

# Inertial sensors on the feet, rather than lumbar sensor only, increase sensitivity of spatio-temporal gait measures to longitudinal progression in ataxia

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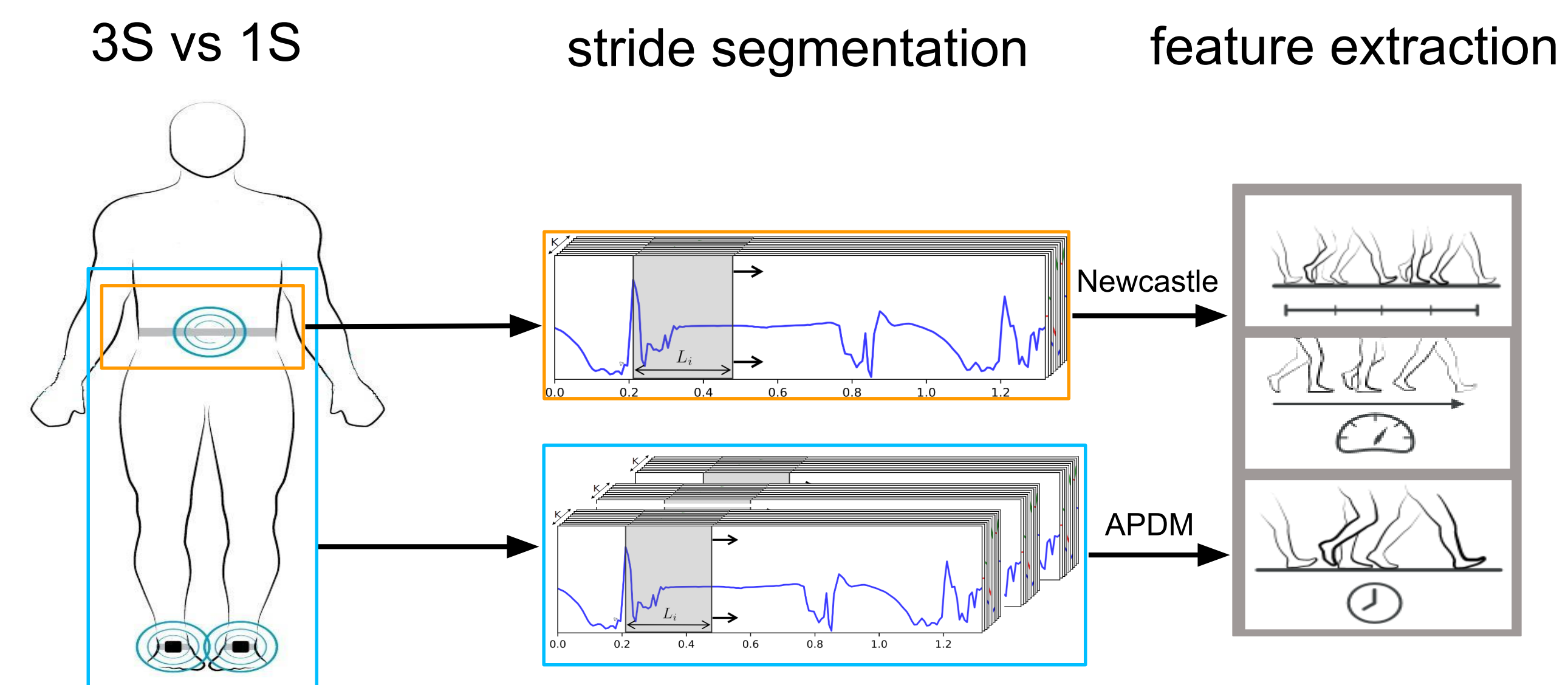
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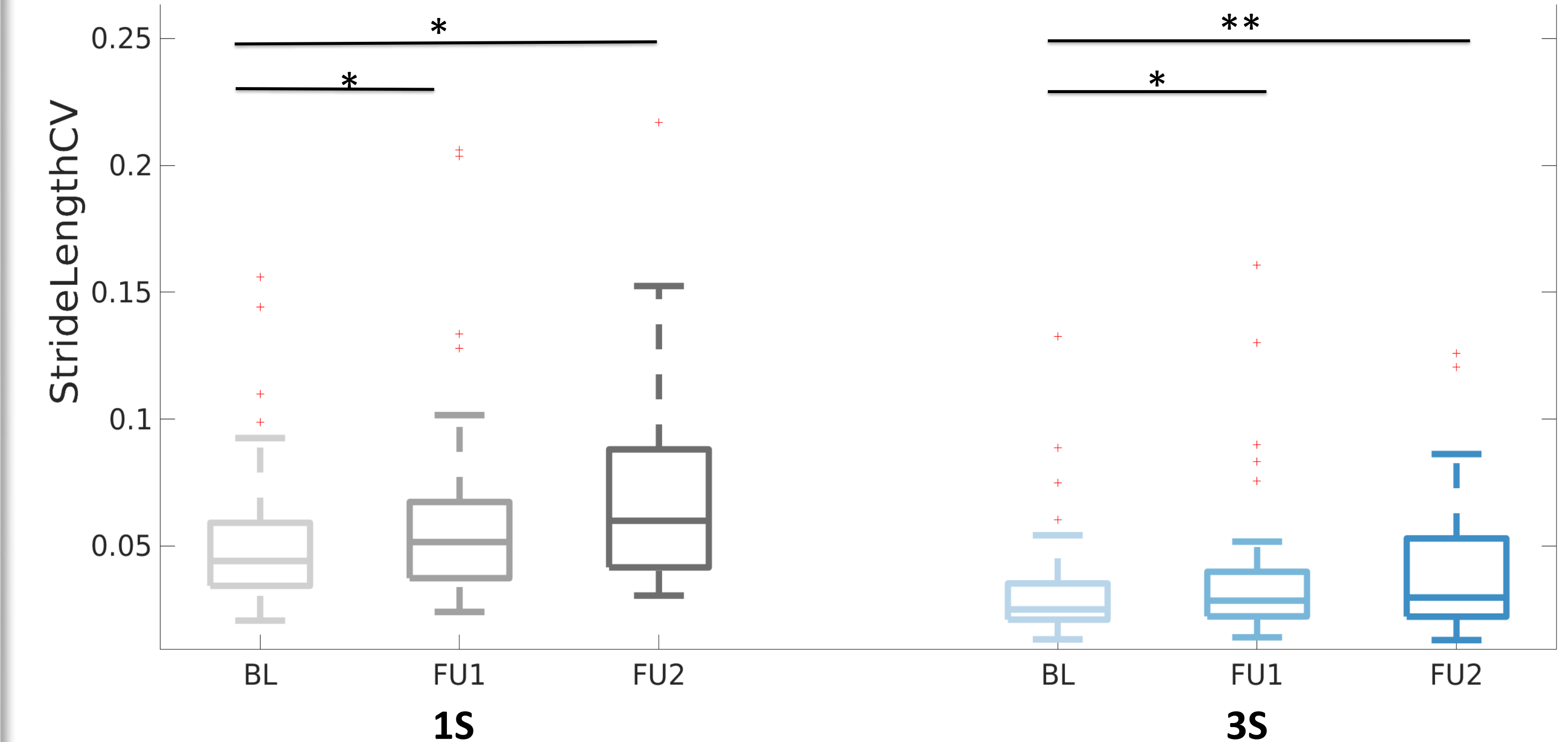
## Background

