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HFD Heat Field Deformation



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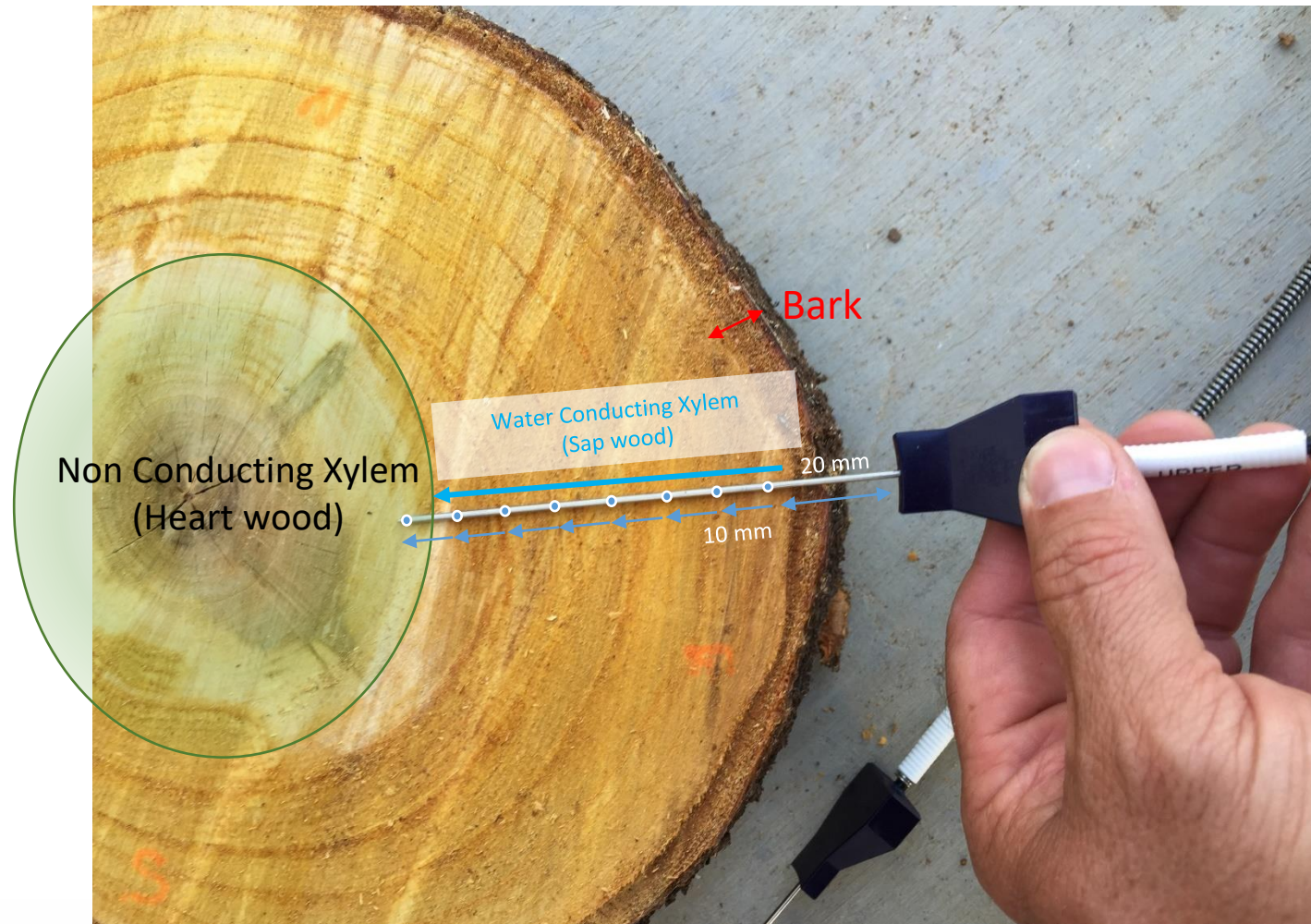
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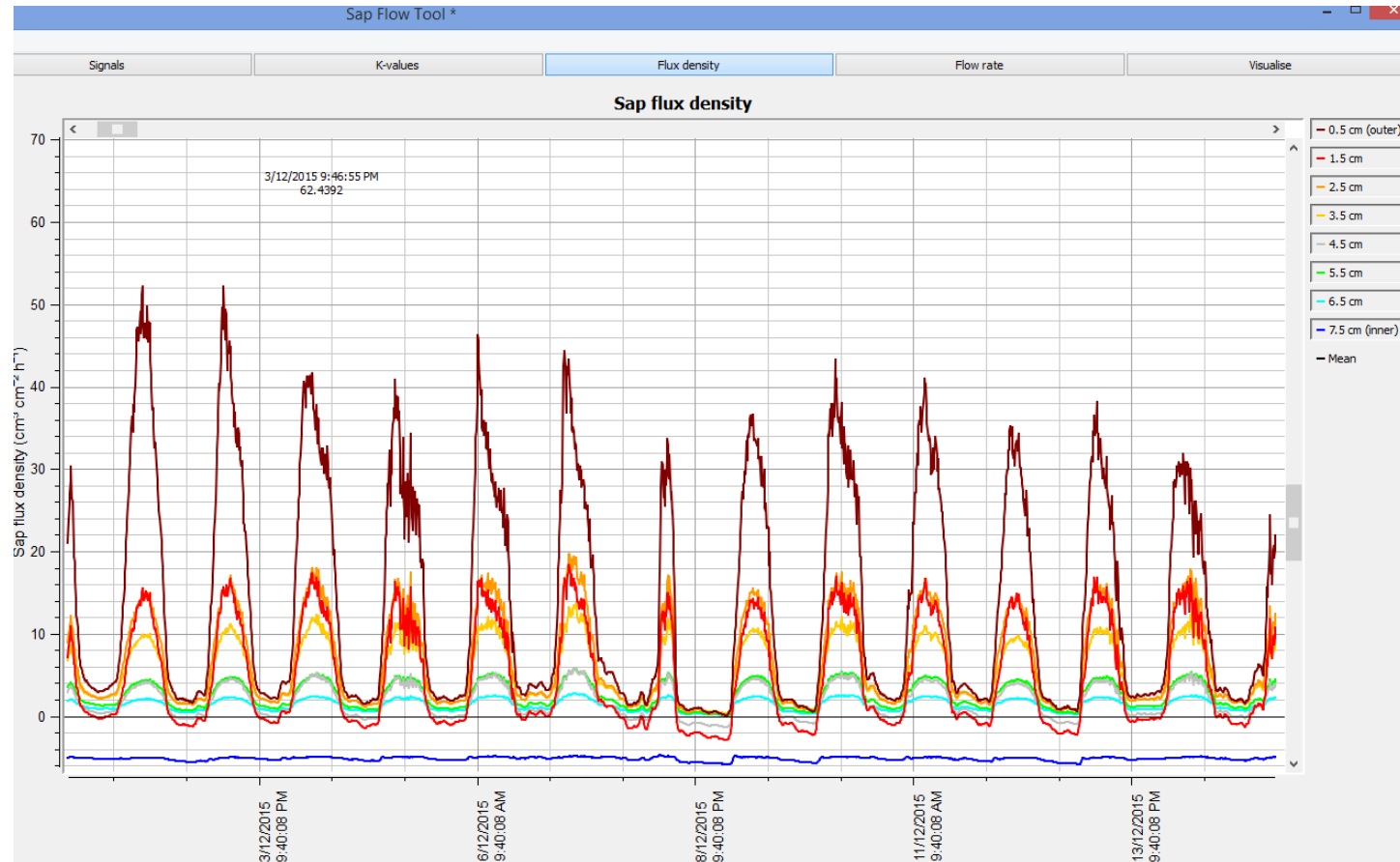
Heat Field Deformation (HFD)



