

Automation and remote control as new challenges on the way to GGOS

FESG

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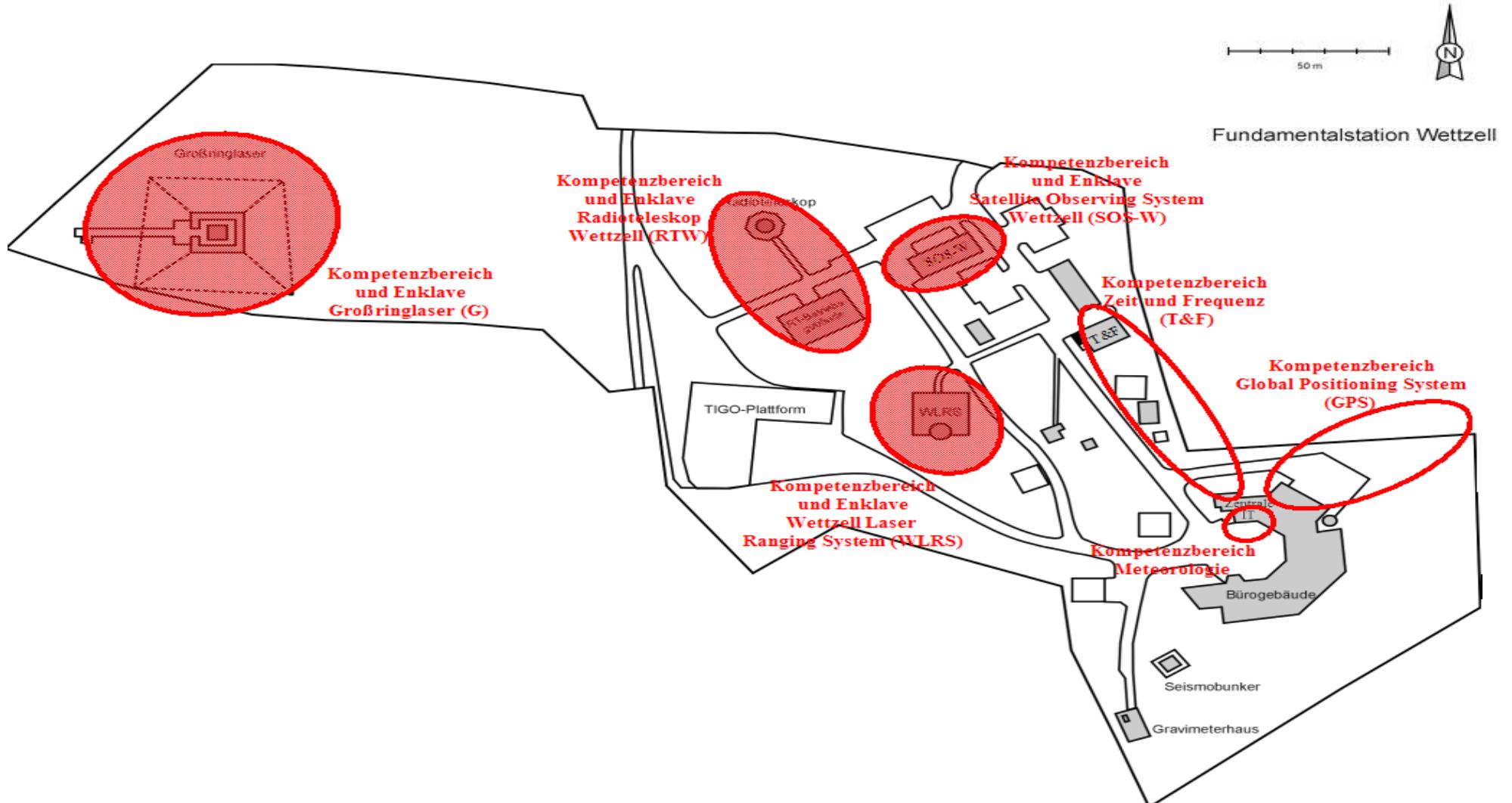


Bundesamt für
Kartographie und Geodäsie

Ettl, M. (FESG), Lauber, P. (FESG); Leidig, A. (BKG); Eckl, J. (BKG); Riederer, M. (BKG);
Dassing, R. (BKG); Mühlbauer, M. (BKG); Plötz, C (BKG), Schreiber, U. (FESG),

A GGOS site ...

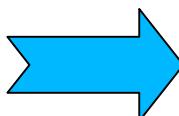
Co-located, interoperable systems



Ursprünglicher Stationsplan von Dr. Klügel, FS Wettzell

Future requirements

- | | |
|------|--|
| SLR | <p>See „The History and Future of Satellite Laser Ranging“⁽²⁾:</p> <ul style="list-style-type: none"> ▪ [...] High Level of Automation [...] Fully automated [...] Semi-automated: Single Operator or Remote Operation[...] ▪ [...] Kilohertz Systems [...] <p>See „The SLR 2000 Pseudo Operator“⁽³⁾:</p> <ul style="list-style-type: none"> ▪ „[...] SLR 2000 Pseudo Operator (POP) controls or directs all aspects of the automated SLR 2000 system. [...] POP will monitor the health and safety of the system foremost and control the acquisition and tracking [...] of the satellites.“ |
| VLBI | <p>See IVS Memorandum 2006-008v01: VLBI2010⁽¹⁾:</p> <ul style="list-style-type: none"> ▪ „[...] Increase observation density [...]“ ▪ „[...] For the highest accuracy the global networks must be tied together. [...]“ ▪ „[...] Automate operations and procedures at all stages [...] Flexibility to add/subtract stations on short notice [...] Automated diagnostic procedures and notification of personnel when necessary [...]“ ▪ „[...] Monitoring [...] will make it possible to account for factors [...]“ ▪ „[...] new observing strategies [...]“ |
| GNSS | <p>See NTRIP: „Nutzung der Internet-Radio-Technologie zur Übertragung von GNSS-Daten“⁽⁴⁾:</p> <ul style="list-style-type: none"> ▪ „[...] Echtzeitübertragung von GNSS-Daten [...]“ ▪ „[...] Möglichkeit der Fernwartung [...]“ |



Flexible, remote accessible, reliable, independent, automated and safe systems (throughout all technical levels)

