# Compare Different SAM2 Checkpoints

In [1]:

```
import os
from sam2.build_sam import build_sam2
from sam2.automatic_mask_generator import SAM2AutomaticMaskGenerator
from segmentation.helpers import show_anns, compute_circularity
import matplotlib.pyplot as plt
import torch
from sam2.build_sam import build_sam2
from sam2.automatic_mask_generator import SAM2AutomaticMaskGenerator
import os
from PIL import Image
import numpy as np
```

In [2]:

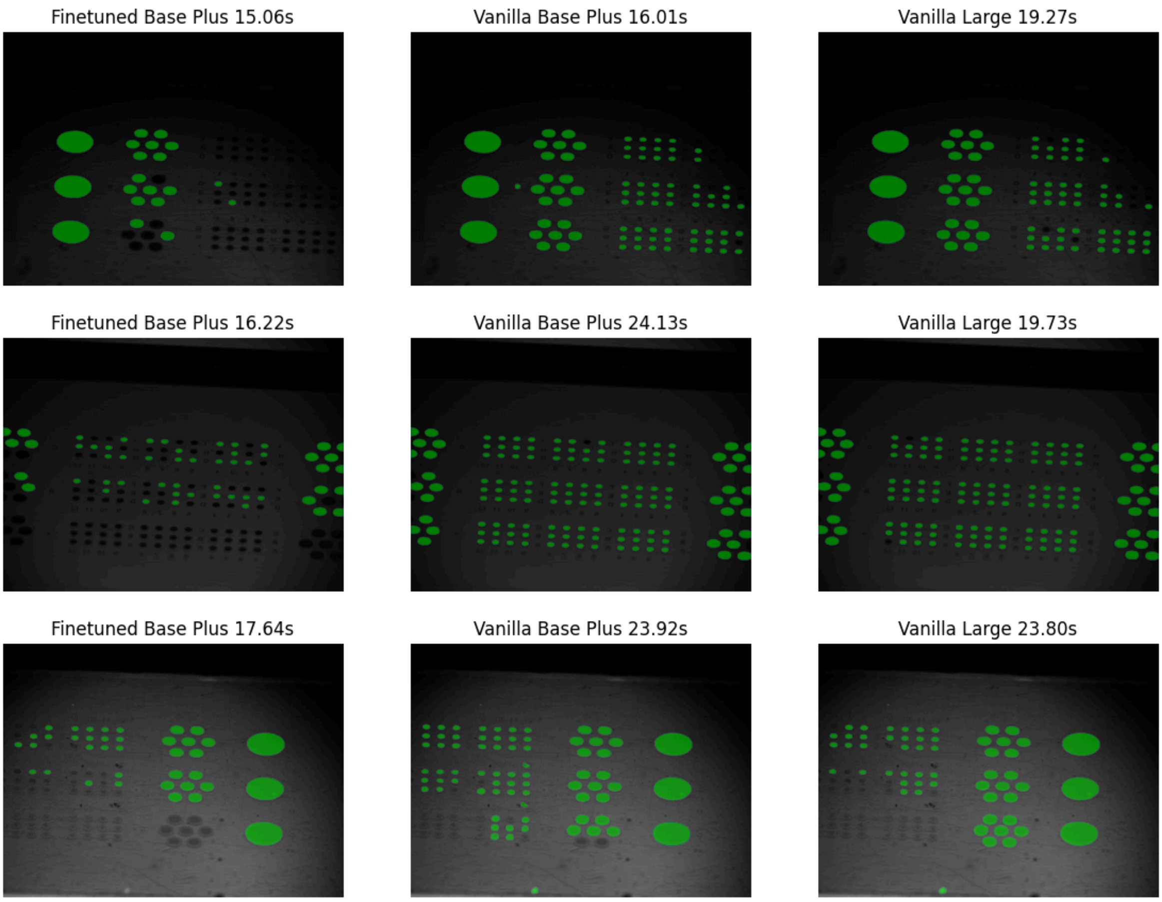
```
# use bfloat16 for the entire notebook
# from Meta notebook
torch.autocast("cuda", dtype=torch.bfloat16).__enter__()
if torch.cuda.get_device_properties(0).major >= 8:
    torch.backends.cuda.matmul.allow_tf32 = True
    torch.backends.cudnn.allow_tf32 = True

checkpoint = "C:/Users/Micha/Desktop/BachelorProject/AI-Powered-Biosensing/model
model_cfg = "C:/Users/Micha/Desktop/BachelorProject/AI-Powered-Biosensing/sam2/s
sam2 = build_sam2(model_cfg, checkpoint, device="cuda")
finetuned_generator = SAM2AutomaticMaskGenerator(
    sam2,
    points_per_side=64
)
checkpoint_base = "C:/Users/Micha/Desktop/BachelorProject/AI-Powered-Biosensing/
sam2_base = build_sam2(model_cfg, checkpoint_base, device="cuda")
generator = SAM2AutomaticMaskGenerator(
    sam2_base,
    points_per_side=64
)

checkpoint_large = "C:/Users/Micha/Desktop/BachelorProject/AI-Powered-Biosensing
model_cfg_large = "C:/Users/Micha/Desktop/BachelorProject/AI-Powered-Biosensing/
sam2_large = build_sam2(model_cfg_large, checkpoint_large, device="cuda")
generator_large = SAM2AutomaticMaskGenerator(
    sam2_large,
    points_per_side=64
)
```

