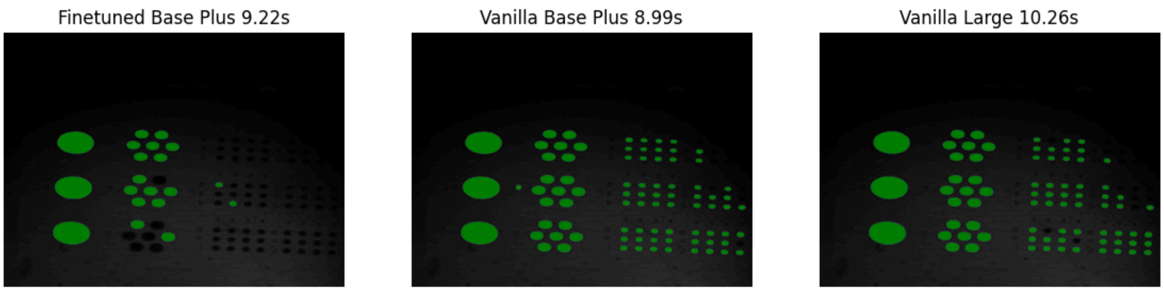
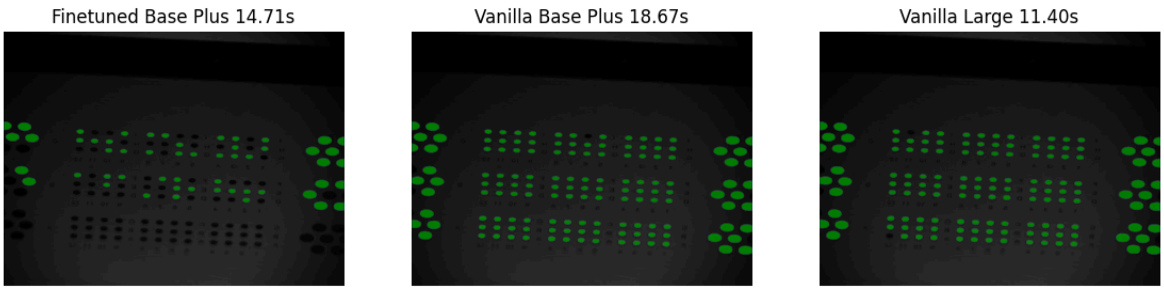
Compare Different SAM2 Checkpoints

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
```

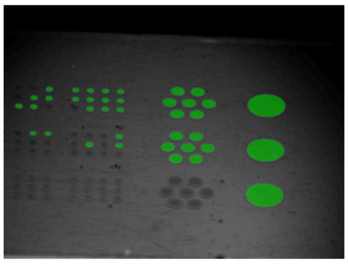
In [2]:
```
# use bfloat16 for the entire notebook
# from Meta notebook
torch.autocast("cuda", dtype=torch.bfloat16).__enter__()
if torch.cuda.get_device_properties(0).major >= 8:
    torch.backends.cuda.matmul.allow_tf32 = True
    torch.backends.cudnn.allow_tf32 = True

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 [3]:
```
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)

f_avg = []
b_avg = []
l_avg = []
count = 0

for name in all_files:
    if name.endswith(".jpg"):
        count += 1
        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
        f_avg.append(time_finetuned)

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

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

f_avg = np.sum(f_avg) / count
b_avg = np.sum(b_avg) / count
l_avg = np.sum(l_avg) / count
print(f"Finetuned Base Plus average time: {f_avg:.2f}s")
print(f"Vanilla Base Plus average time: {b_avg:.2f}s")
print(f"Vanilla Large average time: {l_avg:.2f}s")
```

