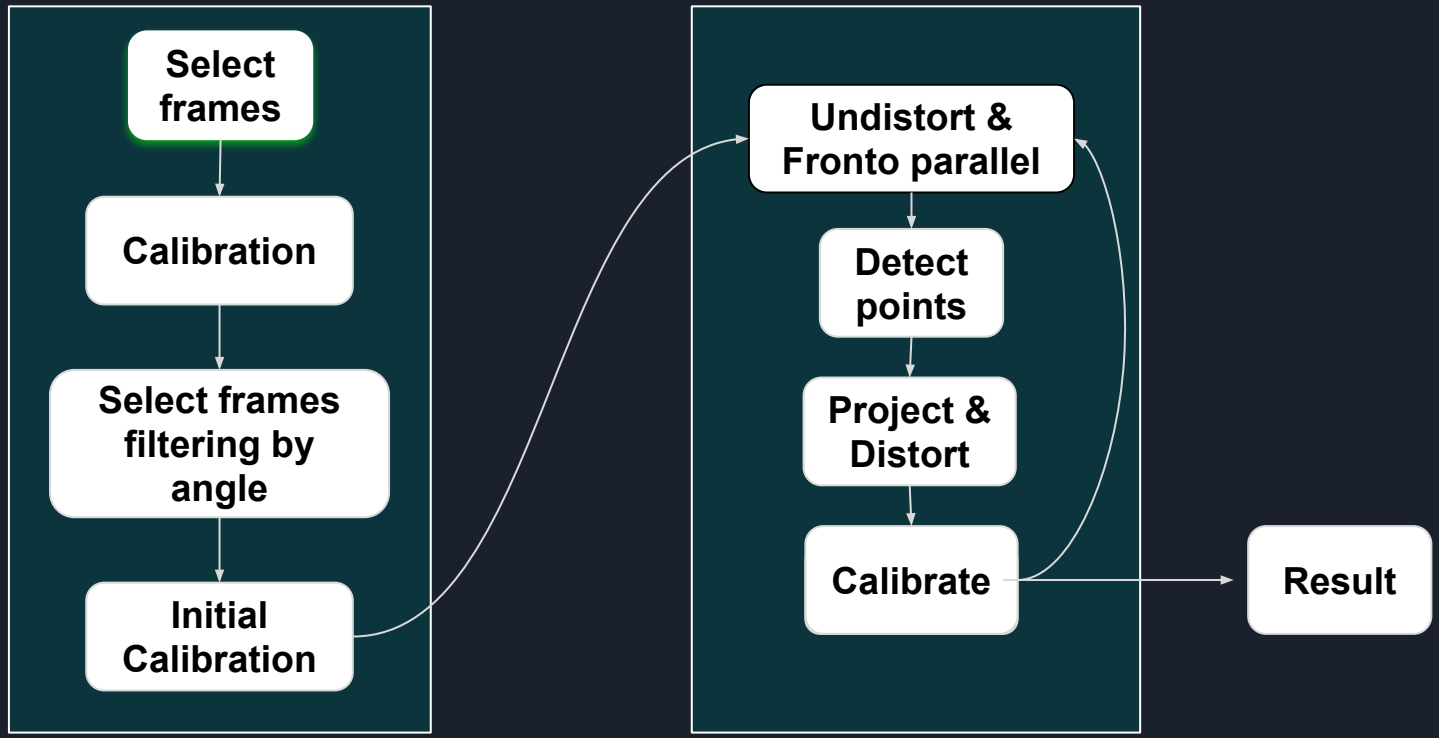
Implementation: Accurate Camera Calibration using Iterative Refinement of Control Points

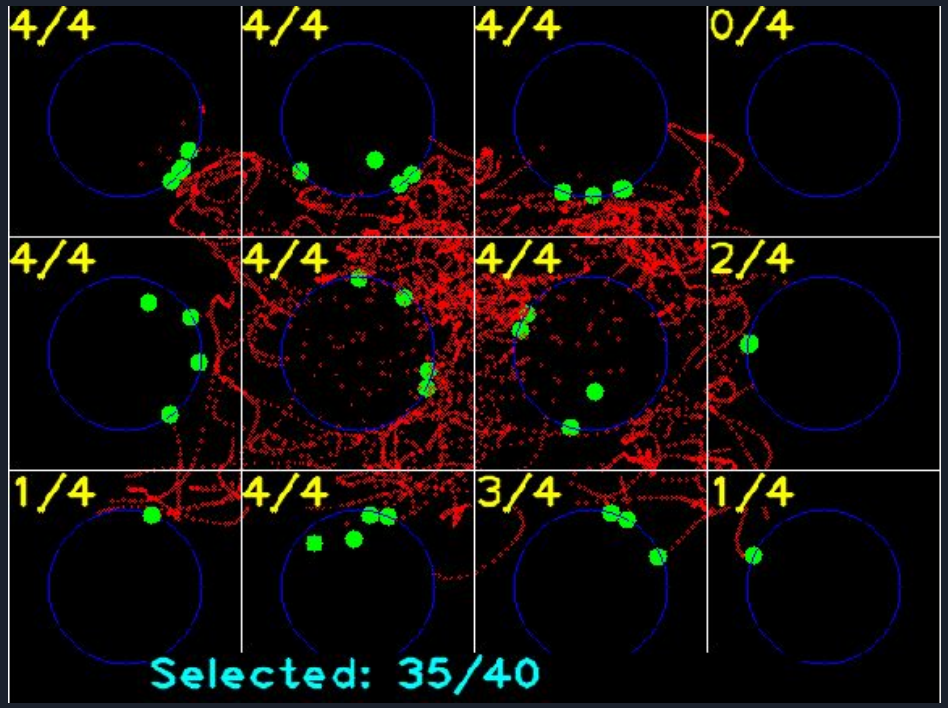
Authors:
Raúl Romaní Flores
Paul Alonzo Quio Añamuro
Jose Jaita Aguilar

