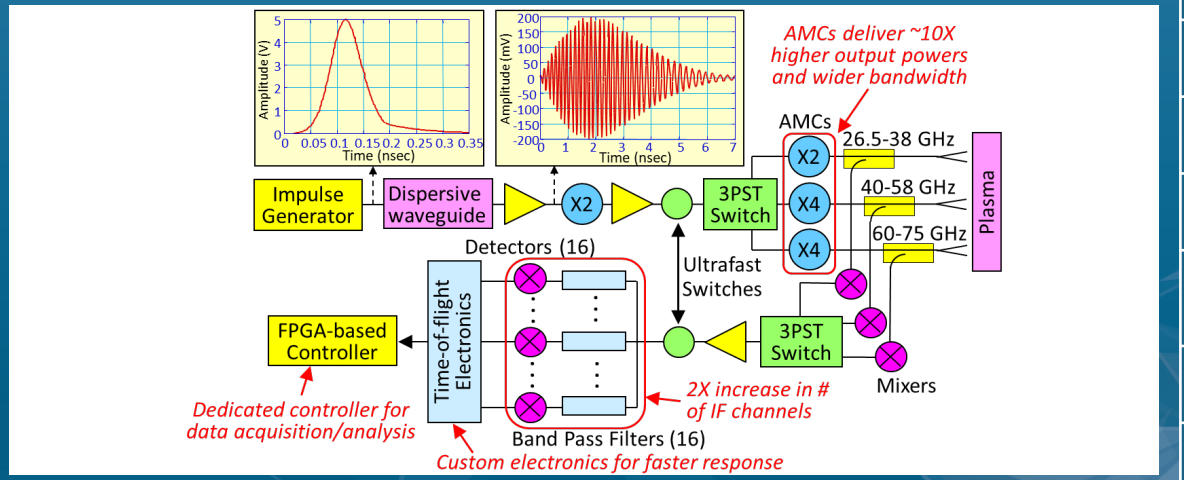
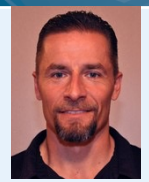
Ultrashort Pulse Reflectometer – Davis, CA

University of California at Davis

- Portable pulsed radar system for density profile measurement
- Measures time-of-flight at 48 frequencies every 3 μsec



Contact(s)	 **Neville C. Luhmann, Jr.** Distinguished Professor ncluhmann@ucdavis.edu  **Calvin W. Domier** Project Scientist cwdomier@ucdavis.edu  **Jon Dannenberg** Development Engr. dannenberg@ucdavis.edu
Key References/Links	A next generation ultra short pulse reflectometry (USPR) diagnostic, *Rev. Sci. Instrum.* **92**, 034714 (2021) https://doi.org/10.1063/5.0040724

Key Properties	
Physical Property to be Measured	Time-resolved electron density profiles
Technique	Pulsed radar reflectometry using 3–5 nsec frequency chirps
Plasma parameter range	Densities varying from 0.9–6.9 x 10^{19} m^{-3} with current setup, expandable to 0.1–15 x 10^{19} m^{-3} with additional components
Resolution (time)	3–12 μsec, depending on the density fluctuation level in the regions being probed
Resolution (space)	3–15 mm, depending on the density fluctuation level in the regions being probed
Resolution (frequencies)	60 frequencies with current setup, easily expanded for increased resolution (time and/or space)
Plasma Device Interface	Requires mid-plane port (or one close to the mid-plane) through which 3 overmoded waveguides and pyramidal horns are positioned to view the plasma
Plasma Control Interface	Self-contained system using FPGA-based digitizers, requiring only START and STOP triggers
Suitable for MCF, ICF, MIF?	MCF
Form factor: transport	All components to fit within a ~1-m^3 wooden transport crate
Form factor: operation	0.2 x 0.2 x 1 m^3 near the device ~0.9 m of 19" equipment rack space away from the device Low loss SMA cables connect device components to rack Ethernet cable connect FPGA to external laptop
Set-up time	3–5 days, not including installation of in-vessel components
Minimum time for a measurement	1 week for commissioning, due to need to evaluate reflected signal levels and adjust signal gains accordingly
Research group website	https://sites.google.co/view/mmwave/home