# TESLA Collaboration Meeting

ISTITUTO NAZIONALE FISICA NUCLEARE
Laboratori Nazionali di Legnaro
Legnaro (Padua) ITALY

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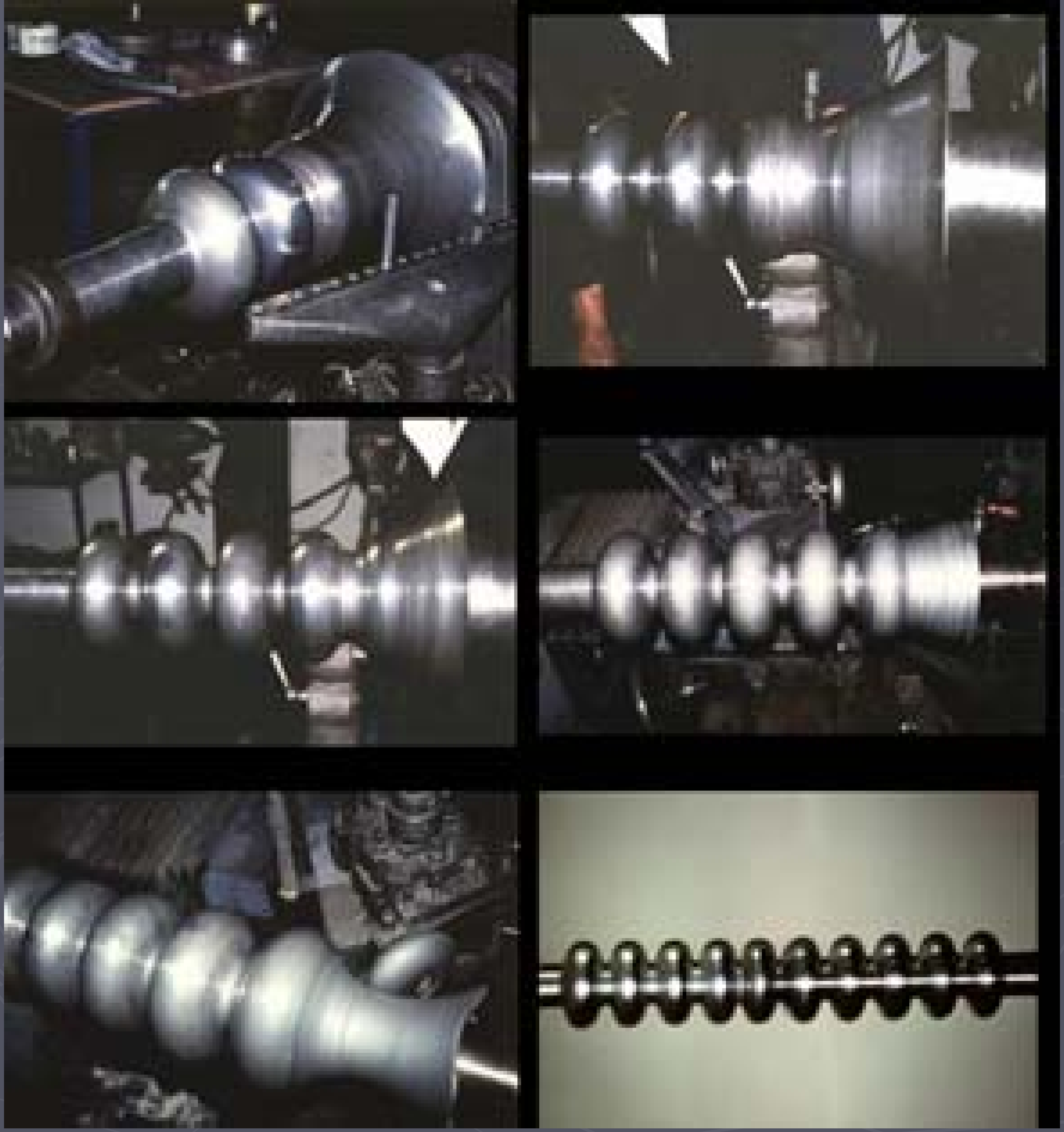
Desy-Zeuten January 21-21, 2004

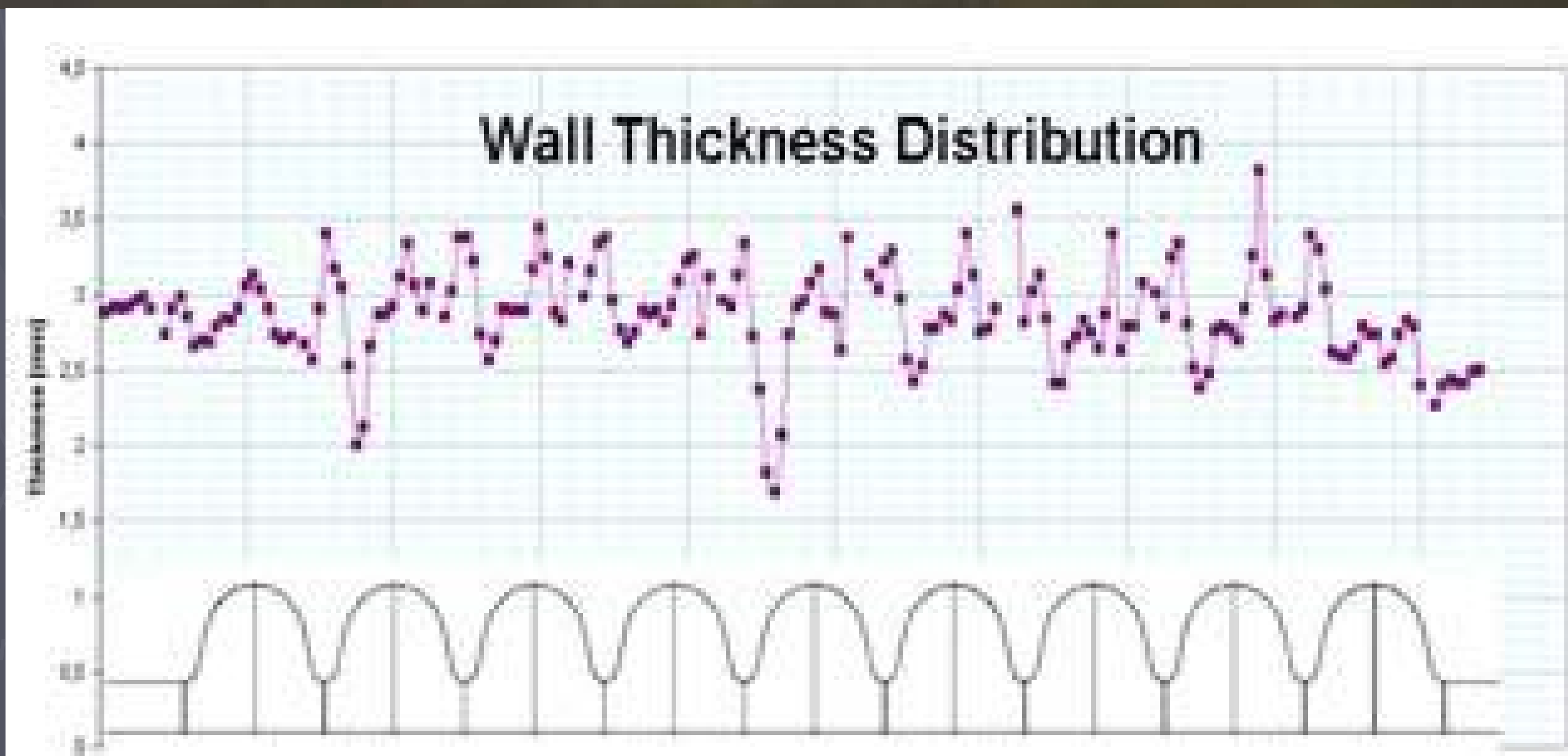
# Contents:

