Feeder for eye of the needle guide systems

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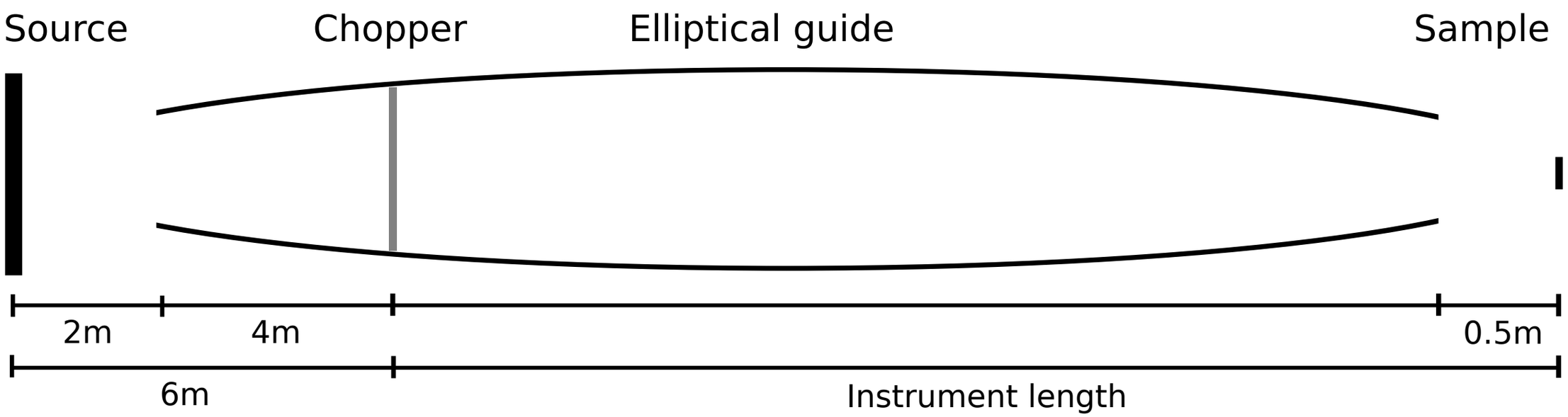
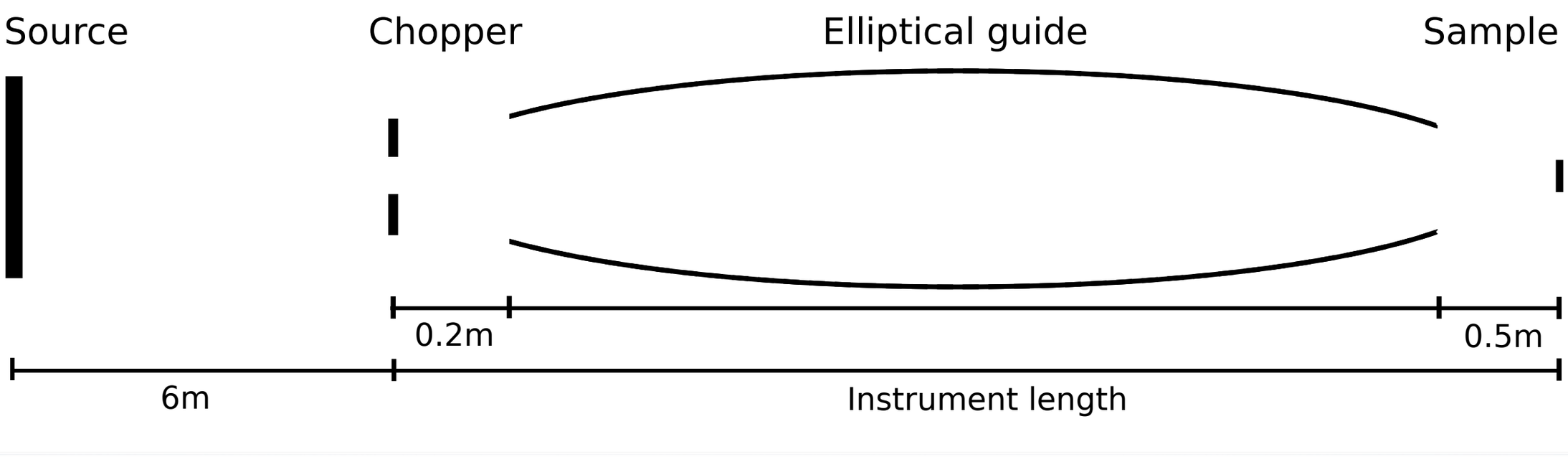
Chopper problem



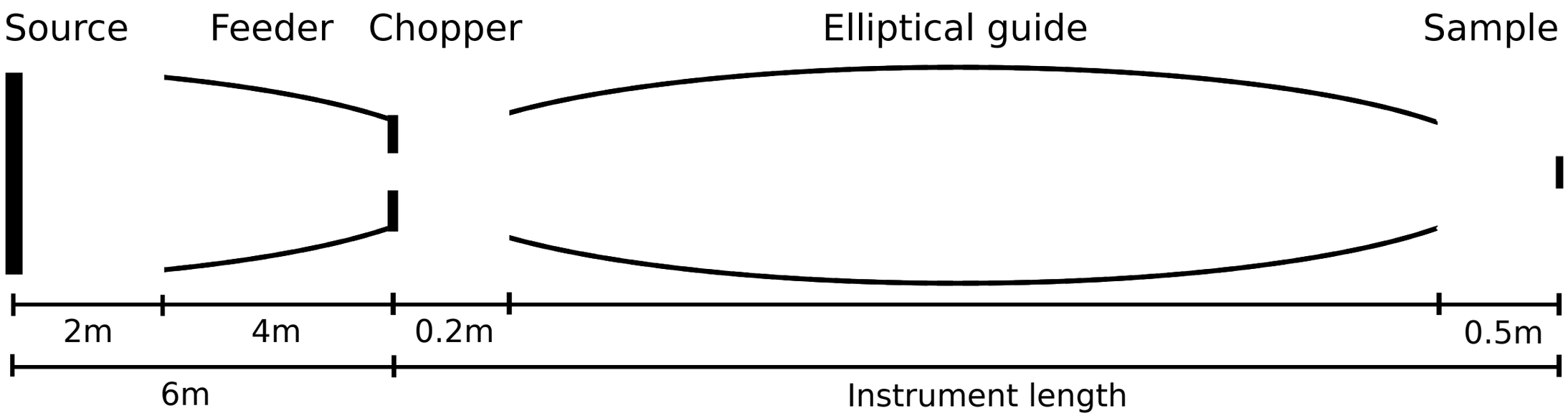
- Elliptical guide width at chopper position: ~16 cm
- Reference for eye of the needle performance

Eye of the needle without feeder



- Variable instrument length, 24m, 75m, 150m, 300m
- Variable square pinhole size, 1cm, 2cm, 3cm, 4cm, 5cm
- Variable divergence requirements, ±0.5°, ±1.0°, ±2.0°
- In total, 60 instruments to optimize with 5 free parameters

Eye of the needle width feeder



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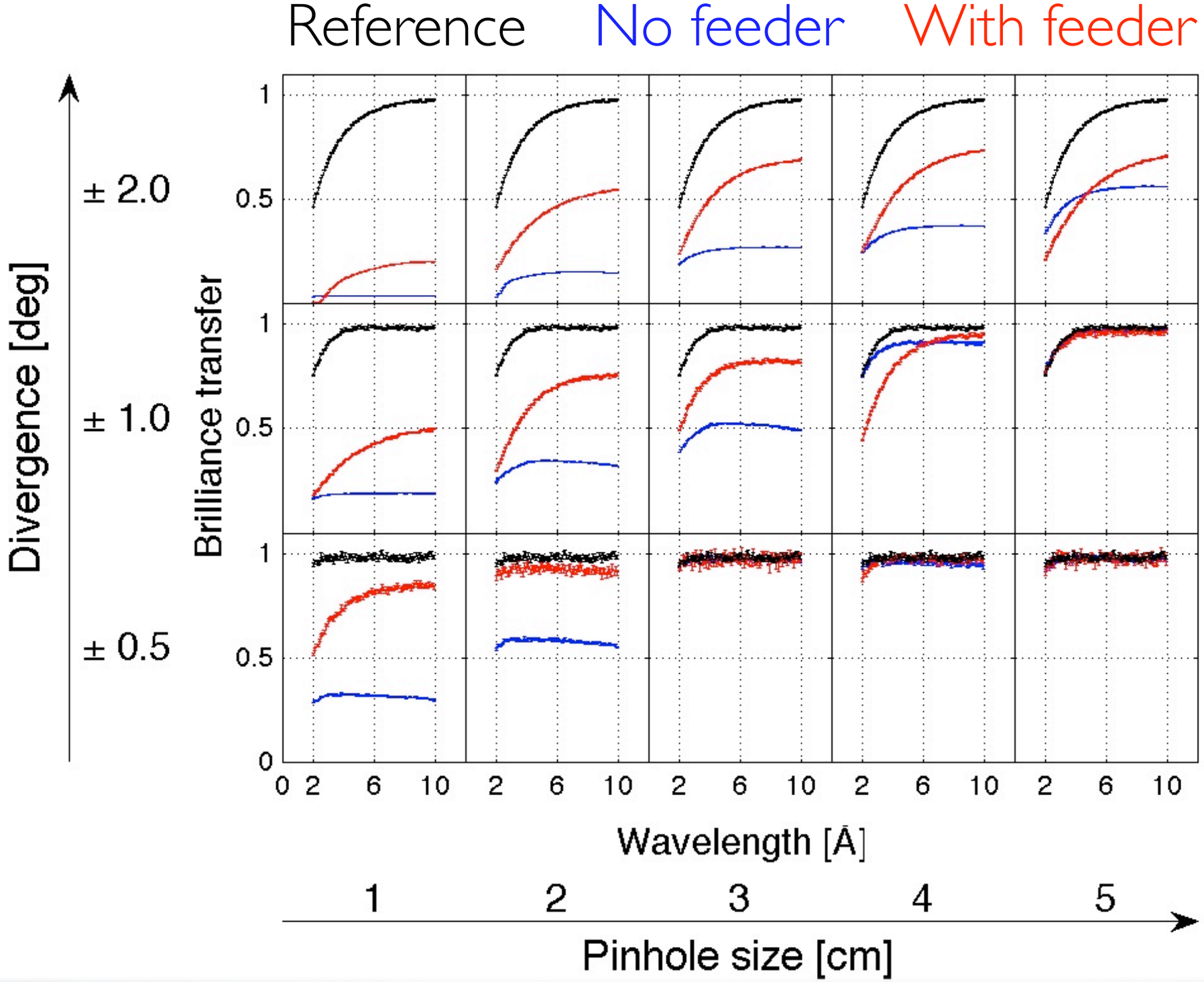
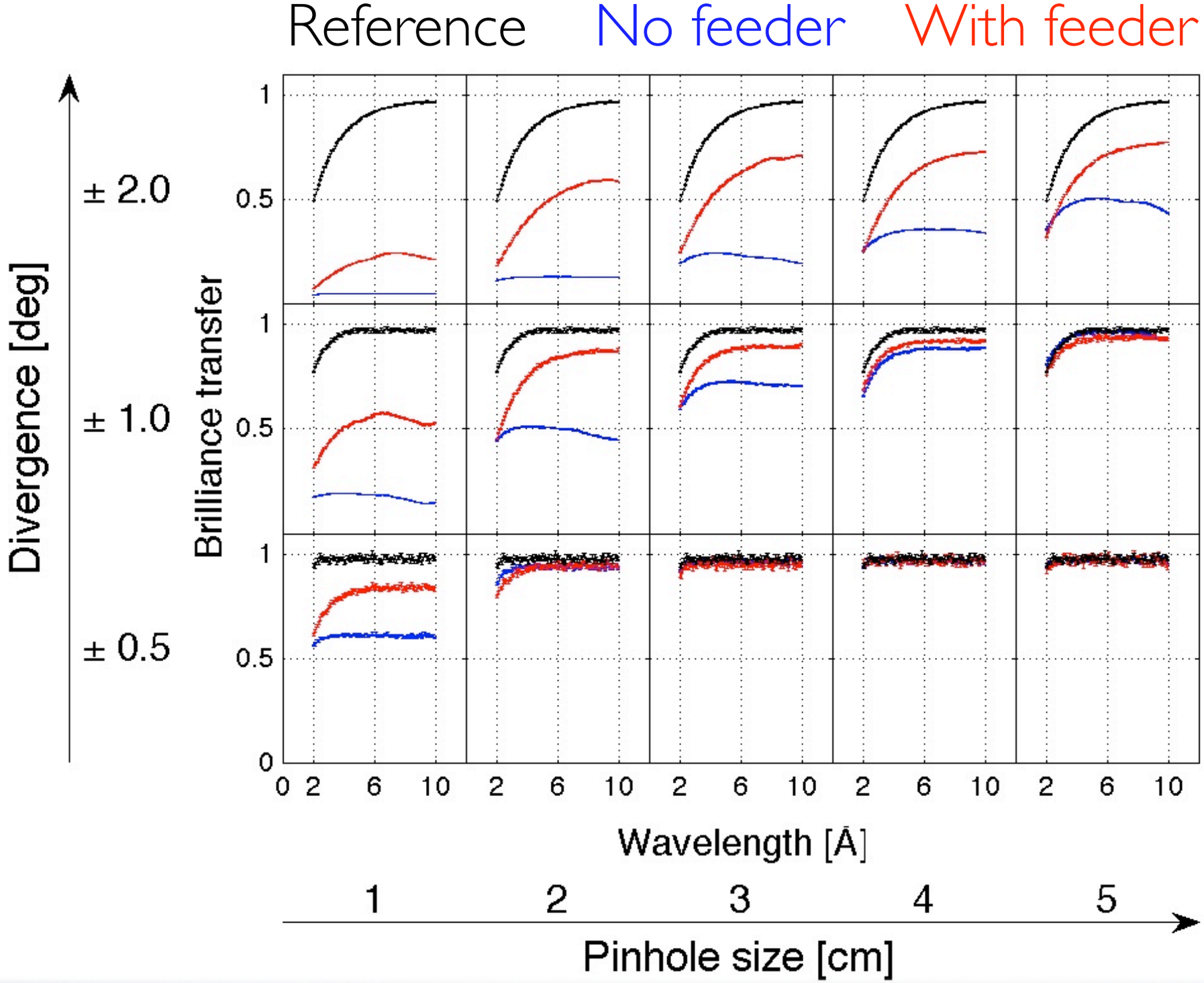
The simulated data

- All guide systems are optimized for a 1x1cm^2 sample
- The figure of merit is neutrons within divergency requirement
- The wavelength band from 2-10Å was simulated
- Some optimizations did not reach a global maximum
- Notice the difference in almost equal performing solutions