In [4]:

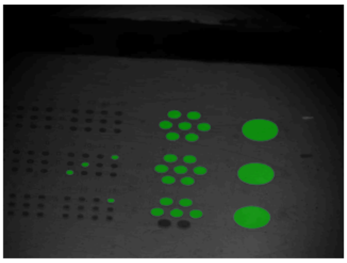
```
import cv2
import matplotlib.pyplot as plt
from PIL import Image
import time

# Mask visualization for AMG masks
def show_anns(anns, ax=None):
    if len(anns) == 0:
        return
    sorted_anns = sorted(anns, key=(lambda x: x['area']), reverse=True)
    if ax is None:
```

```
        ax = plt.gca()
    ax.set_autoscale_on(False)

    img = np.ones((sorted_anns[0]['segmentation'].shape[0], sorted_anns[0]['segm
    img[:, :, 3] = 0
    for ann in sorted_anns:
        m = ann['segmentation']
        color_mask = np.array([0.0, 1.0, 0.0, 0.5])
        img[m] = color_mask
        contours, _ = cv2.findContours(m.astype(np.uint8), cv2.RETR_EXTERNAL, cv
        # Try to smooth contours
        contours = [cv2.approxPolyDP(contour, epsilon=0.01, closed=True) for con
        cv2.drawContours(img, contours, -1, (0, 0, 1, 0.4), thickness=1)

    ax.imshow(img)

# Function to calculate circularity of a contour
def compute_circularity(mask):
    mask_uint8 = mask.astype(np.uint8)
    contours, _ = cv2.findContours(mask_uint8, cv2.RETR_EXTERNAL, cv2.CHAIN_APPR
    if not contours:
        return 0  # No valid contour found

    contour = max(contours, key=cv2.contourArea)  # Get the largest contour
    area = cv2.contourArea(contour)
    perimeter = cv2.arcLength(contour, True)

    if perimeter == 0:  # Avoid division by zero
        return 0

    circularity = (4 * np.pi * area) / (perimeter ** 2)
    return circularity


folder_path = "C:/Users/Micha/Desktop/BachelorProject/AI-Powered-Biosensing/data
all_files = os.listdir(folder_path)

for name in all_files:
    if name.endswith(".jpg"):
        img = np.array(Image.open(os.path.join(folder_path, name)).convert("RGB"

        time_finetuned = time.time()
        finetuned_masks = finetuned_generator.generate(img)
        time_finetuned = time.time() - time_finetuned

        time_base = time.time()
        masks = generator.generate(img)
        time_base = time.time() - time_base

        time_large = time.time()
        masks_large = generator_large.generate(img)
        time_large = time.time() - time_large

        height, width = img.shape[:2]
        area = height * width

        masks = [mask for mask in masks if 0.00025 < mask['area'] / area < 0.03]
        masks = [mask for mask in masks if compute_circularity(mask['segmentatic
        finetuned_masks = [mask for mask in finetuned_masks if 0.00025 < mask['a
        finetuned_masks = [mask for mask in finetuned_masks if compute_circulari
```

