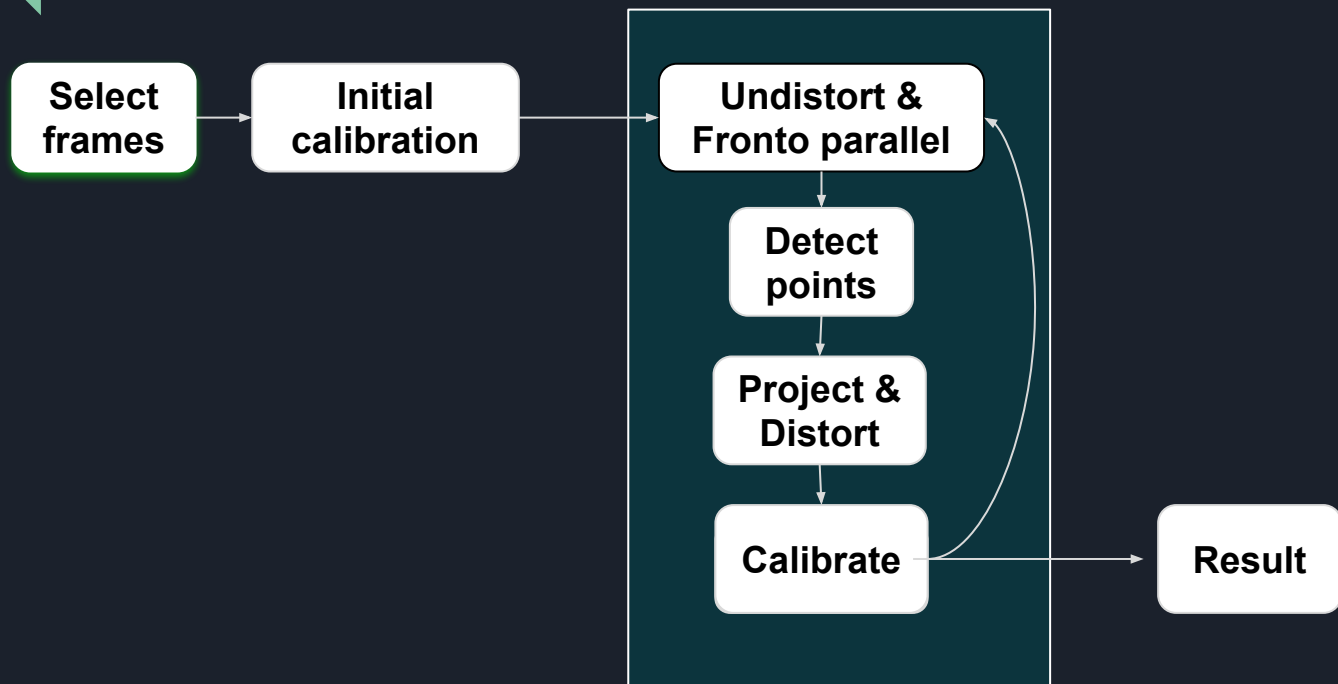


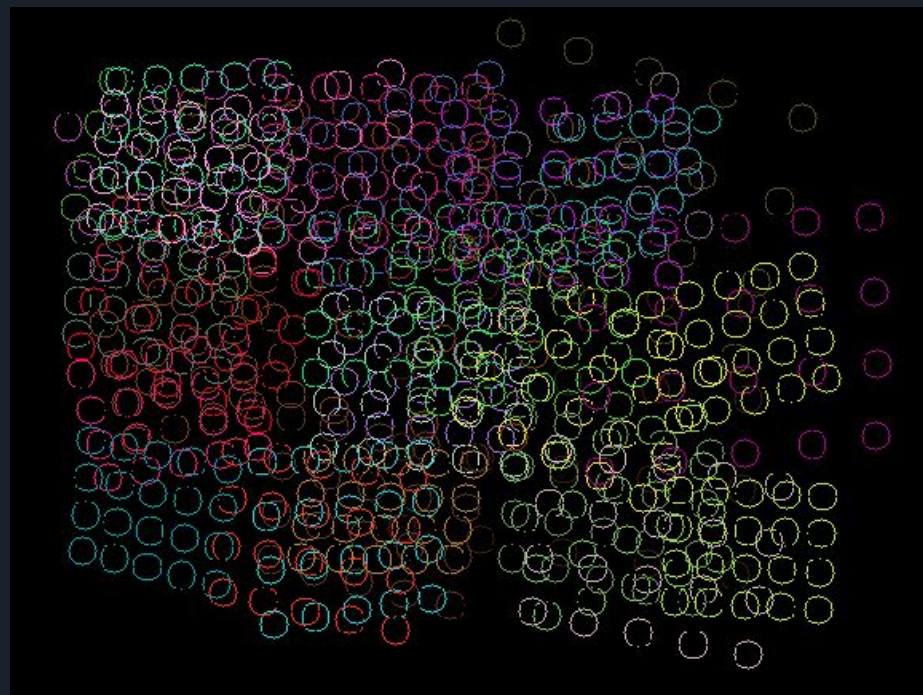
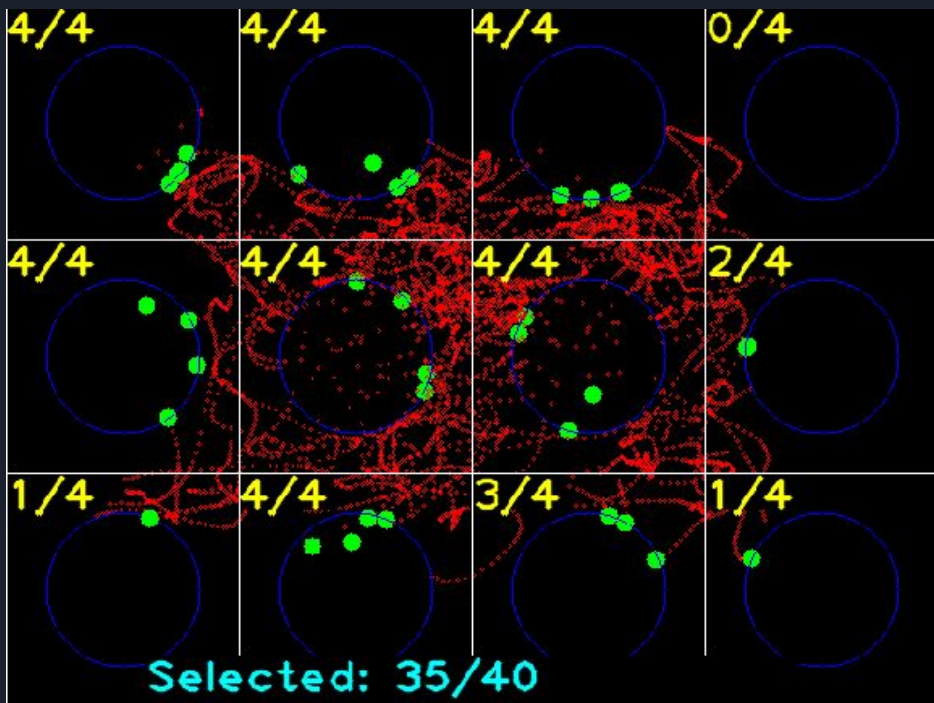
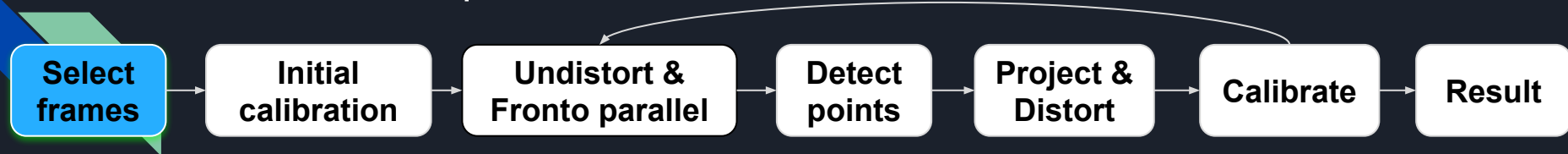
Implementation: Accurate Camera Calibration using Iterative Refinement of Control Points