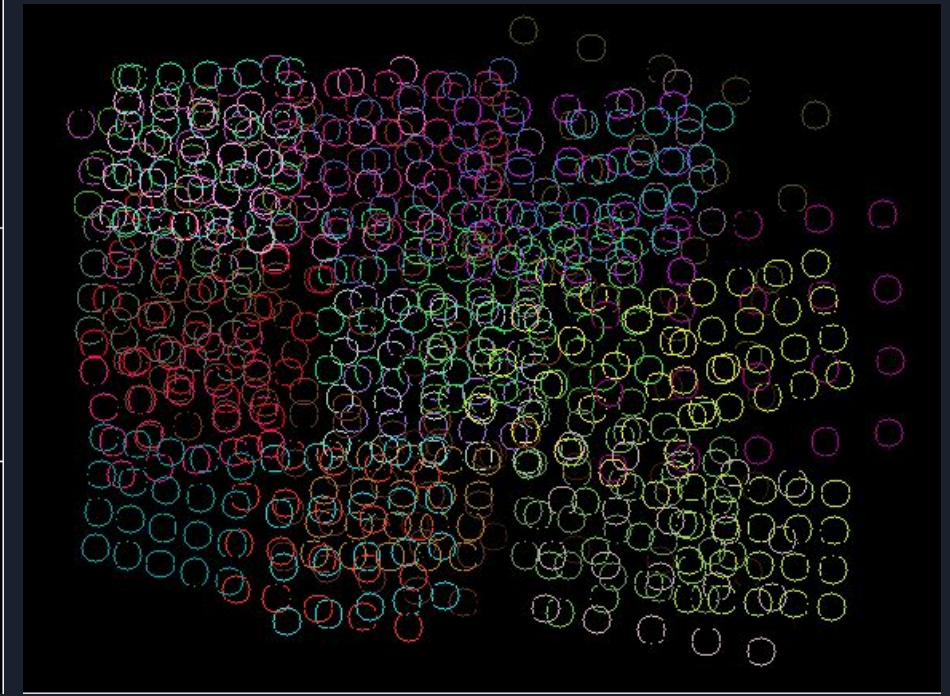
Iterative process for camera calibration



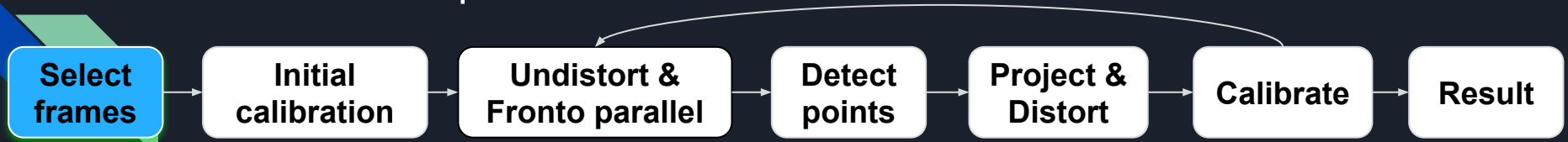
Iterative process

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





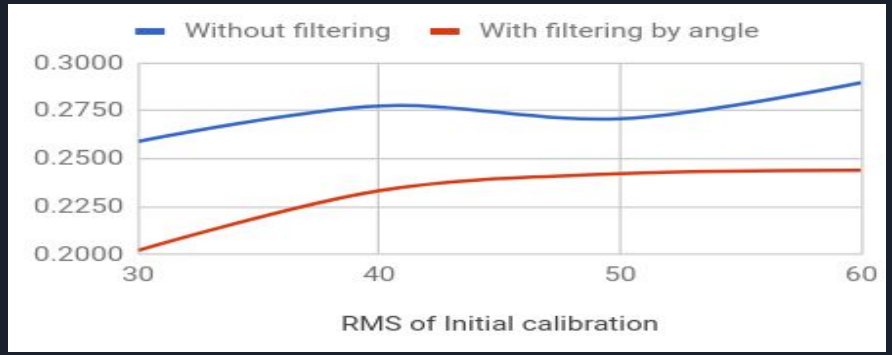
Iterative process

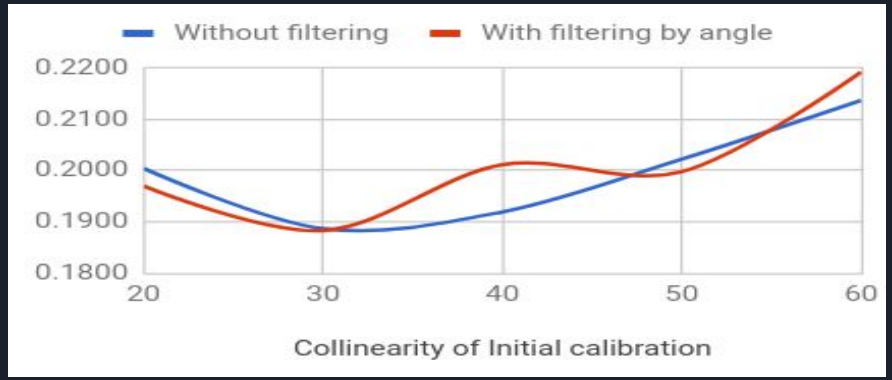


Filter by angle

Initial calibration					
RMS/Samples	20	30	40	50	60
Without filtering	0.2590	0.2776	0.2709	0.2898	0.2890
With filtering by angle	0.2020	0.2333	0.2421	0.2439	0.2684

