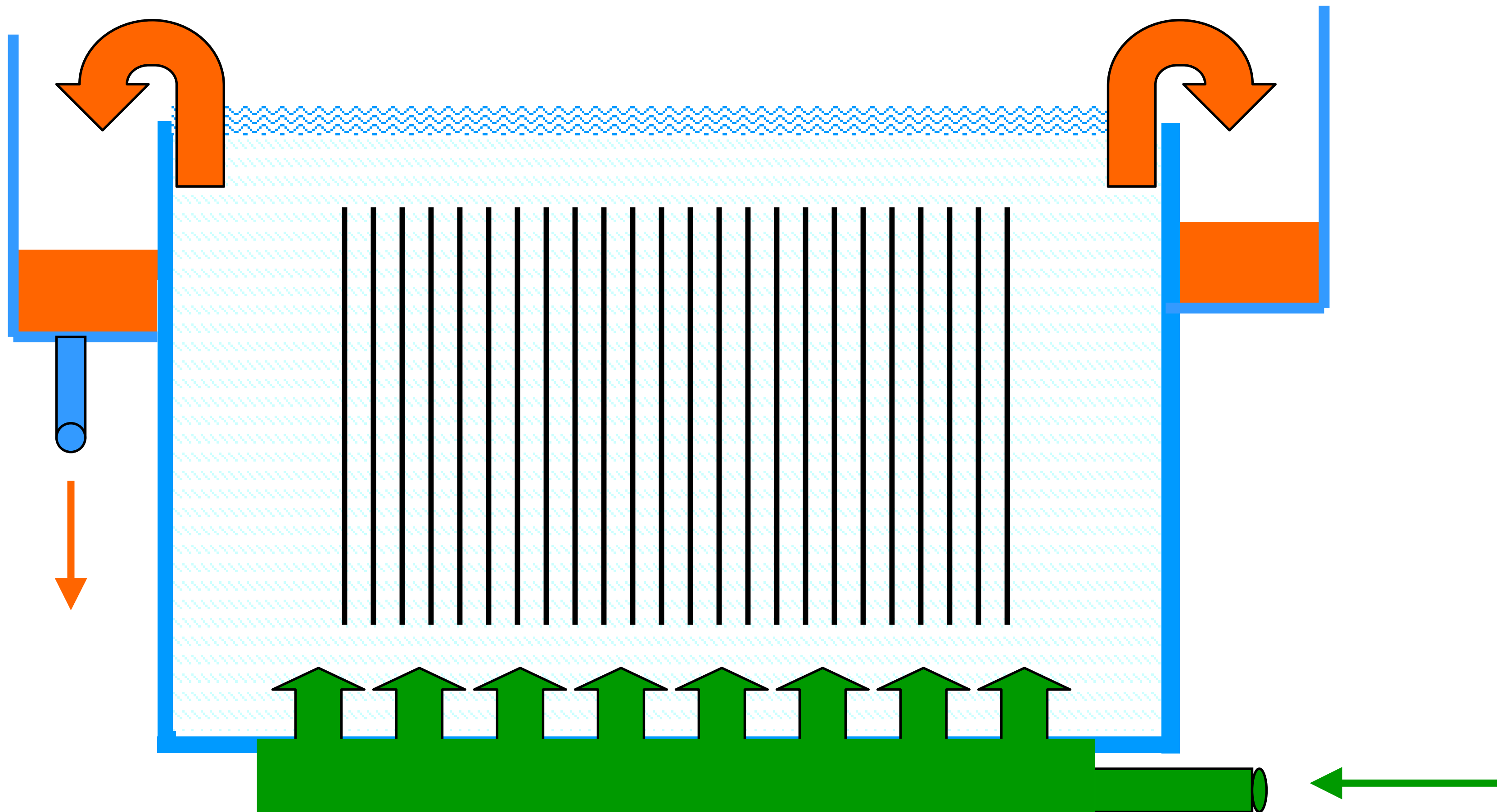
Fluid Dynamics



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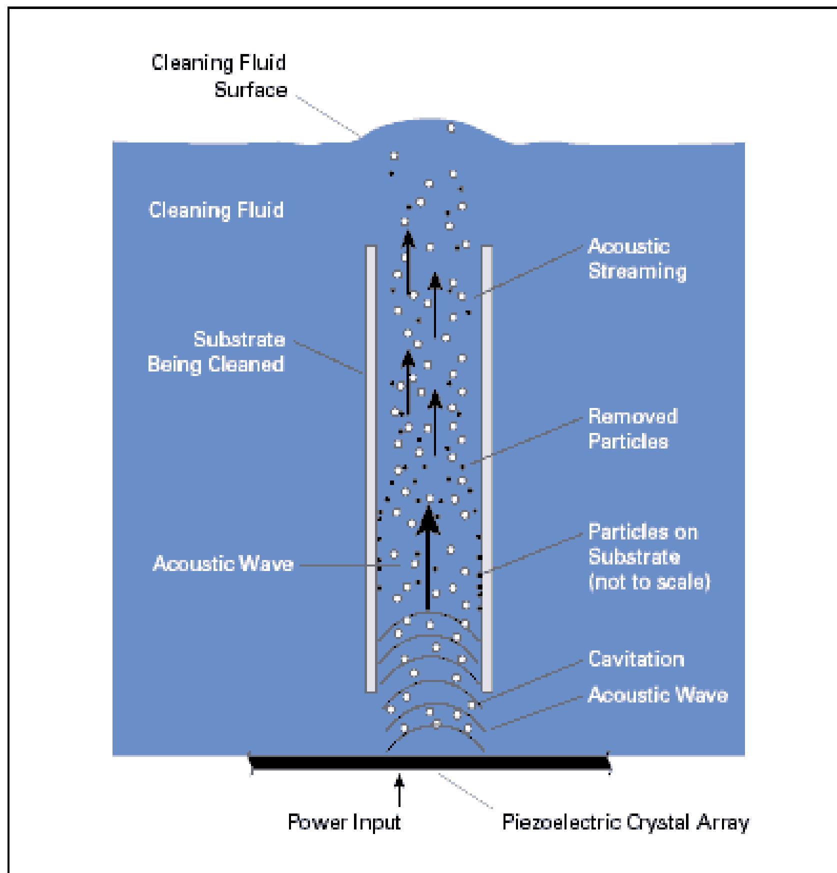
Micro-Streaming



- Shearing forces at wafer surface assist in removing particles
