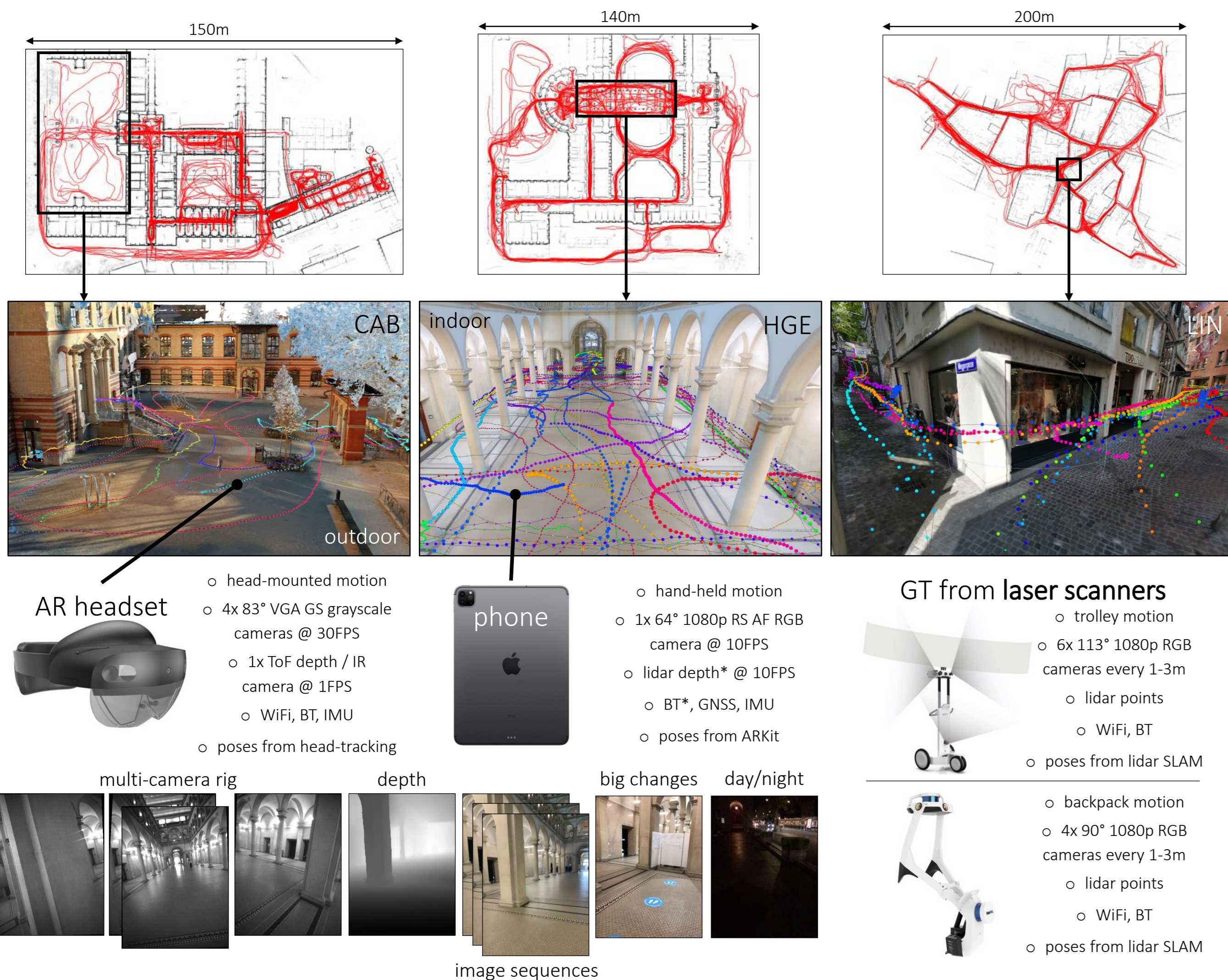




Motivation

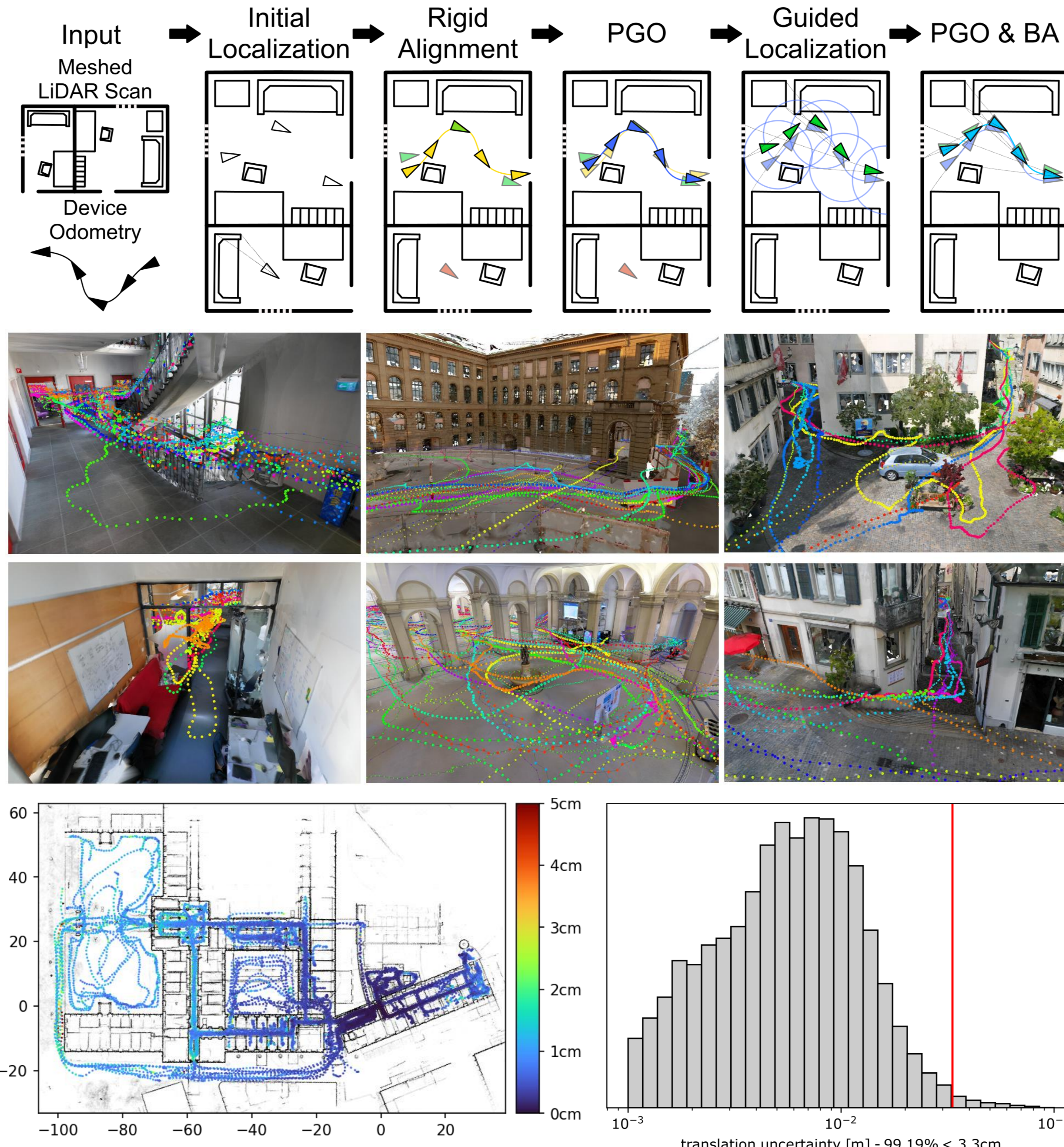
- Existing datasets are not representative for common AR scenarios
- SOTA focuses on single isolated views of locations of interest
- AR must localize from unconstrained data, not necessarily focused on localization
- AR is about streams of posed data (from local on-board tracking)
- AR devices also provide additional sensors (e.g., WiFi, BT, IMU)
- AR exhibits specific motion patterns (head-mounted, hand-held)

