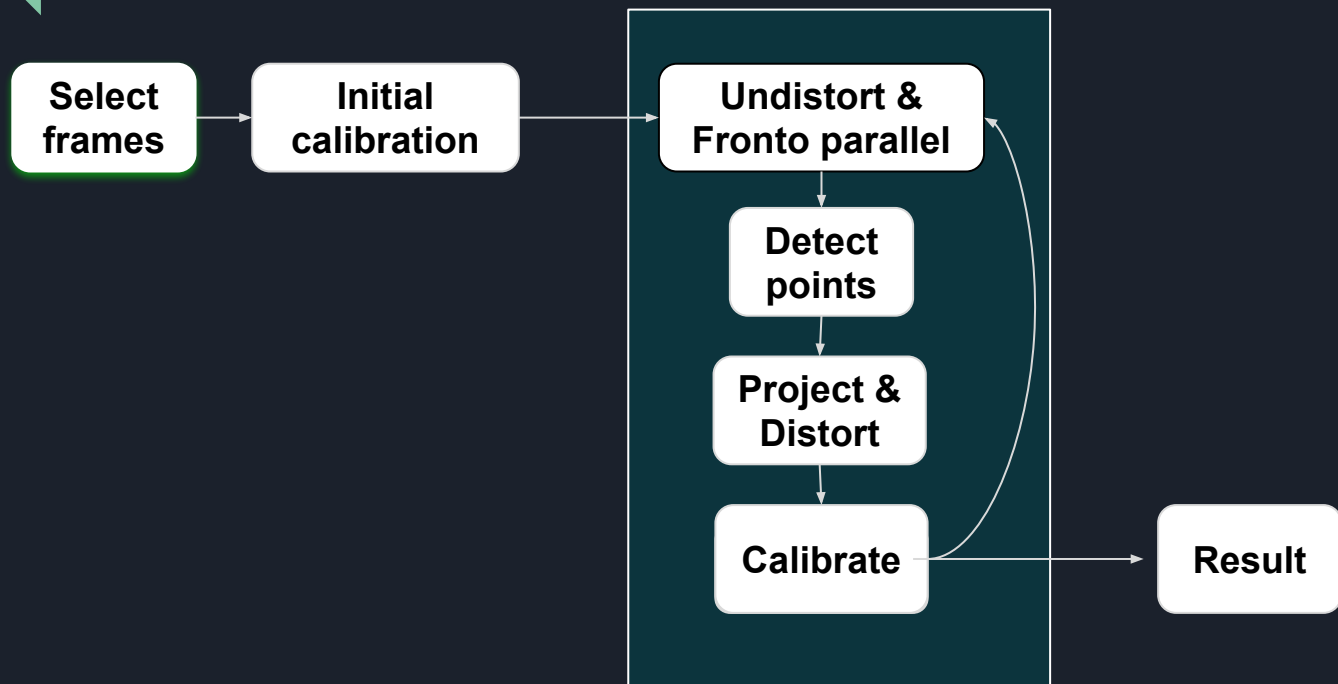# Implementation: Accurate Camera Calibration using Iterative Refinement of Control Points
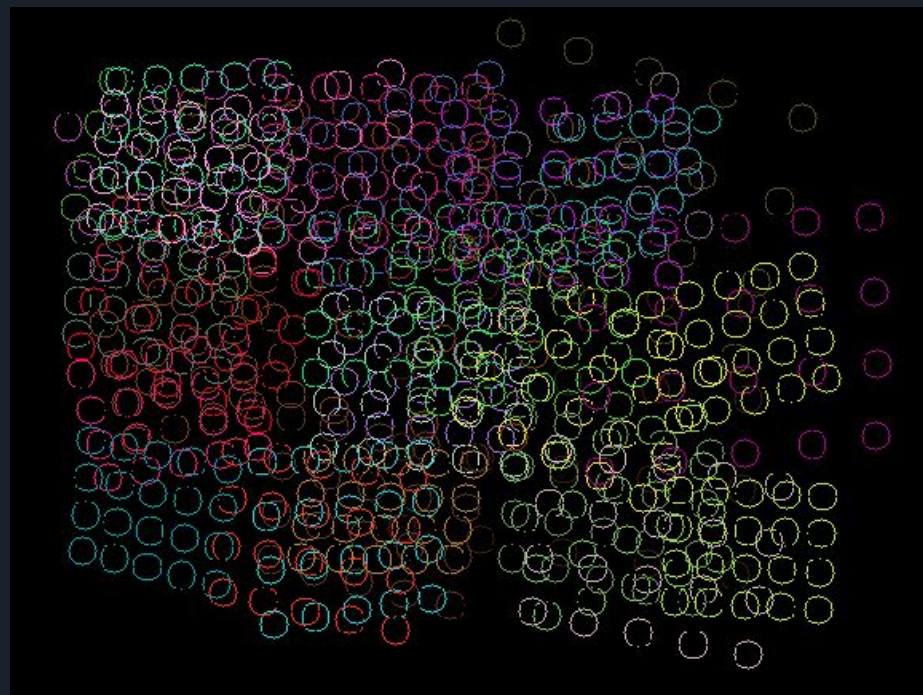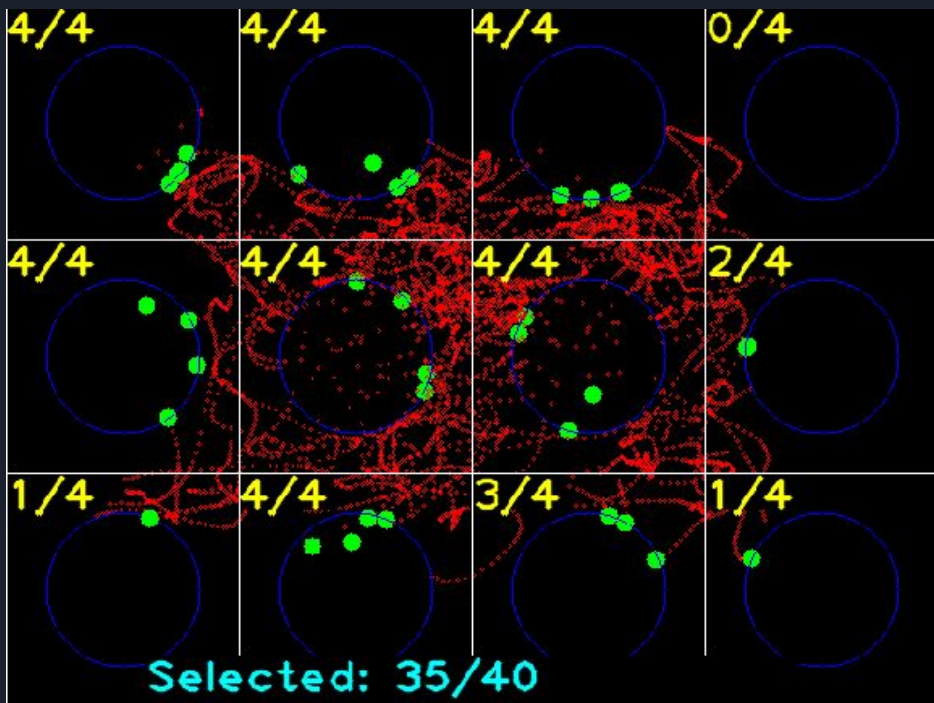