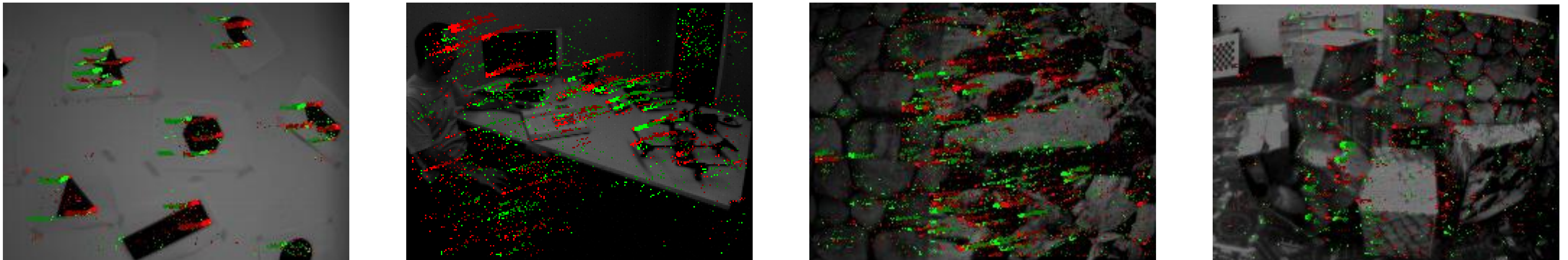


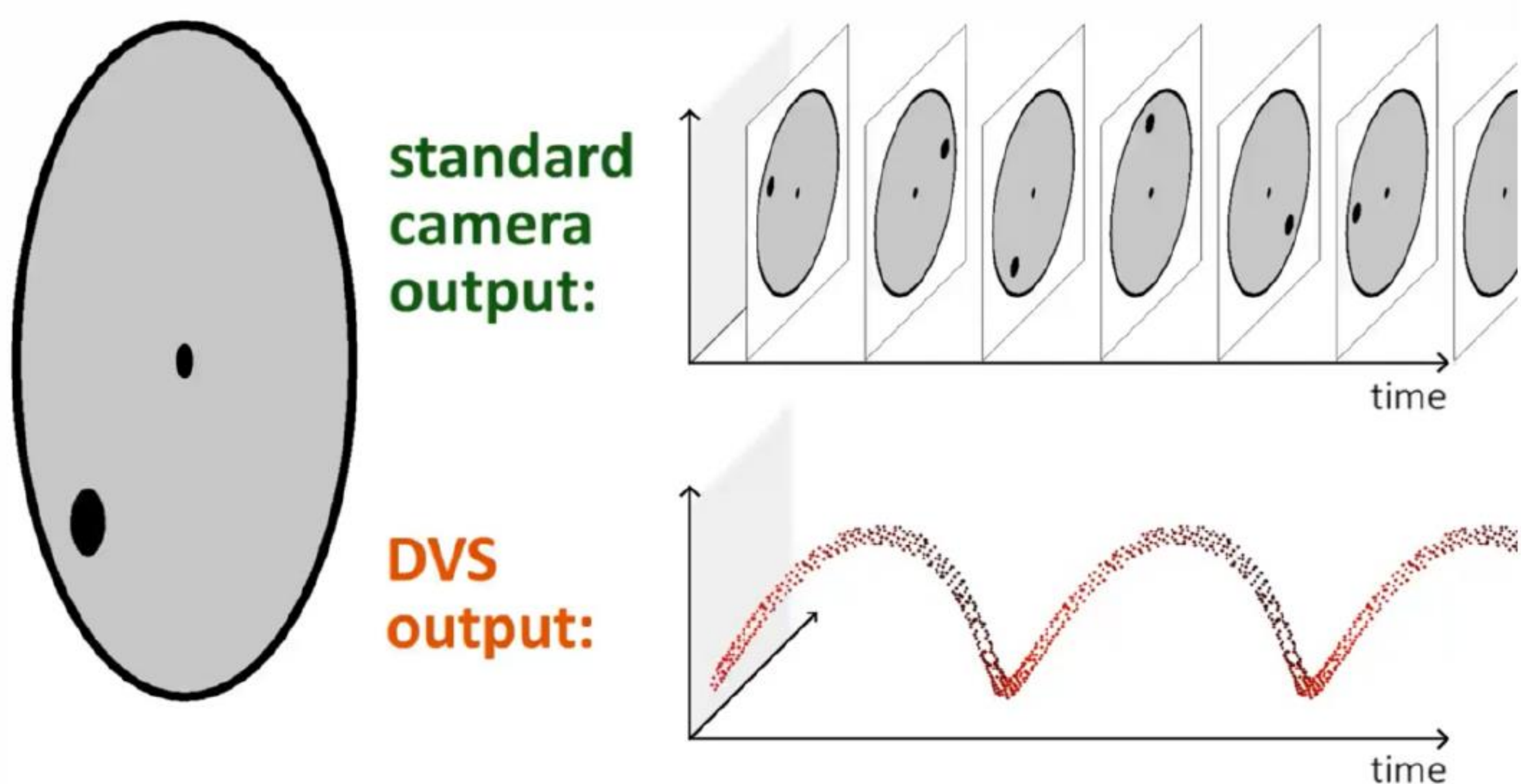
# Fast Event-based Corner Detection