Dataset Overview



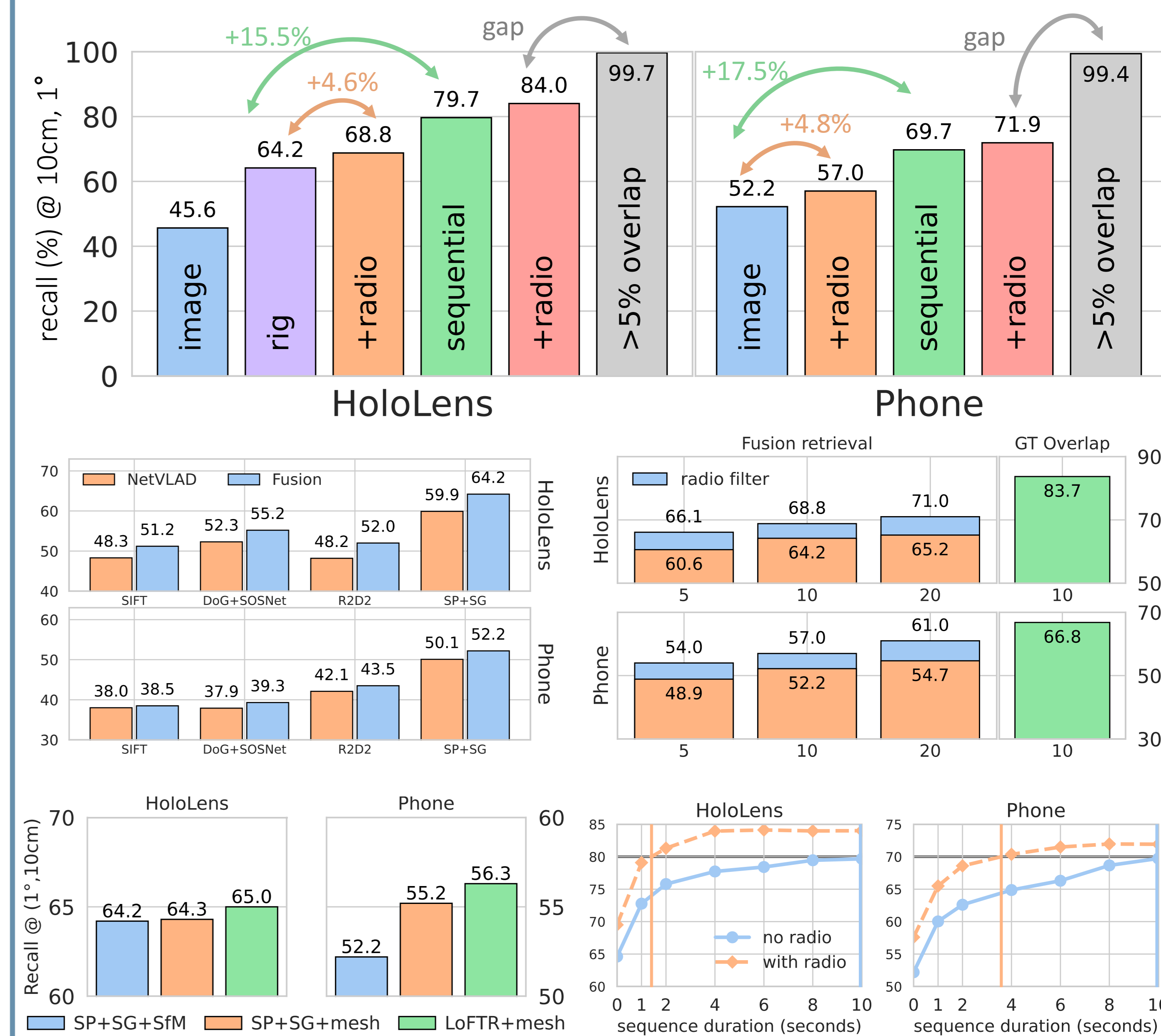
Ground-Truth Pipeline

- Robust scalable automatic pipeline without any manual labelling / custom infrastructure
- Uses dense, highly-accurate reference 3D models from lidar scanners
- Takes advantage of on-device real-time tracker of AR devices
- Sequence to reference alignment followed by global refinement across sequences

