HQ03a / a2 heater tests

M. Marchevsky
LBNL

Test goal

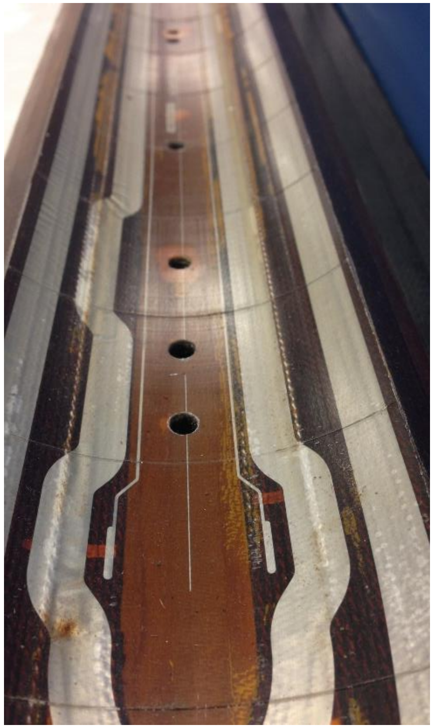
The main goal of heater tests in HQ03a / a2 was to compare performance of the “special design” heaters of Coil 26 with that of the regular style HQ coil heaters.

Results of such testing are of relevance to SQXF heater design validation.