Authors:
Raúl Romaní Flores
Paul Alonzo Quio Añamuro

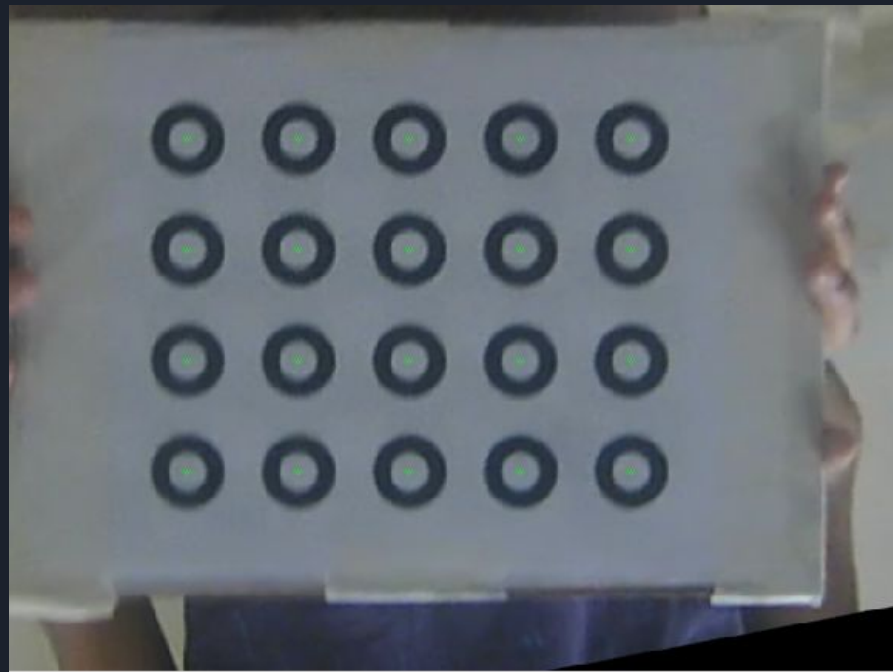
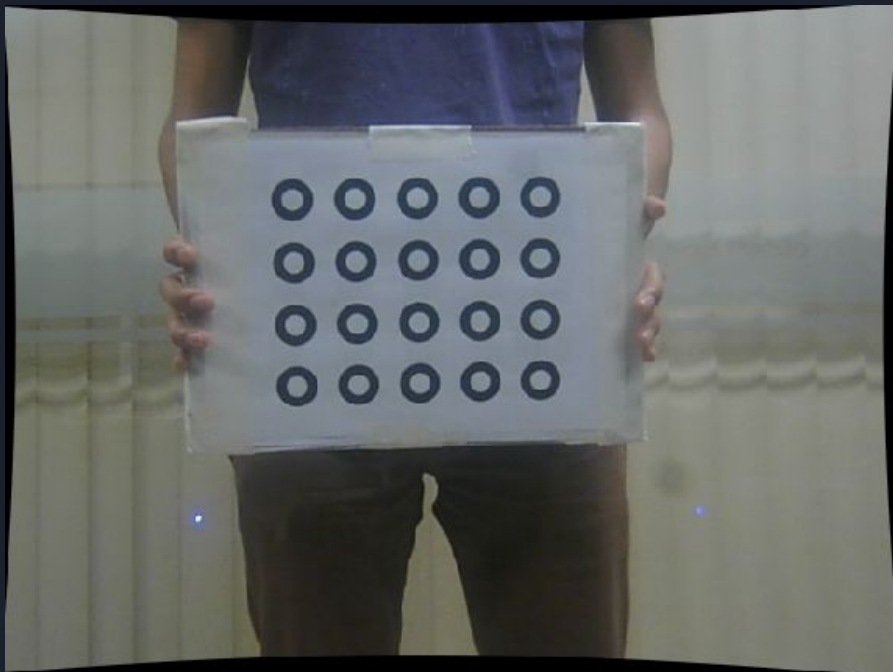
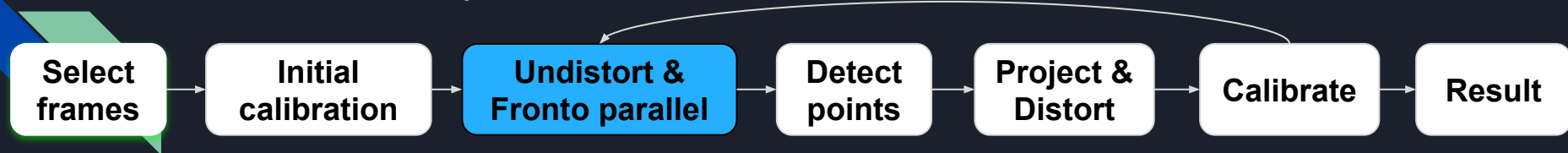
Iterative process for camera calibration