- Seamless cavity spinning from circular blanks

- Nb/Cu thin film investigation: Problem of Q-decay vs $E_{acc}$



# The first Niobium seamless 9-cell cavity ever fabricated

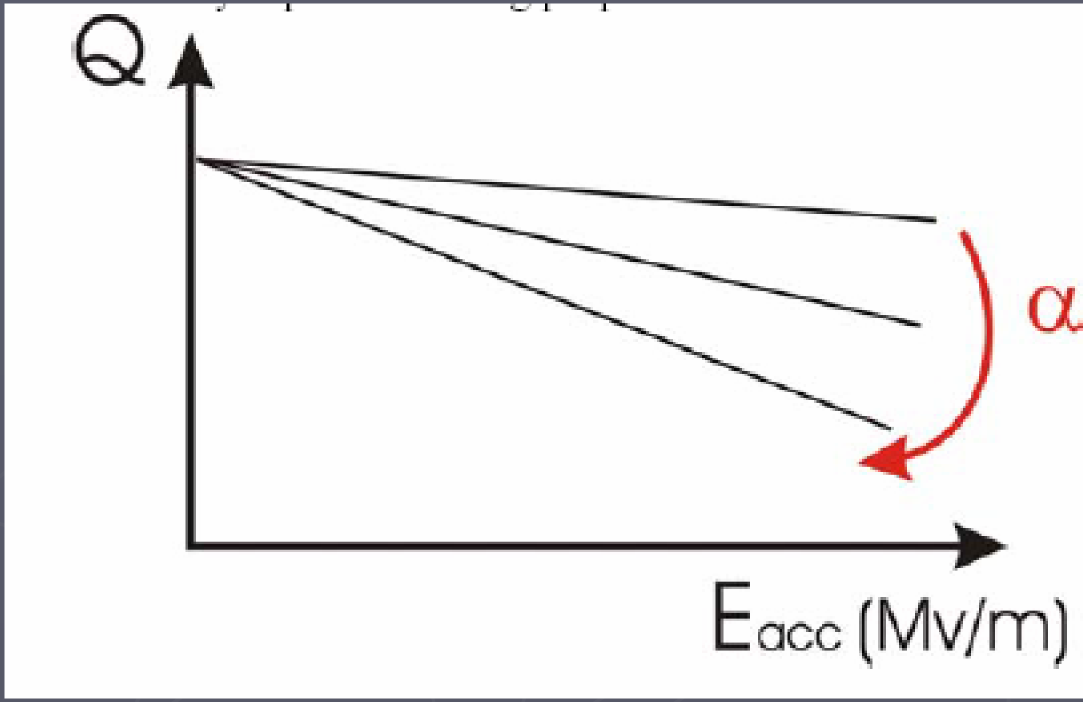


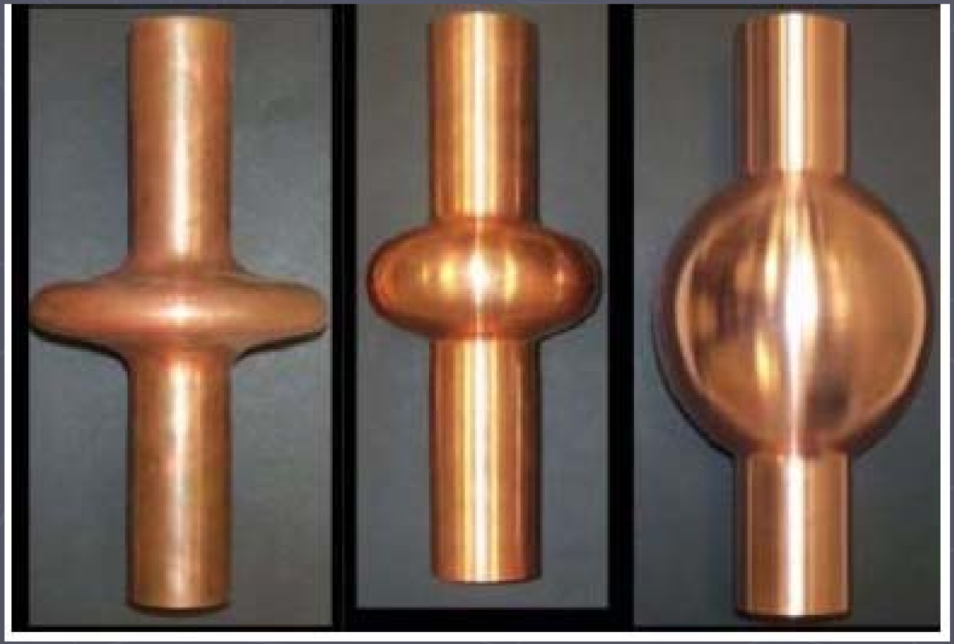
# Advantages of Spinninng technology

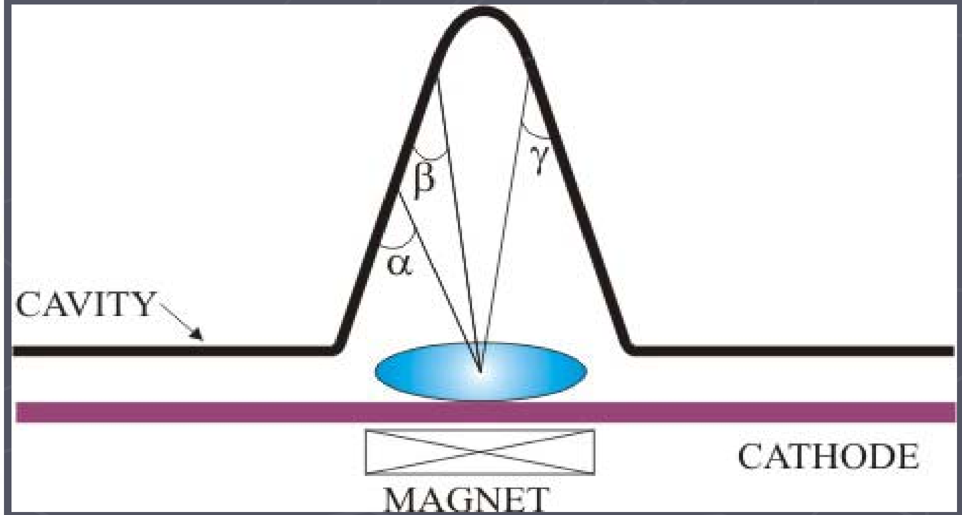
- Short fabrication times
- No welds
- No intermediate annealing
- Almost no swarf
- Low fabrication costs
- Machine adaptability to almost any cavity shape and size without further investments in equipment