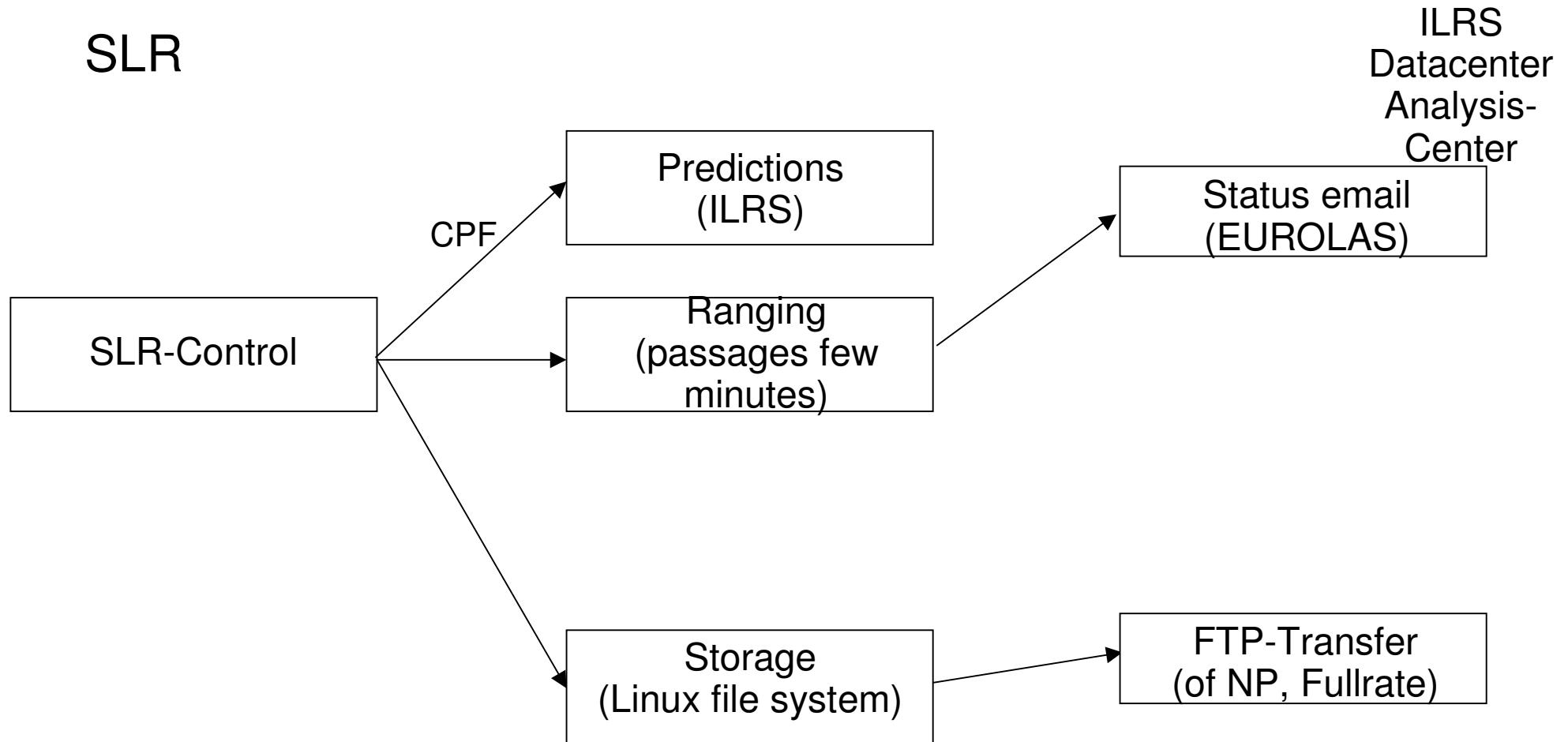
(1) Niell, Arthur; et. al.: IVS Memorandum 2006-008v01. „VLBI2010: Current and Future Requirements for Geodetic VLBI Systems“. Sept. 2004

(2) http://ilrs.gsfc.nasa.gov/docs/degnan_0603.pdf (3) http://cds.nasa.gov/slr2000/docs/pseudo_operator.pdf

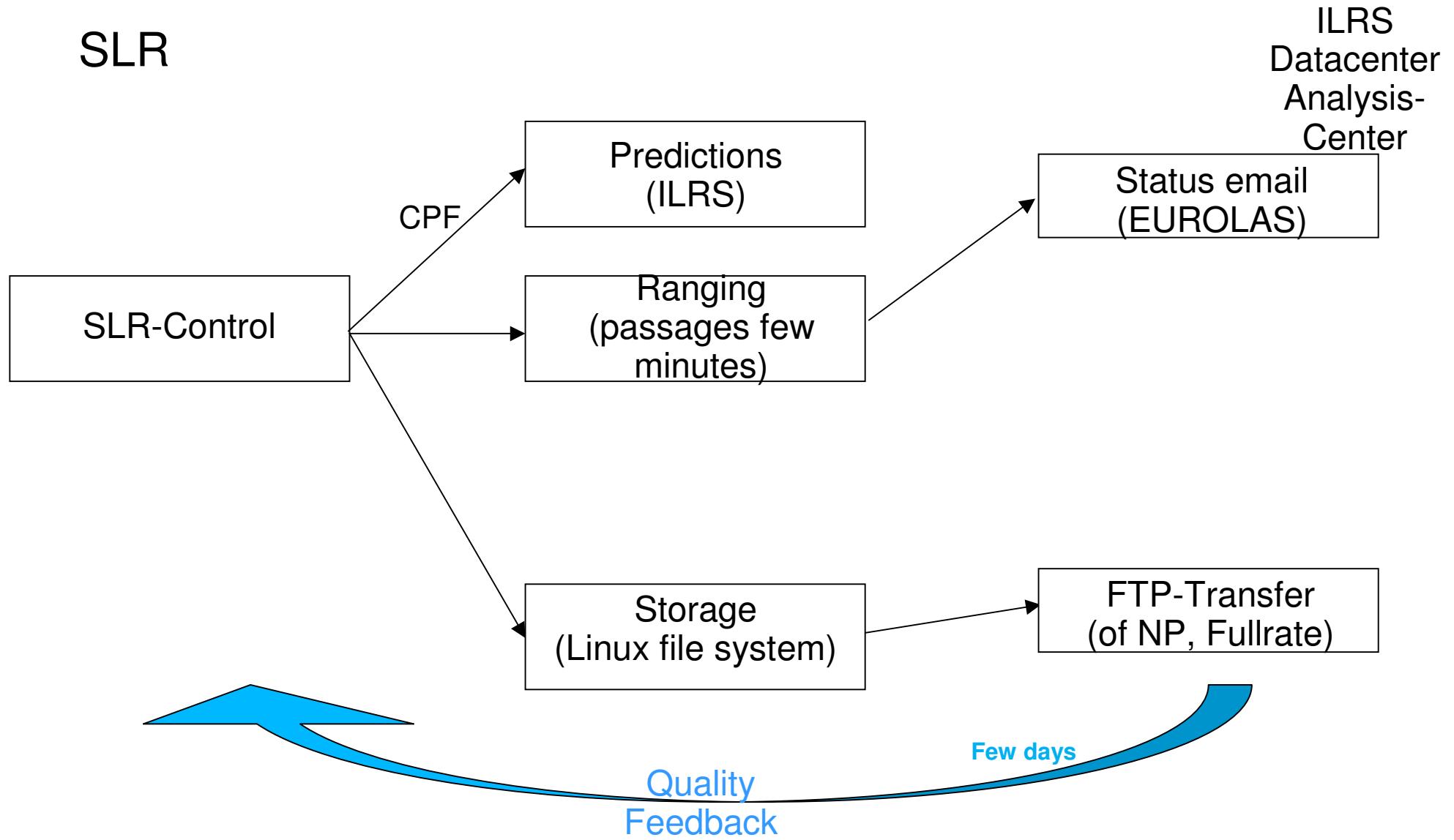
(4) http://igs.bkg.bund.de/root_ftp/NTRIP/documentation/sapos03_gebhard.pdf

