"DID YOU KNOW" DOCUMENT – ACCOMPANYING TEXT

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All integration times are on source, main array integration times assuming dual polarization unless otherwise noted. Times are calculated using the online ALMA Sensitivity Calculator tool. They do not include estimates of overhead.

Note to the ANASAC: Cycle 2 capabilities are still being finalized; references to Cycle 1 configurations and relative integration time estimates between multiple 12m configurations/7m array/total power will be updated before being released.

M83 in molecular gas. [image: CO(1-0) of M83 from Muraoka+ (2009a).]
Dec of M83 is -29:51:57.0, assumed distance is 4.5 Mpc.

– in excited CO (3-2):

CO(J=3-2): 345.8 GHz, in Band 7. Field of view is 18" (400 pc).

Muraoka+ (2009b) measure 30-150 K km/s in the CO(3-2) line over the central kpc, over a full width of ∼150 km/s. A sensitivity of 200 mK in the central 0.5 kpc will yield a 5 sigma detection of Tb=1K. Using 0.25" resolution (6 pc), 2 km/s linewidth, 34 antennas, and sensitivity of 0.2 K in the main array takes 1.8 hours. Note that this resolution requires (Cycle 1) configurations C32-5 or C32-6, so at least in Cycle 1, the ACA would not be offered.

– in dense, star forming HCN:

HCN(J=1-0): 88.6 GHz, in Band 3. Field of view is 71" (1.5 kpc).

Muraoka+ (2009a) detect bright HCN across the central 1.5 kpc of M83 (rms ∼ 4 K km/s) but are sensitivity limited. To get a 5 sigma detection of 4 K km/s intensity, assuming 10 km/s linewidth, 34 antennas, and 1.4" resolution (30 pc), or 80 mK sensitivity, requires half an hour in the main array. With this resolution, the configuration in Cycle 1 would be C32-3 with a max recovered scale of 17", so the ACA would be recommended for structures larger than 370 pc.

– a mosaic of dense, star forming HCN along the entire bar, including the ACA + TP:

HCN(J=1-0): 88.6 GHz, in Band 3. Field of view is 71" (1.5 kpc).

The optical bar is 3.1' by 1.4' (4.1 kpc by 1.8 kpc), requiring a 17-pointing mosaic. Assuming a 10 km/s linewidth, 1.4" resolution (30 pc), and 80 mK sensitivity, the (Cycle 1) C32-4 configuration can achieve the goal in 15.7 hours. With a 32/34 antenna exposure time estimate conversion of 1.13 (using the mosaic calculator in the current OT, which assumes 32 antennas, and the online tool, which can be set to assume 34 antennas), the estimated time for the full 17-pointing mosaic is 14 hours.

References:
Muraoka+ (2009a). PASJ, 61, 163
Muraoka+ (2009b). ApJ, 706, 1213

Redshifted ISM in galaxies. [image: VLA 1.4 GHz (red) and MIPS 24 μm (blue) image of SMG overlaid with ALMA 870 μm contours (Hodge+ 2013).]

– dust emission (thermal continuum) from a normal galaxy at z=3:

Continuum, 350 GHz, Band 7. Field of view is 18" (2.3 Mpc, assuming D_L=25.8 Gpc).

Assuming a flux density detectability curve extrapolated between those shown in Figures 4 and 8 of Blain+ (2002) at $\sim$350 GHz, a dusty, 10^{11} $L_\odot$ galaxy with T$\sim$40K at z=3 has a brightness of 60 μJy. For a 3 sigma detection (rms = 20 μJy), with 8 GHz bandwidth and 34 antennas, a source at Dec = -20 degrees can be detected with this sensitivity in 1.7 hours. Assuming a beam size of 2.0" (250 kpc) ensures that the source remains unresolved; using this beam size, the sensitivity corresponds to 50 μK. The ACA is not required.

