Variable-delay Polarization Modulators (VPMs)

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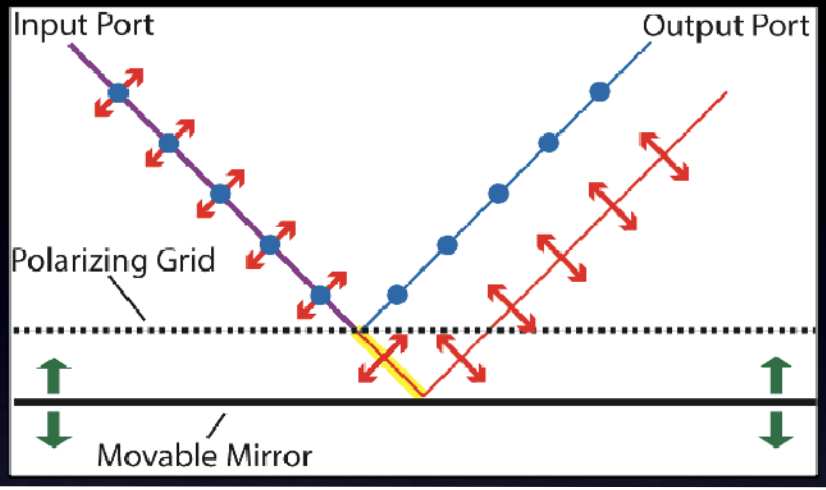
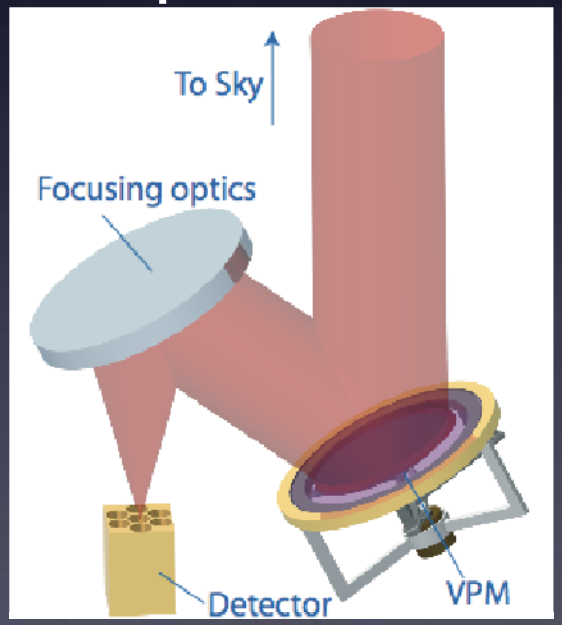
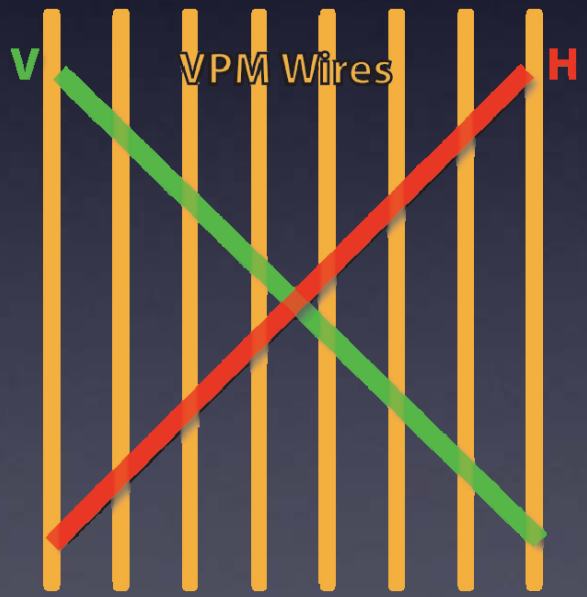
(VPMs)



