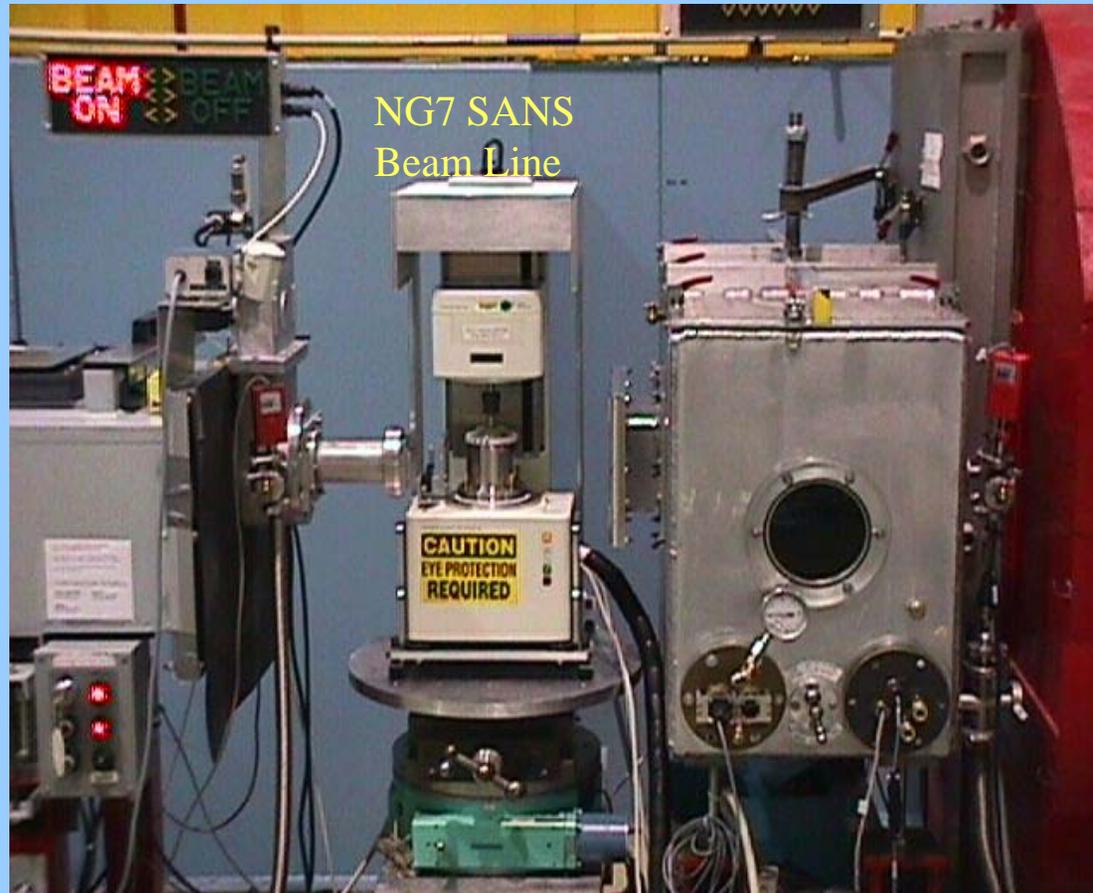


RheoSANS at the NIST-CNR



B Greenwald NIST/UMD, Gaithersburg
MD, USA

The Rheometer

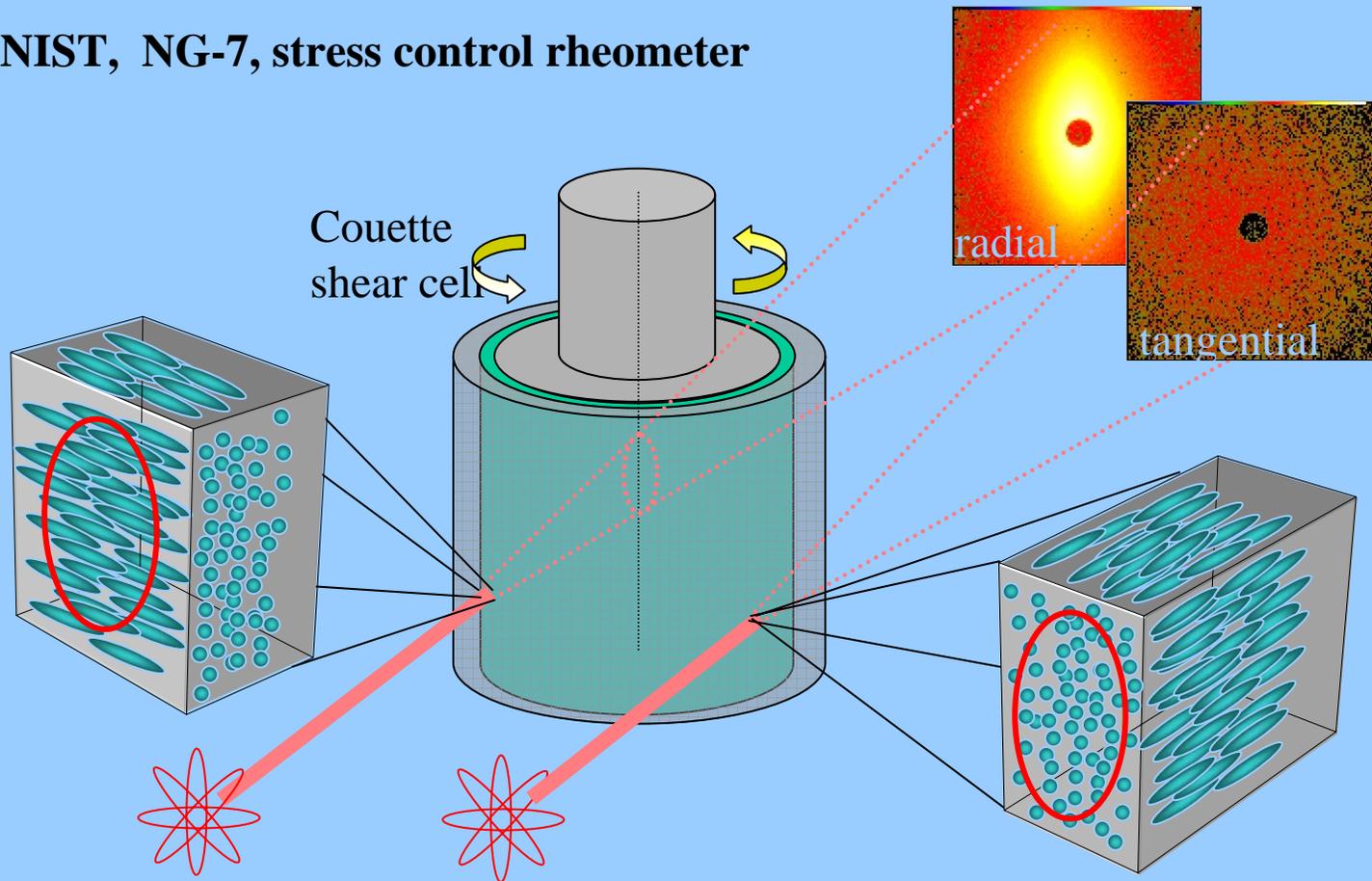
- Paar Physica USD200*
- Radial and tangential configuration
- Quartz or titanium Couette type flow cells
- Gaps of 0.5 or 1mm
- Temperatures ranging from -20°C to 150°C
- Solvent trap preventing solvent evaporation



* The mention of commercial equipment does not imply endorsement by the National Institute of Standards and Technology

