

**New Folder Name** MK II Pumping

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CALIFORNIA INSTITUTE OF TECHNOLOGY  
Laser Interferometer Gravitational Wave Observatory (LIGO) Project

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Refer to: LIGO-T950036-00-R  
Date: May 31, 1995

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Subject: Mk II pumping

A review of RGA calibration (by A. Abramovici and S. Vass), for the unit attached to the Mk II vacuum system, led to the finding that the sum of hydrocarbon fragment (M=41,43,53,55,57) partial pressures is  $3.2 \times 10^{-10}$  torr. The background against which this number is to be evaluated is summarized as follows:

- The nominal hydrocarbon pressure threshold, considered safe for mirrors in vacuum, is  $10^{-11}$  torr.
- From experience with the 1 m mode cleaner, at  $75 \text{ kW/cm}^2$ , we know that  $10^{-11}$  torr is safe, while  $10^{-9}$  torr leads to irreversible mirror degradation.
- The losses of the test masses currently installed in Mk II appear to be increasing; the arm cavities went from overcoupled to undercoupled.
- Cleaning the test masses is a delicate and risky process.
- At present, Mk II is being pumped with the 300 l/s maglev turbo.

Mk II has ion pumps with a total installed pumping capacity of 2000 l/s. Thus it is possible, in principle, to operate the 40 m interferometer with hydrocarbon partial pressure closer to the safe value of  $10^{-11}$  torr.

**Recommendation:** since it is crucial to keep the 40 m interferometer test masses in a healthy operating condition for as long as possible, one should consider making it standard procedure to use the ion pumps for steady state pumping.

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