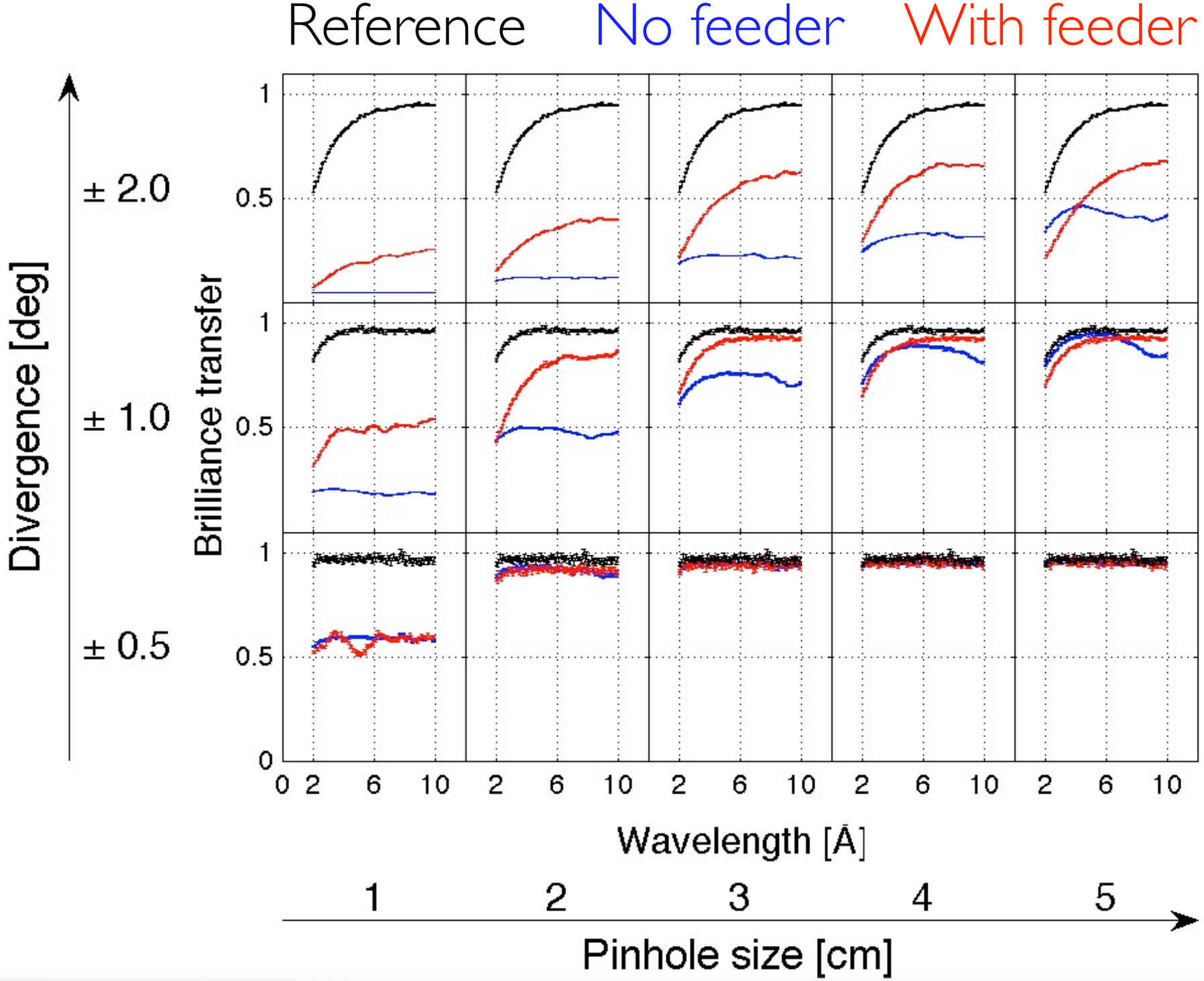
Brilliance transfer for 24 m instrument



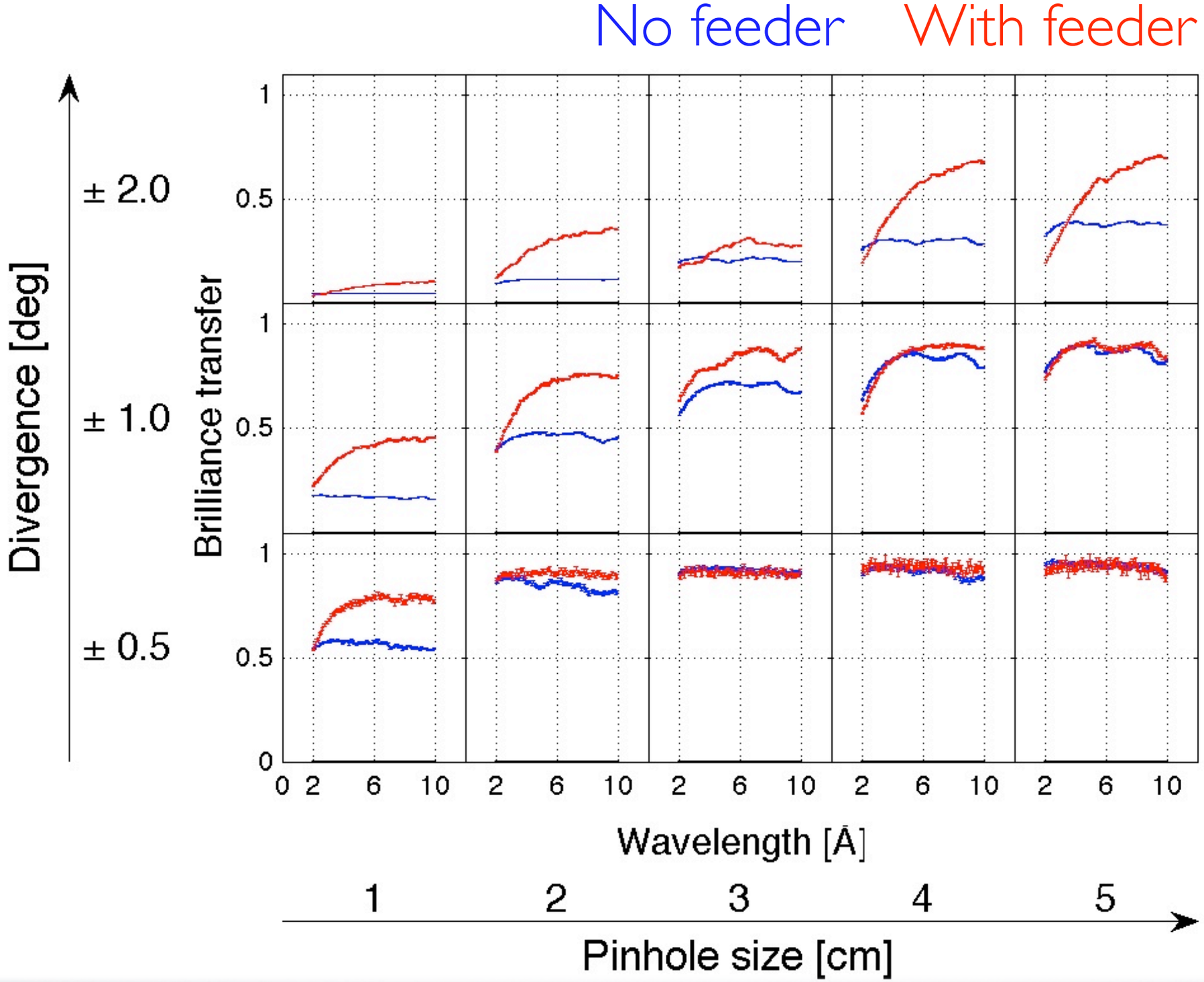
Brilliance transfer for 75 m instrument



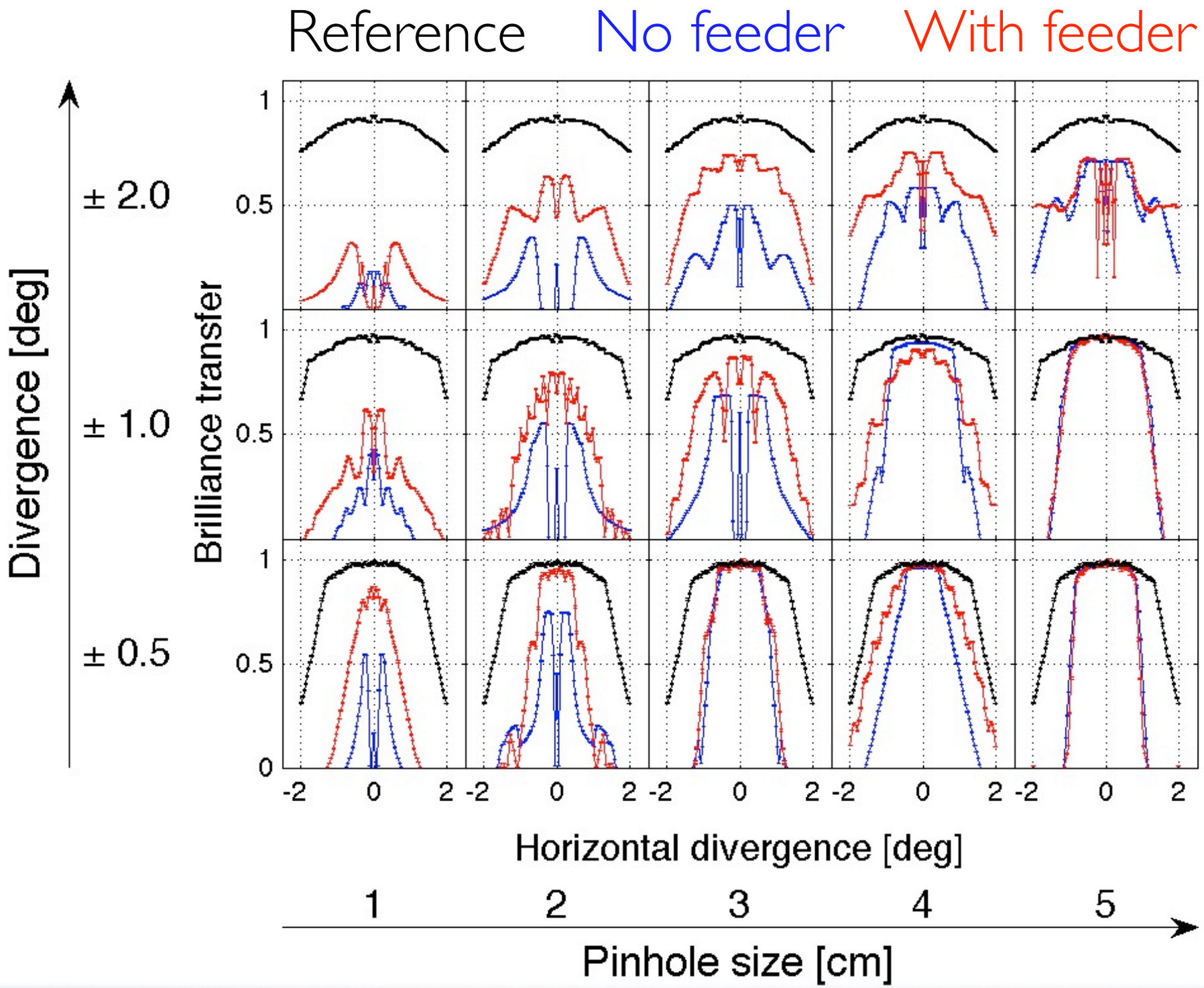
Brilliance transfer for 150m instrument



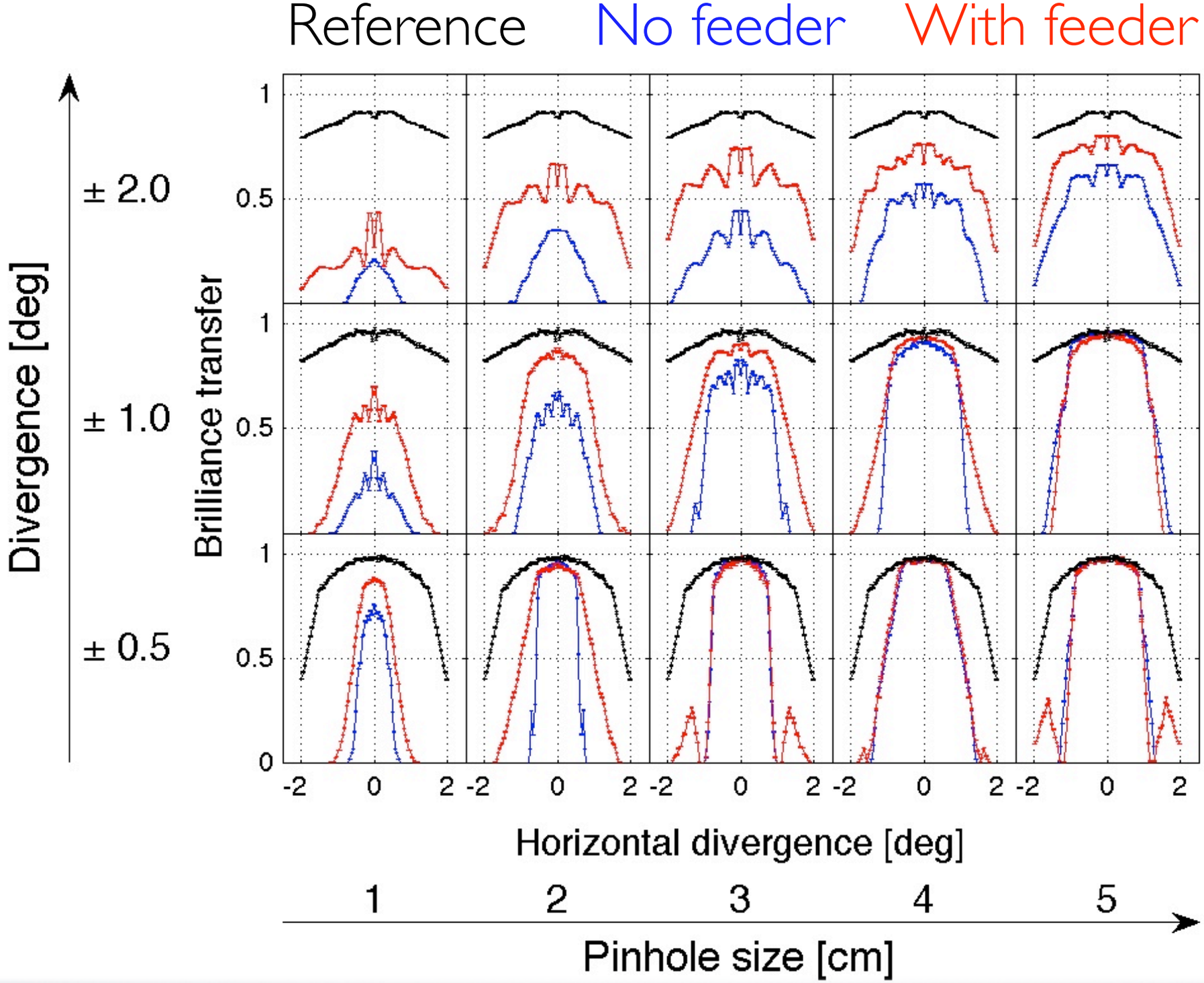
Brilliance transfer for 300m instrument



Brilliance transfer for 24 m instrument

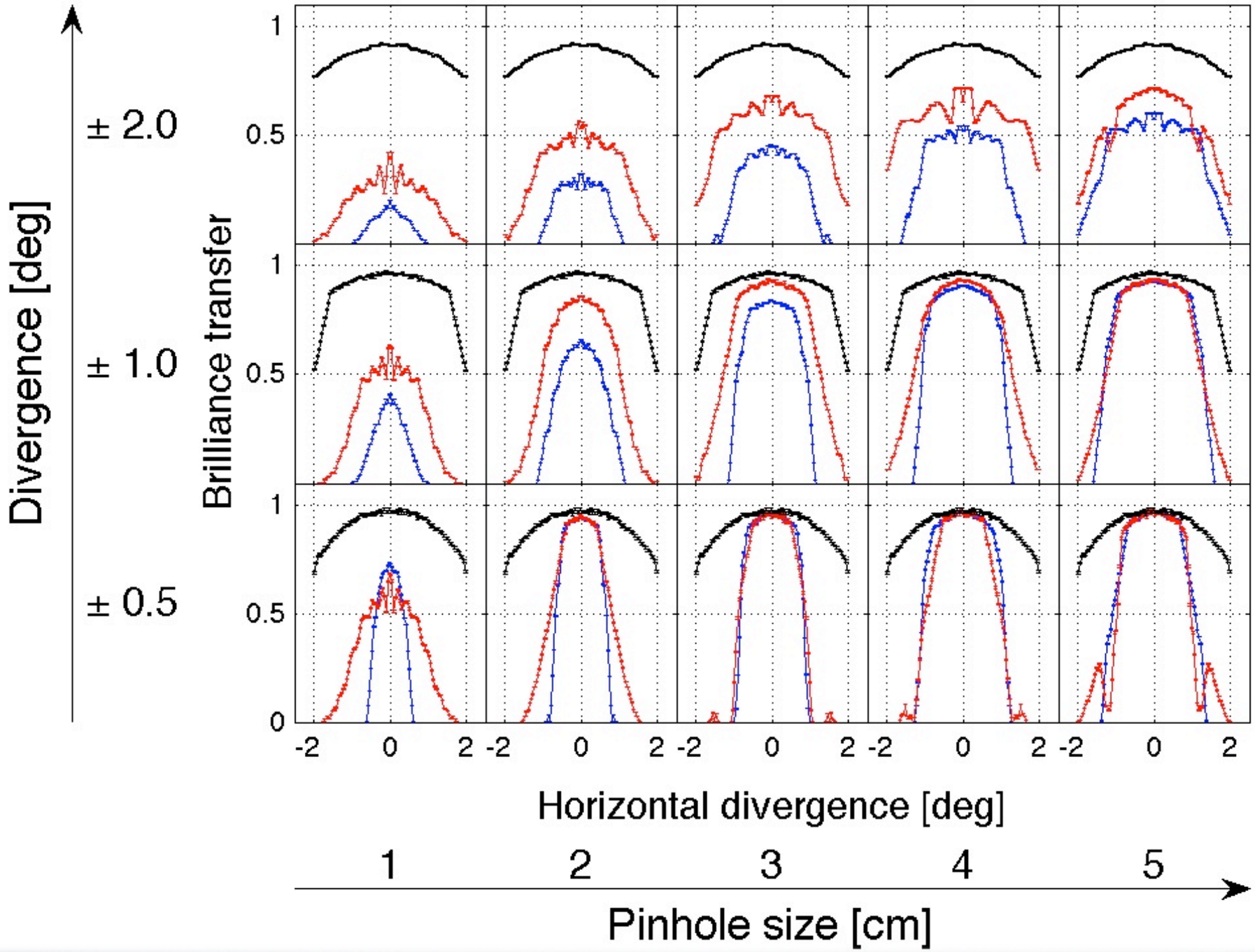


Brilliance transfer for 75 m instrument

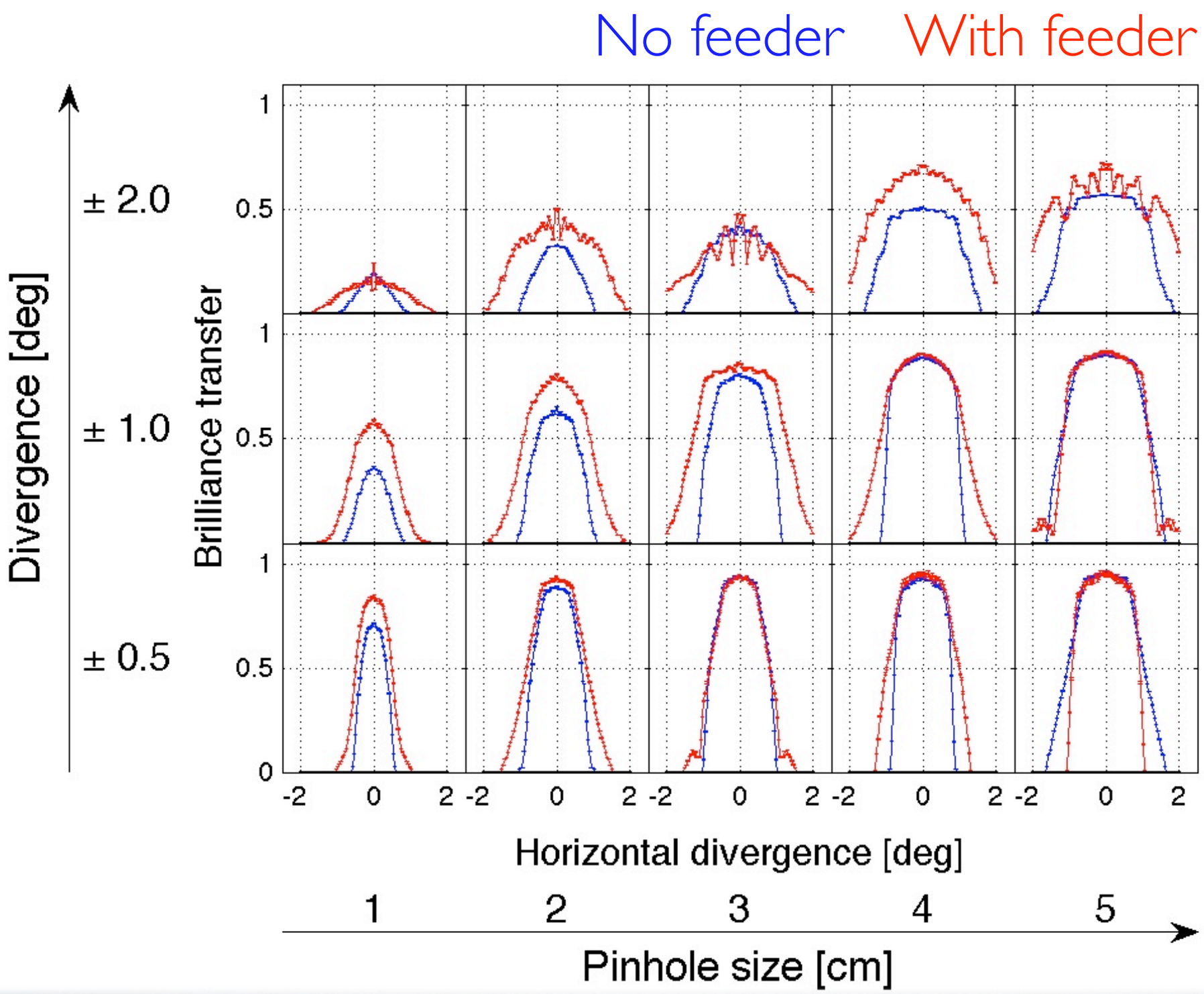


Brilliance transfer for 150m instrument

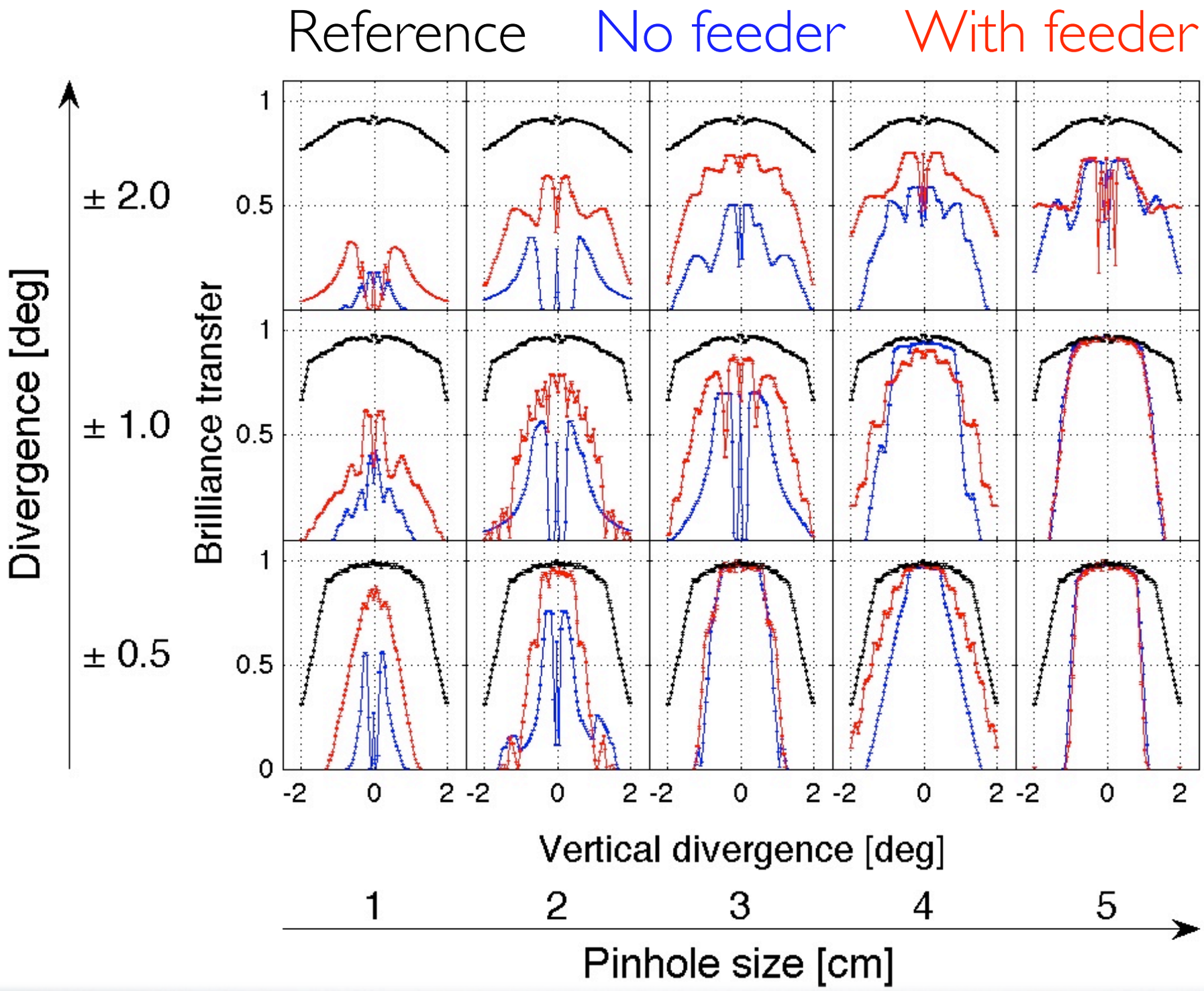
Reference No feeder With feeder



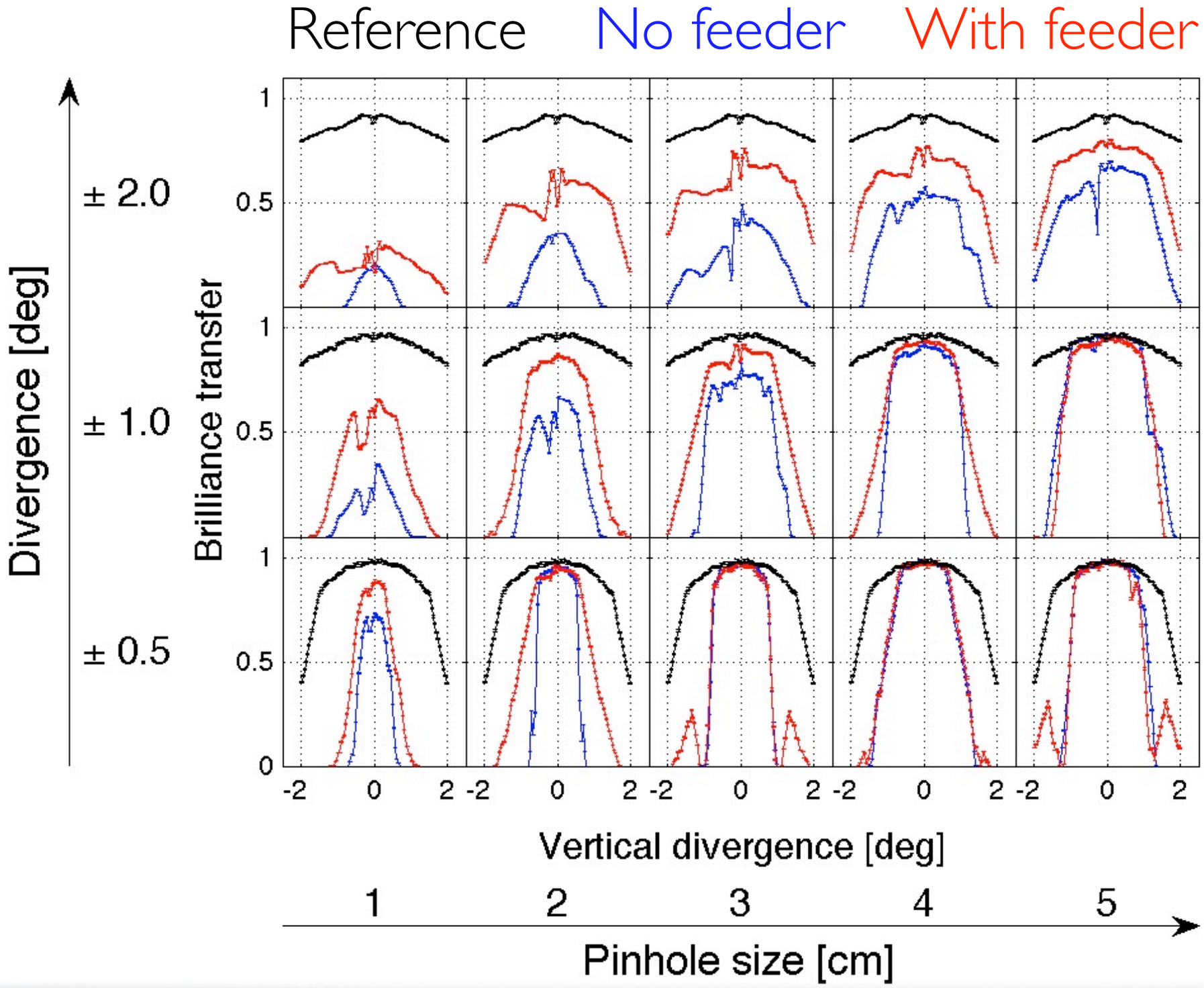
Brilliance transfer for 300m instrument



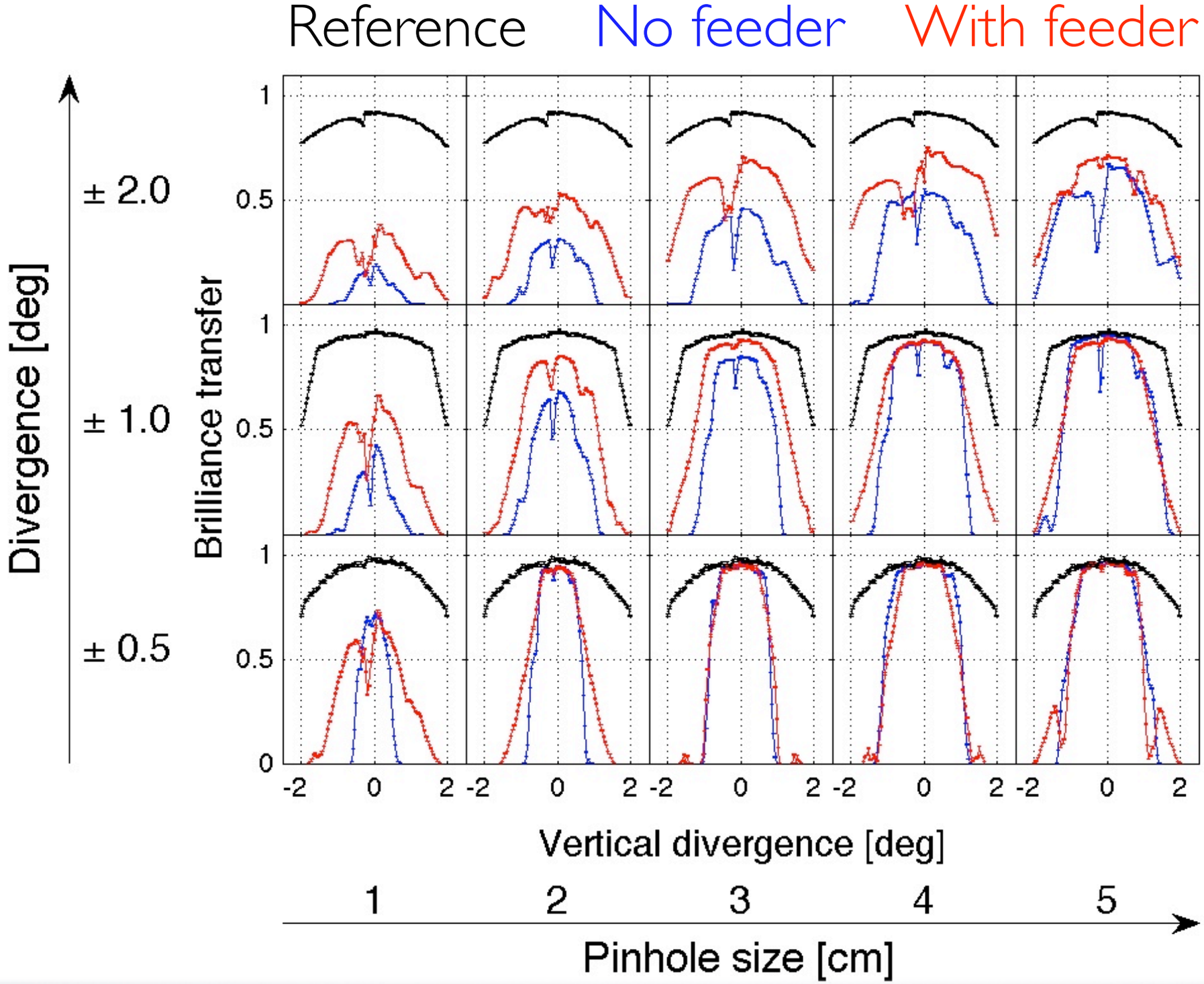
Brilliance transfer for 24 m instrument



