

FAST TRACK Li-DiMES EXPERIMENT

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LI-DIMES EXPERIMENT DESIGN GOAL

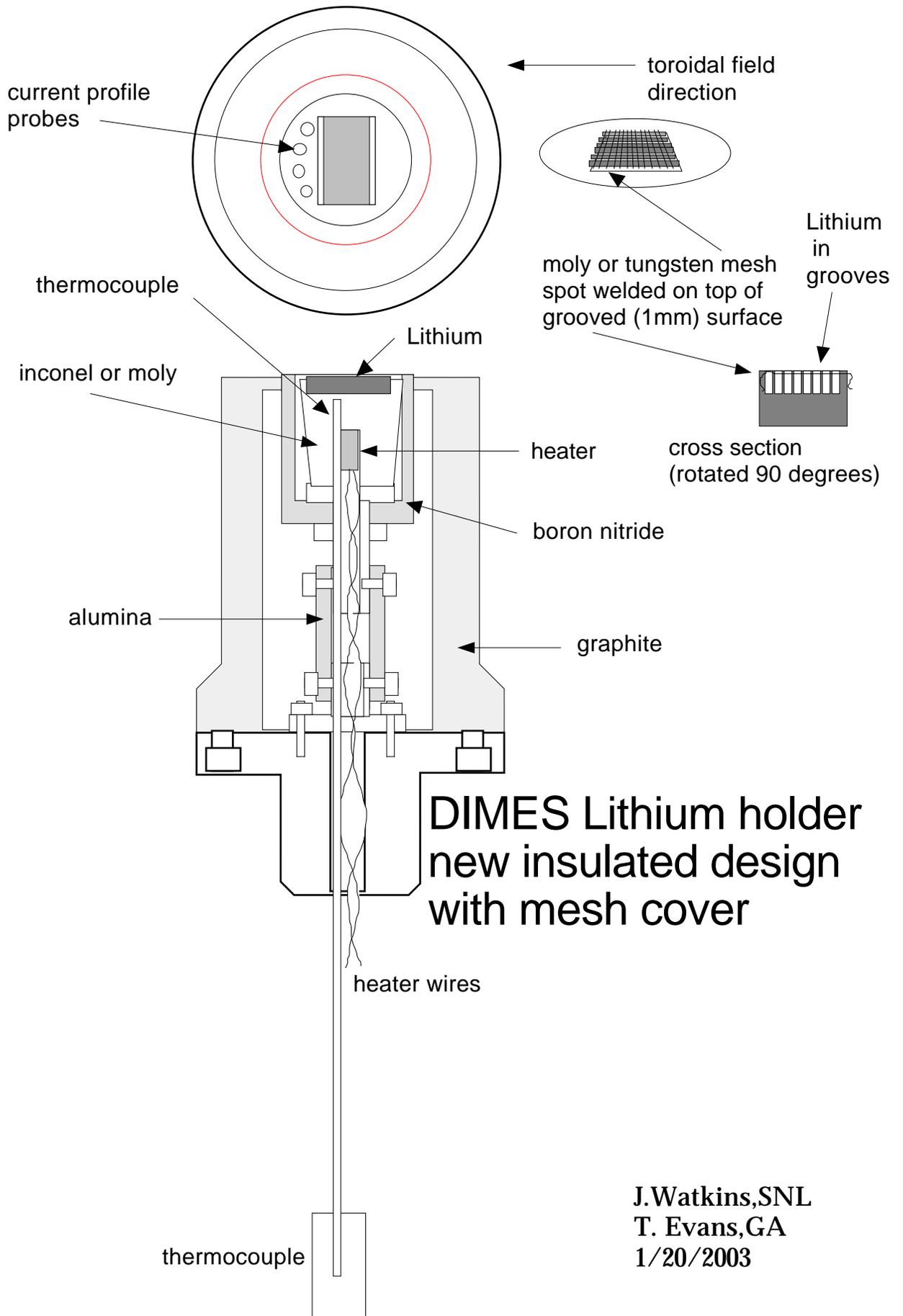
“We would like to understand the MHD interaction between the parallel current and the liquid lithium at the lower divertor of DIII-D.”

(Note that this is a complicated and coupled interactive phenomena.)