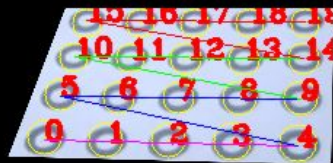
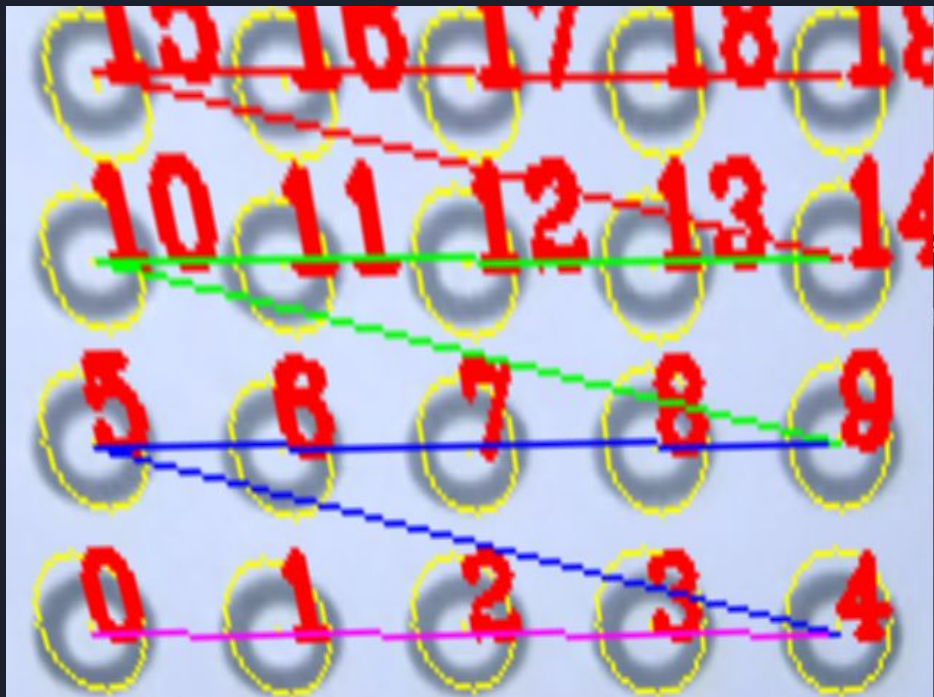
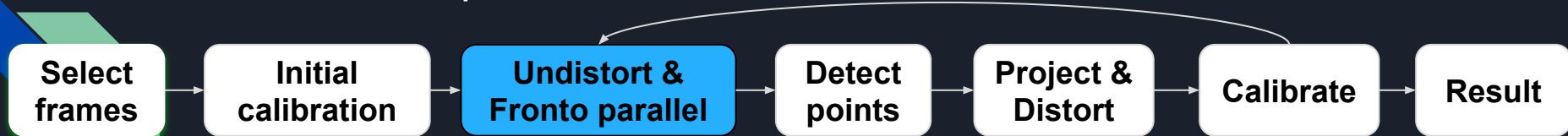
Iterative process