Coil images

Regular HQ coil

OL



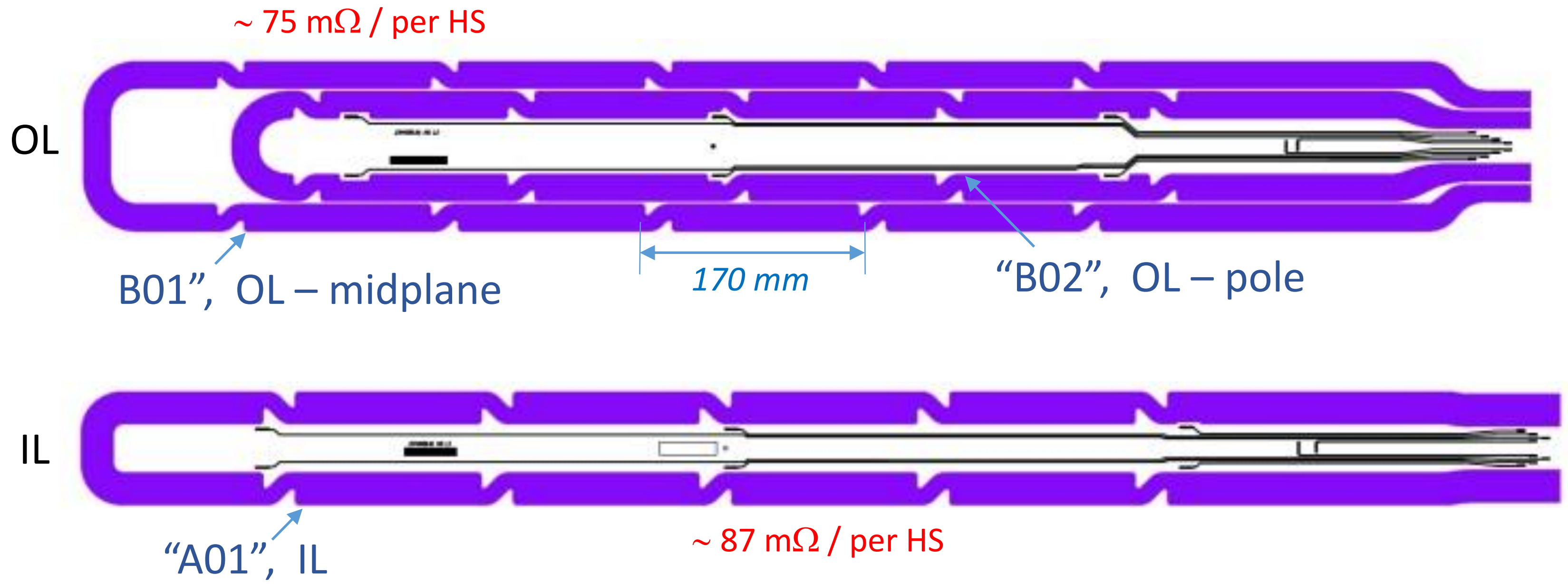
IL

HQ Coil 26

OL

IL

HQ 03 Coil 26 heaters

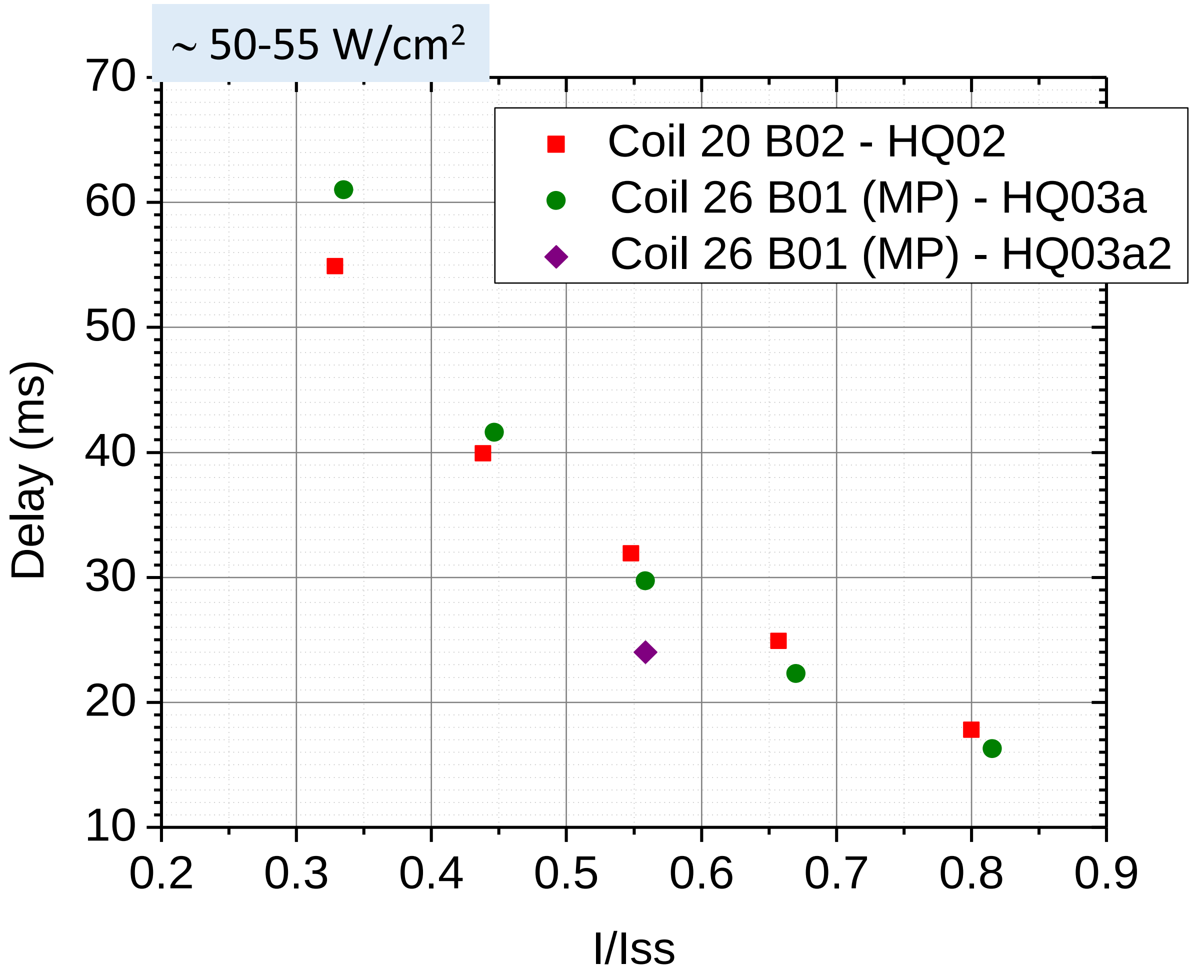


Coil 26 heaters have same main dimensional parameters of heating station (width, ends curvature) as the MQXF "stainless-only" design. Heating stations are separated by ~2x cable twist pitch of 170 mm. This layout can in principle be scaled (going end-to-end, without the loop) to 6.7 m of SQXF-L while keeping power density > 50 W/cm^2 and heater voltage under 450 V.