6 GHz
500 MHz

# Thin film Research

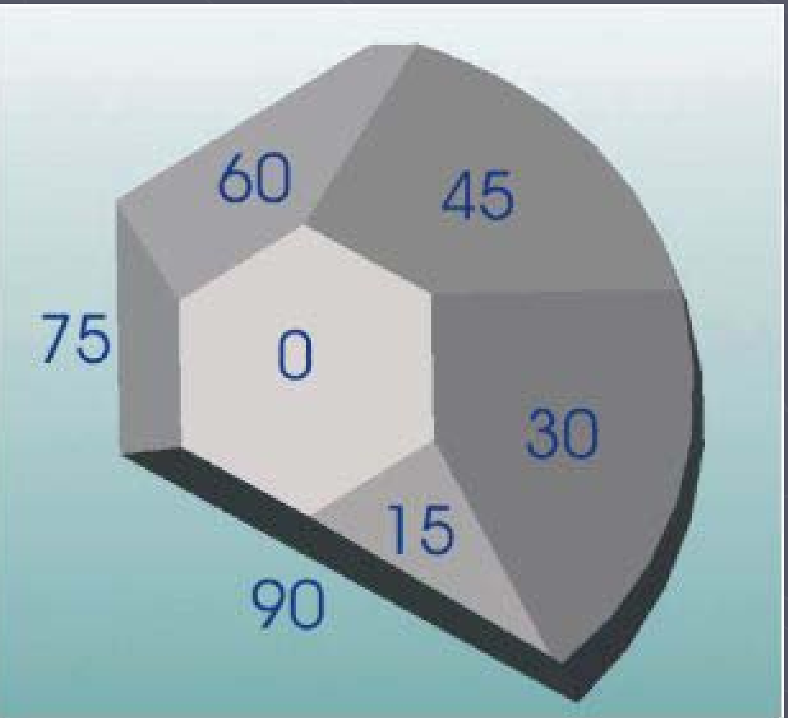


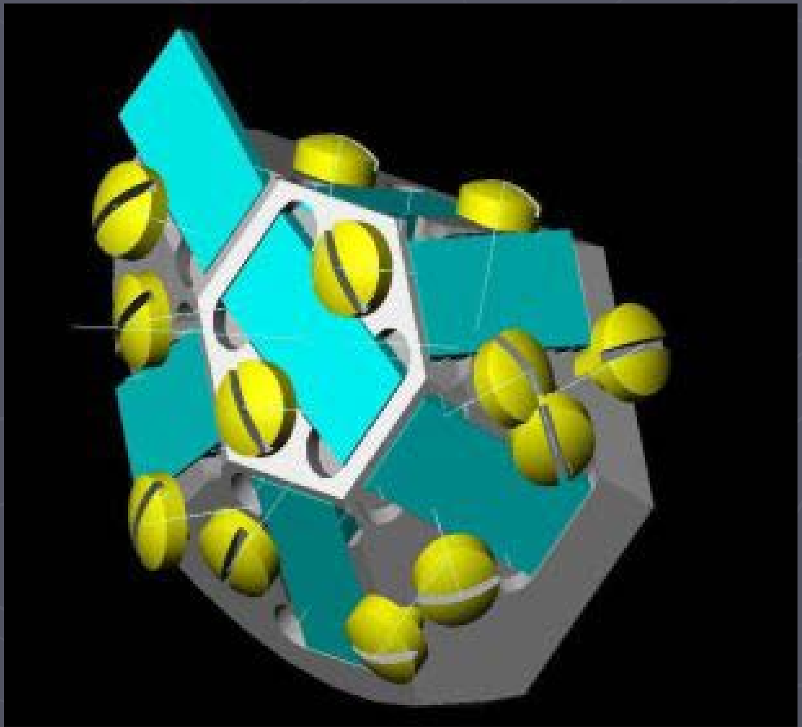





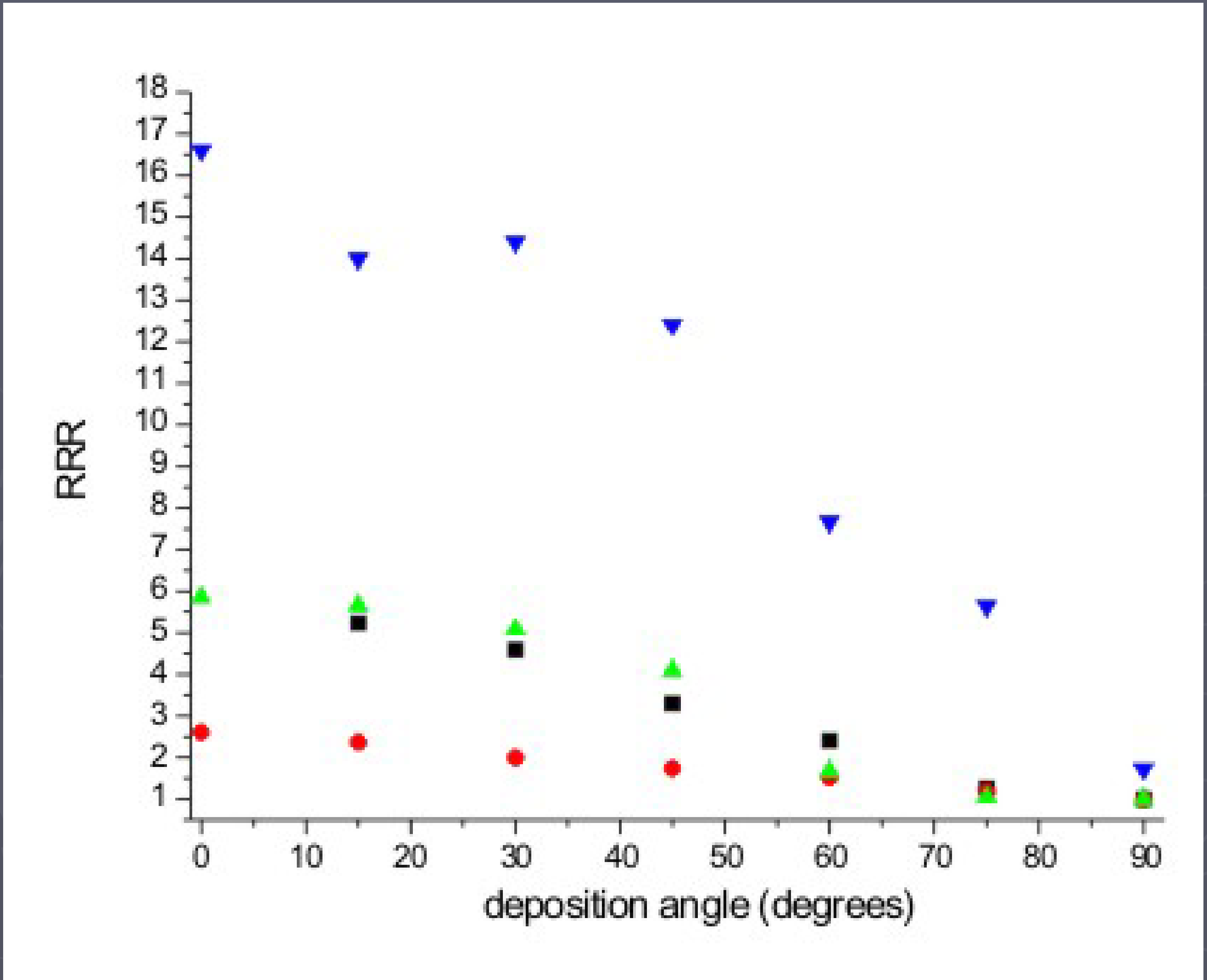
# Multi-angle substrate holders

