



## Minutes from the Riga 2017 ILRS ASC Meeting

*Sunday, October 1, Univ. of Latvia, Riga, 9:00 – 16:00*

### AC/CC STATUS REPORTS

**ASI:** Activities since last ASC meeting: daily and weekly time series adopting ITRF2014, AC performance check, combination s/w update for the systematic error pilot project, time series generation and combination for the systematic error pilot project. The AC performances are presented for the routine products: coordinates, EOP and orbits. The adoption of SLRF2014 started in mid-June and there is an expected improvement of the AC agreement in the coordinate residual WRMS. The coordinate residuals with respect to SLRF2014 are generally smaller; the daily JCET residual seem too small (2 mm) and its scale w.r.t. SLRF2014 is practically zero while the effect is not visible in the weekly solutions. No major differences are visible in the EOP and orbits. **GRGS and NSG solutions are not available.**

Regarding the requested submission for the systematic error pilot project, ESA, GRGS and NSGF are still not contributing. The combination done with the 5 ACs show a good agreement of the estimated biases.

**BKG:** nothing to report

**DGFI:** Routine activities. Horst Mueller announced his retirement.

**ESA:** no one attending.

**GFZ:** weekly solution v70 available, TVG estimation now implemented, PP time series submitted.

**GRGS:** The AC is almost ready to restart its activity after 3 computer crashes and major technical problems (**Action Item**). The financial support is available. Before restarting the routine submission, GRGS will undergo the benchmark test delivering the 2017 time-series to the 2 ILRS CCs. The time series for the systematic error Pilot Project will be delivered by the end of November (**Action Item**), the solutions will be aligned to the ASC guidelines for the wavelength indication in the SINEX file (SOLN field).

**NSGF:** The generation of the standard products (with a priori SLRF2014) will restart by the end of the month (**Action Item**). The 2017 time-series will be delivered directly to the CC for the benchmark. The LOD problems affecting the NSGF solutions has been probably solved. Regarding the participation in the systematic error Pilot Project, the ASC guidelines for the wavelength indication in the SINEX file (SOLN field) will be implemented and the time series submitted by the end of November (**Action Item**).

**LLR:** Nothing to report

**JCET:** Overview of the operational products' status.

- Quarantine Data validation: Quarantine site list has inactive stations since too many years; the CB will contact them and probably eliminate them from the list. Three NASA stations validated to switch from TIUs to ETs; checked several months of TIU & ET data taken in parallel.
- "[Monitoring of ILRS Analysis SC products](#)" on the web has now an updated set of series available from several ACs for the "bias" PP.
- Satellite data distribution statistics for LAGEOS & LARES with plots and tables, available for the entire network and the individual stations; reveals trends in how different sites track these targets: max. elevation of pass, min. elev. of acquisition and loss, max. pass duration
- SLRF2014 is very dynamic with new stations coming in and several existing ones upgrading their system. An update of SLRF2014 is required every time this happens. One such update should be out over the next week or so.
- Re-analysis with SLRF2014: change to the new IERS Conventional Mean Pole (JR made a lot of tests to select the optimal approach, see UAW recommendations), known as "Linear Mean Pole—LMP", long-wavelength gravity terms from UT/CSR with ITRF2014 will also be available in the next weeks and JCET will deliver their extension at least for the coming year. The AC delivery date must be decided (**pending final decision on CoM model to be adopted**).
- Recommendation of the UAW. The ILRSA time series constrained to ITRF2014 will be submitted after the re-analysis.

#### **ISSUES RELATED TO OPERATIONAL PRODUCTS**

- **Decision for ACs that do not deliver operational products** for extended time periods:  
**GRGS and NSGF will have one month extra time to deliver the official products**
- **Reanalysis** (weekly series) with SLRF2014 issues:
  - The adoption of the Conventional Mean Pole was discussed during the UAW. The model to be implemented in the reanalysis will be the linear mean pole model by John Ries
  - CoM model deficiencies pointed out by various groups
    - **D. Arnold** presented on parameters affecting data accuracy: quantization, difference between single and multi-photon systems, distance from the centroid
    - **J. Rodriguez** presented on the activities related to the center of mass corrections (CoM): the CoM cannot be retrieved by range bias because of the correlation. The estimation of the  $R_B$  will solve the problem and remove the urgency of tweaking existing CoM models but it is important to avoid attributing to the stations an error associated with the model. Anyway, the CoM bias is a fraction of the errors found as estimated by H. Mueller. Experiment ongoing at Herstmonceux with a Lageos-like ground target as suggested by D. Arnold. New LAGEOS and ETALON tables probably available for the re-analysis.
    - **H. Mueller** presented the results based on Peter Dunn's modified CoM LAGEOS table for NASA MCP stations using corrected values for the CoM corrections (their source isn't clear). In the weekly solutions, 0.25 ppb scale difference can be attributed to the CoM.
- **Operation Center Data Screening Harmonization Process** presented by K. Stevenson. ILRS Operations Centers perform quality checks (QC) on CRD files received from stations. Currently, the QC performed at the EDC and NASA OC are slightly different. The purpose of the QC upgrade is to align the QC with the CRD format update (currently in progress), implement identical checks at both OCs, and to make the QC more thorough and valuable to the user community. A spreadsheet was distributed and your feedback is expected.