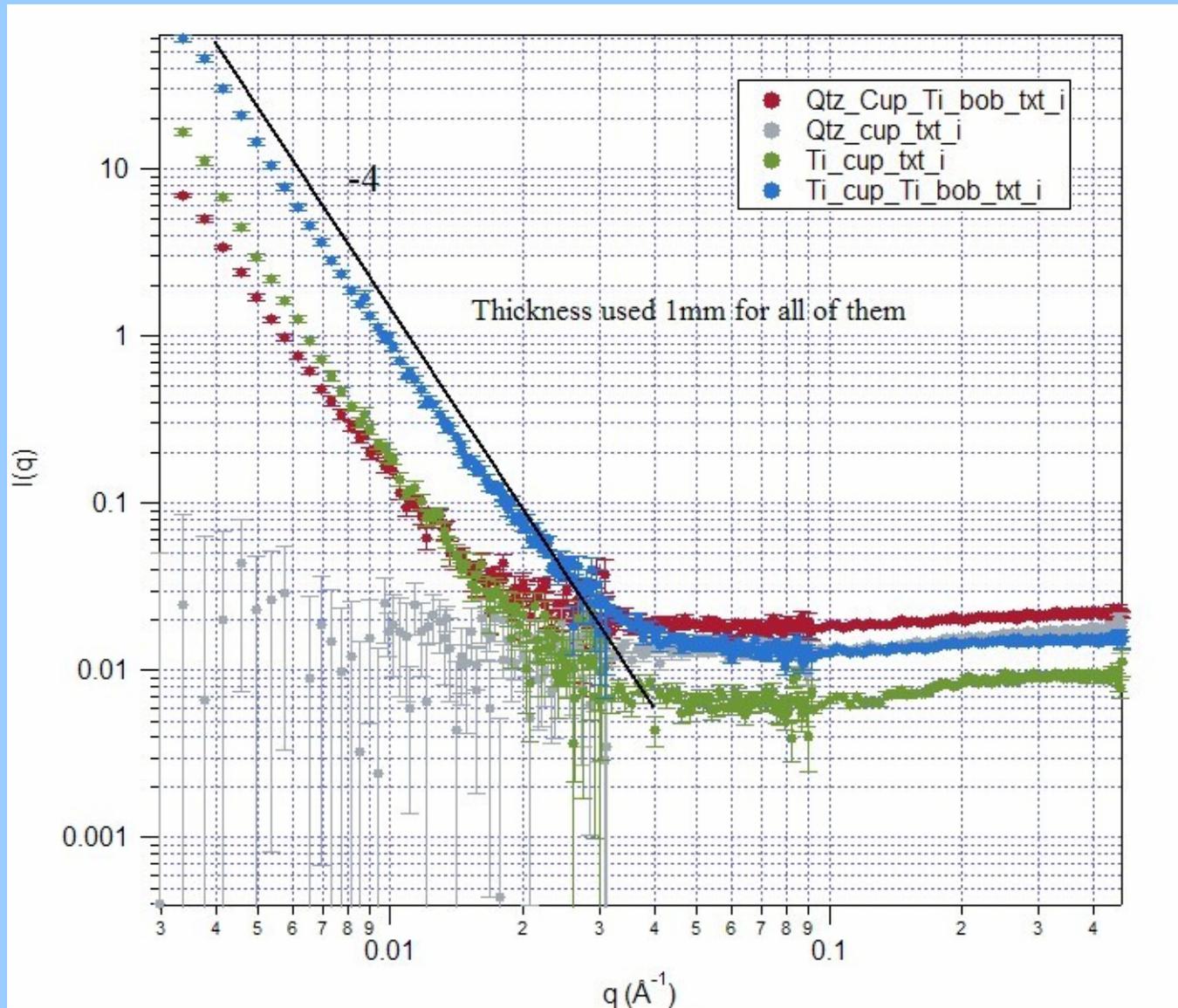
Radial and Tangential?