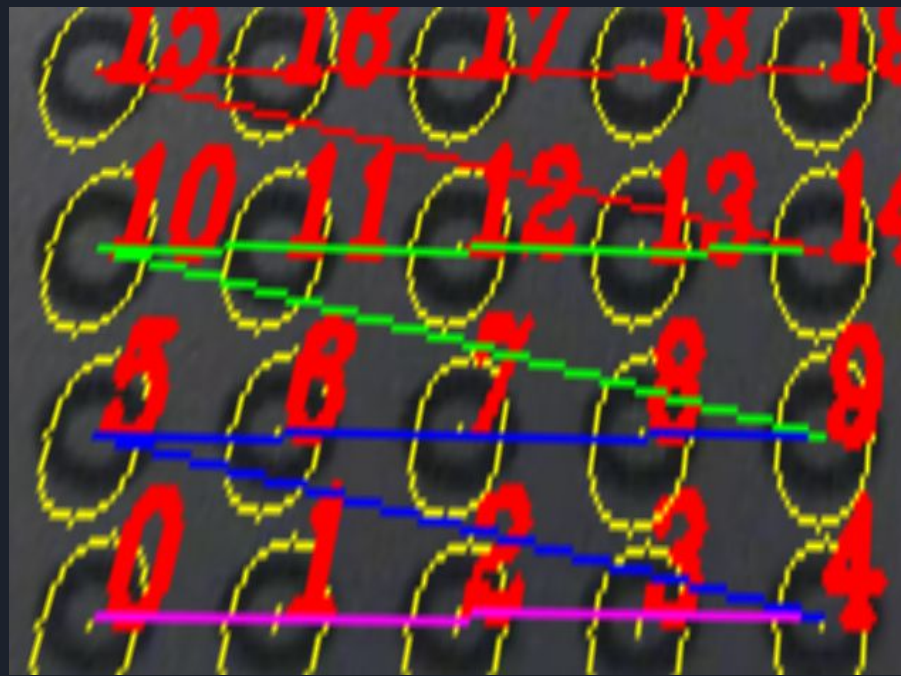
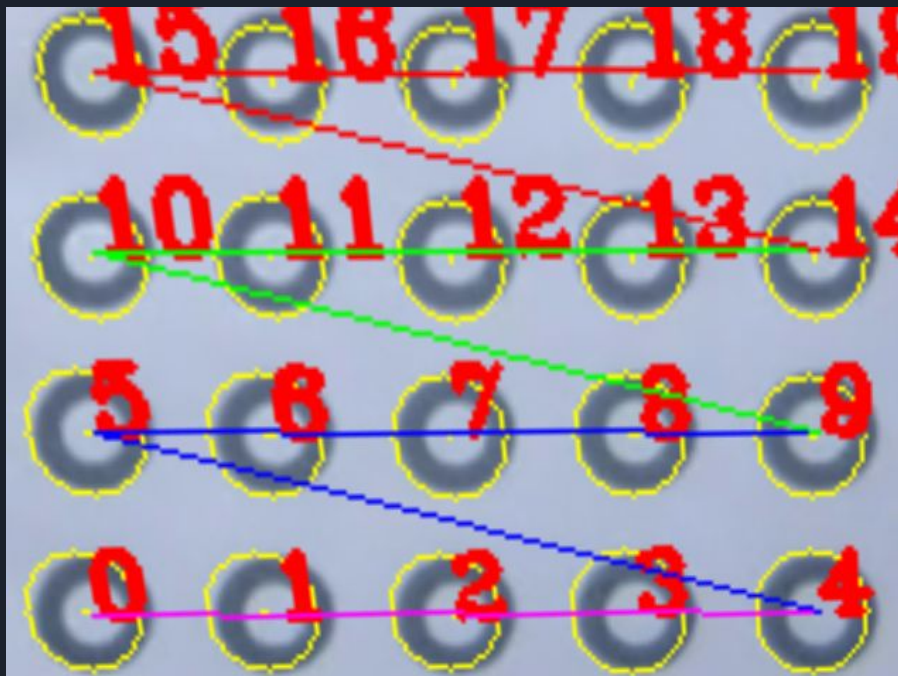
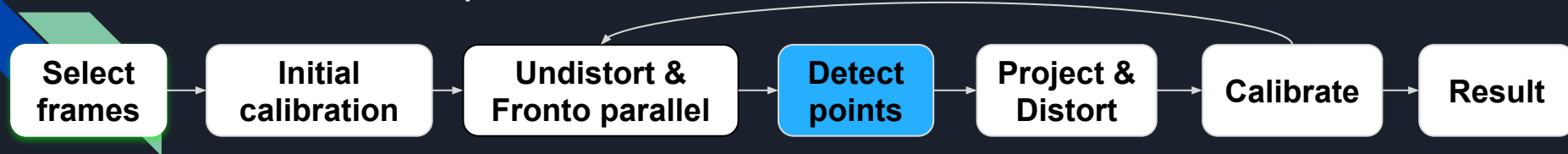
Iterative process



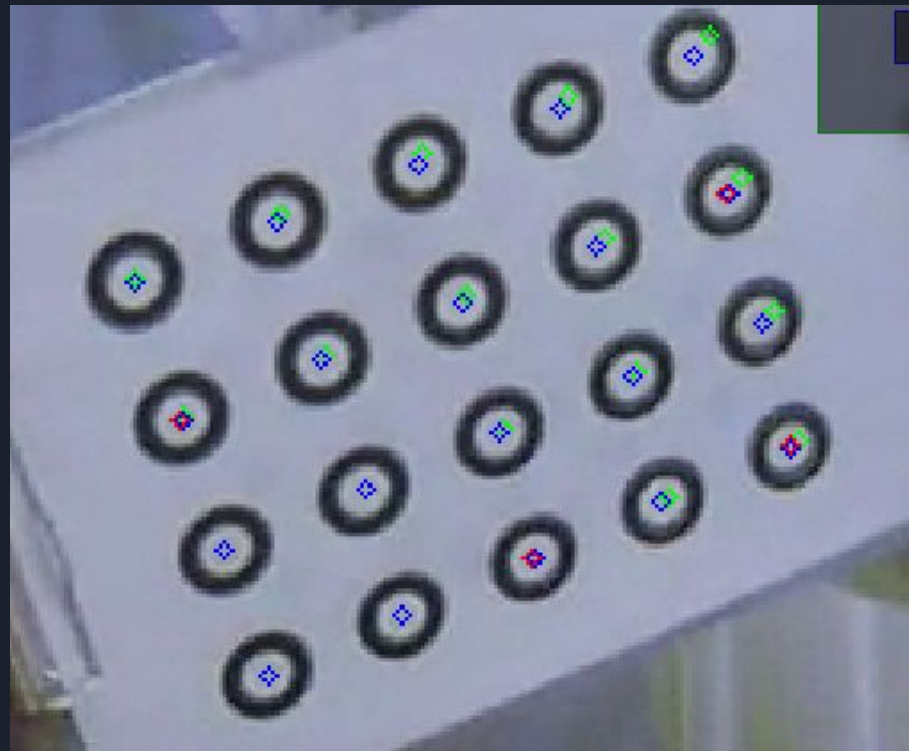
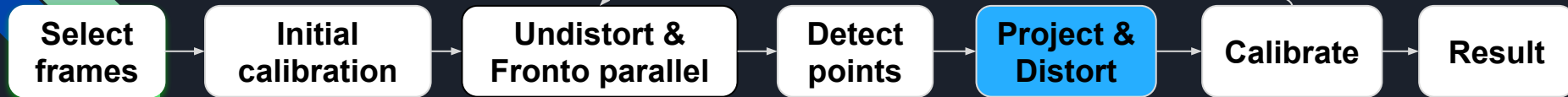
Iterative process



