ERTS 2015

Engineering Rig Test Services (ERTS DW)

Dahlewitz, Brandenburg

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Low Speed Projectile Launcher

High precision low speed launching of artificial bird projectiles for rotating aerofoil impact testing – A new capability of the LSSF at RR-MTOC

Jörn Steglich,
24./25. Februar 2016

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Content

- Impact Testing
- Testing so far
- The Large Specialist Spinning Facility (LSSF)
- Design Concepts
- Selected Solution
- Achieved Accuracy / Tolerances
- Innovation
- Future

Low Speed Impact Testing

Drop chute with projectile in position

Projectile dropping towards impact position

Above 2 still images show impact

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Low Speed Impact Testing - Requirements

Projectile mass		1 – 8	lb
Projectile speed		3 – 10	m/s
Angle	+/-	8	deg
Vertical deviation	+/-	12	mm
Horizontal deviation	+/-	12	mm
Axial deviation / Slice length	+/-	3	mm
Time of Arrival Precision @10m/s	+/-	300	µs

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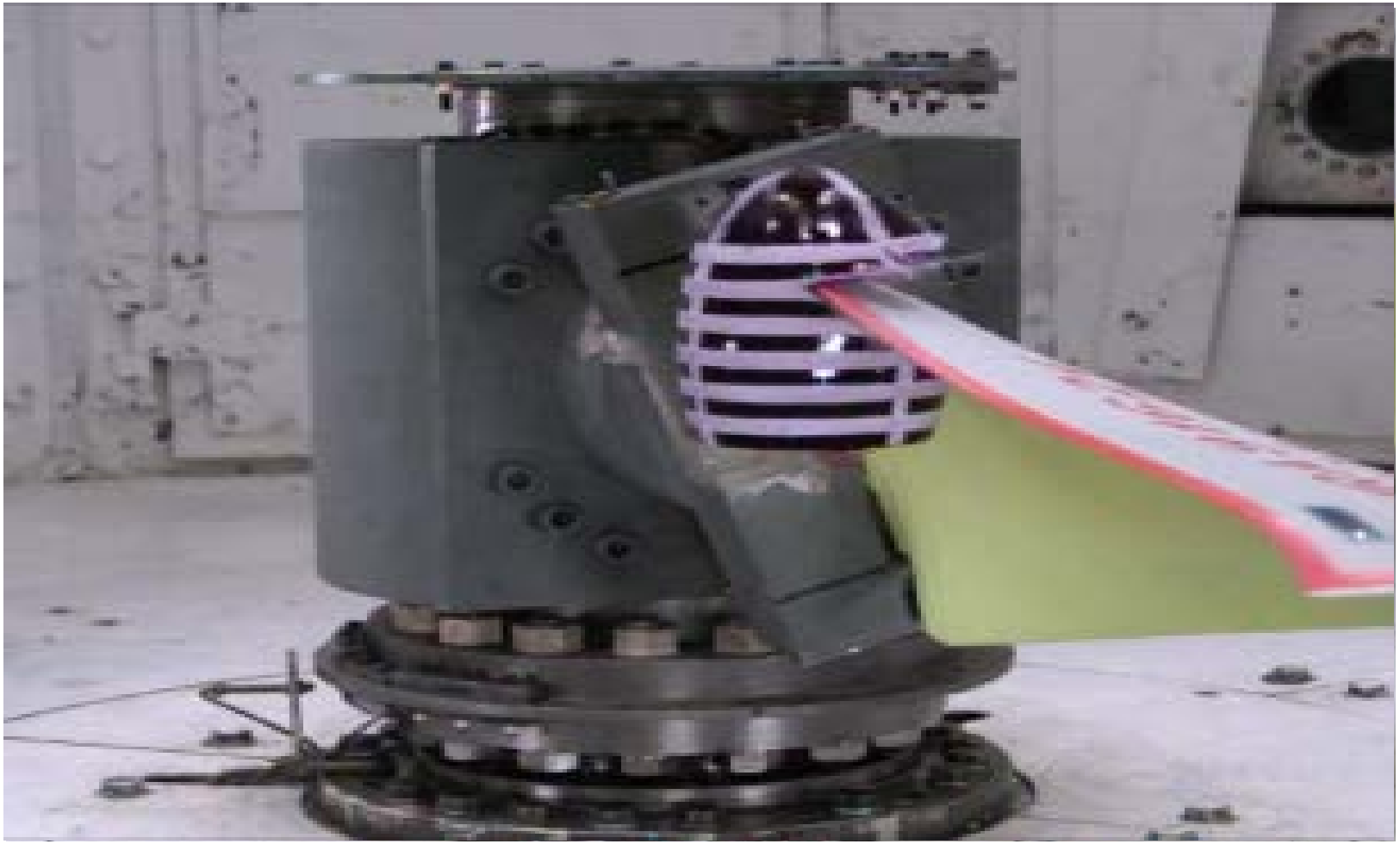
Impact Testing - RR M40 Rig – Vertical Spin Pit