- With drugs on the horizon for spino-cerebellar ataxias, **motor biomarkers** capturing disease progression and treatment-response are highly needed.
- The **optimal number of inertial sensors** for gait analysis in multicentric clinical trials is a **trade-off** between data quality, costs, patient convenience and feasibility.
- Here, we compare specificity, reliability and longitudinal sensitivity of ataxic-specific gait variability assessed by **three sensors (3S) vs a single sensor (1S)**.
- **Aim:** unravel single-sensor based gait biomarkers that allow to quantify **individual progression within one year** for patients with degenerative cerebellar diseases (DCD).

## Single-sensor vs three sensors

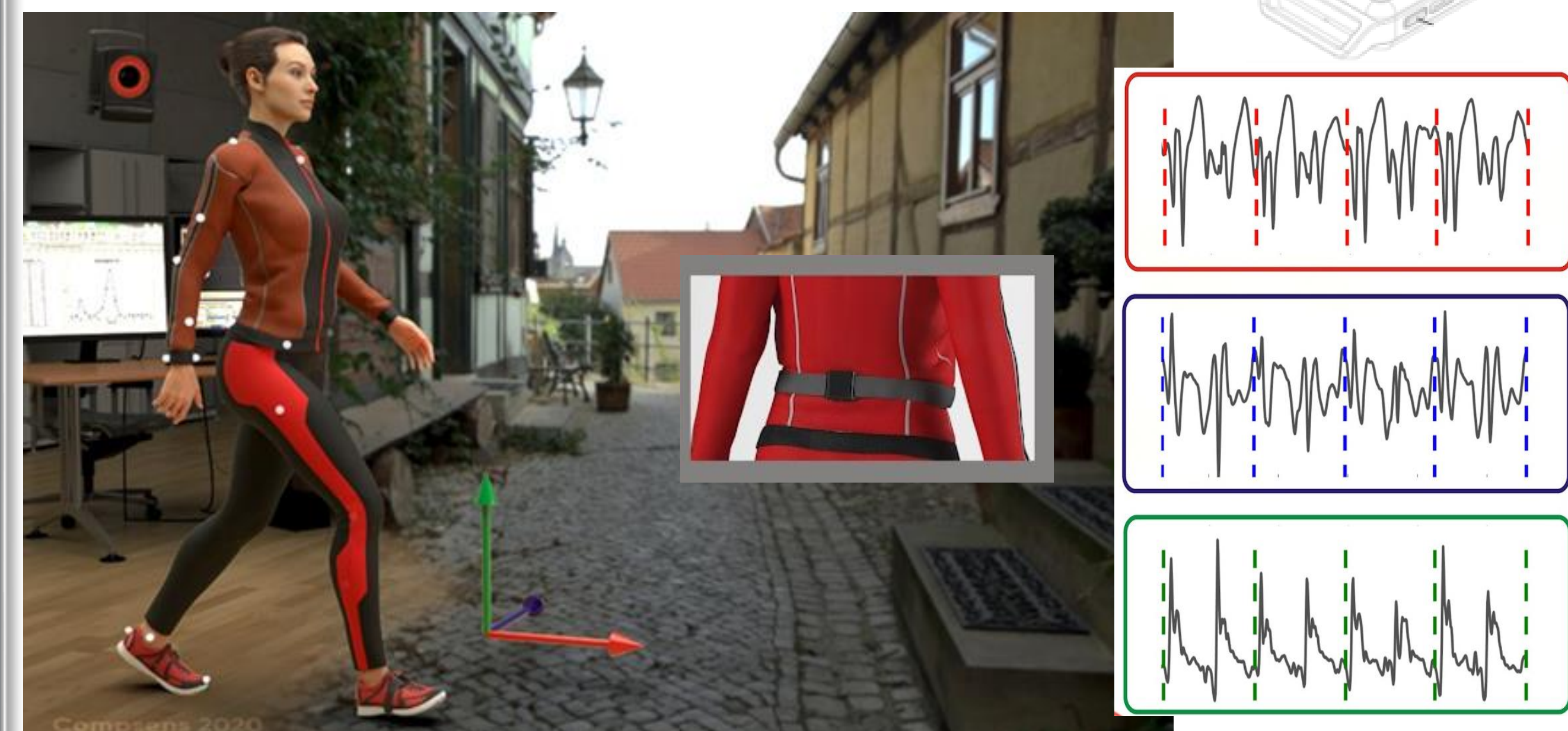


## Sensitivity to progression: 1-year & 2-years FU



Measure	DCD Condition	1-year FU p Δ BL-FU1	effect size	2-years FU p Δ BL-FU2	effect size	ICC
StrideL CV	1S	0.048*	-0.315	0.014*	-0.462	0.608
	3S	0.032*	-0.341	0.005**	-0.531	0.812
Gaitspeed	1S	0.206	0.202	0.079	0.331	0.910
	3S	0.082	0.277	0.006**	0.516	0.972
HRap	1S	0.112	-0.250	0.048*	-0.385	0.744
	3S	0.071	0.287	0.002**	0.579	0.904
SARA	Clinics	0.164	0.313	0.021*	0.714	
SARAgp	Clinics	0.097	0.463	0.023*	0.736	

## Clinical gait recordings



Subjects were recorded by three APDM Opals on feet and hip.