– lensed [CII] emission from a normal galaxy at z=4.2:

[CII]: 1900.5369 GHz / [1+z] = 365.49 GHz, in Band 7. Field of view is 17" (3.2 Mpc, assuming D_L=38.7 Gpc).

Assuming a [CII] flux from a normal, Milky Way-type galaxy of 1x10^8 K km/s pc2 (Fixsen+ 1999, Baker 2009) at z=4.2, the expected flux is 38.6 mJy km/s. Assuming a 300 km/s linewidth and magnification of 10 (average value seen by Hezaveh+ 2013), a 5 sigma detection of 1.3 mJy (in one 300 km/s velocity channel) requires 0.26 mJy rms. For a source at Dec = -20, with a 1.5" beam (280 kpc), 365.0 MHz bandwidth, and 34 antennas, this can be achieved in 27 minutes on source. The ACA is not required.

– dust emission (thermal continuum) from a LIRG at z=10:

Continuum, 353 GHz, Band 7. Field of view is 18" (9.3 Mpc, assuming D_L=106 Gpc).

Assuming a flux density detectability curve extrapolated from the one shown in Figure 4 of Blain+ (2002) for a 5 x 10^{12} $L_\odot$ galaxy at 850 μm, a 10^{12} $L_\odot$ luminous IR galaxy (LIRG) with T=38K at z=10 – assuming these exist at z=10 – should be five times fainter than 1.5 mJy, or 0.3 mJy. For a 5 sigma detection (rms = 60 μJy), with 8 GHz bandwidth and 34 antennas, a source at Dec = -20 degrees can be detected with this sensitivity in 12 minutes. Assuming a beam size of 1.0" (500 kpc), the sensitivity corresponds to 0.6 mK. The ACA is not required.

References:

Baker (2009). ALMA detectability memo.
Blain+ (2002). PhR, 369, 111
Hezaveh+ (2013). ApJ, 767, 132
Hodge+ (2013). ApJ, 768, 91

Solar System objects. [image: CO(2-1) of comet Hale-Bopp from IRAM. (From ESO/ALMA document.)]

– measure global wind patterns in middle atmosphere of Mars:

CO(J=3-2): 345.8 GHz, in Band 7. Field of view is 18" (1.2 $\times 10^4$ km).

The angular diameter of Mars ranges from 3.5" (farthest from Earth, 2.67 AU) to 14" (closest to Earth, 0.67 AU); assuming 10" diameter (where 300 km=0.44") and Dec=0. Lellouch et al. (1991) measure an absorption feature of depth -40.5K in the CO(3-2) line over the entire disk. Assuming 0.5" resolution, 100 m/s channels, and 34 antennas, a 100 sigma detection of 0.4K sensitivity can be achieved in less than 30 minutes. Varying the declination between -20 degrees and 20 degrees (for instance) makes a difference of only a few minutes. With this resolution, the configuration in Cycle 1 would be C32-3 with a max recovered scale of 5.0", so the ACA would be recommended for structures larger than 3400 km (half the diameter of Mars).

– trace the water content in the atmosphere of Venus:

HDO(J=4-3): 335.395 GHz, in Band 7. Field of view is 18" (2.2 $\times 10^4$ km).

The angular diameter of Venus when it is most illuminated, but farthest from Earth, is 9.6" at 1.72 AU; assuming a 10" diameter, a 1.5" beam corresponds to 1800 km. Assuming Dec=0. From recent ALMA observations of Venus (Encrenaz+ in prep.), the absorption line reaches -0.1 Jy/beam (with a 1.65" beam), or 0.40 K. With 1.5" resolution, 34 antennas, and 500 m/s channels, a 10 sigma detection (rms = 40 mK) can be obtained in less than 10 minutes. Varying the declination between -20 degrees and 20 degrees (for instance) makes a difference of only a couple of minutes. With this resolution, the configuration in Cycle 1 would be C32-1 with a max recovered scale of 7.1", so the ACA would be recommended for structures larger than 8500 km (70% of the diameter of Venus).