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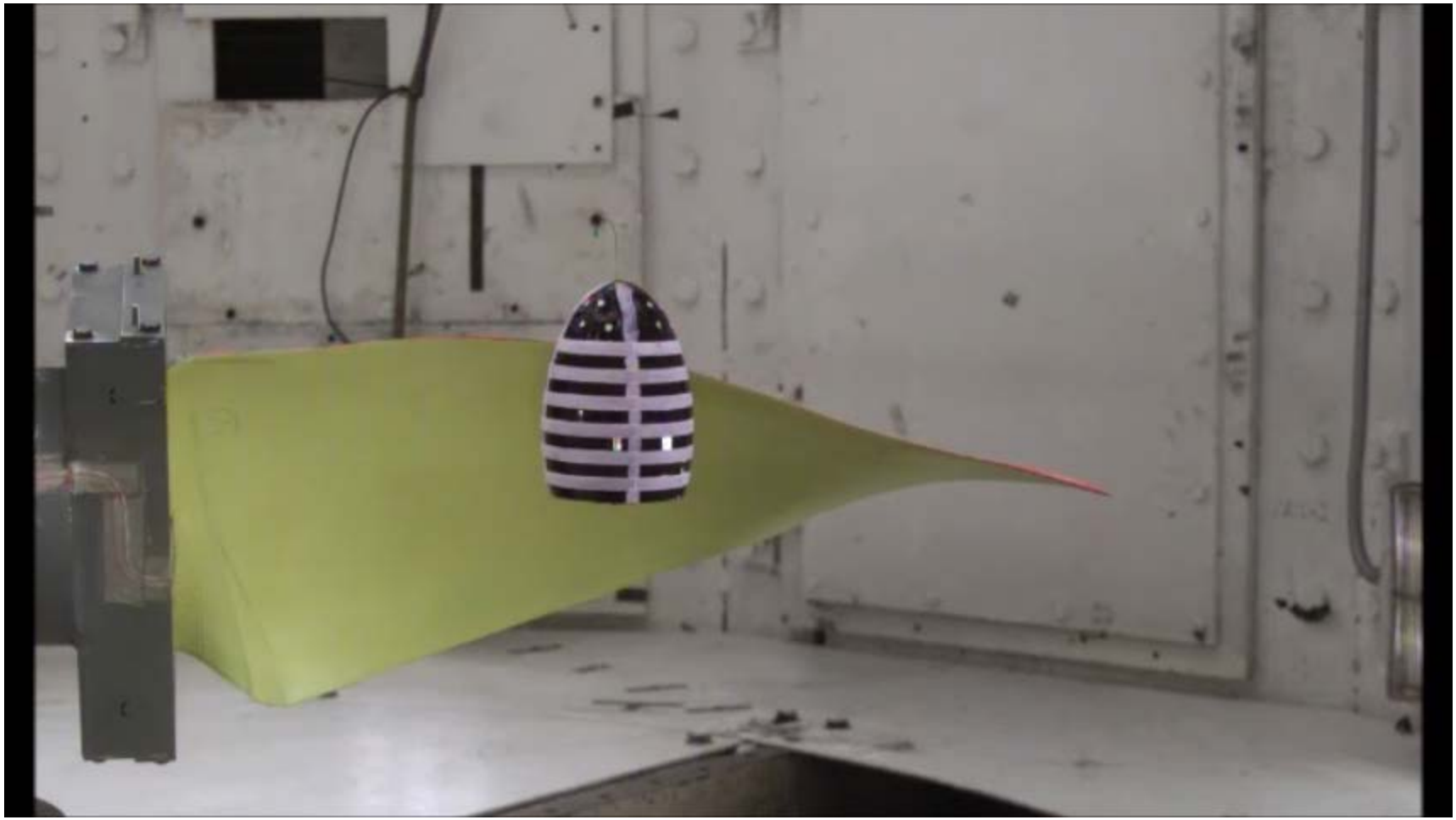
Impact Testing - RR M40 Rig – Vertical Spin Pit