- Streaming enhances transport of detached particles
- Velocity is a function of:

f*(energy, fluid density, fluid type, geometry)*

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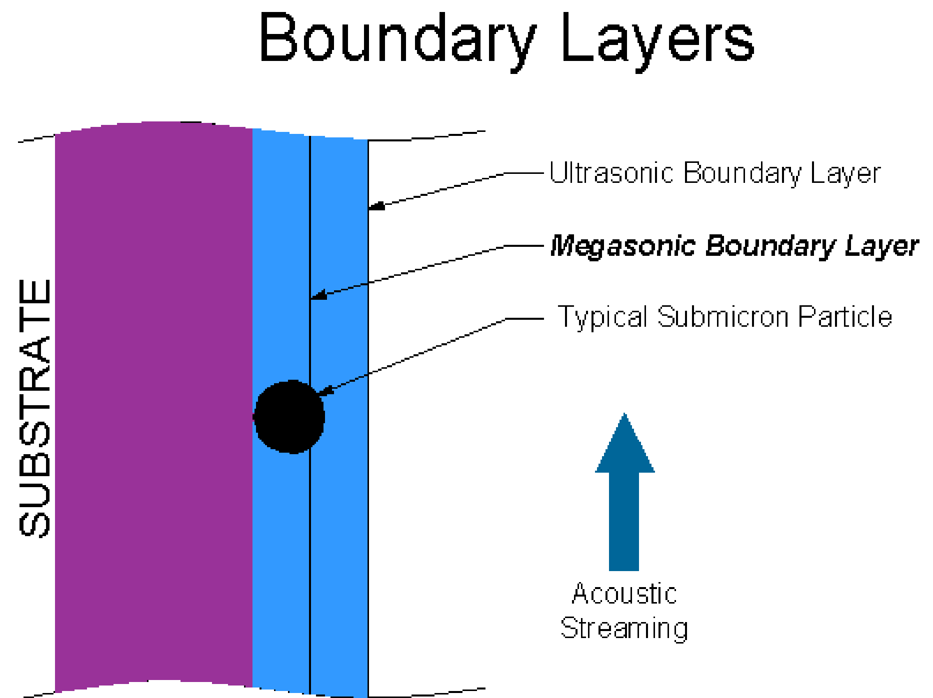
Boundary Layer

