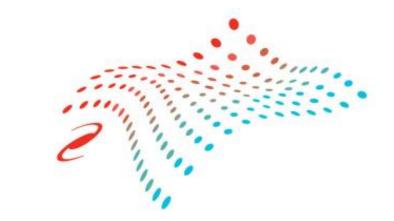


Ray-tracing Arcus in Phase A



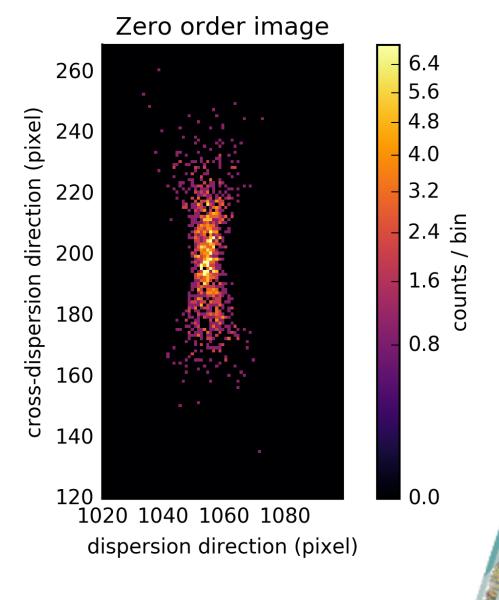


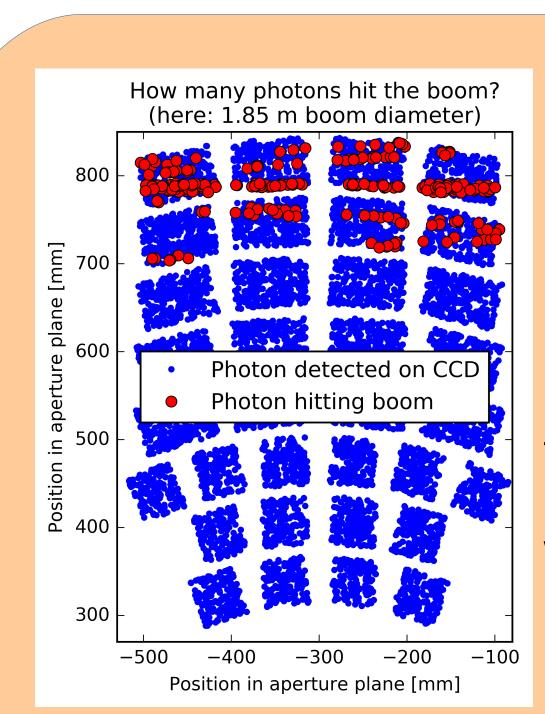
Hans Moritz Günther, Ralf K. Heilmann (Massachusetts Institute of Technology); Casey T. DeRoo, Edward N. Hertz, Randall K. Smith (Smithsonian Astrophysical Observatory); Jörn Wilms (Friedrich-Alexander-Univ. Erlangen-Nürnberg, Germany)

Arcus is a high-resolution X-ray grating spectrometer that was accepted for a Phase A study in 2017 in the NASA MidEx program. The optical design consists of four separate channels that are imaged on the same detector array. Many aspects of the optical layout were studied and improved using ray-tracing. We show some examples here.

See Paper 10699-77 (today 4:50 PM - 5:10 PM) for an overview of the Arcus mission.

Silicon pore-optics (SPO)
Each SPO has many stacked plates,
forming pores
Developed for ATHENA, SPOs allow
large area with low cost and weight