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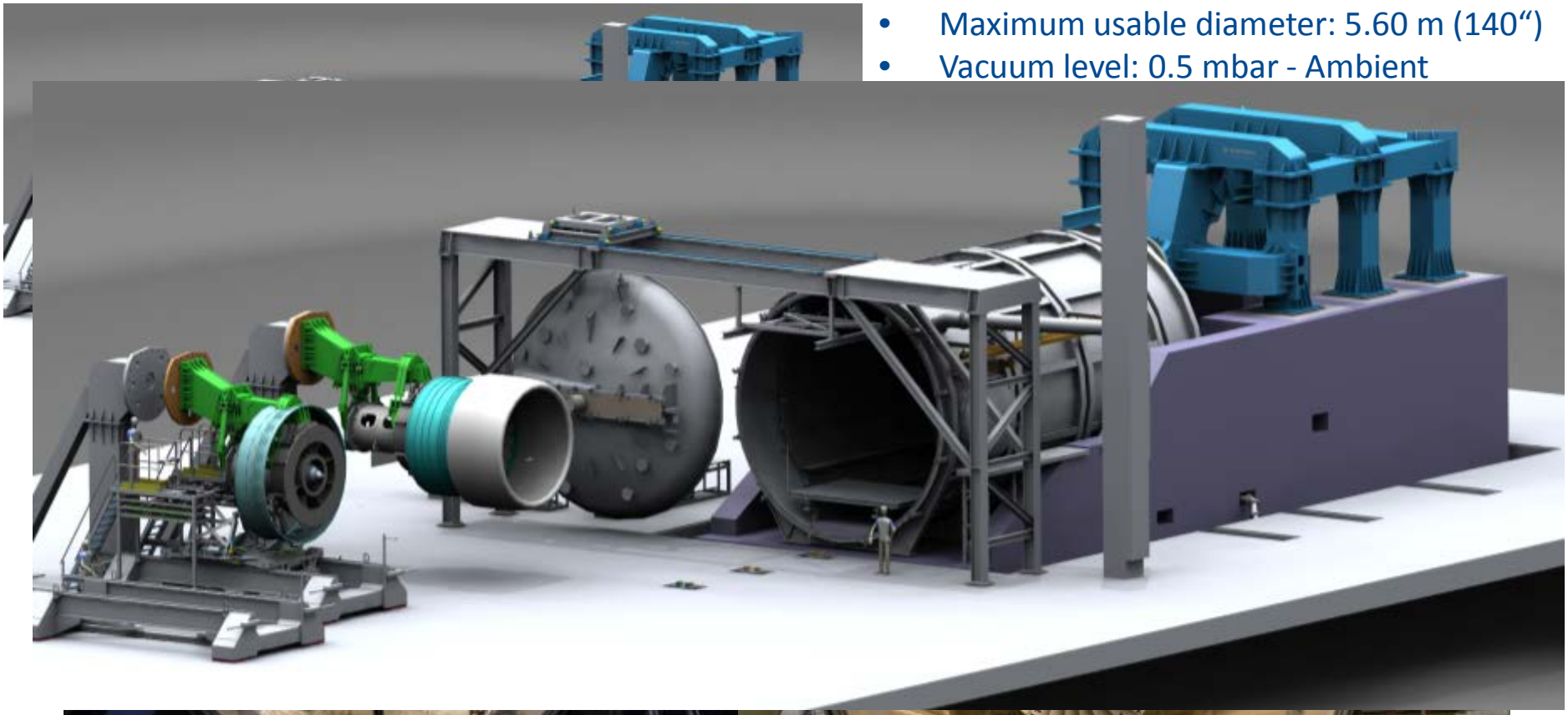
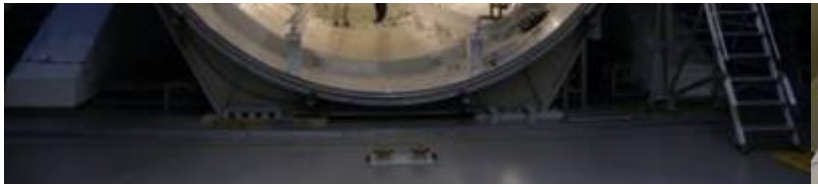
RR - Large Specialist Spinning Facility (LSSF)