Condition	Description
Lab-Based Walking (LBW)	Subjects walk along 50m indoor corridor at preferred speed including one turn.

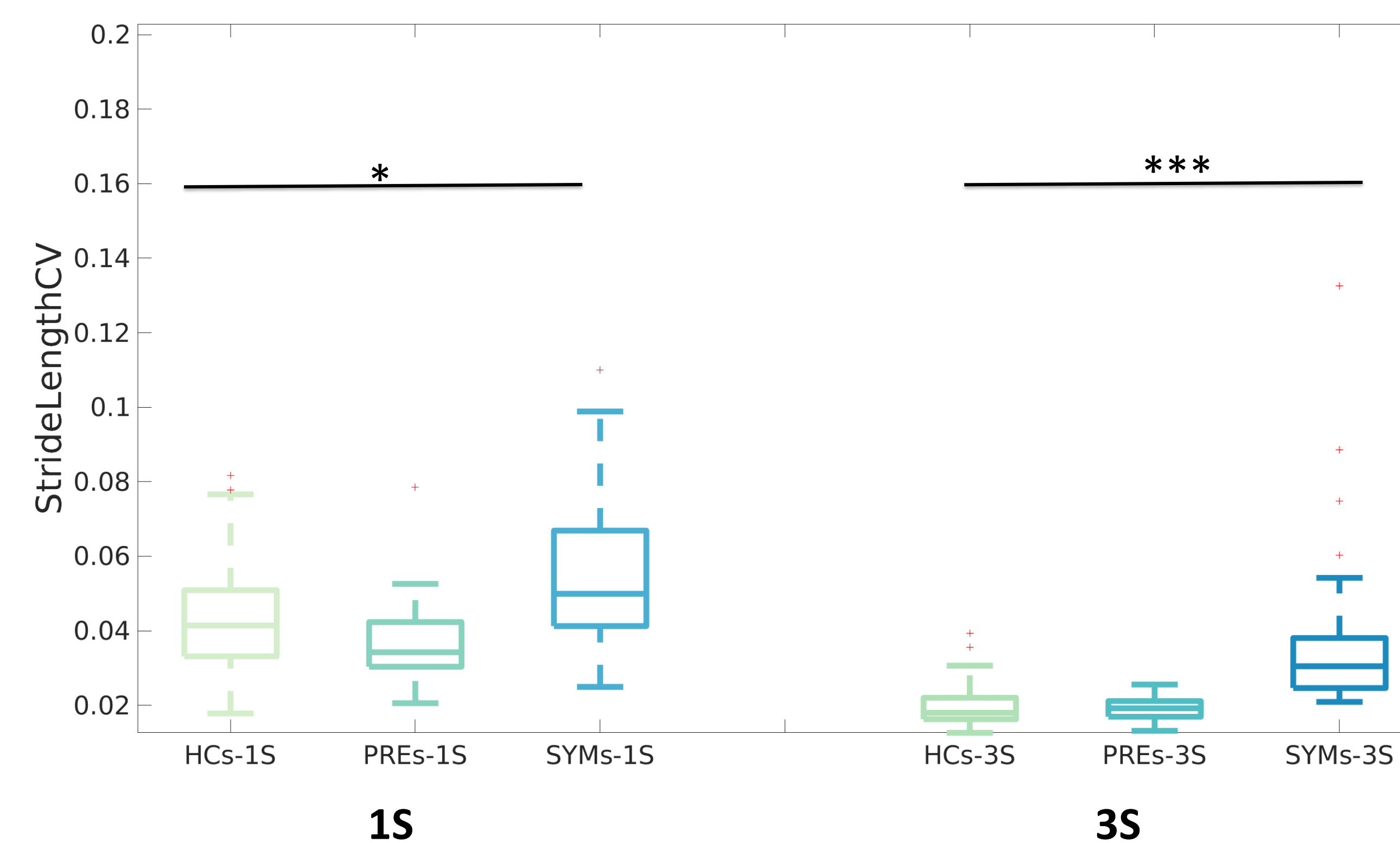
  

Groups	n	Age	SARA		SARAgp	
			BL	FU	BL	FU
HC	44	21	49±12			
DCD	55	38	6.7±5.1	7.2±5.5	2.2±2.3	2.4±2.2