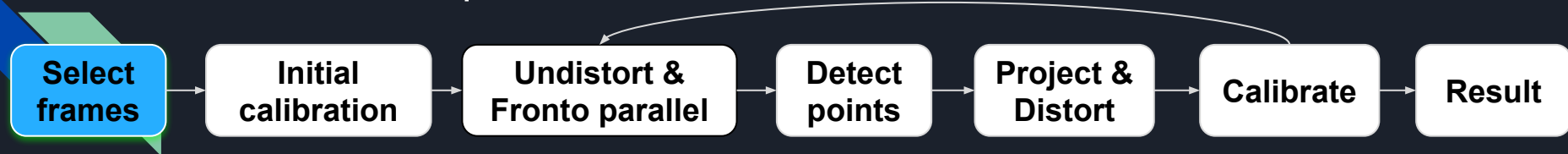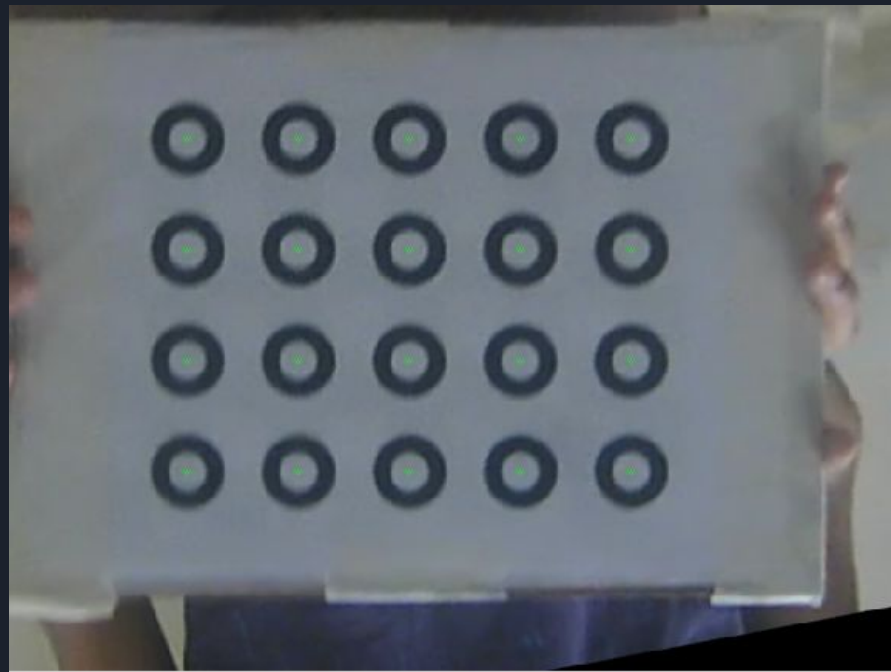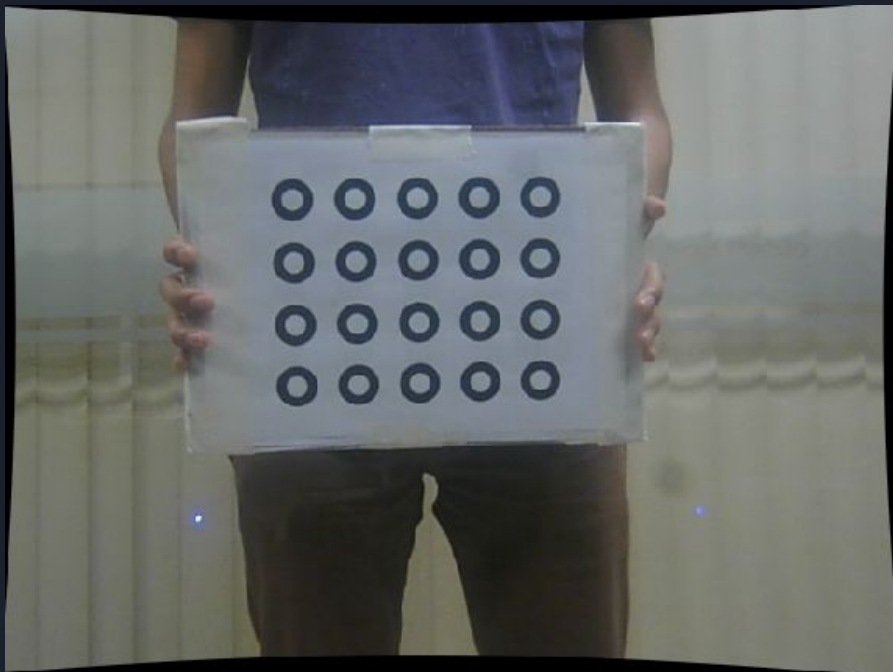
Authors:
Raúl Romaní Flores
Paul Alonzo Quio Añamuro