- Maximum usable diameter: 5.60 m (140“)
- Vacuum level: 0.5 mbar - Ambient





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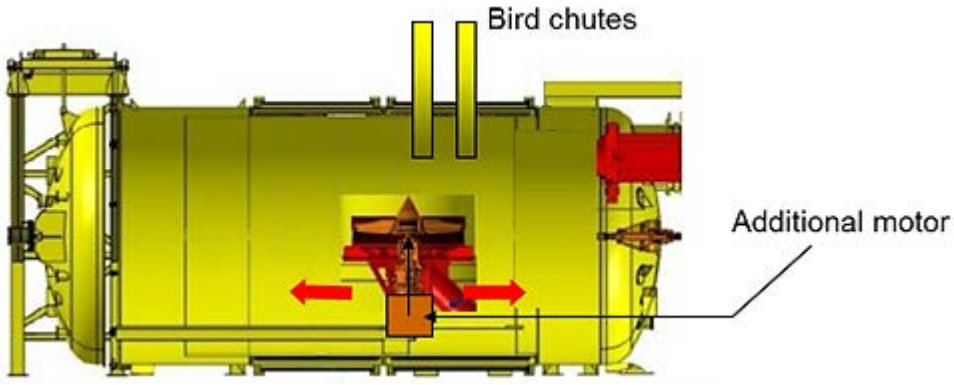
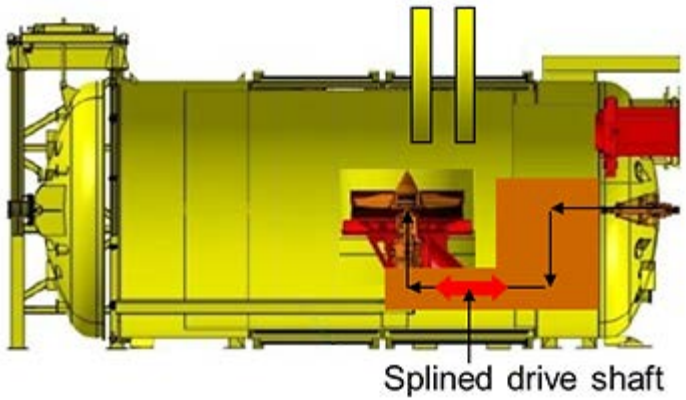
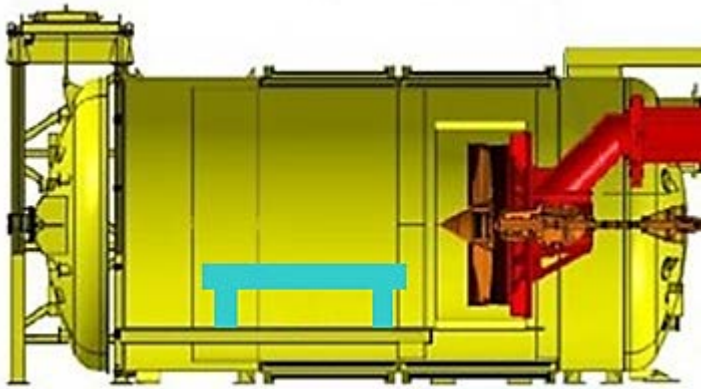
Design Concepts for LSPL



Vertical Drop - Removable Skid With Motor



Vertical Drop - Existing LSSF Motor



Magnetic Actuator System

Pendulum Arm

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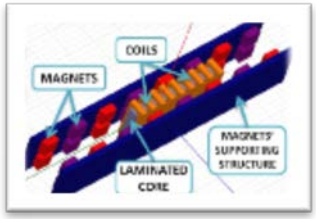
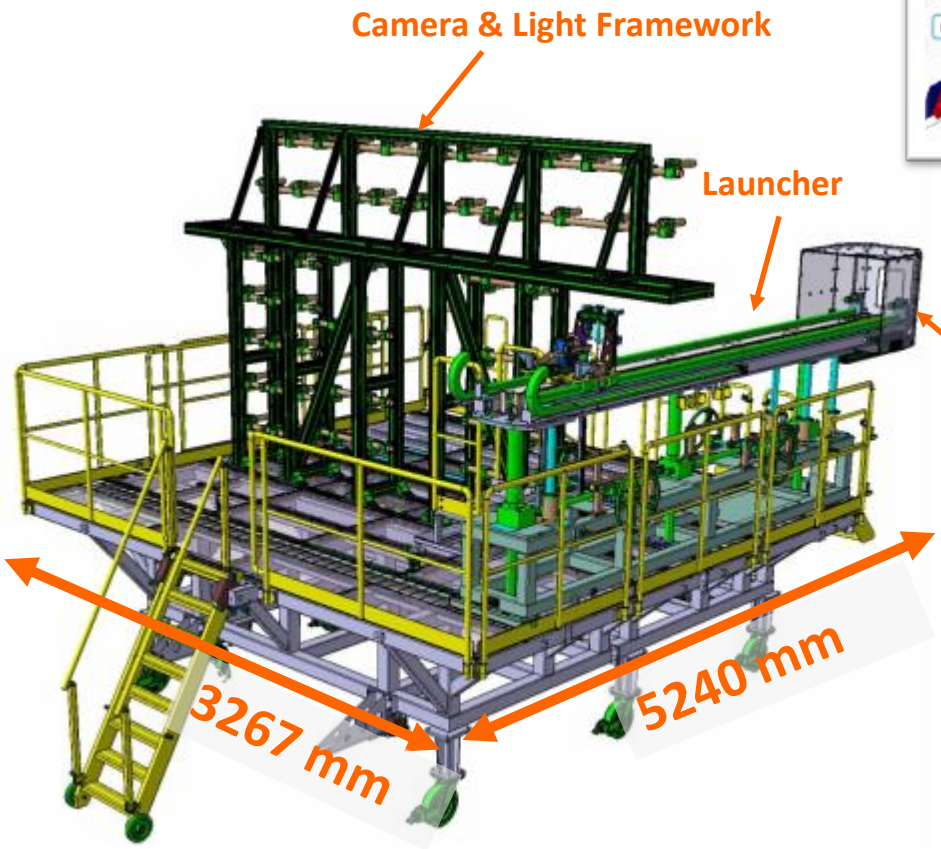
LSPL Solution