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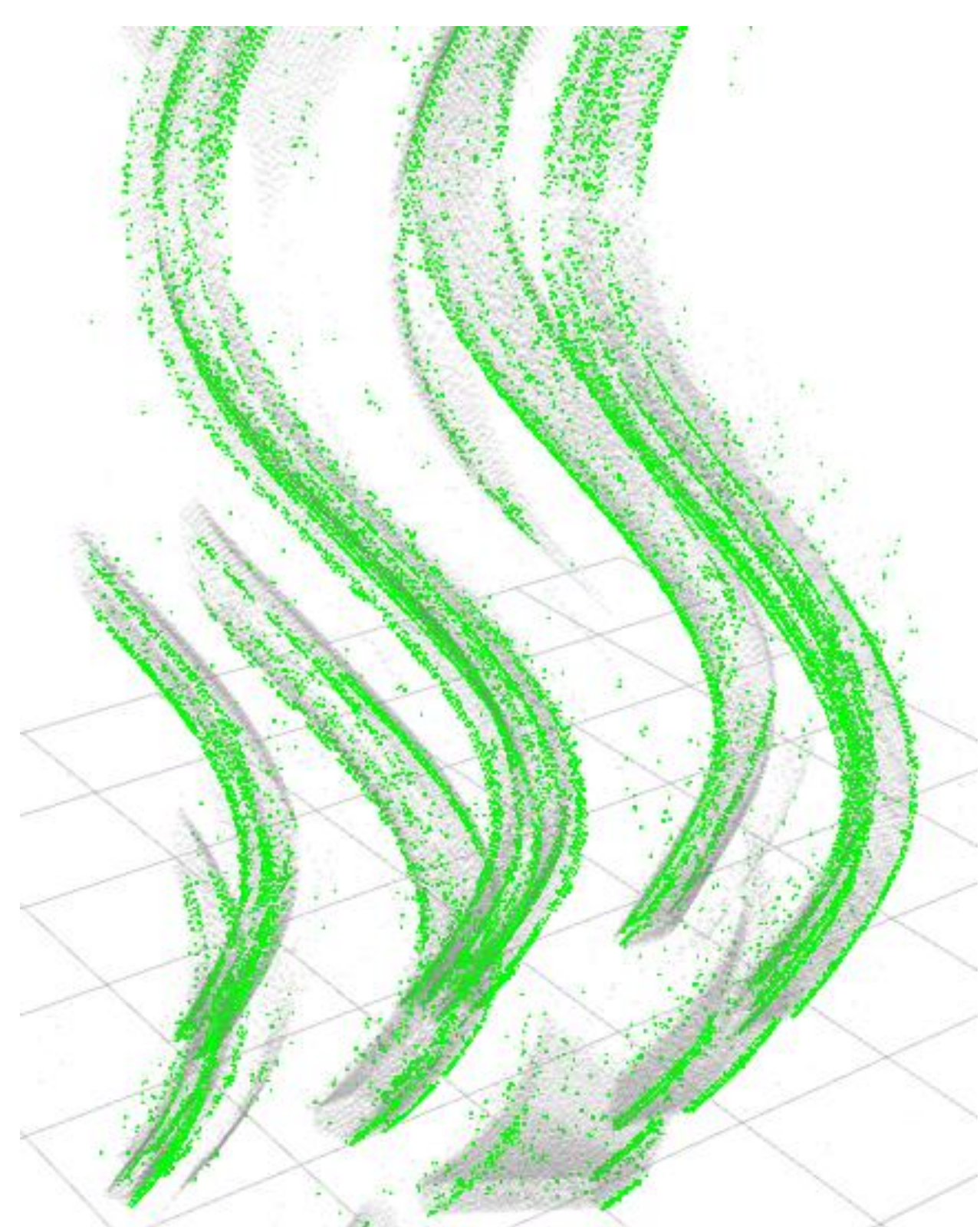
Reduce the event stream to a corner event stream

