FPAs
an Independent View of Field

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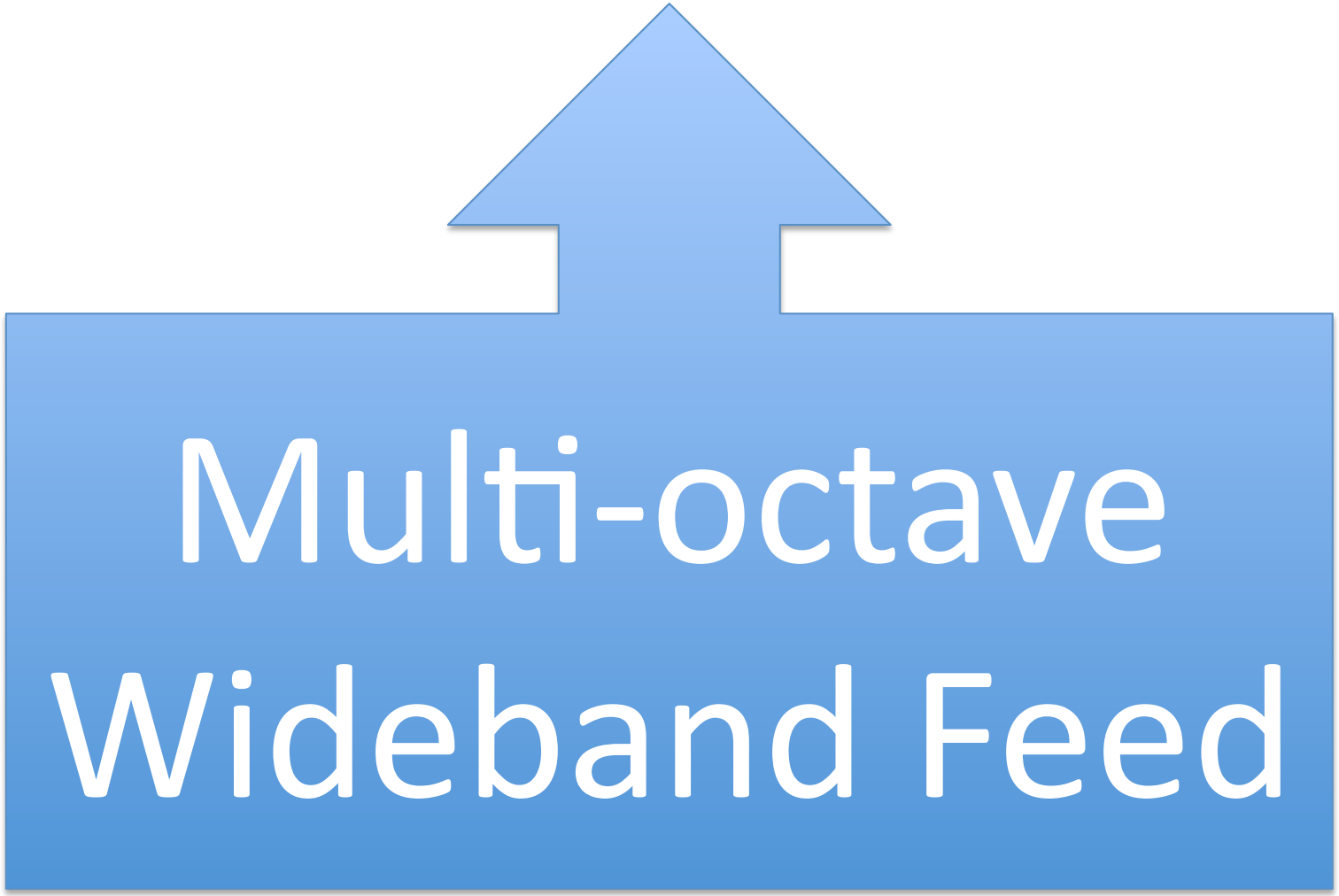
Multi-octave
Wideband Feed

Reiteration

- Cannot discus these things as isolated subsystems, but need to consider system-wide issues, e.g.:
  - Dish diameter
  - Calibration & dynamic range
  - Power & heat
  - Operations & Maintenance
  - Lifetime cost

SS Trade Equations

$$SS \propto N_{beam} \times \left(N_{ant} \times D\right)^2 \times \left(T_{sys}/\varepsilon_{ap}\right)^{-2} \times \lambda^2$$

Increase *SS* of a given array by FoV expansion

For fixed SS

$$N_{ant} \propto \left(T_{sys}/\varepsilon_{ap}\right) \times \sqrt{SS/N_{beam}} \times D^{-1} \times \lambda^{-1}$$

Reduce number of antennas by FoV expansion

$$N_{xcor} \propto SS \times \left(T_{sys}/\varepsilon_{ap}\right)^2 \times D^{-2} \times \lambda^{-2}$$

Number of cross-correlations independent of N_{beam}

Issues

- Performance
  - T_{sys}/ε_{ap}, higher T_{sys} mitigated by ε_{ap}
  - Wide-field polarization performance
  - Inter-beam differences – bias and variance in maps?
  - ≈2:1 bandwidth (cf waveguide feeds)
- Complexity & Technical Risk
  - >1 analogue and digital signal paths per beam
  - Power consumption and heat generation
  - Self-generated RFI
  - Large and heavy payload
- Implementation & Calibration
  - Sky rotation/electronic commutation/beam stability
  - Calibration signal source injection
  - Graceful degradation as elements fail?
  - Match with offset optics

- Corr = Nbeam x Nant^2 / 2
- = 8 / pi^2 x SS x (Tsys/Aeff)^2 / D^2 / lambda^2
- FoV = (lambda / D)^2
- SS = (Ae/Tsys)^2 x Nbeam x FoV
- = pi^2 x D^2 x Aeff^2 x Nant^2 x lambda^2 x Nbeam / Tsys^2 / 16
- Ae = pi x D^2 / 4 x Aeff x Nant
- Nbeam = 16 x SS / pi^2 x (Tsys/Aeff)^2 / D^2 / Nant^2 / lambda^2
- Nant = 4 / pi x (Tsys/Aeff) x lambda x sqrt(SS / Nbeam) / D