Megasonic vs. Ultrasonic

- Megasonic pressure is required to move cleaning fluids in the boundary layer



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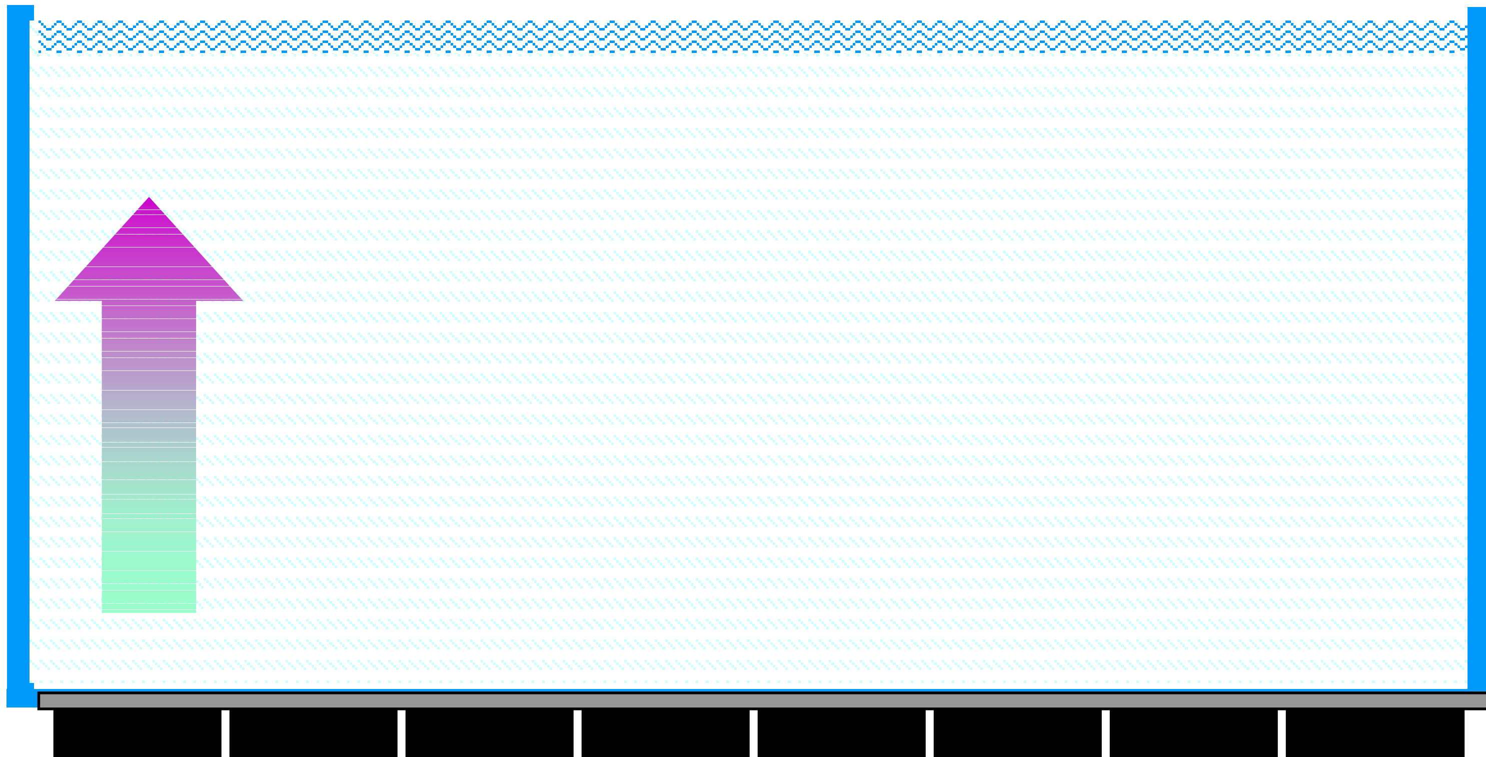
Switched Wave Megasonic