## Event Cameras



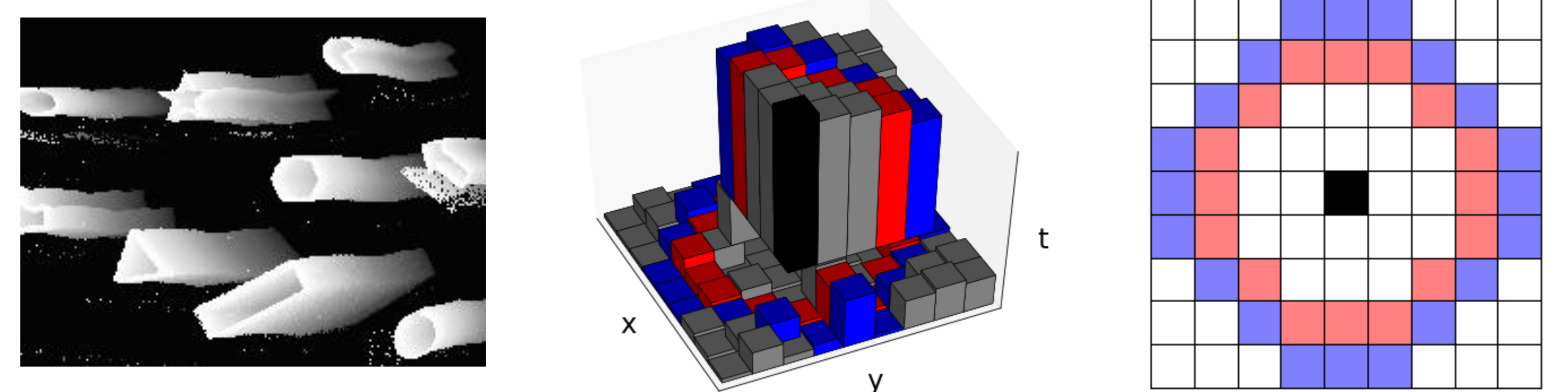
- Novel, neuromorphic vision sensors
- Only local brightness changes (“events”) reported
- **Micro**-second latency and temporal resolution
- Very high dynamic range (140dB)

## Motivation: Data Rate



- Fast motion and highly textured scenes cause **millions of events per second**
- Thus, the processing time *per event* is very limited
- For many applications, **corners** are sufficient (no aperture problem)
- Figure: corners in green, all other events in gray

## Approach



- Data representation: Surface of Active Events (a map with the timestamp of the latest event at each pixel)
- Analyze timestamp distribution around current event
- Detect corners by searching for contiguous pixels with higher timestamps than the rest
- Circular segments: isotropic response and efficiency

## Results

- Evaluated on the **Event-Camera Dataset**
- **Reduction of event rate by a factor of 10 to 20**
- Time per event: 0.78 $\mu$ s (1.3 million events/s)
- Similar corner detection quality, but more than **one order of magnitude faster** than previous Harris method [Vasco et al, IROS 2016]

Method	Time per event [ $\mu$ s]	Max. event rate [e/s]
Harris	11.6	86,230
Ours	0.78	1,275,000

Texture	Dataset	Harris		Ours	
		Red.	FT	Red.	FT
low	shapes_rotation	92.7	74.1	88.9	74.7
	shapes_translation	91.7	78.3	87.8	77.5
	shapes_6dof	90.6	77.1	87.0	76.8
medium	dynamic_rotation	95.1	53.3	96.4	46.4
	dynamic_translation	95.3	62.1	96.7	52.1
	dynamic_6dof	95.4	55.9	96.4	49.4
high	poster_rotation	92.6	35.3	95.7	30.5
	poster_translation	92.3	39.5	95.8	35.9
	poster_6dof	92.4	35.3	95.6	32.1
high	boxes_rotation	92.1	32.9	96.7	25.2
	boxes_translation	92.4	37.0	96.7	30.5
	boxes_6dof	92.7	34.4	96.8	26.7

Red: reduction rate [%], FT: matched Feature Tracks (ground truth) [%]

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