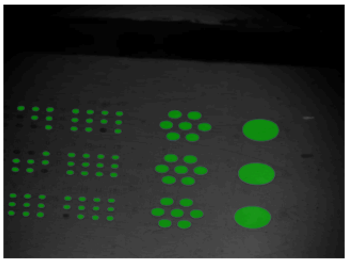
```
        masks_large = [mask for mask in masks_large if 0.00025 < mask['area'] /
        masks_large = [mask for mask in masks_large if compute_circularity(mask[

        fig, axes = plt.subplots(1, 3, figsize=(14, 7))

        # Display original image
        axes[0].imshow(img)
        show_anns(finetuned_masks, axes[0])
        axes[0].set_title(f'Finetuned Base Plus {time_finetuned:.2f}s')

        # Display image with all masks
        axes[1].imshow(img)
        show_anns(masks, axes[1])
        axes[1].set_title(f'Vanilla Base Plus {time_base:.2f}s')

        # Display image with all masks
        axes[2].imshow(img)
        show_anns(masks_large, axes[2])
        axes[2].set_title(f'Vanilla Large {time_large:.2f}s')

        axes[0].axis('off')
        axes[1].axis('off')
        axes[2].axis('off')

        plt.show()
```



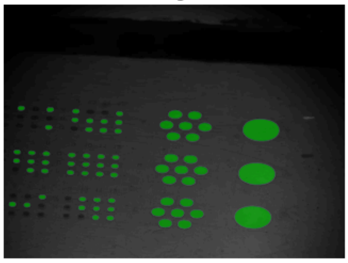
Finetuned Base Plus 14.15s



Vanilla Base Plus 14.34s

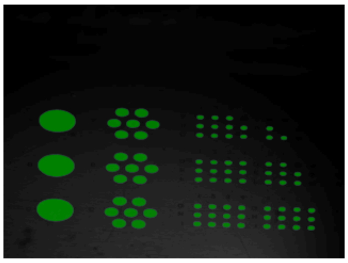


Vanilla Large 20.39s

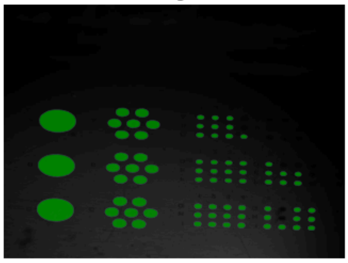


Finetuned Base Plus 14.11s

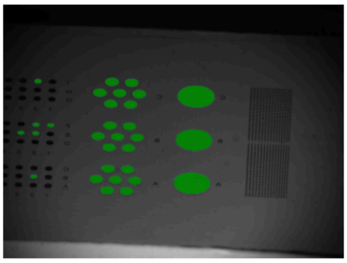
Vanilla Base Plus 14.72s



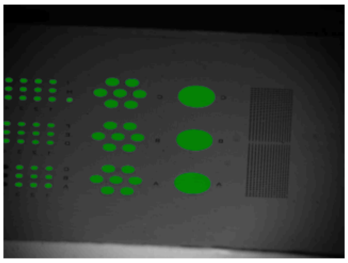
Vanilla Large 18.83s



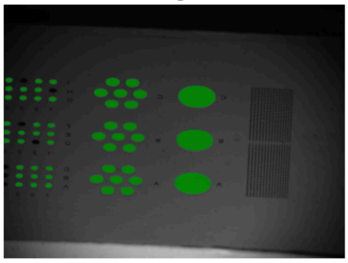
Finetuned Base Plus 17.87s



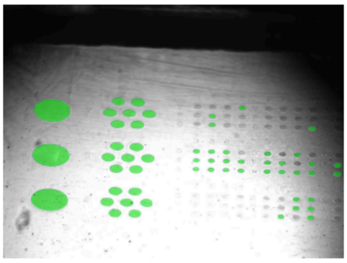
Vanilla Base Plus 35.69s



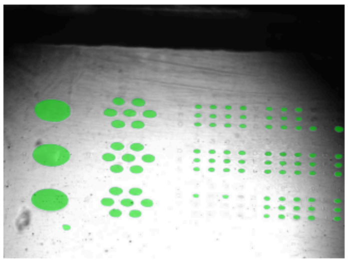
Vanilla Large 38.40s



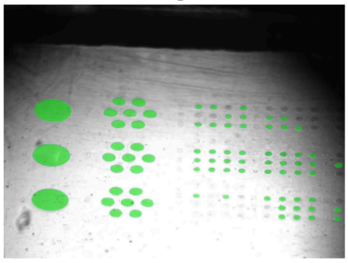
Finetuned Base Plus 14.98s



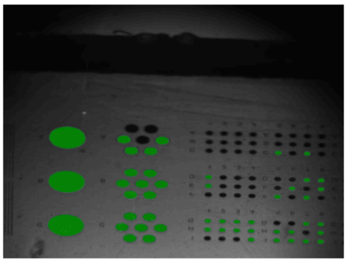
Vanilla Base Plus 20.12s



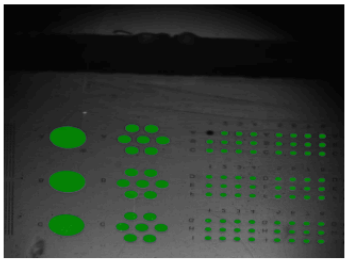
Vanilla Large 20.82s



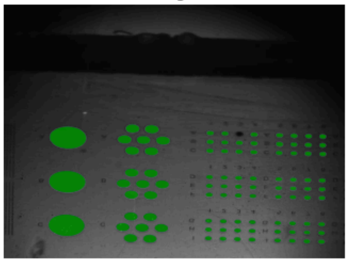
Finetuned Base Plus 14.35s



