

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**

LSPL Innotesting lss02.pptx

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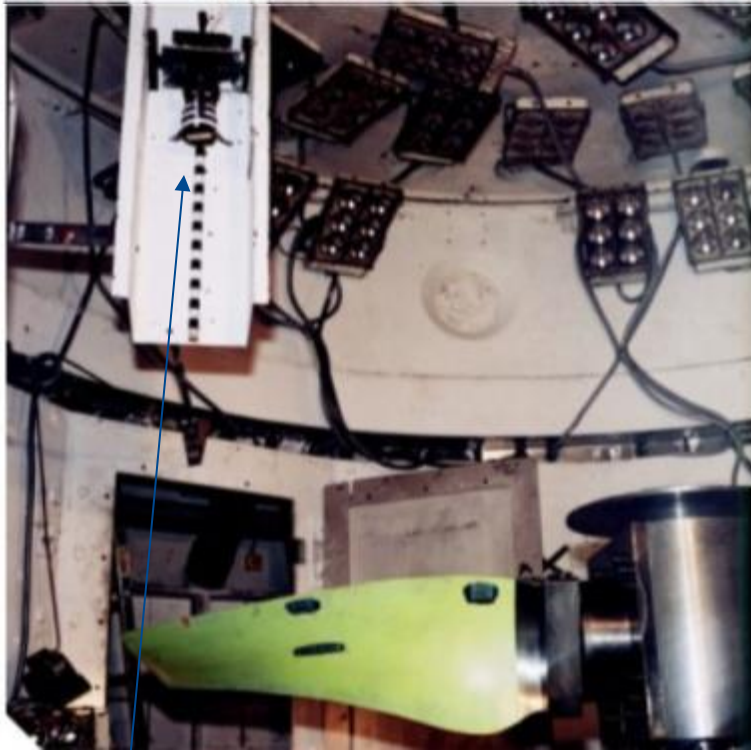
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Content

