

HIGH POWER MEGASONIC CLEANING **in the CMP Application**



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Agenda

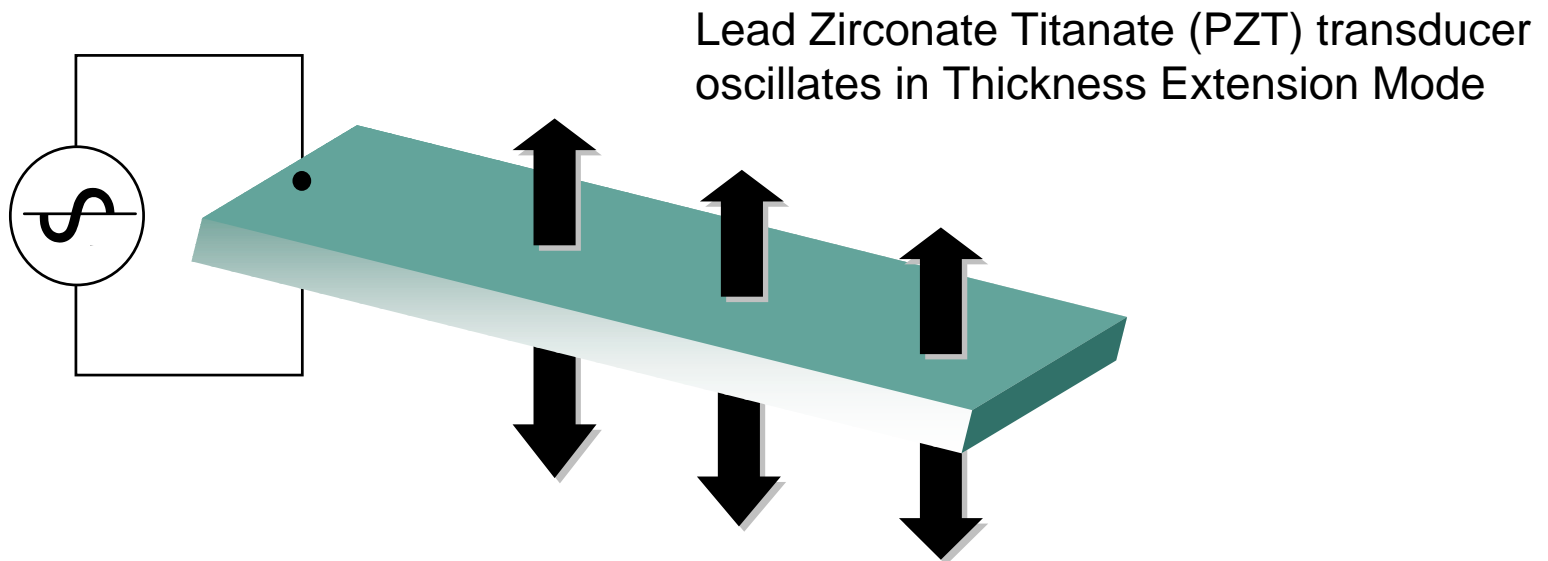
- Company Overview
- Megasonic Technology Review
- CMP Application and Results
- Trends:
 - Chemistry & Physics
 - Batch -vs - Single Wafer
- Summary