– detect molecular species on active comets at aphelion:

Several lines (230-271 GHz) in Band 6. Field of view is 71" (3.6 $\times 10^4$ km).

Following the work of de Val-Borro et al. (2013), several volatiles – HCN, CH_3OH, H_2CO, CS, and HNC – from the comet C/2002 T7 (LINEAR) are detected with the SMT. The best sensitivity reached during the observations is $\sim$15 mK in a $\sim$30" beam. The comet has a water production rate of 3 $\times 10^{29}$ molecules/second and was observed at geocentric distances of 0.70-0.73 AU (heliocentric distances of 0.42-0.52 AU). In Cycle 2, ALMA can achieve five different tunings in one scheduling block to capture each line; assuming a declination of -20 degrees, observing frequency of 260 GHz, 34 antennas, and 3.0" beam (1500 km at 0.7 AU, ensuring that the source is unresolved), a sensitivity of 15 mK in a 0.3 km/s channel can be reached in 10 minutes per tuning, or 50 minutes on source for all five lines.

– directly measure Kuiper Belt Object sizes from their thermal emission:

Continuum, 345 GHz, Band 7. Field of view is 18" (5.1 $\times 10^5$ km).

Assuming a standard thermal model for KBOs (Stansberry et al. 2008) with a beaming parameter of 1.2 and an albedo of 0.08, the expected disk-averaged brightness temperature is 49 K for a body with a diameter of 200 km that is 40 AU from the sun. At its closest position to Earth (d=39 AU), the object has an apparent size of 0.0071", which yields a flux of $\sim$0.14 mJy at 345 GHz. This emission will be unresolved with the smallest possible ALMA beam. Assuming 34 antennas, 8 GHz bandwidth (per polarization), a 5 sigma detection of 28 μJy/beam (in a 0.2" beam, 5700 km at 39 AU, corresponds to 7.2 mK) is possible in 1 hour of observing time. Here we assume the declination is -20 degrees, but varying the declination between -20 degrees and 20 degrees (for instance) makes a difference of only a few minutes. The ACA is not required.

References:

"Science with ALMA". ESO Science Case for ALMA document.

de Val-Borro+ (2013). arXiv:1308.6282
Encrenaz+ (in prep), private communication
Lellouch+ (1991). P&SS, 39, 209
Stansberry+ (2008). "The Solar System Beyond Neptune", Barucci, Boehnhardt, Cruikshank, & Morbidelli (eds.), University of Arizona Press (Tucson), p.161-179

Galactic clouds and star forming regions. [image: CO map of Orion taken with the JCMT (HARP/ACSIS) in 2007.]

– polarization of (optically) dark star forming clouds:

Continuum, 341.5 GHz, Band 7. Field of view is 18" (0.013 pc), restricted to the central third (6", 0.004 pc) for on-axis polarization observations in Cycle 2.

Following the study of the polarized dust continuum of the binary protostar IRAS 16293 performed by Rao+ (2009) with the SMA, two components are detected with flux densities of 6.85 and 4.62 Jy and with 0.5% and 1.0% polarization, respectively. The sensitivity reached in the study, which is sufficient to detect the polarized components at the ∼7 sigma level, is 4 mJy/beam in a 3.1" x 2.0" beam (∼7.2 mK). Assuming a distance of 150 pc, a beam of 0.5" corresponds to a resolution of 75 AU, and reaching a sensitivity of 7 mK with a beam of 0.5" [or $4 * (0.5/2.4)^2 = 0.17$ mJy/beam] with a declination of -24.5 degrees, 34 antennas, 8 GHz bandwidth, and single polarization is achievable in less than 4 minutes. Observing thirty protostars to a similar depth in the same star forming region would take 2 hours of on source integration time, which when added to the extra time required for polarization calibration, yields a sufficiently wide range in parallactic angle to correct for instrumental polarization. Note that polarization observations in Cycle 2 require scheduling blocks at least 3 hours in length (though only two hours are on source). In Cycle 1, a resolution of 0.5" in Band 7 requires the C32-3 configuration, which yields a maximum angular scale of 5.0"; polarization capabilities will be offered only in the 12m array in Cycle 2.