✓ Safety system implemented

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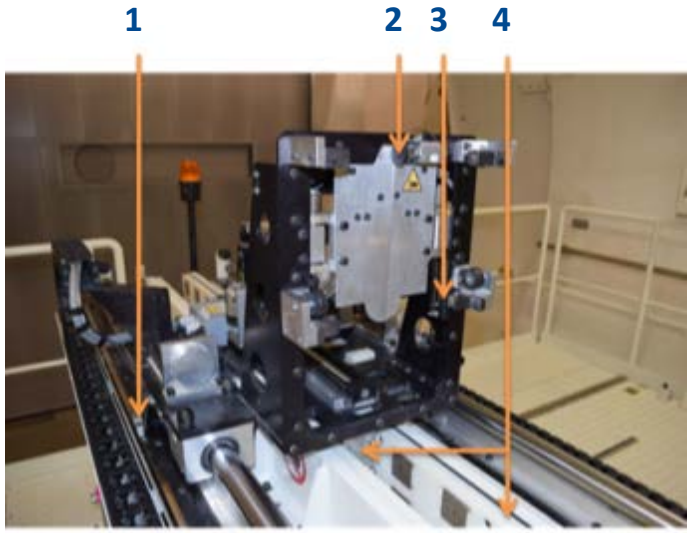
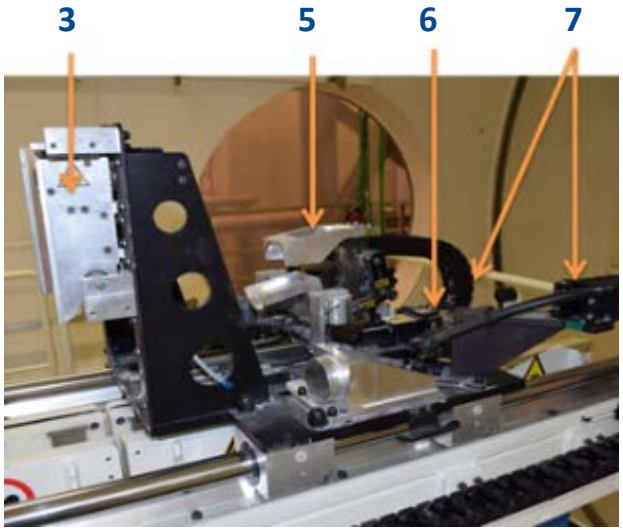
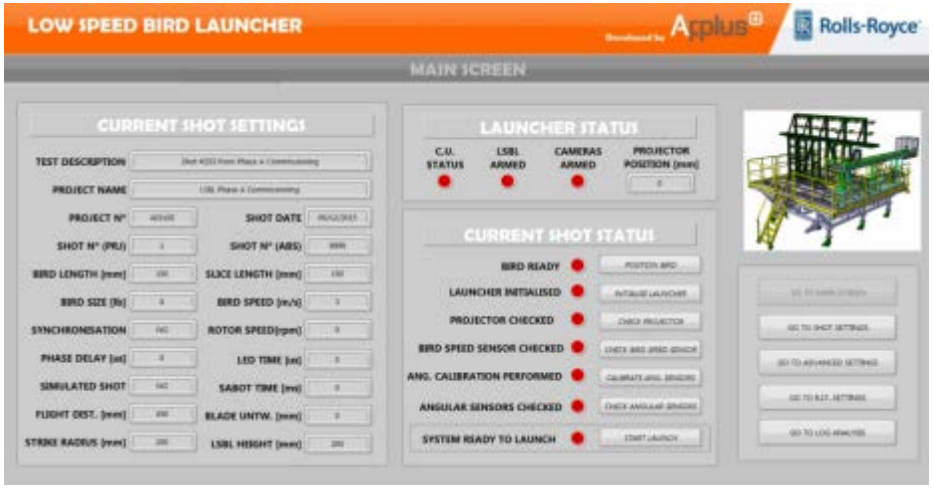
LSPL Solution