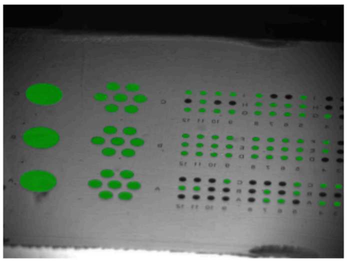
Vanilla Base Plus 17.94s



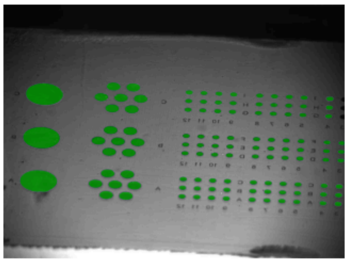
Vanilla Large 18.53s



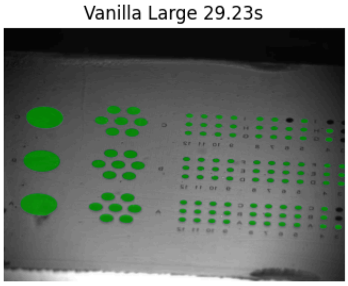
Finetuned Base Plus 16.12s



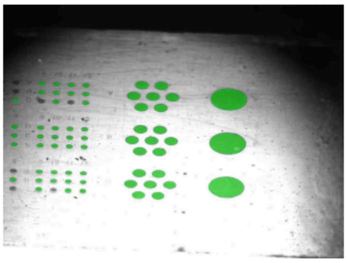
Vanilla Base Plus 22.06s



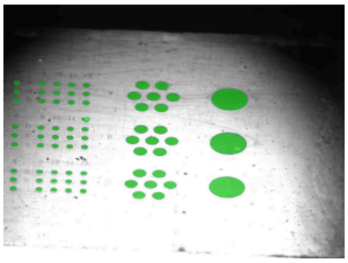
Vanilla Large 29.23s



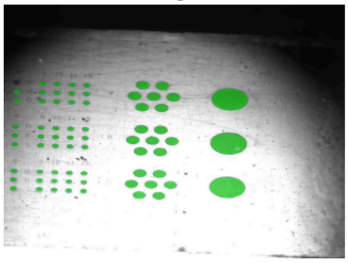
Finetuned Base Plus 14.29s



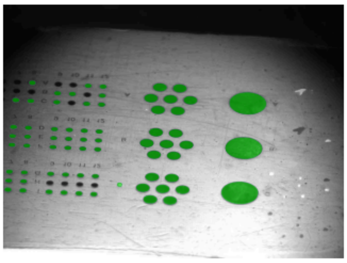
Vanilla Base Plus 18.18s



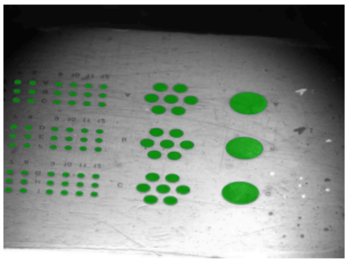
Vanilla Large 18.62s



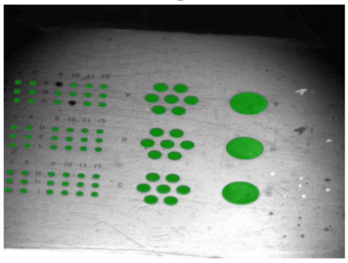
Finetuned Base Plus 16.58s



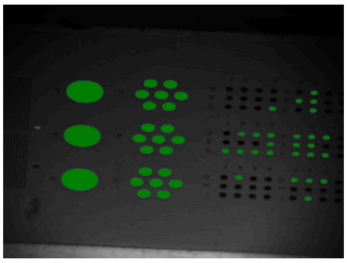
Vanilla Base Plus 20.55s



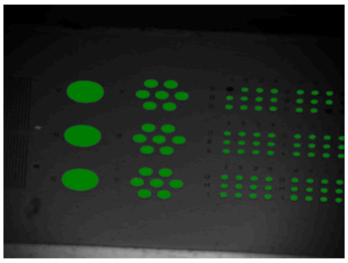
Vanilla Large 23.87s



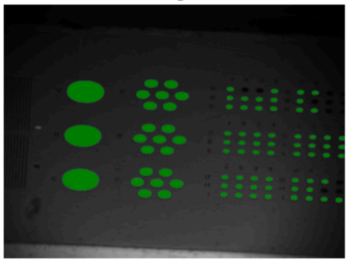
Finetuned Base Plus 18.17s



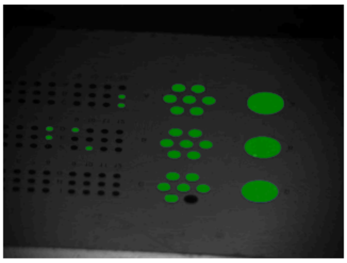