– blind spectral line survey of Galactic molecular cloud (toward the hot core in Orion-KL from Band 6 SV data):

Continuum, 211-275 GHz, Band 6. Field of view is 27" (0.058 pc).

The declination of Orion is approximately -05:23:00. In early SV data (with 16 ALMA antennas), Randall & Remijan detected on average 20 lines above 5σ per 200 MHz of bandwidth of the hot core in a blind Band 6 spectral survey; in their observations, $\sigma = 50$ mJy/beam with a beam of 2.2" (∼280 mK), and the channels are 488 kHz wide (0.6 km/s at 230 GHz), oriented in five separate 1.875 GHz tunings within the 64 GHz band. A spectrum measured toward the hot core Orion-KL (∼5" in size) with the same parameters – 488 kHz (0.6 km/s) channels over a 1.875 GHz bandwidth, 2.0" resolution (880 AU, assuming d=440 pc), and now 34 antennas to three times deeper 100 mK rms sensitivity – can be achieved in 1 minute on source. Covering the entire 64 MHz band (recovering potentially 6000 lines) can be done with 39 tunings (taking into account 0.2 MHz of overlap between tunings), which requires 40 minutes on source. Note that this estimation does not take into account time necessary to calibrate, which is likely to be significant. With this resolution, the configuration in Cycle 1 would be C32-1 with a max recovered scale of 11", so the 7m array would be recommended for structures larger than 4800 AU.

References:

"Science with ALMA". ESO Science Case for ALMA document.
JCMT outreach website. http://outreach.jach.hawaii.edu/pressroom/2007_harpacsis/
Randall & Remijan (2012). Orion B6 spectral scan report (CSV-1507)
Rao+ (2009). ApJ, 707, 921

Formation of galaxy clusters and cosmic structure. [image: Simulated galaxy cluster at z=0.2 at 350 GHz with lensed background galaxies and SZ emission (from ESO/ALMA document).]

– image the Sunyaev-Zel'dovich Effect with high resolution in clusters at high redshift:

Continuum, 90 GHz, Band 3. Field of view is 69".

The most sensitive SZE images currently achieve noise levels as low as $\sim$40 μJy/beam with a 10" beam at 90 GHz (e.g. Mroczkowski et al. 2012, Korngut et al. 2011), which is sufficient to identify and characterize merger shocks in the central regions of merging galaxy clusters. Assuming a declination of -20 degrees, bandwidth of 8 GHz, and 34 antennas in the main array, a 4 sigma detection of 40 μJy/beam * $(5/10)^2 = 10$ μJy/beam in a 5" beam (60 μK) requires 1.5 hours on source.

– measure the bulk Sunyaev-Zel'dovich Effect from high-z clusters:

Continuum, 90 GHz, Band 3. Field of view is 117" (7m array only).

Measuring the more extended, bulk SZE in galaxy clusters requires sensitive coverage with a larger beam; the 7m array in ALMA Cycle 2 at 90 GHz has a beam size of $\sim$23". Assuming that the 7m array takes three times as long as the main array, and assuming (as above) a declination of -20 degrees, bandwidth of 8 GHz, and 9 antennas in the 7m array, 4.5 hours would be required (reaching an rms of 67 μJy/beam in a 23" beam, or 20 μK) to recover the extended emission. Note that the ACA is available in Cycle 2 only in concert with the main array, so these two SZE projects can be performed together.

– survey Lyman-alpha Blobs (LABs) at z=3.1:

Continuum, 353 GHz, Band 7. Field of view is 18" (2.3 Mpc, assuming D_L=26.9 Gpc).