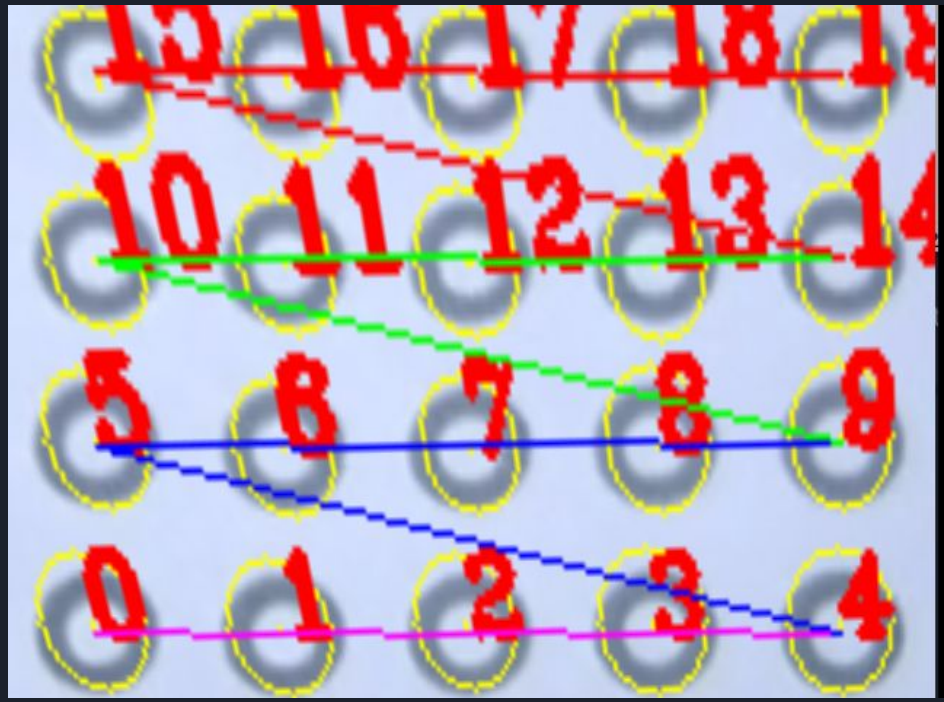
Initial calibration					
Collinearity/Samples	20	30	40	50	60
Without filtering	0.2004	0.1886	0.1919	0.2021	0.2136
With filtering by angle	0.1969	0.1883	0.2011	0.1997	0.2191



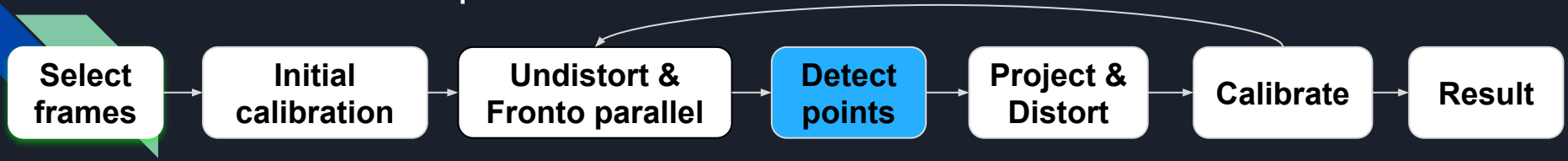


Iterative process

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



Iterative process

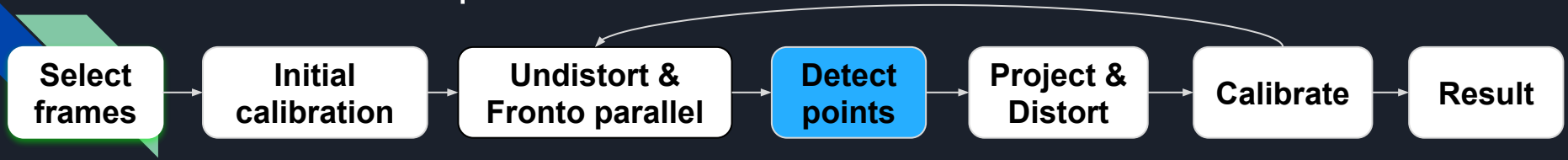


1.- fitEllipse

2.- Center of mass

	Rings - Average					Rings - Center of mass				
Samples	**20**	**30**	**40**	**50**	**60**	**20**	**30**	**40**	**50**	**60**
Rms	0.194	0.190	0.234	0.219	0.251	0.193	0.189	0.234	0.227	0.250
fx	844.143	832.426	823.290	819.639	811.885	844.570	829.719	823.771	799.462	812.651
fy	838.616	826.569	818.583	813.977	807.060	838.924	824.023	819.144	796.585	807.890
cx	328.923	311.706	304.667	299.790	298.915	329.150	312.364	305.356	294.199	298.840
cy	241.277	237.382	244.639	259.618	259.824	241.039	237.254	243.683	255.140	260.558
Collinearity	0.197	0.188	0.201	0.200	0.219	0.197	0.188	0.201	0.207	0.216
Collinearity undistorted	0.073	0.078	0.079	0.088	0.089	0.075	0.073	0.076	0.086	0.087

Iterative process



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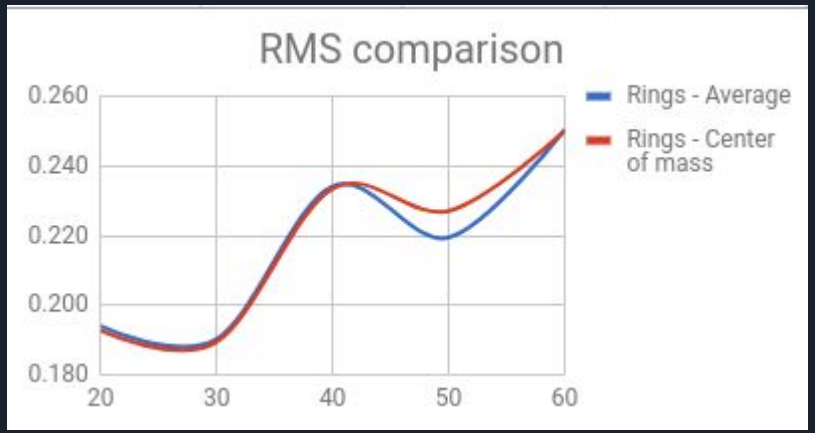
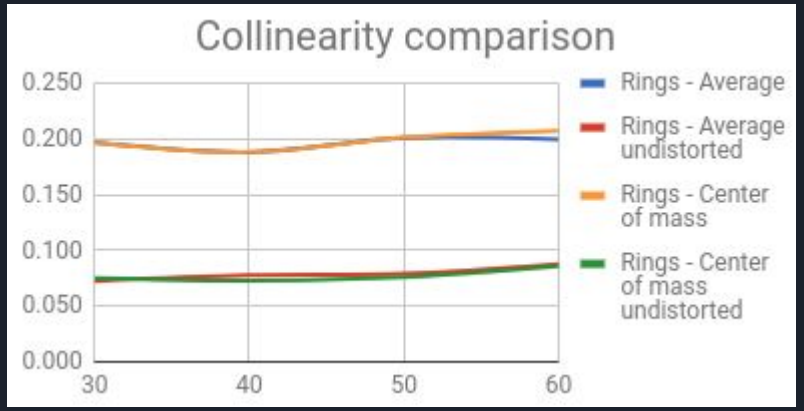
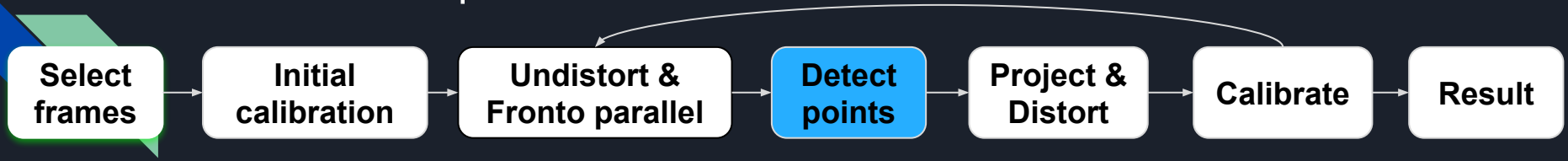
2.- Center of mass