Brilliance transfer for 75 m instrument

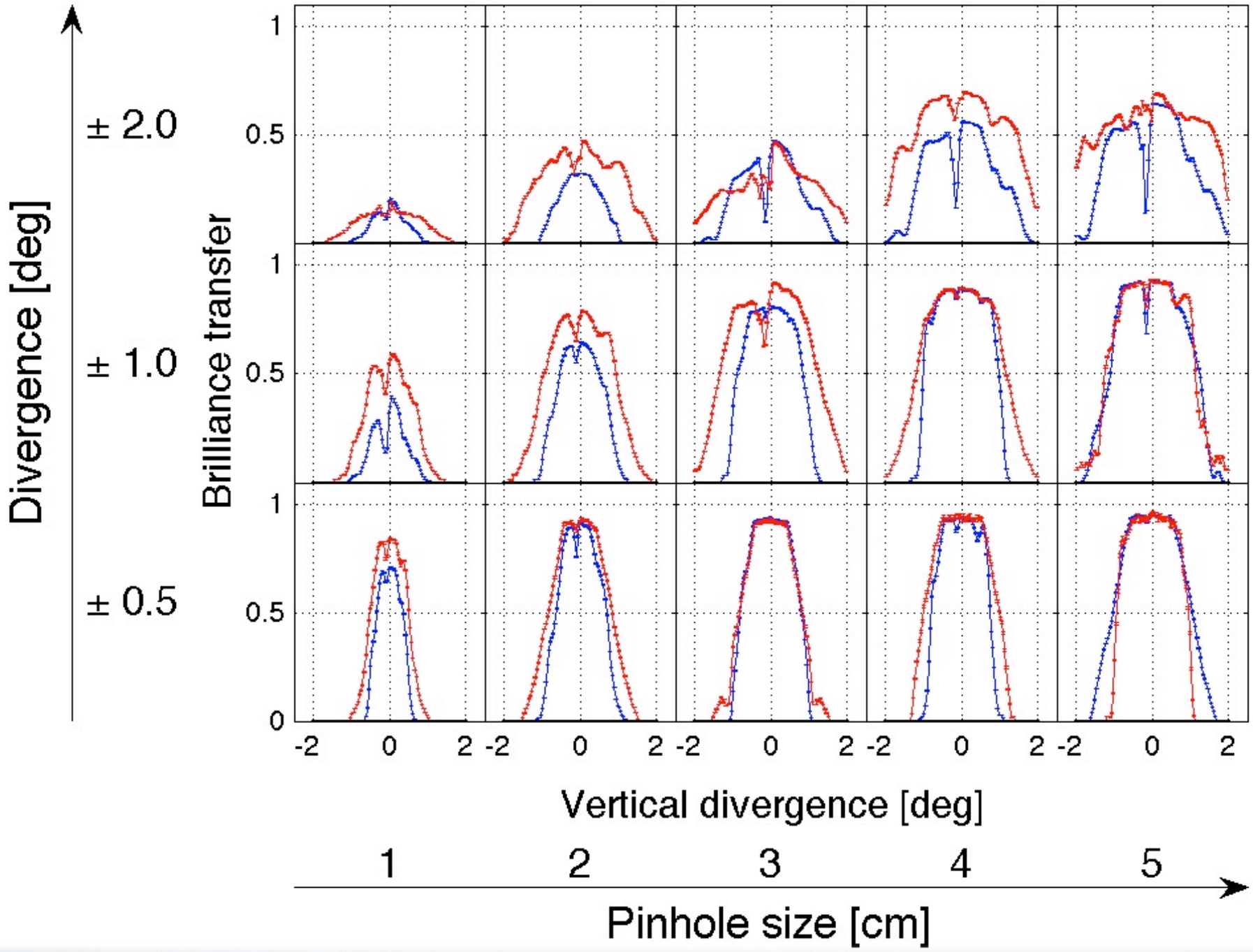


Brilliance transfer for 150m instrument



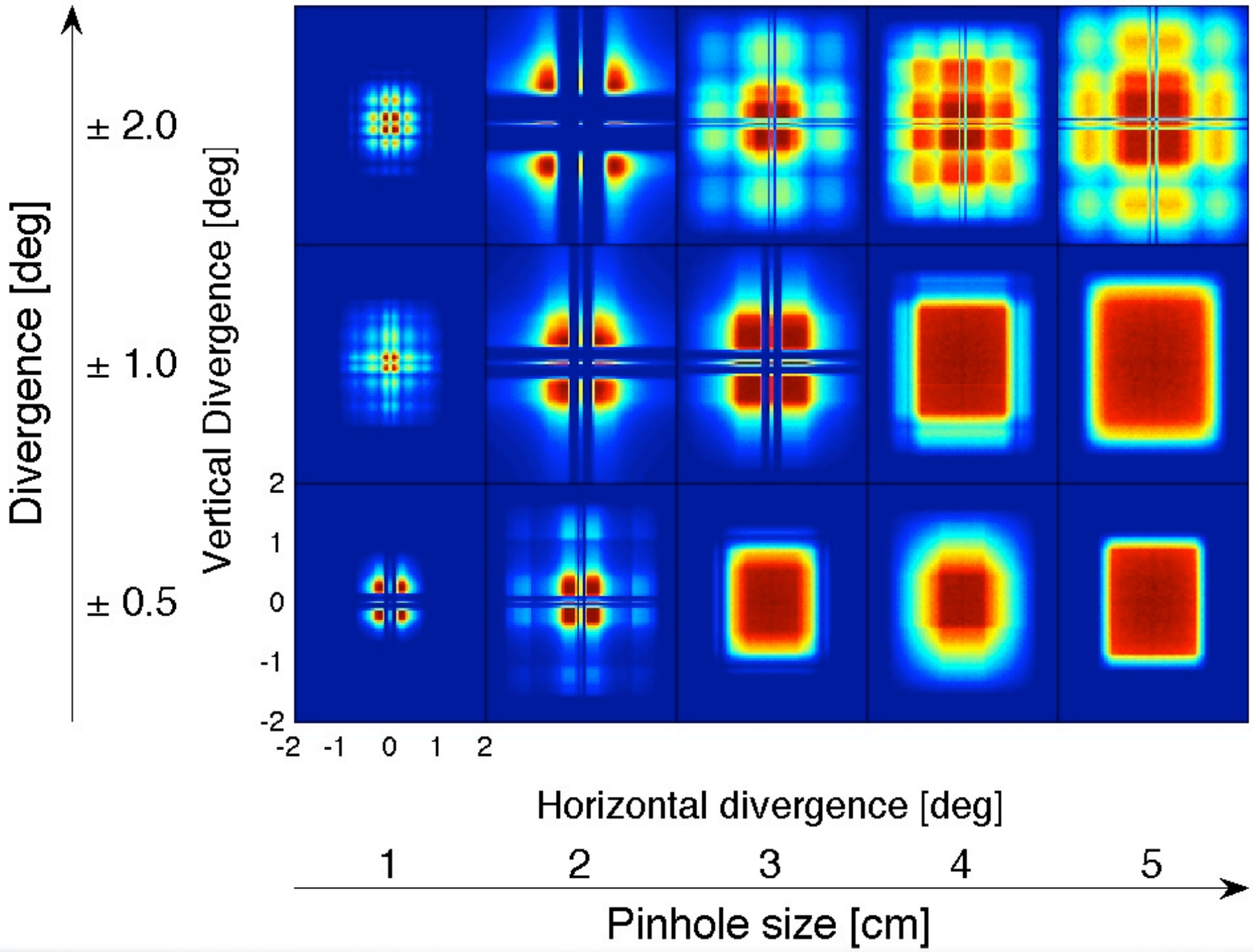
Brilliance transfer for 300m instrument

No feeder With feeder



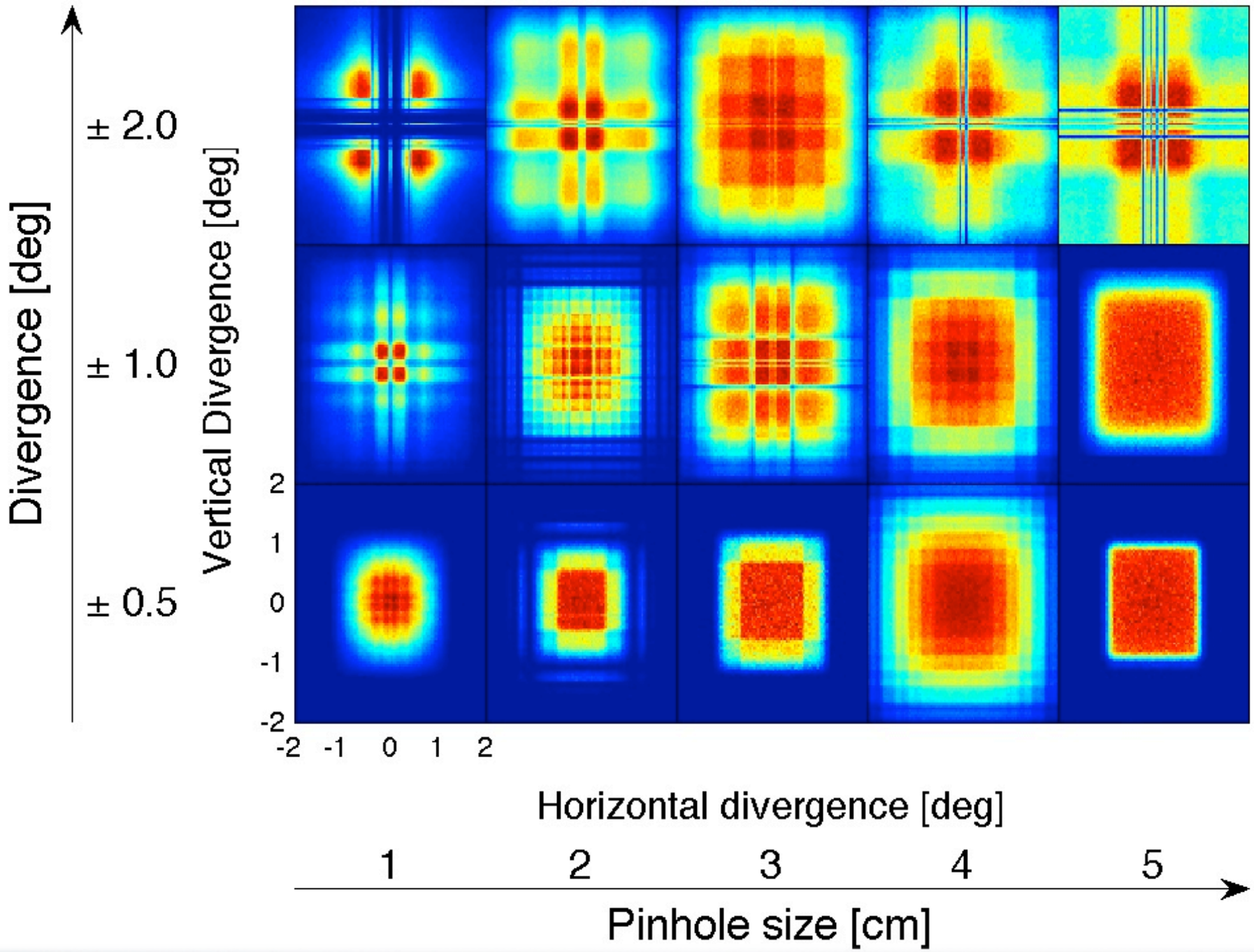
2D divergence for 24 m instrument

No feeder



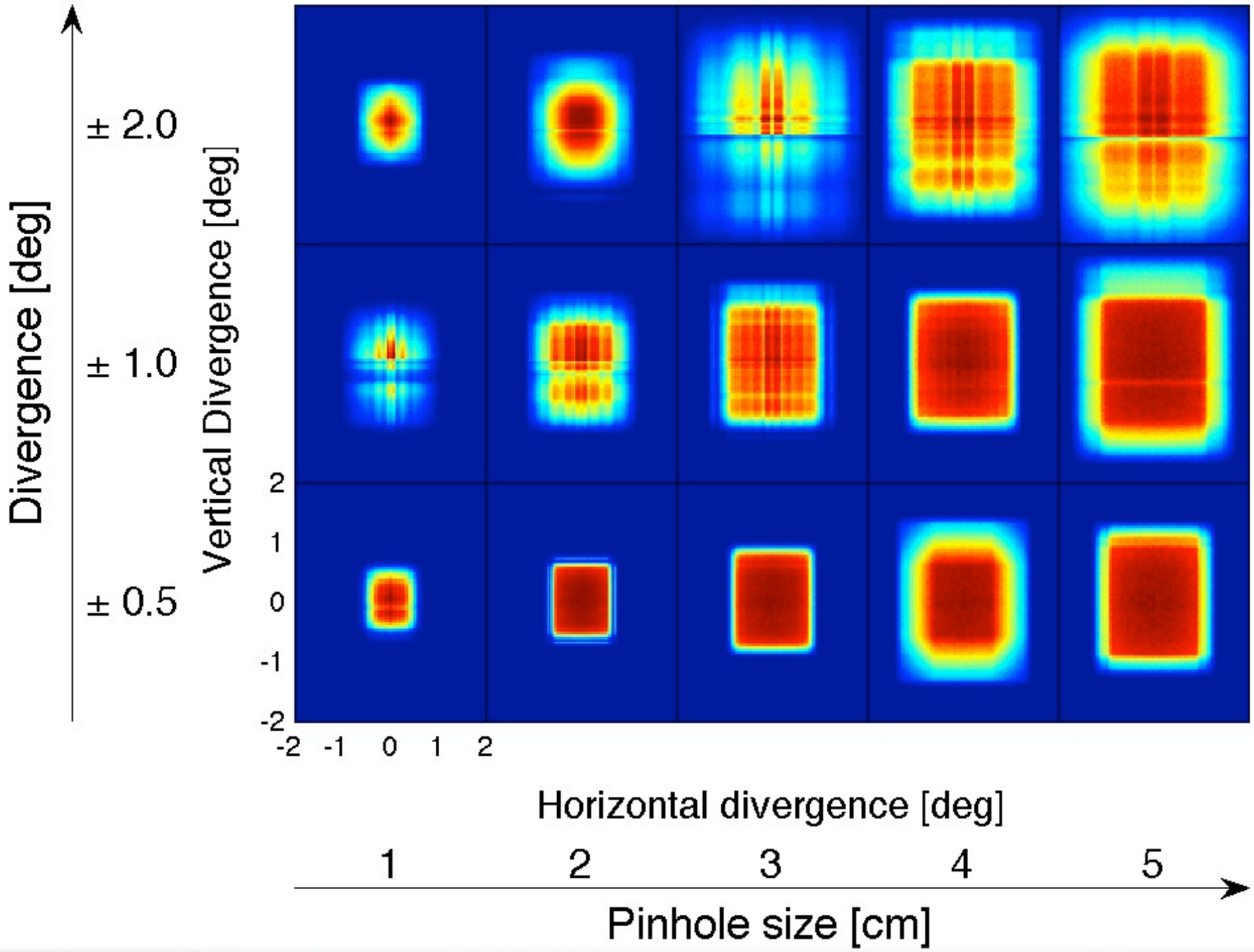
2D divergence for 24 m instrument

With feeder



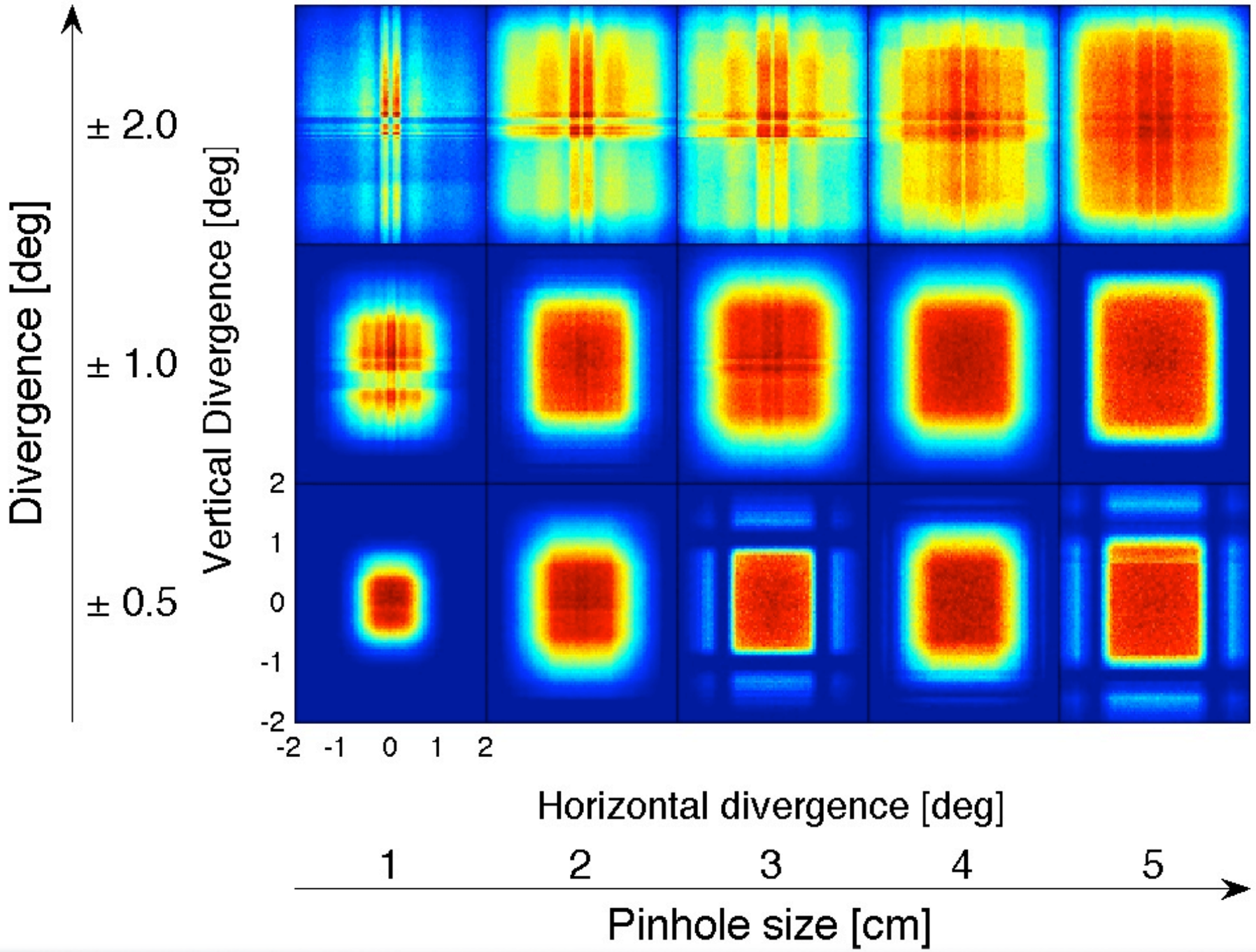
2D divergence for 75 m instrument

No feeder



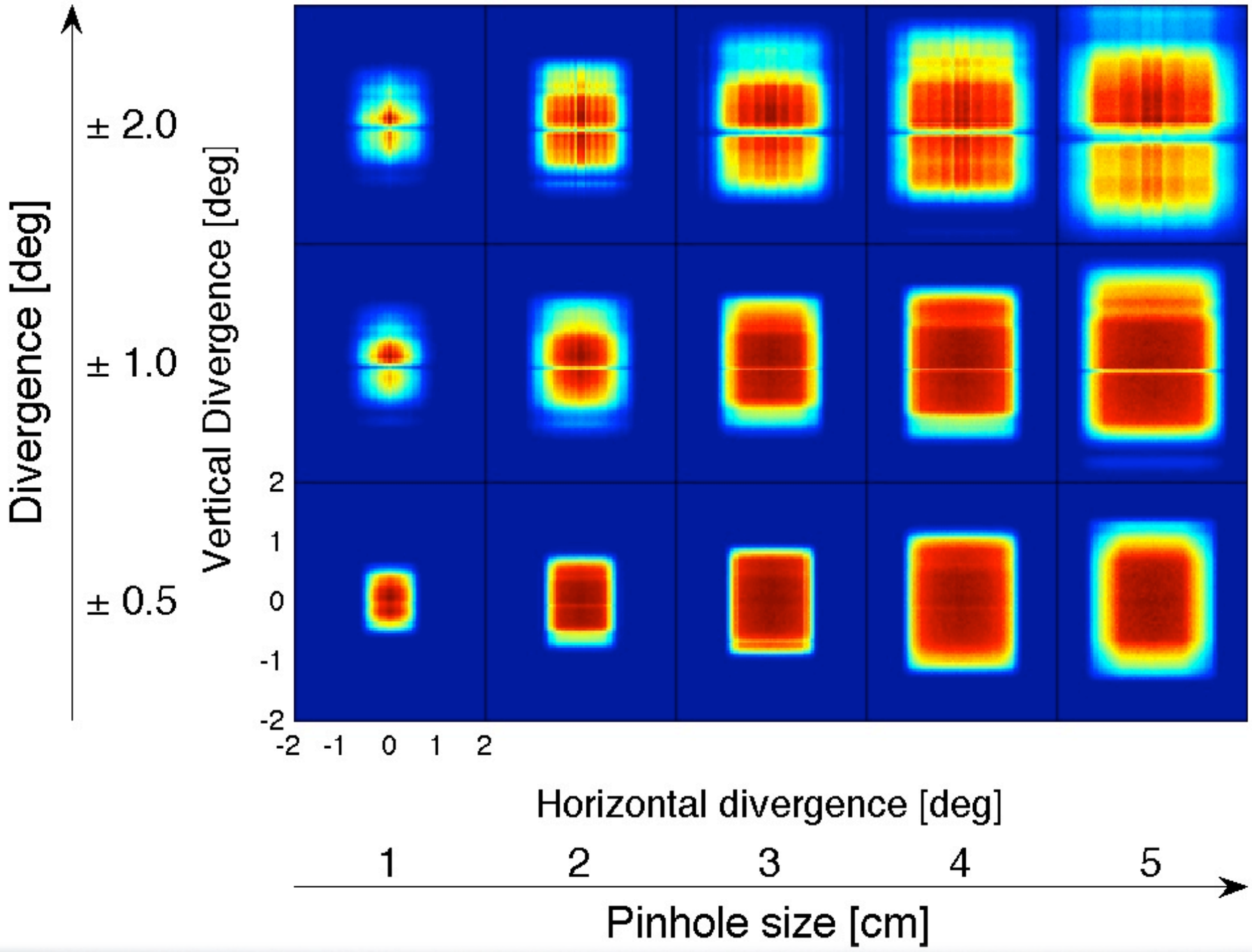
2D divergence for 75 m instrument

With feeder



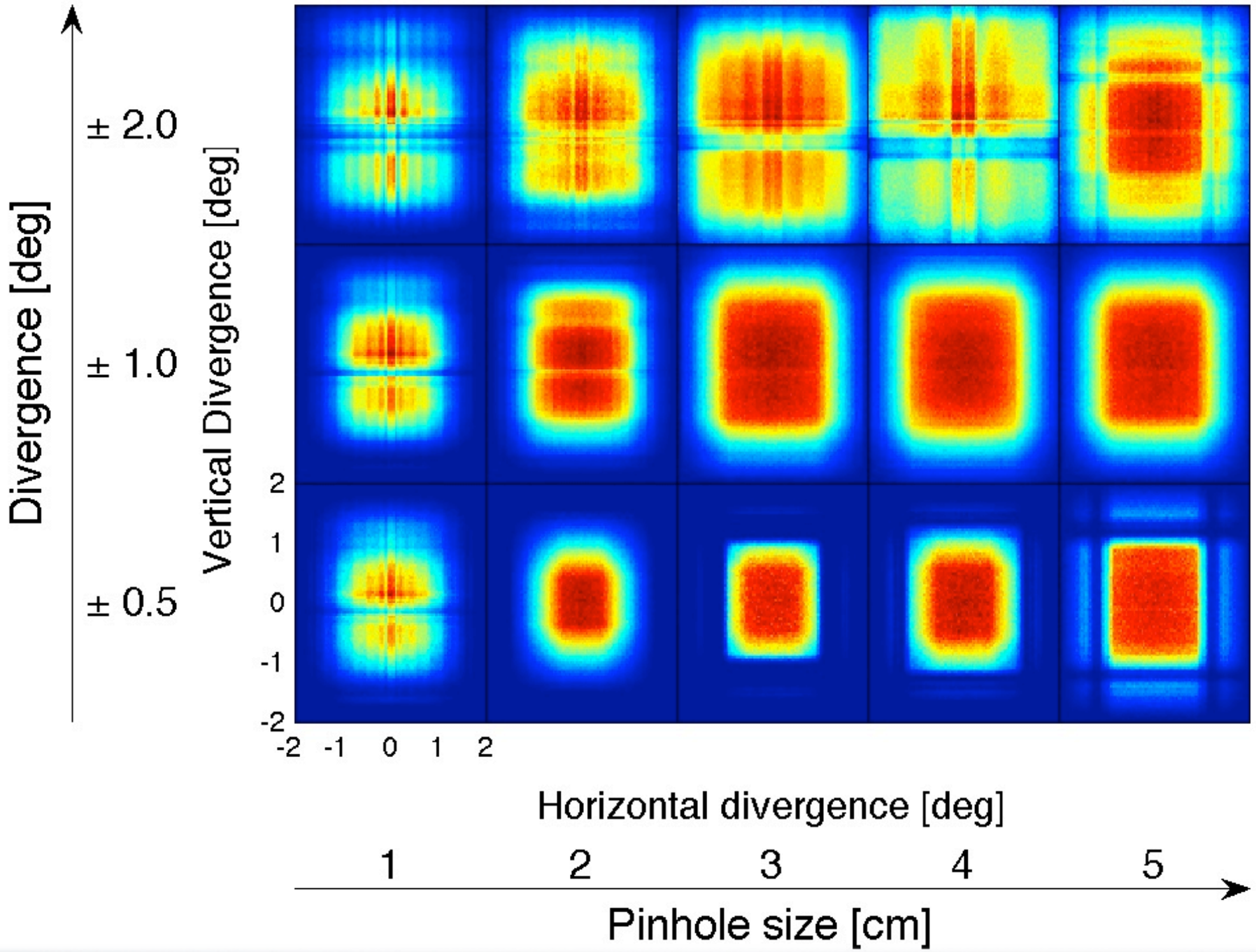
2D divergence for 150m instrument

No feeder



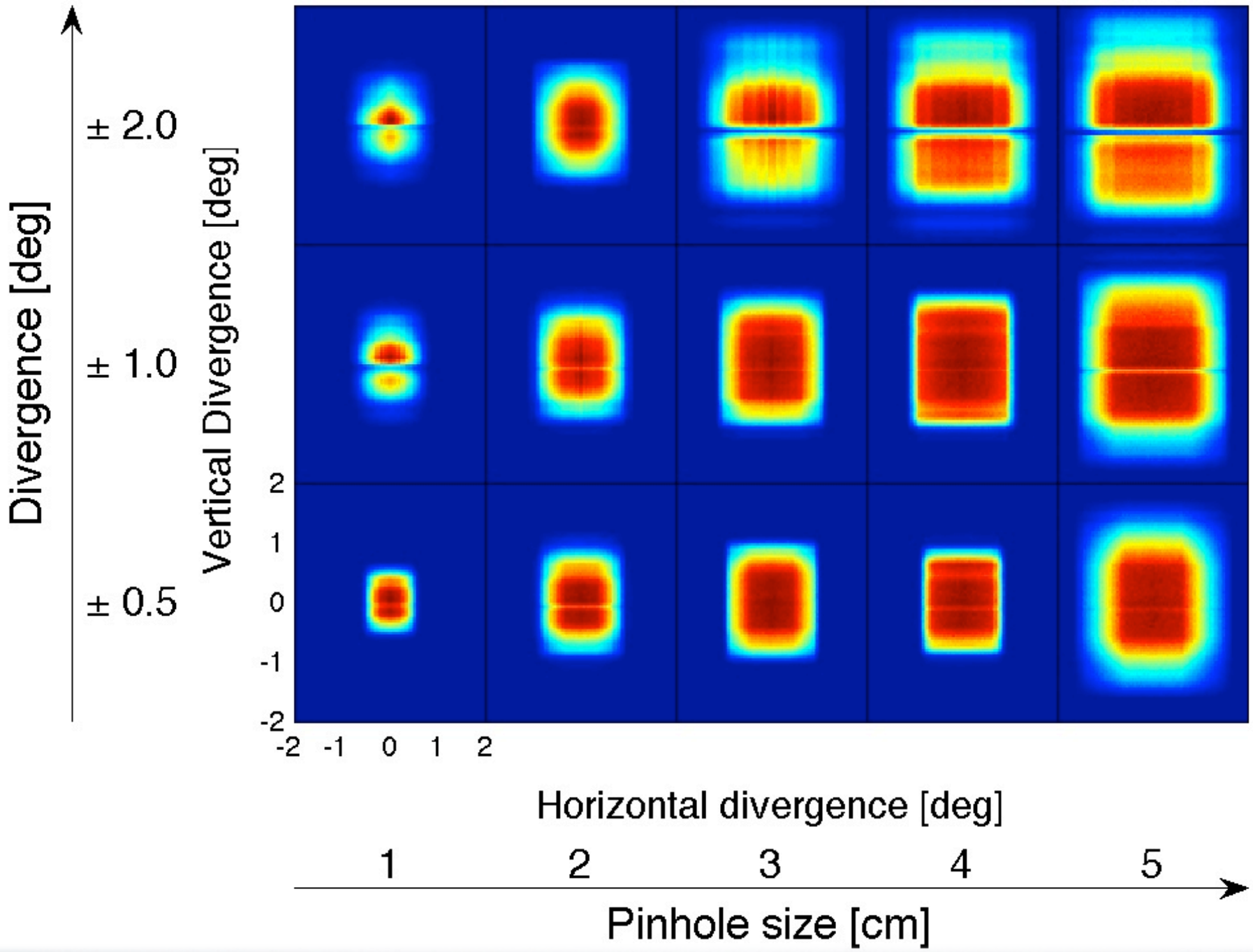
2D divergence for 150m instrument