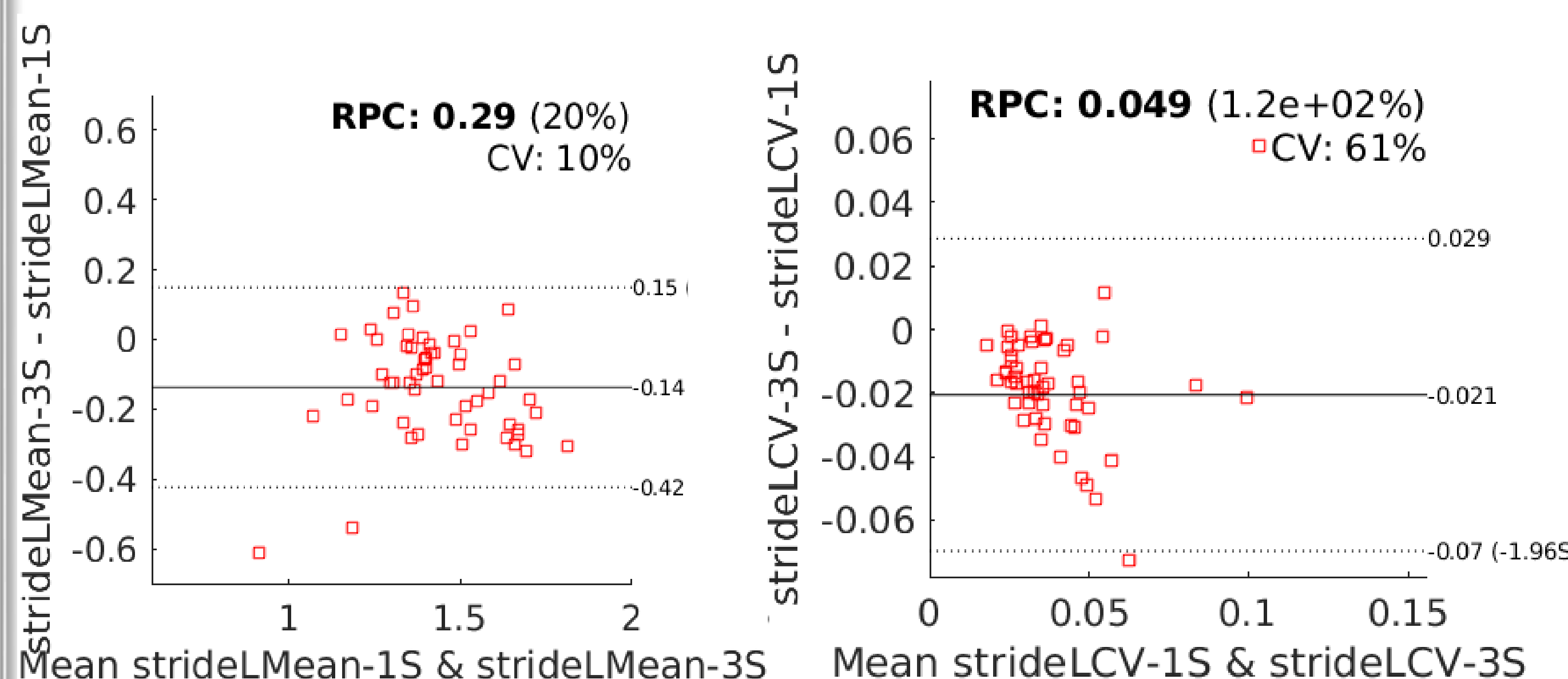
### Measures

- Stride length
- Stride duration
- Gait speed
- Harmonic ratio in AP
- Harmonic ratio in ML
- Harmonic ratio in V

## Group differences



## Reliability



## Conclusion:

- Higher selectivity between patients and healthy controls with three sensors compared to single sensor condition.
- Strong agreement between single and three sensor-based gait parameters for mean values, but not for variabilities.
- With one sensor as well as with three sensors we were able to detect individual progression after 1 year for patients with cerebellar ataxia! However, with three sensors the effect sizes as well as the ICCs are higher.

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