Integration of Advanced Carrier Head Technology for Established CMP Tools

Dan Trojan

VP Engineering

Axus Technology

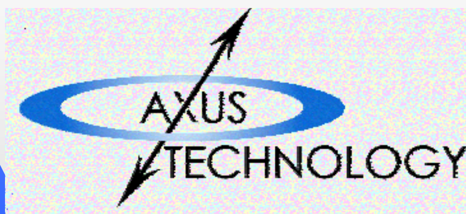
CMPUG September 14, 2011

Agenda

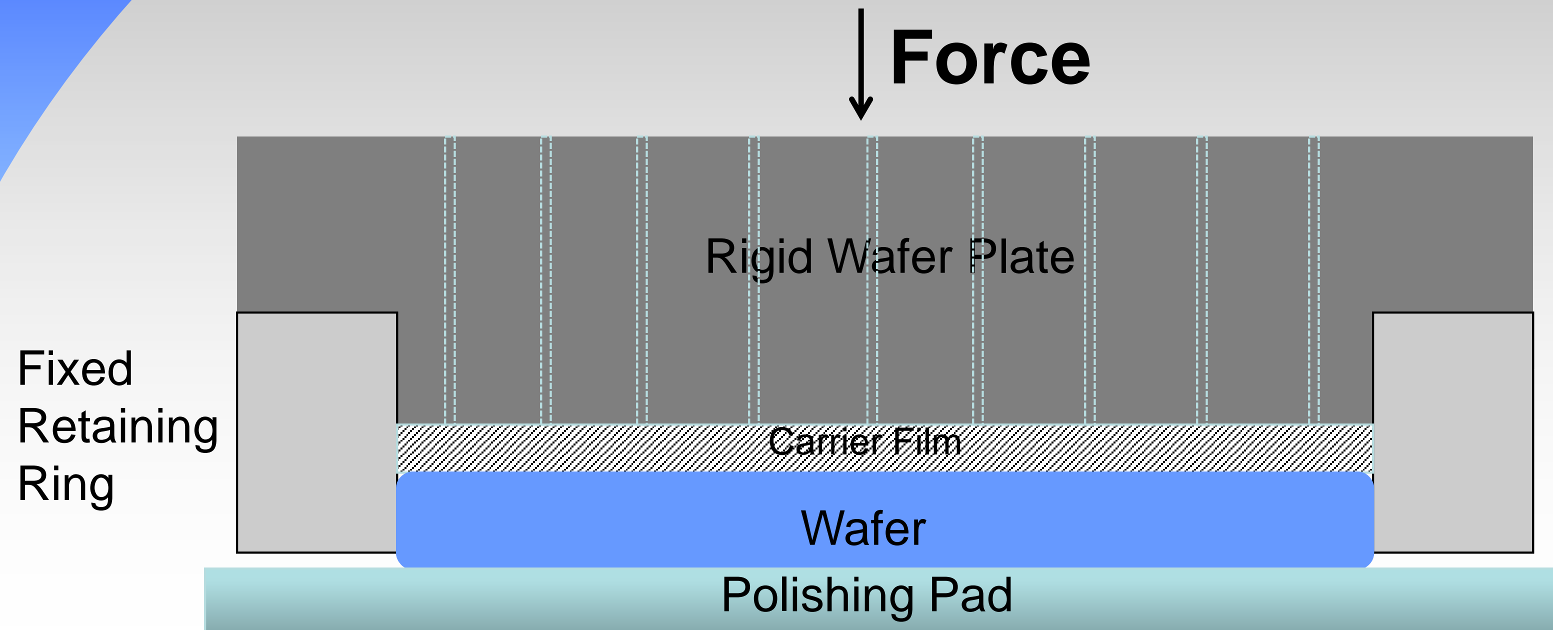
- Technology Background and Evolution
- Process Results Comparison
- Integration Options
- Conclusions