NIST, NG-7, stress control rheometer

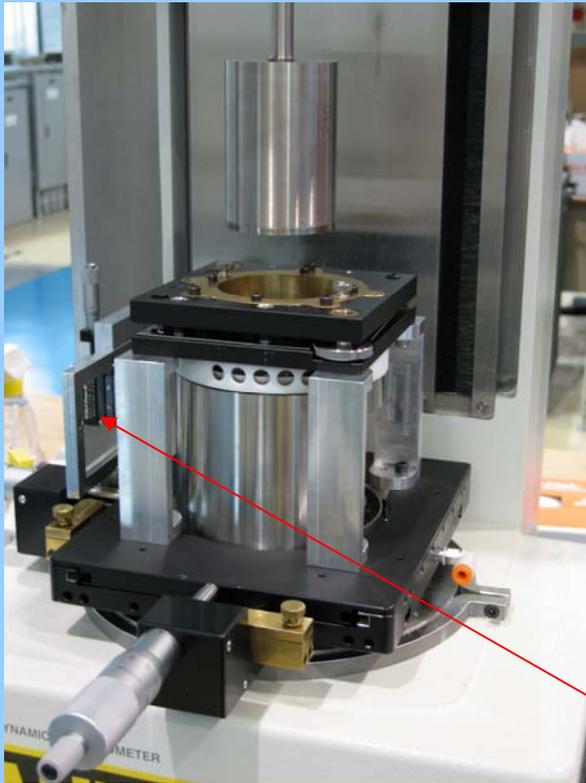


- Radial: Perpendicular to Shear Velocity
- Tangential: Parallel to Shear Velocity

Quartz vs Titanium



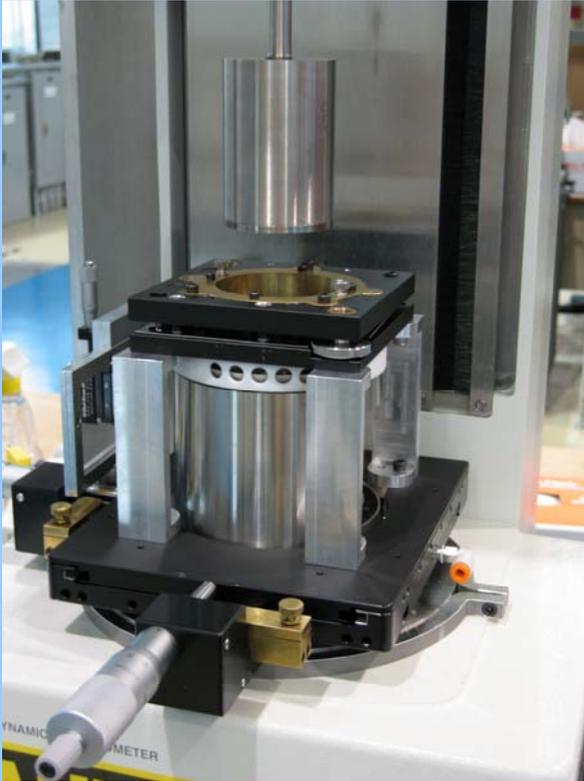
Slit Packages and Alignment



- Radial aperture and tangential slit package
- Boron Aluminum backed with Cadmium
- 1 cm aperture for radial measurement
- 0.3, 0.5, 0.6, 0.8 mm tangential slits