Laser Ranging Workflow

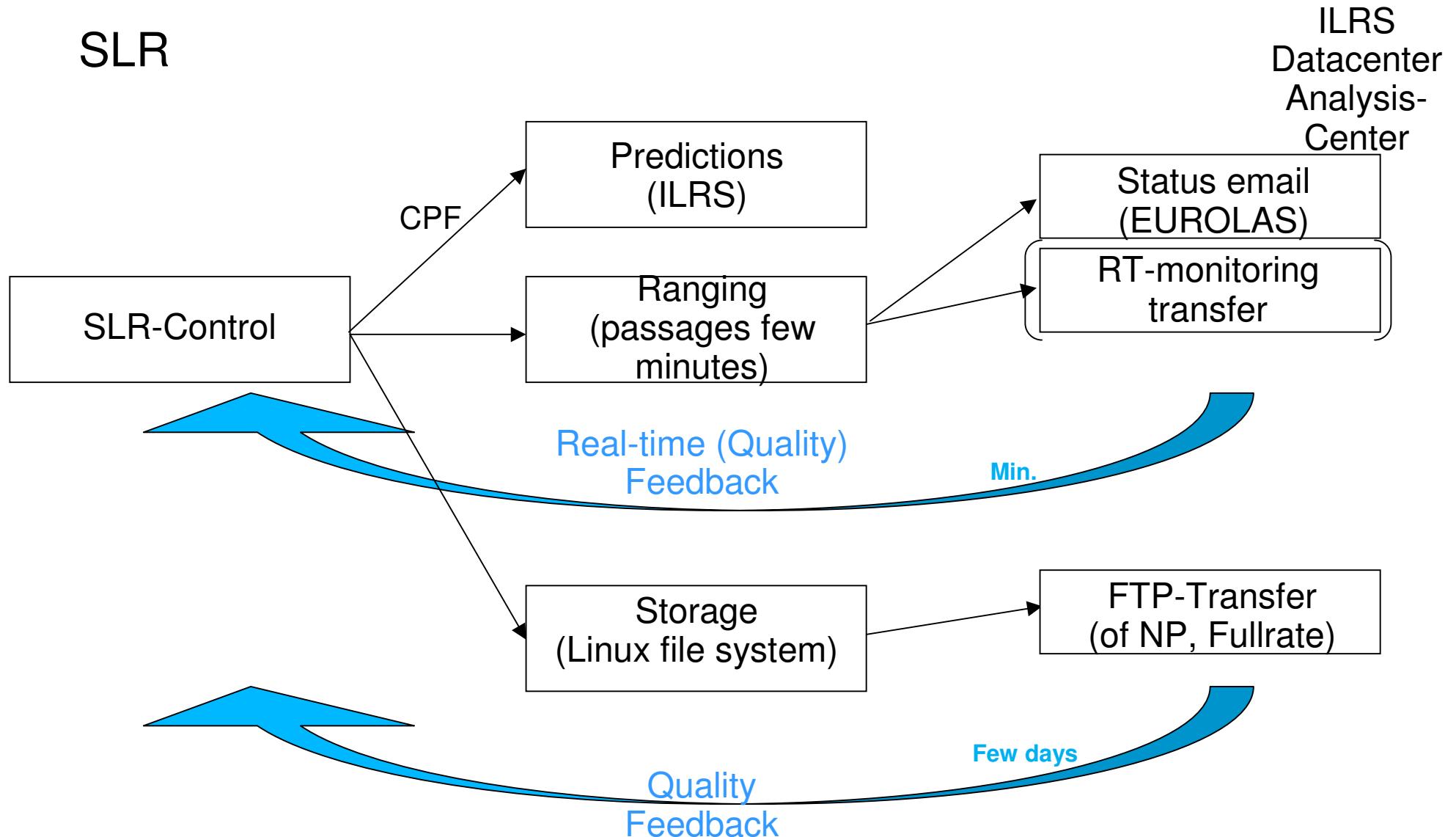
The workflows on a technical point of view