Technology Background and Evolution

- **First generation CMP tools evolved from prime wafer polishing tools**
- **Carrier technology incorporated rigid flat plates for wafer mounting and pressure application**
  - Wax mount
  - Free mount using compressible films
- **Plates with or without pressure orifices for wafer handling and/or backpressure**
- **Fixed retaining rings to position and hold wafer onto carrier face**



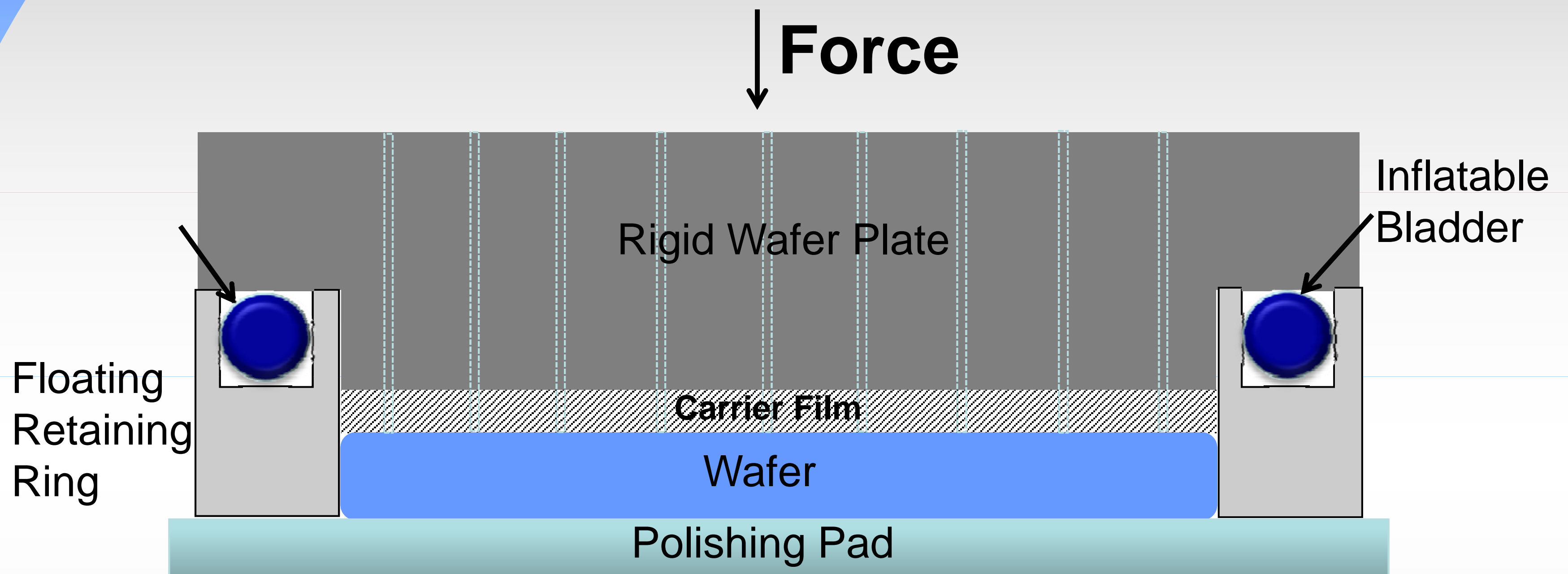
First Generation CMP Carrier



Technology Background and Evolution

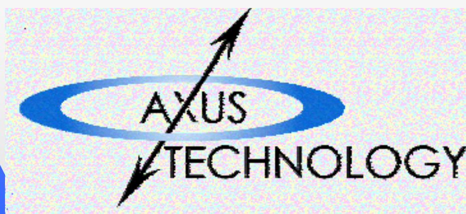
- **Second generation carriers incorporated "floating" retaining rings for improved edge control**
  - Ring contacts pad at controlled pressure independent of wafer pressure
  - Ring pressure optimized to minimize wafer edge non-uniformity resulting from pad compression
  - Eliminates critical adjustment of relative heights between wafer and ring surfaces