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



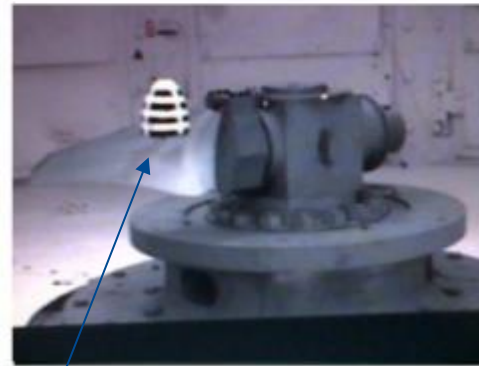
Low Speed Impact Testing



Drop chute with projectile in position



Projectile dropping towards impact position



Above 2 still images show impact



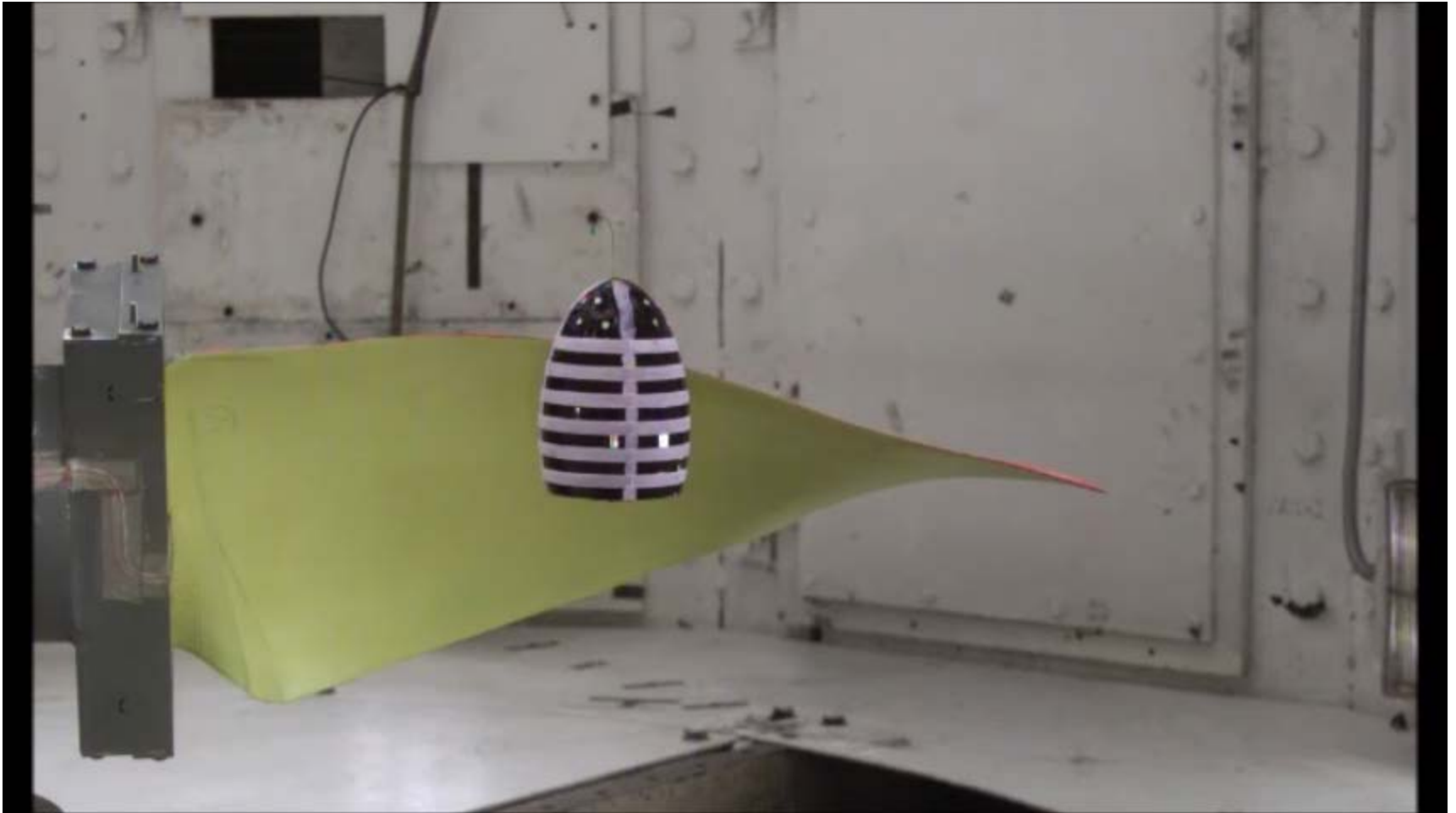
Low Speed Impact Testing - Requirements

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