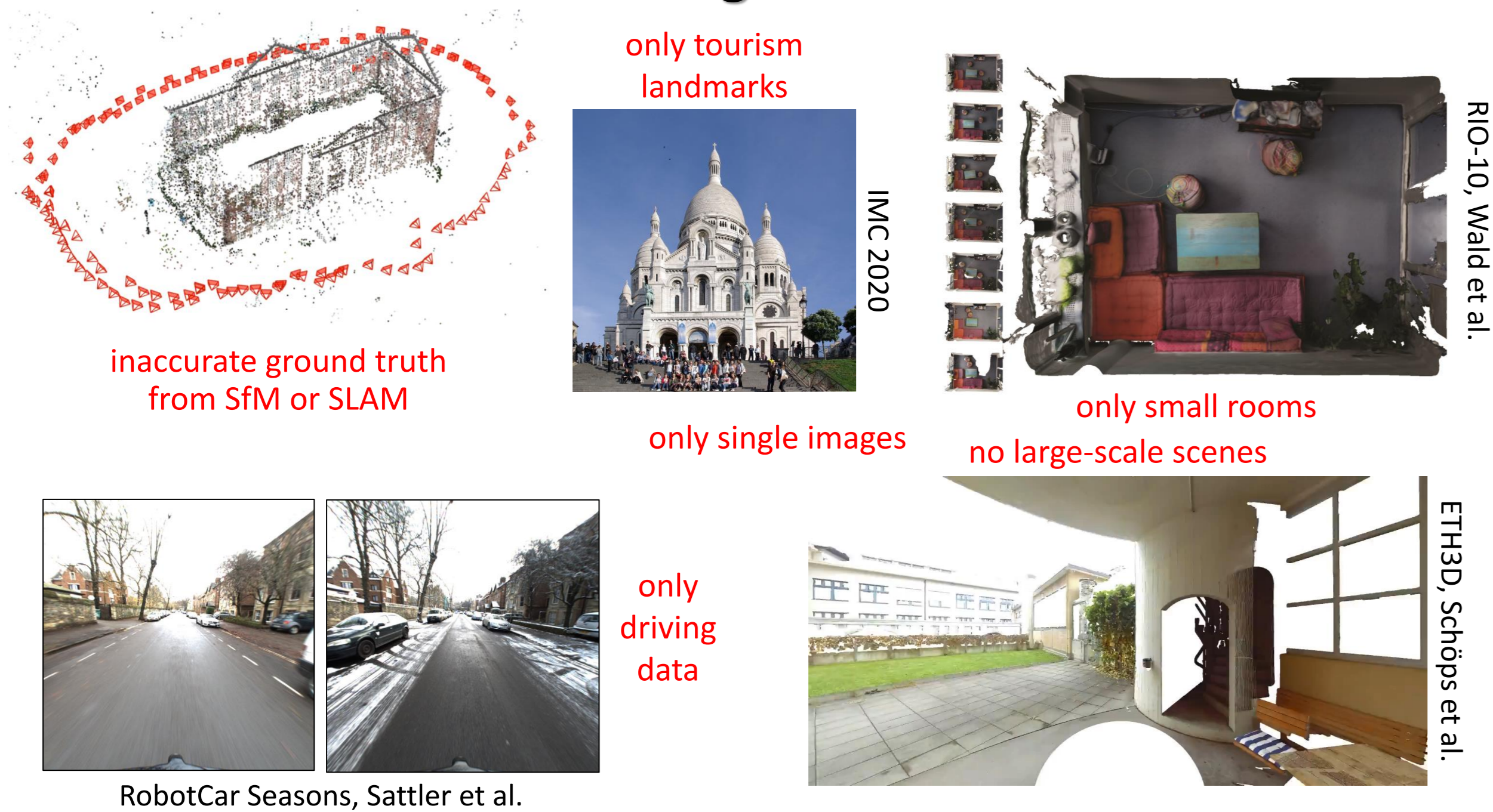


Evaluation

- Single image evaluation is too constrained and not representative for AR performance
- Using radio signals to simplify image retrieval shows significant improvements
- Using posed streams of data is highly beneficial even for short sequence durations
- New task: time-to-recall – one should aim to localize the camera as quickly as possible
- Radio signals reduce TTR by 85% for HoloLens and 60% for Phones



Existing Datasets



dataset	out/indoor	changes	scale	density	camera motion	imaging devices	additional sensors	ground truth	accuracy	
Aachen [66,65]	✓	✗	☆☆☆	☆☆☆	still images	DSLR	✗	SfM	>dm	
Phototourism [34]	✓	✗	☆☆☆	☆☆☆	still images	DSLR, phone	✗	SfM	~m	
San Francisco [14]	✓	✗	☆☆☆	☆☆☆	still images	DSLR, phone	GNSS	SfM+GNSS	~m	
Cambridge [37]	✓	✗	☆☆☆	☆☆☆	handheld	mobile	✗	SfM	>dm	
7Scenes [72]	✗	✓	☆☆☆	☆☆☆	handheld	mobile	depth	RGB-D	~cm	
RIO10 [83]	✗	✗	☆☆☆	☆☆☆	handheld	Tango tablet	depth	VIO	>dm	
InLoc [76]	✗	✓	☆☆☆	☆☆☆	still images	panoramas, phone	lidar	manual+lidar	>dm	
Baidu mall [75]	✗	✓	☆☆☆	☆☆☆	still images	DSLR, phone	lidar	manual+lidar	~dm	
Naver Labs [40]	✗	✓	☆☆☆	☆☆☆	robot-mounted	fish-eye, phone	lidar	lidar+SfM	~dm	
NCLT [12]	✓	✓	☆☆☆	☆☆☆	robot-mounted	wide-angle	lidar, IMU, GNSS	lidar+VIO	~dm	
ADVIO [56]	✓	✓	☆☆☆	☆☆☆	handheld	phone, Tango	IMU, depth, GNSS	manual+VIO	~m	
ETH3D [70]	✓	✗	☆☆☆	☆☆☆	handheld	DSLR, wide-angle	lidar	manual+lidar	~mm	
LaMAR (ours)	✓	✓	3 locations 45'000 m ²	☆☆☆	100 hours 40 km	handheld head-mounted	phone, headset backpack, trolley	lidar, IMU, depth, infrared	lidar+SfM+VIO automated	~cm