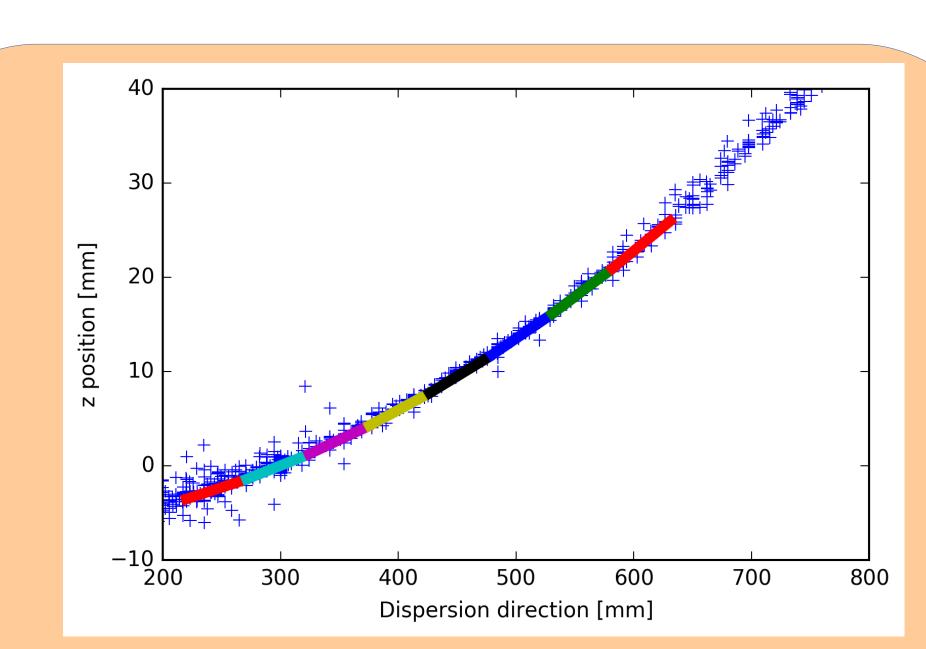




Boom parameters

How many photons hit the boom depending on the boom diameter? We investigated 3 or 4-sided booms of different sizes.

Optical bench folded at launch, deployed in orbit



Test focus position

Colored boxes: Position of CCDs

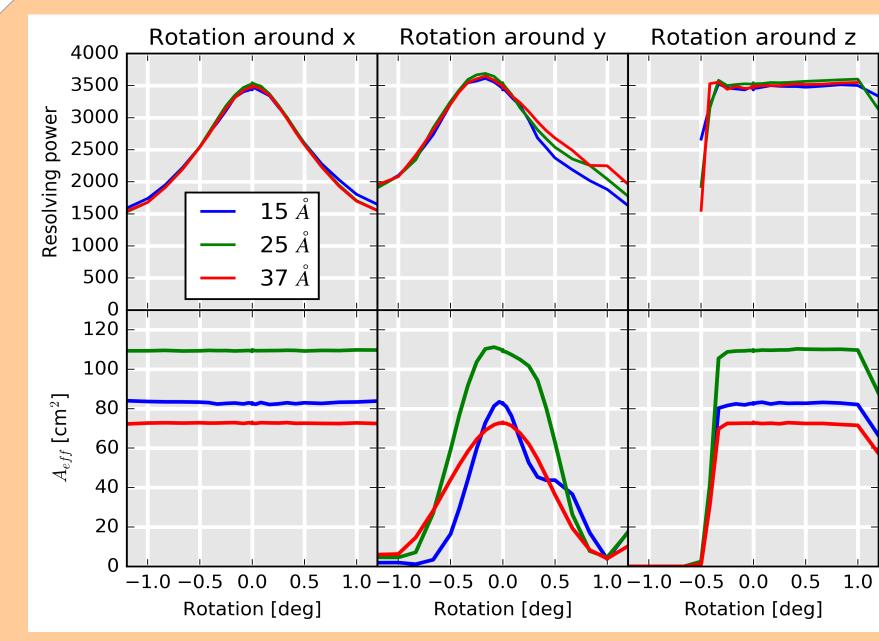
+: Position of best focus from ray-trace simulation. There is some scatter around the Rowland circle, because of simulated scatter in the mirror, but theory and ray-tracing agree to <0.2 mm.

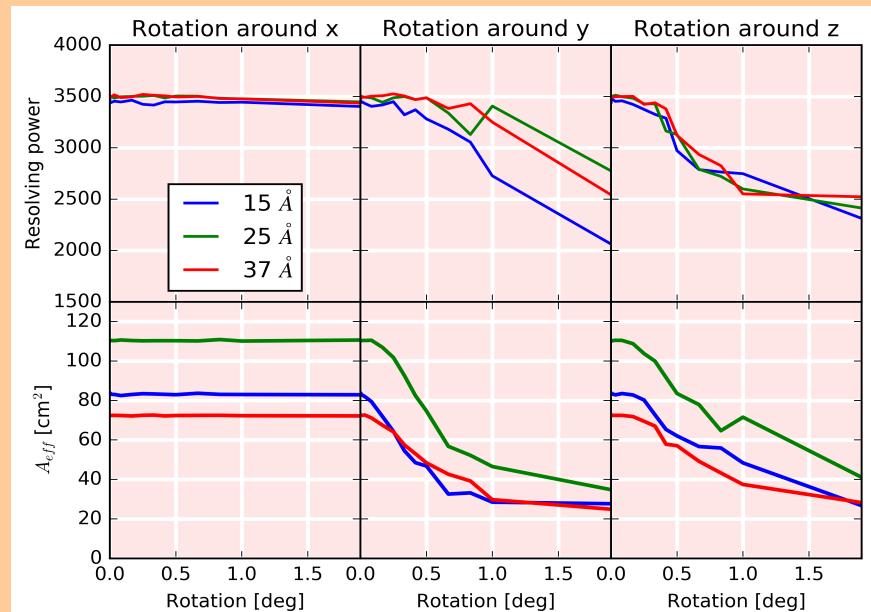
CCDs

2*8 CCDs arranged

on Rowland circle

CAT (critical angle transmission) gratings arranged under the SPOs mounted along Rowland torus with blaze angle 1.8 deg See: 10699-228 and 10699-26

