



# SPECTROHM

A Novel Method for RF Tomography and Acquiring  
Dielectric Signatures for Security Applications

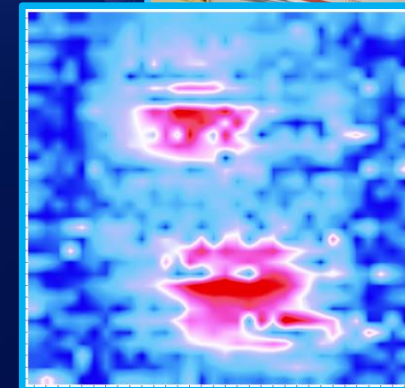
Tim Cargol

<https://Spectrohm.com>

*May 25, 2021*

# So What? Who Cares?

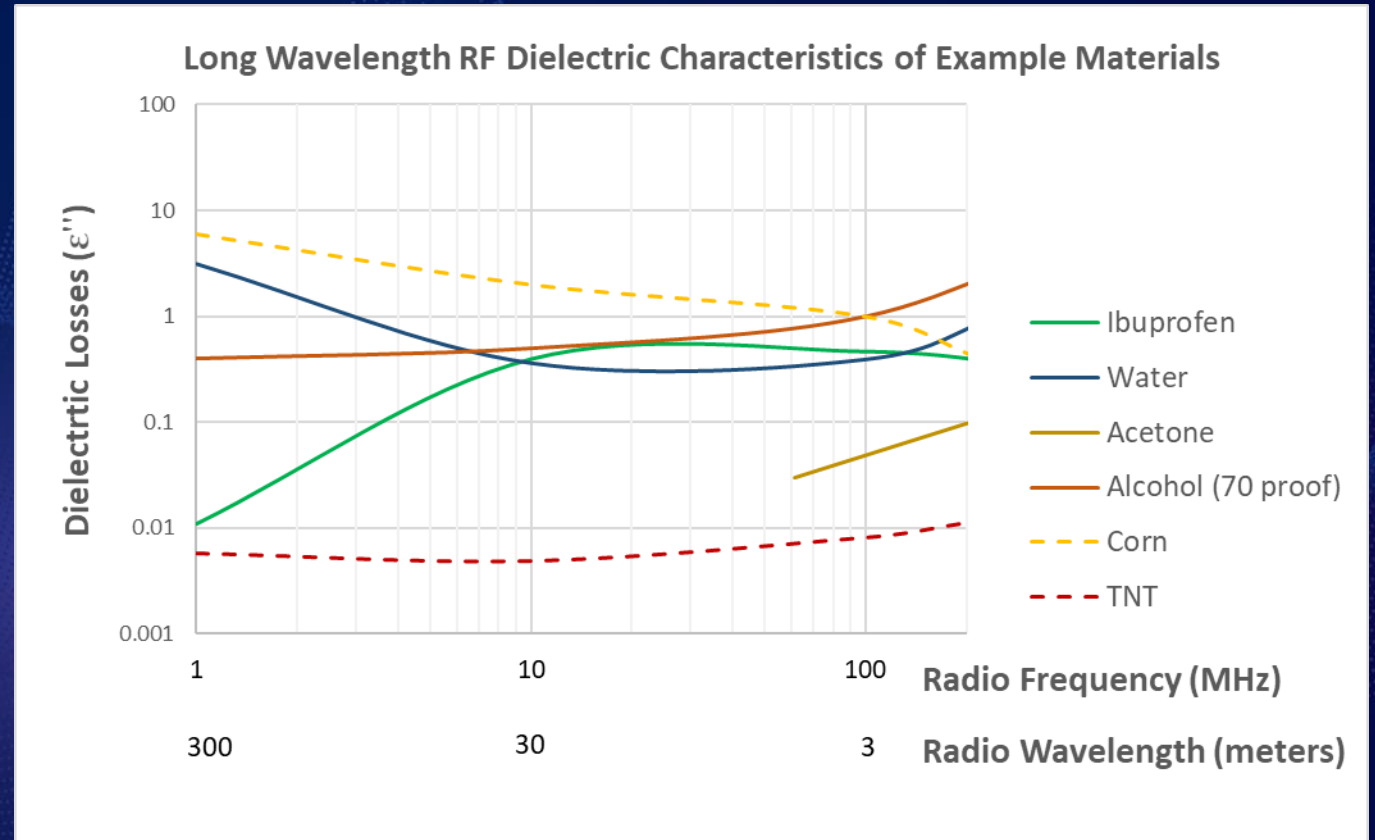
- **Space:** *detection of explosives and contraband in luggage (TSA) and packages (CBP)*
- **Problem:** *need improved speed, detection (PD/PFA)*
- **Solution:** *measure dielectric spectra of potential threats with Transmission Line Tomography--using long, penetrating radio wavelengths to gather material-identifying dielectric spectral information at sub-wavelength resolutions*
- **Results:** *benchtop discrimination of deeply concealed water-based vs flammable products by dielectric constant*
- **TRL:** 3-4