1. Linear Encoder
2. Doors
3. Projectile sensor
4. Magnets
5. Sabot
6. Projectile position
7. Electrical cables

LOW SPEED PROJECTILE LAUNCHER



- ✓ Automatic projectile position before launching
- ✓ Abort system
- ✓ Synchronization system with the LSSF engine
- ✓ Intuitive HMI for adjustment and operation

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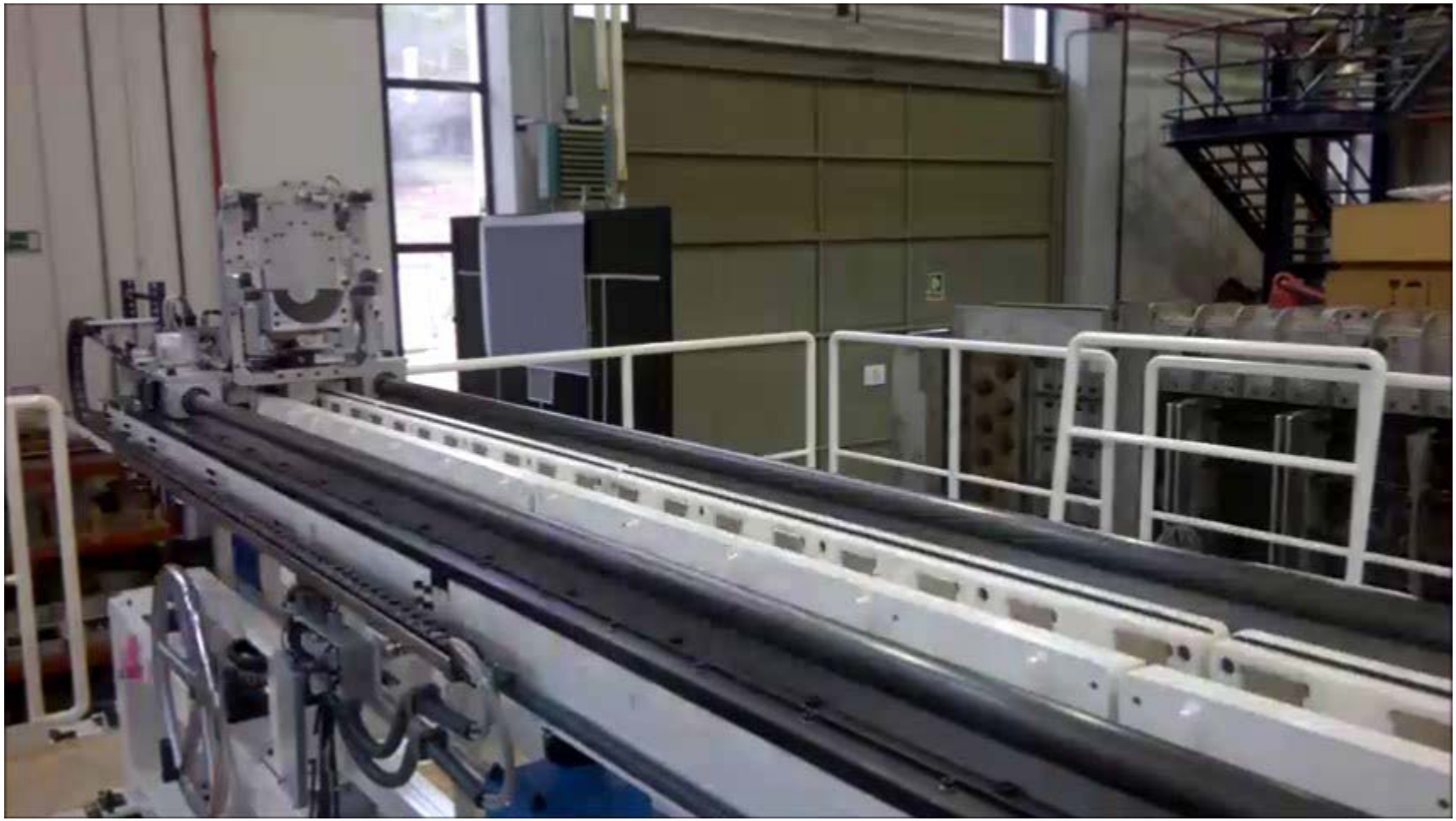
LSPL Solution