Second Generation CMP Carrier



Carrier-Induced Process Results

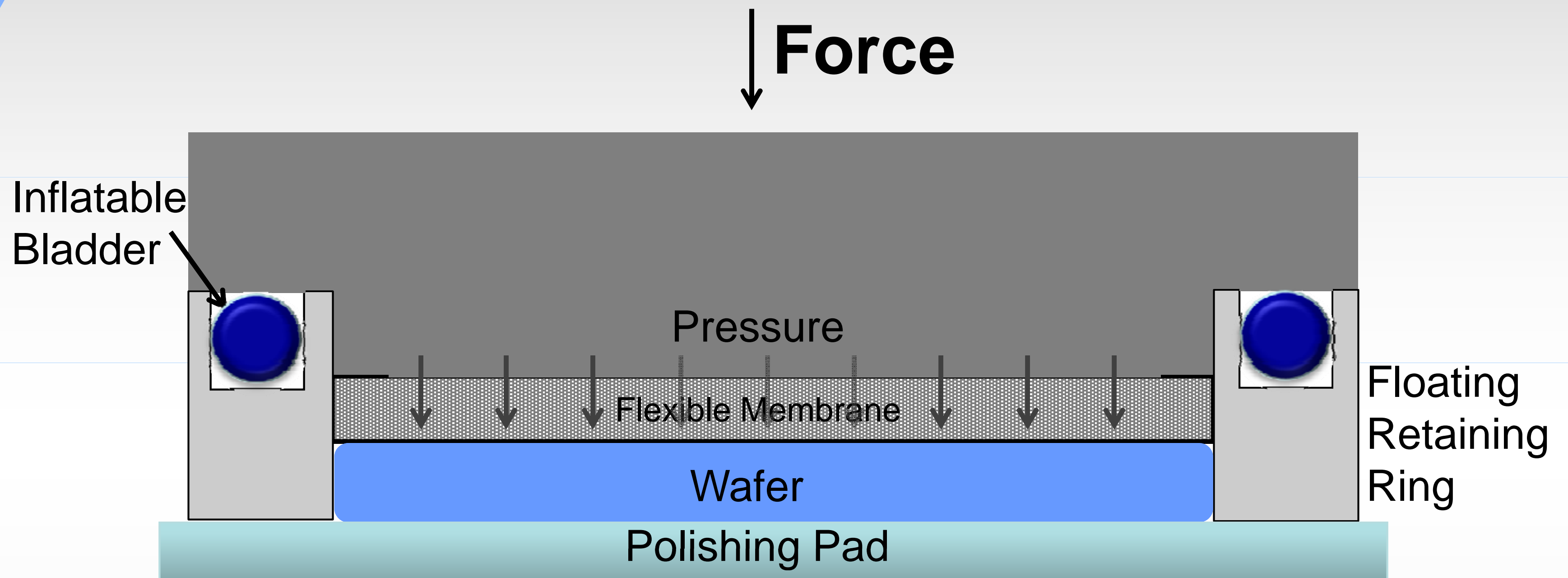
- **Rigid carrier characteristics**
  - Possible "transfer" of substrate thickness variation to CMP layer nonuniformity
  - High dependence on consistency and age of carrier film for optimum uniformity
  - Difficult to control and optimize material removal profile
    - Can be improved somewhat with backpressure zone control



Current Generation Carrier

- Rigid backing plate and carrier film replaced with molded flexible membrane
- Controlled pressure behind membrane provides wafer/pad contact pressure profile
- Variations of quantity and geometry of membrane zones among multiple carrier designs
- Carrier design variables provide across-wafer pressure profile control
- Well suited for low-pressure CMP processes