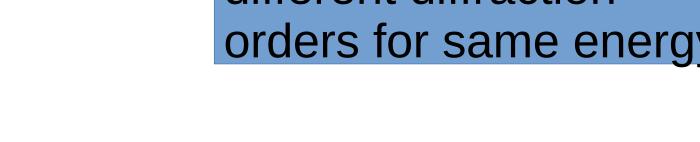


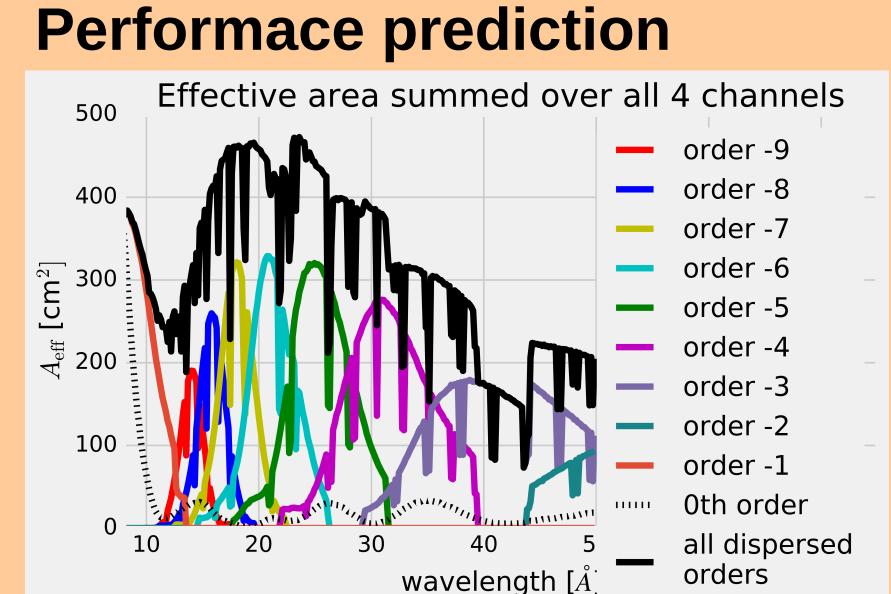


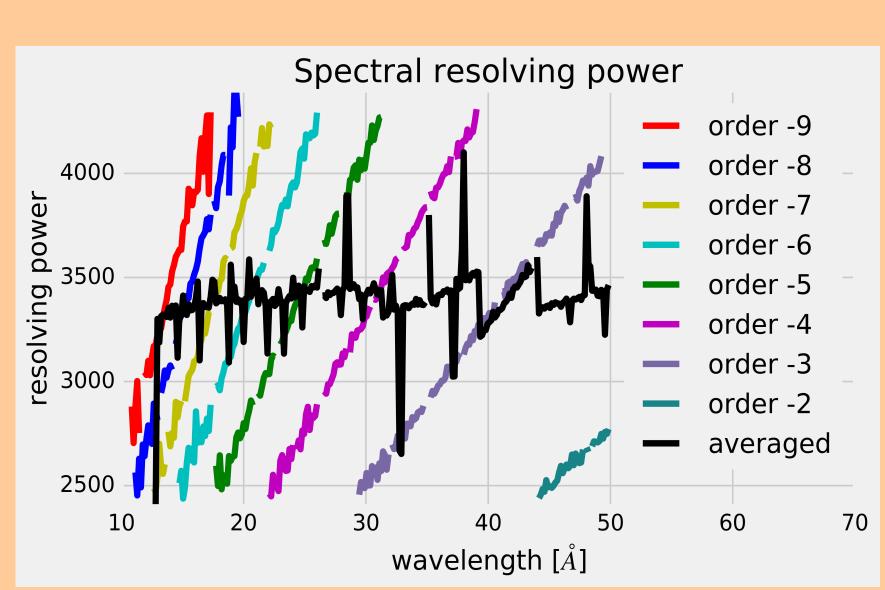
Alignment requirements

Ray-trace simulations show how much effective area or spectral resolving power is lost if components are misaligned with respect to each other by translation in x,y,z or rotation around their center of mass in any axis so that an error budget for the mission can be set. Top: Entire grating petal is misaligned with respect to SPOS (x: dispersion direction, y: cross-dispersion, z: optical axis). **Bottomt: Individual** gratings are misaligned within the grating petal.

Colors show different diffraction orders for same energy







Scan QR code for interactive model of Arcus.

