9.3 Pickup Connecting Wires

One would think that the wire connecting the pickups with the switches and controls do not have any significant influence on the electric parameters of a guitar. In most cases this assumption would indeed be correct – however there are exceptions.

In Fender guitars, the internal wiring is often done via **single stranded wires** which are paired and soldered to the pickups as a so-called two-wire line. Such a connection can - for the audio range - described with very good approximation as a pure capacity having about 50 pF/m. A length of 20 cm (as it would typically occur inside a guitar) would thus yield a capacitance of 10 pF which is a value that is clearly negligible relative to the capacity of the guitar cable. Losses, as well, do not play any role: even if one would assume $d = 0{,}01$, the loss resistance in the equivalent circuit would be more than 100 MΩ.

As an alternative to the two-wire line, **coaxial wiring** may be used. An insulated internal conductor is surrounded by a concentric shielding braid or stranded wire. Depending on geometry and the dielectric, capacities of 50 - 200 pF/m will occur – which is already more than what the two-wire line exhibits but still immaterial for the typical small lengths in the guitar interior. But then, there's Gibson. Many of the pickups of this manufacturer sport a coaxial cable with astounding characteristics. When we measured the 50-cm-long cable of a **P90** pickup for the first time, our spontaneous reaction was: our PM6303 instrument is clearly broken. The display showed 700 pF in parallel with 500 kΩ at 1 kHz – which is a whole order of magnitude away from the expected value. However: Philips again proved to be dependable: the instrument worked flawlessly. The cable capacity was indeed that high (**Fig. 9.13**). Typical insulators have a dielectric constant of between 2 and 4 – this could not explain such a large capacitance. There is however a substance with a high dielectric constant of about 80 which could help to explain what was going on: water! If indeed the fibrous insulating material is hygroscopic und absorbs water, such a large capacitance could actually result. We tried and heated the cable to 75° C for 5 hours – and, alas, the (cooled down) capacitance dropped to 160 pF.

Such a "special" cable hits back in several ways: the high capacitance exceeds possibly even that of the guitar cable and this audibly reduces the resonance of the pickups, plus the high losses dampen the resonance. These effects are dependent on humidity! in the humid basement the guitar sounds duller than in dry, heated rooms – and this is due to a cable, not due to the wood! We would have liked to print here a comment by the manufacturer .... but those concerned preferred not to reply to an inquiry.

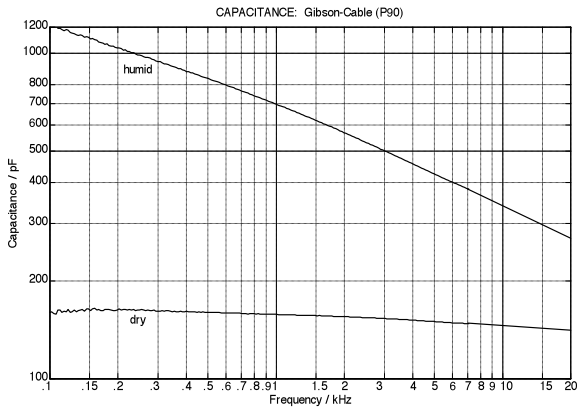

Fig. 9.13: capacitance of a 50 cm long Gibson pickup cable (pickup disconnected). The two curves were measured at different points in time.