Impact Testing - RR M40 Rig – Vertical Spin Pit

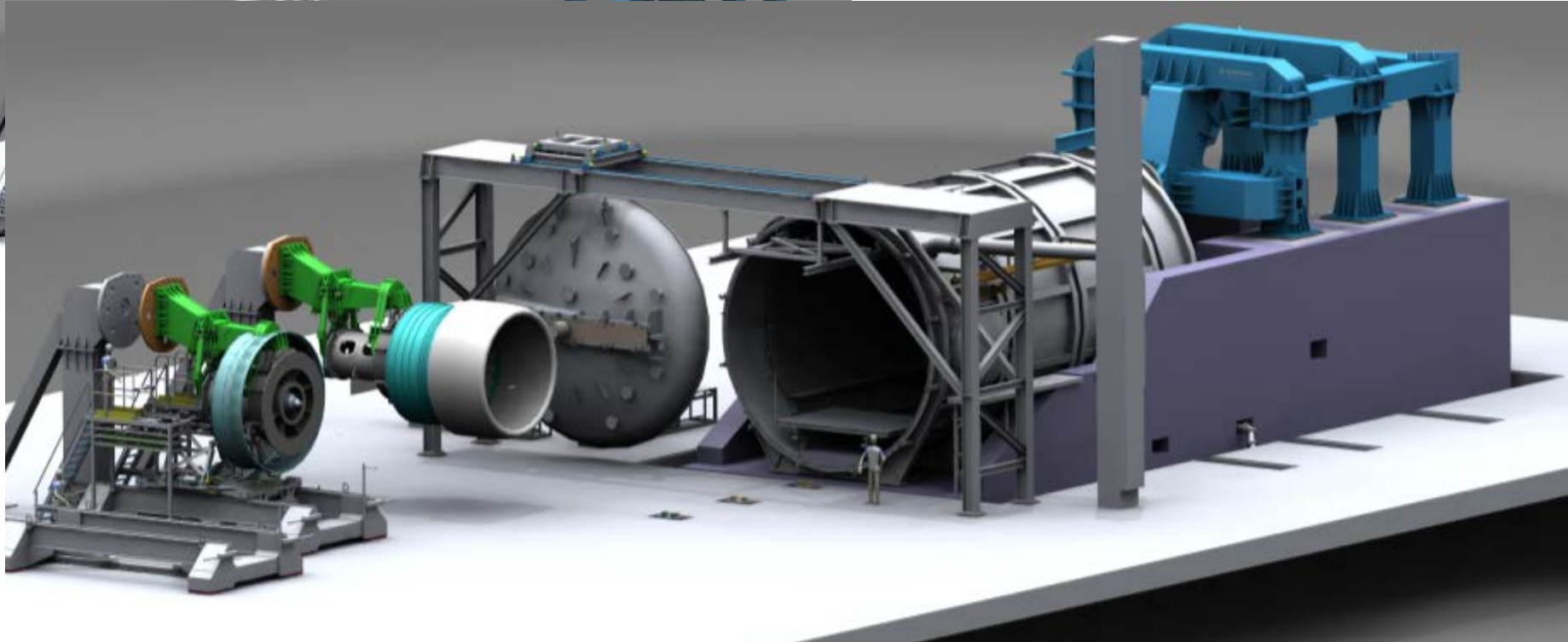


Impact Testing - RR M40 Rig – Vertical Spin Pit 7

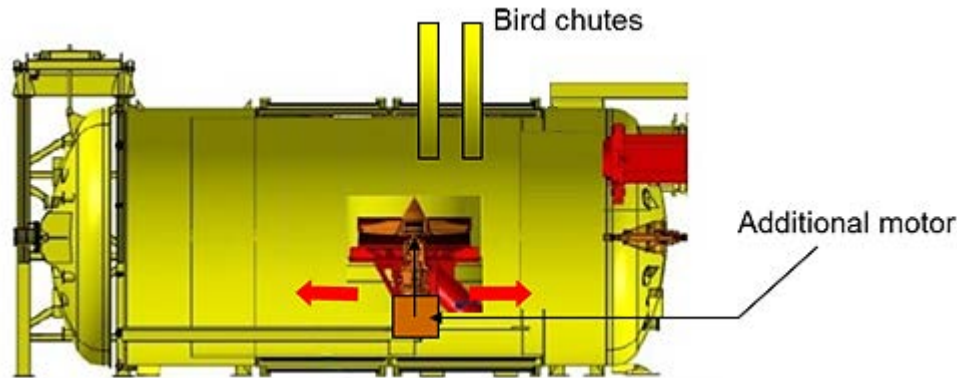


RR - Large Specialist Spinning Facility (LSSF)

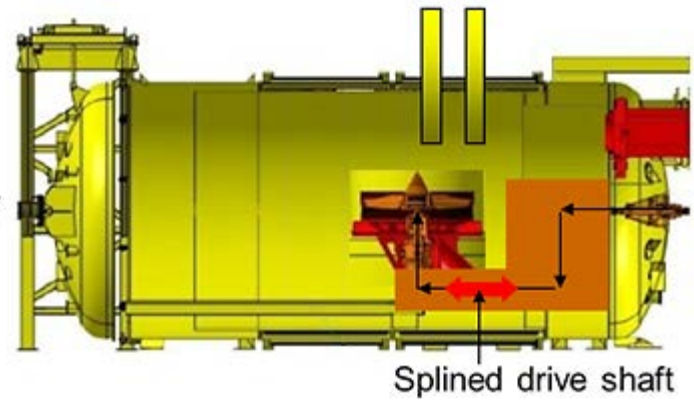
- Maximum usable diameter: 5.60 m (140")
- Vacuum level: 0.5 mbar - Ambient