Non-destructive Determination of Almond Sapwood Area



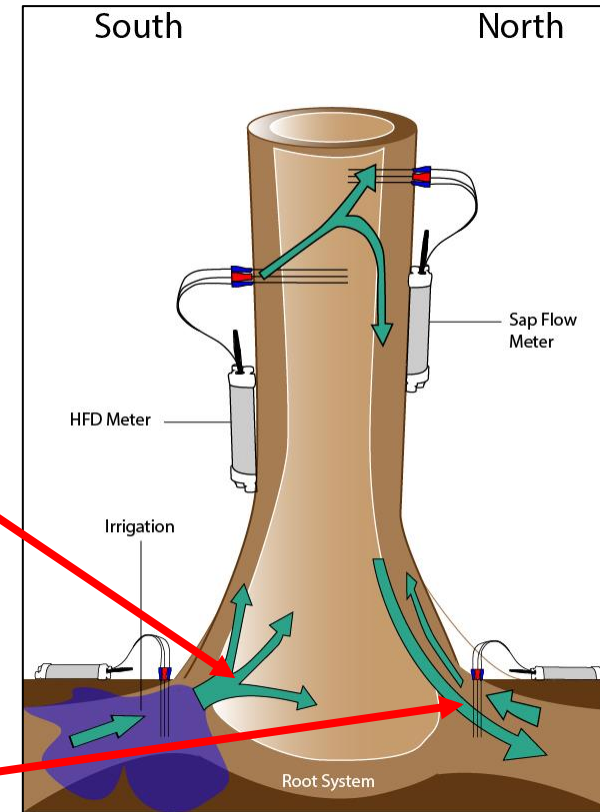
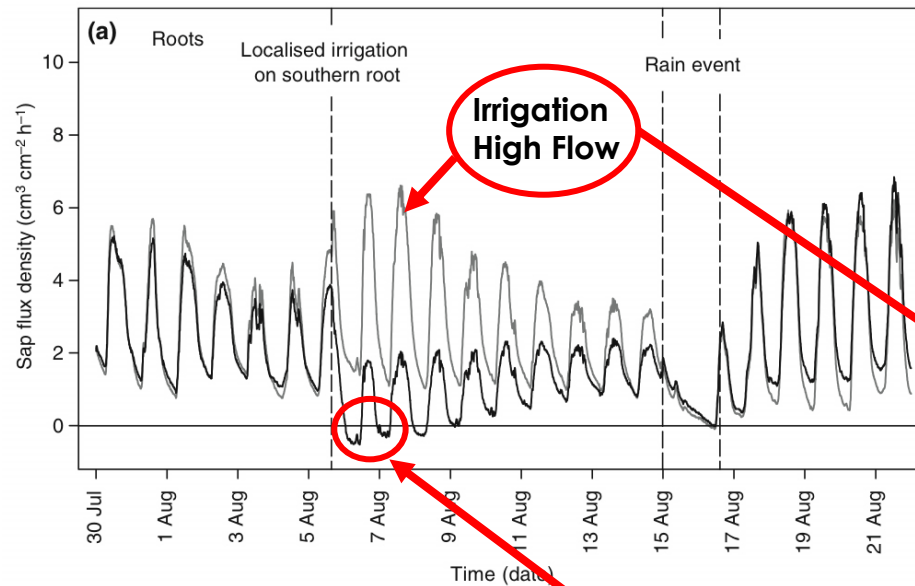
Non-destructively Measured Radial Profile