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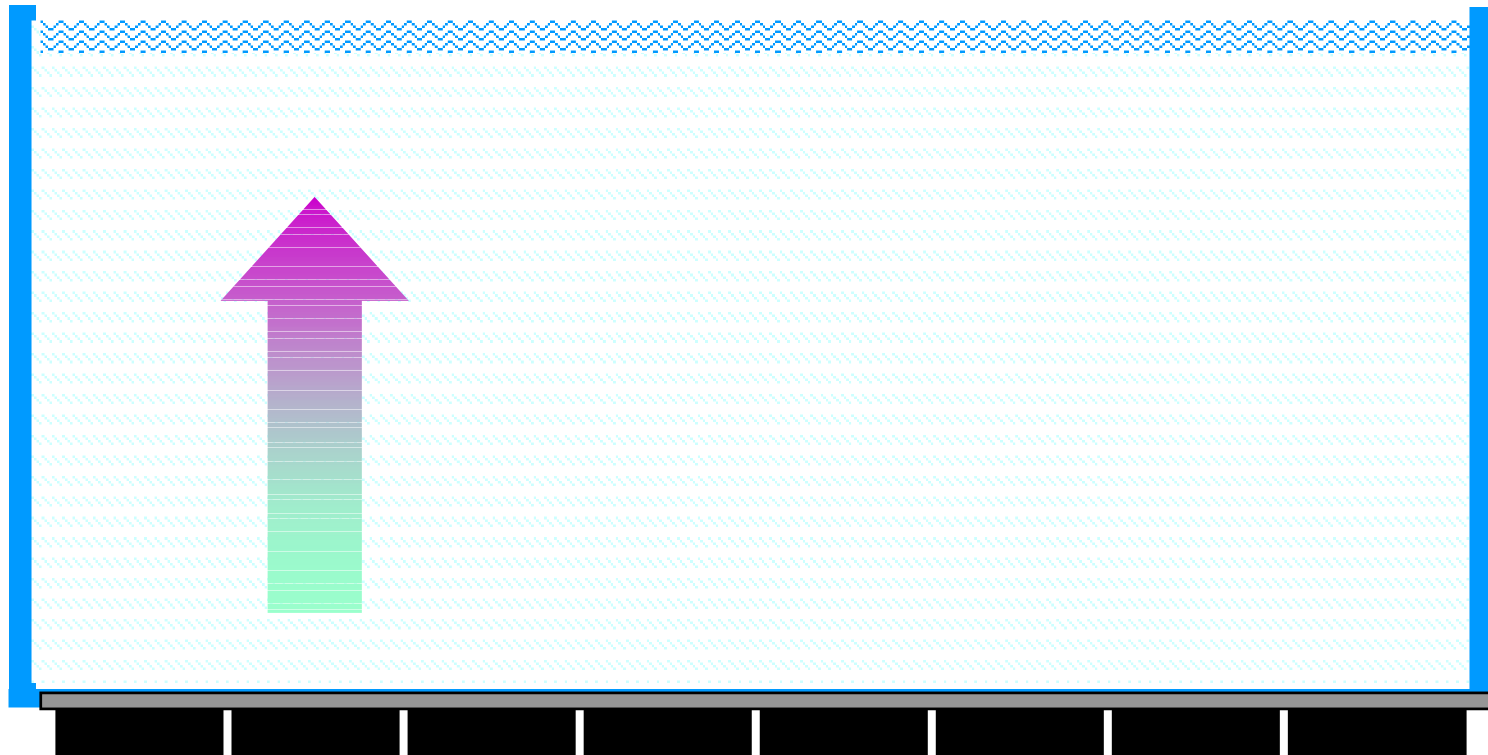
Switched Wave Megasonic