Experimental criteria:

- 1. Expose melted lithium to the plasma. (This is to avoid the additional complexity due to the phase change of the Li.)**
- 2. Expose the lithium to the plasma and not metallic edges or screen.**
- 3. Measure the induced current in the lithium, which could then be confirmed by modeling.**
- 4. Measure the tile/parallel current variation as a function of time and space during a low power L-mode discharge with different locations of the strike point. This means the addition of plasma current monitors.**
- 5. Quantify the temperature change of the liquid lithium.**
- 6. Record all plasma parameters at the divertor and the lithium signals in the SOL and in the core.**

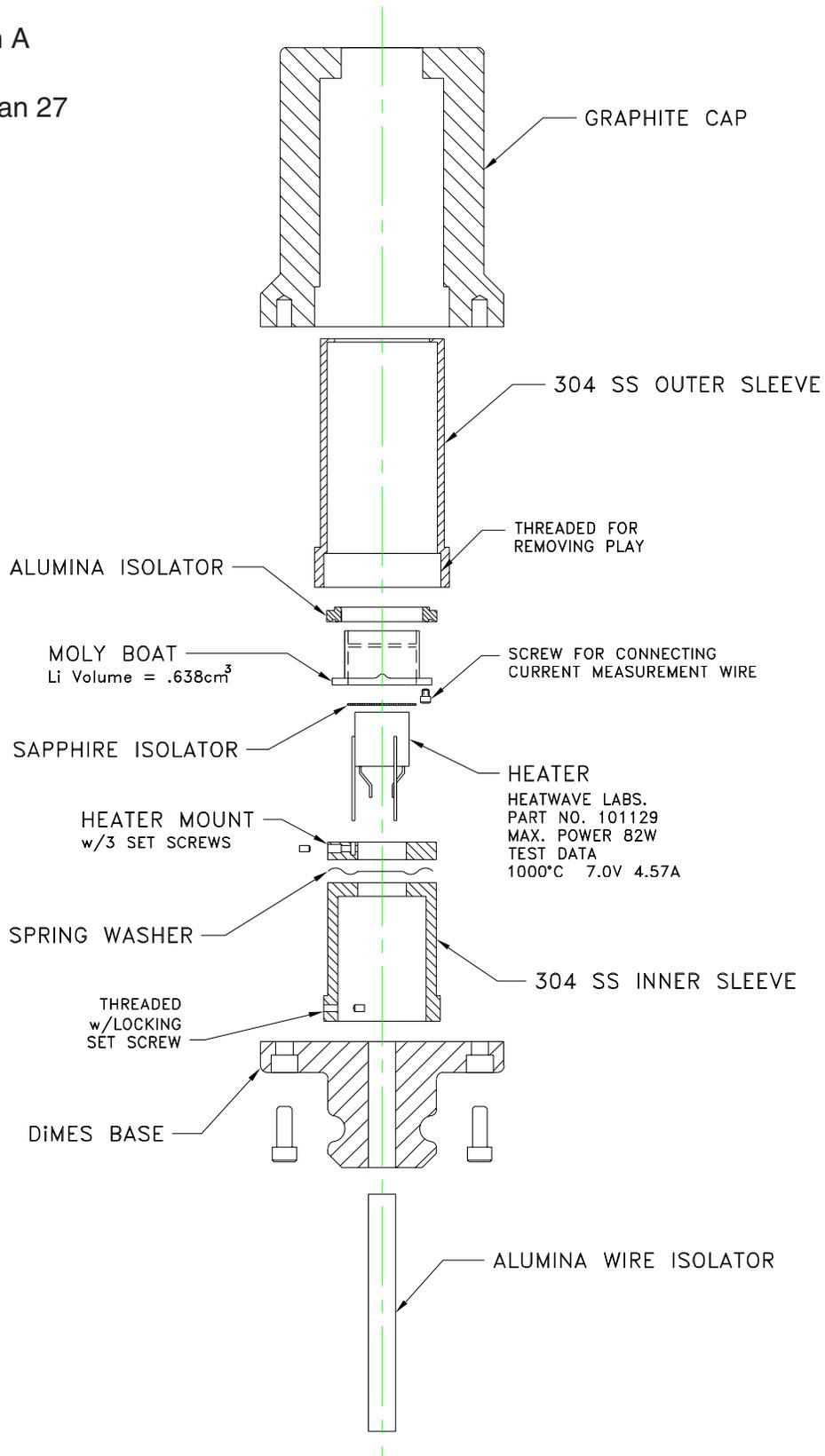
(The sample design will be limited by the number of appropriate conductors in the DiMES system.)