faces at 0°, 15°, 30°, 45°, 60°, 75°, 90°

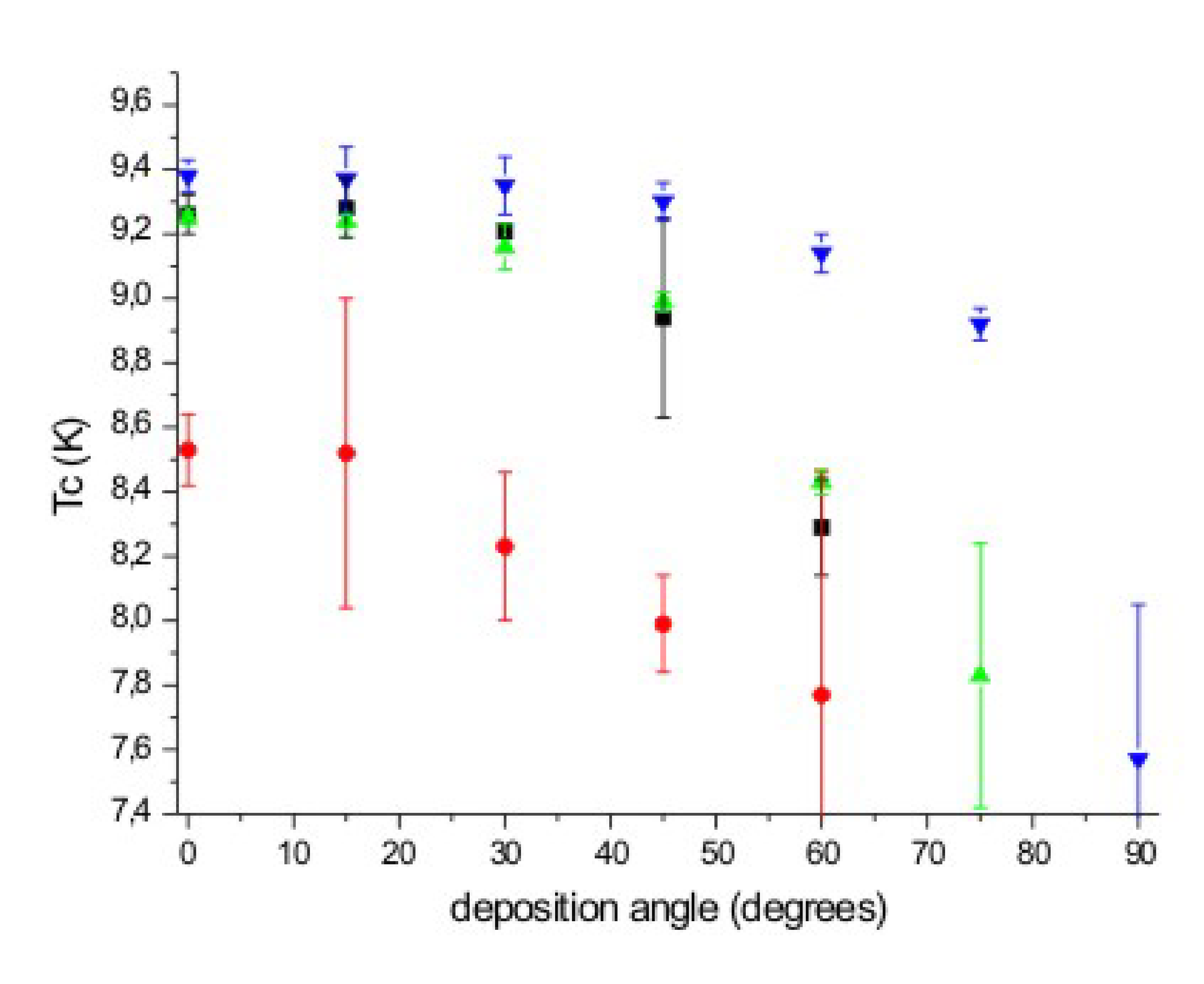


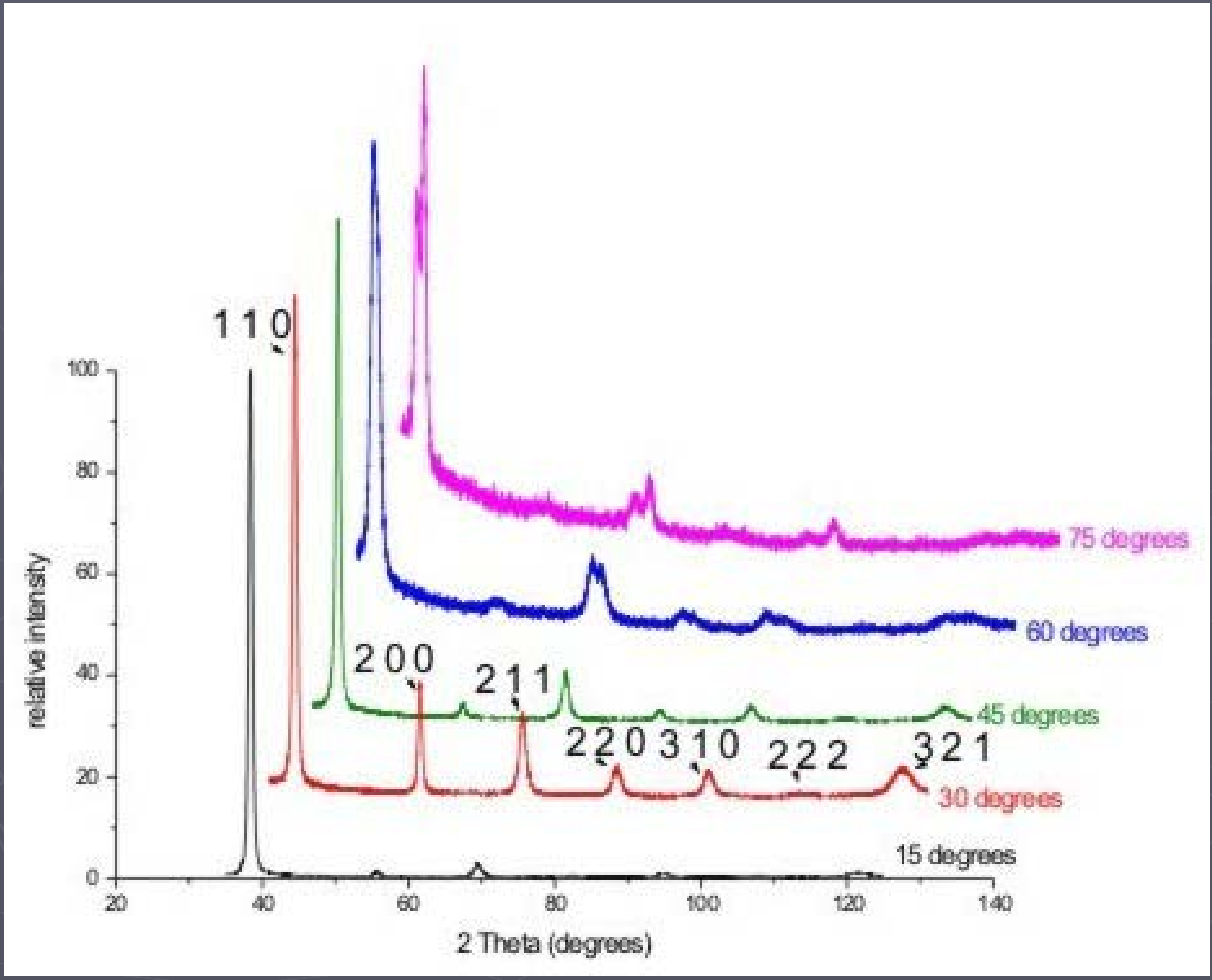
# RRR vs. deposition angle for samples at different level of contamination