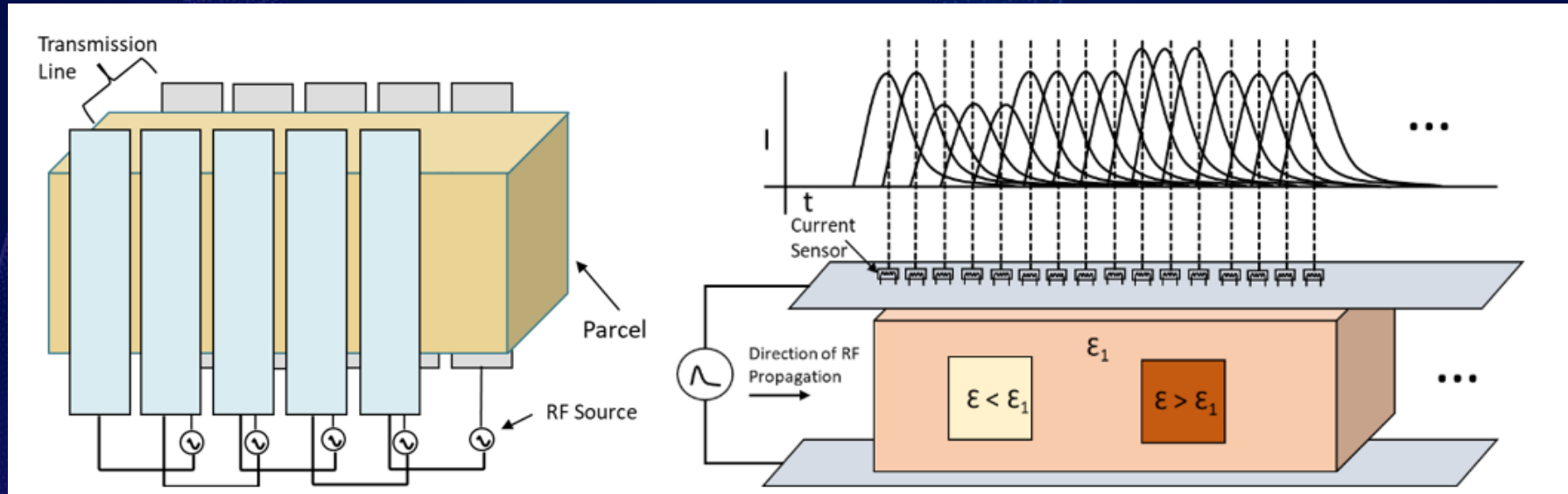
# Radio Frequencies Can Both Image and Also Gather Material-Identifying Dielectric Spectral Information

But there has been a capability tradeoff between short and long radio wavelengths:

- Short wavelengths (MMW, 30GHz) image well, but have difficulty penetrating thick or lossy materials
- Long wavelengths (meters, 1-1000MHz) penetrate deeper and cover many material-identifying spectra, but previously could not image



# Spectrohm's Transmission Line Tomography Confines Long Radio Wavelengths to Short Dimension Waveguides to Achieve Sub-Wavelength Resolution