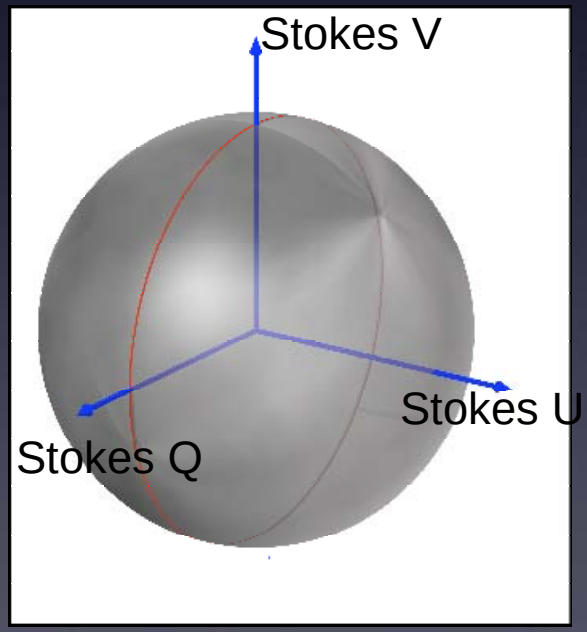
Operational Principle

Implementation

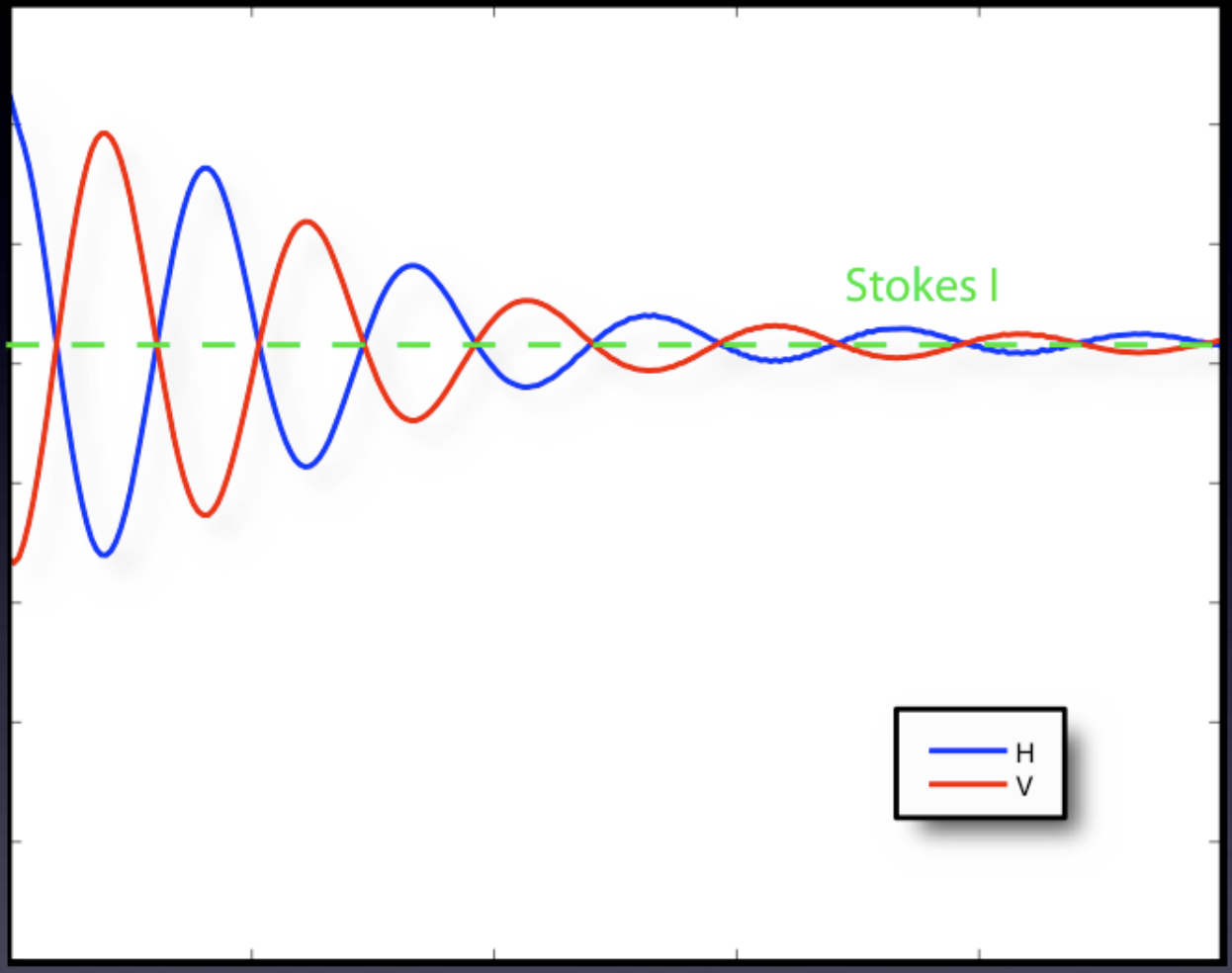