Company Overview

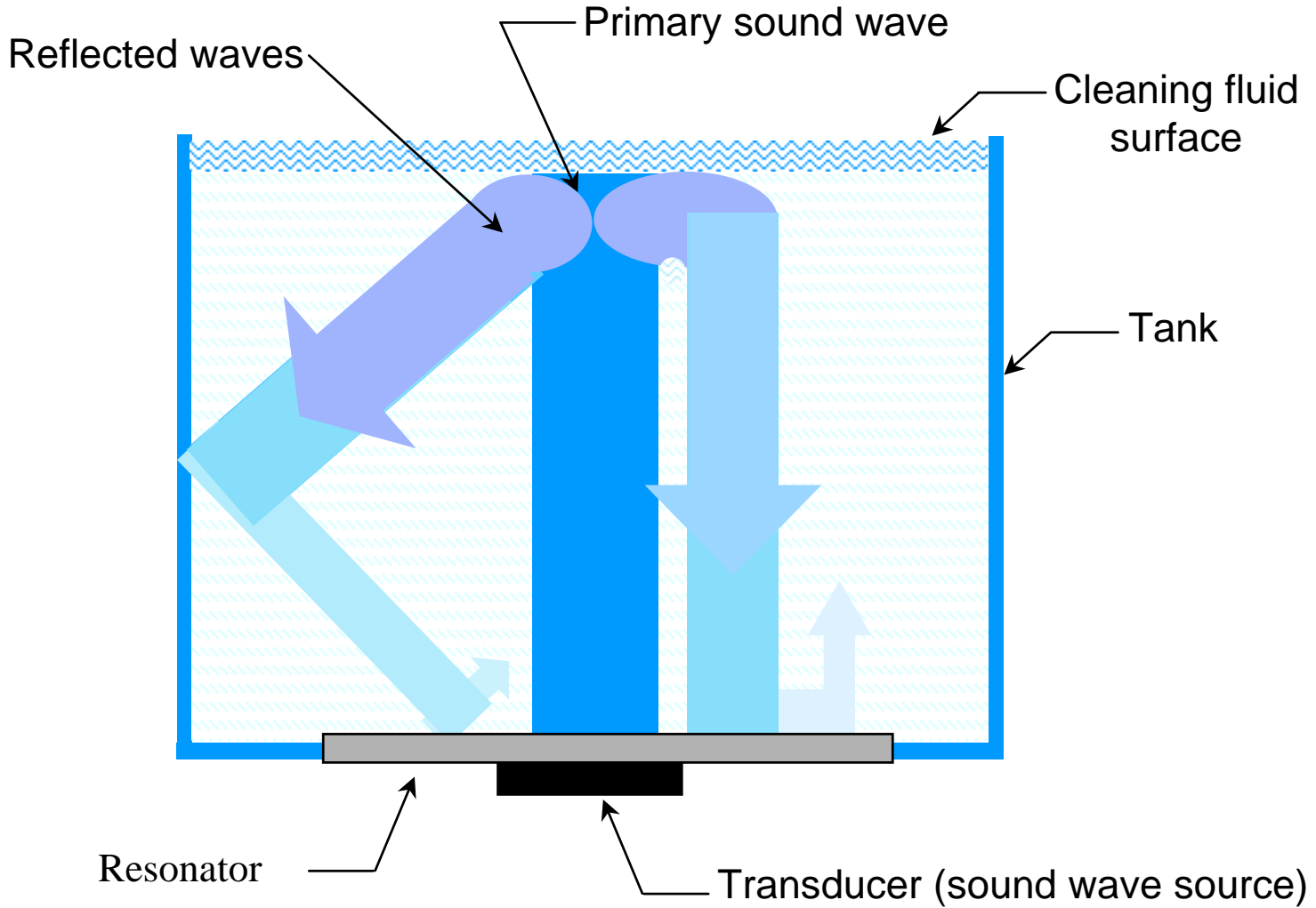
- 6 year old - privately held corporation
- Superior technology
 - Bonding
 - High Speed Electronics
 - High Power RF
- Patents issued and applied for
- Customer Base (70+ units in the field)
- 9000sq/Ft in Campbell, Calif. (Class 10 cleanroom)