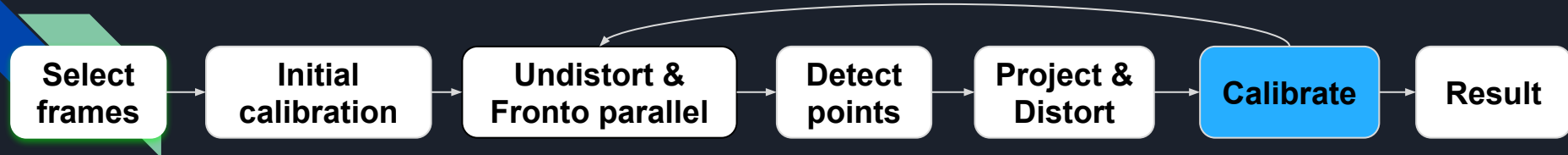
Iterative process



Iterative process

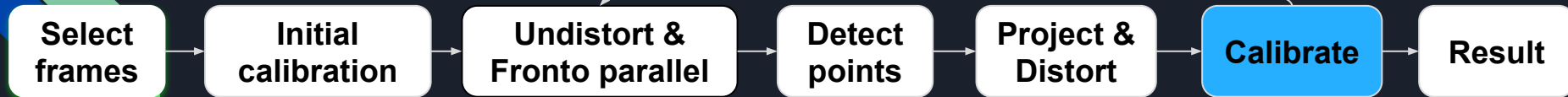


PS3



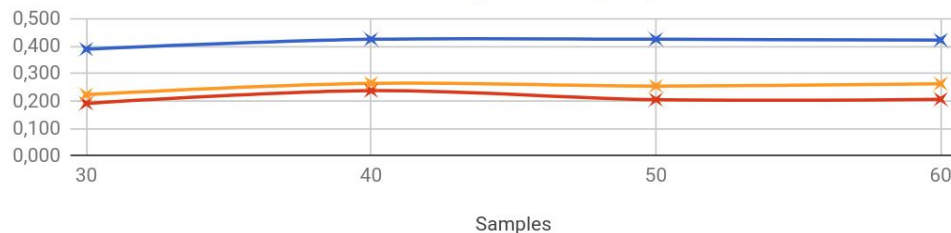
	Chessboard					Circles					Rings				
Samples	20	30	40	50	60	20	30	40	50	60	20	30	40	50	60
Rms	0,390	0,426	0,426	0,423	0,423	0,192	0,239	0,206	0,207	0,226	0,224	0,265	0,255	0,264	0,260
fx	813,725	820,161	820,161	845,004	845,004	799,140	832,183	834,295	845,796	838,066	848,202	847,880	829,118	841,530	832,514
fy	809,813	815,512	815,512	835,884	835,884	794,294	827,273	828,058	840,258	835,511	842,190	840,456	826,297	836,341	827,218
cx	359,364	315,476	315,476	320,676	320,676	316,854	329,727	367,877	360,050	360,822	325,649	331,315	307,625	299,637	303,603
cy	250,695	256,814	256,814	257,091	257,091	252,407	319,372	259,705	262,200	276,342	247,831	247,318	229,413	248,058	250,308
Collinearity	0,443	0,465	0,465	0,495	0,495	0,145	0,152	0,140	0,141	0,145	0,173	0,167	0,178	0,187	0,198
Collinearity undistorted	0,265	0,306	0,306	0,291	0,291	0,144	0,154	0,140	0,140	0,145	0,077	0,072	0,090	0,085	0,082

PS3



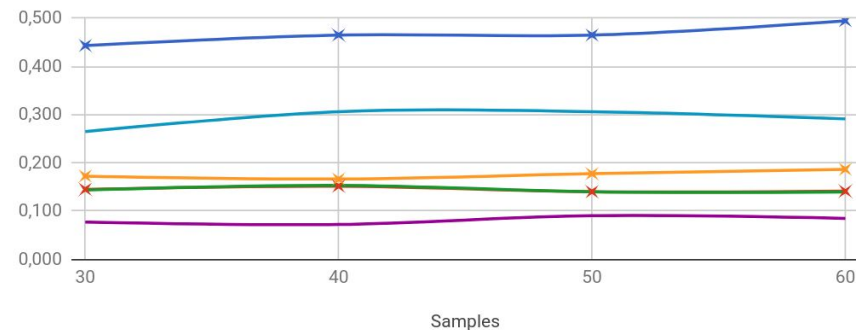
RMS

× Chessboard × Circles × Rings



Collinearity

× Chessboard × Circles × Rings × Circles undistorted × Rings undistorted
— Chessboard undistorted