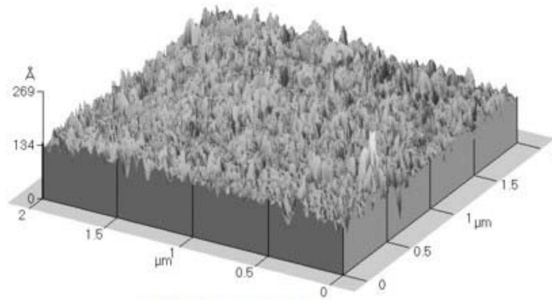
## Tc vs. deposition angle for samples at different level of contamination



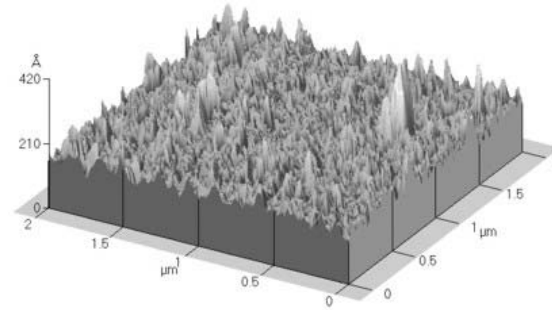
# Normalized X-ray diffraction spectra at various deposition angles



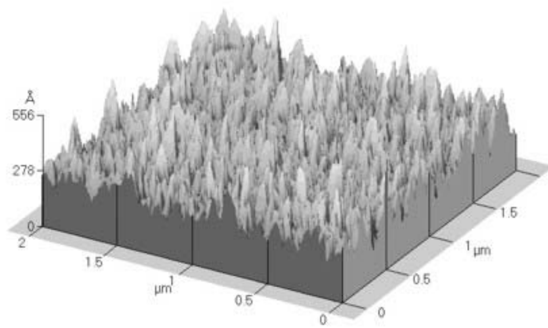
# AFM topographic images of niobium films at different target-substrate angle