Technology

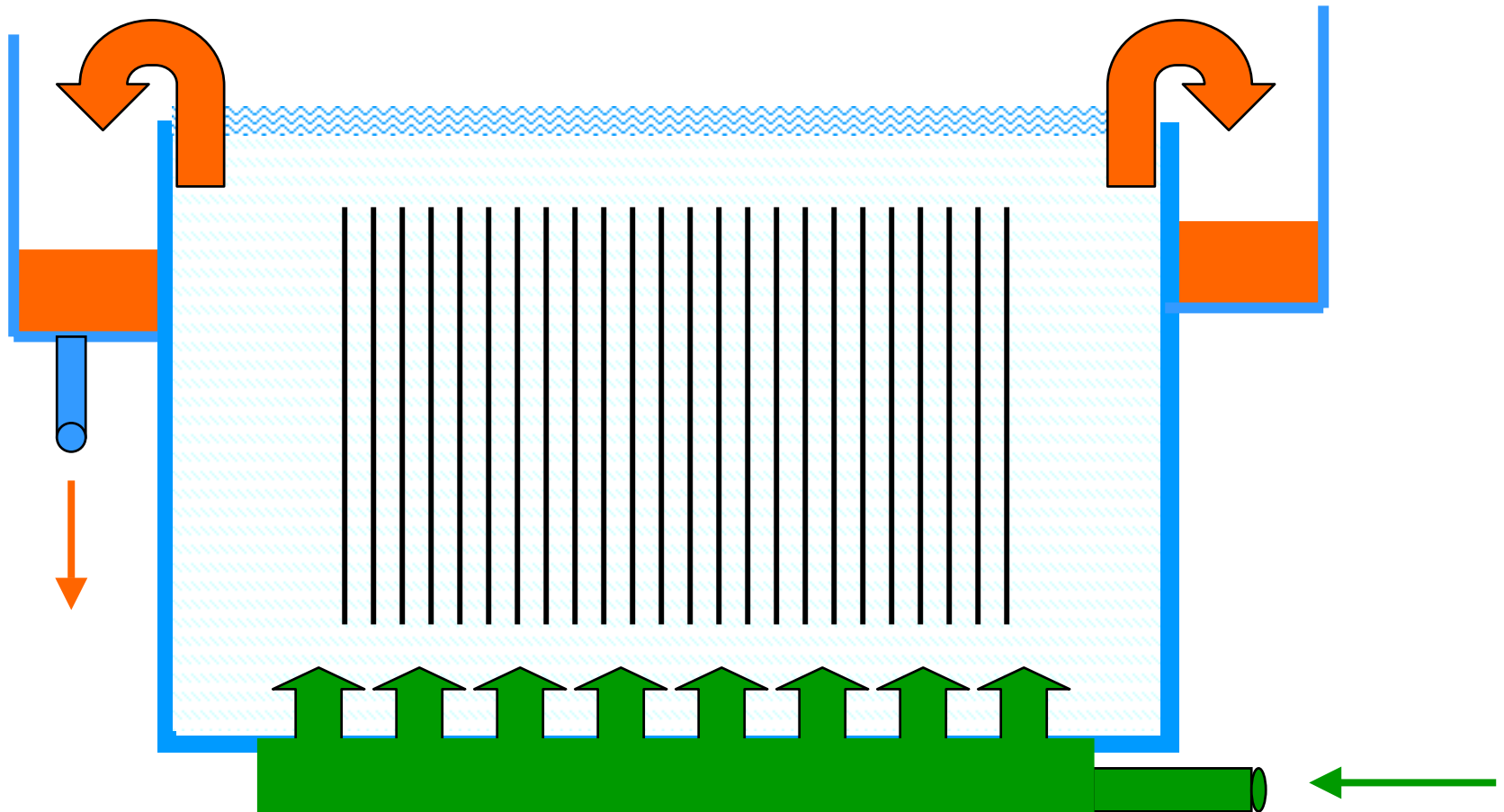
- What is Megasonics?
 - **Megasonic** cleaning uses high-frequency acoustic energy to generate pressure waves in a liquid bath.