PS3

Select
frames

Initial
calibration

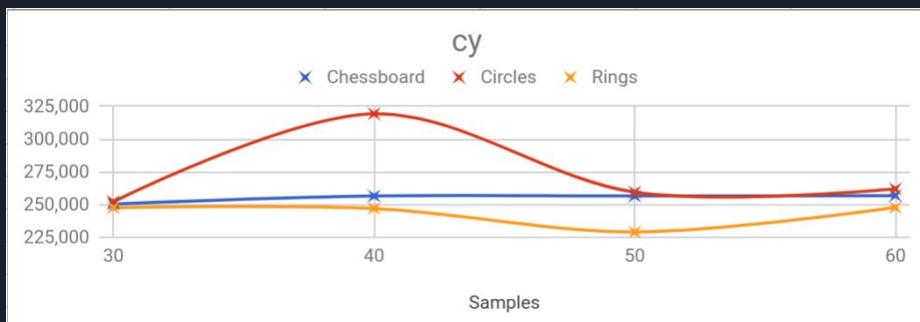
Undistort &
Fronto parallel

Detect
points

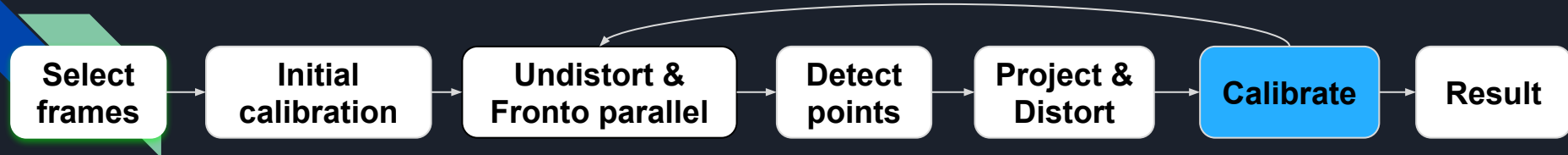
Project &
Distort

Calibrate

Result

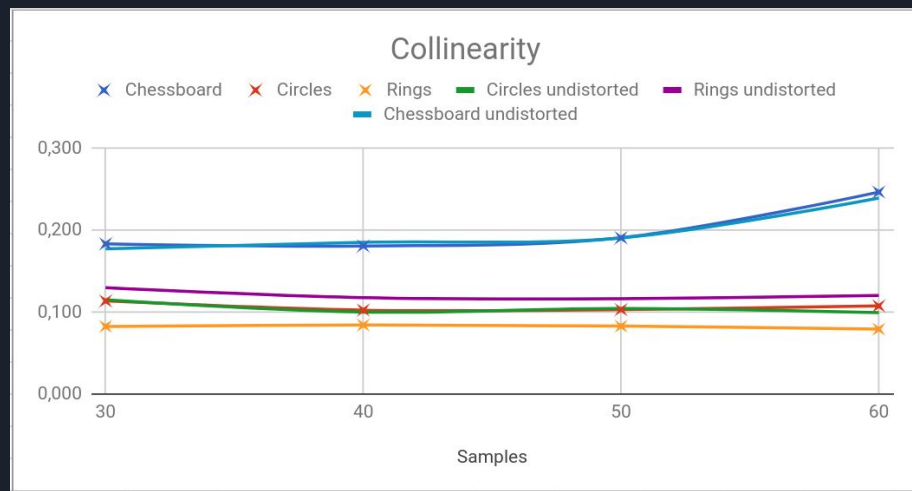
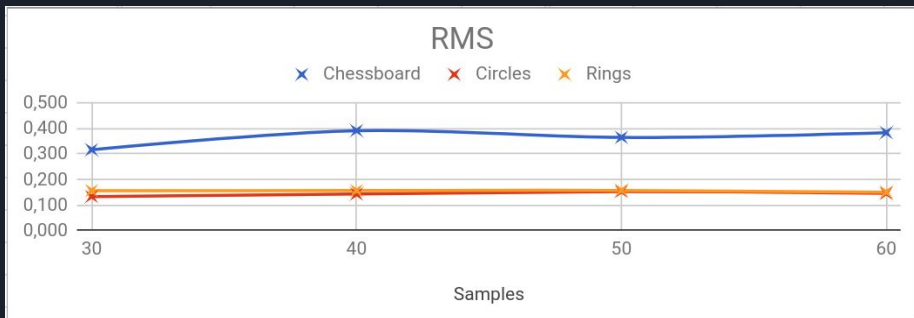
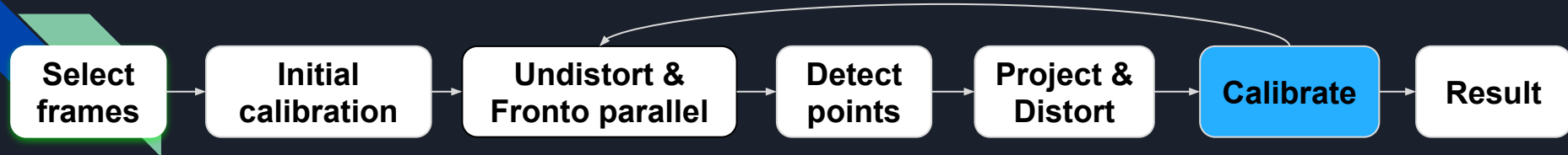


Lifecam



	Chessboard					Circles					Rings				
Samples	20	30	40	50	60	20	30	40	50	60	20	30	40	50	60
Rms	0,317	0,392	0,365	0,384	0,447	0,133	0,143	0,153	0,146	0,146	0,156	0,157	0,157	0,150	0,149
fx	592,424	604,732	588,222	594,538	577,396	647,129	613,707	638,809	630,977	644,893	561,505	565,586	563,842	568,962	568,983
fy	591,990	598,184	580,326	586,648	572,452	643,747	614,923	635,728	631,196	644,245	558,071	562,136	560,000	565,347	565,909
cx	365,692	337,721	323,025	326,155	333,391	336,306	331,074	334,358	326,686	326,254	320,645	318,235	320,239	324,489	323,410
cy	252,566	239,212	237,711	242,498	240,347	234,667	231,740	234,522	233,461	232,634	226,959	229,333	224,278	222,154	217,304
Collinearity	0,183	0,181	0,191	0,247	0,272	0,113	0,102	0,103	0,107	0,106	0,082	0,084	0,083	0,079	0,080
Collinearity undistorted	0,177	0,185	0,191	0,239	0,256	0,115	0,100	0,104	0,099	0,111	0,130	0,117	0,116	0,120	0,112