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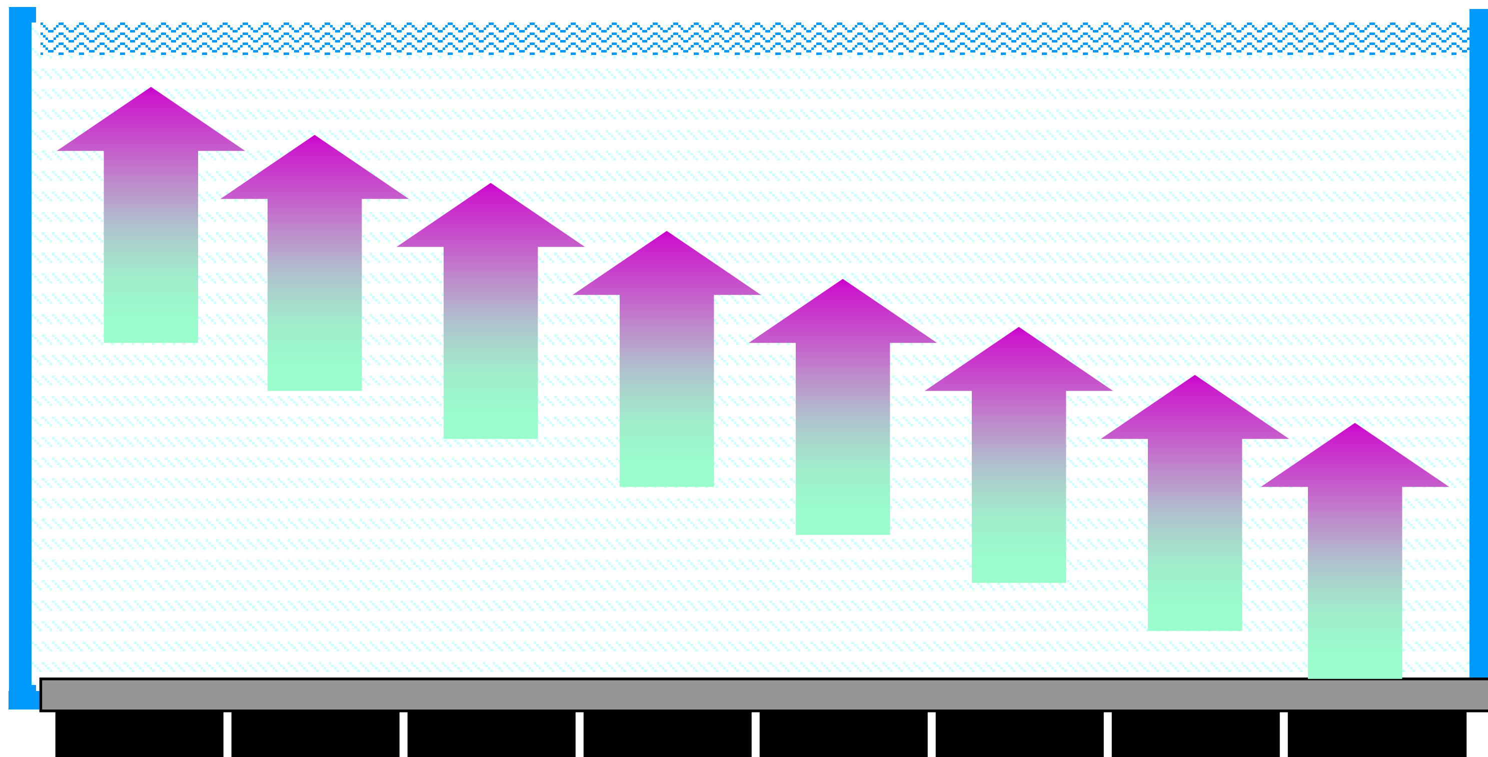
Switched Wave Megasonic