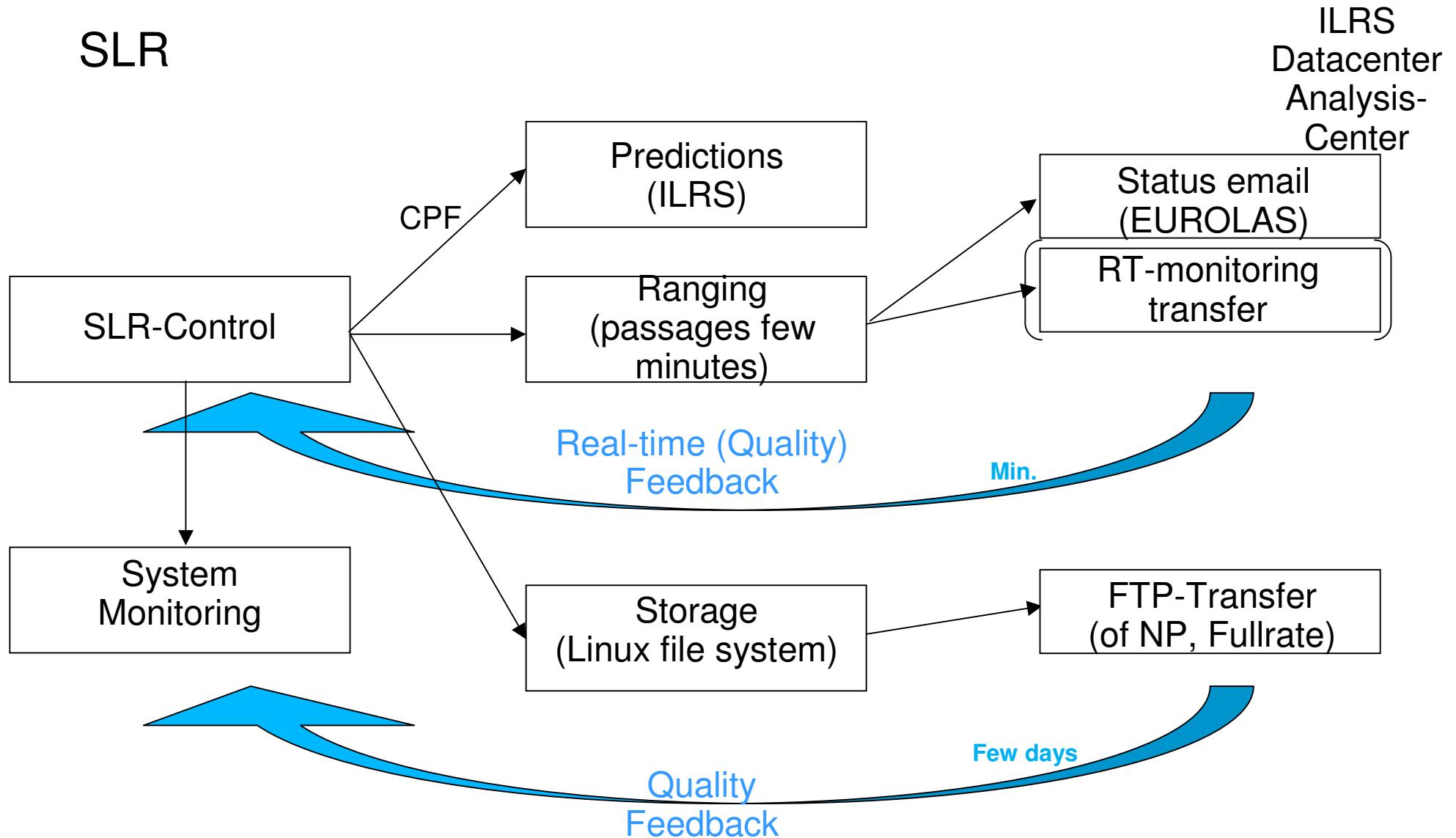
The workflows on a technical point of view



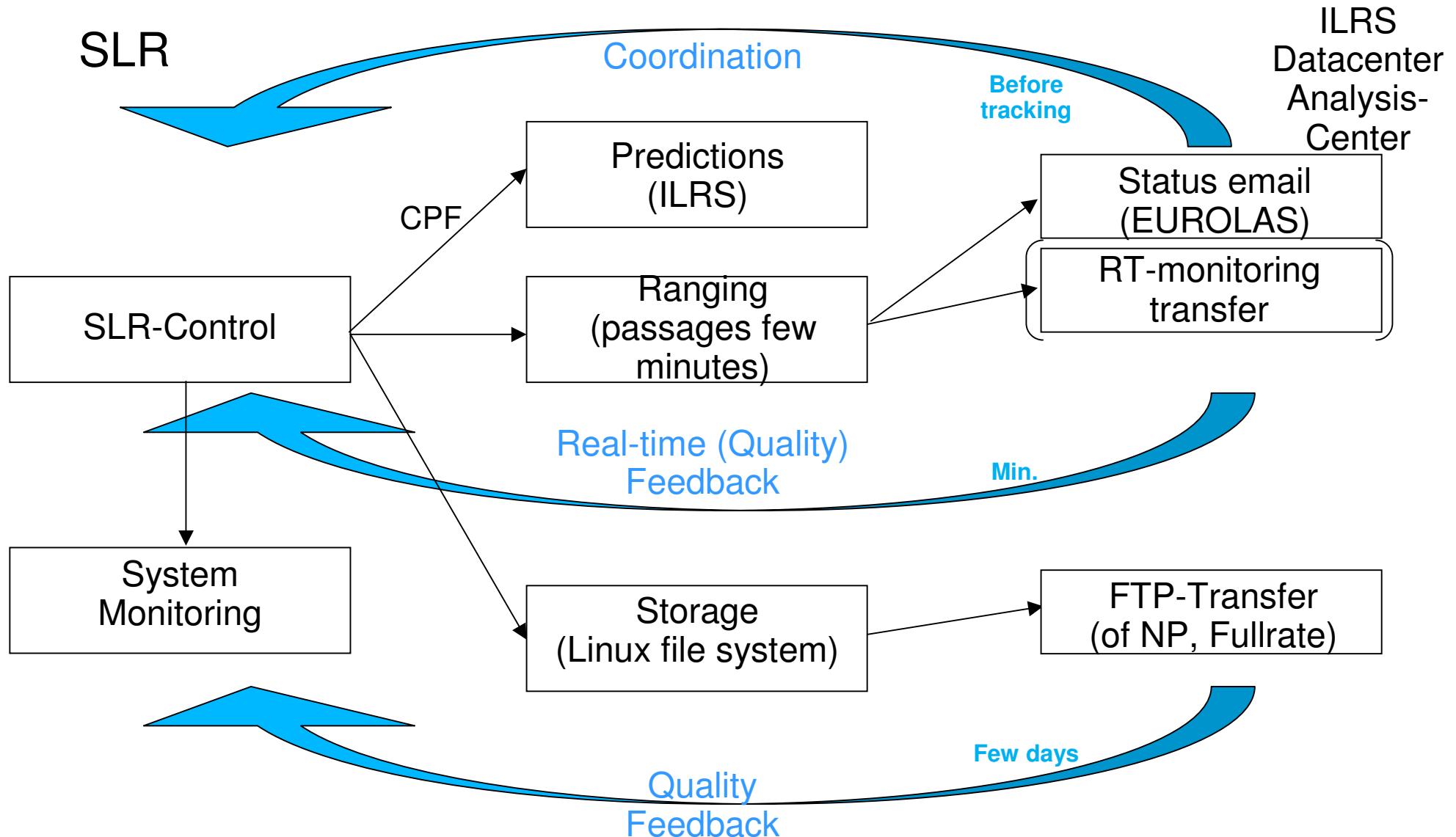
The workflows on a technical point of view



The workflows on a technical point of view



The workflows on a technical point of view



Standardizing interfaces and system software

Control includes ...