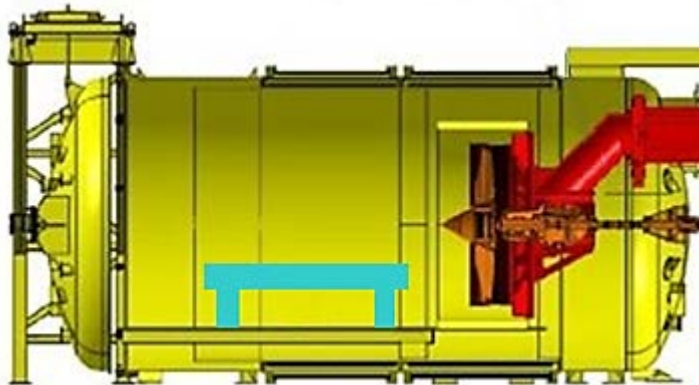
Design Concepts for LSPL



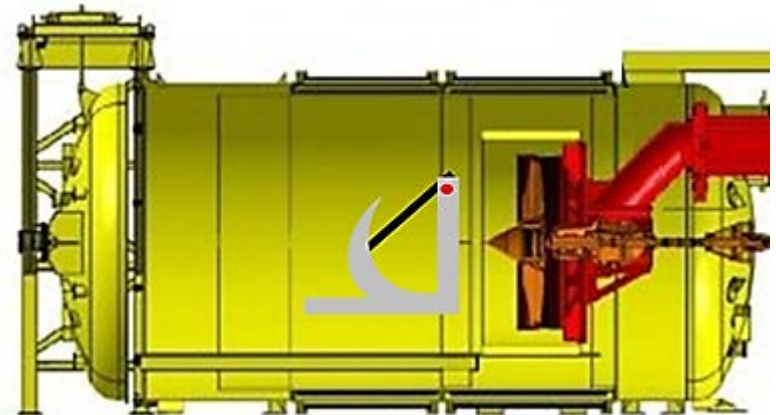
Vertical Drop - Removable Skid With Motor



Vertical Drop - Existing LSSF Motor

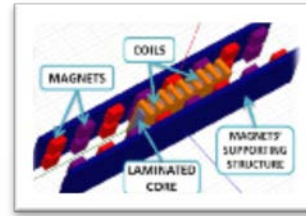
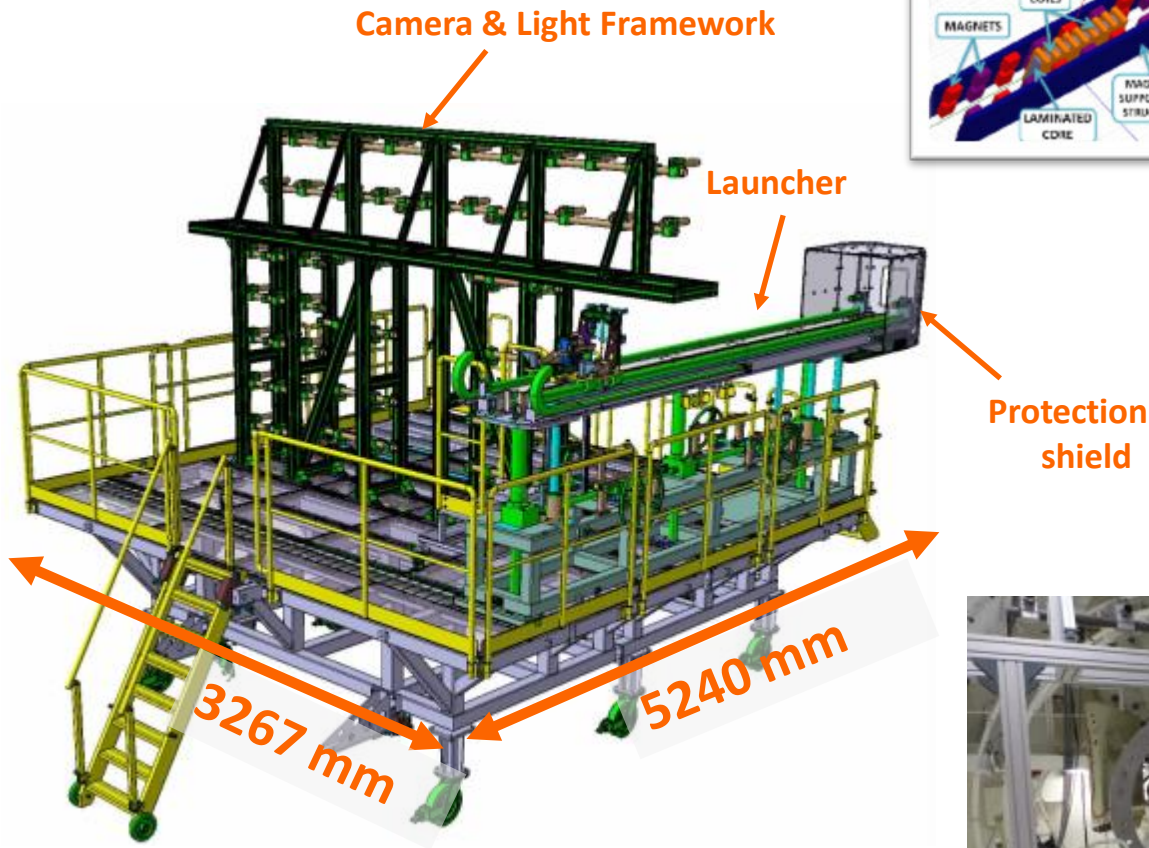