With feeder



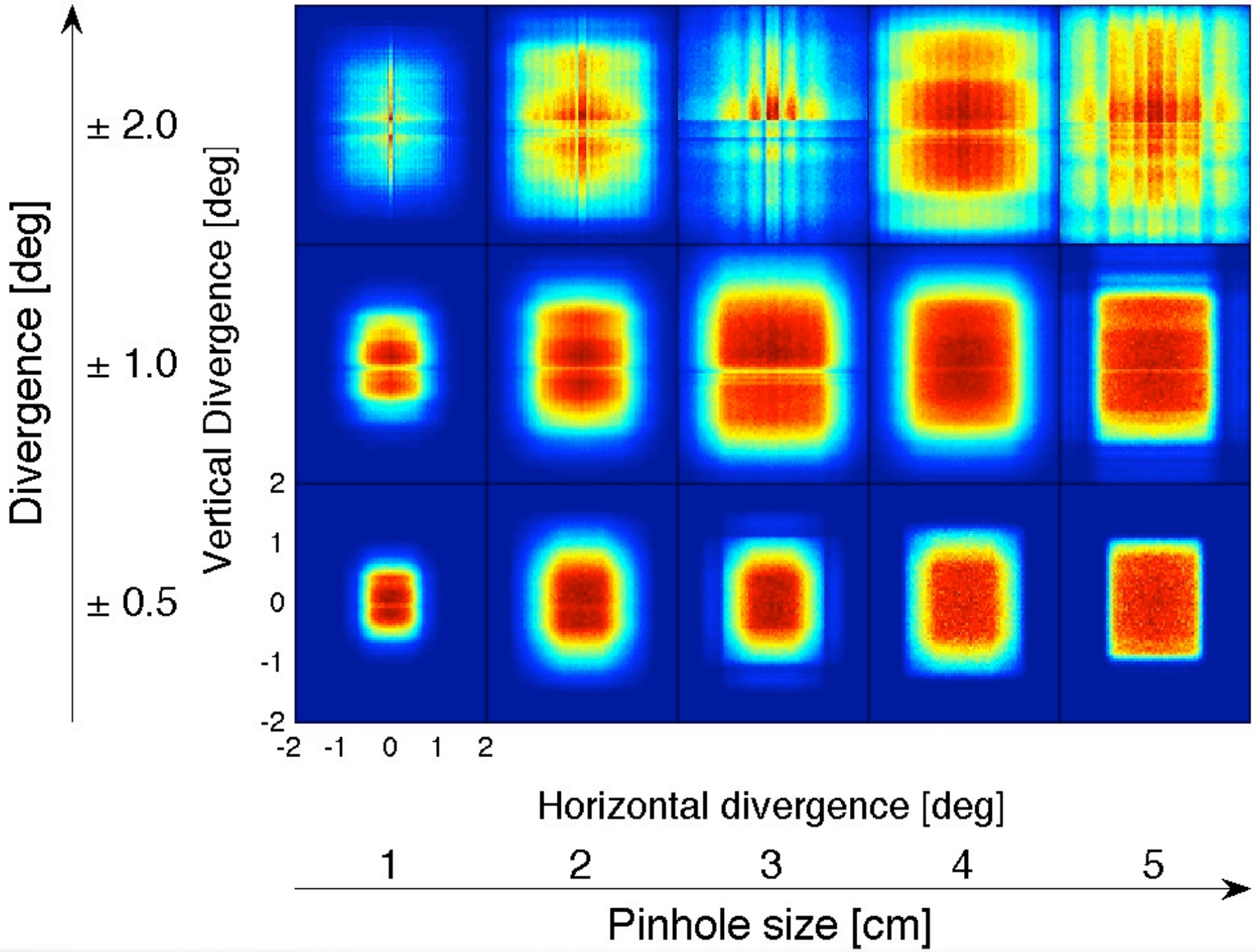
2D divergence for 300m instrument

No feeder



2D divergence for 300m instrument

With feeder



Conclusions

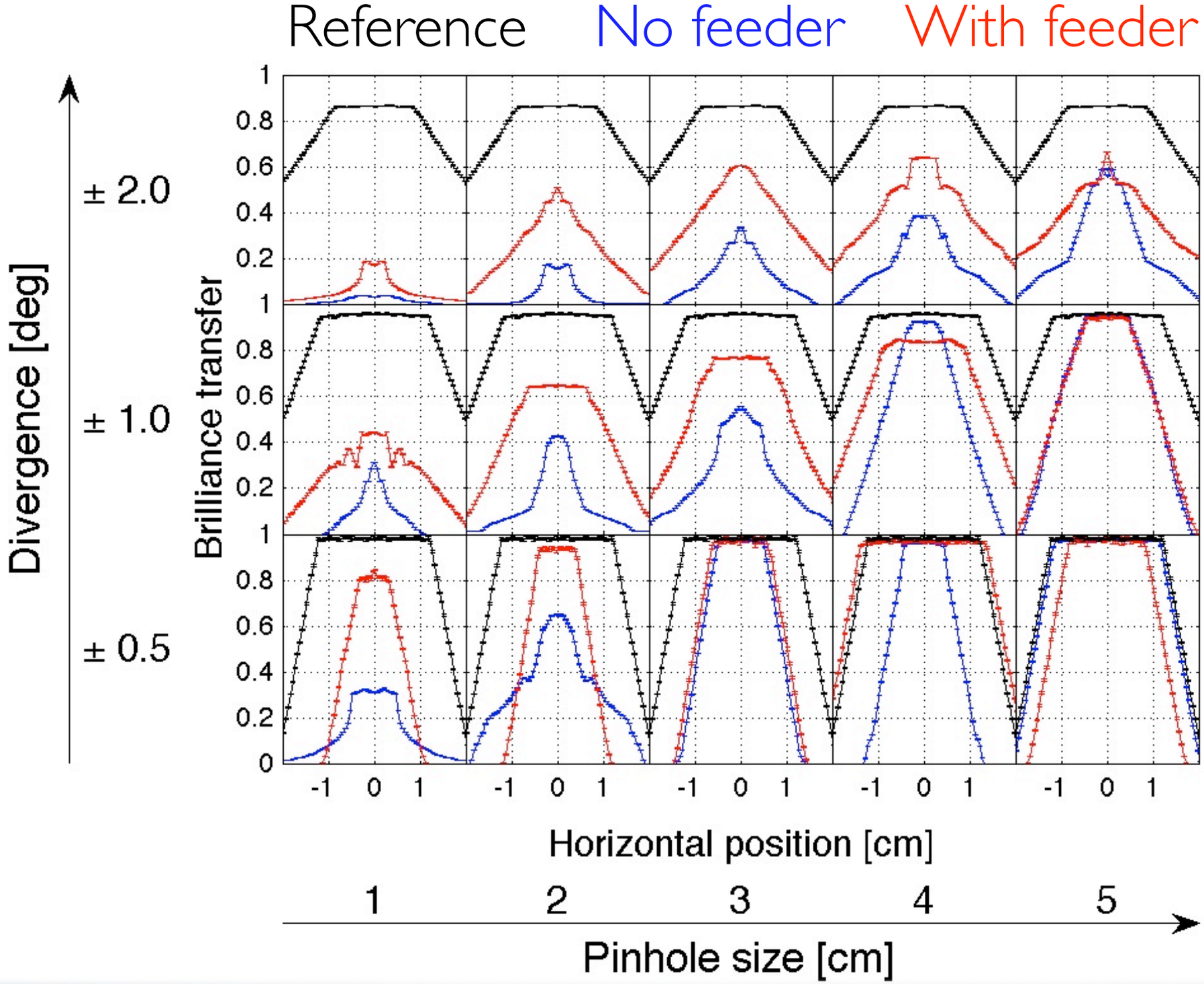
- It is possible to design a well performing guide with the restriction of a small pinhole at the pulse shaping chopper position when divergency requirements are ±1.0° or below

- A feeder is not always necessary, but does reduced the required pinhole size in order to reach a certain performance

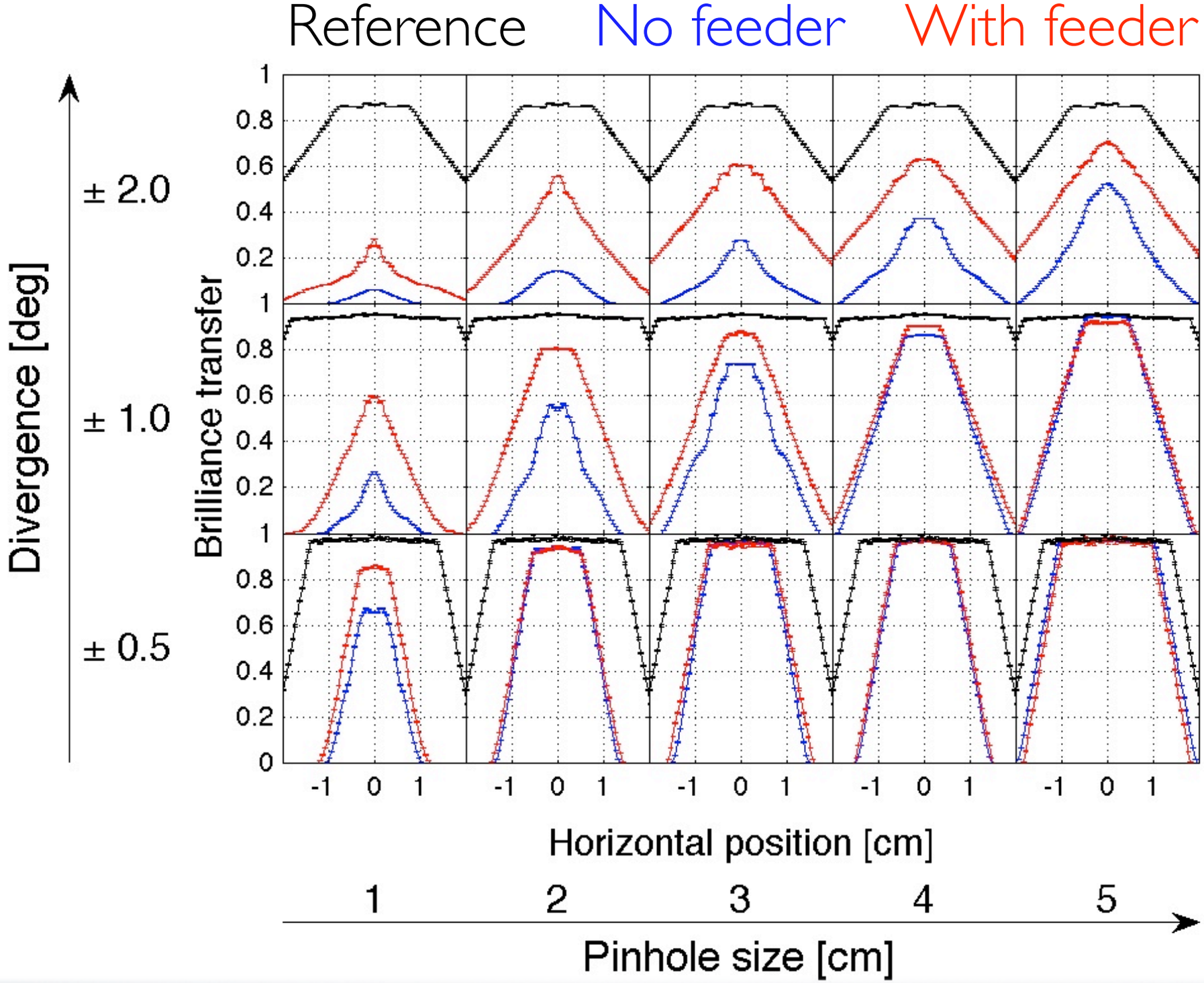
- A feeder will mainly improve transmission of cold neutrons

- It seems that many solutions are possible for each instrument and thus it might be possible to require more from the solutions without losing brilliance transfer