Iterative process for camera calibration

```
Select          Initial              ┌─────────────────────┐
frames    →    calibration    →      │  Undistort &        │
                                     │  Fronto parallel ←──┐│
                                     │        ↓           ││
                                     │    Detect           ││
                                     │    points           ││
                                     │        ↓           ││
                                     │   Project &         ││
                                     │   Distort           ││
                                     │        ↓           ││
                                     │   Calibrate ────────┘│ →  Result
                                     └─────────────────────┘
```

Iterative process

Select frames → Initial calibration → Undistort & Fronto parallel → Detect points → Project & Distort → Calibrate → Result

Selected: 35/40

Iterative process

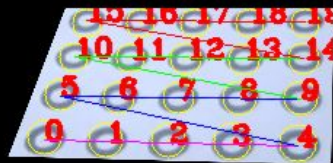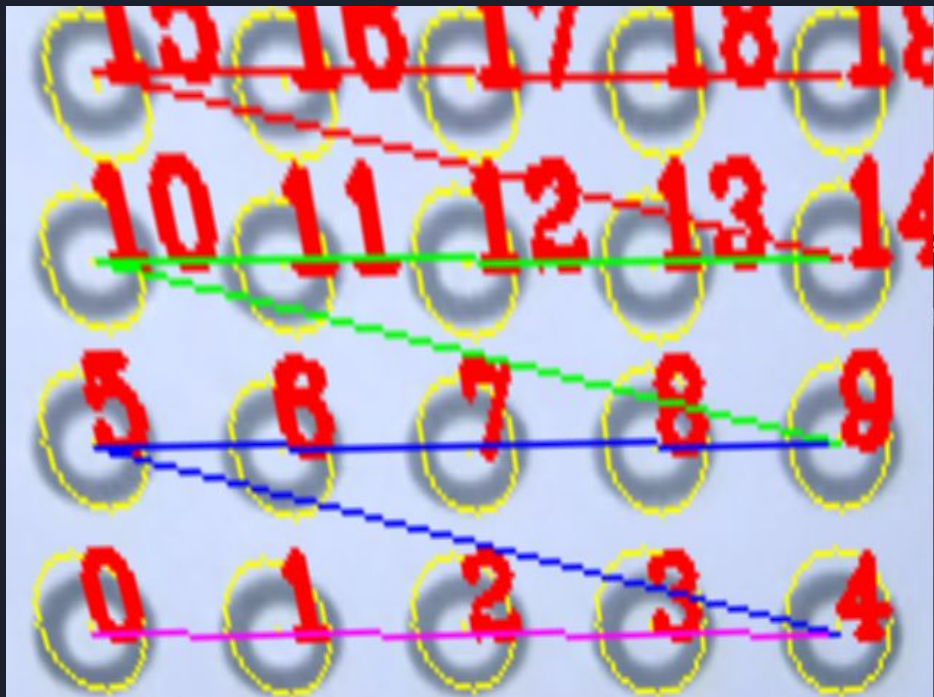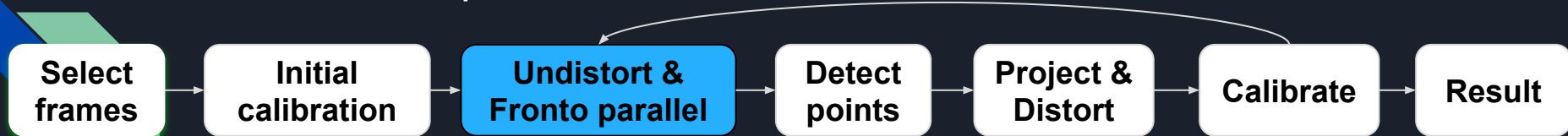Select frames → Initial calibration → **Undistort & Fronto parallel** → Detect points → Project & Distort → Calibrate → Result
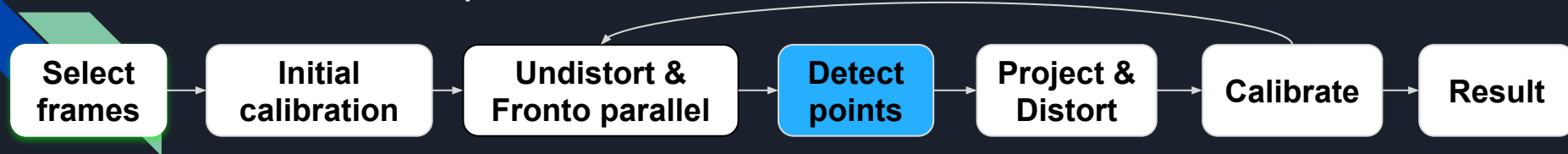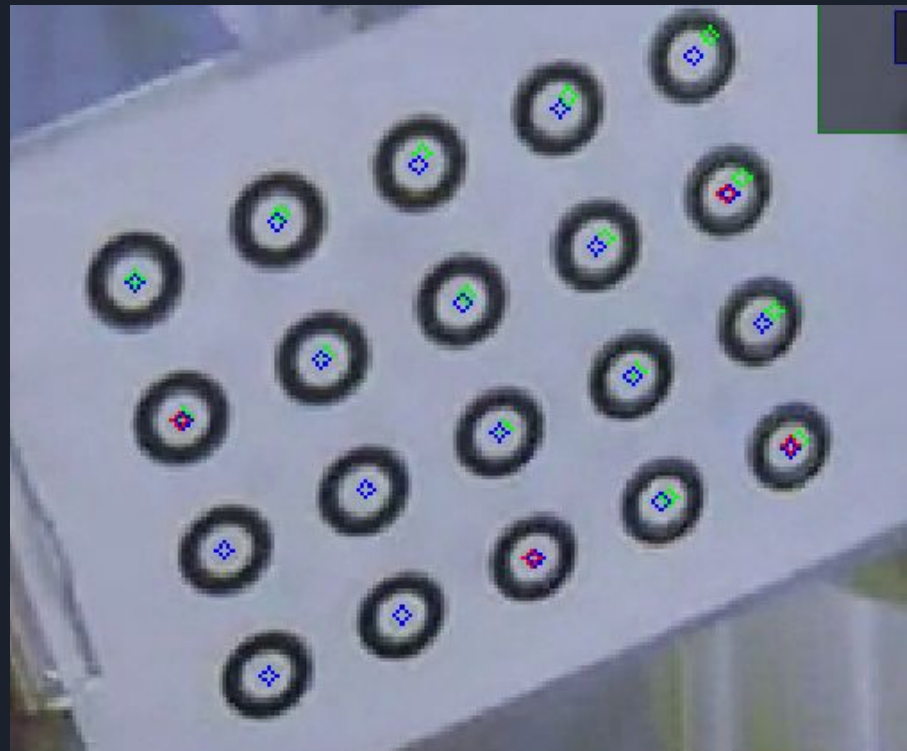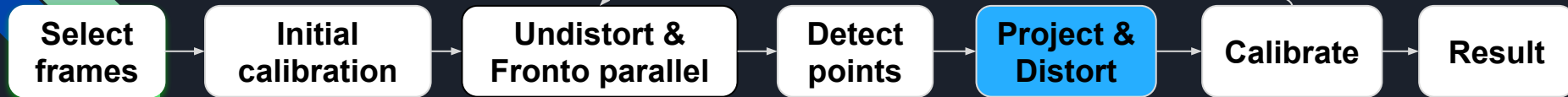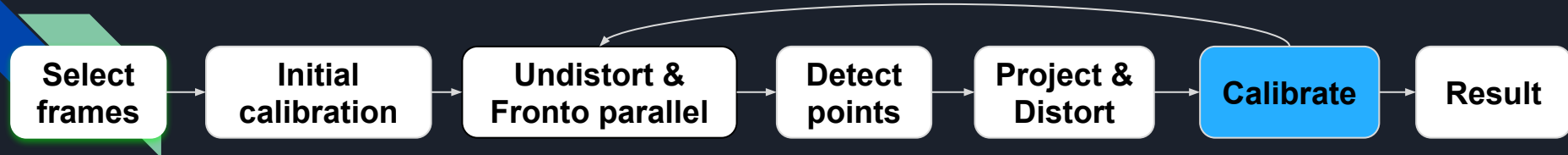
Iterative process