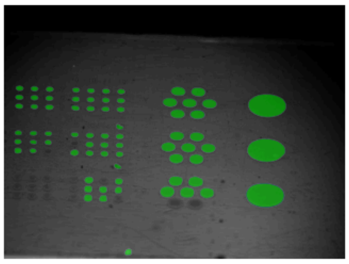




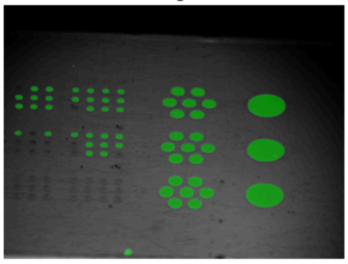
Finetuned Base Plus 17.55s



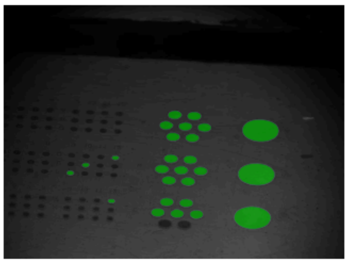
Vanilla Base Plus 21.61s



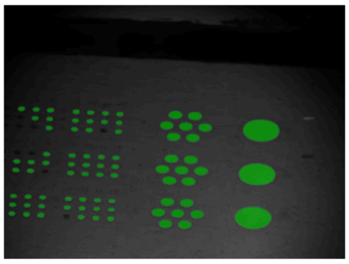
Vanilla Large 20.92s



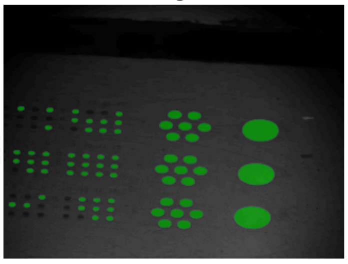
Finetuned Base Plus 14.40s



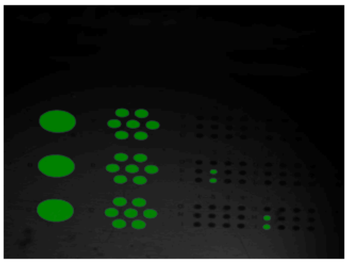
Vanilla Base Plus 15.23s



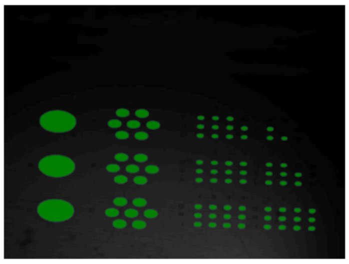
Vanilla Large 16.21s



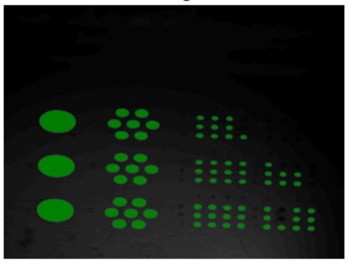
Finetuned Base Plus 8.51s



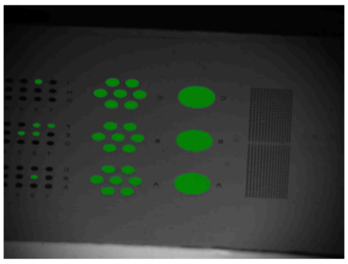
Vanilla Base Plus 8.72s



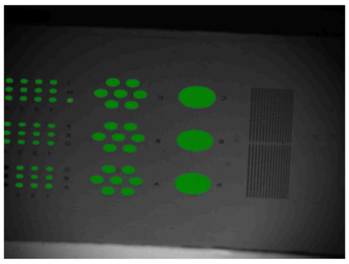
Vanilla Large 8.03s