Iterative process



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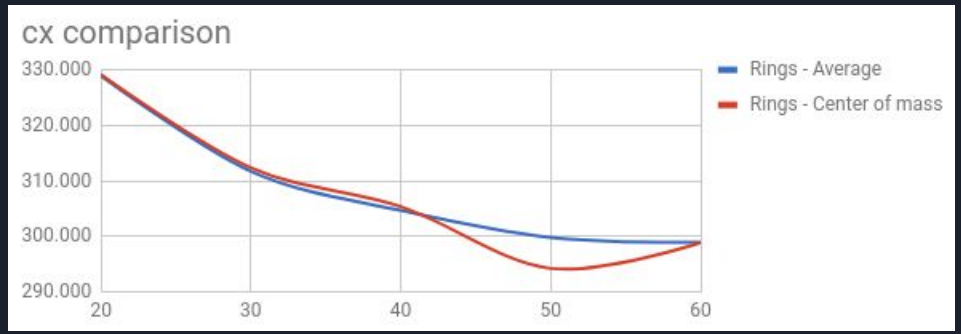

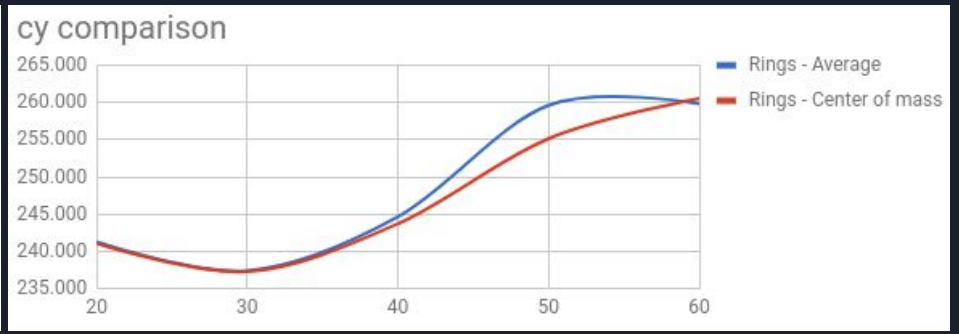

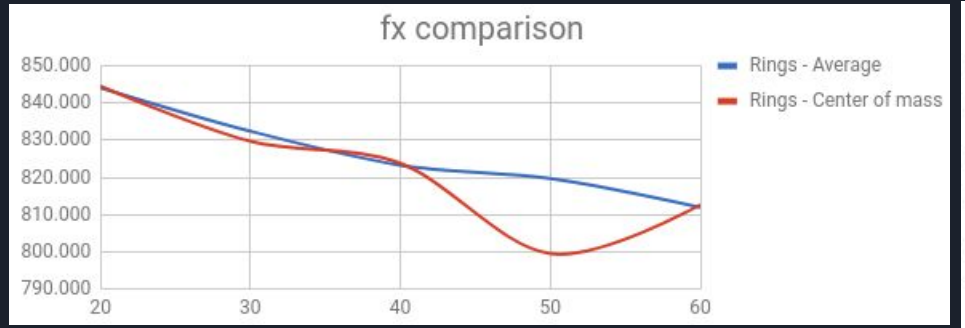

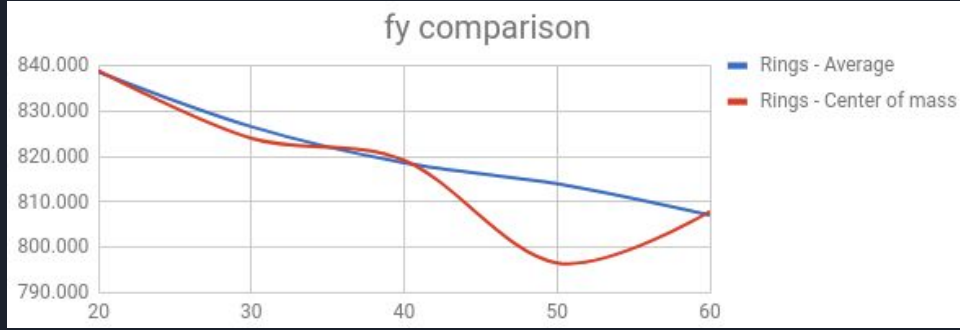

Iterative process

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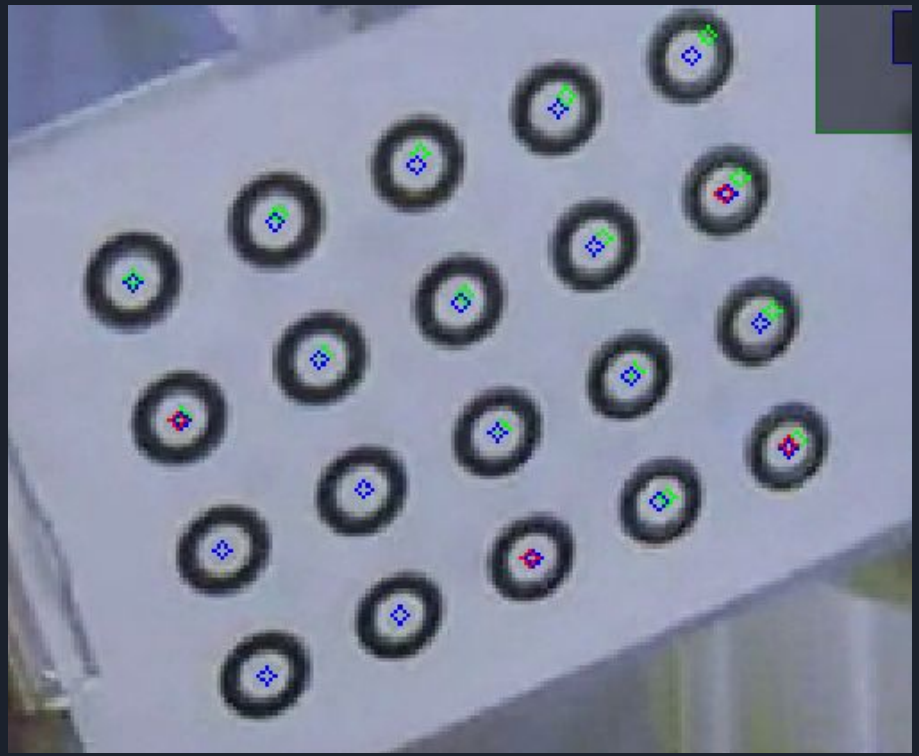
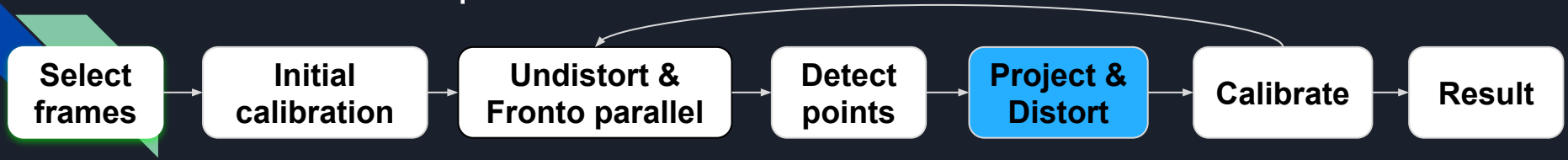