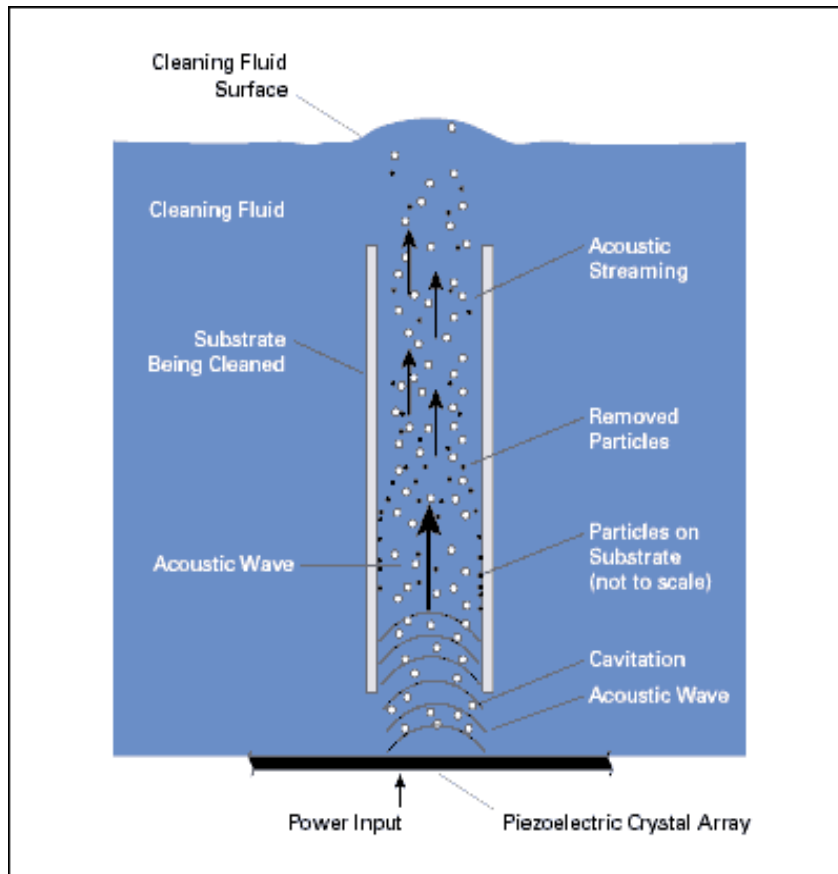
Continuous Wave Megasonics



Fluid Dynamics



Micro-Streaming

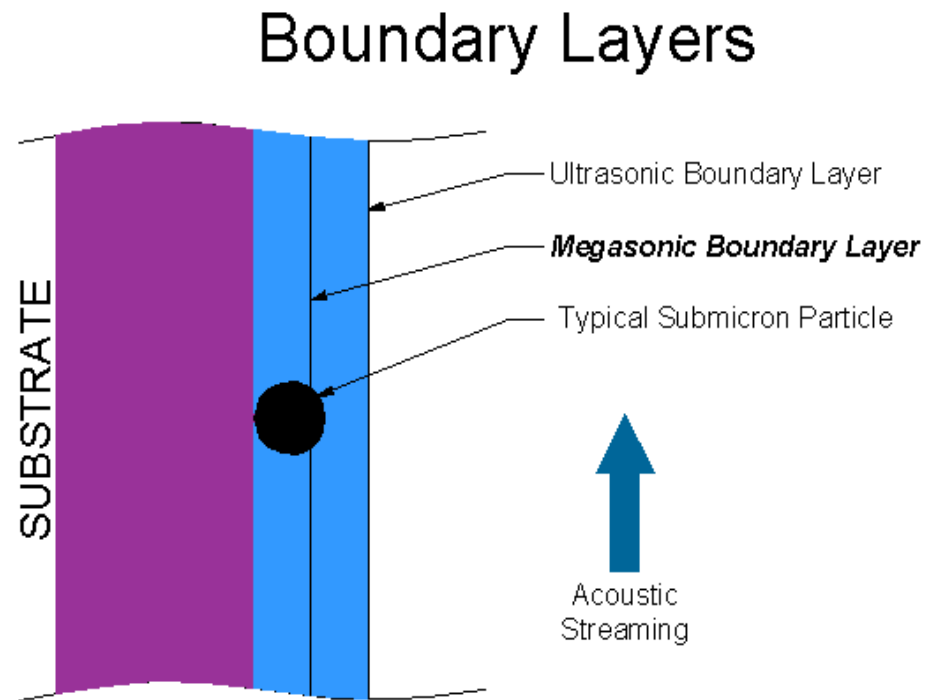


- Shearing forces at wafer surface assist in removing particles
- Streaming enhances transport of detached particles
- Velocity is a function of:
***f**(energy, fluid density, fluid type, geometry)*