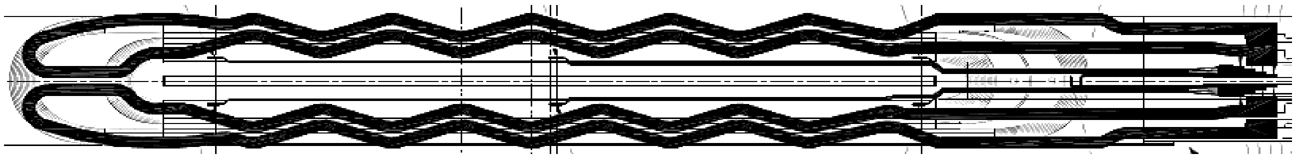
Heater	Full heater resistance	Full heater resistance incl. wiring	Heating station resistance	Heating station area
PHA01	2.33 Ω	3.285 Ω	58.4 mΩ	3.56 cm^2
PHB01	2.60 Ω	3.55 Ω	49.8 mΩ	2.91 cm^2
PHB02	2.40 Ω	3.35 Ω	50.7 mΩ	2.91 cm^2

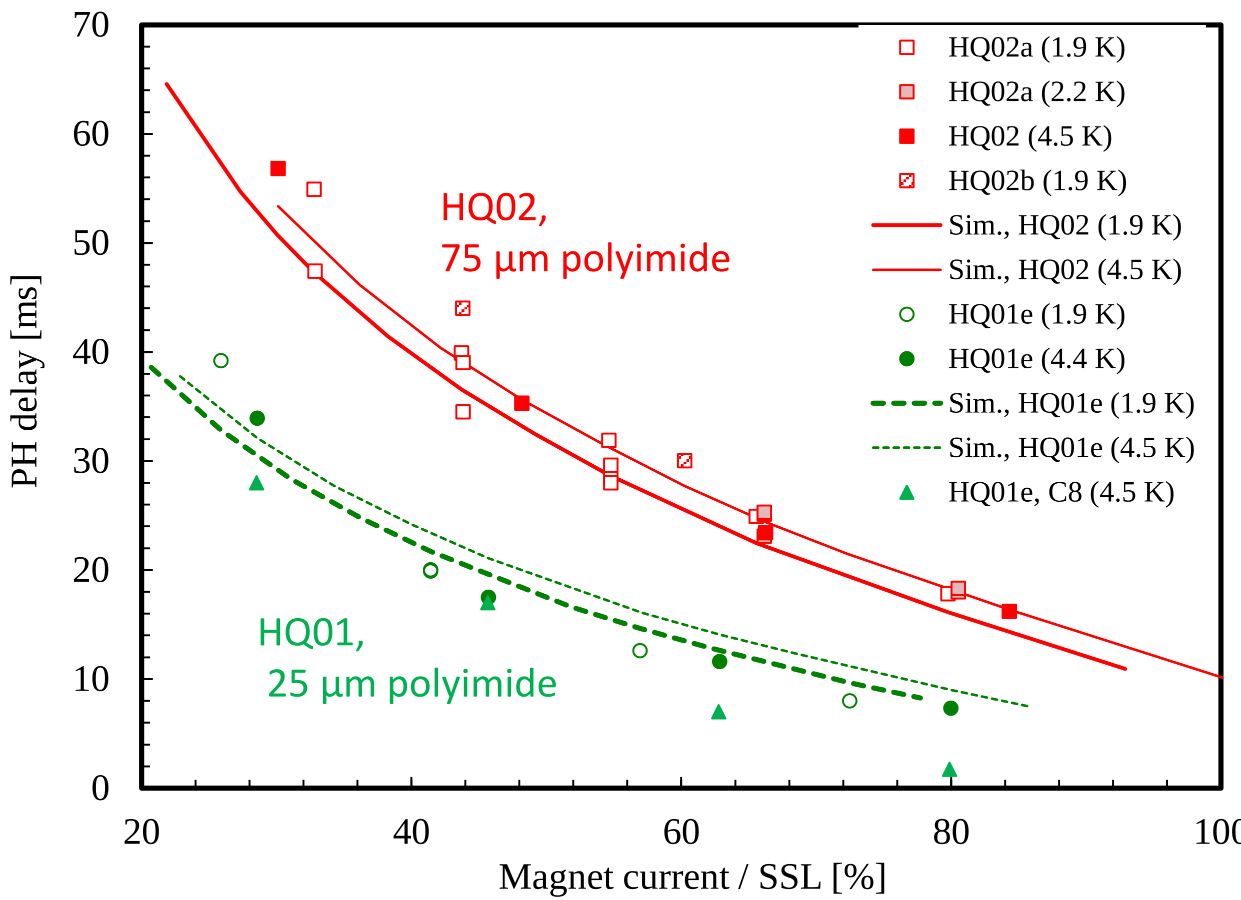
Heaters are separated form the coil by 50 μm of polyimide insulation