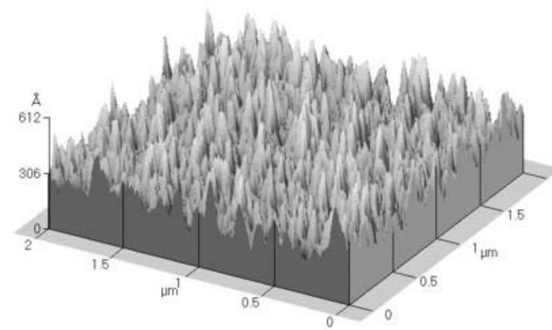

15 degrees



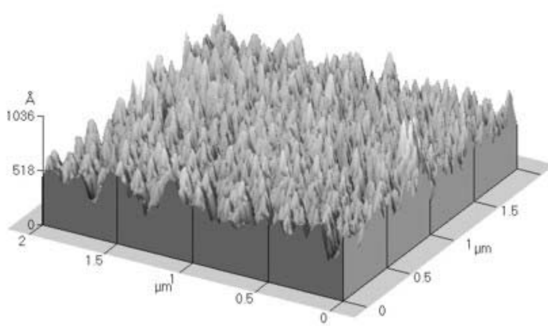

30 degrees



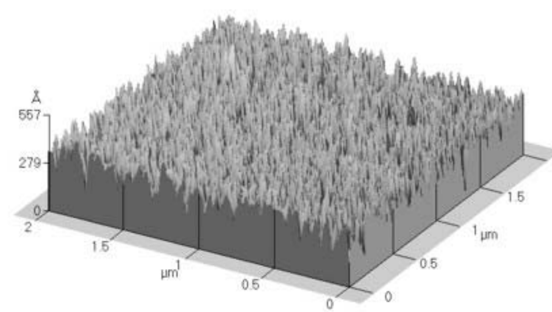

45 degrees




60 degrees

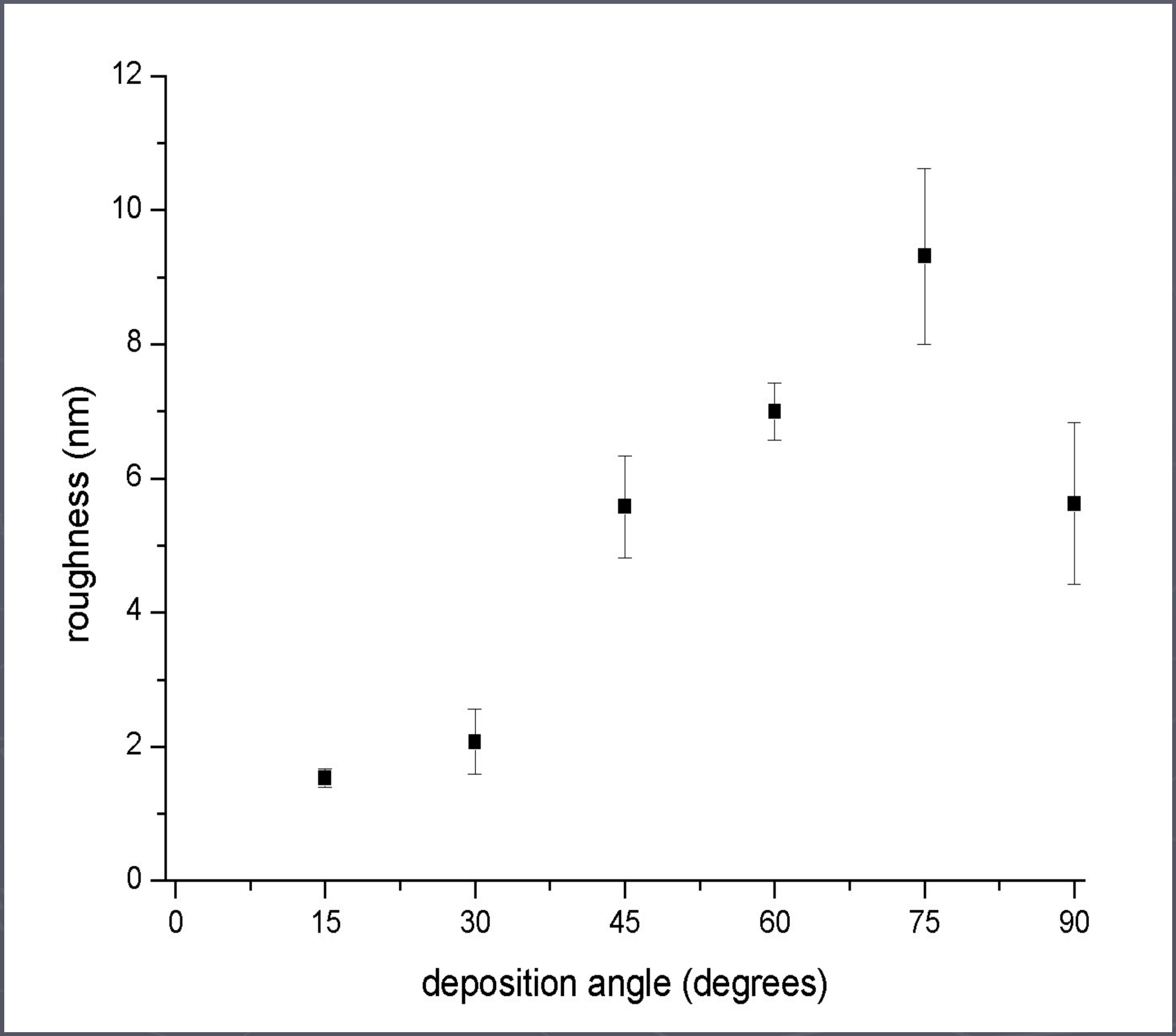



75 degrees

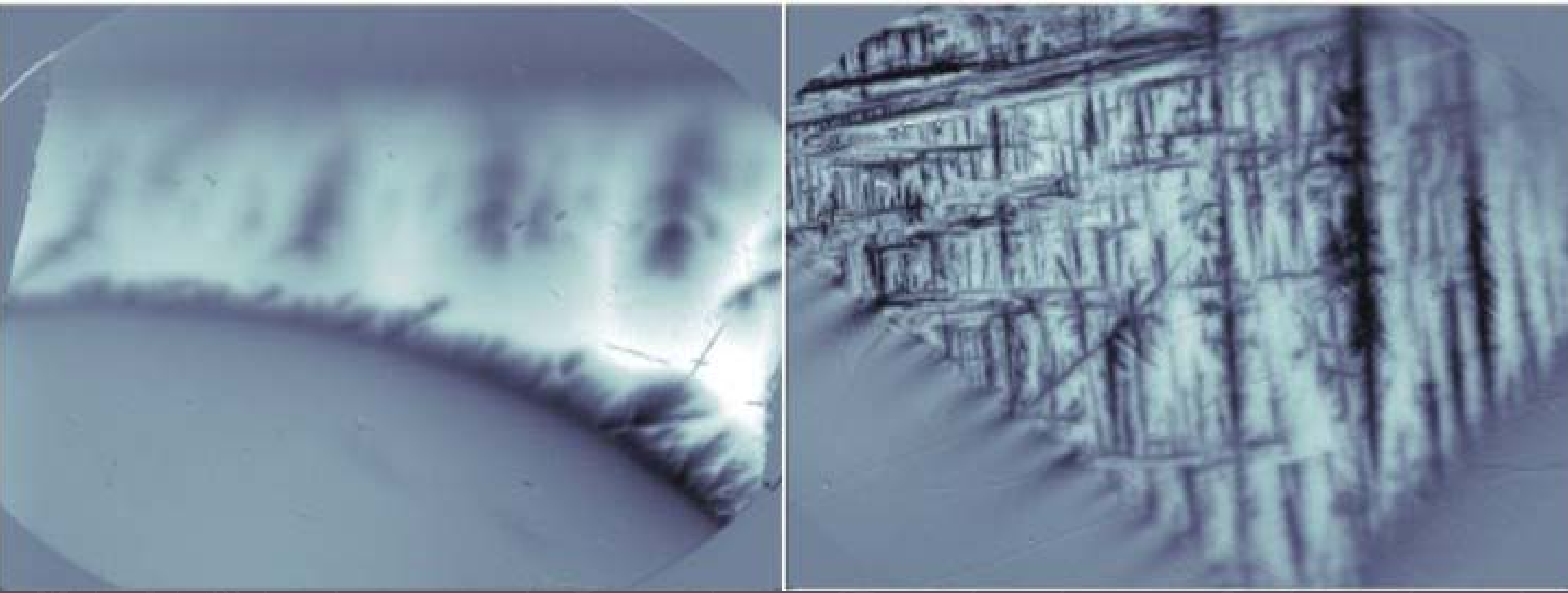



90 degrees

# AFM average roughness vs. deposition angle



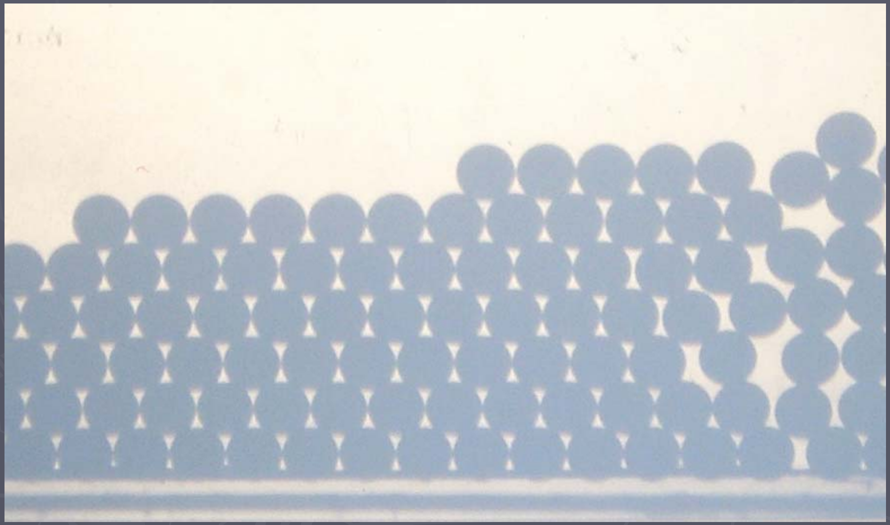
Magneto-optical images of Nb film deposited on Cu for parallel target - substrate (left) and at 45 (right) degrees



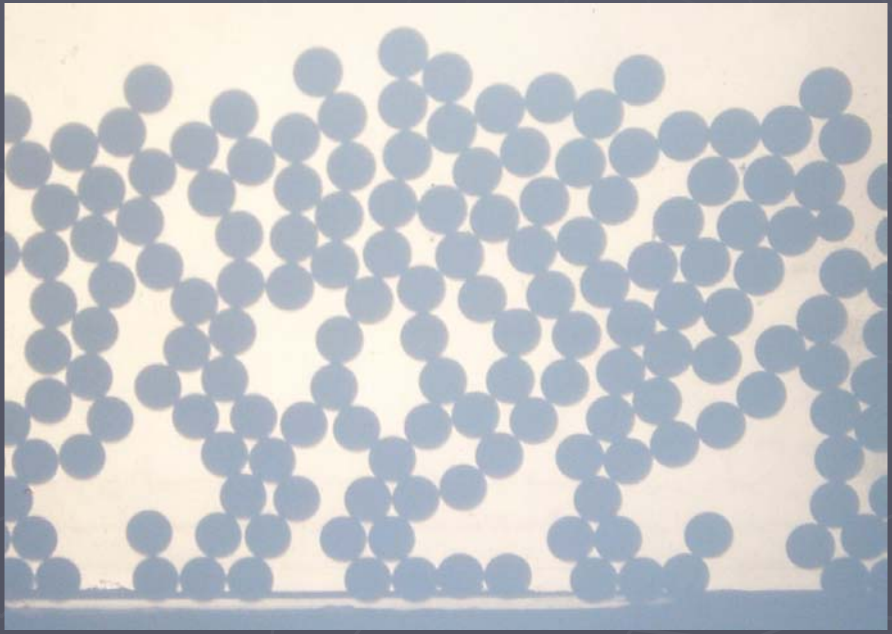
**External applied field is 176 mT at T = 5K**