Boundary Layer

Megasonic vs. Ultrasonic

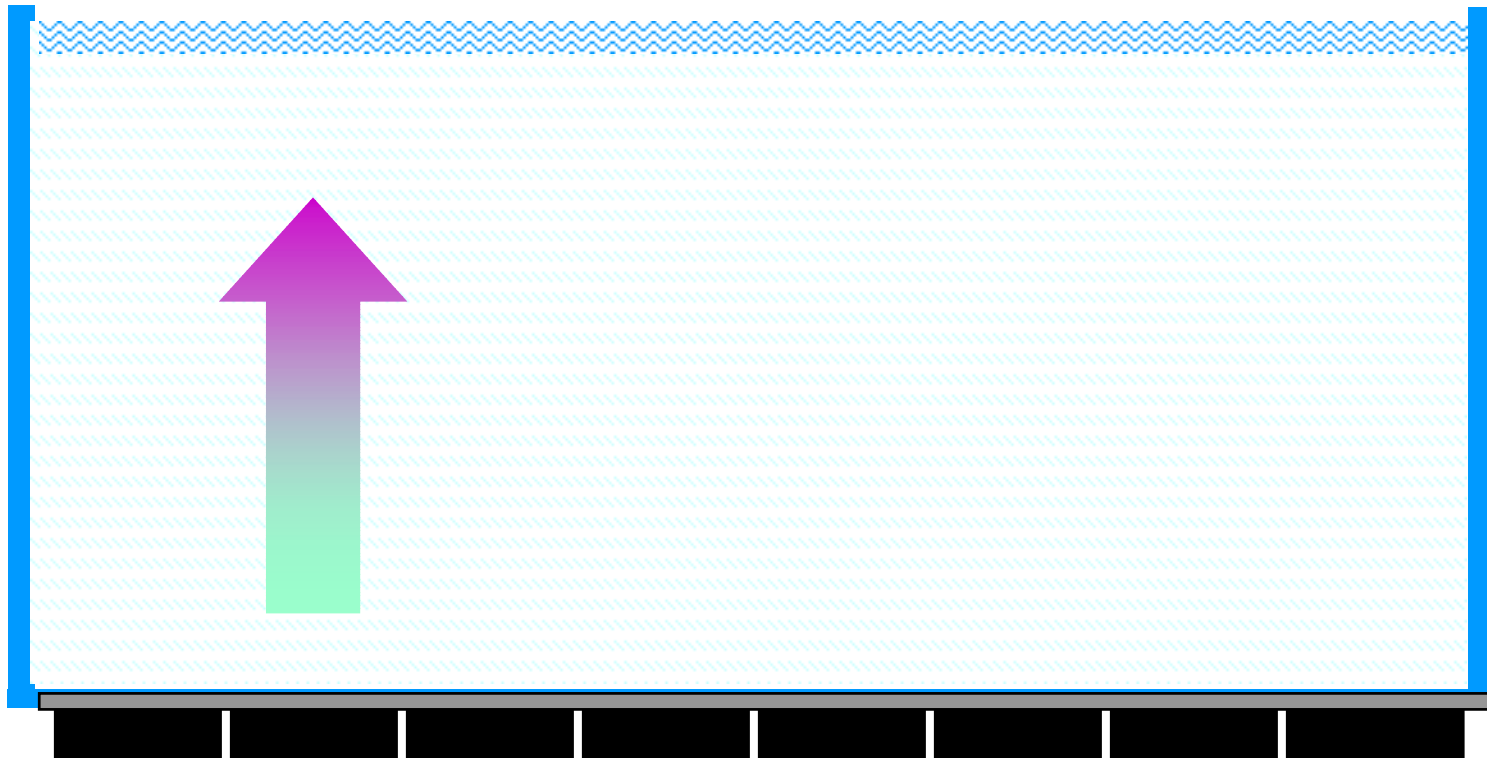
- Megasonic pressure is required to move cleaning fluids in the boundary layer



