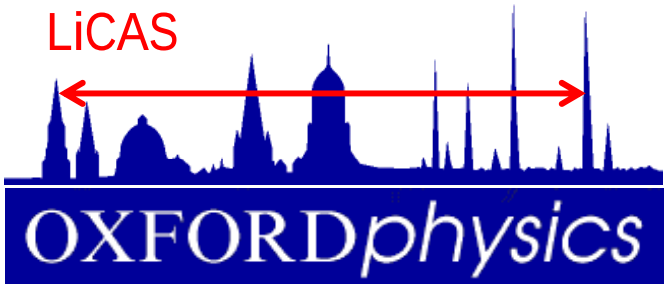
The LiCAS Rapid Tunnel Reference Surveyor

The status after commissioning

David Urner for the LiCAS collaboration.

Warsaw University



17.04.2008

LiCAS Measurement Unit Assembly

- Assembly = VERY hard work for very long time under clean room conditions
- Oxford workshop and students essential (overtime, weekends, long hours, fast turnaround)
- John did 30 davs in the clean room with no dav off!!

Thank you

John

Greg

Mike

Mike

Roy

Mark

Ron

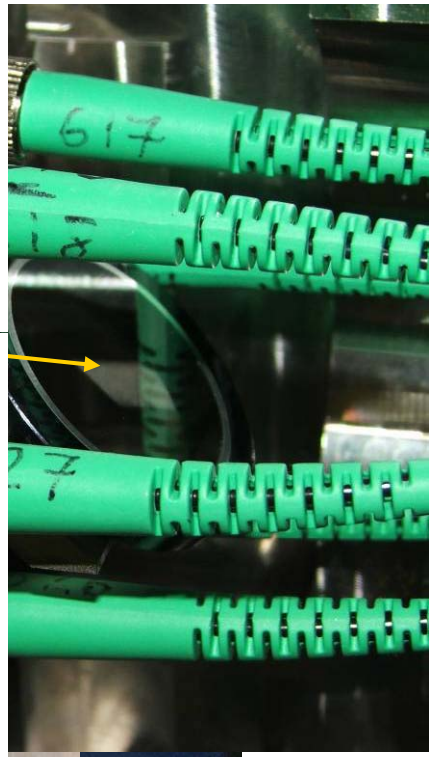