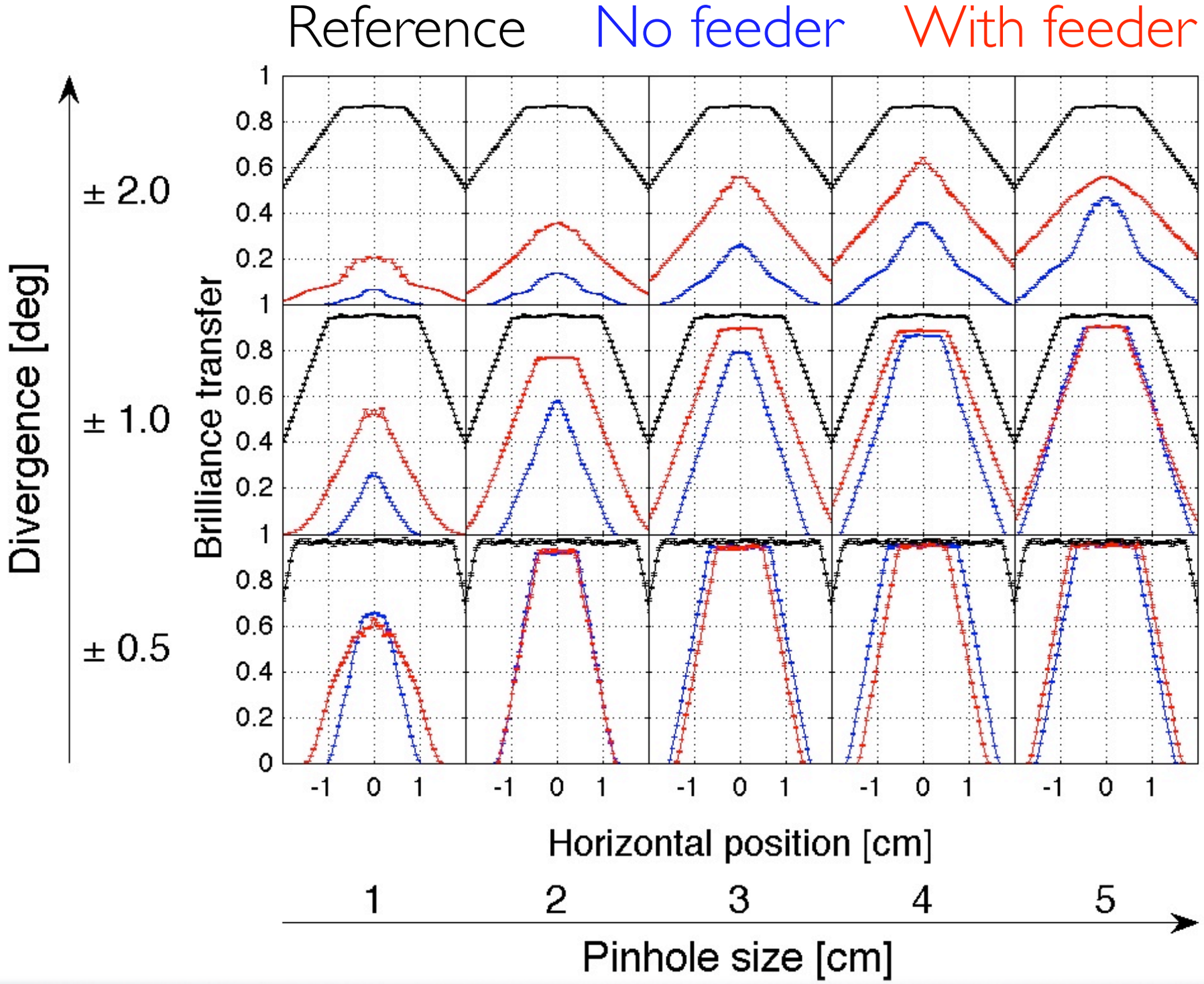
Brilliance transfer for 24 m instrument



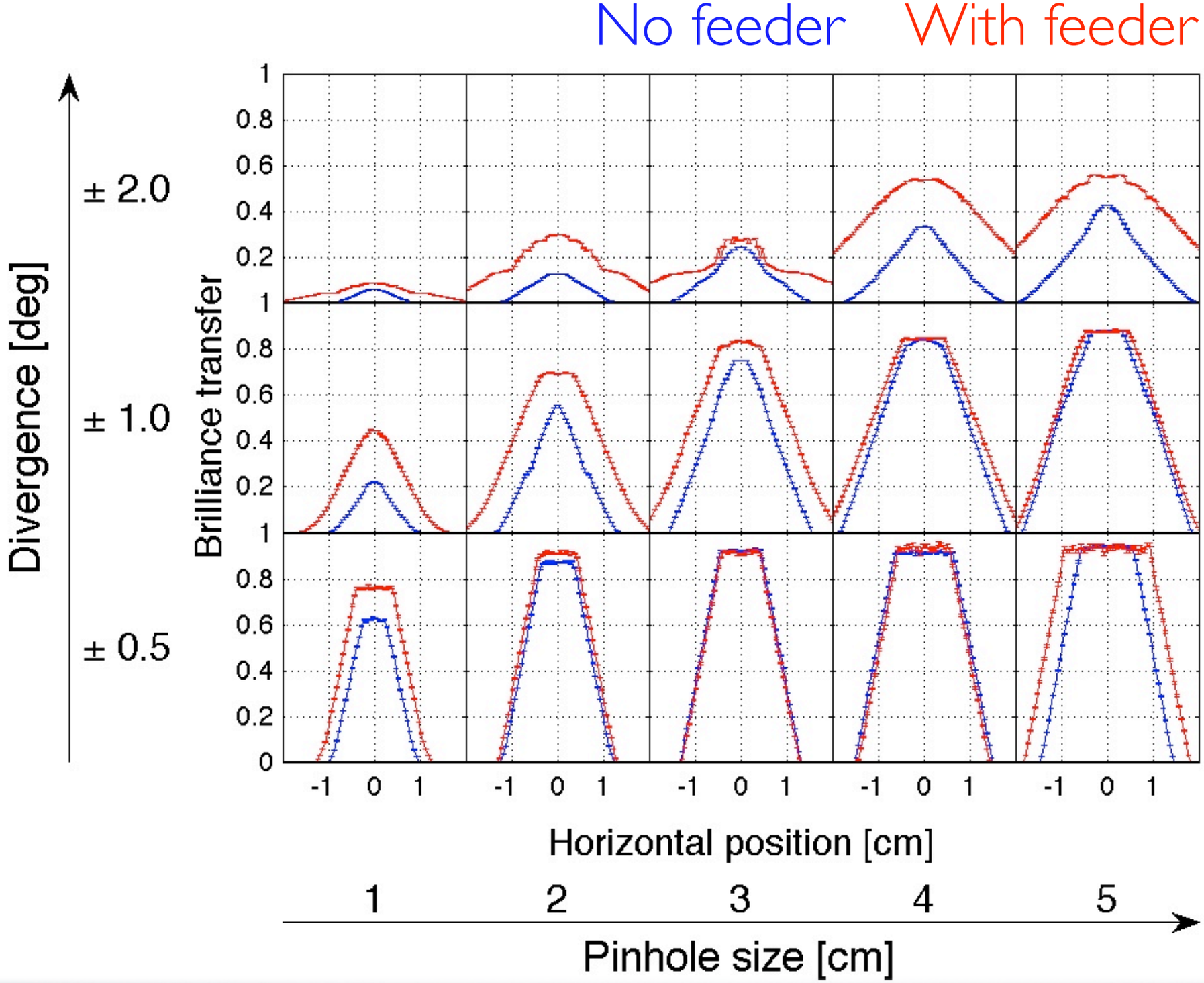
Brilliance transfer for 75 m instrument



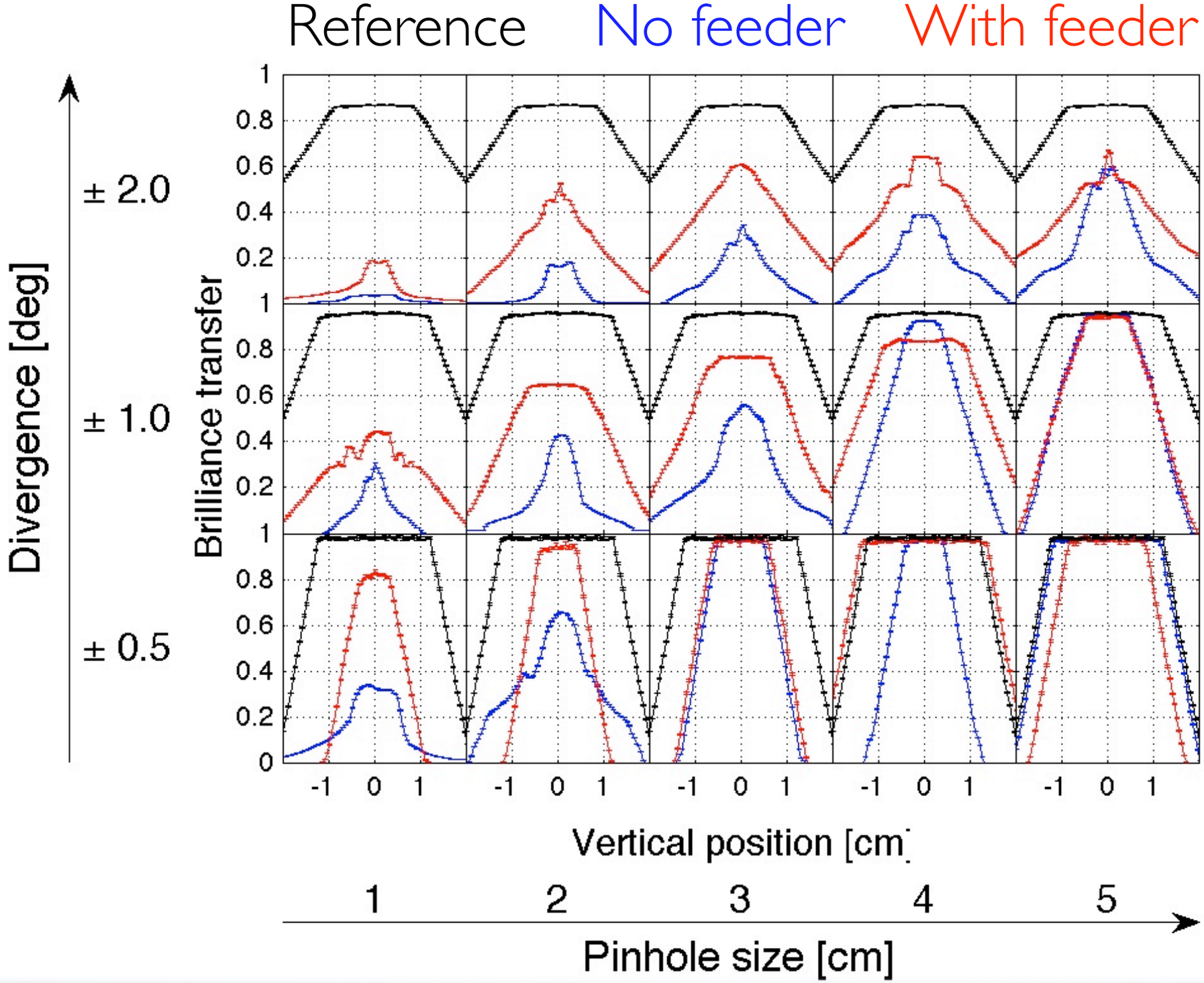
Brilliance transfer for 150m instrument



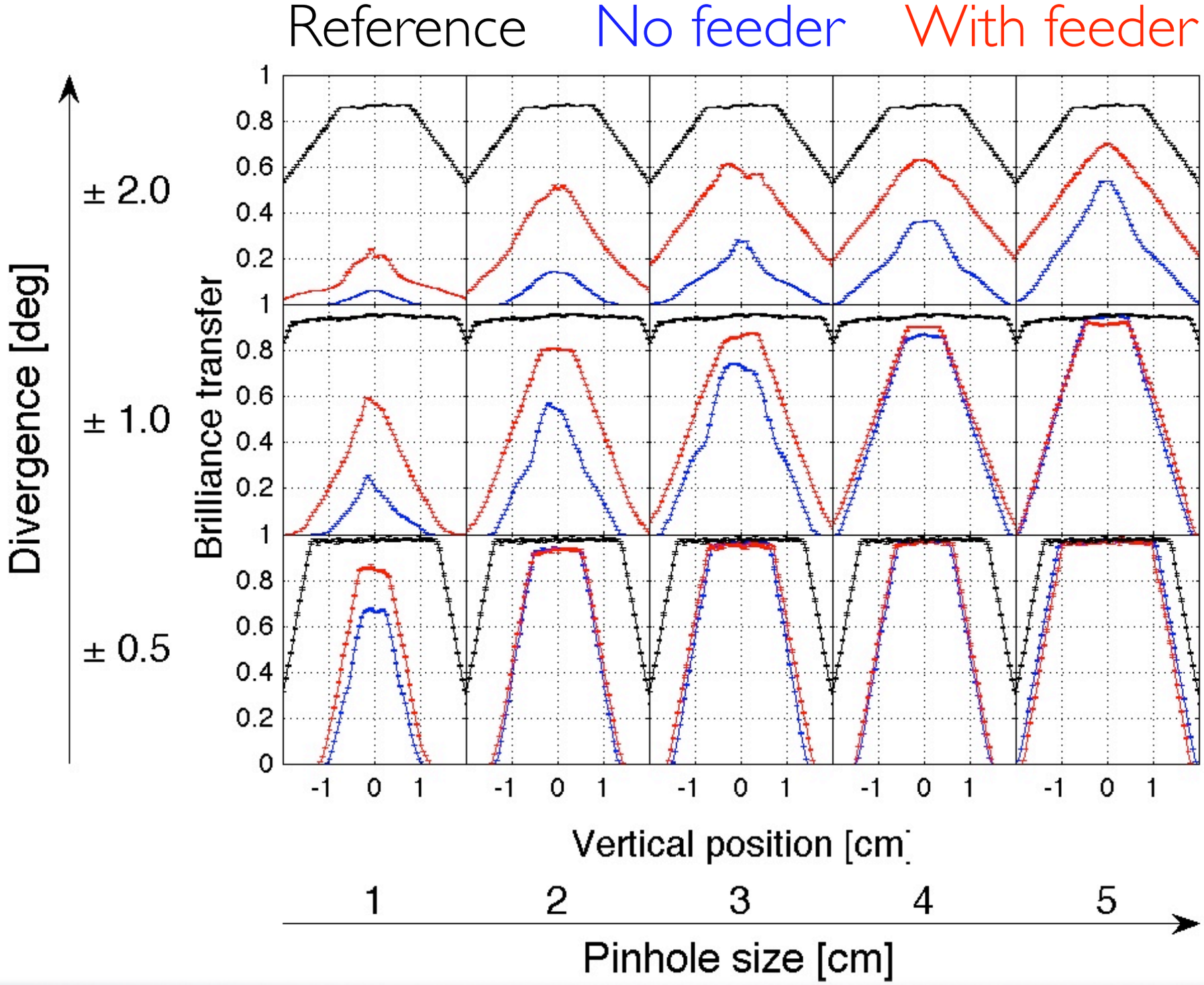
Brilliance transfer for 300m instrument



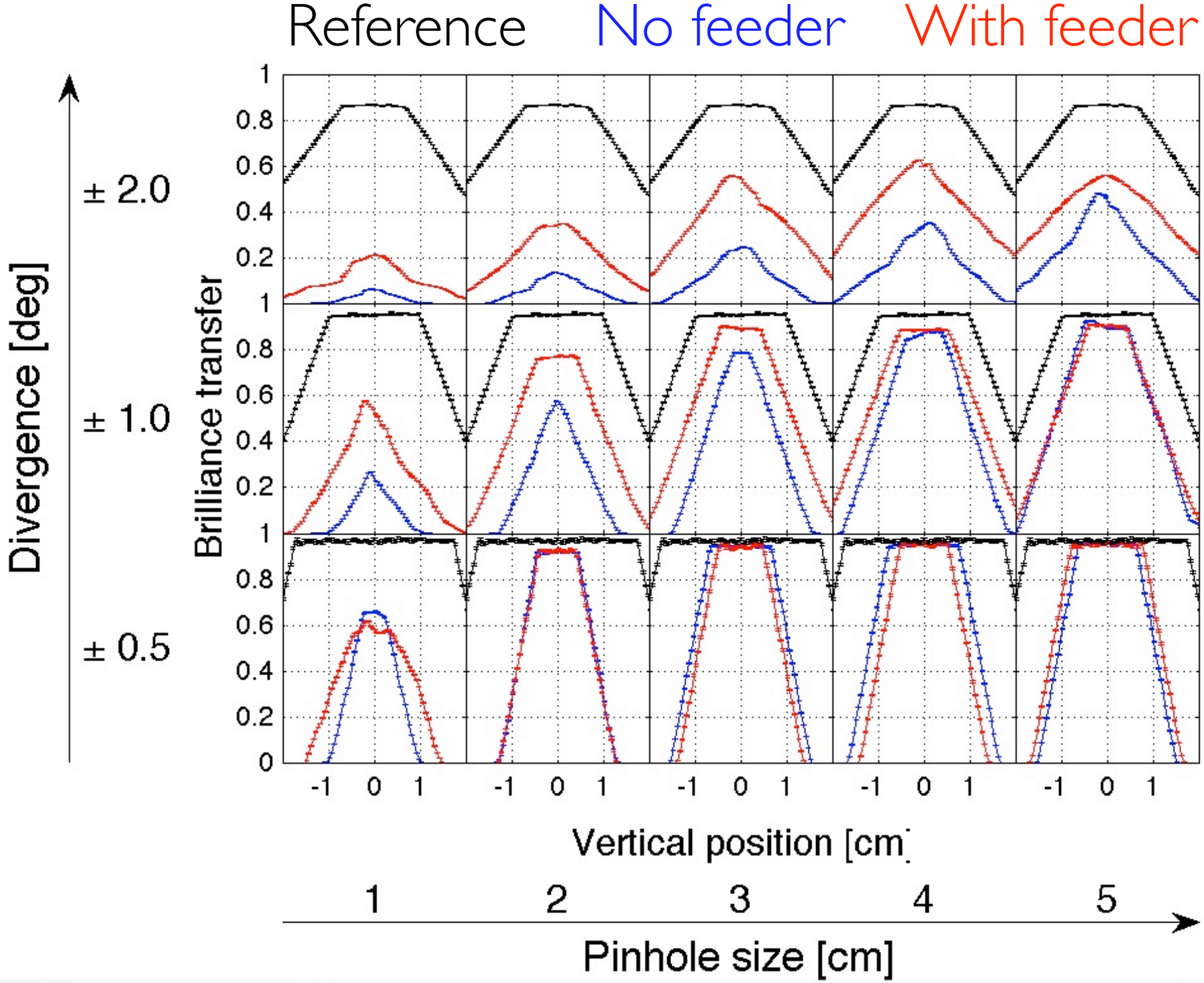
Brilliance transfer for 24 m instrument



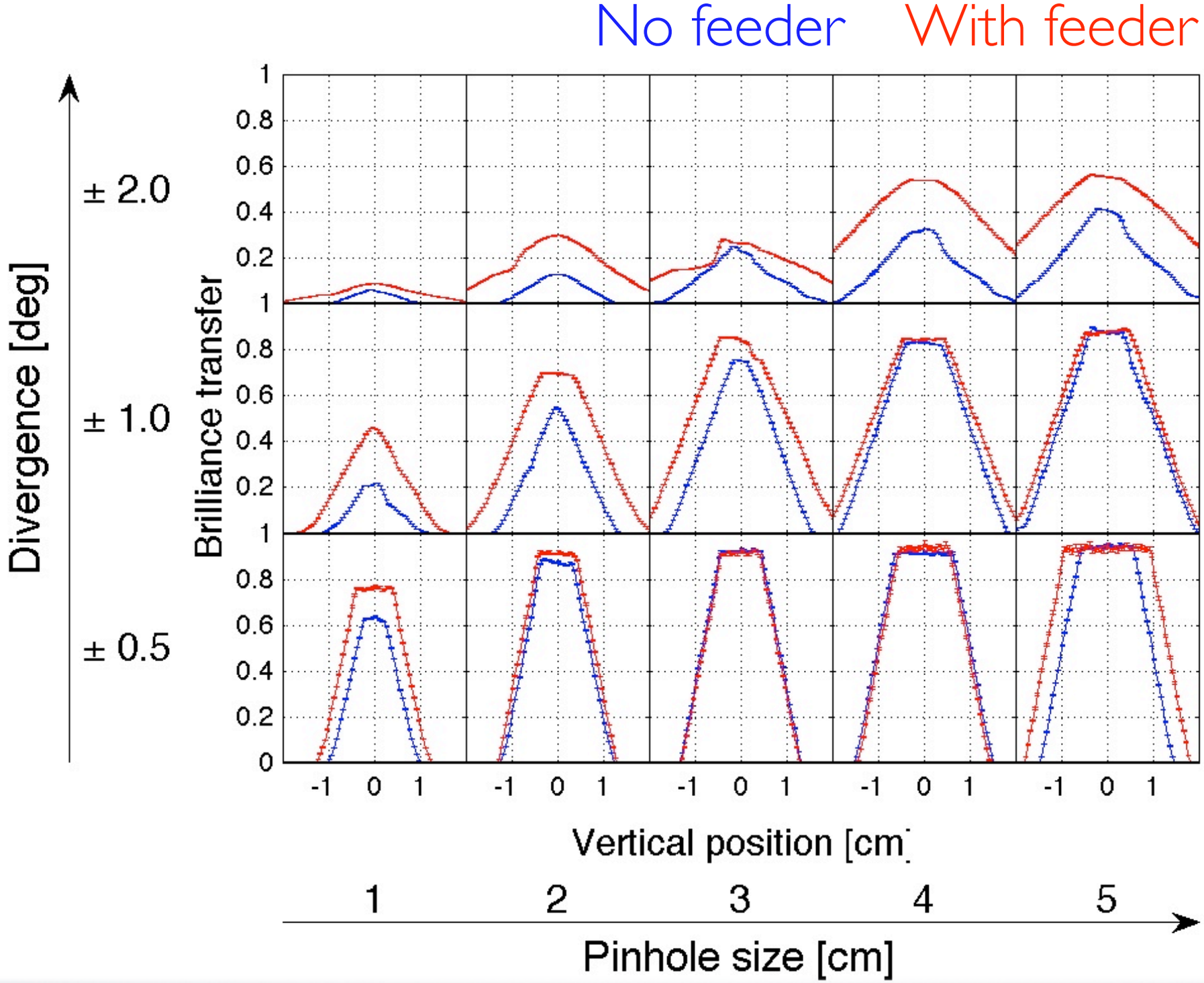
Brilliance transfer for 75 m instrument



Brilliance transfer for 150m instrument

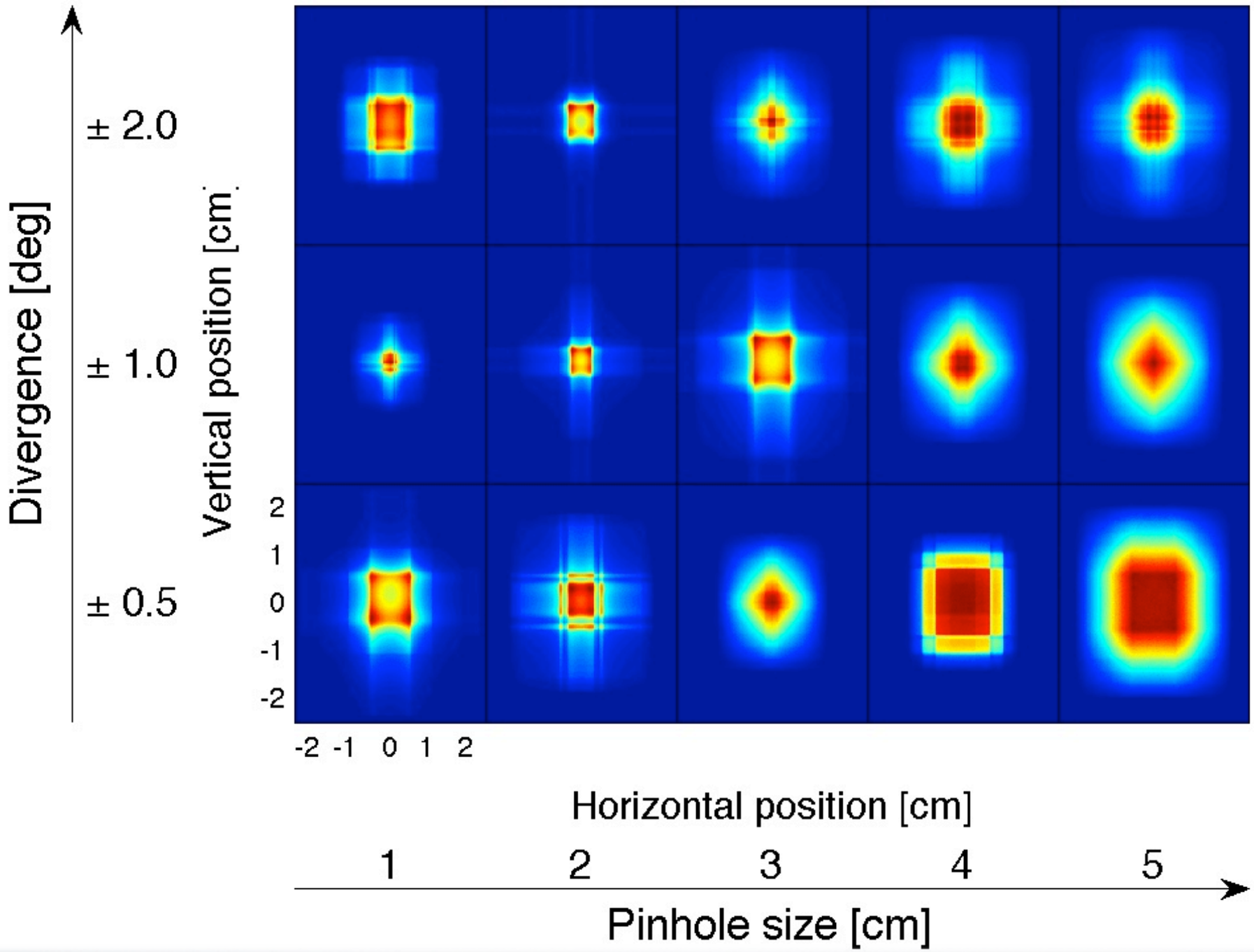


Brilliance transfer for 300m instrument



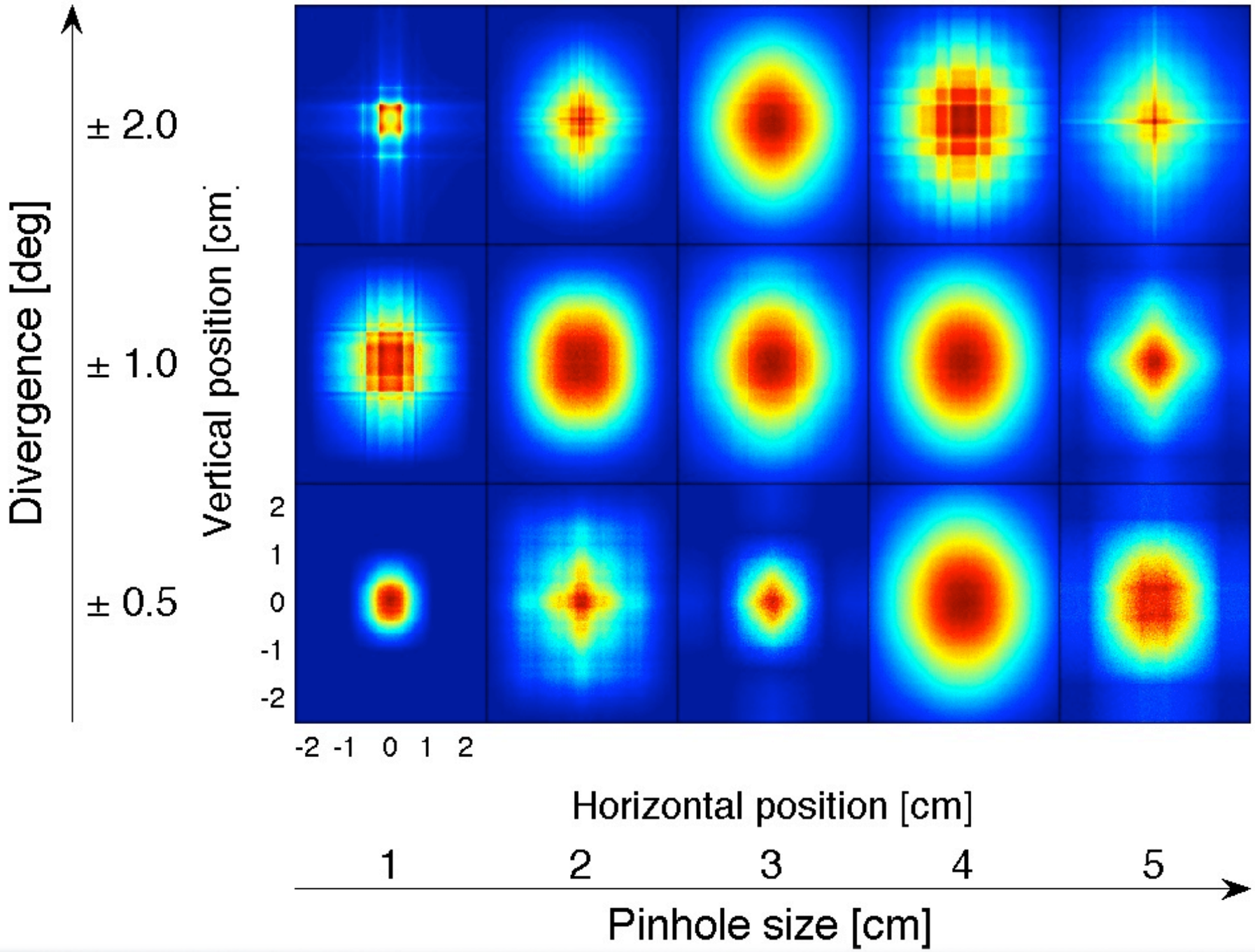