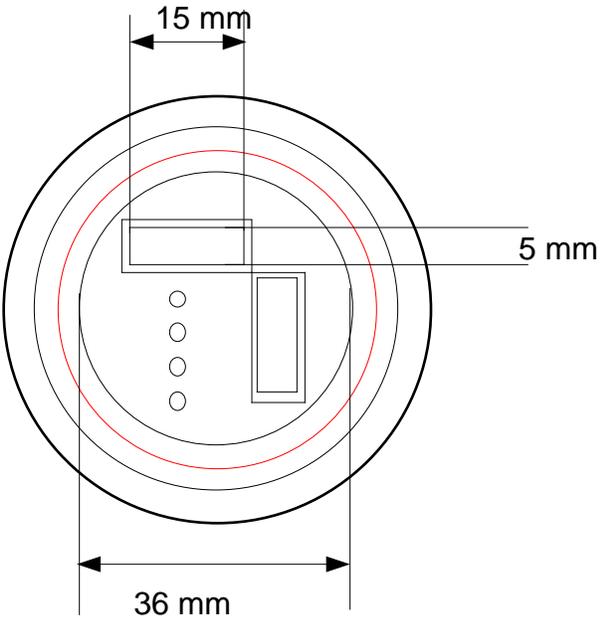
DiMES # 121

version A

2003 Jan 27



DIMES Lithium sample
perpendicular grooves



J. Watkins
2/6/2003

NUMBER OF CONDUCTORS

There are 5 shielded cable pairs:

1 pair is 20G for power supply

4 pairs are 24G for diagnostics.

The shields are ganged to an outside lead.

One pair of thermal couple wires wrapped around the phone cord.

We have a total of 13 conductors leading to the outside, 1 is the ganged shields, 2 are for the thermal couple, 10 are for power and diagnostics.



MEASURING INDUCED CURRENT

Observation from Dimitry Rudakov:

If the current can be up to 10s of A, it is worth trying to measure it. Even if the resistivity is around 15 micro-ohm cm, for 10 A we will have a signal of 1 mV, which should be measurable with a low-noise differential amplifier. We should not aim at very high bandwidth, since fast amplifiers are noisier and have low gain. Also, I would rather not use 50 Ohm terminations to avoid loop current pickup. I think we can easily get away with bandwidth of a few tens of kHz. Since our shunt will be of very low impedance and the measuring circuit of very high impedance and differential, we should avoid both electrostatic and electromagnetic pickup. We will have to find a way to distinguish between noise and induced current. If the focused current is 100s of A, we should have be able to measure it easily.

LABORATORY TESTS

- Melting and filling of lithium
- Wetting of lithium in the SS slot
- Compatibility between BN and Li
- Surface geometry of the Li

Li-Wetting and Li/BN compatibility experiments at UCSD



ISSUES TO BE ADDRESSED/RESOLVED

- **DIII-D dedicated run time**
- **DiMES system operation**
Primary vacuum
- **Wetting of Li in SS holder slots**
Concave surface of melted lithium
Other options: mesh, fine slits
- **Compatibility between BN and Li**
- **Electrodes in the Li**
- **External equipment: Power supply,
digitizer...etc.**

REVERSED CHRONOLOGICAL SCHEDULE

- **Complete the MHD story January 2004 (~~Oct. 2003~~)**
- **Complete modeling analysis of the Li-DiMES experiment if necessary, end of Aug. 2003**
- **Complete 3-D MHD modeling, end of July, 2003**
- **Provide plasma data, 3 weeks after the experiment is performed.**
- **Li-DiMES experiment performed earlier than June, 2003.**
- **Li-DiMES sample ready for experiment in DIII-D, ASAP around March 3rd., 2003, if not, no later than early May, 2003.**
- **Li-DiMES sample DIII-D reviewed late March, no later than mid-April, 2003**
- **Complete mock-up tests by end of March. 2003**
- **Initiate mock-up tests early Feb. 2003**
- **Initiated Li-DiMES module design.**