# Simulation of film growth for:

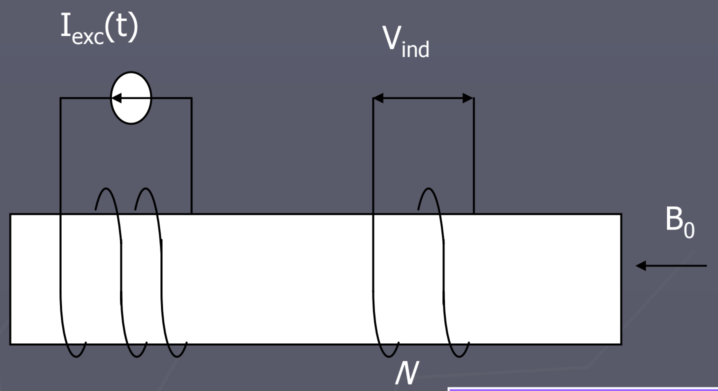
target parallel to substrate

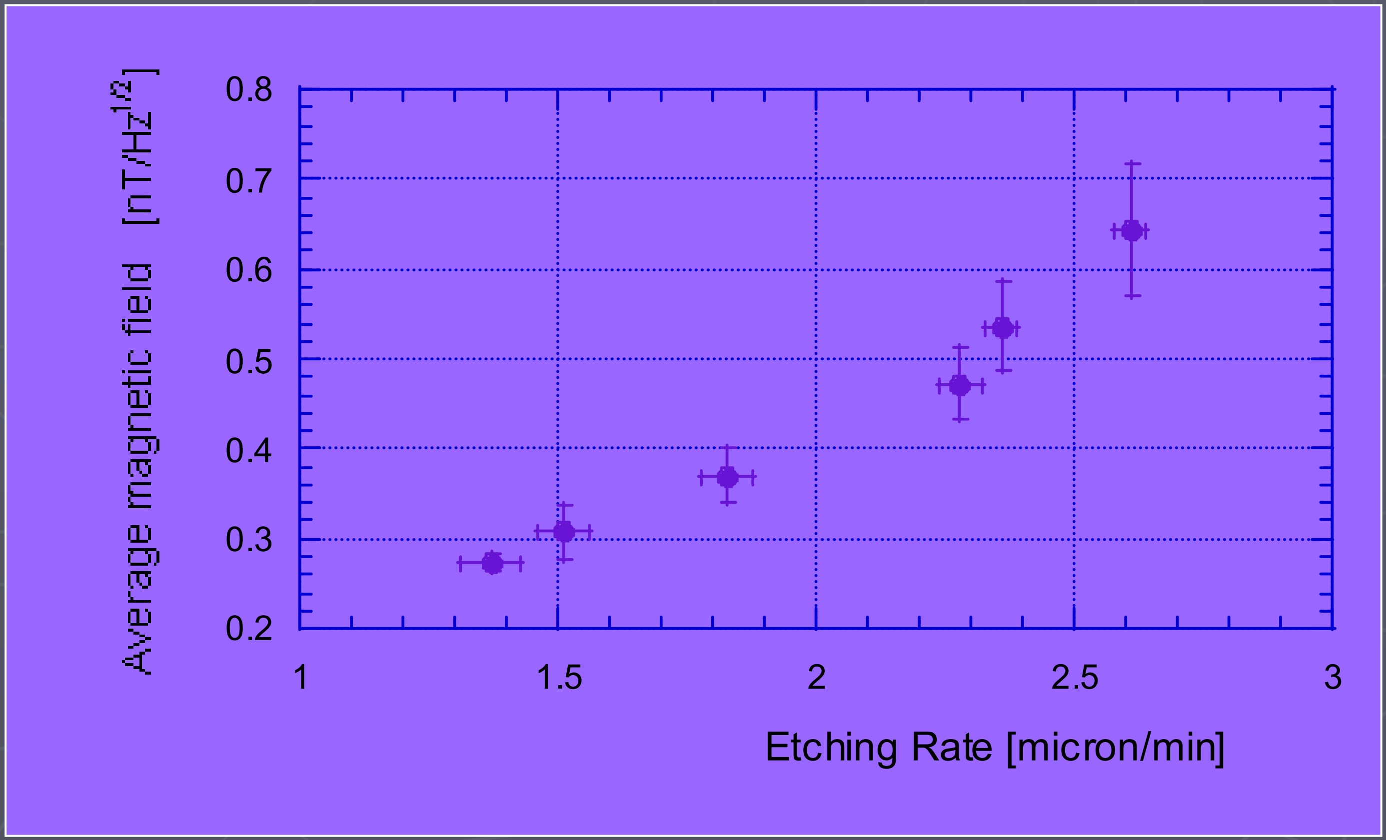


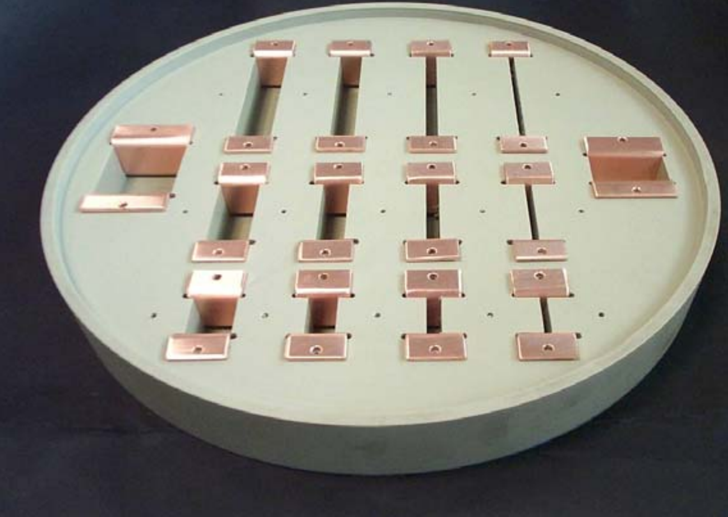
45 degrees orientation

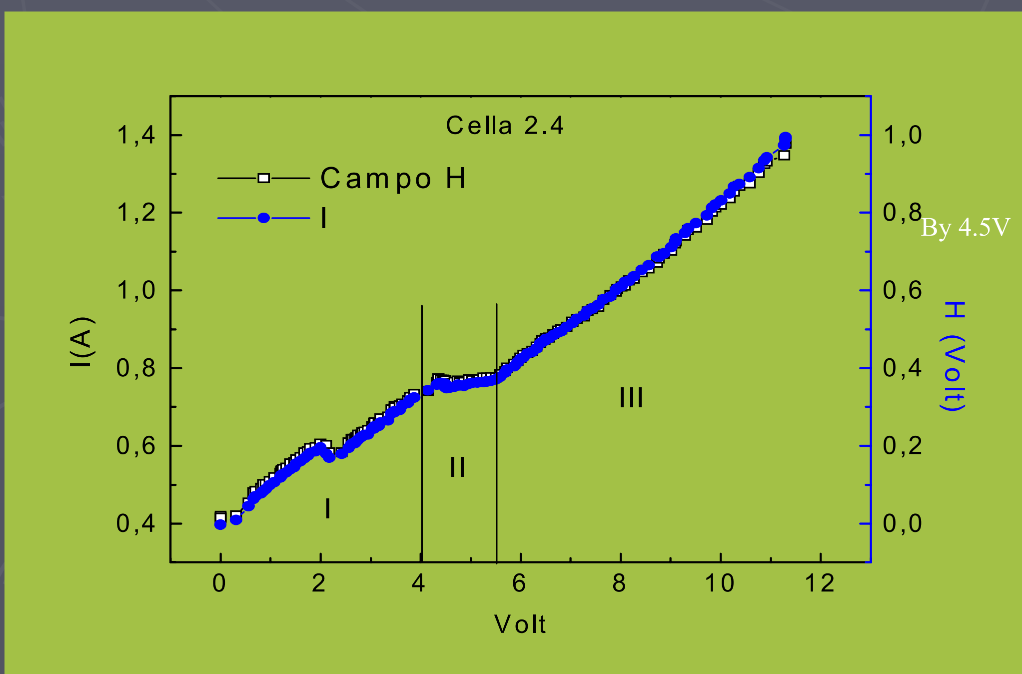


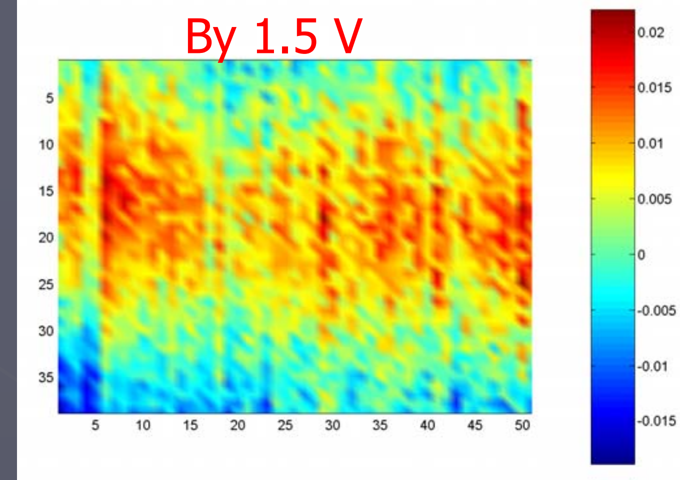
# Flux gate Magnetometer

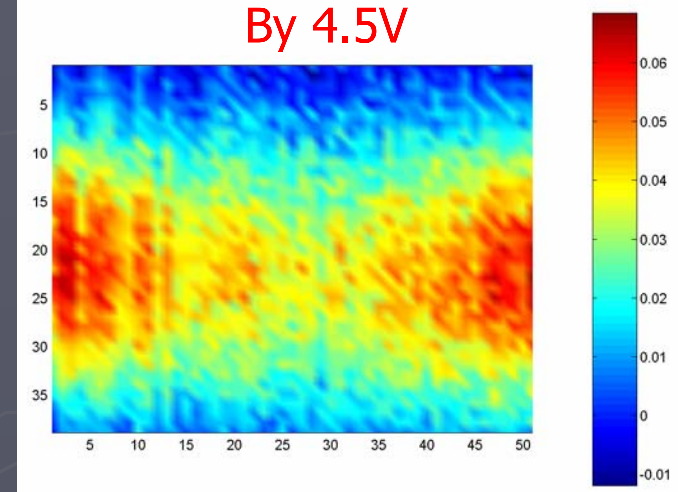


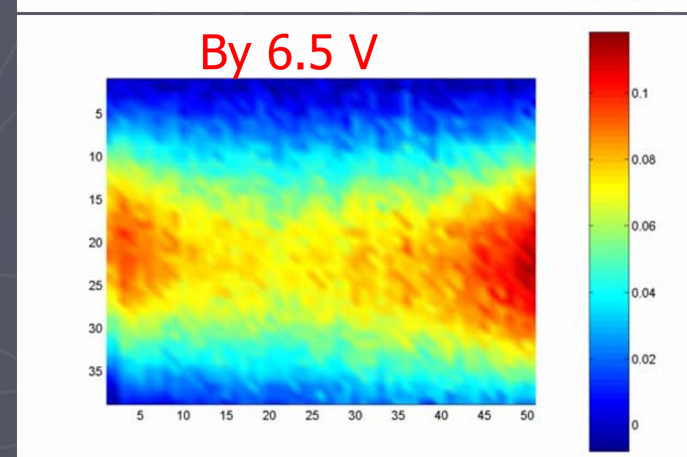






Cella 2.4
Campo H
I
I(A)
H (Volt)
Volt
I
II
III
By 4.5V


By 1.5 V


By 4.5V


By 6.5 V

# Inverting the Biot-Savart law

$$\mathbf{B}(\mathbf{r}) = \frac{\mu_0}{4\pi}\int \frac{\mathbf{J}(\mathbf{r}') \wedge (\mathbf{r}-\mathbf{r}')}{|\mathbf{r}-\mathbf{r}'|} d^3 r'$$

assuming the continuity equation and the condition $J_z = 0$,