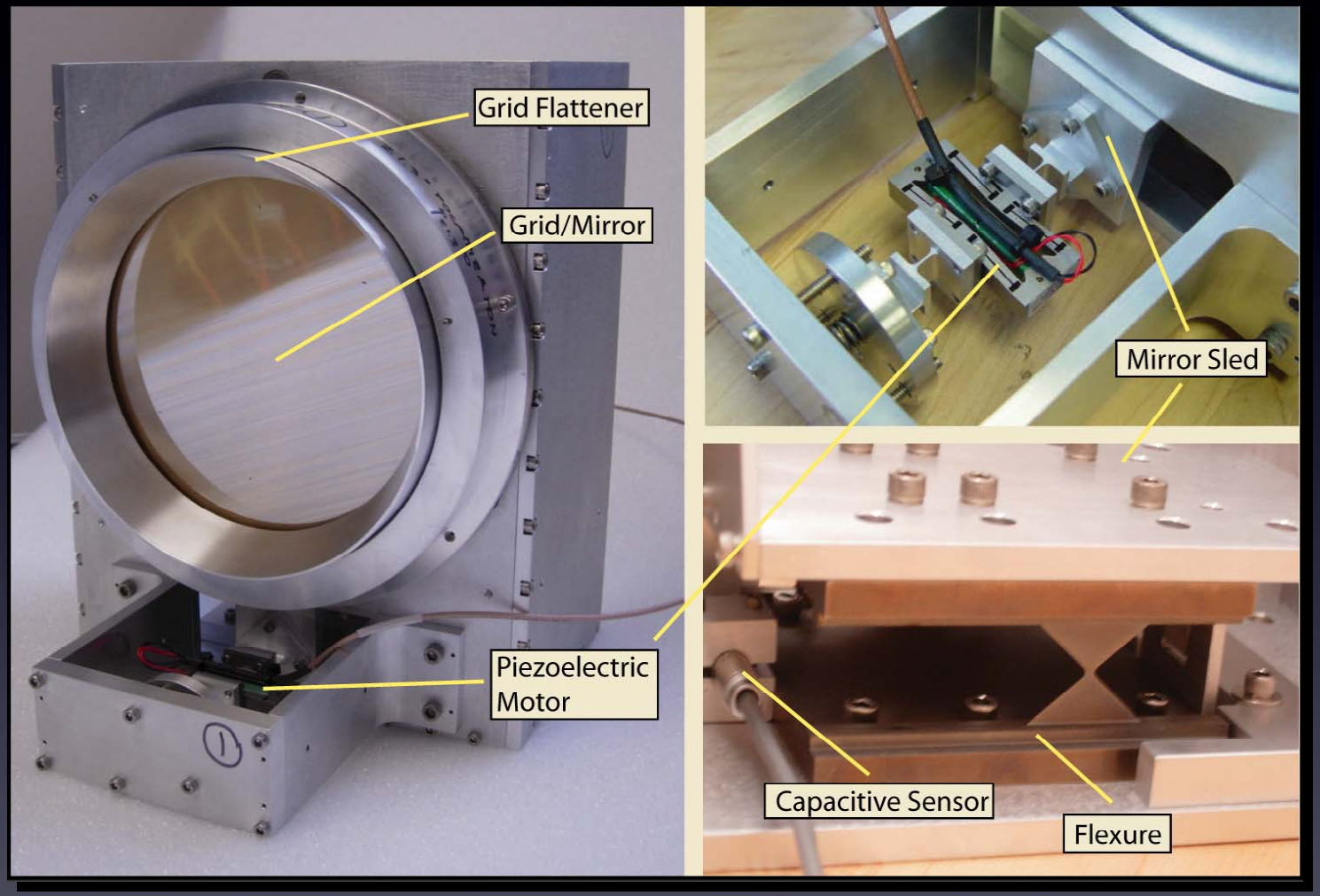
$$Q_{detector} = Q\cos\phi + V\sin\phi$$