Magnetic Actuator System



Pendulum Arm

LSPL Solution

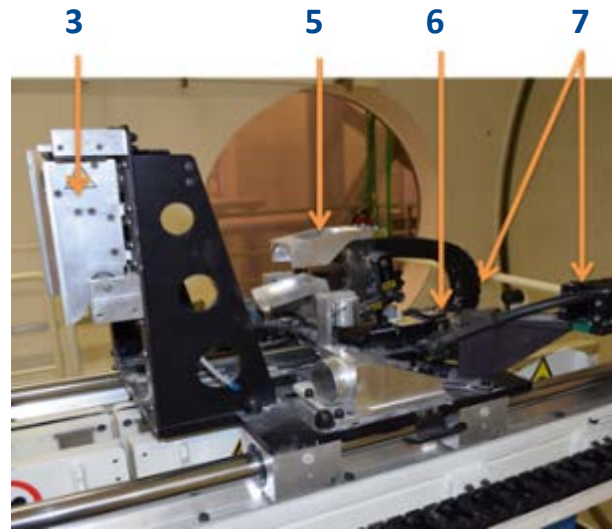
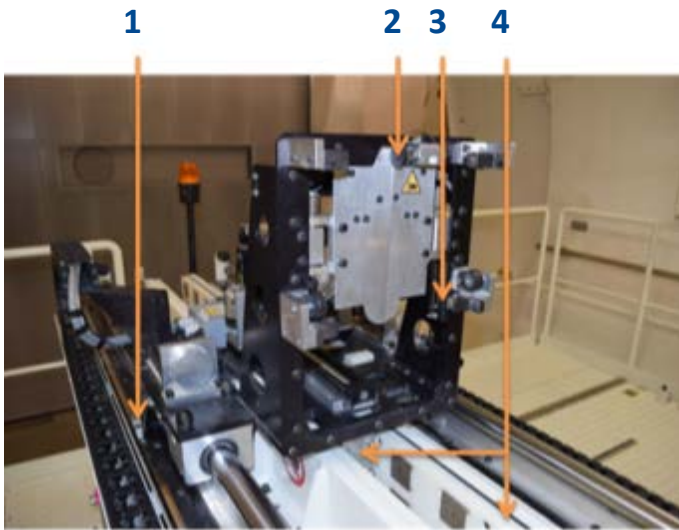