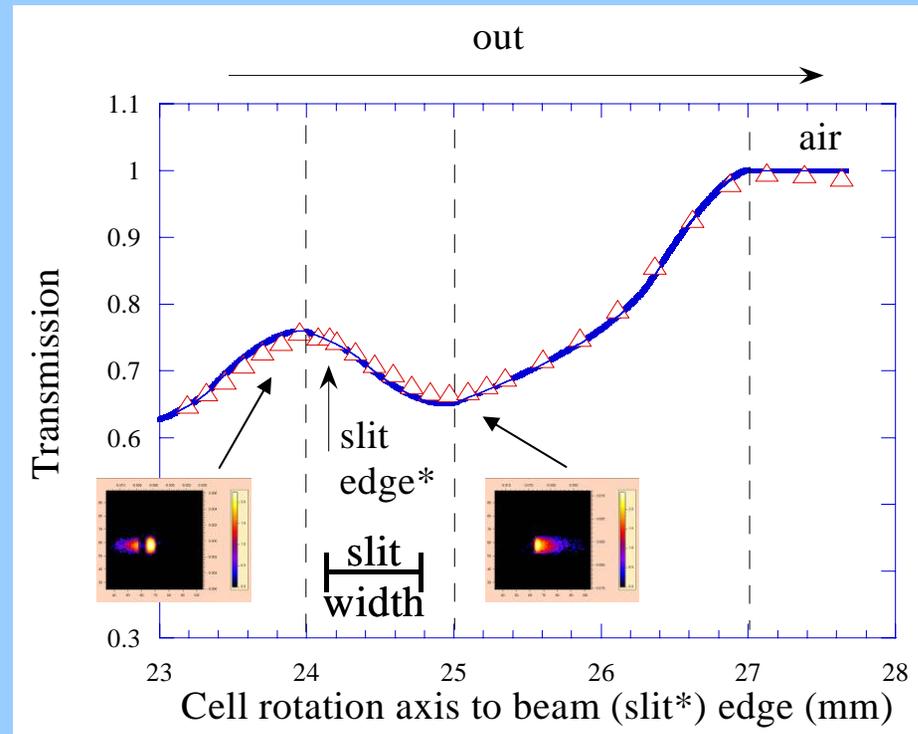
Slit Packages and Alignment



- 2 micrometer screws in the X and Y plane and 2 screws to adjust the tilt aid in alignment of cup with bob

Slit Packages and Alignment

- Transmission measurements across gap
- Changes are interception with material boundaries
- Alignment indicated by arrow marked “slit edge”



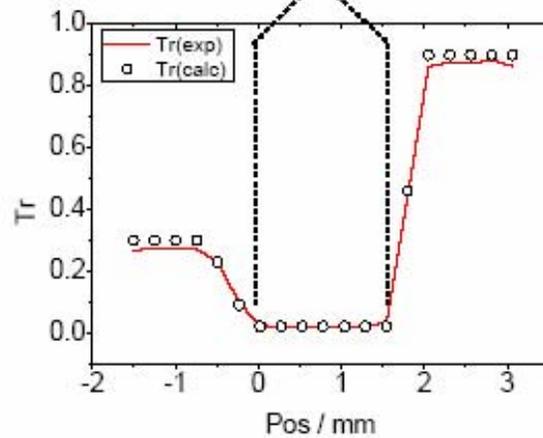
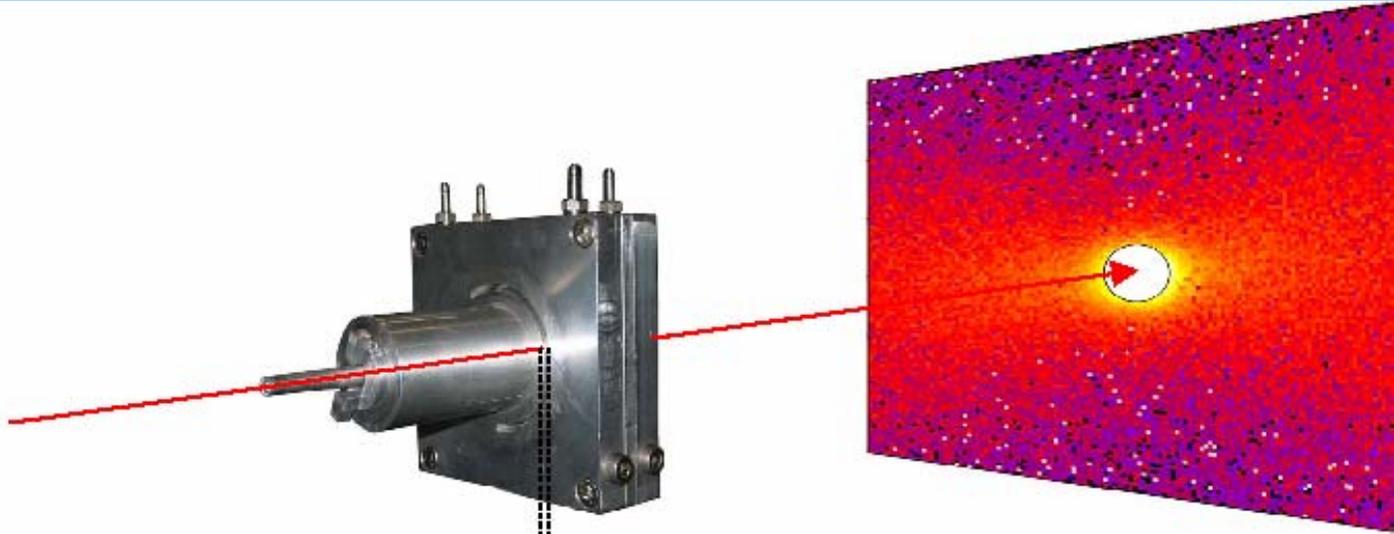
Technical Attributes