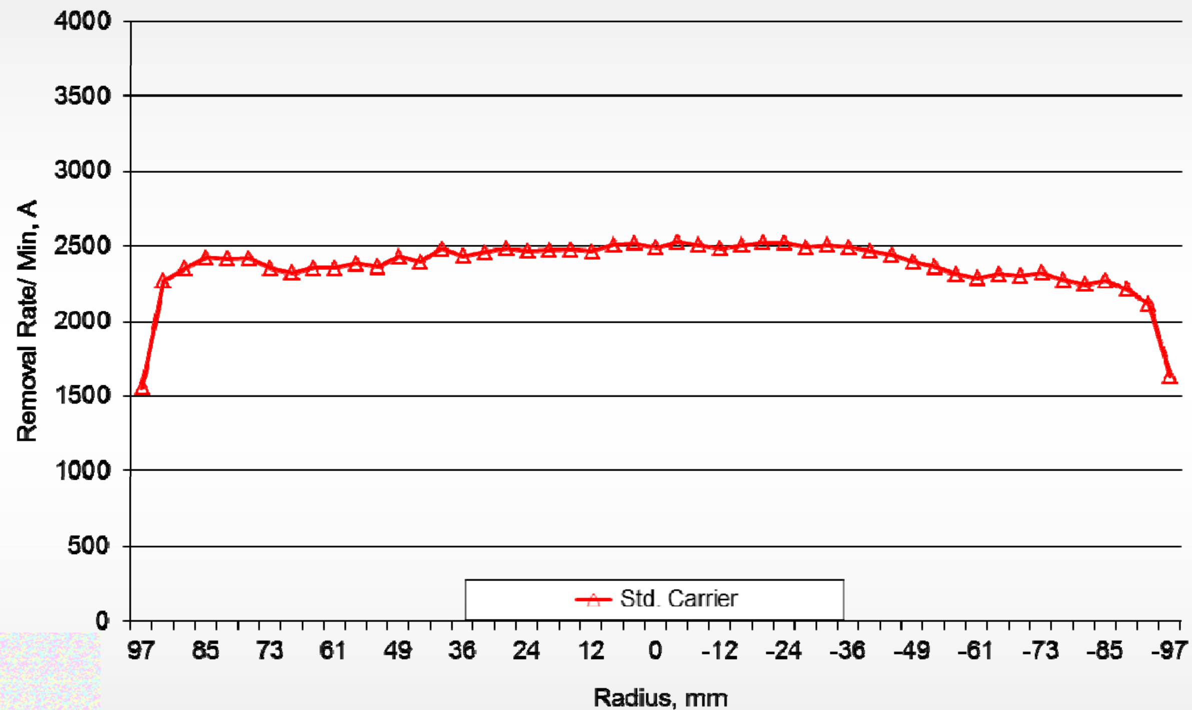
Current Generation Carrier



Process Results

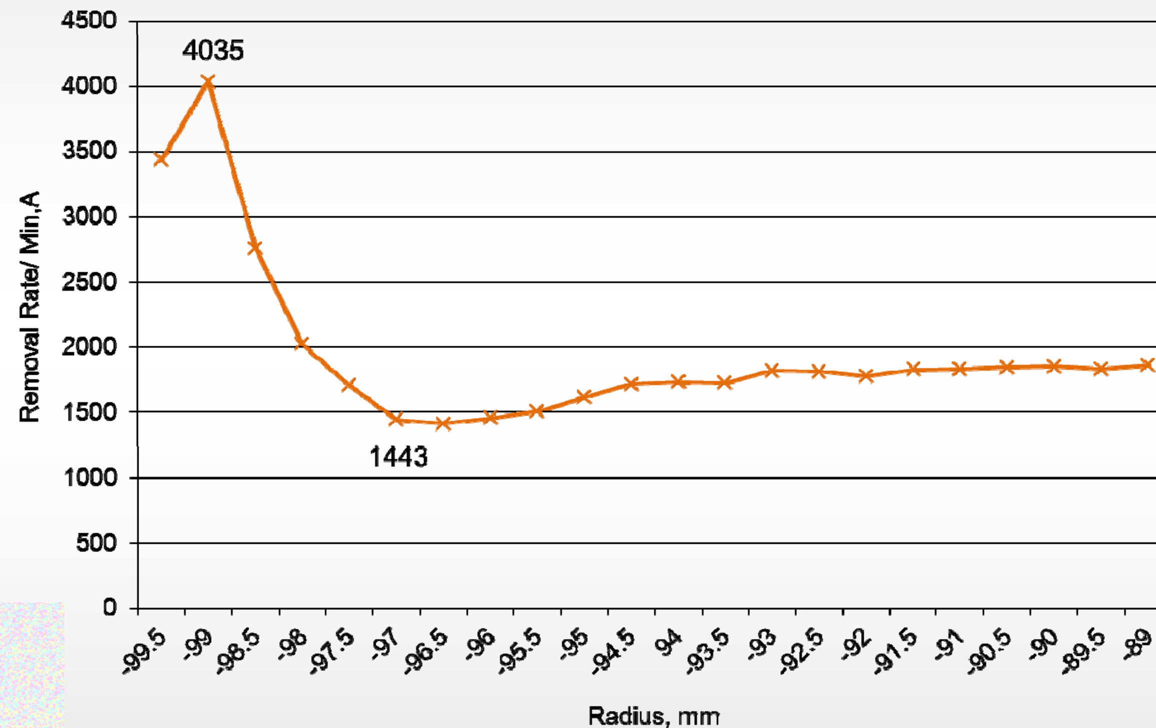
- **Typical material removal profile with rigid plate carrier**