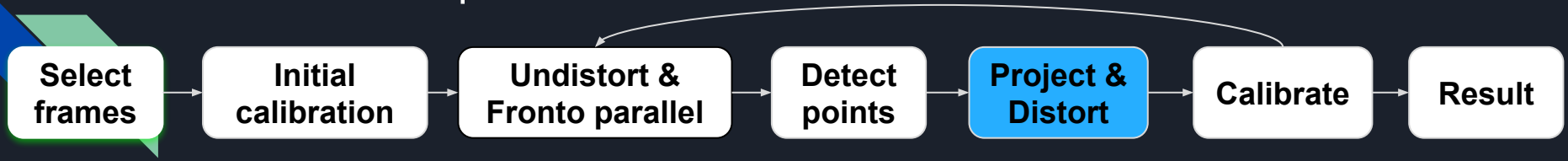
Iterative process



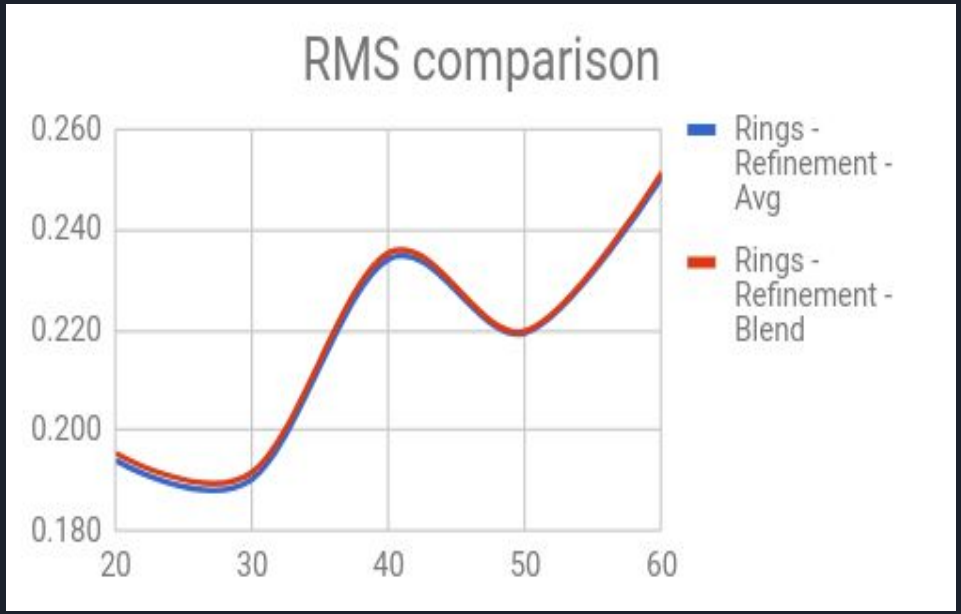
Refinement comparison

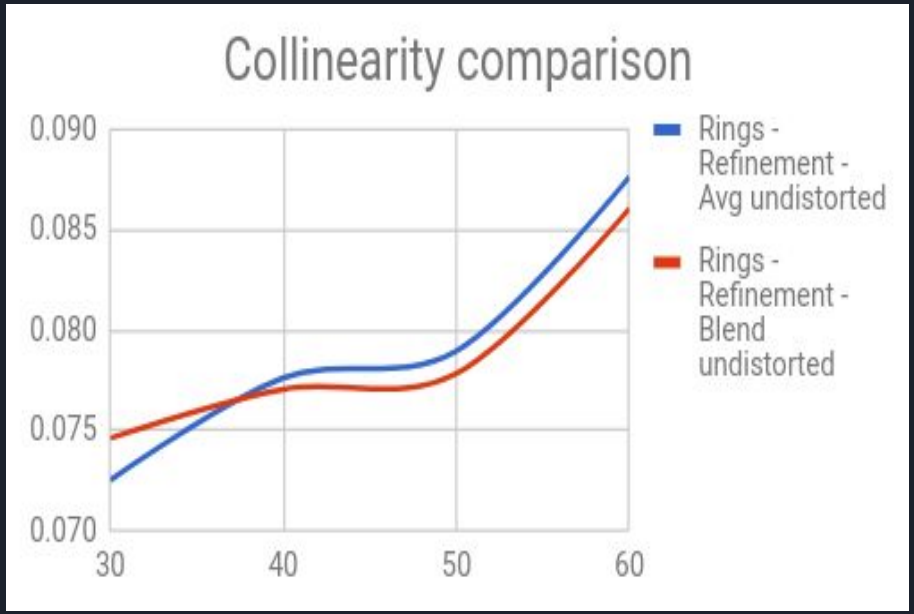
	Rings - Refinement - Avg					Rings - Refinement - Blend				
Samples	**20**	**30**	**40**	**50**	**60**	**20**	**30**	**40**	**50**	**60**
Rms	0.194	0.190	0.234	0.219	0.251	0.195	0.192	0.235	0.220	0.251
fx	844.143	832.426	823.290	819.639	811.885	845.748	829.826	823.726	819.288	812.192
fy	838.616	826.569	818.583	813.977	807.060	840.082	824.040	819.035	813.653	807.466
cx	328.923	311.706	304.667	299.790	298.915	329.338	312.016	304.019	299.733	298.165
cy	241.277	237.382	244.639	259.618	259.824	241.683	238.191	244.391	259.171	259.310
Collinearity	0.197	0.188	0.201	0.200	0.219	0.197	0.188	0.201	0.200	0.219
Collinearity undistorted	0.073	0.078	0.079	0.088	0.089	0.075	0.077	0.078	0.086	0.089

Iterative process

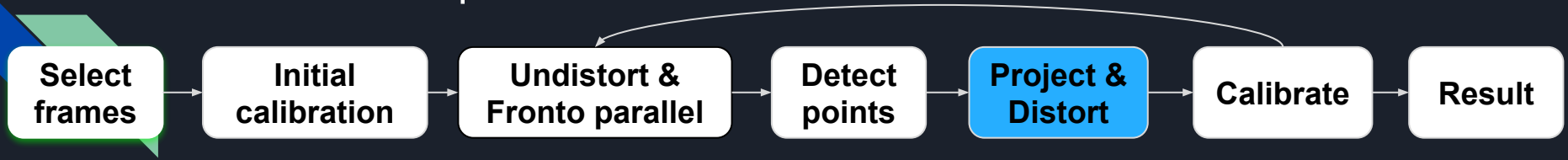


Refinement comparison





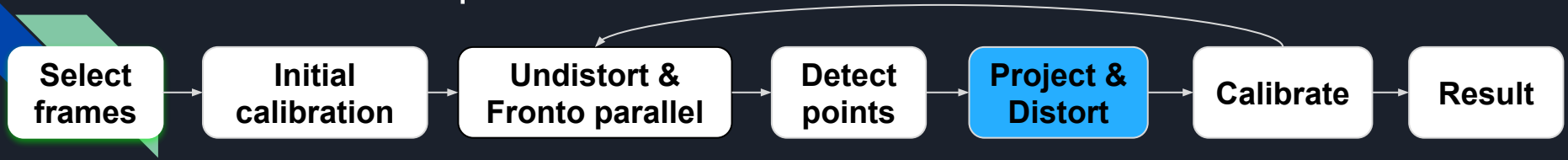
Iterative process



Refinement using ideal points

	Rings - Average					Rings - Center of mass				
Samples	**20**	**30**	**40**	**50**	**60**	**20**	**30**	**40**	**50**	**60**
Rms	0.144	0.146	0.200	0.192	0.194	0.173	0.170	0.206	0.205	0.208
fx	831.698	829.754	818.353	819.020	827.578	837.996	841.098	822.289	819.604	827.559
fy	826.859	823.600	813.559	813.132	821.988	833.216	835.851	818.738	816.035	822.820
cx	321.502	311.597	317.957	311.591	303.610	309.248	316.610	305.148	309.821	303.397
cy	257.509	247.419	252.088	254.260	254.331	246.846	248.250	231.453	233.980	245.119
Collinearity	0.190	0.184	0.191	0.189	0.200	0.191	0.184	0.186	0.185	0.198
Collinearity undistorted	0.083	0.077	0.083	0.082	0.089	0.069	0.070	0.081	0.083	0.078