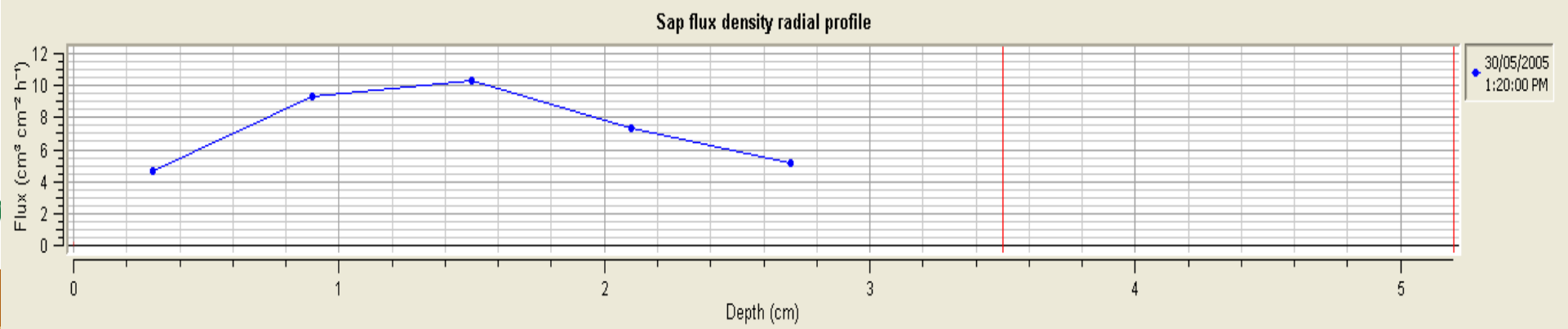
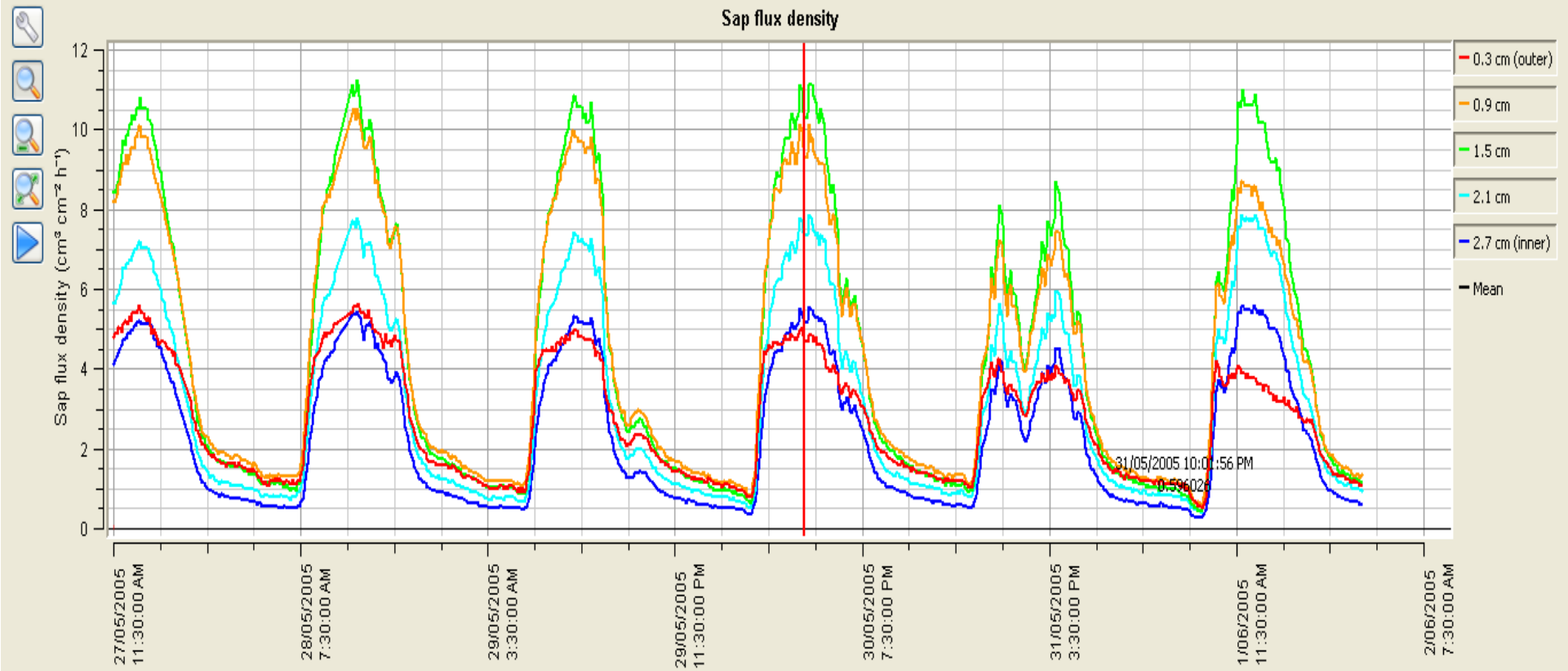