2D PSD for 24 m instrument

No feeder



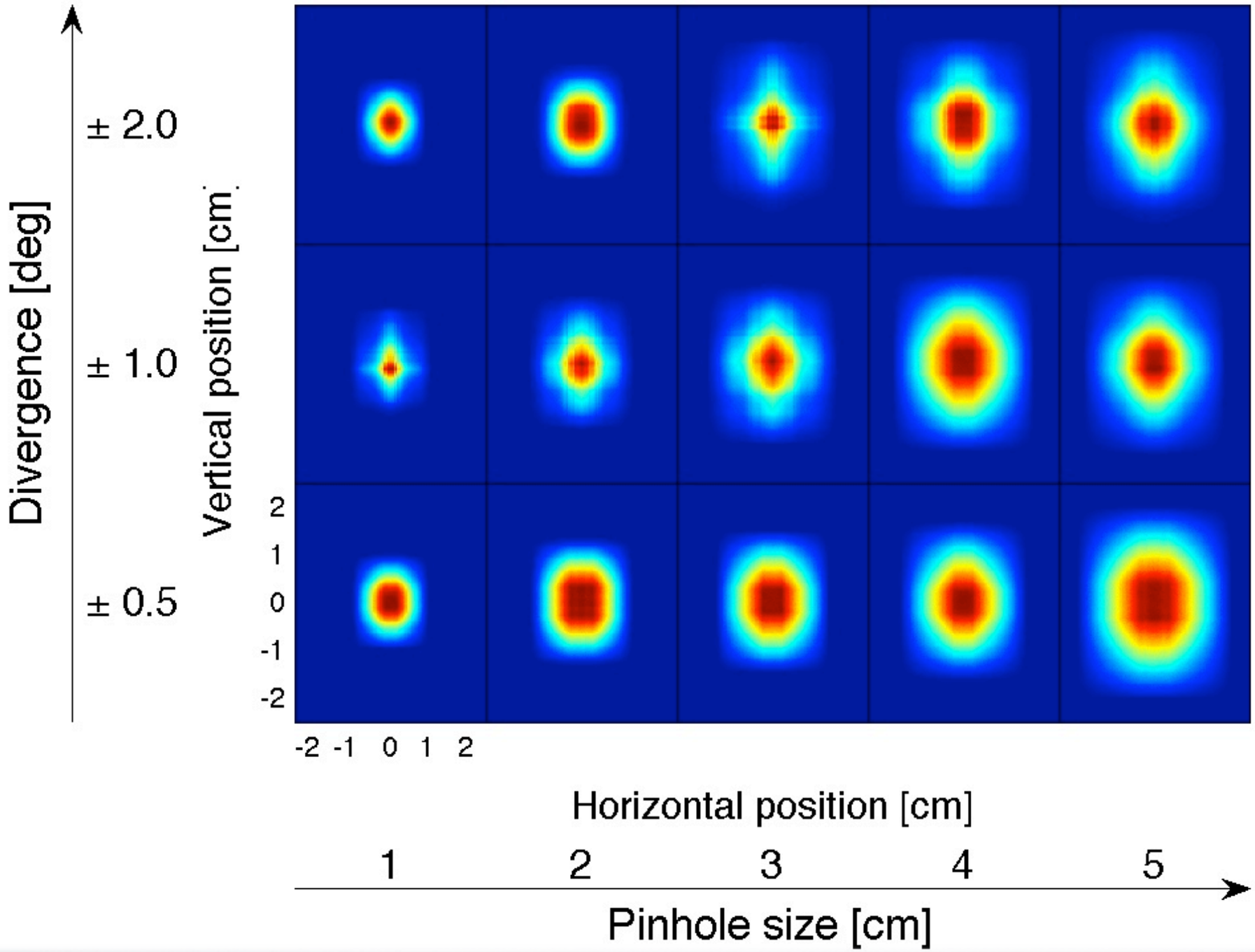
2D PSD for 24 m instrument

With feeder



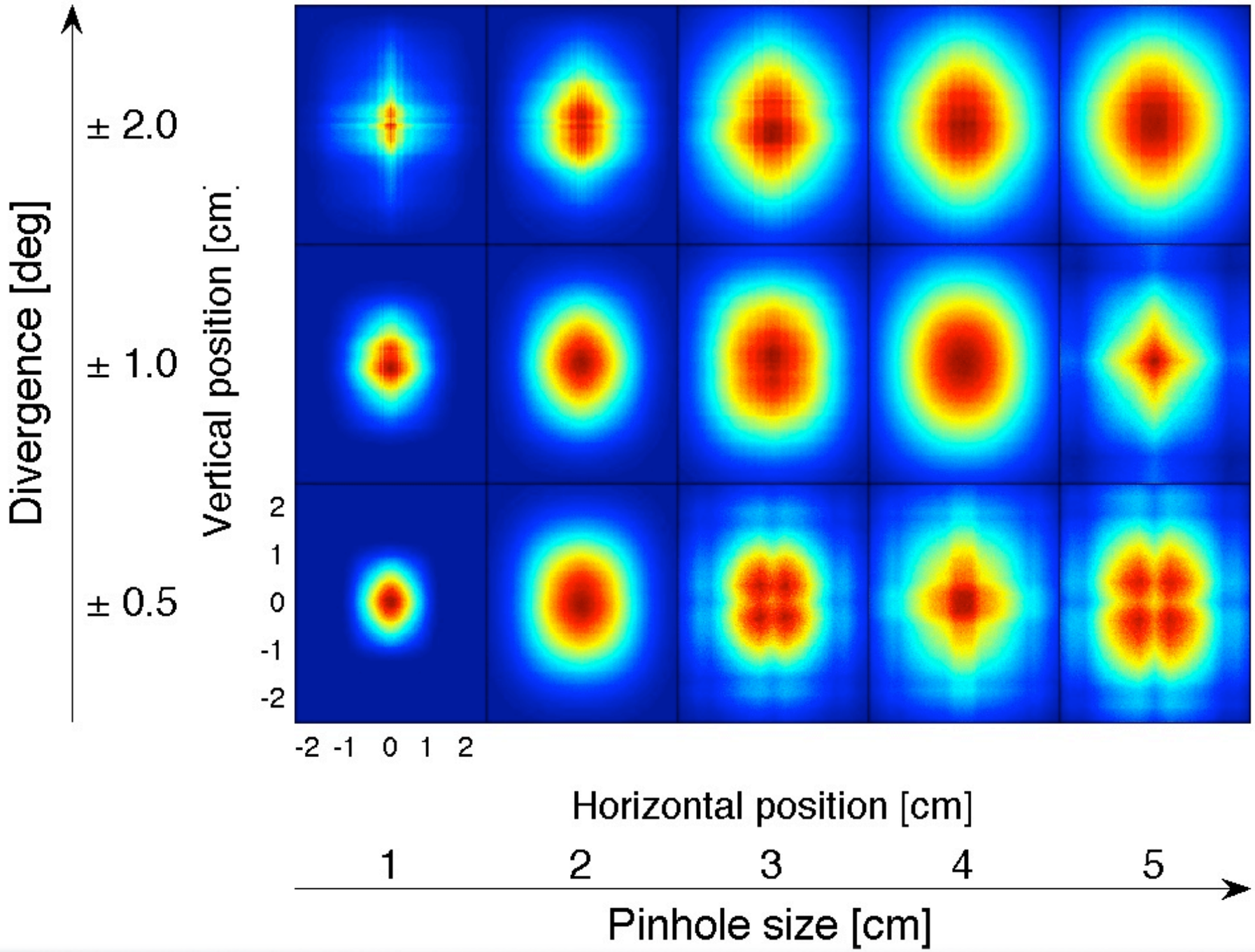
2D PSD for 75 m instrument

No feeder



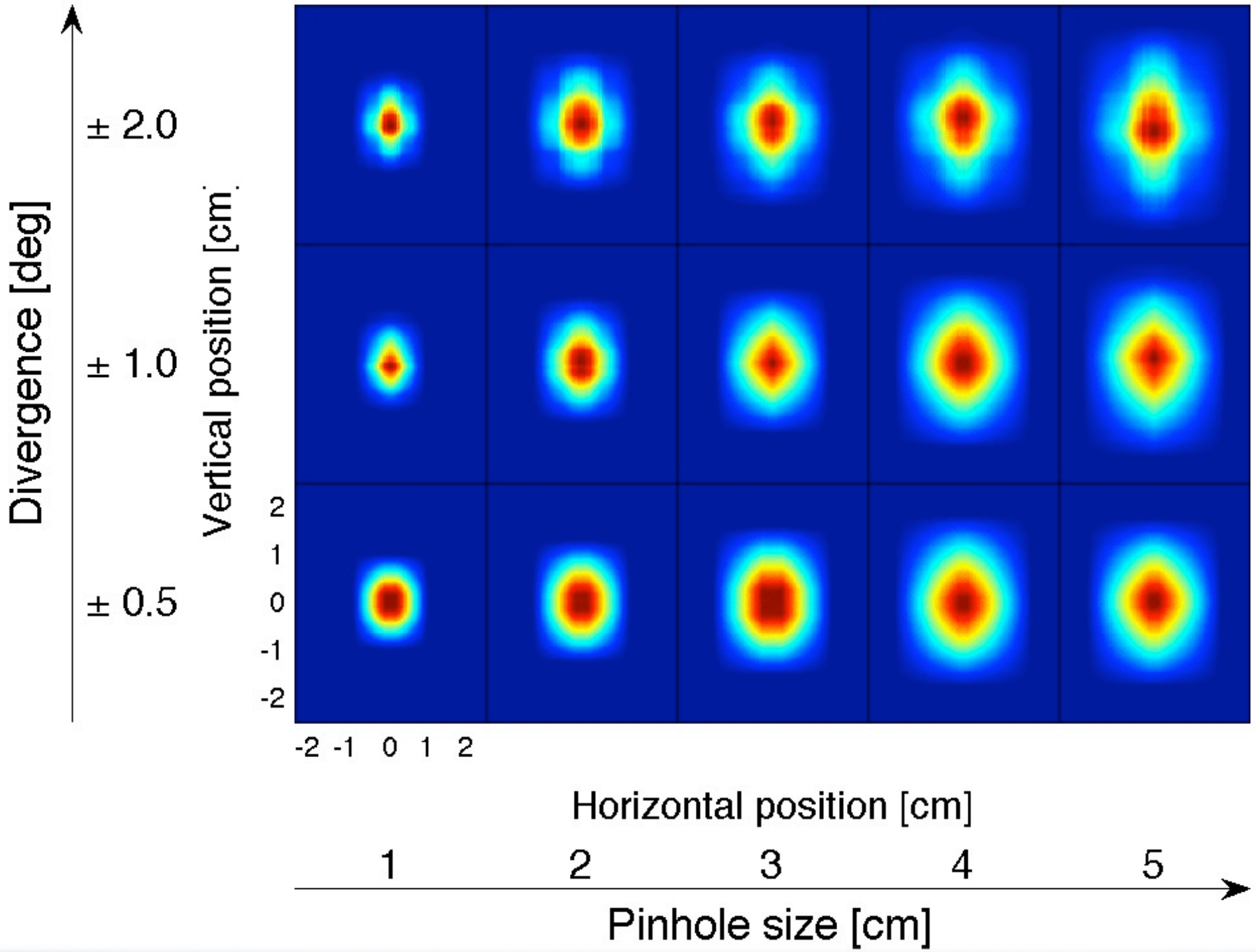
2D PSD for 75 m instrument

With feeder



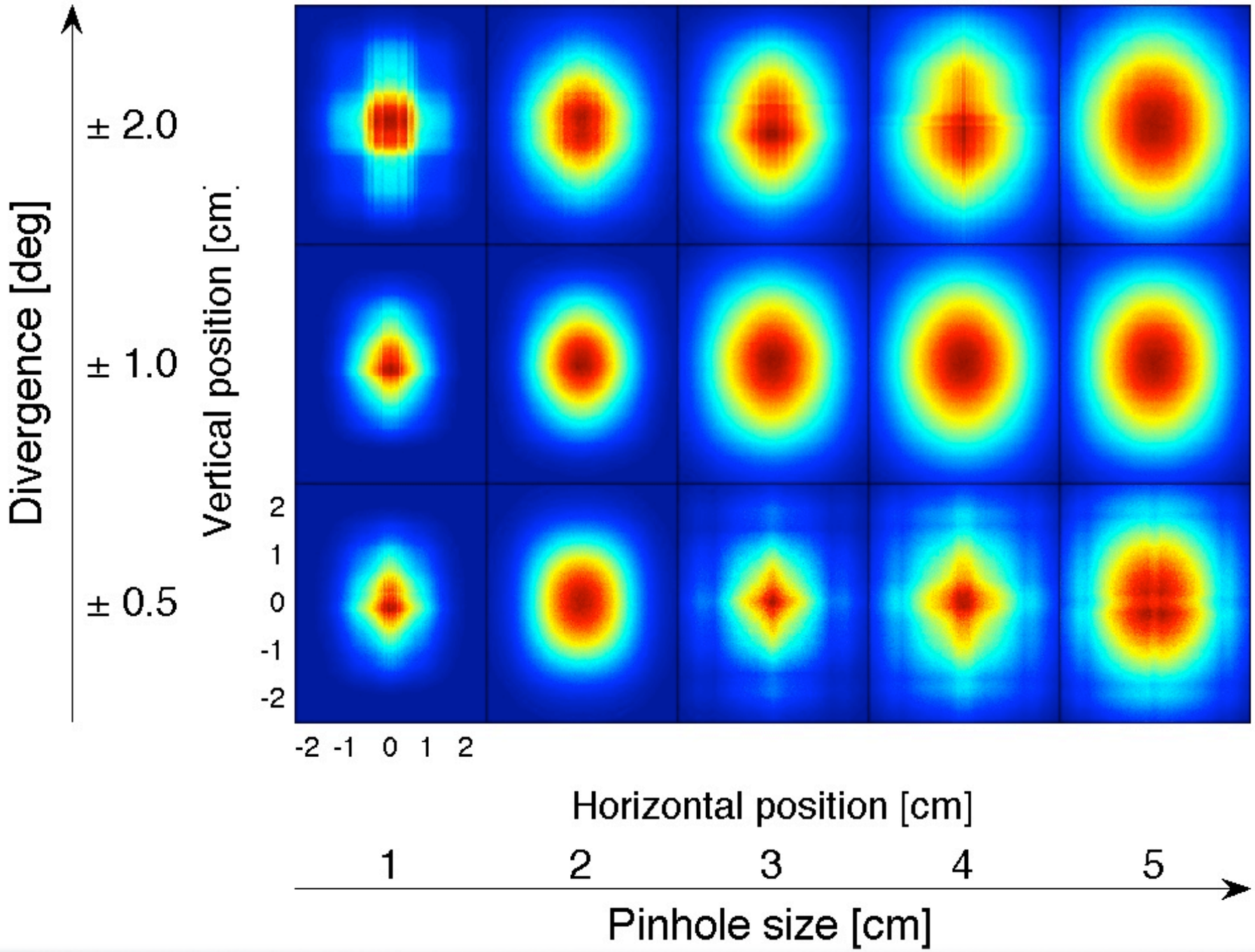
2D PSD for 150m instrument

No feeder



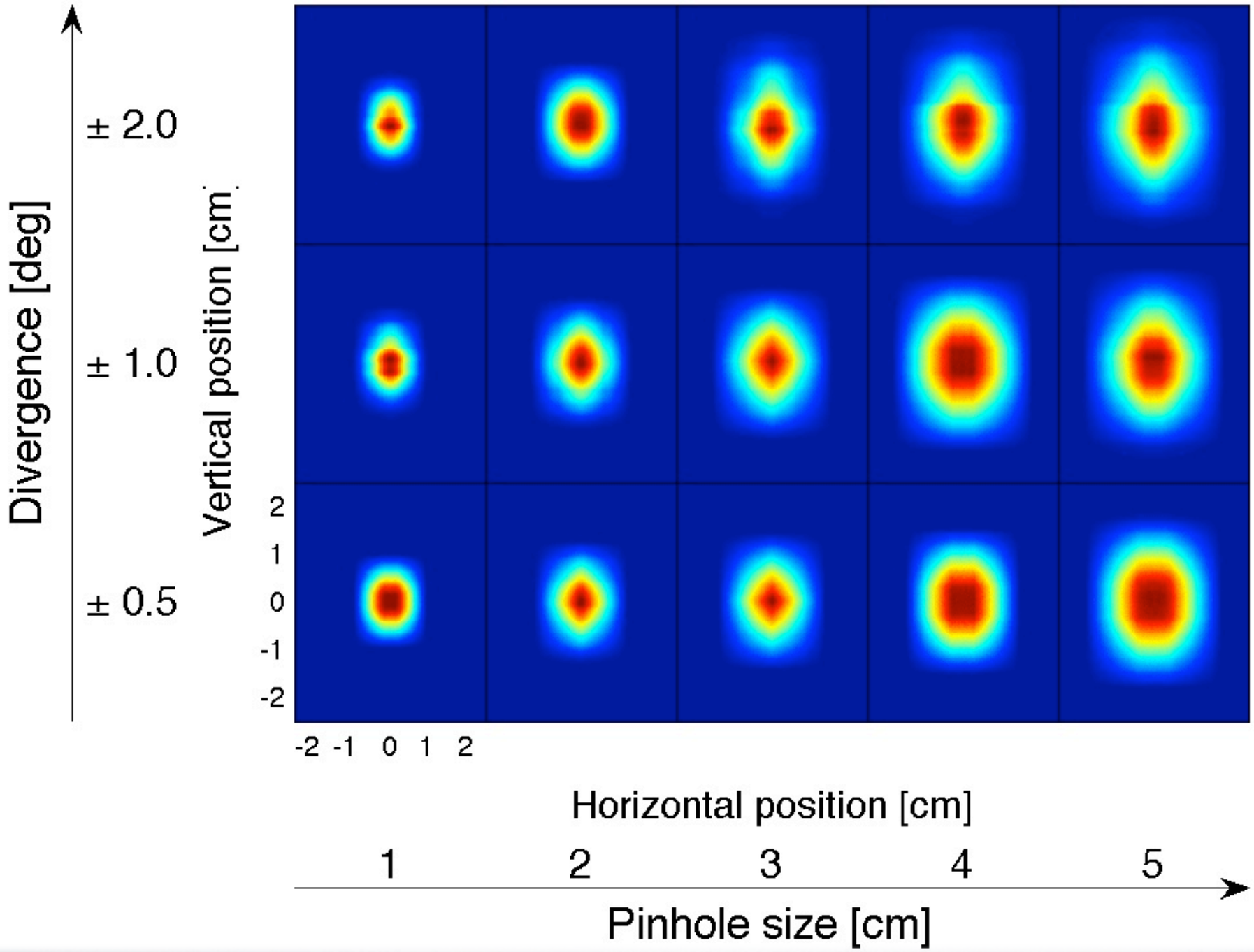
2D PSD for 150m instrument

With feeder



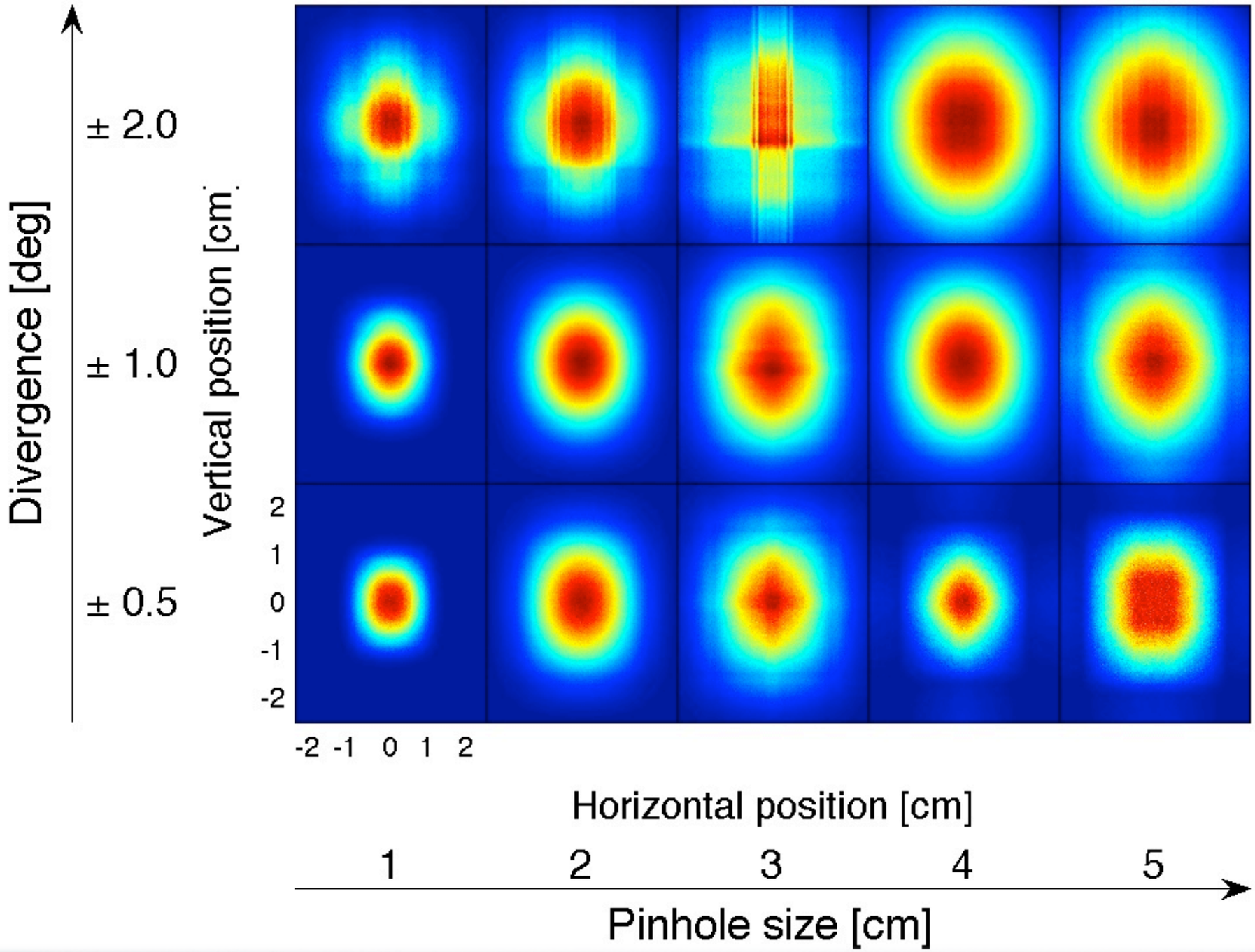
2D PSD for 300m instrument

No feeder



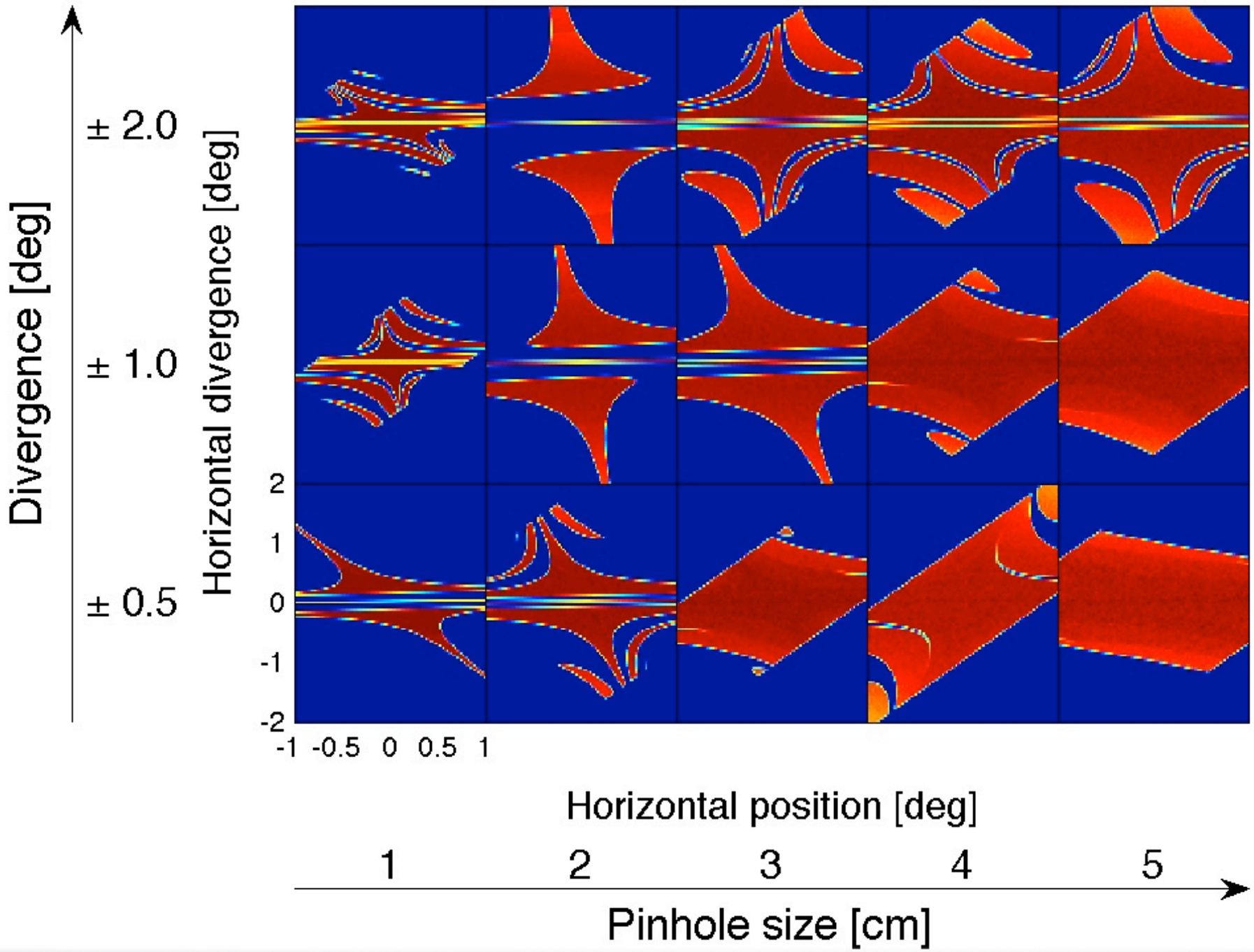
2D PSD for 300m instrument

With feeder



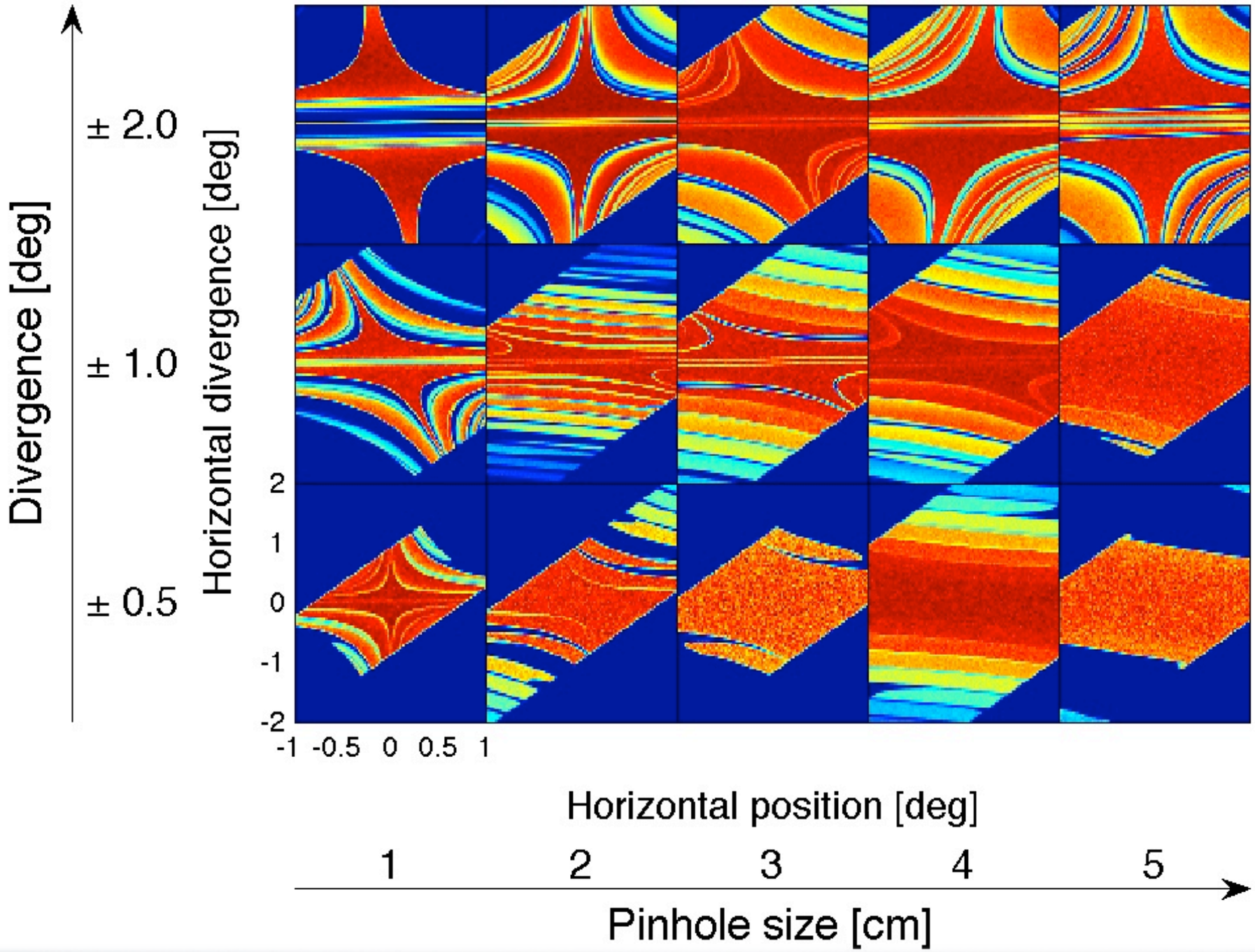