Iterative process



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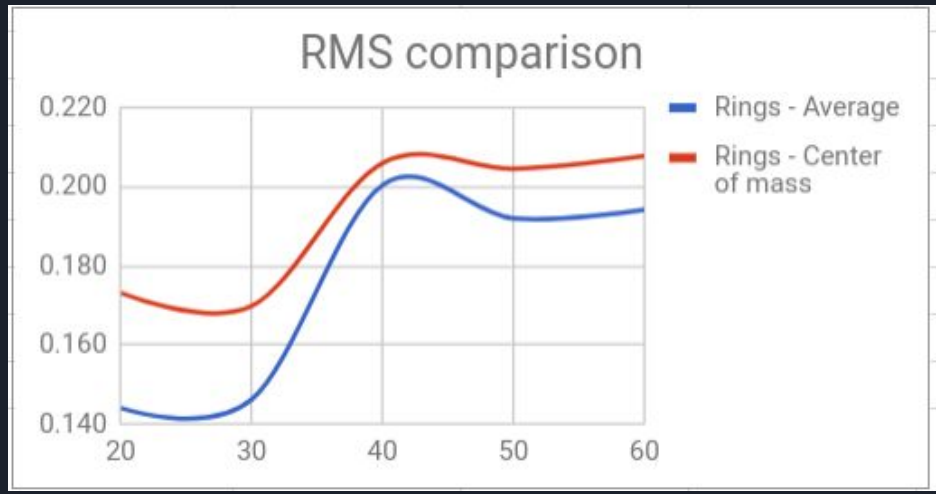
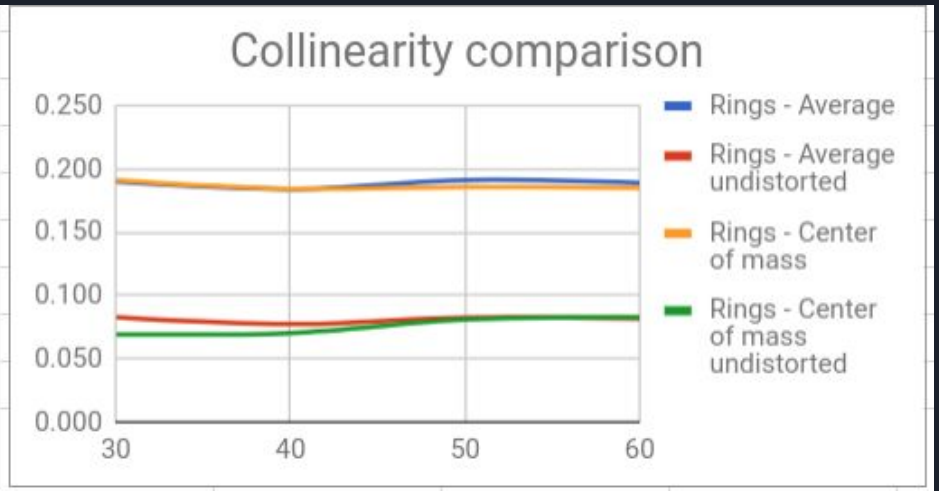
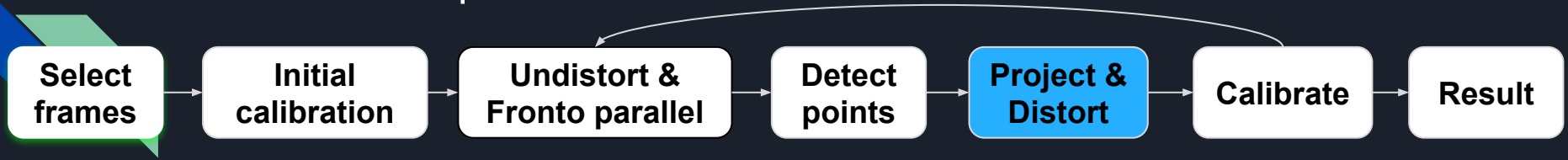




Iterative process



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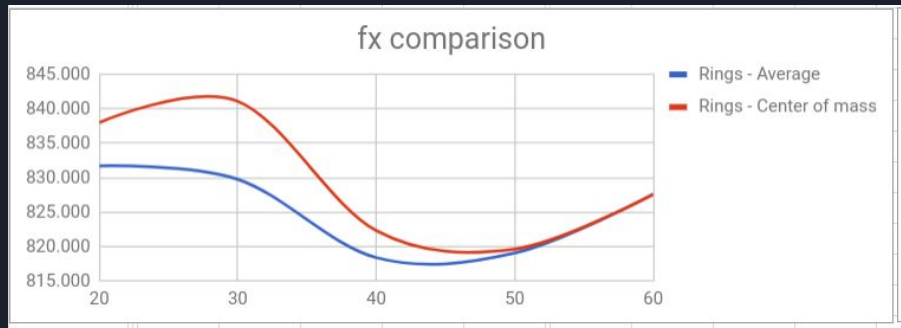