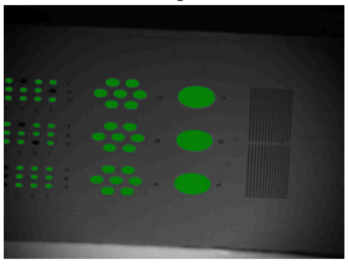
Finetuned Base Plus 12.43s



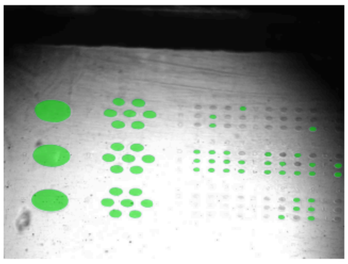
Vanilla Base Plus 23.25s



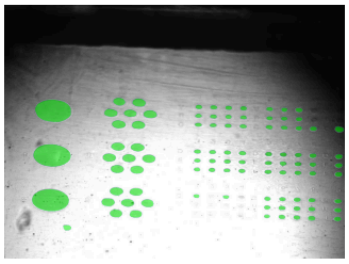
Vanilla Large 22.62s



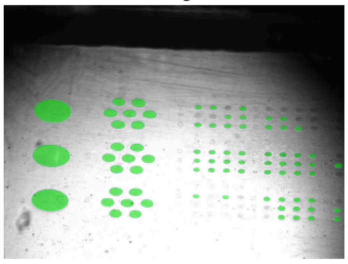
Finetuned Base Plus 7.63s



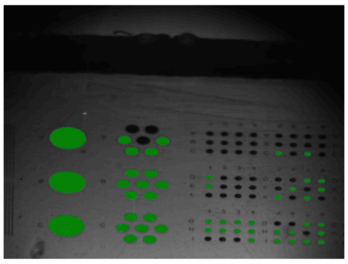
Vanilla Base Plus 11.16s



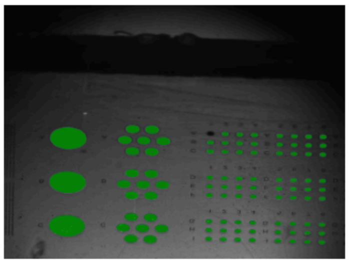
Vanilla Large 9.02s



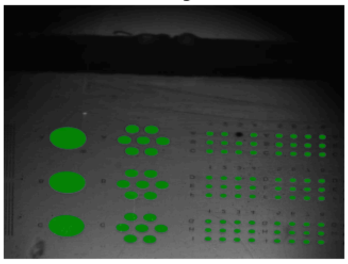
Finetuned Base Plus 7.68s



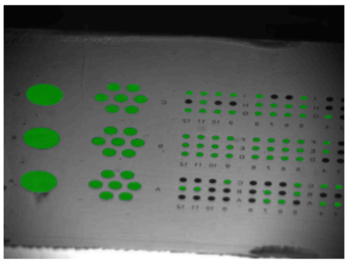
Vanilla Base Plus 10.28s



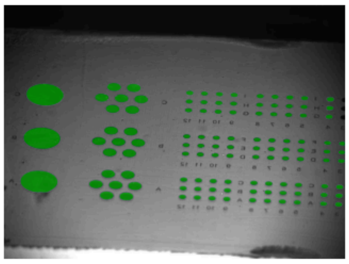
Vanilla Large 8.47s



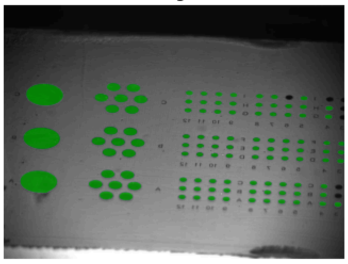
Finetuned Base Plus 9.16s