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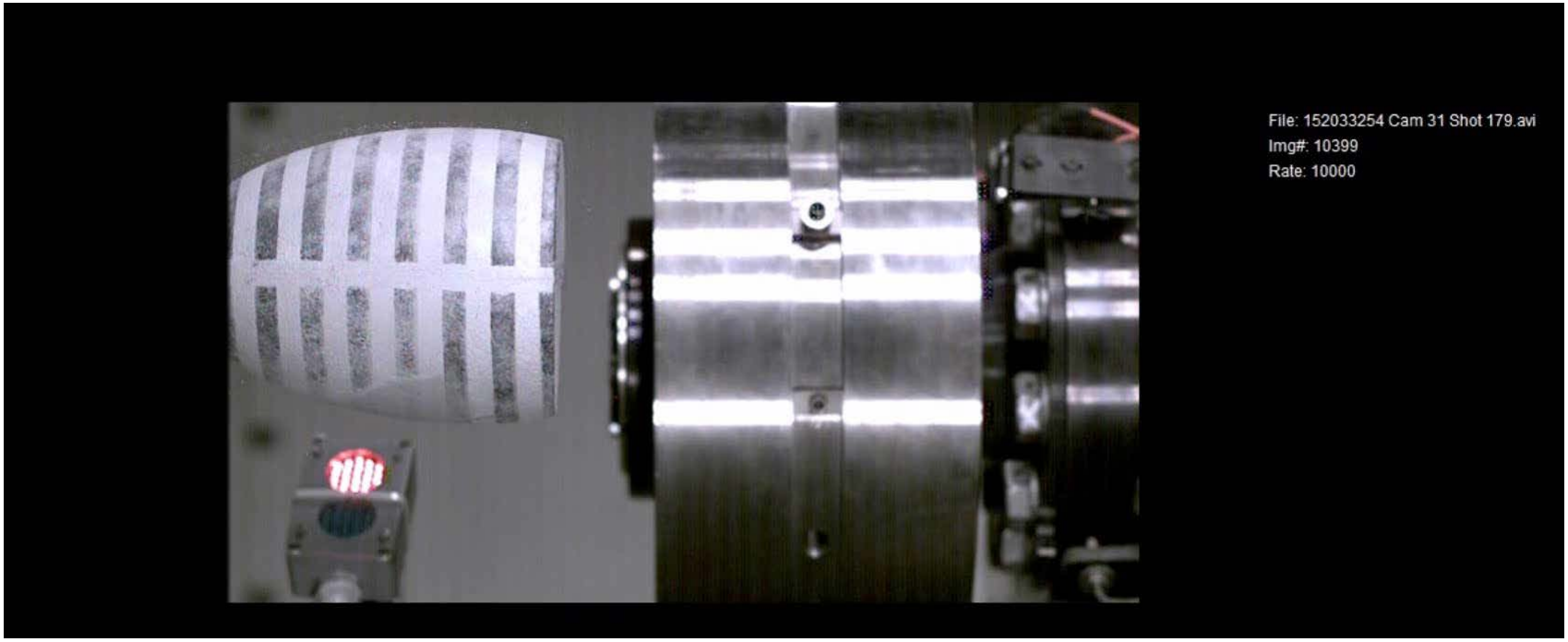