✓ Safety system implemented

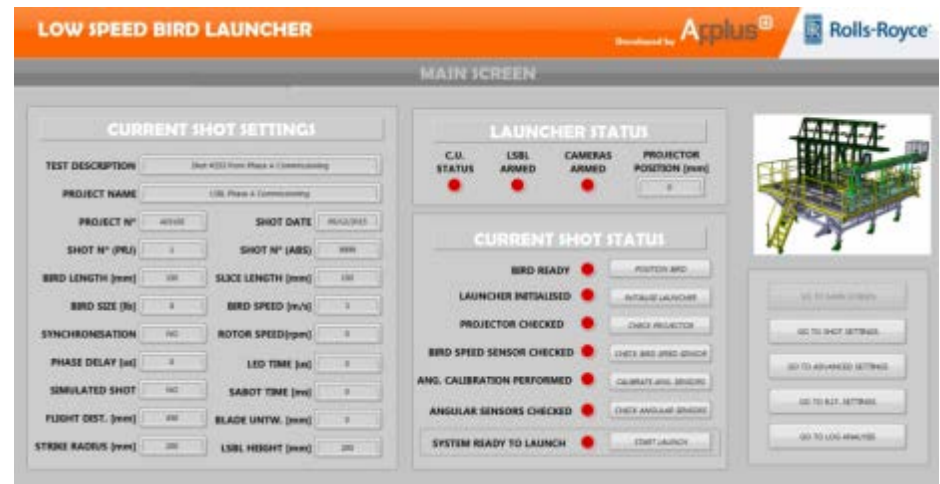
Applus⁺ Solution
laboratories

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

Applus⁺ Solution
laboratories



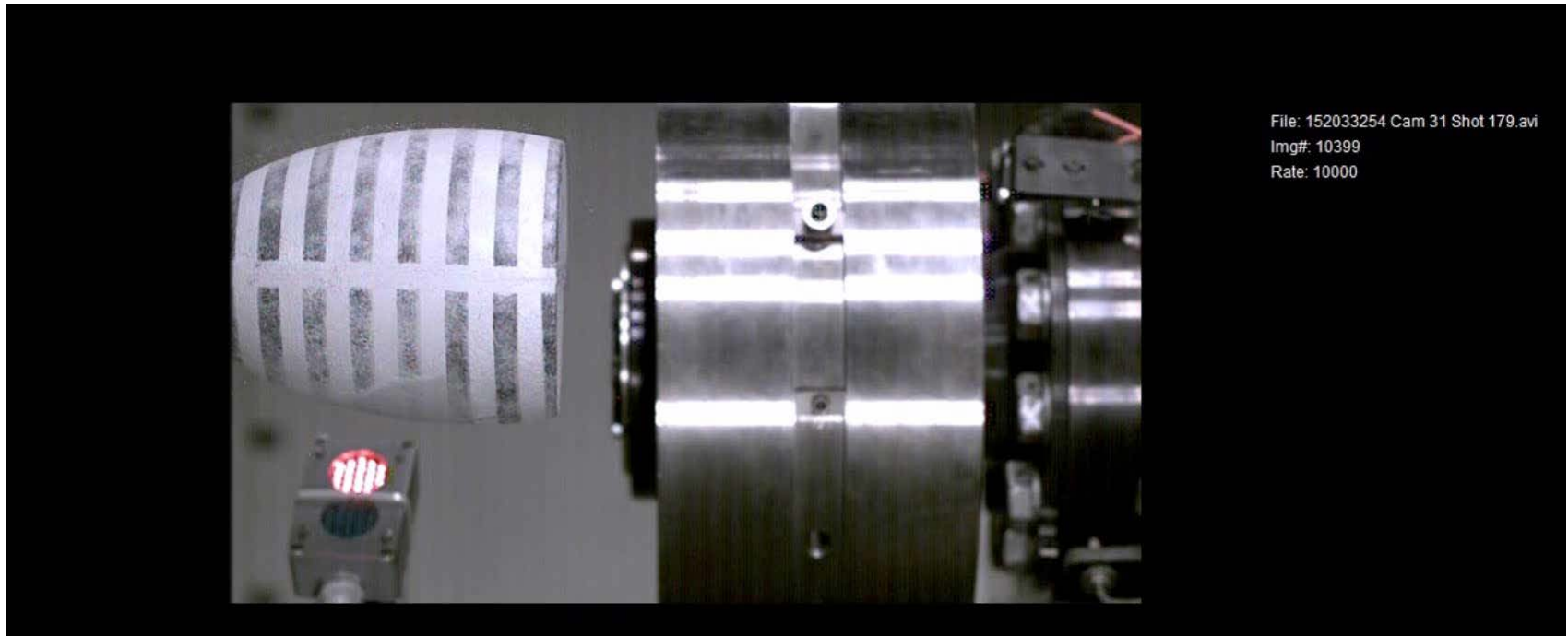
LSPL Solution



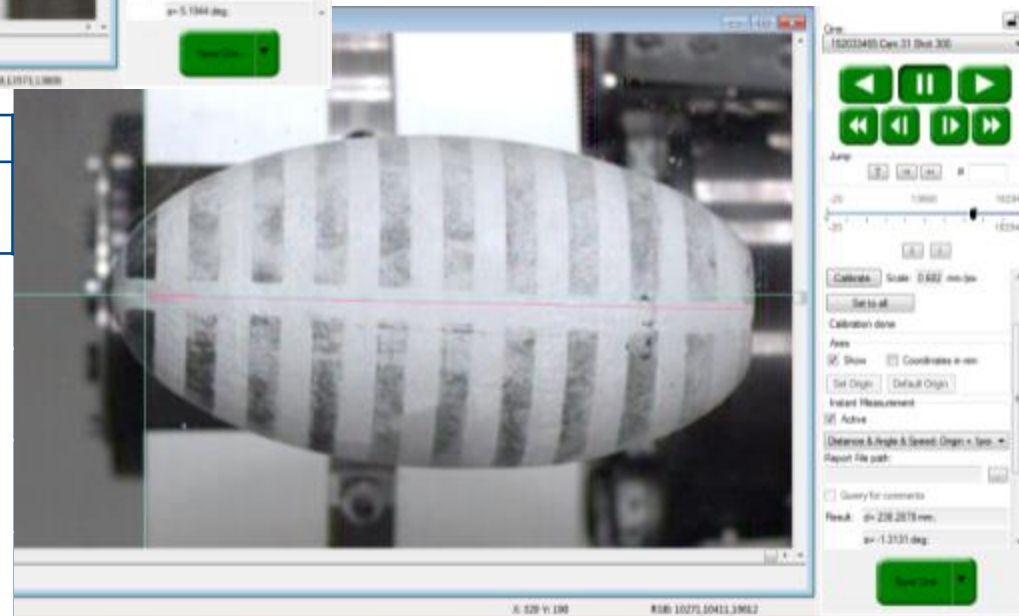