Data Stream



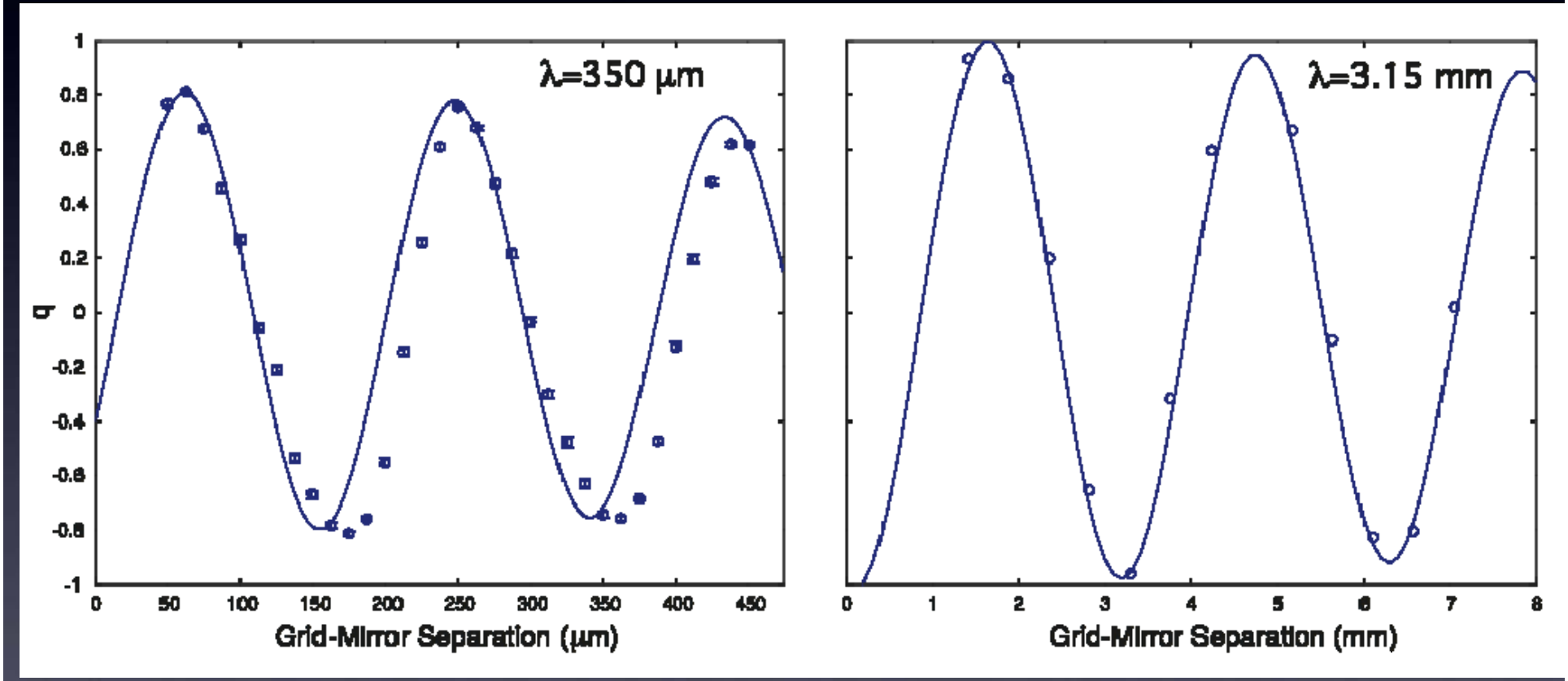
Grid-Mirror Separation