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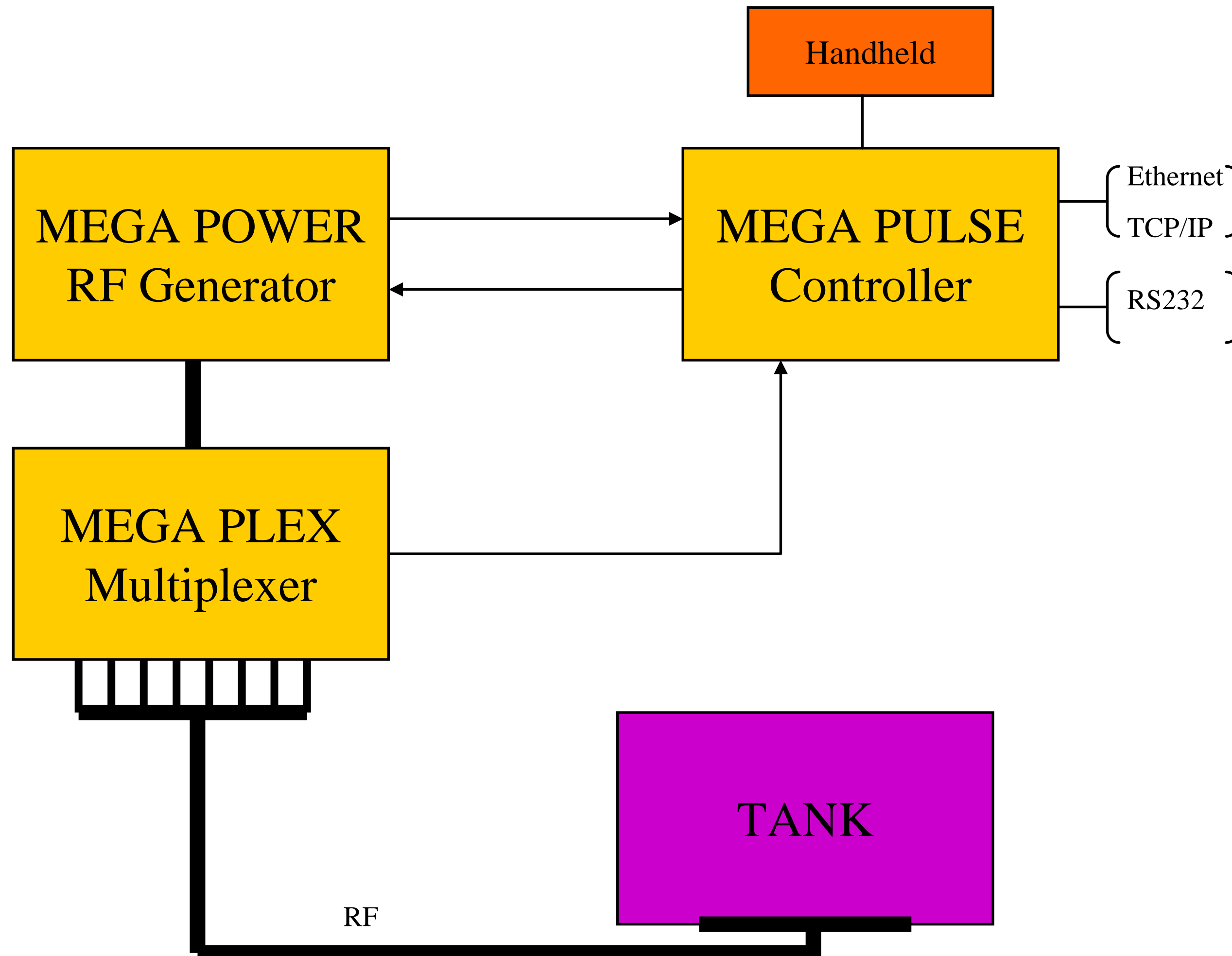
Electronics

System Configuration



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Advanced Electronics

- Advanced RF design (Class D/E - 85% efficient) based on proven technology
- 900 - 950 kHz, 0 - 1000watts (<25w/cm2) Pending Resonator Material
- Controls:
  - Forward Power
  - Reflected Power
  - Real Power
- Embedded Controller (Motorola "ColdFire")
- Ethernet, TCP/IP and RS-232 compatible
- Standard 19" rack mount

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Trends
Chemistry & Physics

- **High Concentrations** SC-1 (5:1:1) - time dependant
- **Increased heat** (50º - 100ºC) - reduced time
- **Ultrasonics** - reduced time but increased damage
- **Megasonics (2-6w/cm2)**
  - smaller particles (lower boundary layer)
  - reduced damage
- **High Power Megasonics (<25w/cm2)**
  - Reduced heating (<60ºC)
  - Reduced Concentrations (>100:1:1)
  - Faster throughput

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Trends

MEG Batch vs. Single Wafer

- Batch tanks through 150mm
- Batch & Single wafer CMP at 200mm
- High Power Meg batch continues at 300mm
- Single wafer CMP and Cleans at 300mm
    - Vertical wafer
    - Horizontal wafer (on spinners)

    Note: Radial uniformity becomes important

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Summary

- Technology advances in Megasonics offer unique new capabilities (Power and Control)
- High Power Megasonics clean slurries with
  - Low concentrations of chemistry (<100:1:1)
  - Excellent results down to 0.16µ LPDs
  - High throughput
- Batch is extended into 300mm with High Power Megs
- Trend is toward single wafer for all 300mm applications

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