



ESAC 2017 JWST Workshop



MIRI Imaging Observations of SN1987A. Sarah Kendrew, Macarena Garcia Marin, Stacey Bright. Based on Margaret Meixner and Patrice Bouchet GTO program

ETC hands-on experience





•Background Goal: SN1987A is one of the most well studied SN. It consists of a bright ring, enclosing the dust ejecta from the SNa. One challenge is to detect the ejecta without saturating the ring.

•Ring diameter \sim 1.1 arcsec, with thickness \sim 0.2 arcsec

- •Total emitting area ~ 1.3 arcsec².
- •With a MIRI pixel scale of 0.11 arcsec/px -> \sim 107 pixels

•Ejecta occupy approx. 4 pixels, i.e. just-resolved.

Goal: Create an ETC workbook that estimates the exposure time needed to observe the SN1987A (ring and ejecta) with the MIRI Imager.









In the "Scene and Sources" tab you can create different sources and combine them to make an astronomical scene. Design three sources:

Source 1: Ejecta-alone: a point source centred at (0,0) with BB of 100K normalised to 0.1 mJy at 10 μ m

<u>Source 2</u>: The Spitzer integrated spectrum (5-30+ micron), representing combined ring + ejecta

- Use the provided mid-IR Spitzer spectra (sn1987a_spitzer_kendrew.txt format: first column wavelength in microns, second flux in mJy) to create a source using the following options:
- No renormalize
- Extended source with flat shape (i.e. assumed uniform). Semi-minor and semi-major axis 0.638".
- Source centred in the middle of the scene.



Source 3: The ring alone.

An extended flat-profile source, radius 0.638", with BB spectrum of 400K, normalised to 80 mJy at 10 μm



Design three different scenes:

- SN1987a, ejecta only (source 1)
- SN1987a, Spitzer (source 2)
- SN1987a, ring + ejecta (source 1+3)









<u>MIRI imaging, F560W</u>: dust ejecta is very faint at this wavelength but ring v bright. Use the SUB256 subarray to avoid saturation (ring itself is \sim 1.1 x 0.9" in size).

• Use scene 2 for this, the Spitzer spectrum

• Pick aperture of 0.06" radius for this one to show how you'd get SNR per pixel for a large extended target.

• For potentially complex extended scenes it's better to choose "noiseless background" for background subtraction strategy, which is not contaminated by anything else in the scene (~equivalent to obtaining an off-source background exposure)

• Exposures = 4, to simulate a 4-pt dither pattern.

MIRI imaging, F1000W: as above.

- Use scene 3, the combined ring+ejecta modelled as BB sources.
- Again choose 0.06" aperture radius to get per-pixel SNR,

place it off-centre to simulate what you'd expect from the ring only



• Use Scene 1, the ejecta only scene, which is v bright at these wavelengths

<u>Hints:</u> With MIRI favour long single integrations (that do not saturate) over short multiple integrations. The default readout mode for the MIRI imager is FAST.