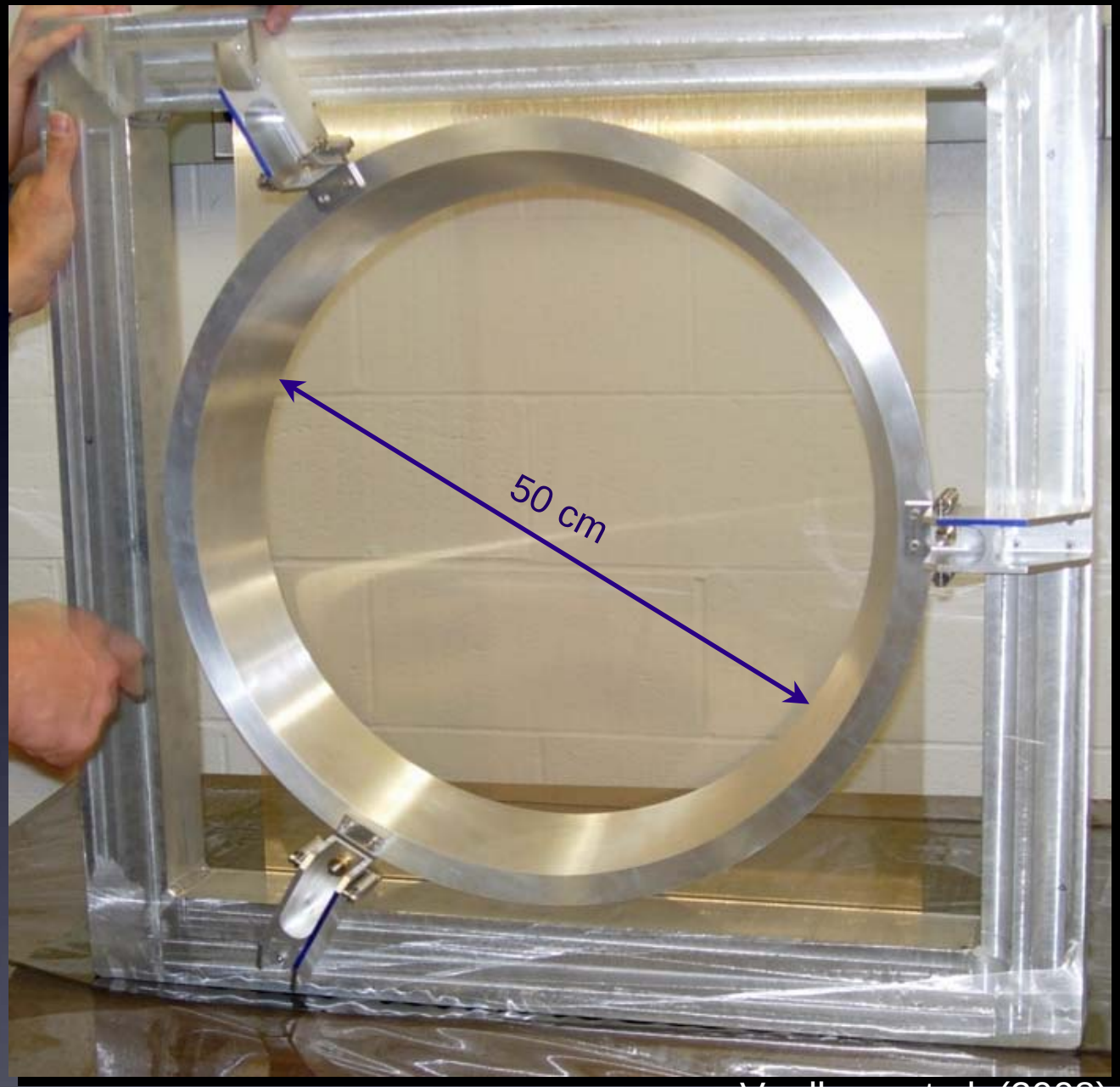
Voellmer et al. (2006), Krejny et al. (2008)