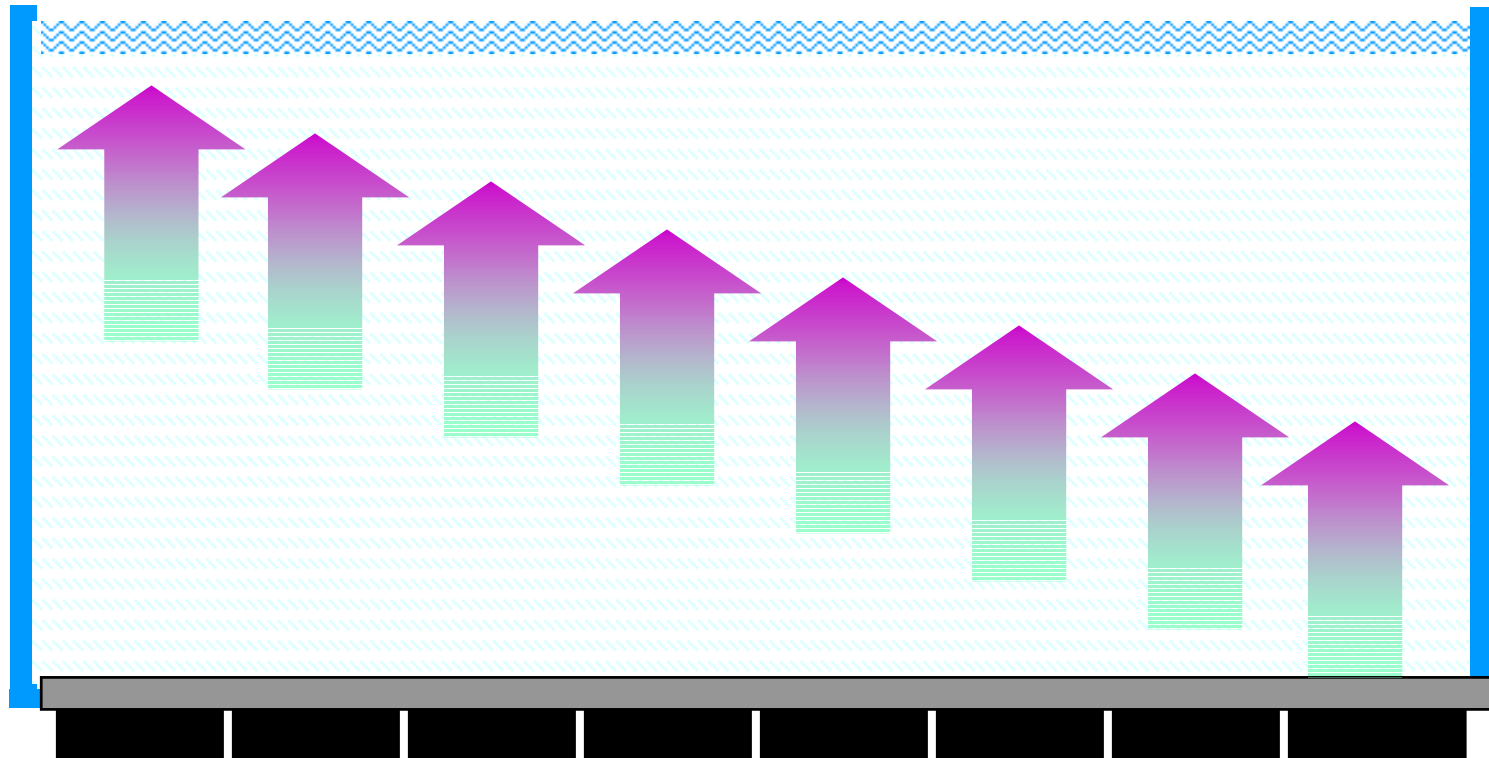
Switched Wave Megasonic



Switched Wave Megasonic



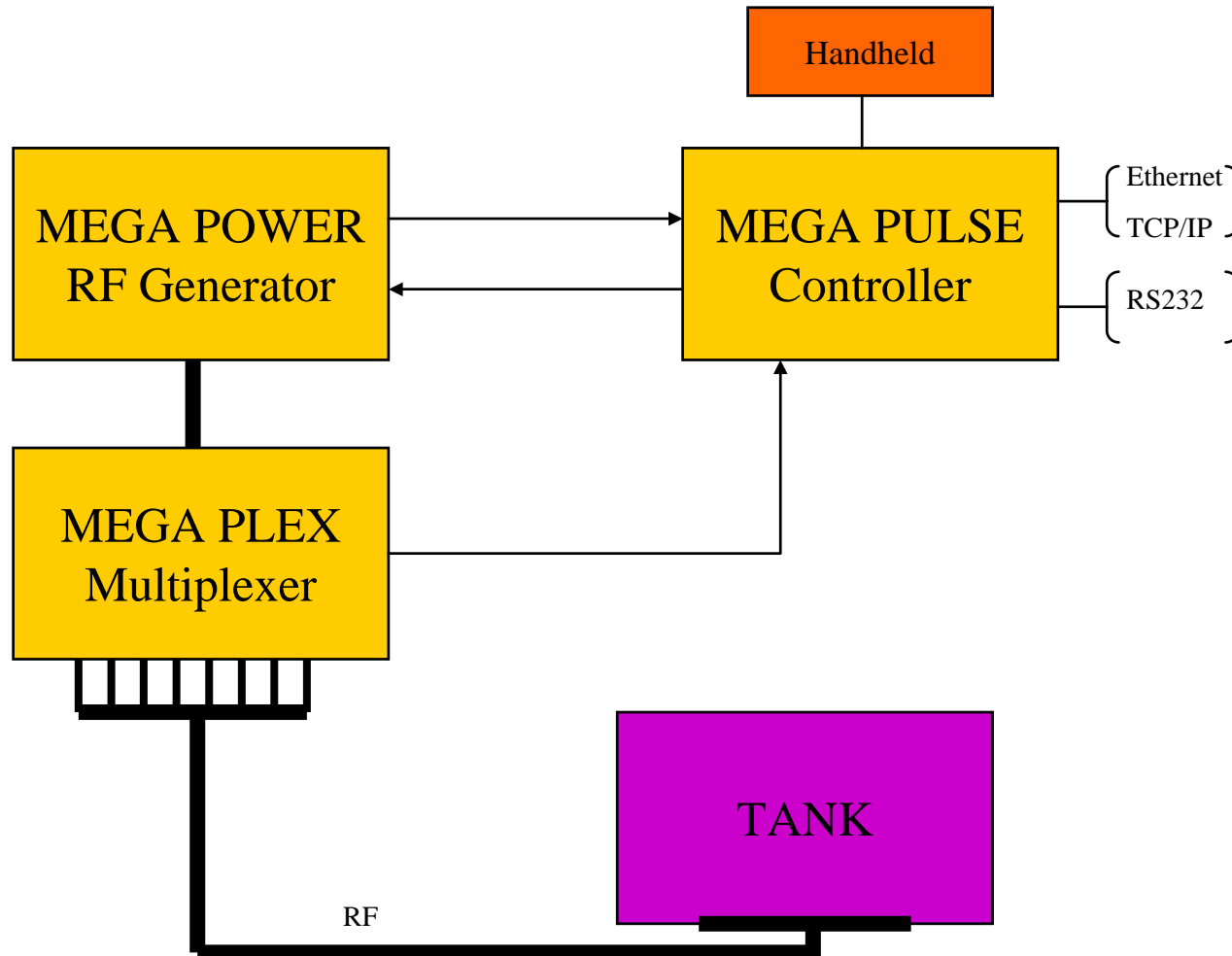
Switched Wave Megasonic



Electronics



System Configuration



Advanced Electronics

- Advanced RF design (Class D/E - 85% efficient) based on proven technology
- 900 - 950 kHz, 0 - 1000watts ($<25\text{w}/\text{cm}^2$) 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

Trends

Chemistry & Physics

- **High Concentrations SC-1 (5:1:1)** - time dependant
- **Increased heat (50° - 100°C)** - 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 (<60°C)
 - Reduced Concentrations (>100:1:1)
 - Faster throughput

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

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 0.16 μ LPDs
 - High throughput
- Batch is extended into 300mm with High Power Megs
- Trend is toward single wafer for all 300mm applications