Lab Tests of the Magnetohydrodynamics of Liquid Metal Jets

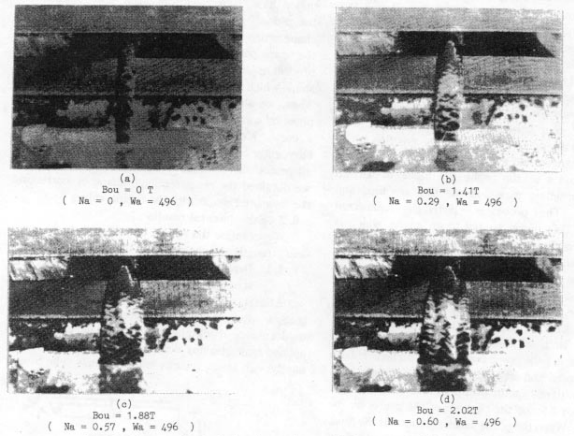

Fig. 9 Photographs of the jet for various applied mag- netic field strengths

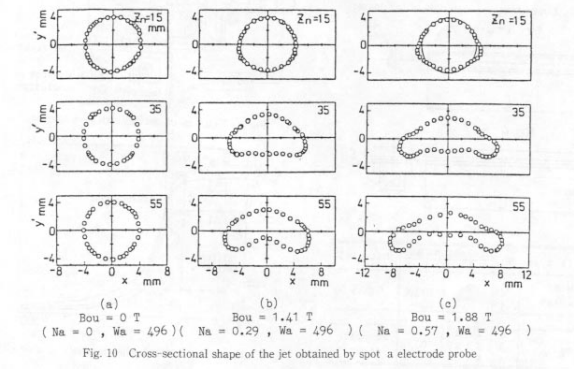

Fig. 10 Cross-sectional shape of the jet obtained by spot a electrode probe

S. Oshima *et al.*, JSME Int. J. **30**, 437 (1987).

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Issues

A strong magnetic field can damp some hydrodynamic instabilitites of a liquid metal jet:

- Breakup due to surface tension (Rayleigh instability).
- Some of the perturbations due to the proton beam.

But it is difficult to get a metal into a magnet:

- If conductivity is too high, almost impossible to enter the field.
- Radial pinch on entering a solenoid $\Rightarrow$ increase in internal pressure.
- Axial retarding force on entering and exiting a solenoid.
- Strong shear forces, especially if enter at an angle.
- Quadrupole deformation due to transverse field.

Calculations give some confidence, but laboratory confirmation is needed that a liquid metal jet can enter the solenoid without undue distortion.

A First Test

- Use a 5-T solenoid
- with 4-cm warm bore,
  and coil inner diameter of 6 cm.