Lee

David

Matt

Sigal

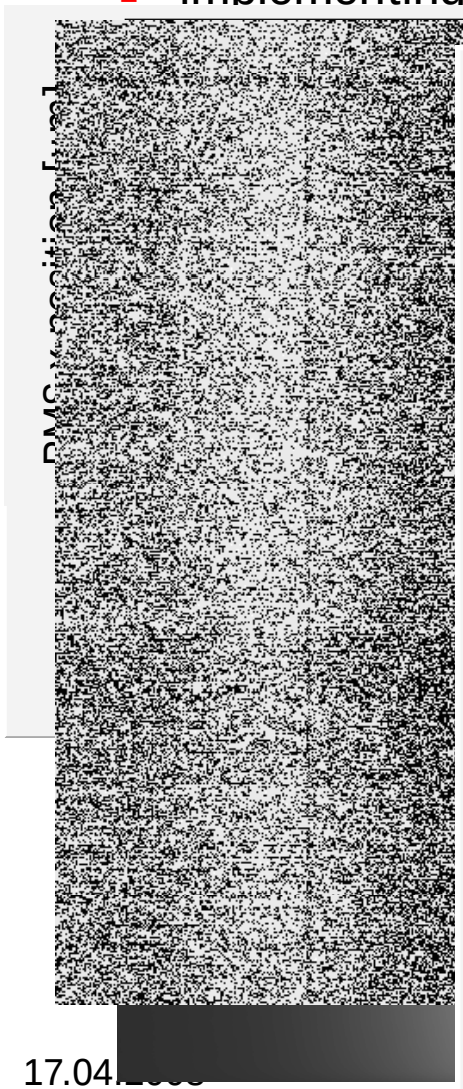
Yanmei

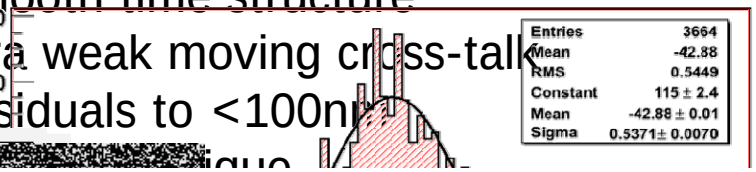


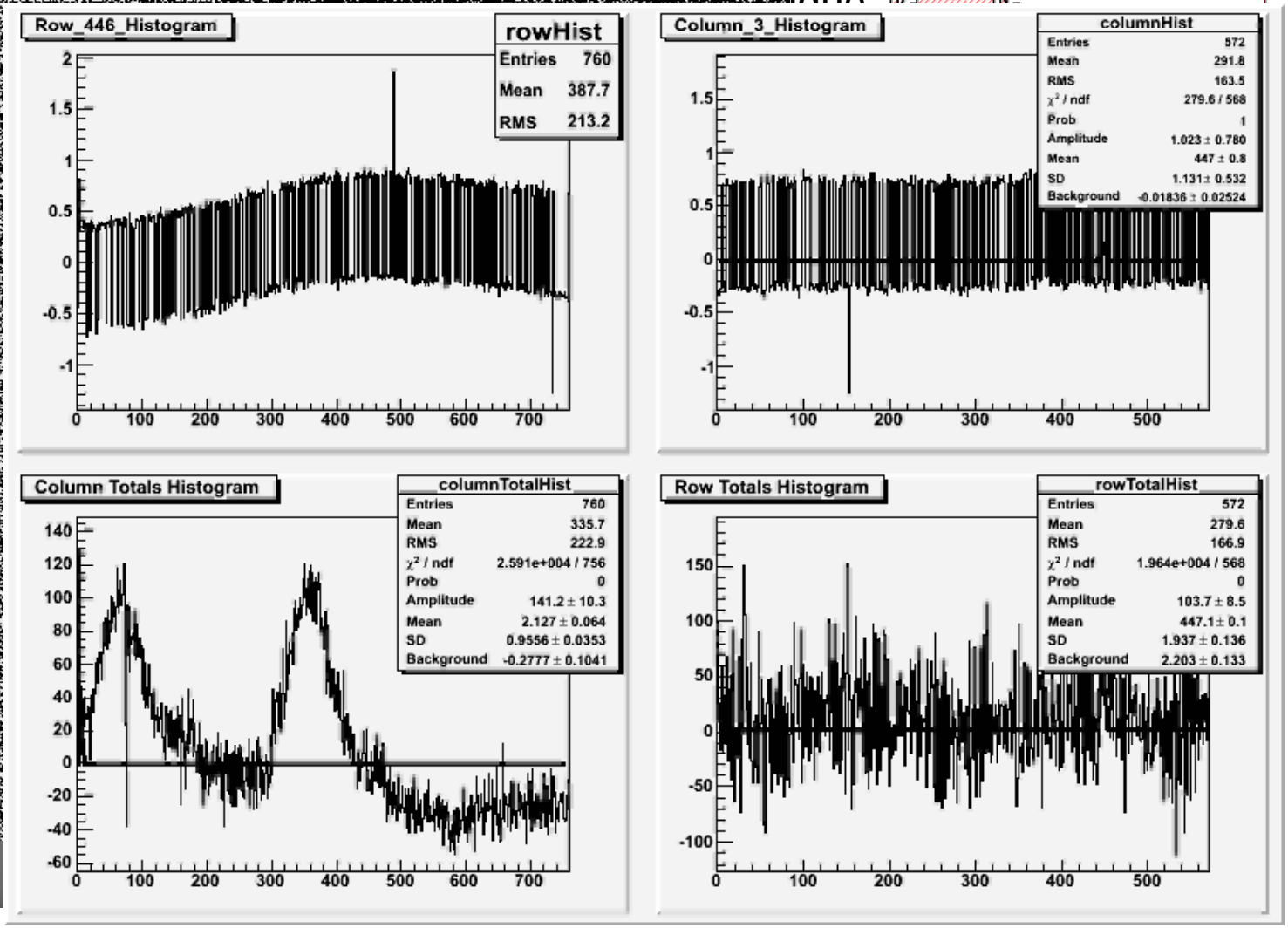
Laser Straightness Monitor

Greg Moss LC-ABD, D. Urner for A. Reichold

- 3 weeks ago vertical (horizontal) spot residuals were 0.5 (1.3) µm over 40h
  - observing data @ 25 Hz in vacuum reveals smooth time structure
  - very careful examination of images shows ultra weak moving cross-talk
  - implementing simple averaging can reduce residuals to <100nm