Iterative process
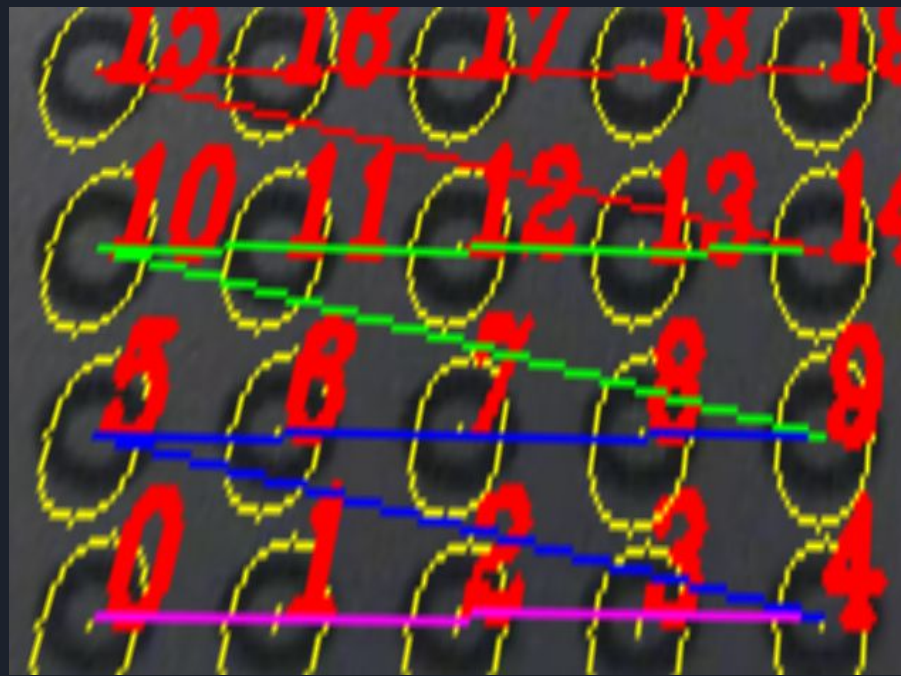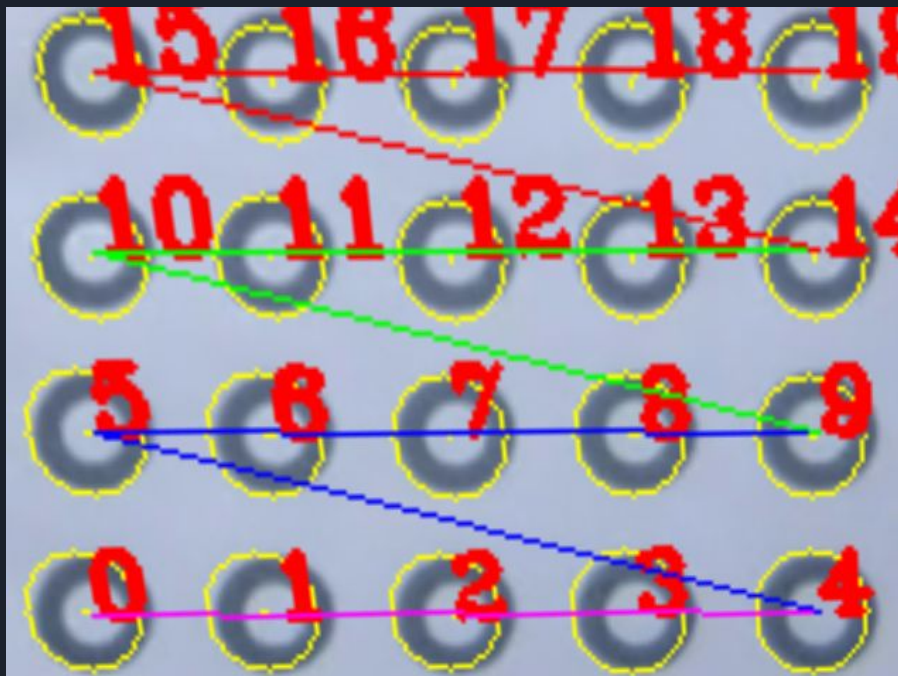
Select frames → Initial calibration → Undistort & Fronto parallel → Detect points → Project & Distort → Calibrate → Result

Iterative process

Select frames → Initial calibration → Undistort & Fronto parallel → Detect points → Project & Distort → Calibrate → Result

PS3

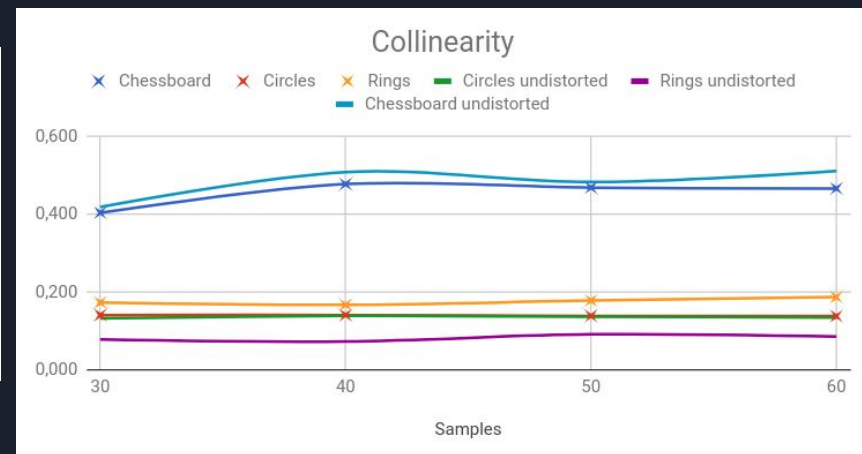Select frames → Initial calibration → Undistort & Fronto parallel → Detect points → Project & Distort → Calibrate → Result