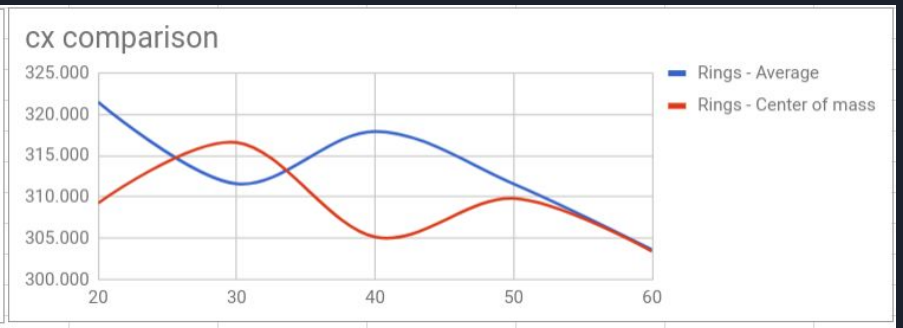

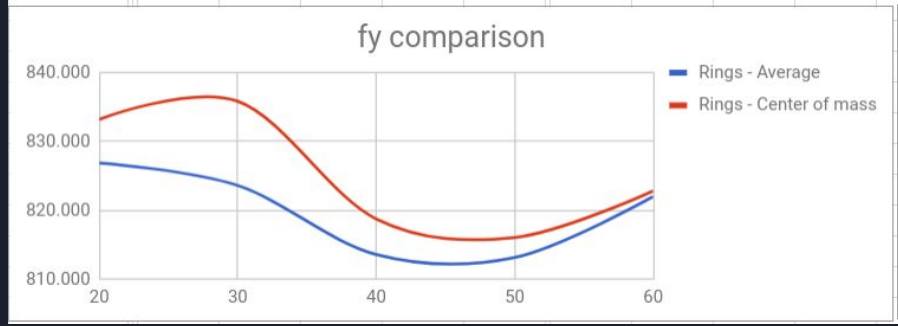

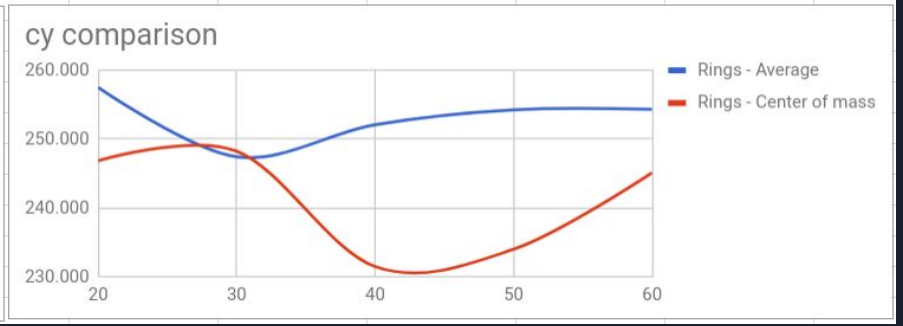

Iterative process

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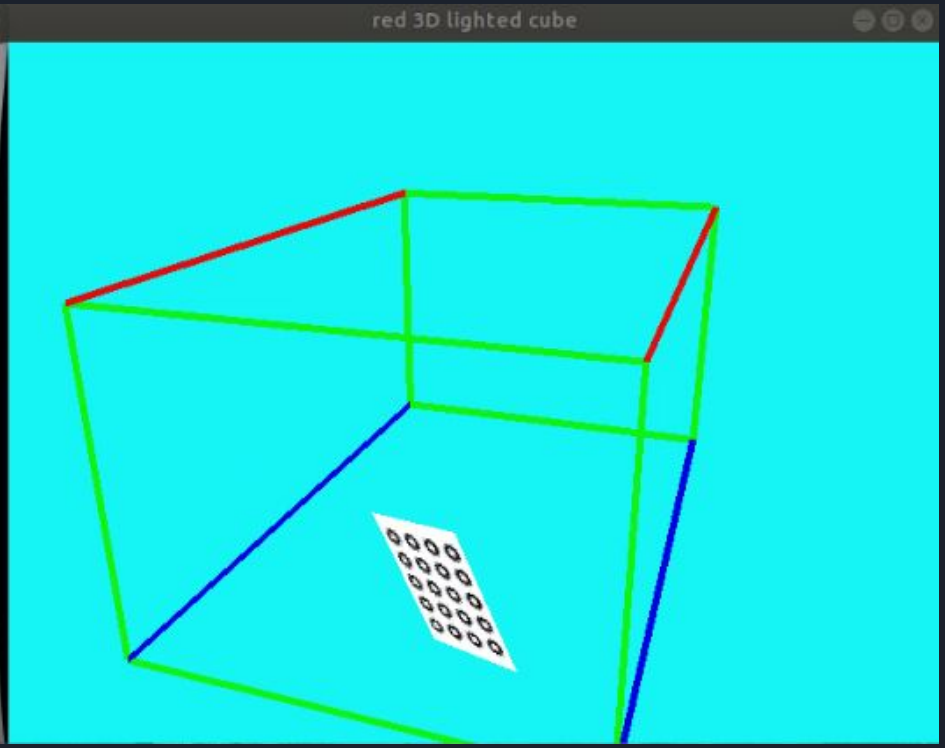