●=350 microns

●=3.15 mm

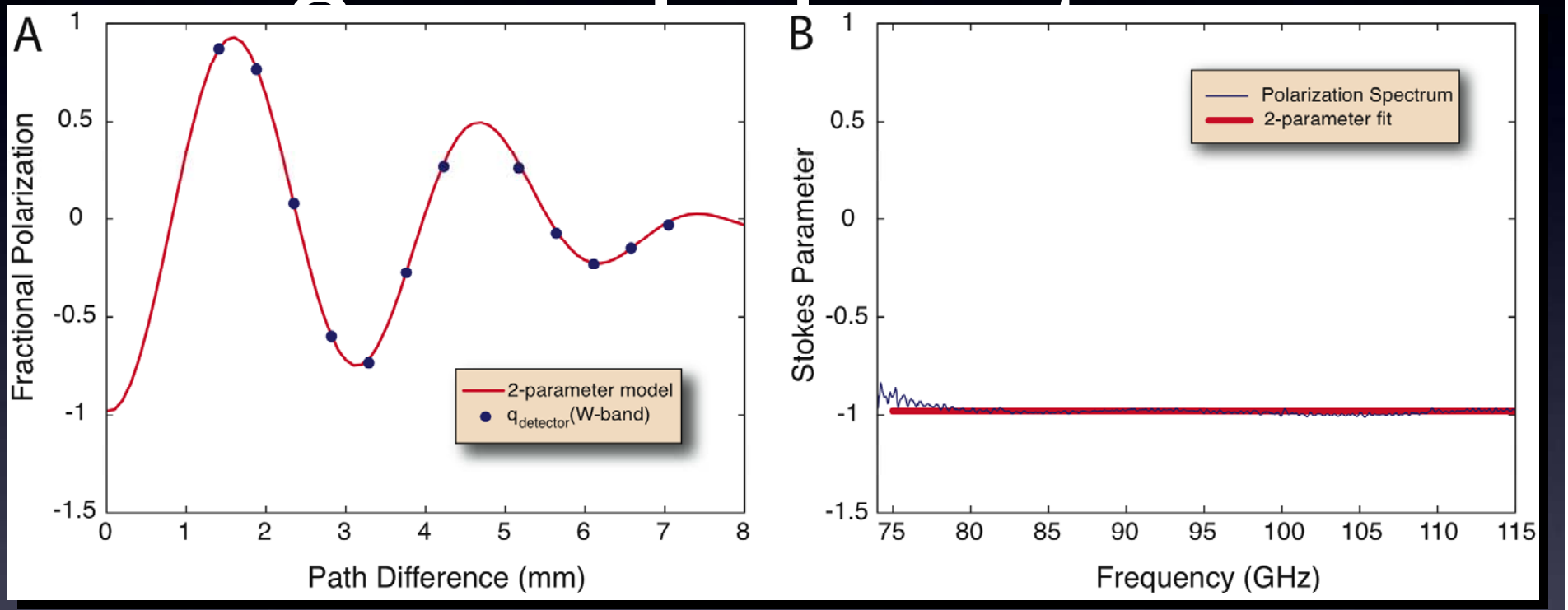


- Wire diameter = 67 ❍m
- Wire spacing = 200 ❍m
- Grid diameter = 50 cm
- Flatness < 50 ❍m
- Wire resonant frequency > 128 Hz
- ~2 miles of wire
- ~2 Tons of force on the frame



Voellmer et al. (2008)

Advantages	Disadvantages
Can be made large for placement close to the sky	Wire is potentially fragile
Interferometric modulation- inherently large bandwidth	Modulation frequency is ~<10 Hz
Non-dielectric (bi-attenuance, no AR coatings, no deep-dielectric or surface charging)	Lower TRL than competing architectures (3-4)
Good control of Q-> U (E->B) mixing (Beam crosspol residuals in V, not U)	Measurement of single Stokes Parameter requires additional time/detectors
Systematics can be placed in modes orthogonal to signal (E.g. variable vignetting/emission is common mode to detectors)	


A
Fractional Polarization
1
0.5
0
-0.5
-1
-1.5
0
1
2
3
4
5
6
7
8
Path Difference (mm)
2-parameter model
$q_{detector}$(W-band)
B
Stokes Parameter
1
0.5
0
-0.5
-1
-1.5
75
80
85
90
95
100
105
110
115
Frequency (GHz)
Polarization Spectrum
2-parameter fit