Following the study of Geach et al. (2005), in which a sample of 23 LABs in a z=3.1 overdensity were observed with the JCMT, the average flux of the targets was 3.0 mJy at 850 μm. To achieve a 20σ detection of each LAB, an rms of 150 μJy is required. Assuming an 8 GHz bandwidth and 34 antennas at the declination of the overdensity (Dec = 0 degrees), the necessary integration time for one target is 2 minutes; all 23 sources can be observed to this sensitivity in less than an hour on source. Assuming a beam size of 1.0" (130 kpc) ensures that the source remains unresolved; using this beam size, the sensitivity corresponds to 1.5 mK. The ACA is not required.

References:

"Science with ALMA". ESO Science Case for ALMA document.
Geach+ (2005). MNRAS, 363, 1398
Korngut+ (2011). ApJ, 734, 10
Mroczkowski+ (2012). ApJ, 761, 47

Resolve planetary disks around young stars. [image: HCO+ in transition disk HD142527 (Casassus+ 2013), taken from visualization created by S. Perez.]

– snow line, where gas freezes out onto dust grains, in the disk of HD 163296:

H_2CO(J=3-2): 225.69778 GHz, in Band 6. Field of view is 28" (0.017 pc).

Using the ALMA simulation performed by Qi, Oberg, & Wilner (2013) of the H_2CO transition in the disk surrounding Herbig Ae star HD 163296, made with 1 hour of observing time and a beam size of 0.3", the snow line is easily resolved. Their SMA observations utilize 0.6 km/s channels. The declination is -21:57:21.9. To detect their faintest contour level, 25 mJy km/s, at 10 sigma in a 0.6 km/s channel requires an rms of 4.2 mJy in their assumed 0.3" beam (37 AU, assuming d=122 pc, or 1.12 K). Assuming 34 antennas, this sensitivity is achievable in 15 minutes. Note that this resolution requires (Cycle 1) configurations C32-5 or C32-6, so at least in Cycle 1, the ACA would not be offered.

– HCO+ flows across disk gaps:

HCO+(J=4-3): 356.73424, in Band 7. Field of view is 17" (0.012 pc).

The Cycle 0 ALMA observations of Casassus+ (2013) of the HCO+(4-3) imaging of the disk around the young star HD 142527 detect (and resolve) dense gas flowing across the gap in the disk. The observations utilized 0.1 km/s channels and reached a sensitivity of 15 mJy in a beam of 0.51"x0.33" (∼0.8 K) in 52 minutes on source. In Cycle 2, these observations (repeated for the same target) can be achieved assuming a declination of -42:19:23.3, 0.1 km/s channels, 34 antennas, a 0.42" beam (59 AU, assuming d=140 pc), and rms of 0.8 K (14.7 mJy) in 15 minutes. With this resolution, the configuration in Cycle 1 would be C32-3 with a max recovered scale of 5.0", so the ACA would be recommended for structures larger than 700 AU.

– Jupiter mass planet gap in disk at 50 pc:

Continuum, 353 GHz, Band 7. Field of view is 18" (0.010 pc).

Following the ALMA simulations of Gonzalez+ (2012), a gap induced by a 1 Jupiter mass planet in a dust disk 40 AU from its parent star is detectable at 850 μm with a beam size 0.15" or better at a distance of 140 pc. From their Figure 12, the gap in a disk around a star in Ophiuchus (d=120 pc, Dec=-24 degrees) can be well resolved in an hour with 0.12" resolution (15 AU, achievable provided the longest baseline in Cycle 2 is 1.5 km). Assuming 8 GHz bandwidth, 34 antennas, and the other parameters specified above, the sensitivity reaches 19 μJy in 2 hours of integration time, consistent with the sensitivity shown to be necessary in Figure 12 of Gonzalez+ (2012). Note that this resolution is even higher than those offered in (Cycle 1) configurations C32-5 or C32-6, for which (at least in Cycle 1) the ACA was not offered.