Quench delay for the OL heaters



HQ01 and HQ02 – Outer layer

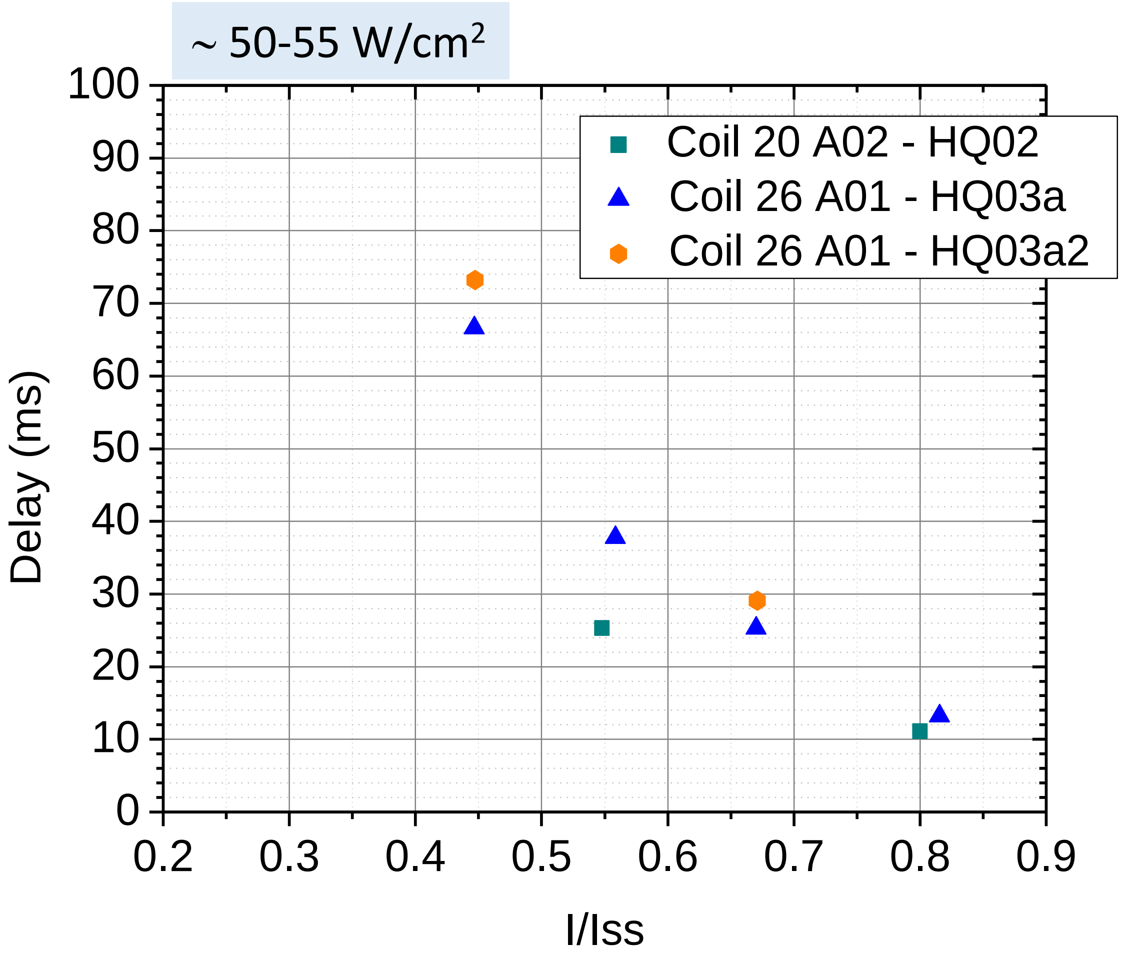




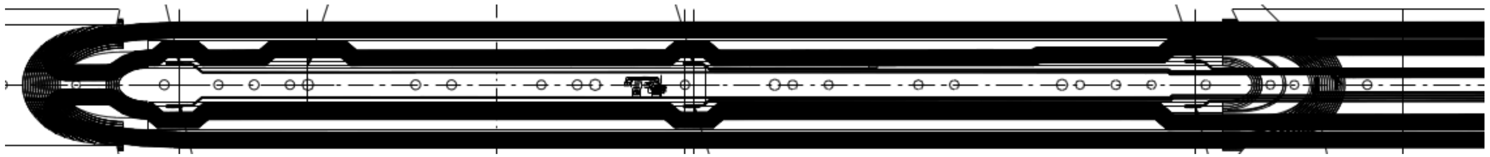
PH peak power = 50-55 W/cm^2, τ = 40-45 ms