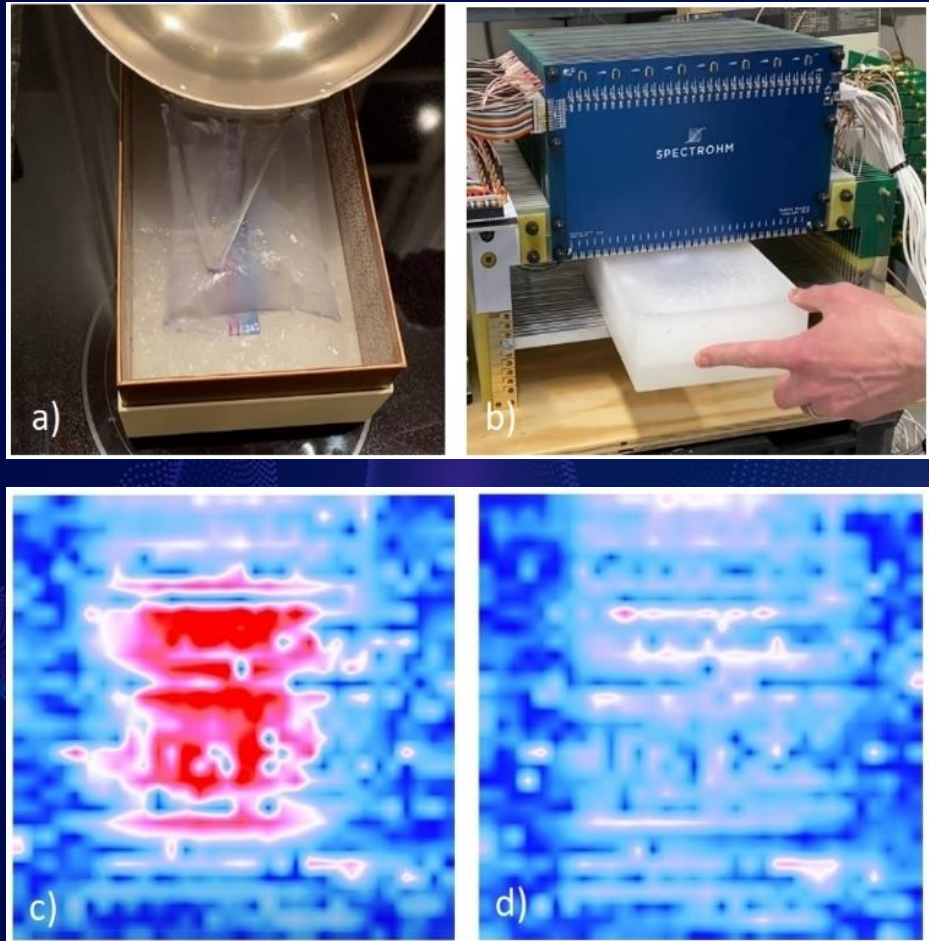


Our resolution is defined by transmission line spacing,  
not wavelength

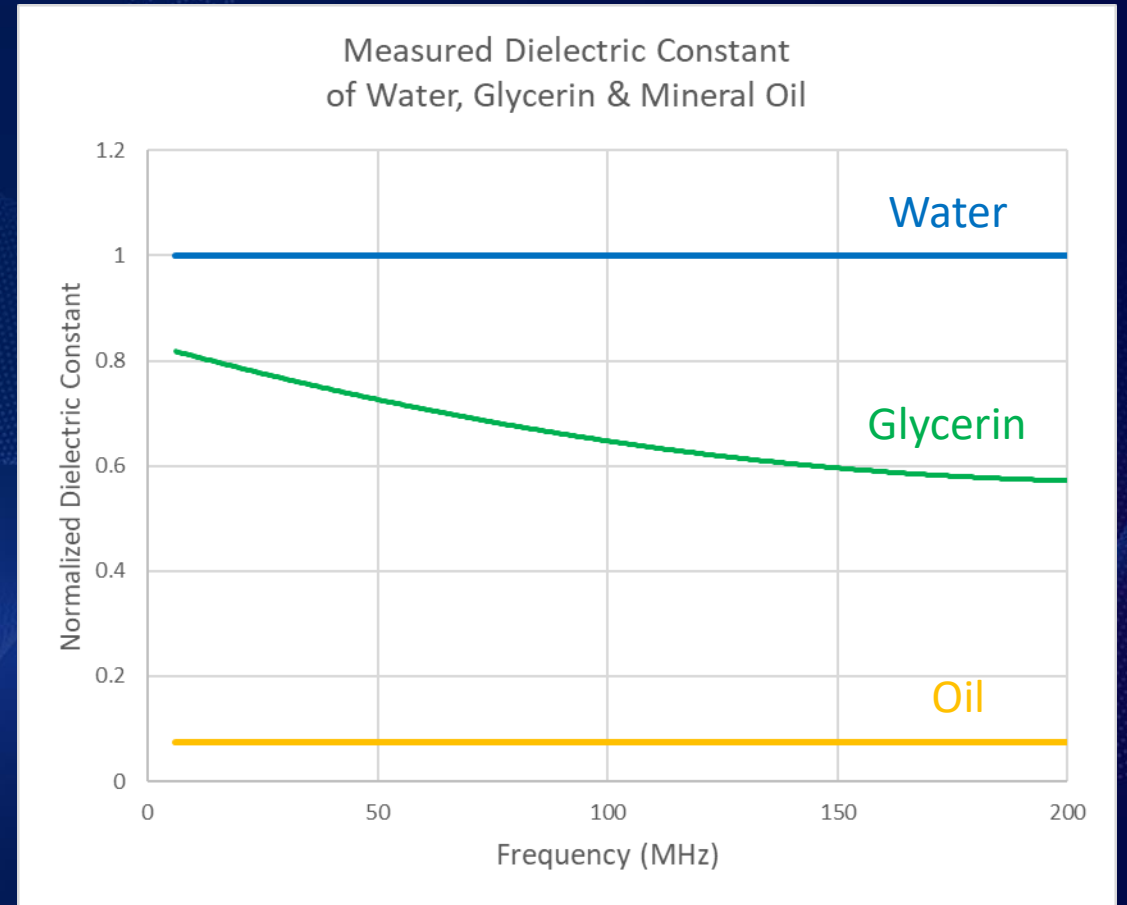
- We can achieve short wavelength-like resolutions with long radio wavelengths
- Imaging volume is between waveguiding panel structures
- No moving parts—can operate at high speed



# Results



Using 30m wavelengths to image at 1cm resolution  
a water baggie concealed within a cast block of wax



Dielectric spectral curves measured with  
prototype system

# Next Steps

Looking for partners, sponsors to help:

- Identify applications/use cases to increase TRL for a relevant environment
  - What are we looking for; what are we looking in?
- Build out dielectric spectral library for target use case
  - Access to threat materials
- Systems engineering for target use case
  - Improve sensitivity?
- Outputs and integration
  - Adjunct to existing X-ray (X-ray spatial signature + RF spectral signature)?
  - Automated threat recognition?