Technical Specifications

Accuracy	1% of maximum value
Minimum Torque	150 mNm
Torque Resolution	0.01 μ Nm
Speed Range	10^{-4} to 1000 min^{-1}
Shear Rate Range	$1.3 \cdot 10^{-4}$ to $4.8 \cdot 10^3 \text{ s}^{-1}$
Shear Stress Range	0.67 to $3.5 \cdot 10^4 \text{ Pa}$
Viscosity Range	$1.7 \cdot 10^{-3}$ to $2.7 \cdot 10^8 \text{ Pas}$
Temperature Range	-20 to 90 $^{\circ}\text{C}$
Volume	8, 12 mL
Gap Size	0.5, 1 mm

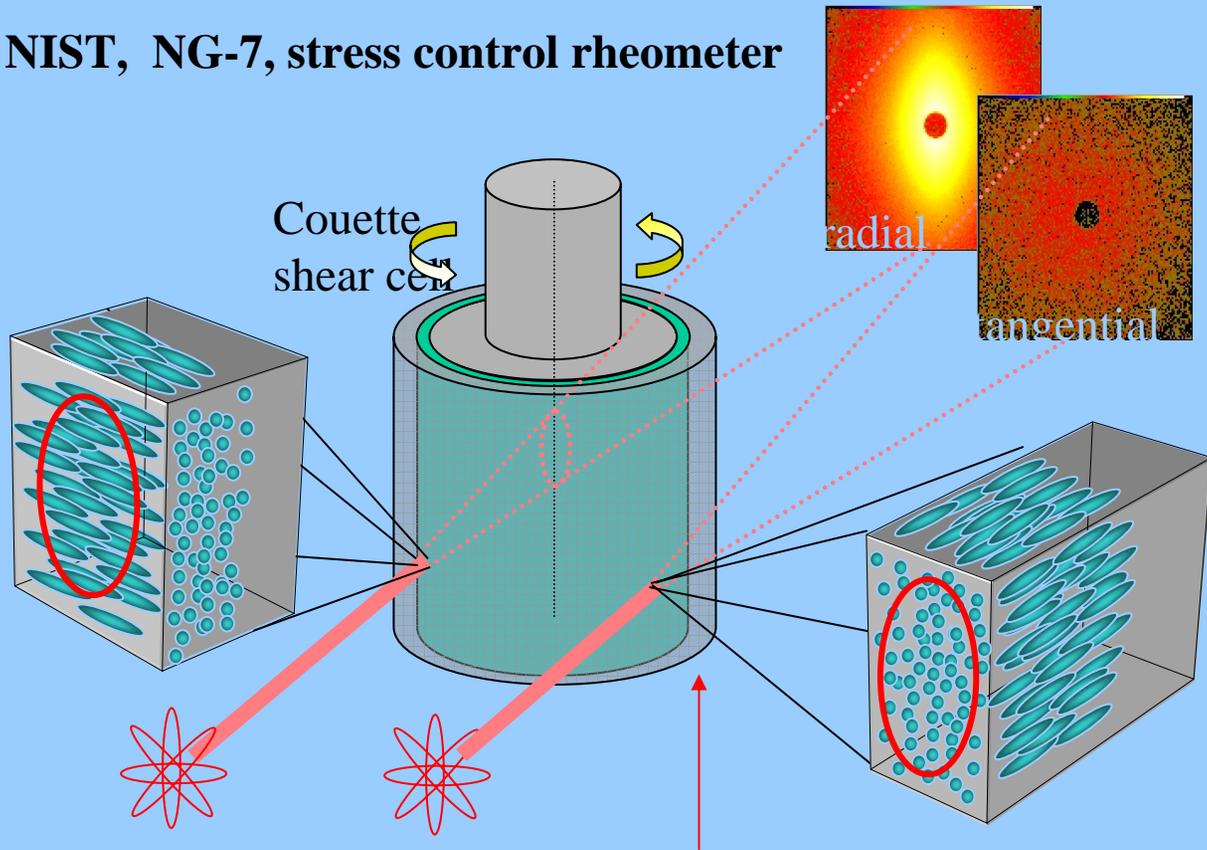
- Temperature control by passing heated N₂ gas by the cell
- 0.5 and 1 mm gaps requiring 8 and 12 mL respectively
- Solvent trap to prevent evaporation of solvent during experiment

1-2 Plane Shear Cell



1-2 Plane?