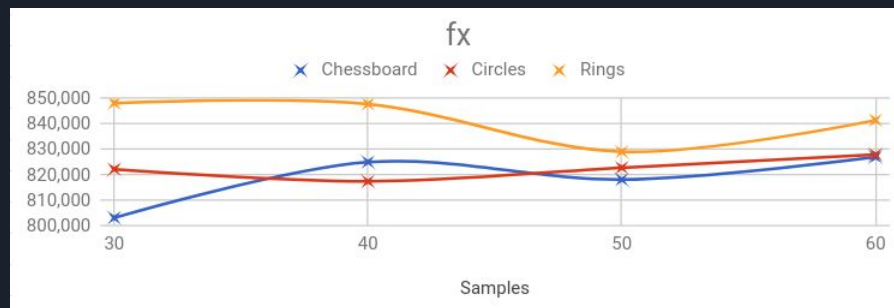|	Chessboard					Circles					Rings				
Samples	20	30	40	50	60	20	30	40	50	60	20	30	40	50	60
Rms	0,262	0,254	0,285	0,315	0,360	0,139	0,138	0,143	0,140	0,141	0,156	0,157	0,157	0,150	0,149
fx	603,680	598,587	614,062	589,908	608,175	622,187	627,543	611,911	616,490	597,534	561,505	565,586	563,842	568,962	568,983
fy	598,078	592,554	608,043	586,780	601,994	618,420	623,832	609,088	613,799	595,217	558,071	562,136	560,000	565,347	565,909
cx	341,020	338,831	336,989	334,041	335,024	332,034	332,372	331,953	331,686	332,058	320,645	318,235	320,239	324,489	323,410
cy	230,507	232,836	232,454	233,823	235,454	231,810	230,314	231,117	230,166	229,393	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

PS3

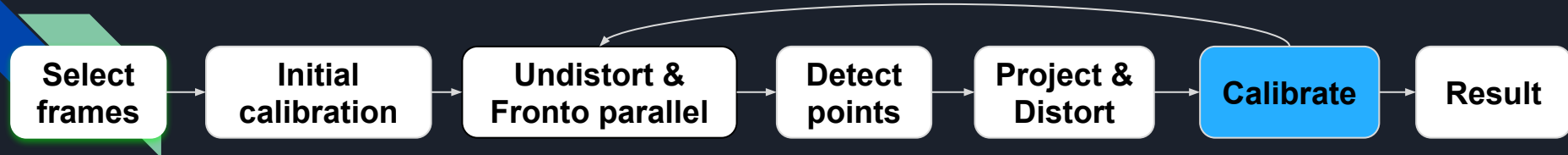Select frames → Initial calibration → Undistort & Fronto parallel → Detect points → Project & Distort → Calibrate → Result
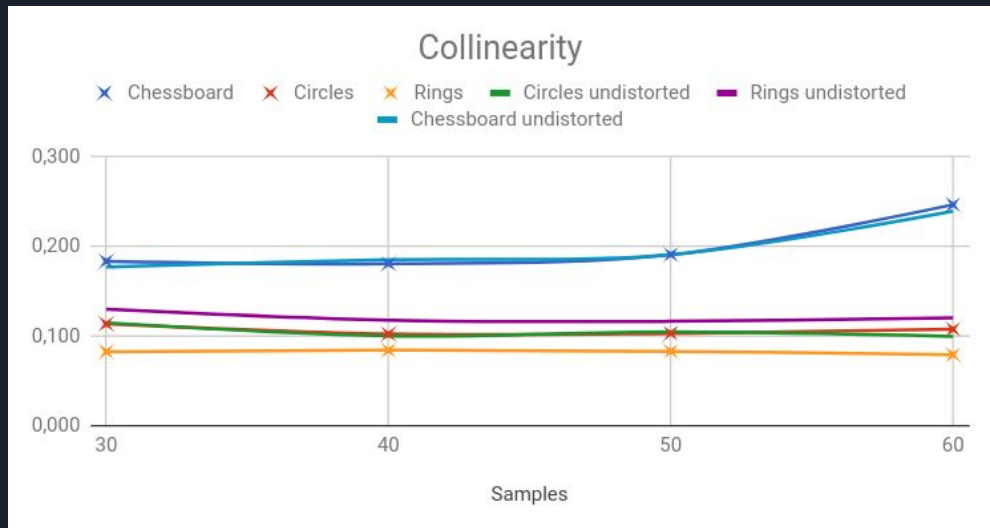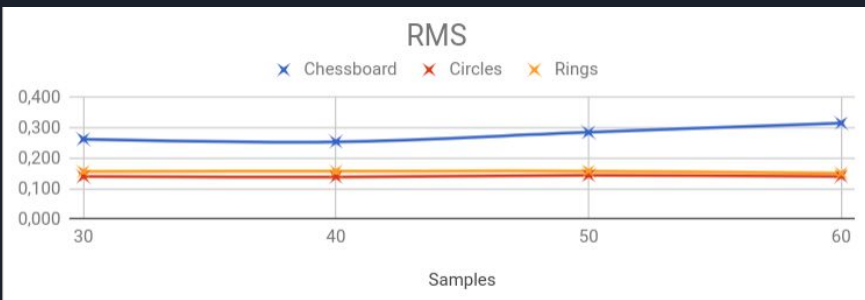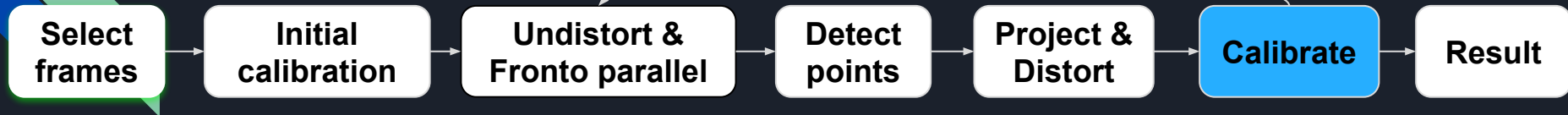
PS3