Lifecam



Lifecam

Select
frames

Initial
calibration

Undistort &
Fronto parallel

Detect
points

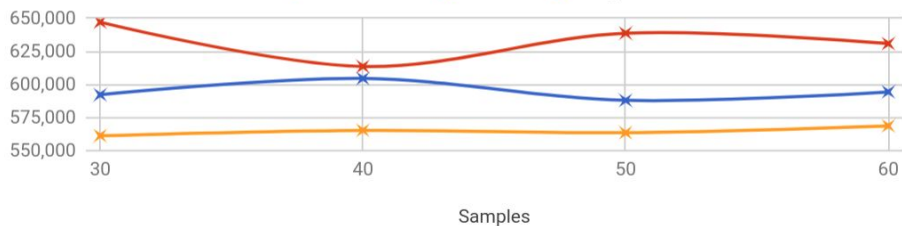
Project &
Distort

Calibrate

Result

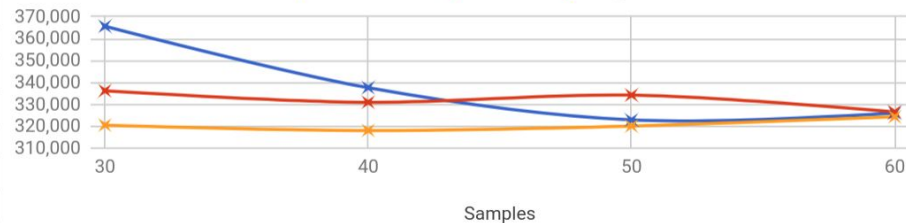
f_x

× Chessboard × Circles × Rings



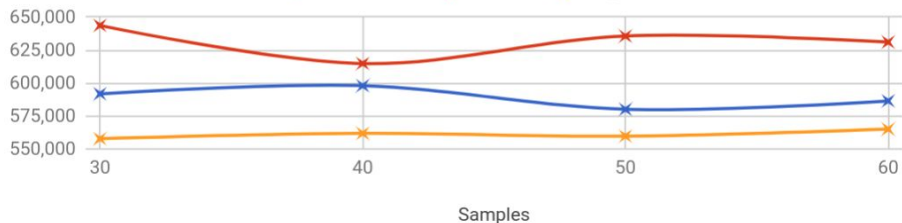
CX

× Chessboard × Circles × Rings



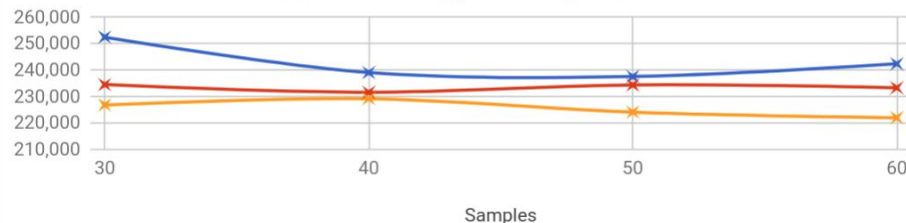
f_y

× Chessboard × Circles × Rings

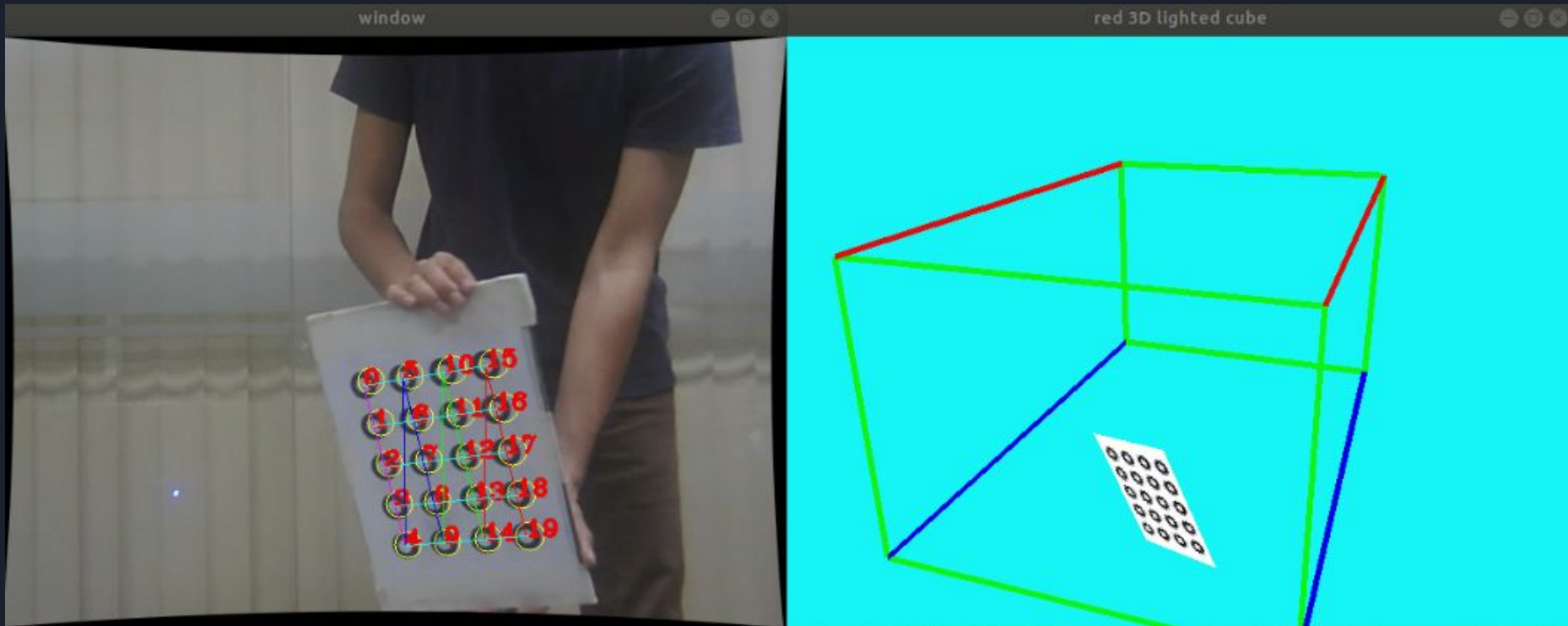
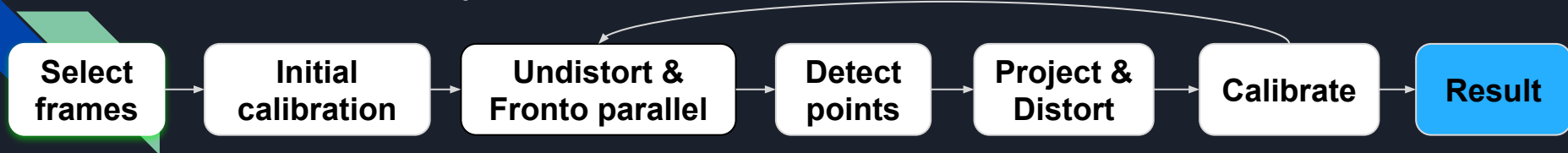