Vanilla Base Plus 33.41s



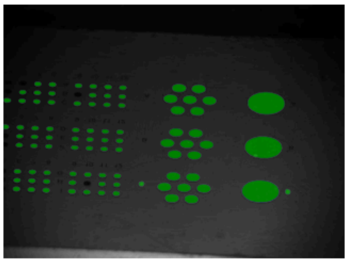
Vanilla Large 27.23s



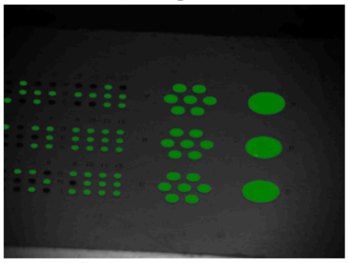
Finetuned Base Plus 19.82s



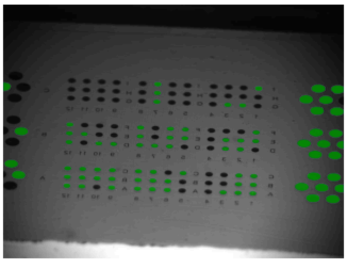
Vanilla Base Plus 30.59s



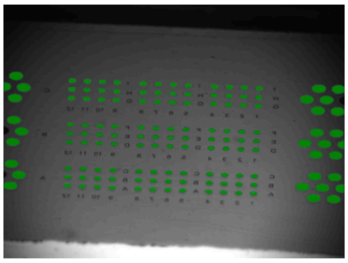
Vanilla Large 31.74s



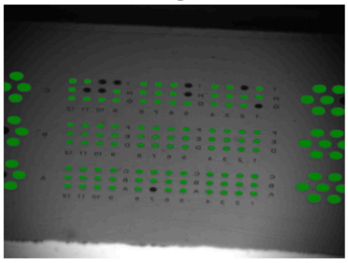
Finetuned Base Plus 19.64s



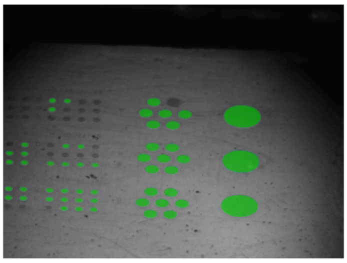
Vanilla Base Plus 31.13s



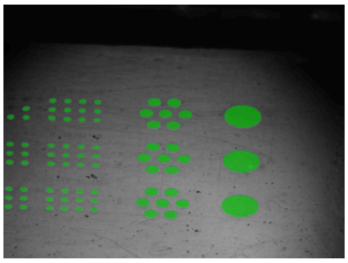
Vanilla Large 34.95s



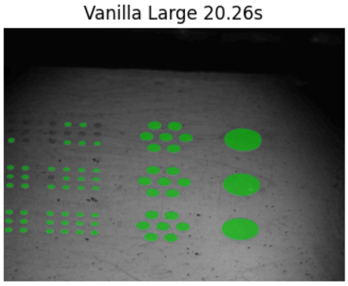
Finetuned Base Plus 15.96s

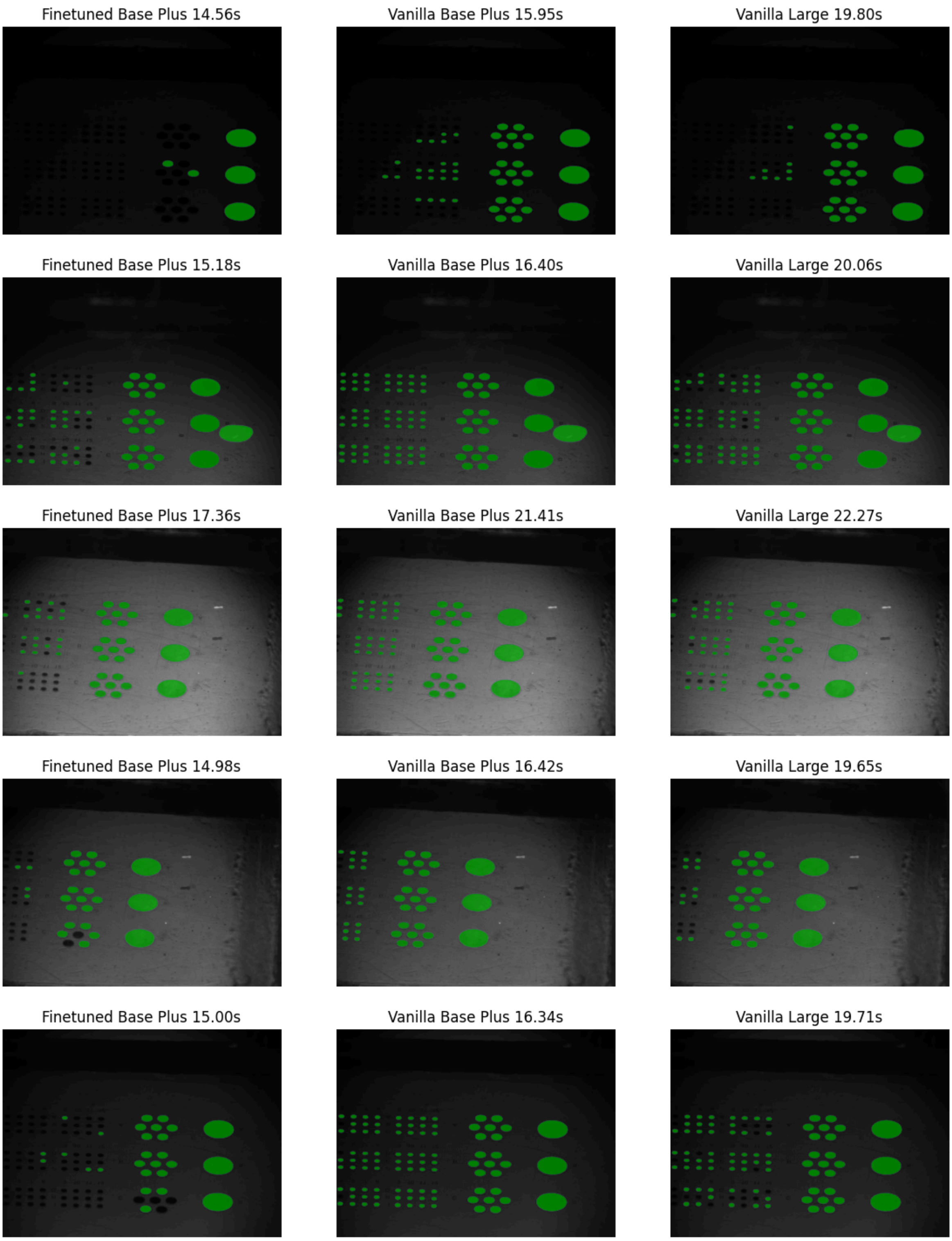


Vanilla Base Plus 20.44s



Vanilla Large 20.26s






In [6]:
```
from PIL import Image
from ipywidgets import interact, IntSlider
import numpy as np

def plot_image_with_points(image_path, n):
    # Load the image
    img = Image.open(image_path)
    img_array = np.array(img)

    # Get image dimensions
    height, width = img_array.shape[:2]

    # Compute point positions
    x = np.linspace(0, width - 1, n)
```

```
    y = np.linspace(0, height - 1, n)
    xx, yy = np.meshgrid(x, y)

    # Plot image and points
    plt.figure(figsize=(8, 8))
    plt.imshow(img_array)
    plt.scatter(xx, yy, color='red', s=5)  # adjust size/color as needed
    plt.axis('off')
    plt.title(f'{n}×{n} Points Overlay')
    plt.show()

image_path = "C:\\Users\\Micha\\Desktop\\BachelorProject\\AI-Powered-Biosensing\
interact(lambda n: plot_image_with_points(image_path, n),
         n=IntSlider(min=8, max=128, step=8, value=5, description='Grid Points p
```

```
interactive(children=(IntSlider(value=8, description='Grid Points per Side', max=
128, min=8, step=8), Output()…
```

```
Out[6]: <function __main__.<lambda>(n)>
```