Lifecam

Select frames → Initial calibration → Undistort & Fronto parallel → Detect points → Project & Distort → **Calibrate** → Result

	Chessboard					Circles					Rings				
Samples	20	30	40	50	60	20	30	40	50	60	20	30	40	50	60
Rms	0,421	0,395	0,409	0,405	0,403	0,195	0,200	0,194	0,213	0,218	0,224	0,265	0,255	0,264	0,260
fx	803,207	825,080	818,227	827,063	837,876	822,269	817,519	822,858	828,038	822,269	848,202	847,880	829,118	841,530	832,514
fy	794,491	815,203	808,314	817,174	826,528	816,662	811,107	815,924	817,858	813,552	842,190	840,456	826,297	836,341	827,218
cx	345,217	321,290	329,525	347,541	334,064	294,508	298,843	306,098	331,563	320,350	325,649	331,315	307,625	299,637	303,603
cy	268,313	263,757	269,007	278,261	259,409	280,811	273,740	269,710	280,456	277,338	247,831	247,318	229,413	248,058	250,308
Collinearity	0,404	0,478	0,469	0,467	0,451	0,140	0,140	0,138	0,138	0,137	0,173	0,167	0,178	0,187	0,198
Collinearity undistorted	0,419	0,509	0,483	0,512	0,477	0,132	0,139	0,136	0,134	0,136	0,077	0,072	0,090	0,085	0,082