– planetary presence from astrometric motion of dust clumps around epsilon Eri:

Continuum, 353 GHz, Band 7. Field of view is 18" (58 AU).

Following the model of Moran, Kuchner, & Holman (2004) of the debris disk around epsilon Eri (Dec = -09:27:29.7), which hosts dense dust clumps being dynamically affected by a massive planet, the dust distribution (in addition to the clumps) can be well resolved by ALMA in Cycle 2. At the distance of epsilon Eri (3.22 pc), 1 AU = 0.31". From the Moran model, a sensitivity of 0.7 mJy/beam (with a 1.85" beam) is required to recover the faintest emission at the edge of the disk, which corresponds to 19.7 μJy with a 0.31" beam, or 6.6 μJy rms for a 3 sigma detection. This sensitivity can be achieved with 34 antennas and 8 GHz bandwidth in 17 hours on source. The dense clumps within the disk (brighter than ∼48 μJy/beam) can be observed to 16 μJy sensitivity in much less time (∼3 hours). Note that this resolution requires (Cycle 1) configurations C32-5 or C32-6, so at least in Cycle 1, the ACA would not be offered.

References:

Casassus+ (2013). Nature, 493, 191

Gonzalez+ (2012). A&A, 547, A58
Moran, Kuchner, & Holman (2004). ApJ, 612, 1163
Qi, Oberg, & Wilner (2013). ApJ, 765, 34

Measure stellar activity. [image: CO(2-1) contours (Cox+ 2000) over 2.15 μm continuum image (Sahai+ 1998) of the Egg Nebula.]

– molecular outflow in a pre-planetary nebula:

CO(J=2-1): 230.3581, in Band 6. Field of view is 27" (0.20 pc).

Following the Cycle 0 ALMA observations of Sahai+ (2013) of the Boomerang Nebula (Dec=-54:31:11.4) as an example, outflowing CO(2-1) can be imaged with 0.63 km/s resolution and a 2.4" x 1.6" beam to a sensitivity of 7.5 mJy/beam (∼43 mK in a 2.0" beam, or 3000 AU assuming d=1.5 kpc) in Cycle 0. In Cycle 2, assuming 34 antennas, this sensitivity and velocity resolution can be reached in 5 minutes on source. With this resolution, the configuration in Cycle 1 would be C32-1 with a max recovered scale of 11", so the ACA would be recommended for structures larger than 0.08 pc.

– measure heating mechanisms of red giant stars:

Continuum, 250 GHz, Band 6. Field of view is 25".

Following the model of Harper+ (2013), the expected millimeter fluxes of nearby giant stars range from 6-80 mJy at 250 GHz. The stars considered in their study will be unresolved even with the smallest Cycle 2 beam, but assuming 0.2" resolution, even the faintest of these stars will be detectable with a S/N of 50 (rms = 0.12 mJy/beam, or 55 mK) in 2 minutes of integration time (assuming 34 antennas, 8 GHz bandwidth, and a declination of -20 degrees). The ACA is not required.

– GRB afterglow emission:

Continuum, 100 GHz, Band 3. Field of view is 63" (7.9, 32 Mpc, assuming D_L=25.8, 106 Gpc).

Following the GRB afterglow model plotted in Figure 6 of de Ugarte Postigo+ (2012), 1-2 days after a typical burst, a z=3 (z=10) afterglow peaks around 0.3 (0.08) mJy in Band 3. For a 10 sigma detection of each afterglow, assuming an observation at Dec = -20 degrees, 8 GHz bandwidth, and 34 antennas, we require an rms of 0.03 mJy/beam (in a 1.0" beam – 125 kpc at z=3 – yields 3.7 mK) and 0.008 mJy/beam (in a 1.0" beam – 500 kpc at z=10 – yields 1.0 mK). These are achievable in 11 minutes and 2.6 hours, respectively. The ACA is not required.