Access points,
available functionalities

Communication rules
and styles

Communication and
operation schedule

Communication data and
storage descriptions

Communication software and
hardware in a
development process

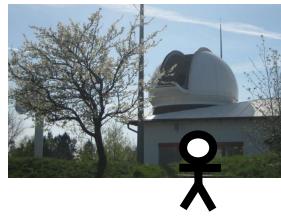
(New) strategies to operate
sites using communication

Authenticity and reliability

Standardization
&
synergies over
services and
system borders

New control strategies

New control strategies



Local

- Standard operations
- Local operator

New control strategies



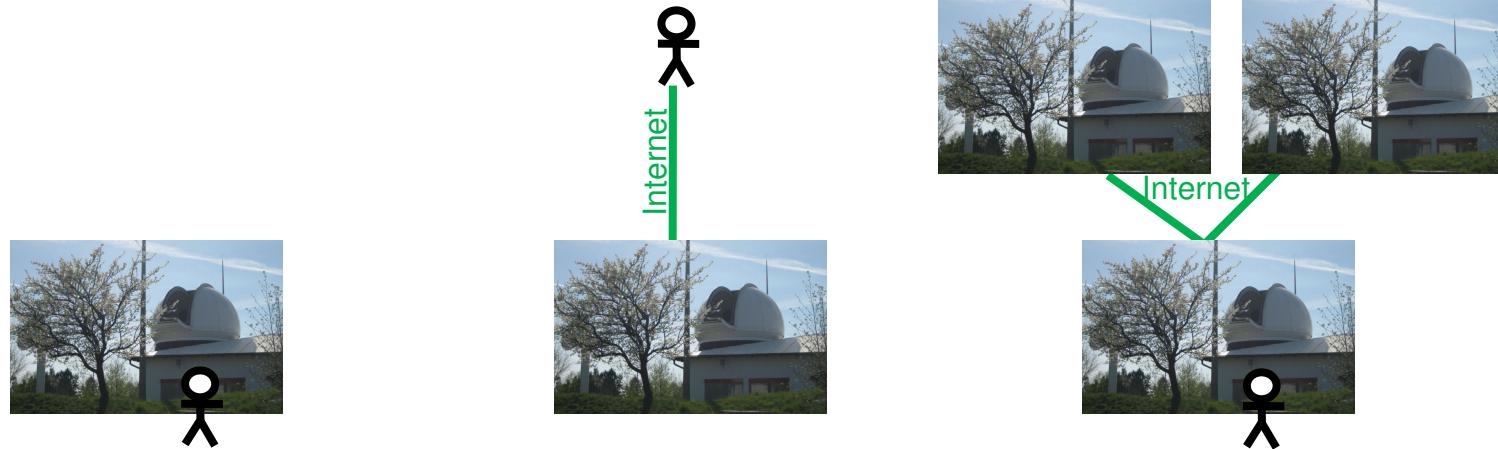
Local

- Standard operations
- Local operator

Remote

- Check system states from everywhere at the observatory
- Tele-working
- Remote assistance and diagnostics
- Control very remote, inaccessible telescopes