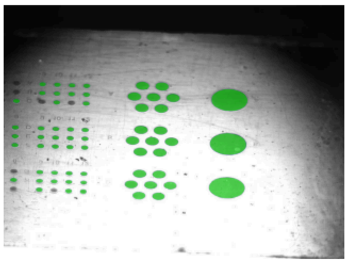
Vanilla Base Plus 14.69s



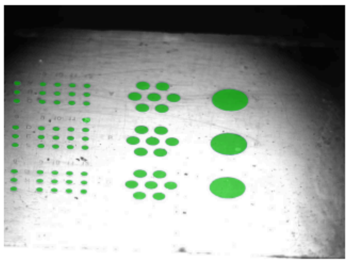
Vanilla Large 18.04s



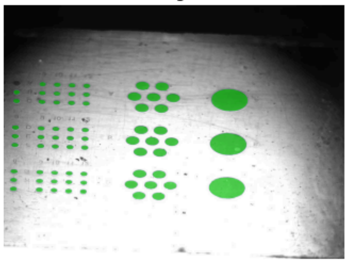
Finetuned Base Plus 11.94s



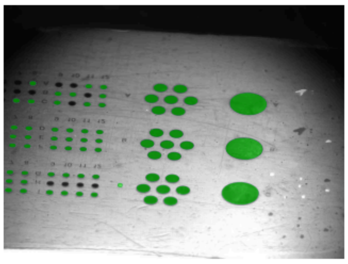
Vanilla Base Plus 18.18s



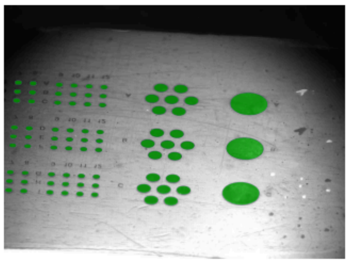
Vanilla Large 12.89s



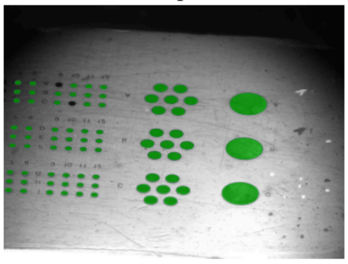
Finetuned Base Plus 11.72s



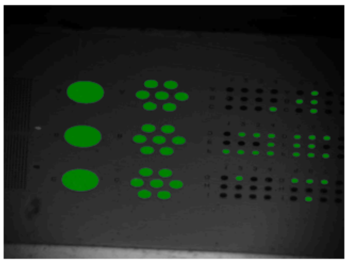
Vanilla Base Plus 12.32s



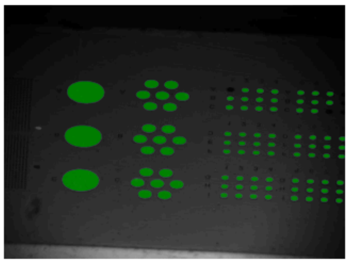
Vanilla Large 21.63s



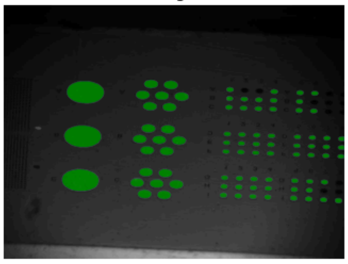
Finetuned Base Plus 17.92s



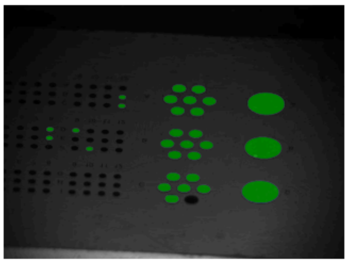