References:
Cox+ (2000). A&A, 353, L25
de Ugarte Postigo+ (2012). A&A, 538, 44
Harper+ (2013). MNRAS, 428, 2064
Sahai+ (1998). ApJ, 492, L163
Sahai+ (2013). arXiv:1308.4360

Accretion onto black holes. [image: CO(2-1) AGN extended torus model of NGC 1068 at ALMA resolution (Wada & Tomisaka 2005).]

– black hole mass measurement from CO (2-1) kinematics:

CO(J=2-1): 230.3581, in Band 6. Field of view is 27" (2.1 kpc).

Following Davis+ (2013), the mass of the central black hole in NGC 4526 (d=16.4 Mpc) can be modeled using high-resolution observations of molecular gas [CO(2-1)] obtained with multiple configurations of CARMA. This work achieves a resolution of 0.25" (20 pc) and rms of 2.9 mJy/beam ($\sim$ 1 K) in 10 km/s channels. In ALMA Cycle 2, the galaxy can be observed with 0.17" (13.5 pc) resolution (assuming that the longest baseline offered is 1.5 km) and 2 km/s channels, and the same sensitivity (1 K, or 1.3 mJy/beam) can be reached in an hour on source. Note that this resolution is even higher than those offered in (Cycle 1) configurations C32-5 or C32-6, for which (at least in Cycle 1) the ACA was not offered; emission on scales larger than a few arcseconds ($\sim$250 pc) would be resolved out. However, the sphere of influence of the black hole in this system is 20 pc (Davis+ 2013), so extended emission is not relevant in this case.

– gas properties in the host galaxy of obscured quasar AMS12 (z=2.7672):

CO(J=3-2), CO(J=7-6): 91.796 GHz (in Band 3), 214.148 GHz (in Band 6). Fields of view are 69", 29" (7.8, 3.3 Mpc, assuming D_L=23.4 Gpc).

Here we replicate with ALMA the study by Schumacher+ (2012), which utilizes observations of the CO ladder with the PdBI to derive the kinetic temperature and density of the gas in the host galaxy of obscured quasar AMS12. In Cycle 2, the redshifted CO(3-2) and CO(7-6) lines fall into available bands (3 and 6, respectively). The quoted sensitivities to reach are 0.7 mJy/beam (Band 3) and 2.0 mJy/beam (Band 6), each in 30 km/s channels; the source is unresolved in the Schumacher+ observations. We flip the +59 degree declination of the source to be -59 degrees and assume 30 km/s channels, 34 antennas, and a 1.0" beam (110 kpc, assumed to keep the source unresolved); the necessary integration time in Band 3 is 18 minutes and in Band 6 is 1.5 minutes, for a total of 20 minutes on source. The ACA is not required.

– study the sub-mm emission from Sgr A* while it flares in the infrared:

Continuum, 345 GHz, Band 7. Field of view is 18".

Haubois+ (2012) present observations of 870 μm emission from the Galactic center with APEX, which they observe to decrease during infrared flares, with a sensitivity of 60 mJy/beam in a 19" beam. In a 2.0" beam (0.08 pc, assuming d=8.3 kpc), this corresponds to 60 mJy/beam * $(2.0/19.0)^2$ = 0.66 mJy/beam. Sgr A* has a declination of -29 degrees, and assuming 34 antennas and 8 GHz bandwidth, this sensitivity can be reached in much less than a minute. With this resolution, the configuration in Cycle 1 would be C32-1 with a max recovered scale of 7.1", so the 7m array would be recommended for structures larger than 0.29 pc.

References:

Davis+ (2013). Nature, 494, 328
Haubois+ (2012). A&A, 540, A41
Schumacher+ (2012). MNRAS, 423, 2132
Wada & Tomisaka (2005). ApJ, 619, 93