New control strategies



Local

- Standard operations
- Local operator

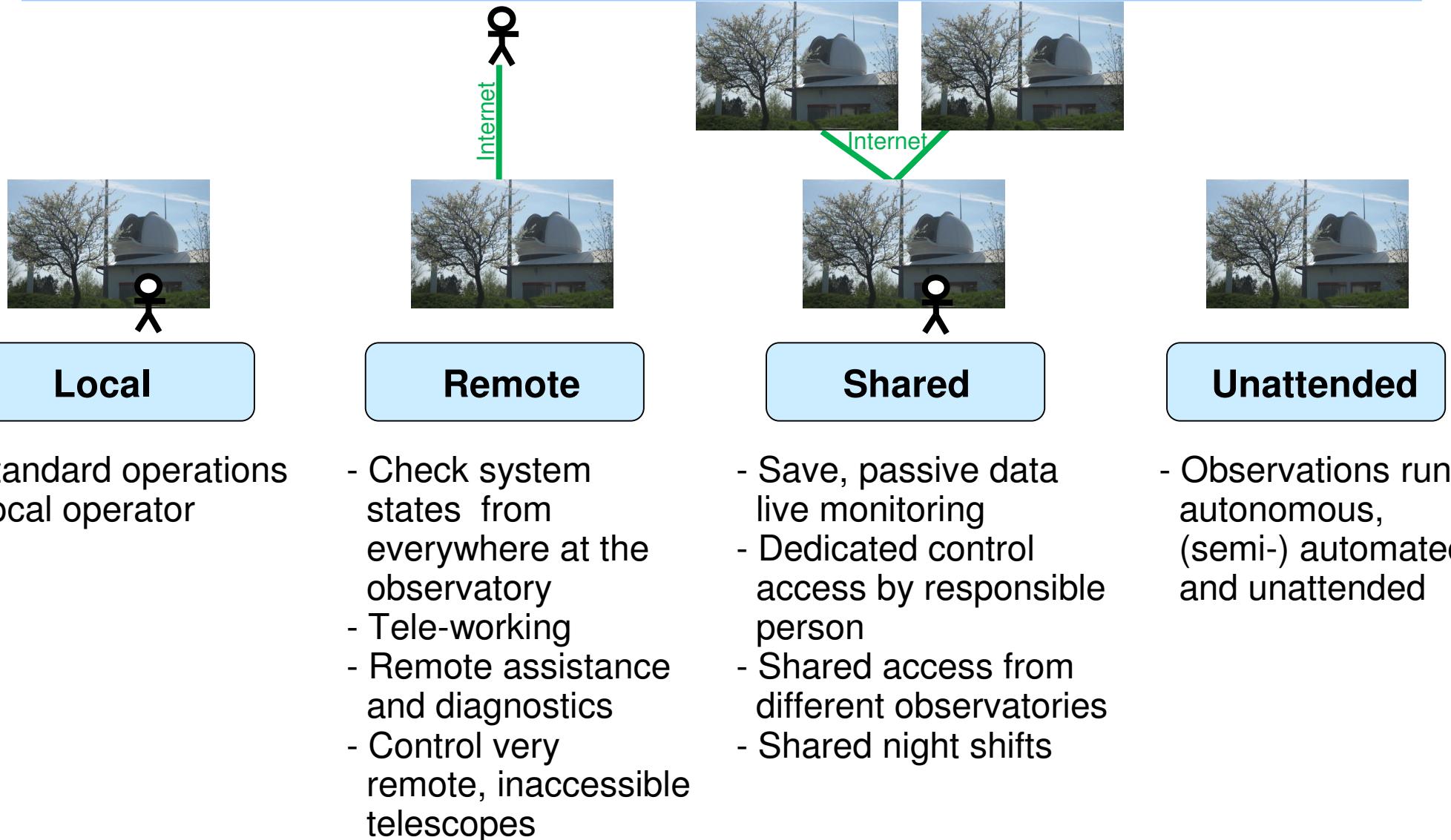
Remote

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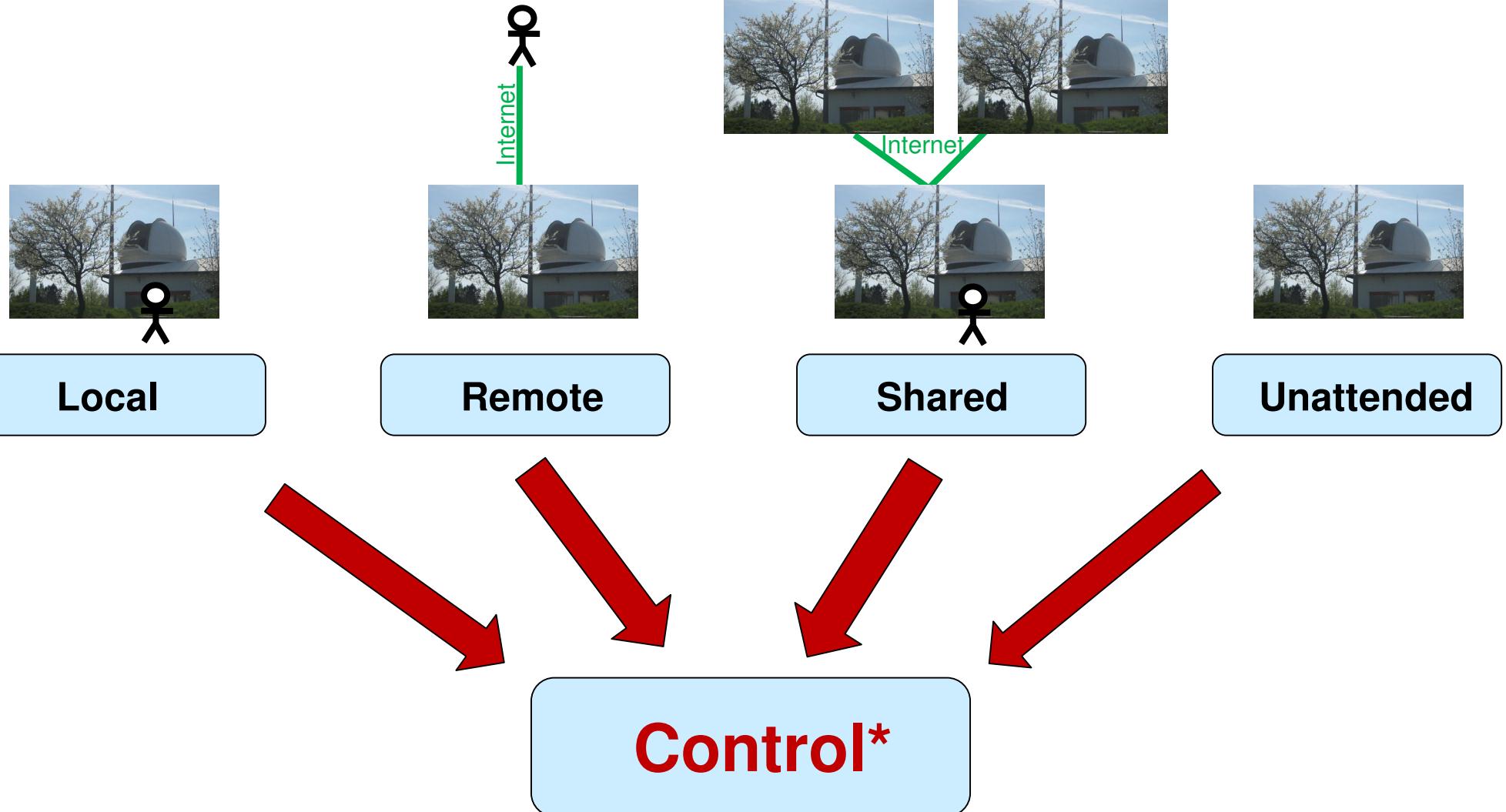
Shared

- Save, passive data live monitoring
- Dedicated control access by responsible person
- Shared access from different observatories
- Shared night shifts