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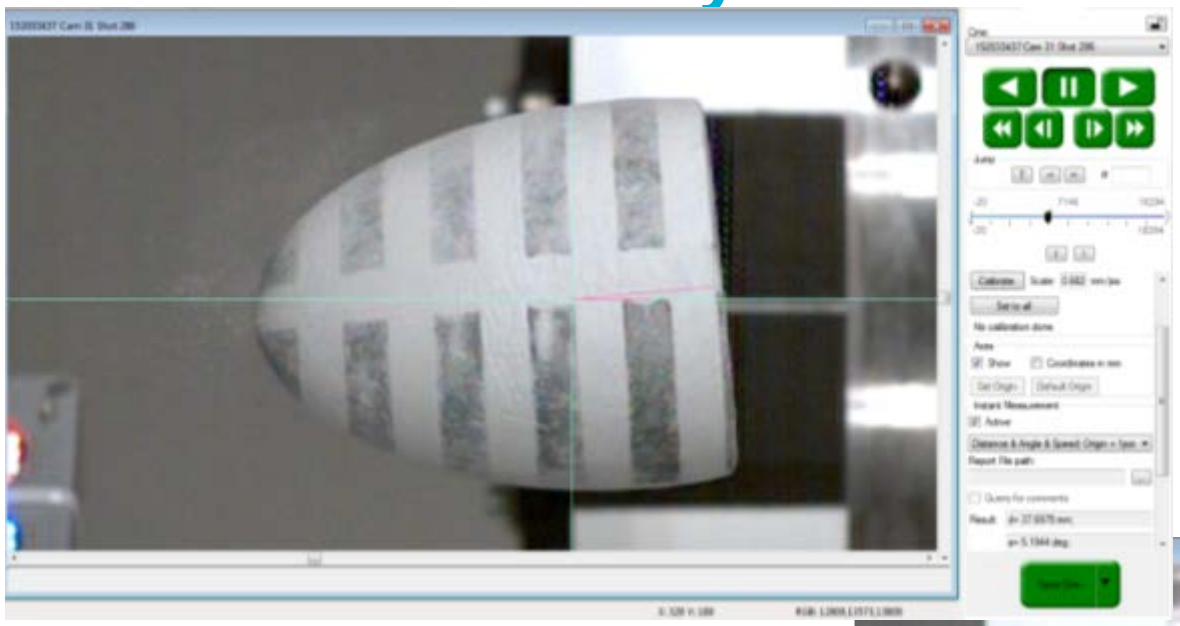
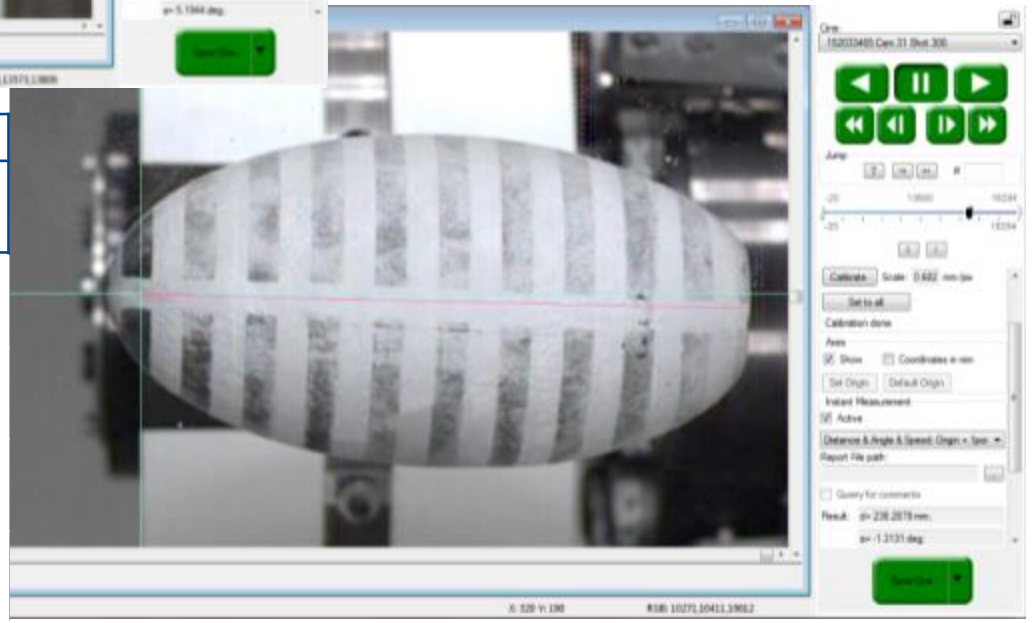
Achieved accuracy / tolerances





	Required	Achieved	
Angle, pitch	+/-8	-7.0 5.3	deg

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Innovation

- Highly specialised test system - highly demanding technical requirements
- High control precision and understanding of the jelly material
- Friction of projectile and positioning in the Sabot is a big contributor to the tumbling angle
- LSPL is working in vacuum in terms of electrical issues and jelly behaviour

Future

- LSPL fulfils current customer requirements for Low Speed Impact Testing (slicing)
- Suitable to prove design relevant impact scenarios
- New developments such as Open Rotor or UltraFan™ may require mechanical changes