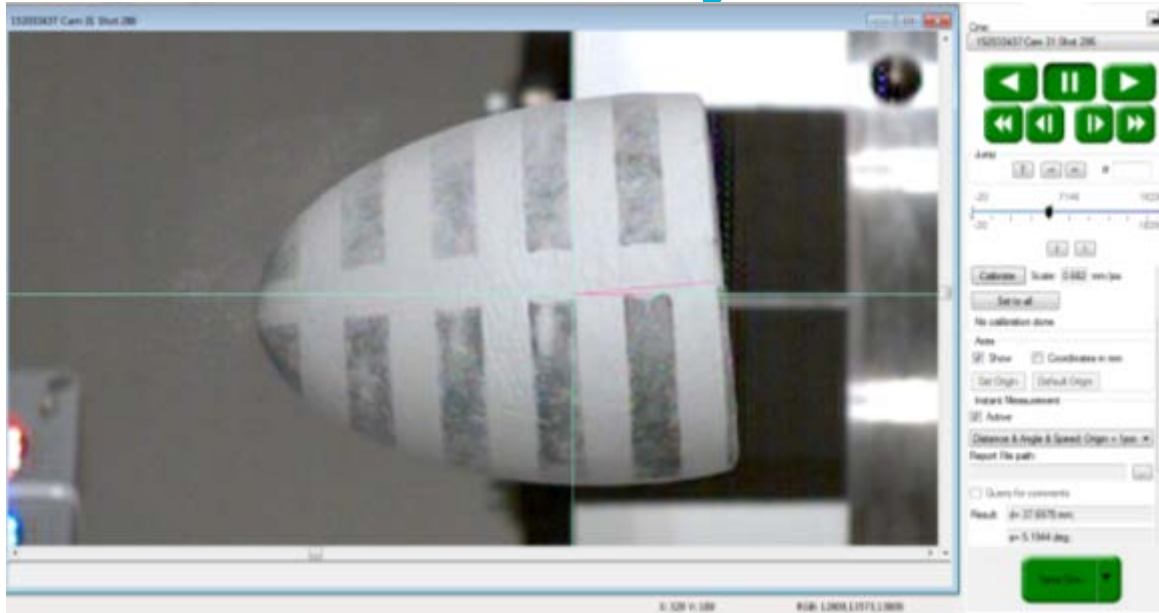
LSPL Solution



LSPL Solution



Achieved accuracy / tolerances



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



- 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

- 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