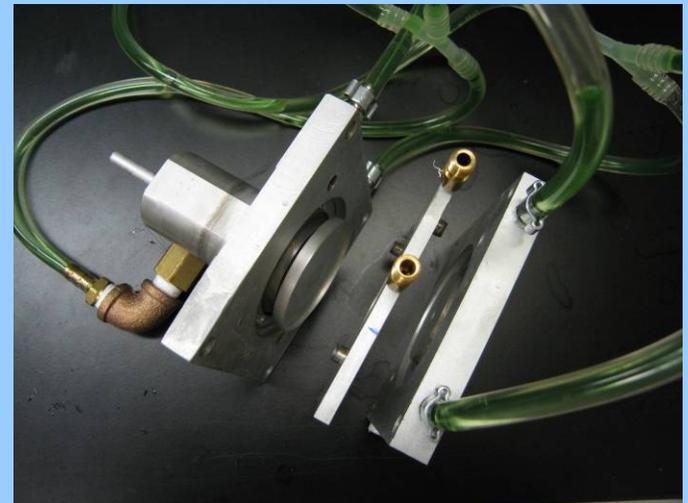
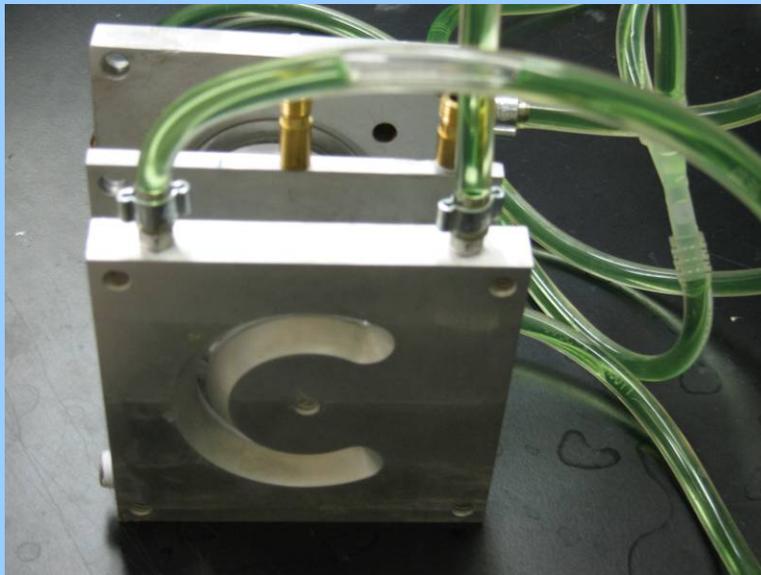
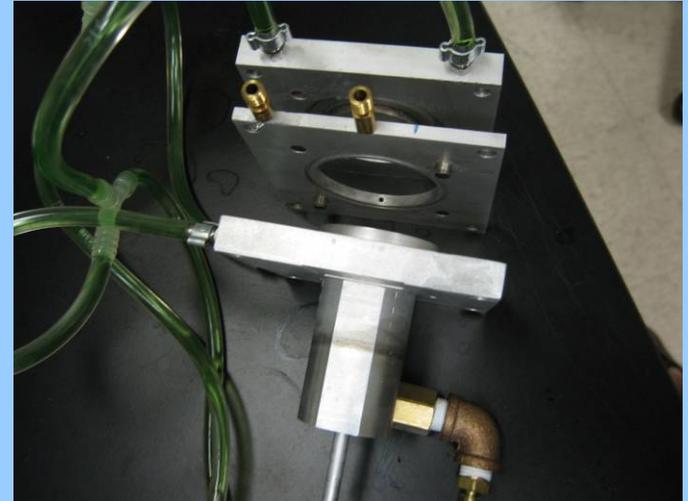
NIST, NG-7, stress control rheometer