Horizontal acceptance diagram for 24m

No feeder



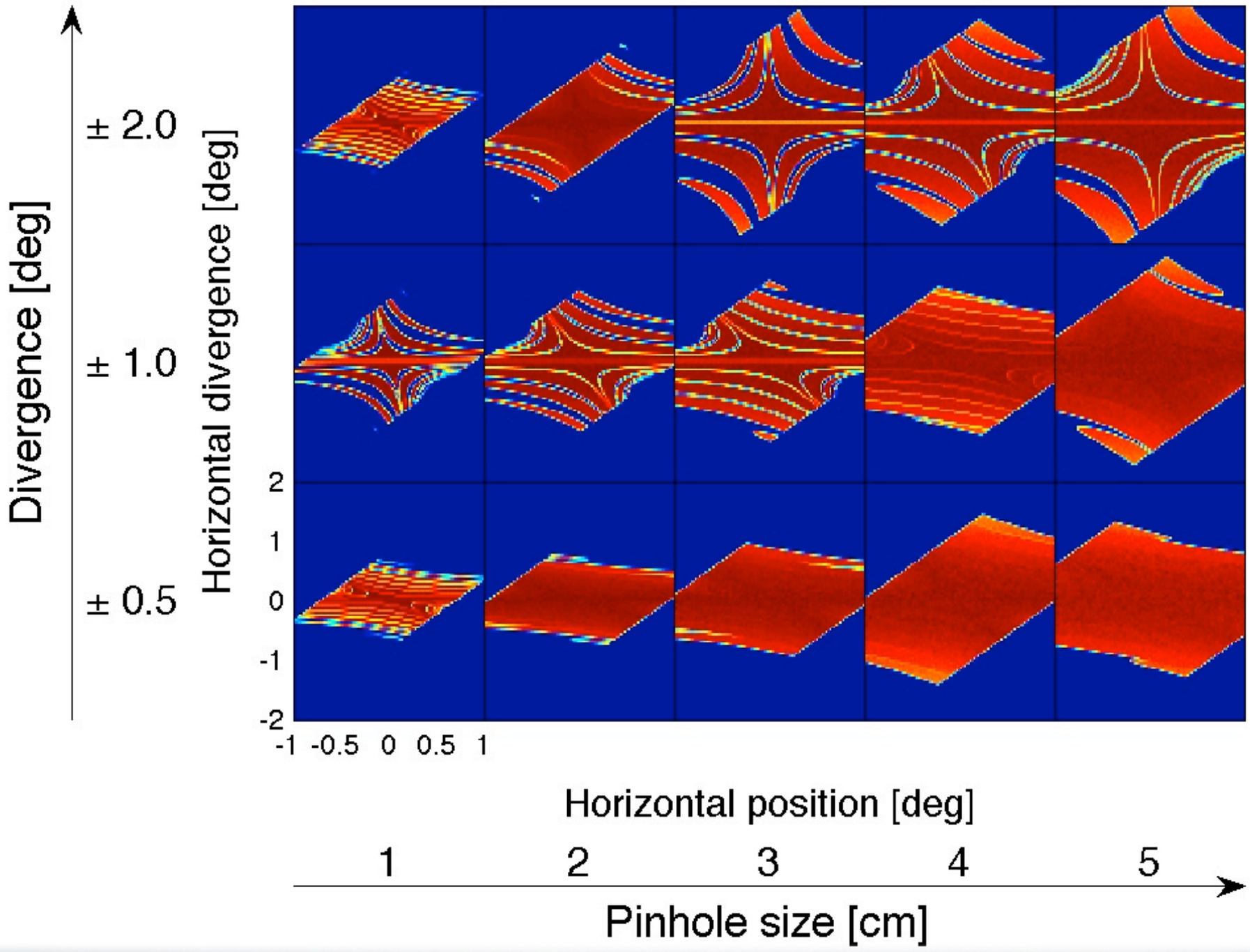
Horizontal acceptance diagram for 24m

With feeder



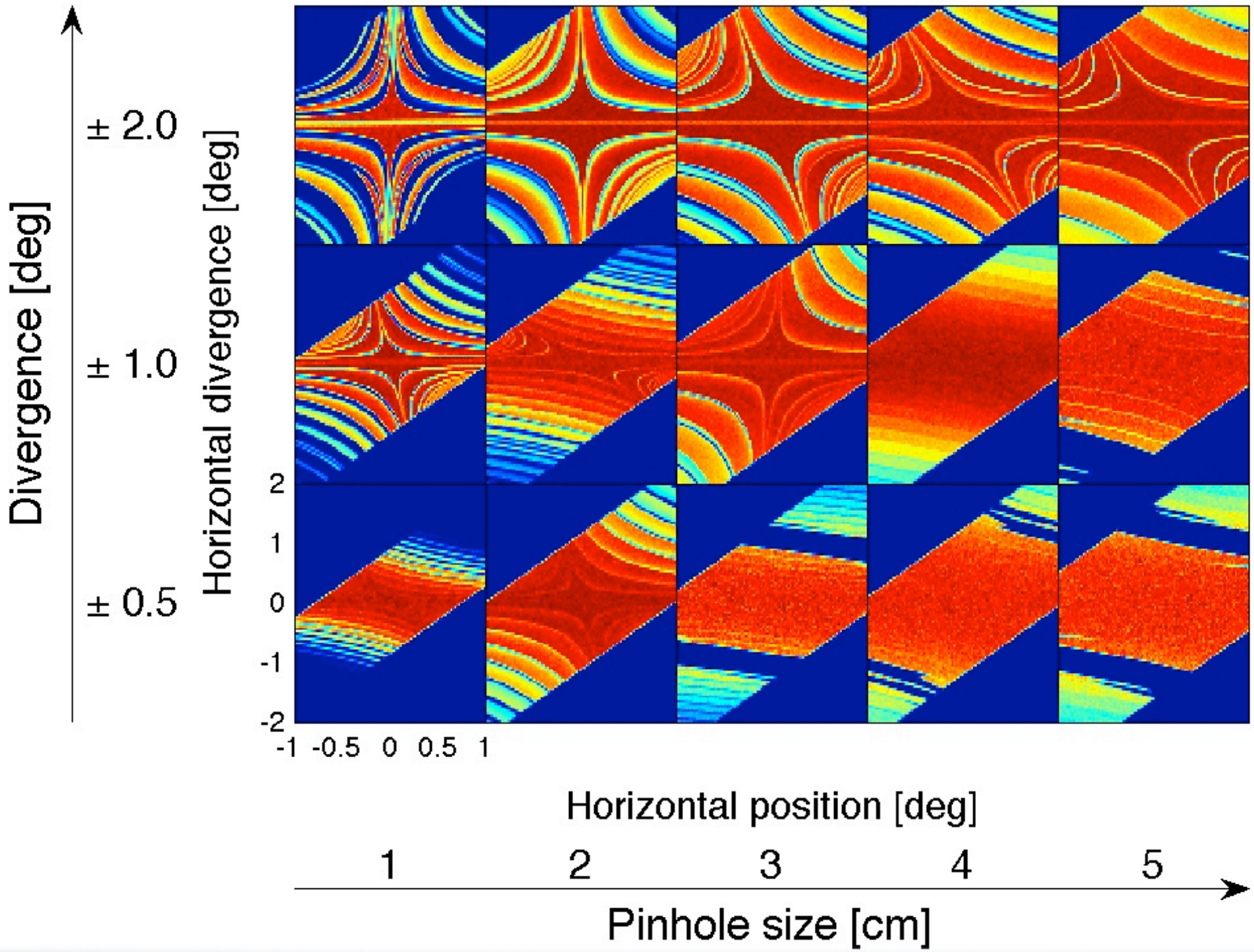
Horizontal acceptance diagram for 75m

No feeder



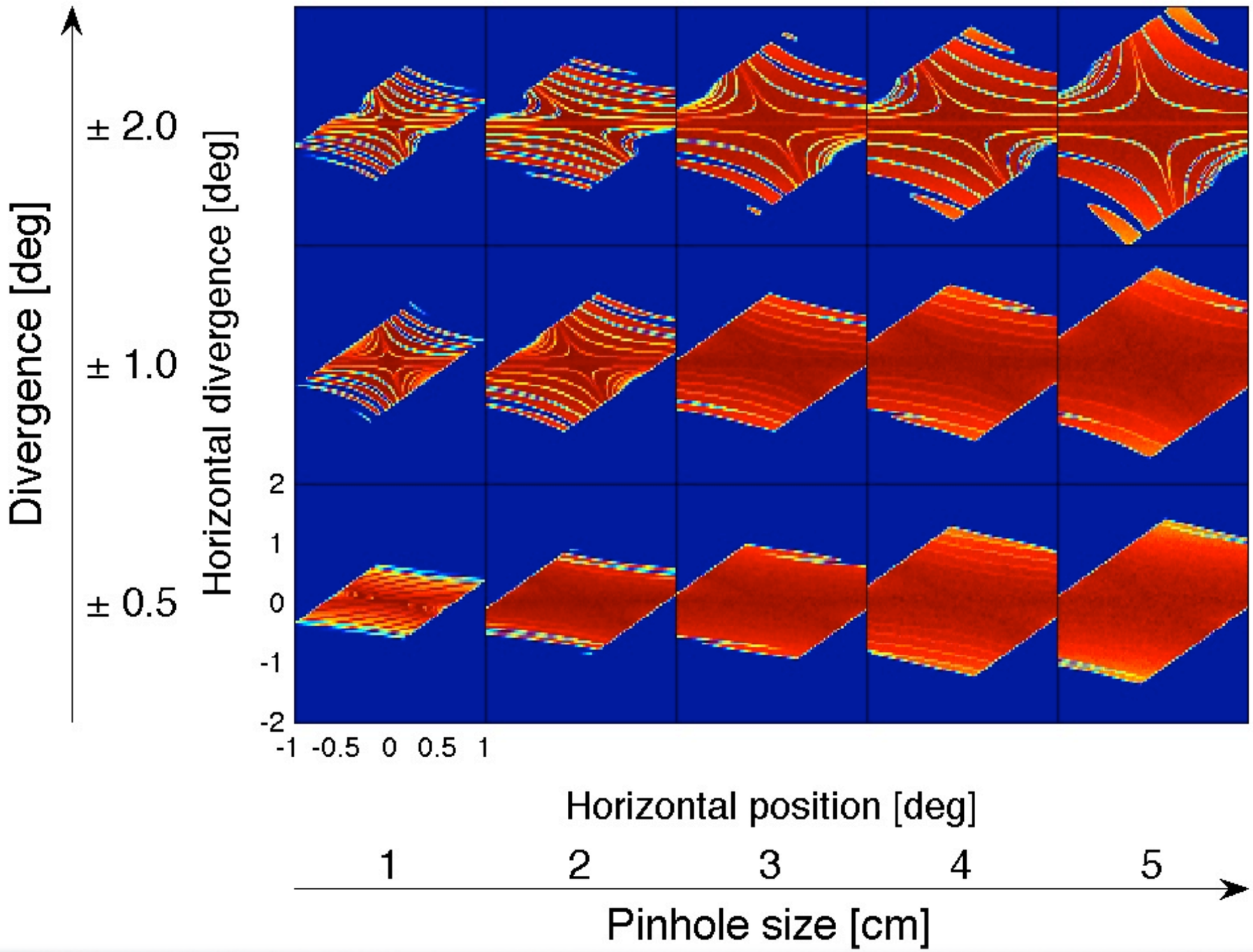
Horizontal acceptance diagram for 75m

With feeder



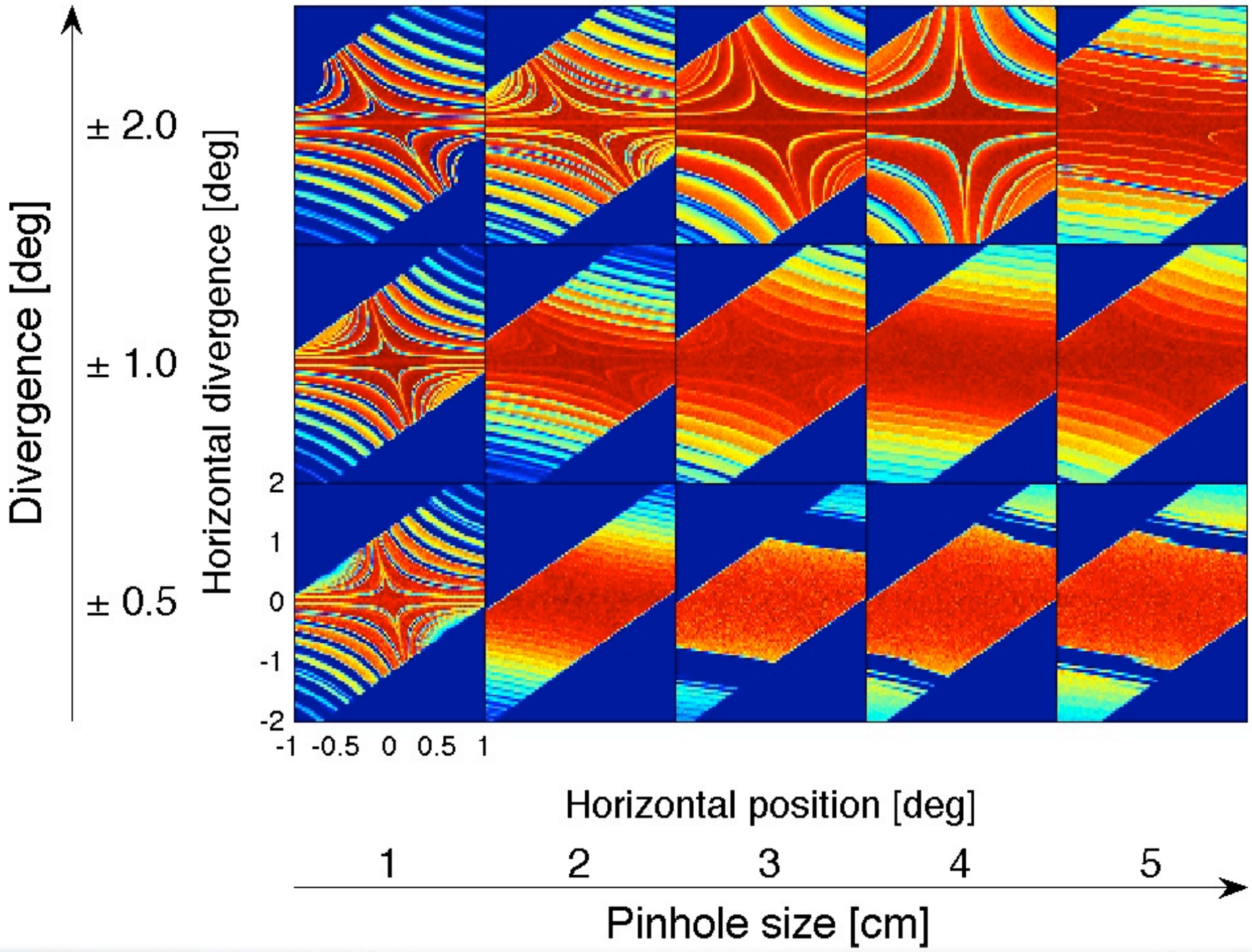
Horizontal acceptance diagram for 150m

No feeder



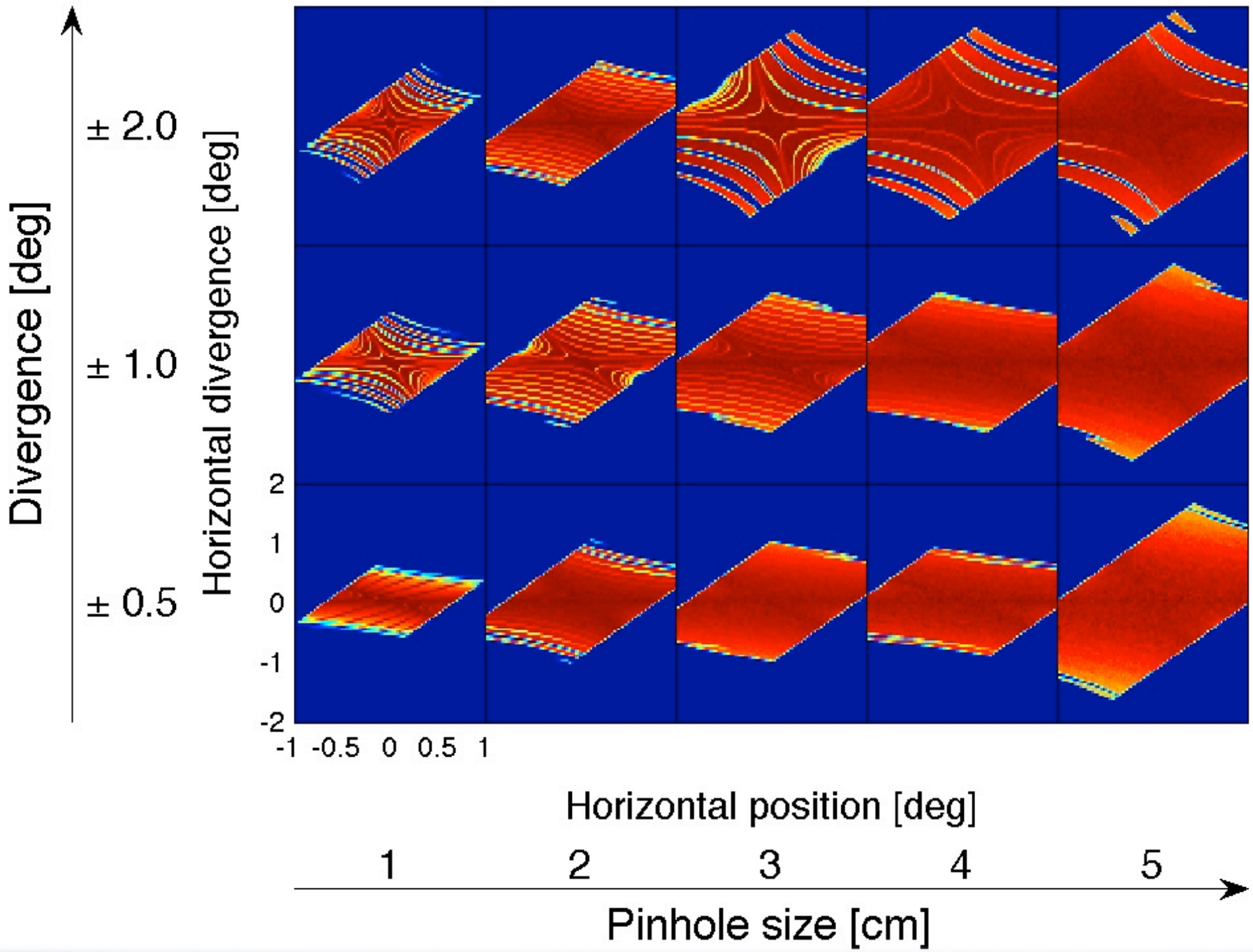
Horizontal acceptance diagram for 150m

With feeder



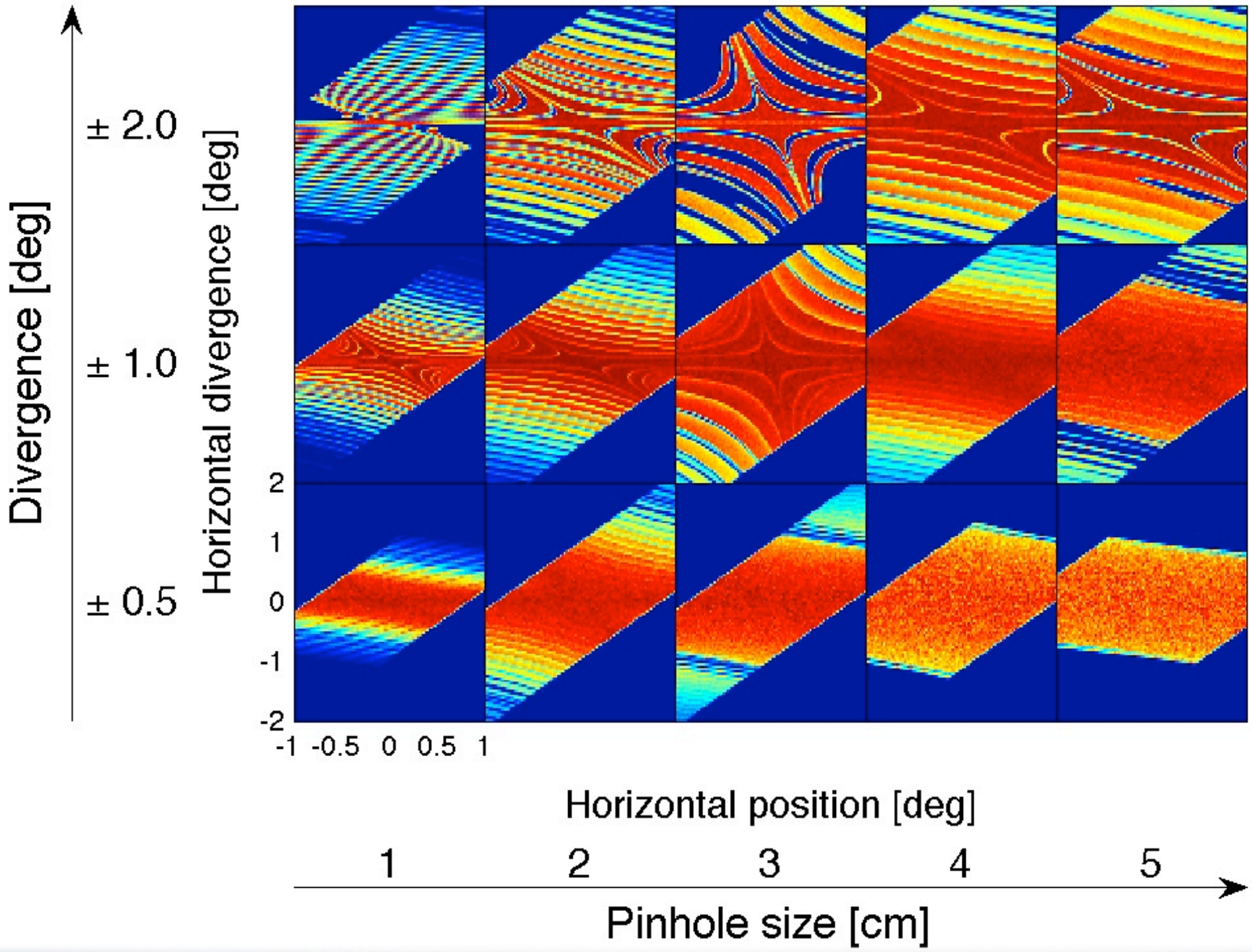
Horizontal acceptance diagram for 300m

No feeder



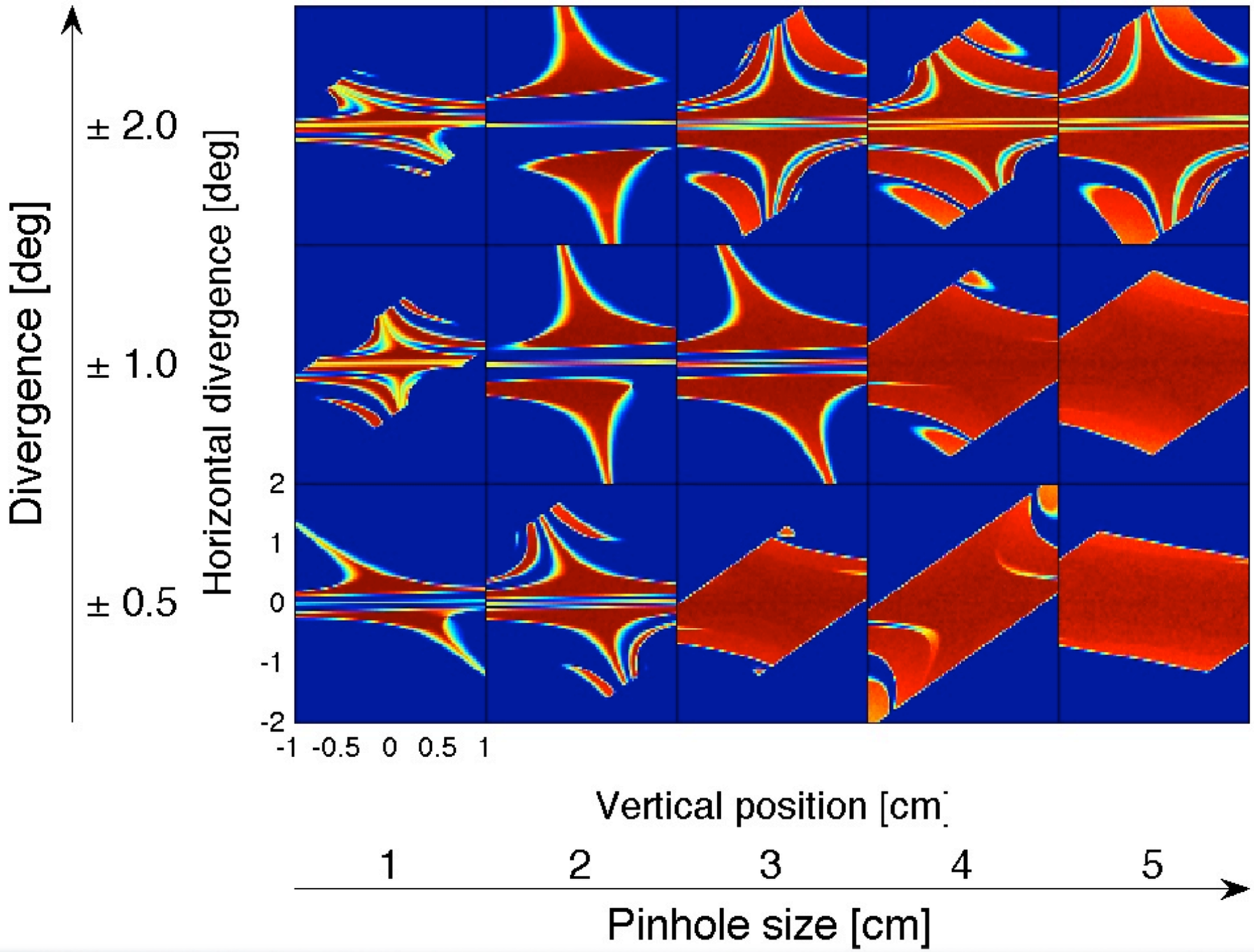
Horizontal acceptance diagram for 300m