Vanilla Base Plus 38.87s



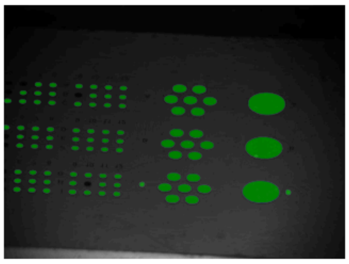
Vanilla Large 37.32s



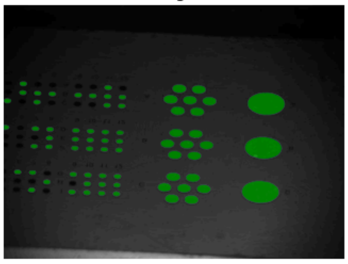
Finetuned Base Plus 21.41s



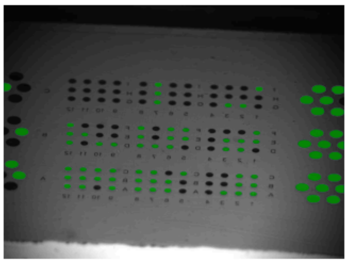
Vanilla Base Plus 34.11s



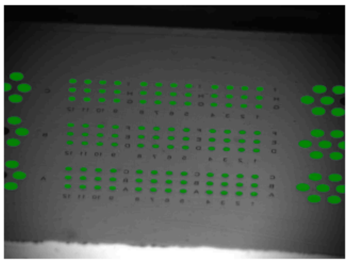
Vanilla Large 34.01s



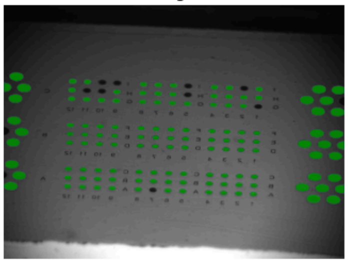
Finetuned Base Plus 19.82s

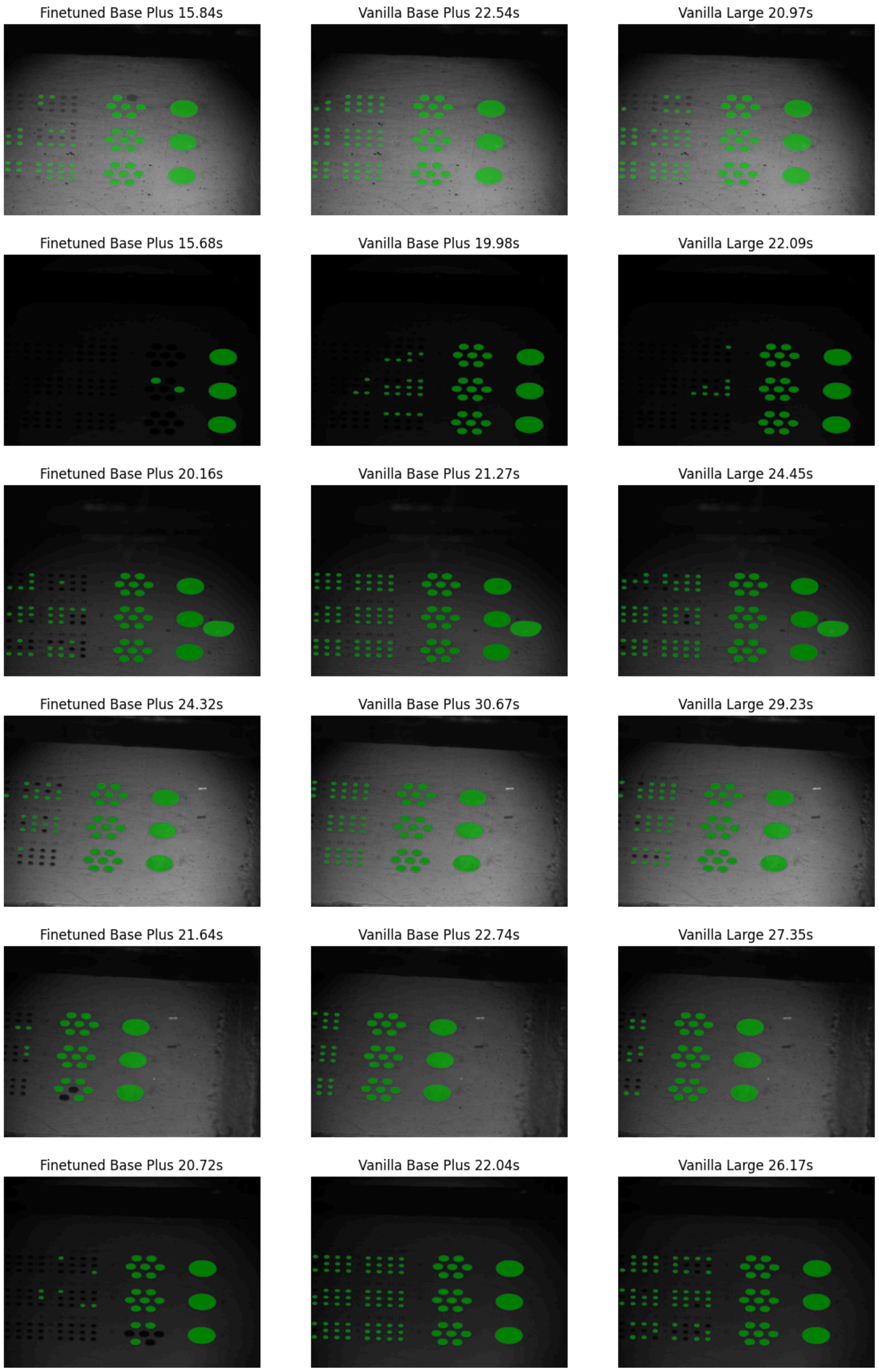


Vanilla Base Plus 31.94s



Vanilla Large 35.47s





```
Finetuned Base Plus average time: 15.12s
Vanilla Base Plus average time: 20.36s
Vanilla Large average time: 20.83s
```

In [6]:
```python
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)>
```