New control strategies

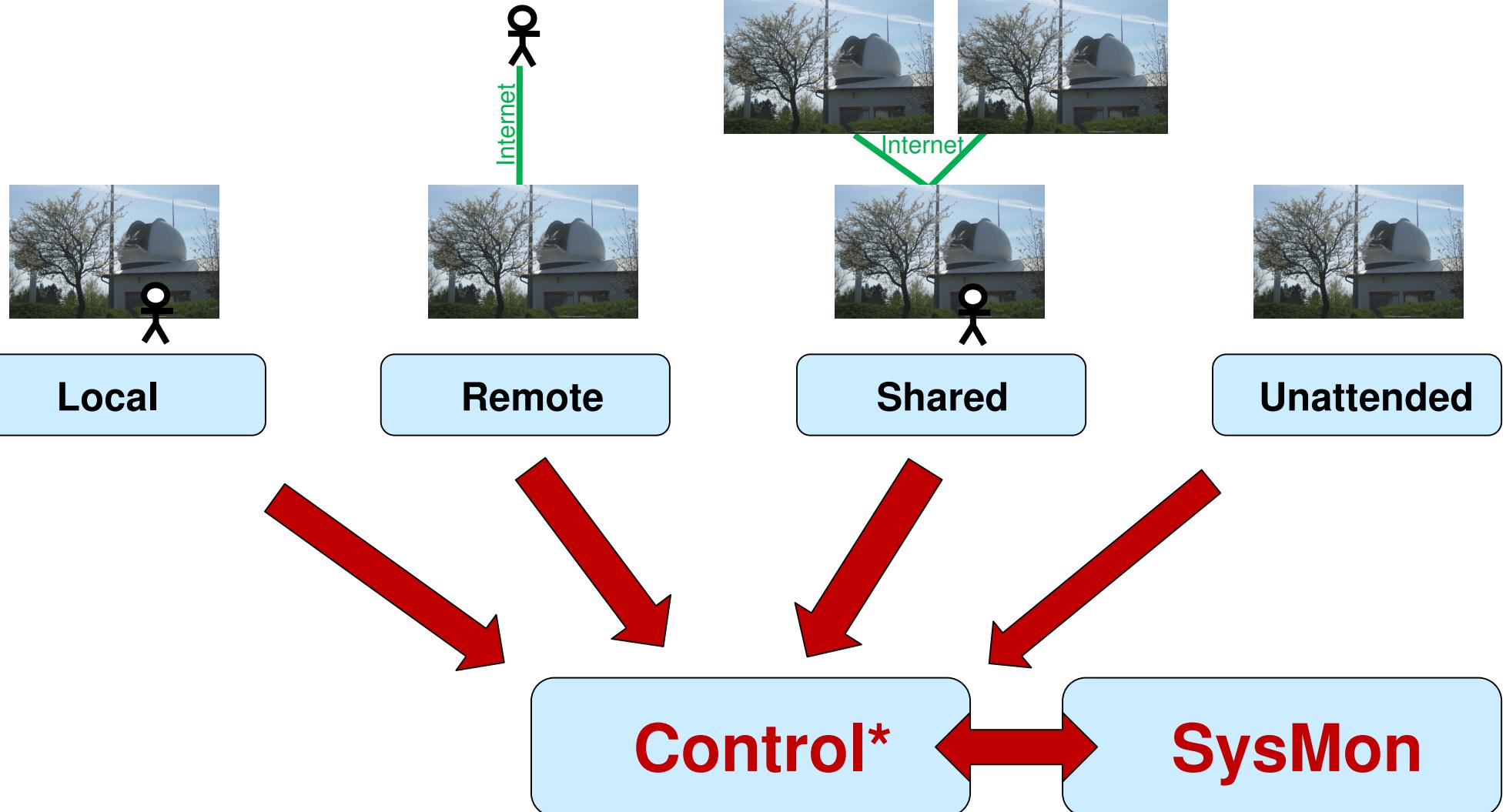


New control strategies



* per system with individual restrictions and
only with reliable, well educated personnel staff on site

New control strategies



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An example from astronomy: The Liverpool telescope

Prof. Iain Steele, Telescope Director



<http://telescope.livjm.ac.uk/>

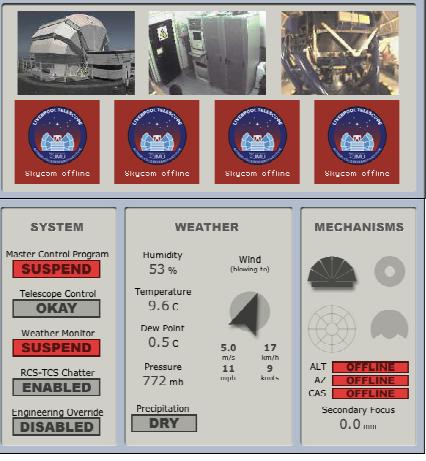
The Liverpool Telescope

- 2.0 metre f/10
- La Palma, Canary Islands
- Operating since 2004
- Fully Robotic (no on site staff).
- Multiple instruments (change time 20 seconds)
 - CCD imagers
 - Polarimeter
 - Spectrograph
- Common user (~50 users from ~20 institutions)
- Total Operating Budget 600,000 Euro/year
- <http://telescope.livjm.ac.uk/>



Web Based User Interaction

Live Status 2011 May 17
11:12:55 GMT



SYSTEM

- Master Control Program: **SUSPEND**
- Telescope Control: **OKAY**
- Weather Monitor: **SUSPEND**
- RCS-TCS Chatter: **ENABLED**
- Engineering Override: **DISABLED**

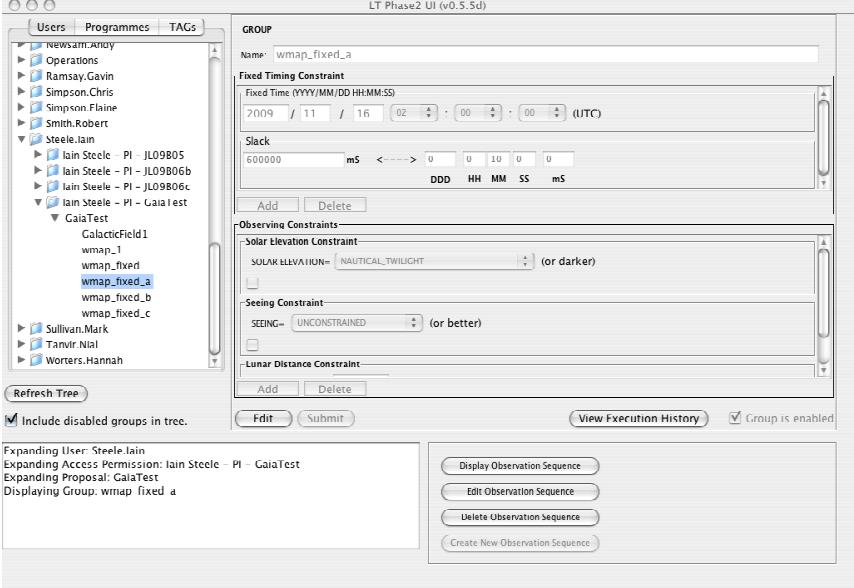
WEATHER

- Humidity: 53 %
- Temperature: 9.6 °C
- Dew Point: 0.5 °C
- Pressure: 772 mb
- Precipitation: DRY

Mechanisms

- Wind (blowing to): 5.0 mph (11 km/h)
- Secondary focus: 0.0 mm

LT Phase2 UI (v0.5.5d)



GROUP

Name: wmap_fixed_a

Fixed Timing Constraint

Fixed Time (YYYY/MM/DD HH:MM:SS)
2009 / 11 / 16 02:00:00 (UTC)