- Excellent Stability of long FSI lines, <100nm @ 4m over 30h
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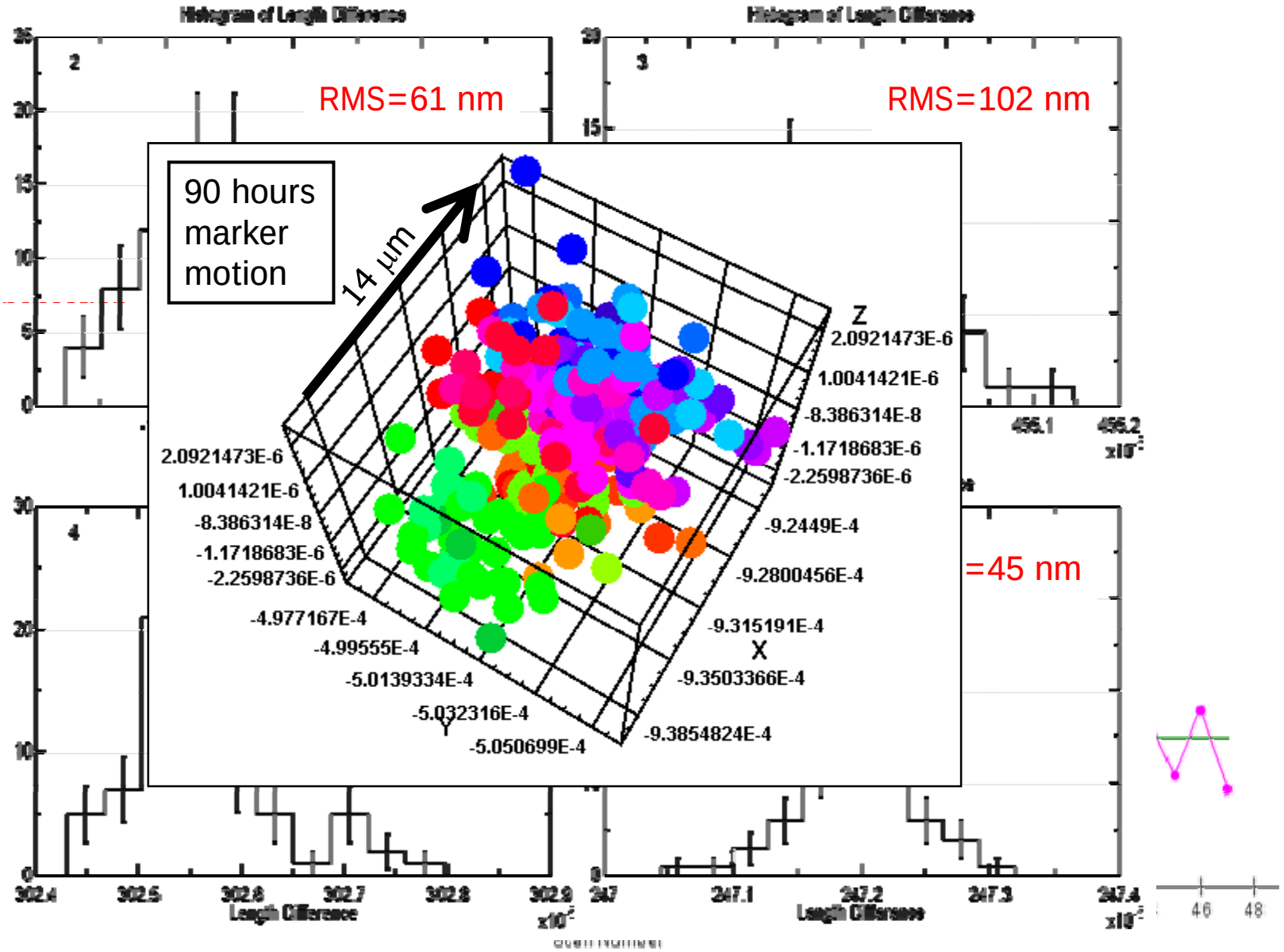