7.9% WIWNU
2370 A/min
968A range



Process Results

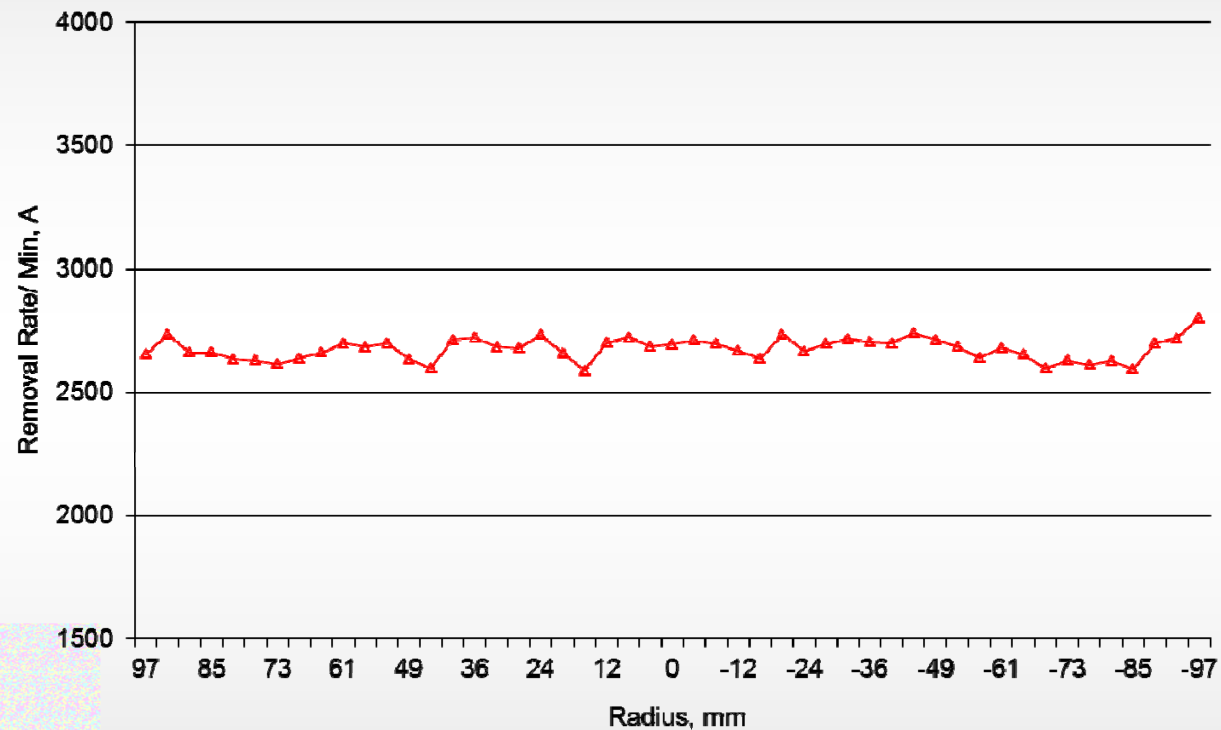
- **Typical edge removal profile with rigid plate carrier**



