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Development of a Low Cost Novel PT Logging Tool for High Temperature Operation (600°C)

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Exploitation of super-critical water from deep geothermal resources can potentially give a 5-10 fold increase in the power output per well. Such an improvement represents a significant reduction in investment costs for deep geothermal energy projects, thus improving their competitiveness.

In the previous European Horizon2020 DESCramBLE (Drilling in dEep, Super-Critical AMBients of continental Europe) project it was demonstrated drilling of a deep geothermal well with super-critical conditions (>375°C, >220 bar) by extending an existing well in Larderello, Italy to a depth of around 4km. As state-of-the-art electronic logging tools could not operate reliably at these conditions, DESCramBLE developed and tested a novel pressure and temperature logging tool for these supercritical conditions. Target specification for the slickline operated tool was 8 hours logging operation time at 450°C/450 bar, limited by the critical temperature for the available battery technology used for the application. During testing in the supercritical well in Larderello, Italy in 2017, the tool recorded a maximum well temperature of 443.6°C.

The instrument developed in the DESCramBLE project, although being state-of-the-art in its performance, was costly and advanced in addition to having a larger outer diameter than desired in for example slim-well applications. Therefore, there is a need for a simpler, lower cost version of this tool with a smaller outer diameter.

The tool being developed, based on the H2020 DESCramBLE project, consists of off-the-shelf high temperature electronics, sensors and batteries shielded from the environment by a heat and pressure shield (Dewar). The target specification for the tool is 600°C/500Bar, with a shorter operational time than the DESCramBLE tool.

In this work, we describe the tool requirements and discuss the design choices made regarding mechanical parts, seals, electronics platform, sensors, and available battery technology. 3D CAD drawings and simulations of the thermal performance of the tool will be presented, as well as preliminary test results of the electronic platform combined with the sensors and batteries. Production and testing of the physical tool will not be within the scope of the project.