Lifecam

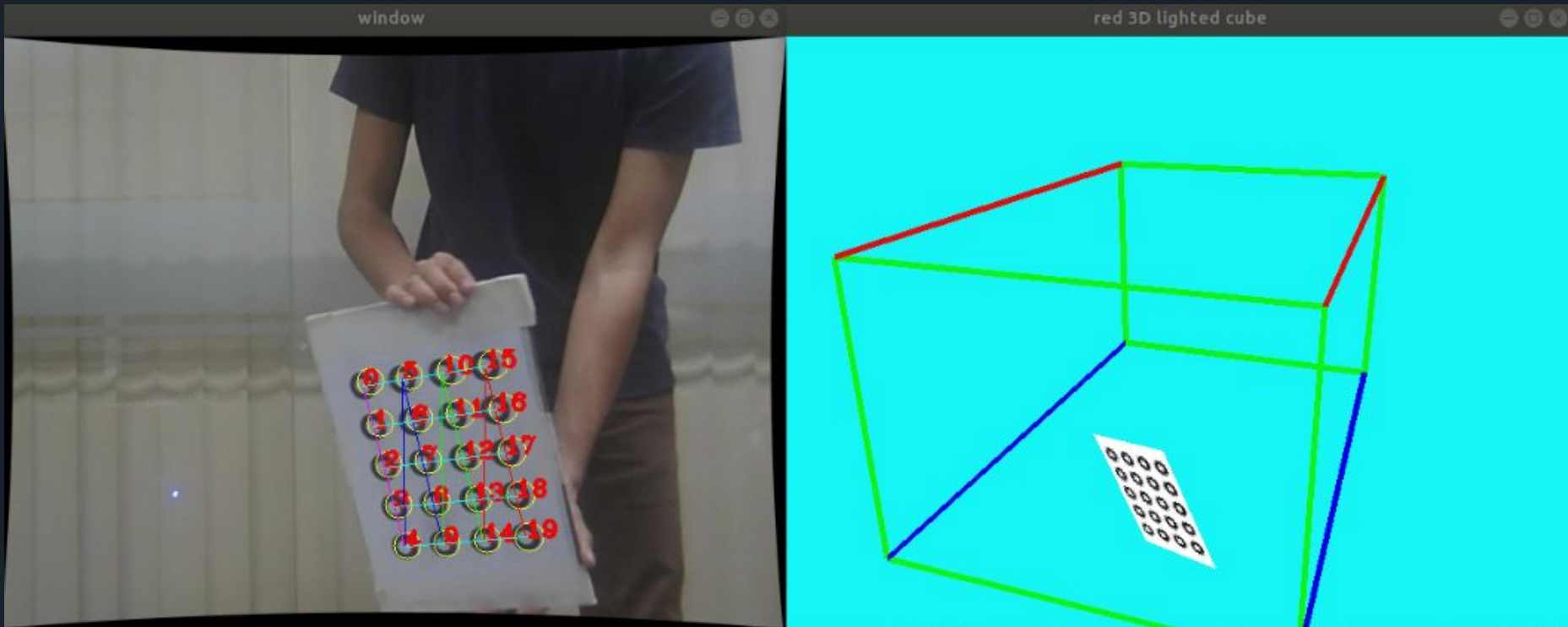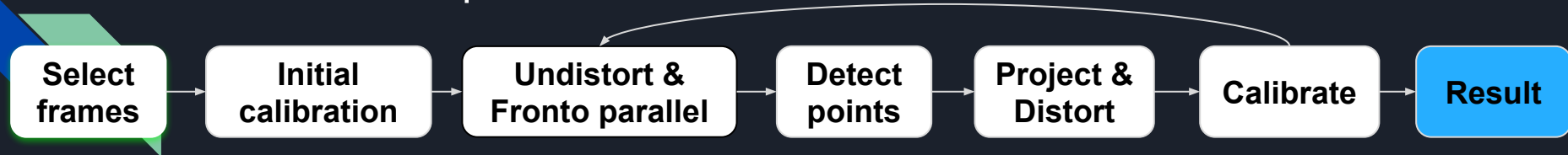Select frames → Initial calibration → Undistort & Fronto parallel → Detect points → Project & Distort → Calibrate → Result
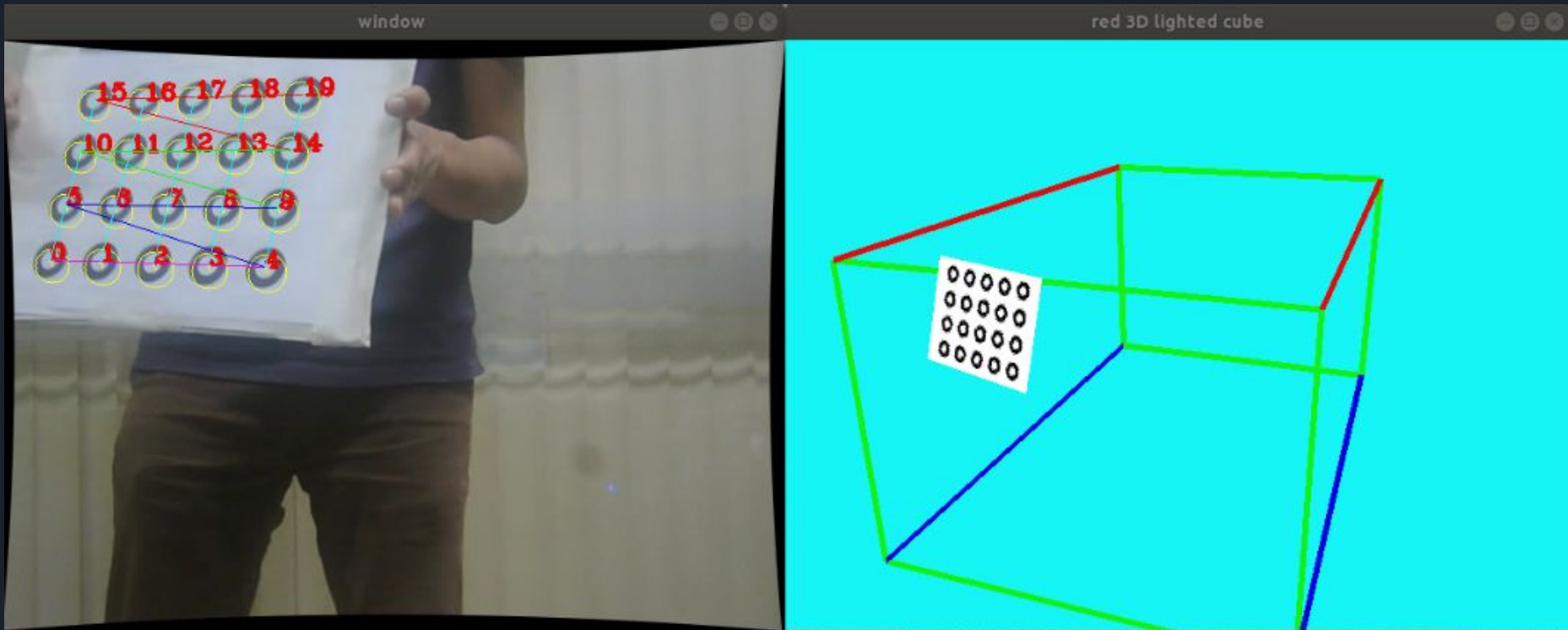

RMS

Collinearity

Lifecam

Select frames → Initial calibration → Undistort & Fronto parallel → Detect points → Project & Distort → Calibrate → Result

Iterative process

Select frames → **Initial calibration** → **Undistort & Fronto parallel** → **Detect points** → **Project & Distort** → **Calibrate** → **Result**

Iterative process

Select frames → Initial calibration → Undistort & Fronto parallel → Detect points → Project & Distort → Calibrate → Result
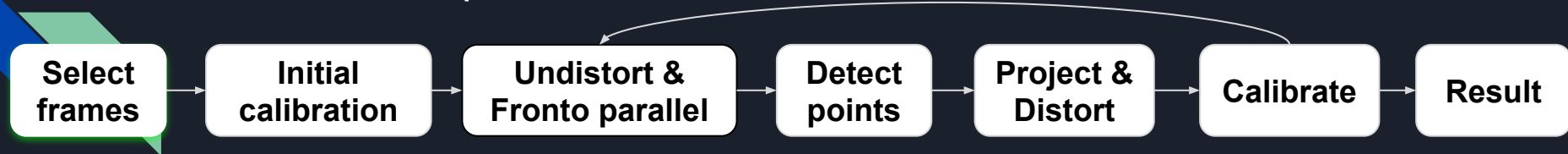
Thank you