With feeder



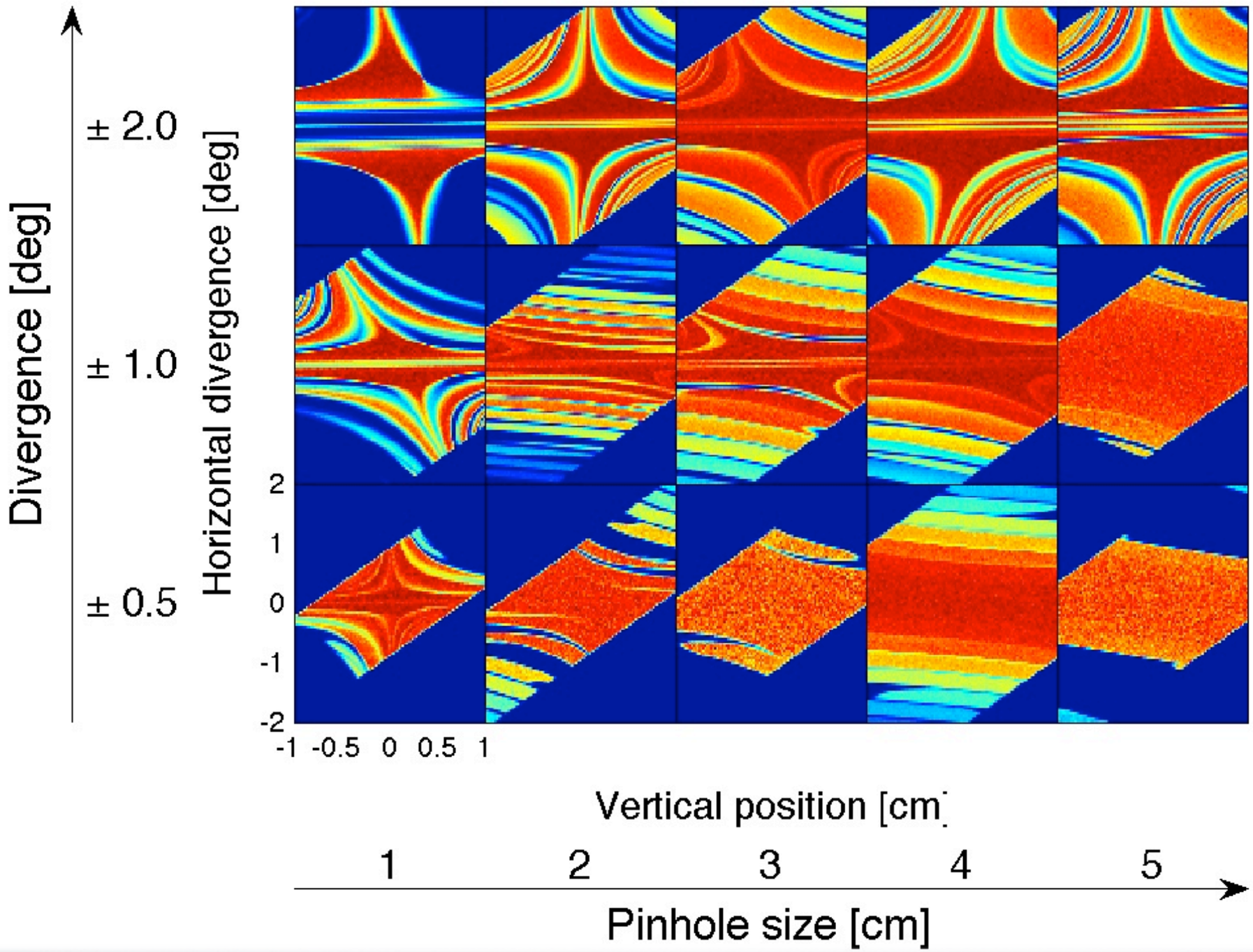
Vertical acceptance diagram for 24m

No feeder



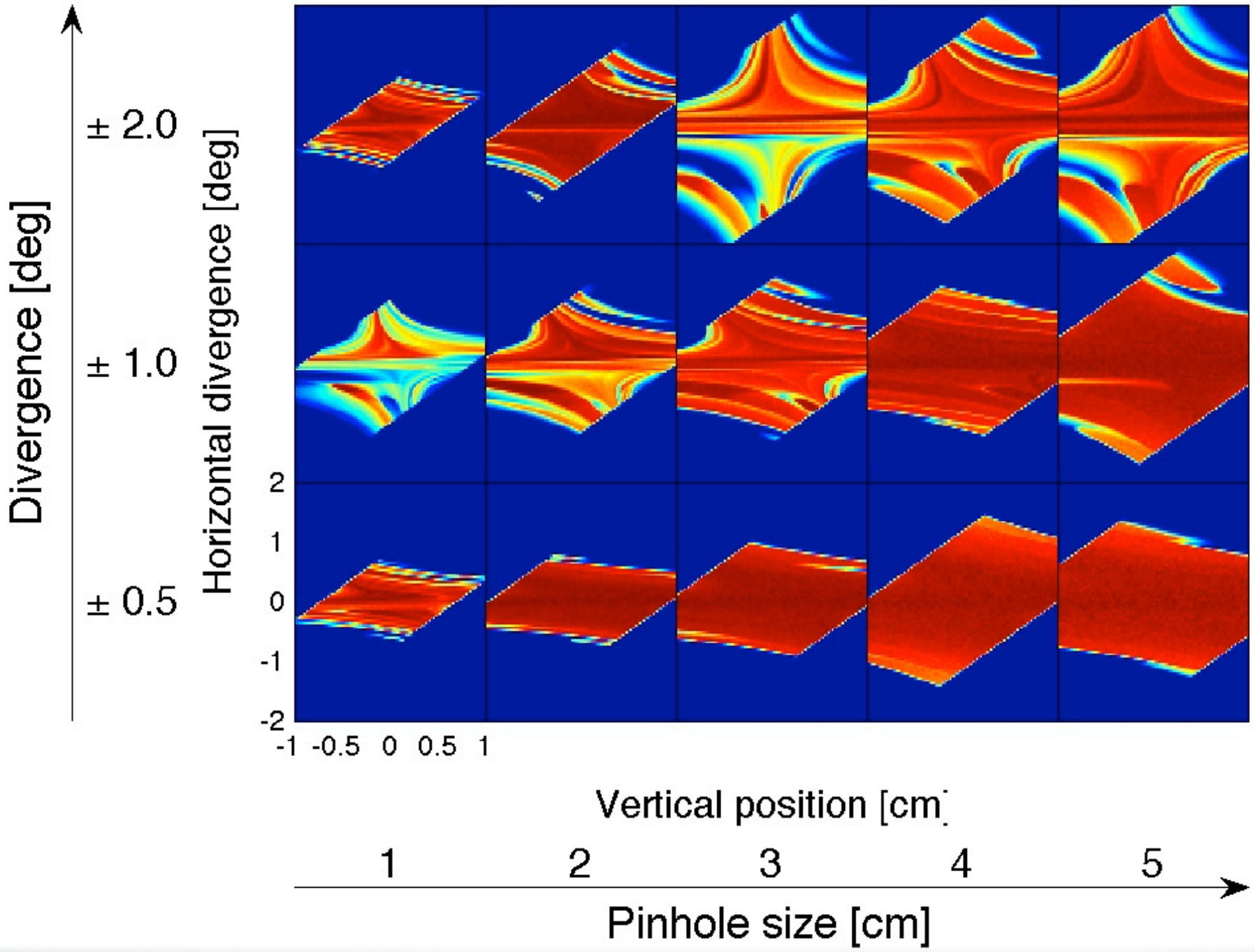
Vertical acceptance diagram for 24m

With feeder



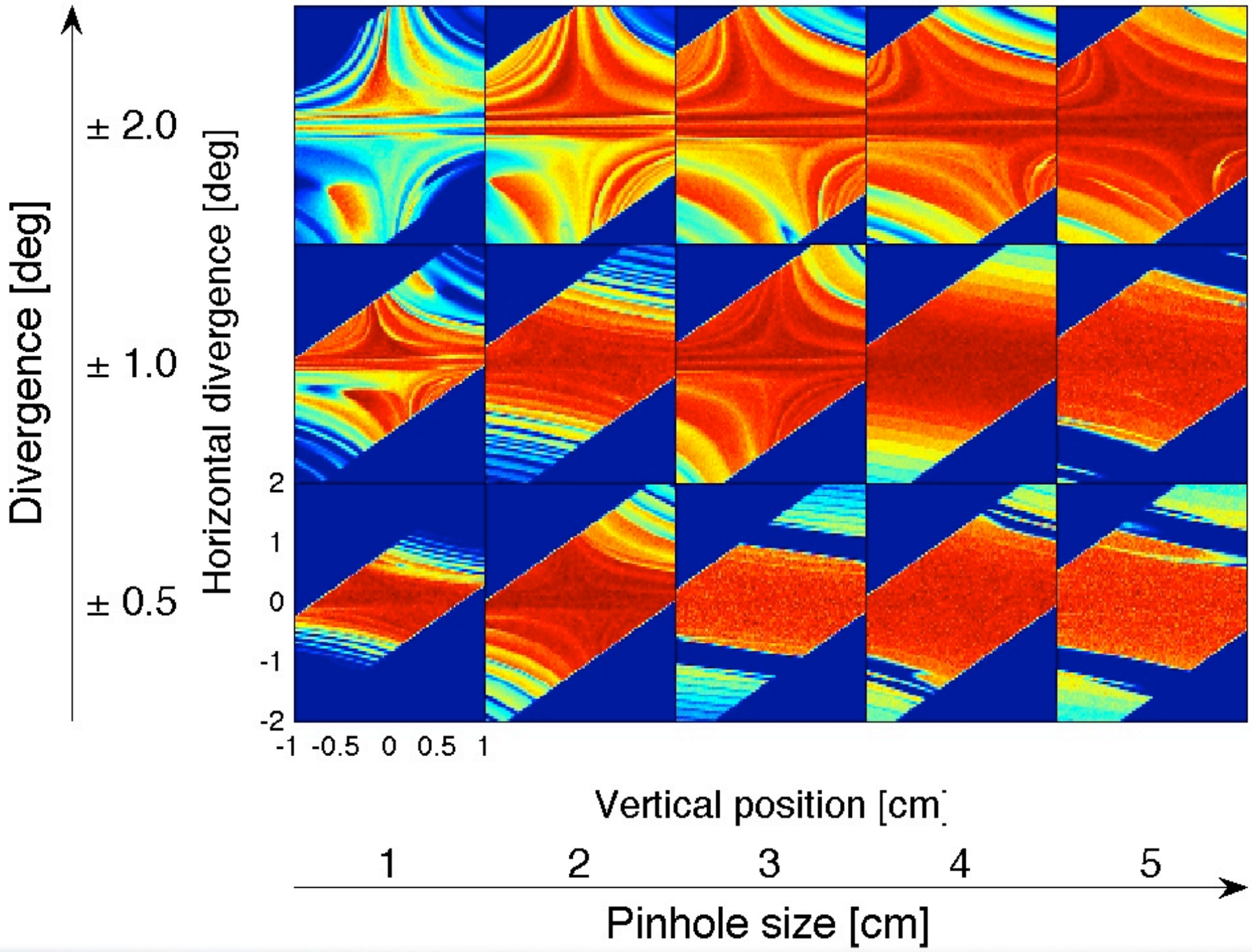
Vertical acceptance diagram for 75m

No feeder



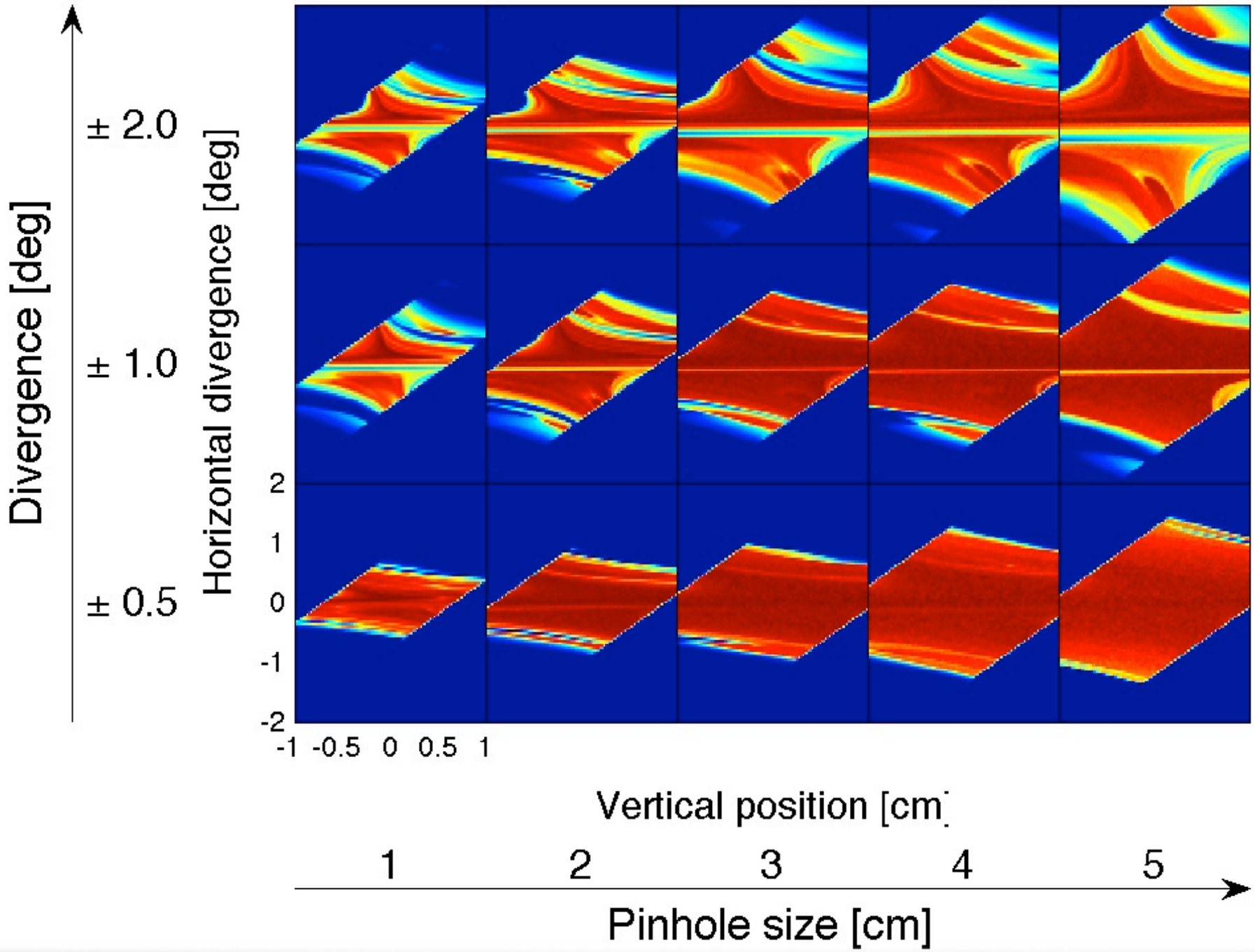
Vertical acceptance diagram for 75m

With feeder



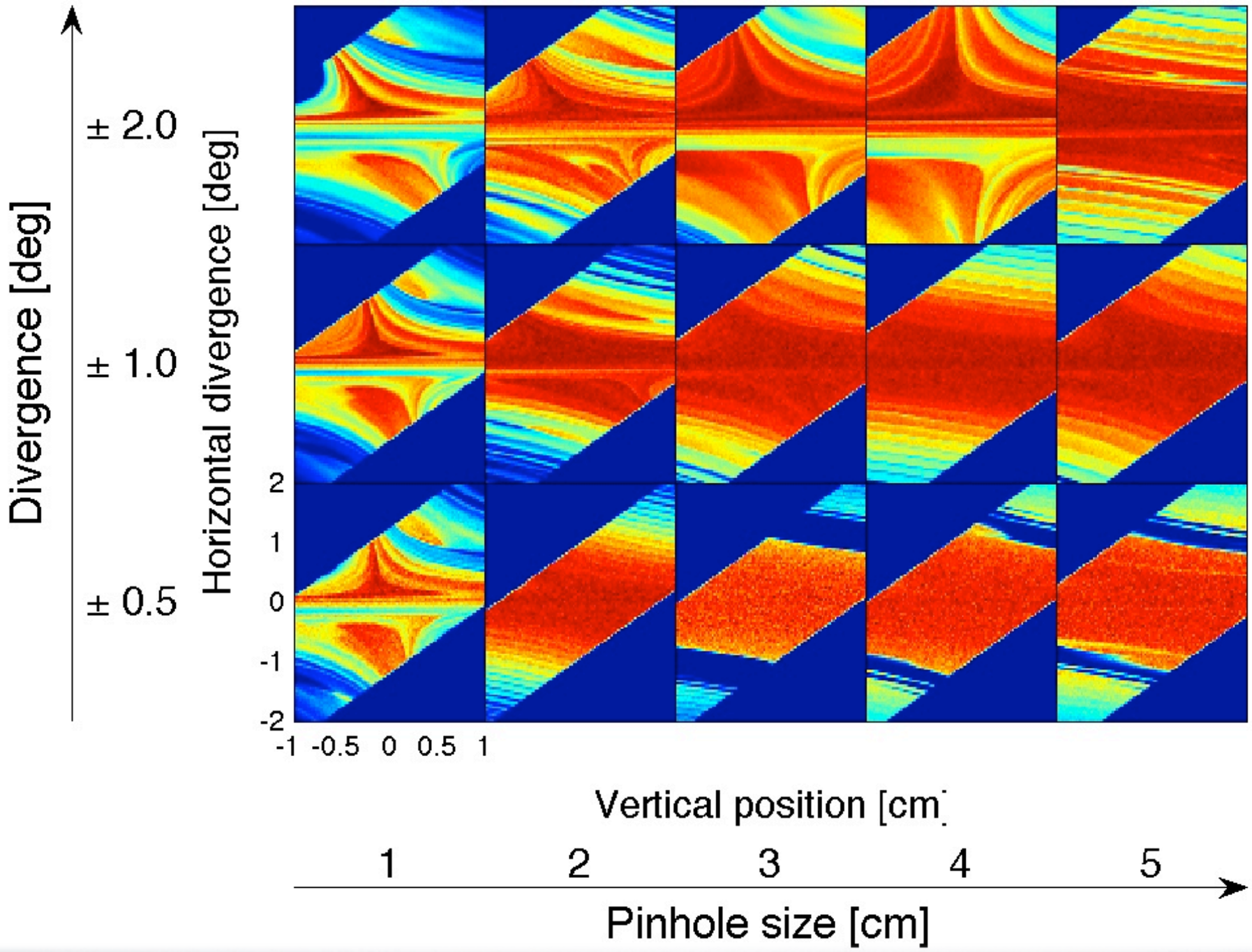
Vertical acceptance diagram for 150m

No feeder



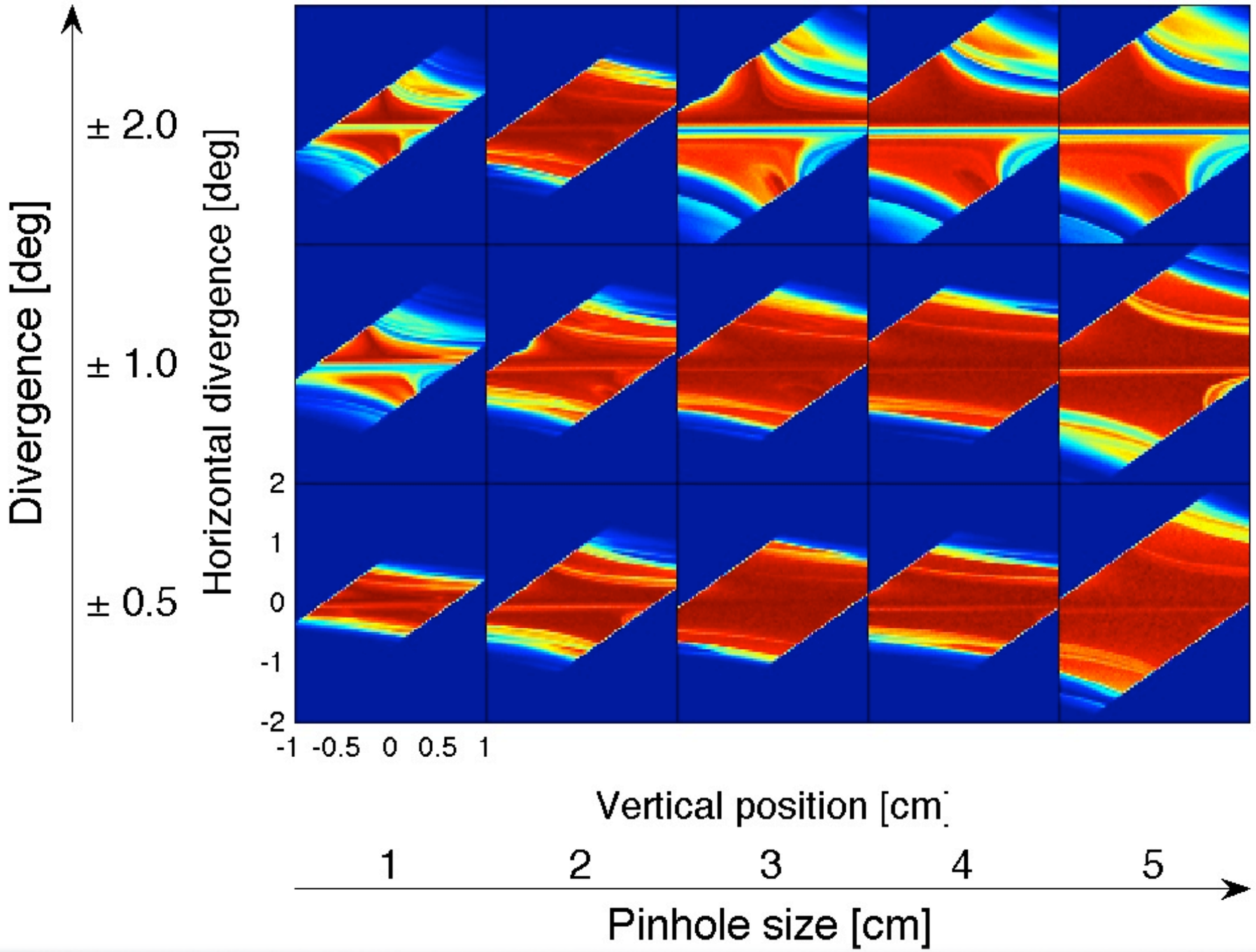
Vertical acceptance diagram for 150m

With feeder



Vertical acceptance diagram for 300m

No feeder



Vertical acceptance diagram for 300m

With feeder