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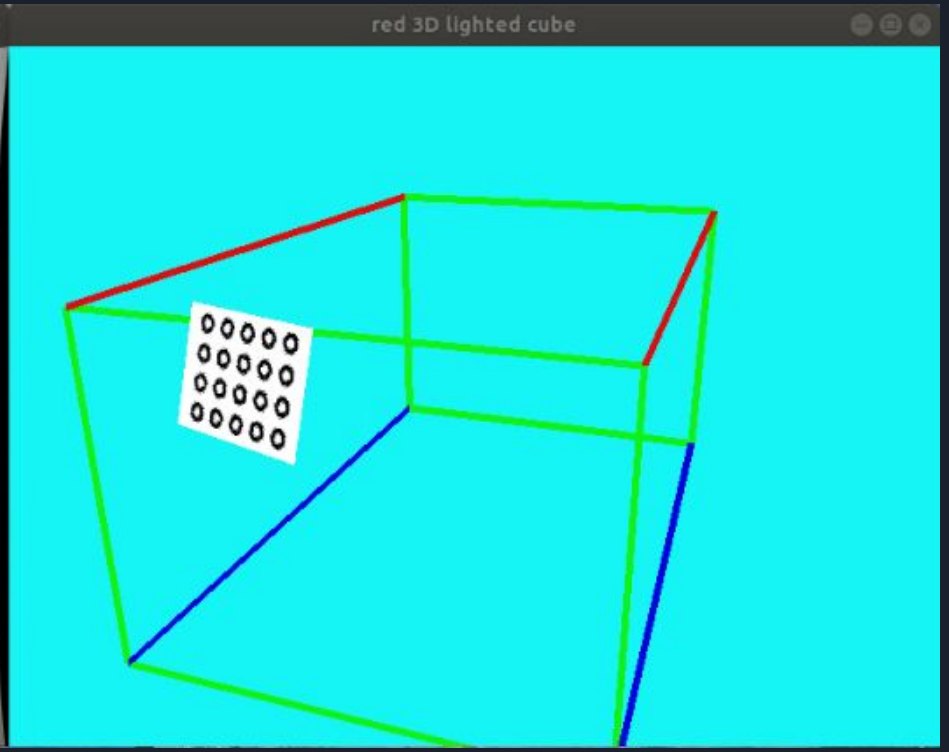

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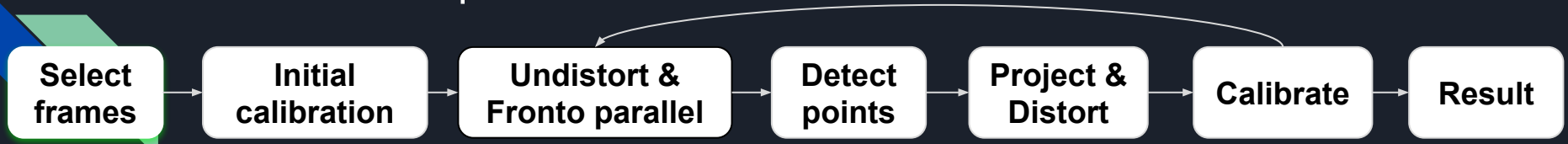

Thank you