cy

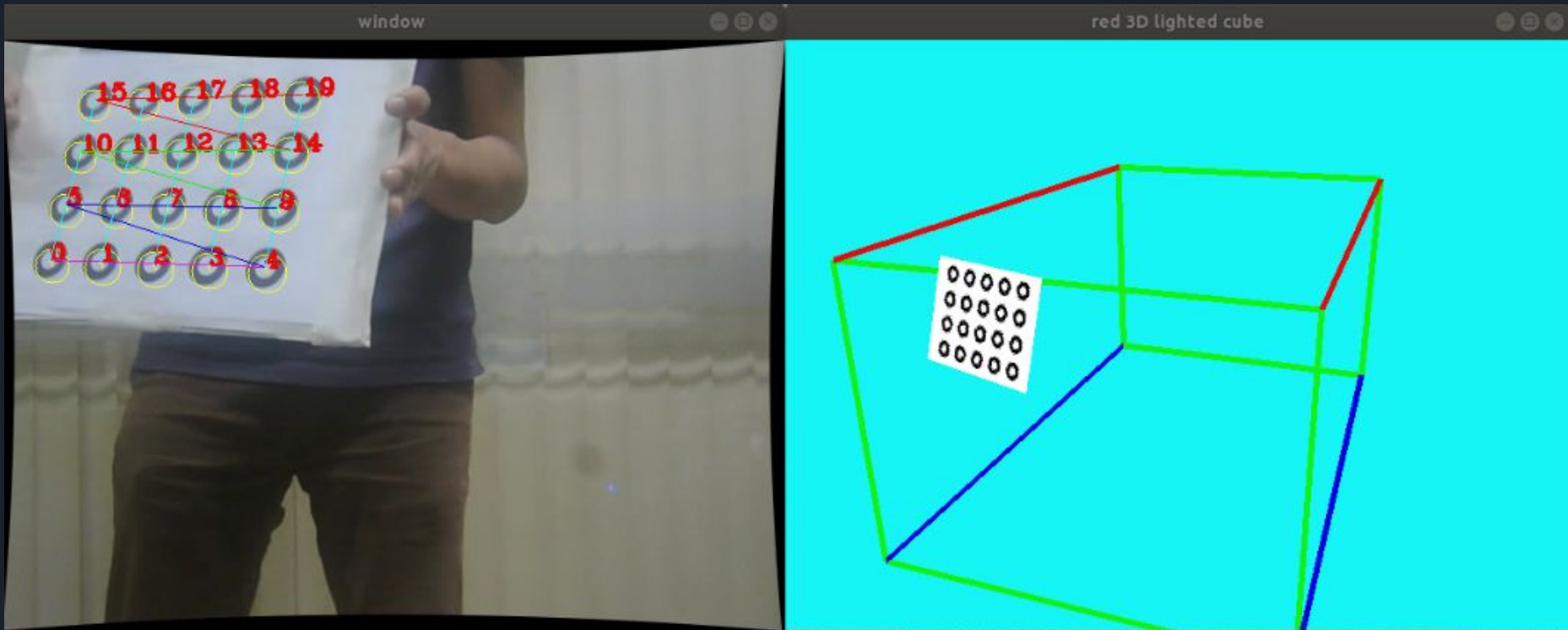
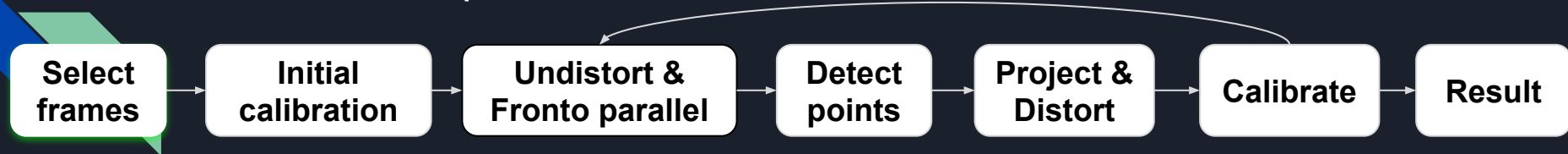
× Chessboard × Circles × Rings



Iterative process



Iterative process





Thank you