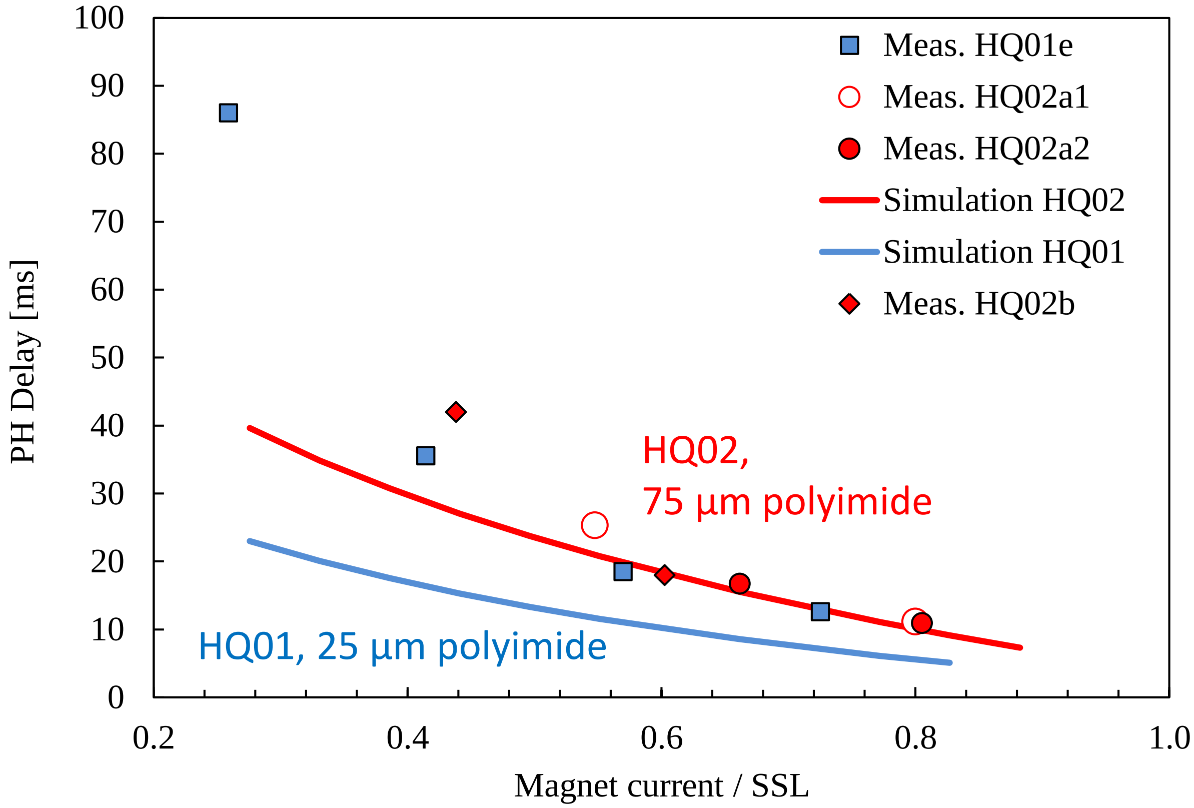
T. Salmi

Quench delay for the IL heaters



HQ01 and HQ02 – Inner layer



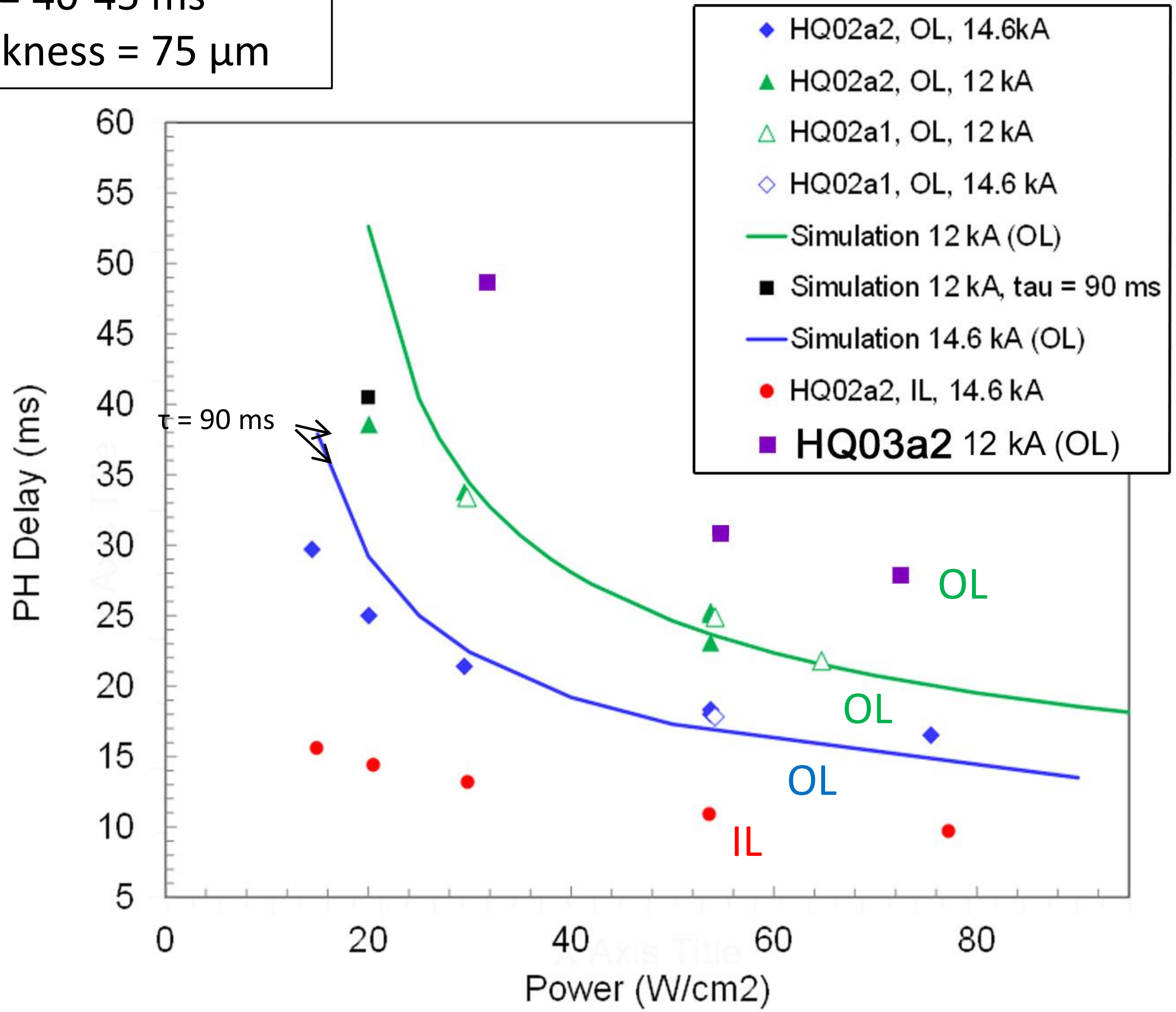


PH peak power = 50-55 W/cm², τ = 40-45 ms
Top = 1.9 K

T. Salmi

HQ02 – Delay vs. power

T = 1.9 K, τ = 40-45 ms
Kapton thickness = 75 μm



Conclusions

- Heater delays for Coil 26 OL heater are very similar to those of a regular style HQ OL heater in the 0.3-0.8 range of I/I_{ss}
- The IL heater of Coil 26 exhibits longer delays compared to the regular style IL HQ heater
- Quench delays are very well reproducible between the tests (HQ03a and HQ03a2)
- Delays for the Coil 26 OL heater measured at 12 kA magnet current in the 30-70 W/cm^2 power density range are longer than those for the regular style HQ OL heater