it is possible to deduce the current density induced by the magnetic field

$$\mu_0 \mathbf{H}_{ind} \cdot \hat{\mathbf{i}} = \mu_0 H_x(x,y,z) =$$
$$= \frac{\mu_0}{4\pi}\iiint \frac{J_y(x',y',z')\cdot(z-z') - J_z(x',y',z')\cdot(y-y')}{\sqrt{\left[(x-x')^2+(y-y')^2+(z-z')^2\right]^3}} dx'dy'dz'$$

$$\mu_0 \mathbf{H}_{ind} \cdot \hat{\mathbf{j}} = \mu_0 H_y(x,y,z) =$$
$$= \frac{\mu_0}{4\pi}\iiint \frac{J_z(x',y',z')\cdot(x-x') - J_x(x',y',z')\cdot(z-z')}{\sqrt{\left[(x-x')^2+(y-y')^2+(z-z')^2\right]^3}} dx'dy'dz'$$

$$\mu_0 \mathbf{H}_{ind} \cdot \hat{\mathbf{k}} = \mu_0 H_z(x,y,z) =$$
$$= \frac{\mu_0}{4\pi}\iiint \frac{J_x(x',y',z')\cdot(y-y') - J_y(x',y',z')\cdot(x-x')}{\sqrt{\left[(x-x')^2+(y-y')^2+(z-z')^2\right]^3}} dx'dy'dz'$$