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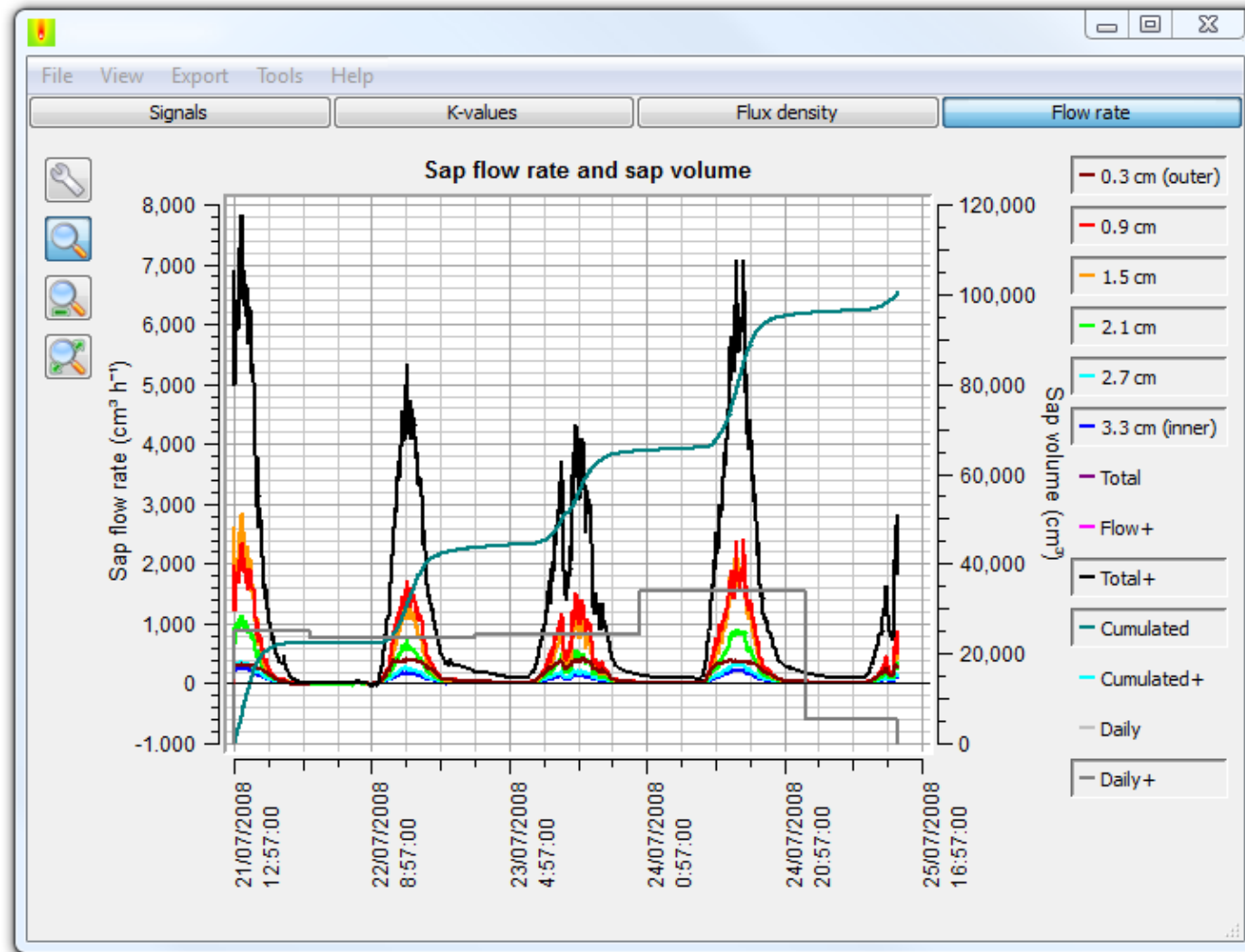
Hydraulic Redistribution In 54 Year Old Oak Tree - Europe

- Water Movement
- Nutrient Redistribution





Sap Flow - Heat Field Deformation (HFD)



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Live Display of measured temperatures

The screenshot shows the ICT HFD software interface. The title bar indicates it is connected to 'apple in Obora (branch 2 sites)' with FW Revision: R1-0-1. The software version is 1.0.0.8. The interface is divided into several sections:

- Configuration Panel (Left):** Contains fields for Name ('apple in Obora'), Comment ('branch 2 sites'), Device Serial # ('HFD1C902'), APP Ver. ('R1-0-1'), COM Ver. ('R2-3-2'), External Supply ('Solar/Power Supply: 12.3V @ 97mA'), Battery ('4.17 V, 19.6°C'), and Charging Status ('idle'). There is a 'Download Data' button and an 'Update sensor name and comment' button.
- Measurement Status (Top Center):** Shows 'Measurement Running' and 'Next Value Logged: 20:20:00'. A 'View Live Mode' button is also present.
- Data Table (Center):** A table with 6 columns: Point, Upper °C, Lower °C, Side °C, dT sym °C, and dT asym °C. It displays 8 rows of data for different measurement points.
- Status Bar (Bottom):** Shows 'Connected', COM186, Battery status (4.17 V, 19.6°C), Date/Time (22/09/2012 20:19), and Power consumption (0.063W/cm). A temperature indicator shows -79.

Point	Upper °C	Lower °C	Side °C	dT sym °C	dT asym °C
1	15.595	15.356	16.720	0.239	1.364
2	15.555	15.364	16.749	0.191	1.385
3	15.446	15.325	16.744	0.121	1.419
4	15.324	15.255	16.701	0.069	1.445
5	15.172	15.132	16.617	0.040	1.485
6	15.021	14.995	16.522	0.026	1.527
7	14.857	14.836	16.432	0.022	1.597
8	14.636	14.668	16.165	-0.031	1.498

Log messages at the bottom of the interface:

- 04:00:54 We are connected
- 04:02:21 Sensor Information Updated OK.
- 04:02:56 Updating device date and time successfull
- 04:03:16 Updating device date and time successfull
- 04:05:50 File renamed OK.
- 04:12:15 HFDVC should be initialised
- 04:12:15 We are connected
- 04:14:26 Sensor Information Updated OK.



Main advantages of the HFD-method:

- **Measurements of wide range of flow rates including zero and reverse flow**
- **Measurements of flows of any directions simultaneously in series of points along xylem radius**
- **Application for a wide range of stem size**
- **Continuous measurements with high time resolution**
- **Suppressing the impact of surrounding medium on sap flow calculations**





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