- Parallel to Vorticity direction
- Degree of Structural Anisotropy
- Direction of Anisotropy within the plane

The Guts

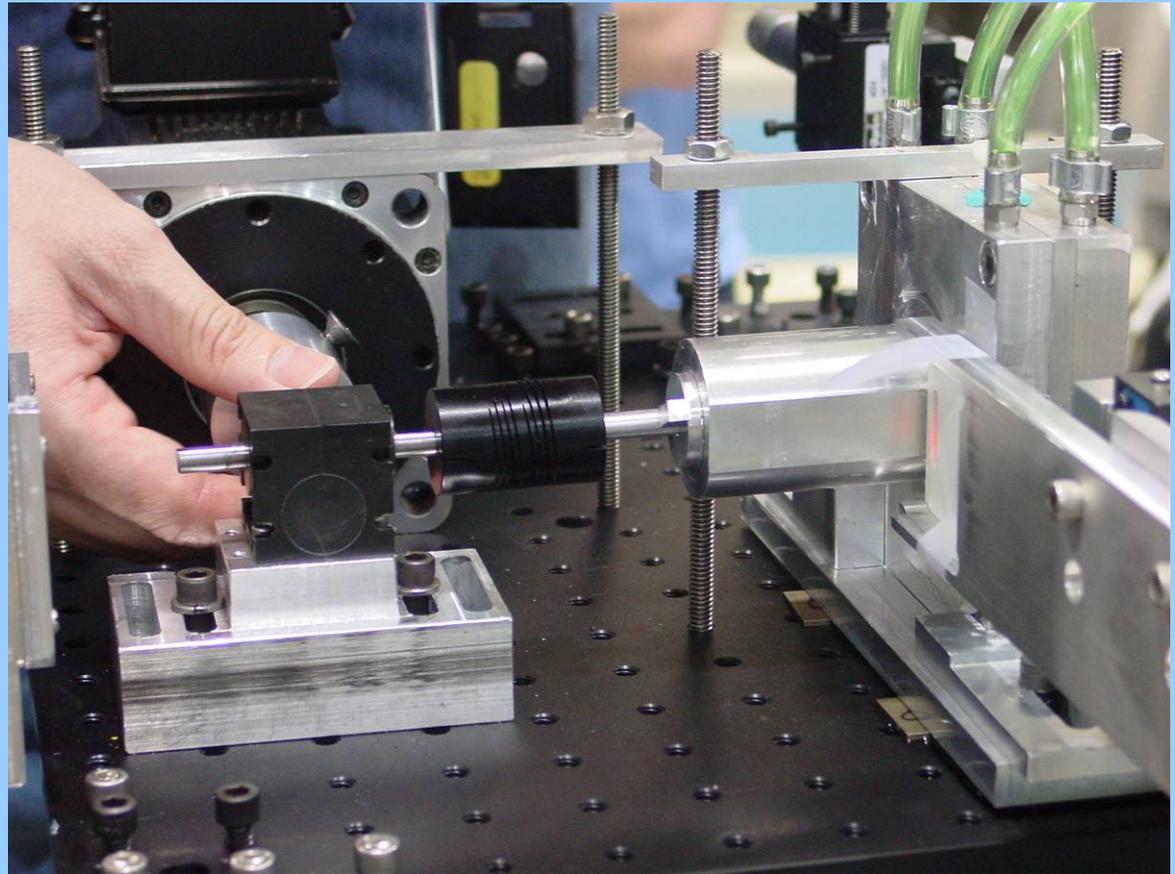
- Quartz windows
- Temperature range -10 to 90 C
- 1.5 mm Gap
- Sample loading



The Assembly and Technical Attributes

Technical specifications:

- Path length 5 or 7mm
- Gap 1.5mm
- Sample volume ~10ml
- Slit 0.2,0.4 mm x 3mm
- Shear rate 0.01-500s⁻¹



Thanks!

www.ncnr.nist.gov/sans/programs/equipment/rheometer.html

L Porcar^{1,2}, P D Butler², N Wagner³

¹University of Maryland; College Park, MD 20705

²NIST Center for Neutron Research; Gaithersburg, MD 20899

³University of Delaware; Newark, DE 19716