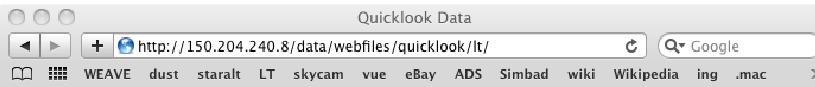
Slack: 600000 ms

Observing Constraints

- Solar elevation Constraint: SOLAR ELEVATION= NAUTICAL_TWILIGHT (or darker)
- Seeing Constraint: SEEING= UNCONSTRAINED (or better)
- Lunar Distance Constraint:

Display Observation Sequence
Edit Observation Sequence
Delete Observation Sequence
Create New Observation Sequence

Expanding User: Steele.Iain
Expanding Access Permission: Iain Steele - PI - GaiaTest
Expanding Proposal: GaiaTest
Displaying Group: wmap_fixed_a



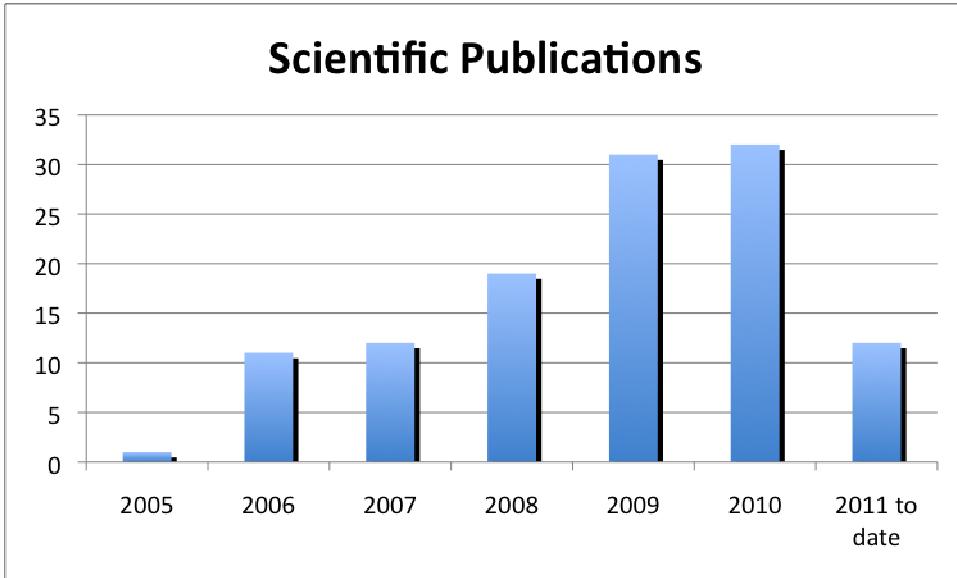
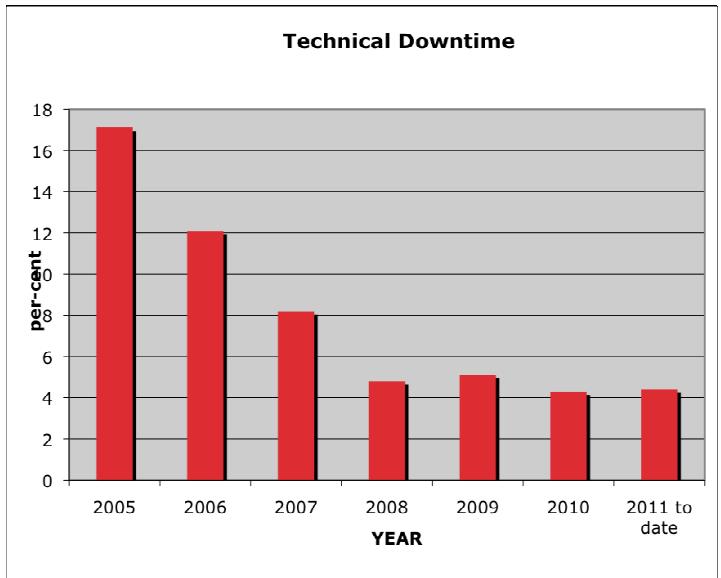
Liverpool Telescope Quicklook Data

Proposal	User Name	16/05	15/05	14/05	13/05
JL10B04	Ian McHardy	8	9	-	-
JL11A02	Mike Bode	-	25	180	24
JL11A03	Iain Steele	-	24	-	27
JL11A04b	David Bersier	-	-	3	-
PL10B02	David Sing	-	20	-	12
PL10B03	Tom Barclay	3	1	-	1
PL10B08	Mark Sullivan	3	-	-	3
PL11A02	Steven Parsons	-	-	-	100
PL11A03	M.T. Botticella	-	11	24	-
PL11A08	Ian McHardy	3	6	-	7
PL11A13	Keith Horne	-	-	-	3
CL11A01	Jose Moreno	-	-	-	100
CL11A05	Luis Goicoechea	15	-	1	1
CL11A06	Nancy Elias	-	-	5	11
CL11A08	Jorge Velasquez	-	8	-	-
IL10B01	Rubina Kotak	30	47	47	41
None	None	4	-	-	-
NSO Priority 1	Andy New sam	3	9	-	-
NSO Priority 2	Andy New sam	3	11	31	4
NSO Priority 3	Andy New sam	14	9	5	10
NSO Priority 4	Andy New sam	-	4	-	-
OL11A31	Ernst deMooij	9	9	9	9
RATStand	LTOps	98	98	84	98
RingoStand	LTOps	-	-	-	10
Standards	LT_RCS	284	48	4	8

All RATCam, FrodoSpec and SupIRCam data obtained on the telescope are available here about five minutes after the exposure is complete. A subset of RISE data are also included, though due to the high data rate from this instrument, not every file.

Data here are **quicklook reductions only**. They do not use the most up to date flat fields and have not undergone any detailed quality control inspection. Final reductions are available from the [searchable data archive](#) and [Recent Data](#) web pages next working day.

Some statistics and references ...



- The Liverpool Telescope: performance and first results, Steele I.A. et al., *Proc SPIE, 5489, pp. 679-692 (2004)*.
- Design of low cost and reliable instrumentation for robotic telescopes, Mottram, C.J. et al.. *Proc SPIE, 5492, pp. 677-688 (2004)*.
- Robotic telescope scheduling: the Liverpool Telescope experience, Fraser S. & Steele, I. A., *Proc SPIE 5493, pp. 331-340 (2004)*.
- Switching the Liverpool Telescope from a full-service operating model to self-service, Smith R.J. et al., *Proc SPIE 7713 (2010)*.

Thank you!