Process Results

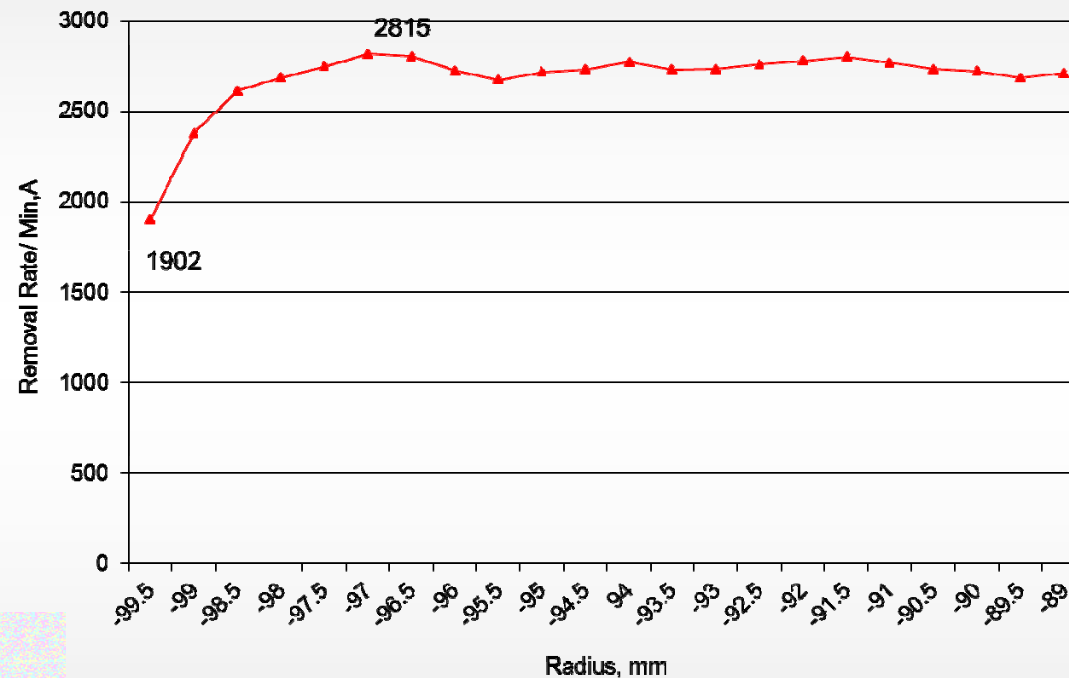
- **Typical material removal profile with flexible membrane carrier**

1.7% WIWNU
2677 A/min
214A range



Process Results

- **Typical edge removal profile with flexible membrane carrier**



Integration Options

- **CMP Tool Options:**
  - IPEC 372M, 472
  - Strasbaugh 6DS-SP
  - Ebara EPO and FREX series
- **Carrier Options:**
  - 150mm Titan
  - 200mm Titan
  - 200mm Profiler

IPEC 472 with Titan Carrier Upgrade

Conclusions

- Carrier technology evolution has enabled substantial improvements in CMP process capability and metrics optimization
- Advanced carrier technology has been successfully integrated with established CMP tools
- Integration options support a wide matrix of tool and carrier configurations
- Upgrading established CMP tools with advanced carrier technology offers a compelling value proposition