Software

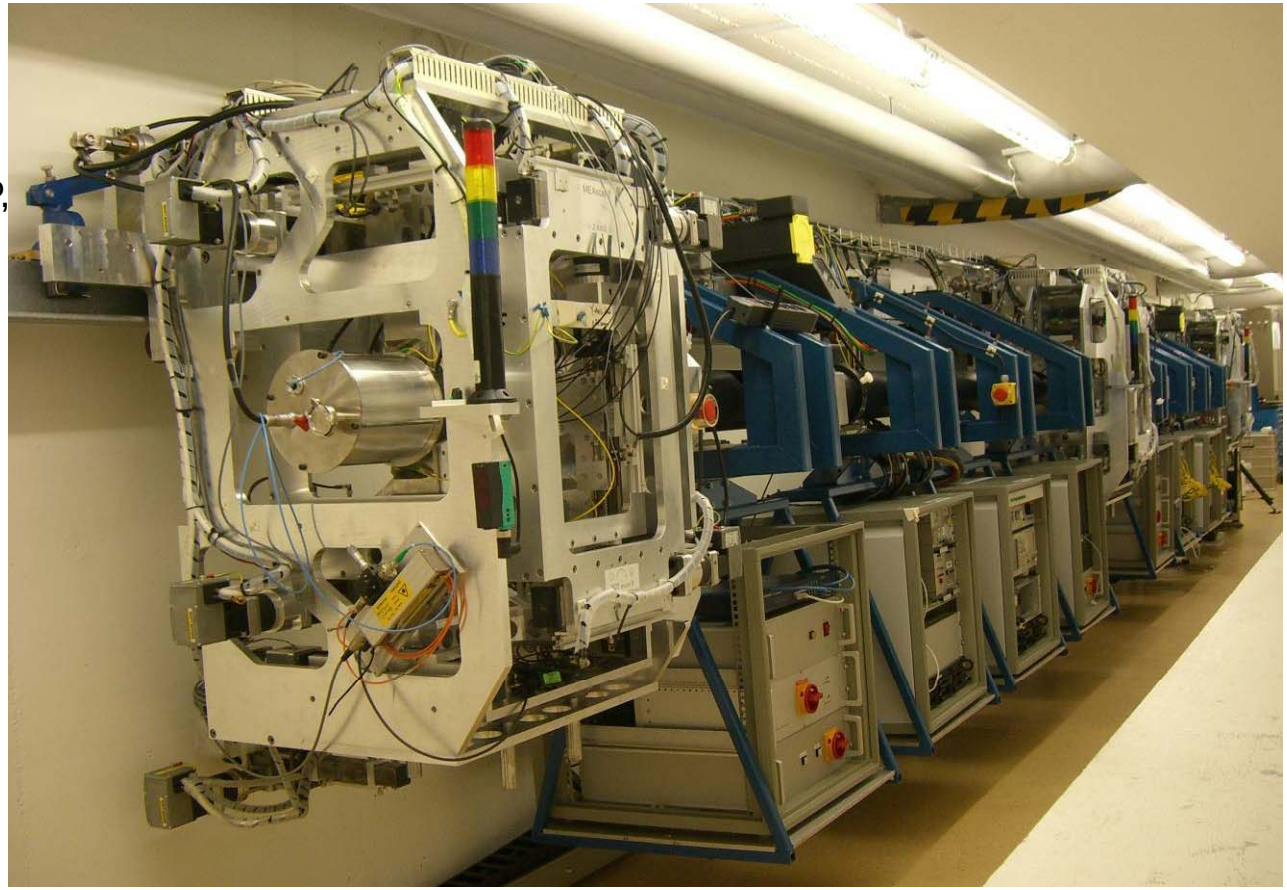
Software Package	lines of code
Firmware	13008
Simulgeo and simulations	30894
Drive motor control	625
LSM reconstruction & calib	86328
FSI reconstruction & calib	47322
Global reconstruction & calib	1125
Temperature calibration	6000
FSI file I/O	1897
Stepper motor control	4615
DAQ	72107
GIACoNDE and binary java I/O	17604
Total	281525

- That is 3.60 times "The lord of the rings" but provides a slightly less thrilling reading experience

Current prototype functionality

LC-ABD, D. Urner for A. Reichold

- RTRS = Large scale robotic sensing system
  - Robotics:
    - 1 ton moving mass
    - each measurement unit moves in 6D
    - 25 axis of motion
    - 39 CAN bus controlled stepper motors
    - 6 network controlled picco motors
    - 3 drive motors with 6 kW total power
    - 82 limit and proximity switches
- DAQ
  - 204 MB data per stop
  - 4 servers with 1.2 TB storage take data via:
  - CAN, USB-II, RS485, TCP-IP, PCI
- Pre-Calibration
  - all sensing elements measured with CMM and smart scope
- Mechanics
  - vacuum system with > 100 accesses, joints and feedthroughs, many custom
- Sensing systems (data source rate):
  - 38 FSI interferometers (210 MB/sec)
  - 12 LSM cameras (298 MB/sec)
  - 3 wall marker cameras (78 MB/sec)
  - 96 calibrated temperature sensors
  - 3 computer controlled lasers
  - 12 axis of gravity reference tilt sensors



Plans for next year

- Operation of current prototype at DESY until Aug08
  - run calibration experiments
  - improve vibration isolation
  - perform multiple full tunnel surveys
    - use various RTRS configurations (swap units, rotate units)
    - use variable fraction of measurements in analysis to test redundancy
    - check systematics against laser trackers
  - operation with Helium instead of vacuum
  - study of different analysis and calibration methods (linear algebra)
- Build small scale dual laser scanning FSI DAQ and test it on the RTRS
- **CANNOT** do the acid test use the RTRS in the X-FEL over long distances due to termination of ILC program in the UK

Thanks for your attention