- **Replacement of the TIU data** with concurrent ET data (kept in quarantine archives at present). The ASC decides that the ET data will replace the TIU s soon as they become the nominal data of the station. The ET data of the quarantine period will be online and available but will not replace the TIU data in the official databases.
- **Time biases from T2L2, A. Belli.** ASC will Implement timing errors by means of T2L2 tracking on Jason-2 in the Data Handling File. Time bias table available in SINEX format. The table will be cleaned and the data handling file will contain only the time biases to be applied (**Pavlis, Mueller, Luceri Action Item**). Website available at: <http://www.geoazur.fr/t2l2/en/data/v4>

#### **Implications of the IERS 2017 Unified Analysis Workshop for the ILRS**

- Summary of the ILRS-relevant sessions and plans for the implementation of the proposed changes:
  - The new Conventional Mean Pole—CMP: new linear model for the reanalysis
  - The new requirements for the SINEX products submitted to the next ITRF development effort:  $R_B$  and  $T_B$  included in the SINEX as a separate block, not with the estimated parameters.
  - IERS Pilot Project to test various High Frequency EOP models (info and request for volunteers). **ACs interested can join the PP contacting E.C. Pavlis**

#### **Station Systematic Error Monitoring Pilot Project**

- **GRGS and NSGF will submit the series by the end of November.** ESA will be contacted to be notified of its responsibility (**Action Item - Pavlis**)
- Results from the so far submitted series have been presented during the AC/CC status report session
- Plan:
  - AC submit their time series by the end of 2017. ASC chair will issue the call (**Action Item**)
  - The  $R_B$  table will be ready by the end of February 2018
  - The operational service is expected to come online by April 2018

#### **Planning the next Pilot Project and launch date:**

1. Estimation of low-degree SH of the gravity field and inclusion of LARES as a 5th satellite in our operational product development: the **ACs are requested to deliver the 2016 time-series with 4x4 gravity field as soon as they can do that.** Combination activity by the CCs in 2018. The chair will issue the call (**Action Item**)
2. Revisit NT Atm. Loading & Gravity implementation as an internal PP (eventually to be used operationally for new series—NOT for ITRF use). To be planned after the previous PP.

#### **The Journal of Geodesy Special Issue—JOGSI (Status Update, submissions):**

- We finally received 39 abstracts and did not turn down any submission;
- Submitted to the Editor in Chief of JoG (Jürgen Kusche) for initial approval and estimation of total pages: probably two issues.
- Two more guest editors will be identified to help (**Toshimichi Otsubo and Ulli Schreiber accepted and joined the board**).

***Next meeting in Vienna, during the EGU week, on Thursday 12 April, 09:00-17:00***

# APPENDIX

## I. SUMMARY of ACTION ITEMS:

AI No.	Responsible Entity	Action Item Description
1	JCET	Reconcile the SLRF2014-product scale with that of the SLRF2008 series
2	ESA, GRGS & NSGF	Deliver v201 SINEX files for the Syst. Error PP by the end of November
3	GRGS & NSGF	Restart your operational product line by the end of the month and deliver the 2017 time-series for validation to the 2 ILRS CCs
4	GRGS & NSGF	Implement the new format for bias labels (SOLN field) for above test!
5	JCET	Deliver the UT/CSR low-degree term series for the reanalysis series
6	JCET	Deliver John Ries' "linear mean pole" model adopted at the UAW2017
7	JCET	Clarify the CoM model status with the ad hoc WG and report to ACs for the reanalysis series
8	ALL	Respond to the OC Data Screening Harmonization Process using the spreadsheet provided already and available also in the Appendix today
9	Luceri, Pavlis, Müller	Review T2L2 TB estimates and decide on the ones to be applied; integrate them in the current Data Handling File.
10	ALL ACs	If interested in contributing to the <i>GGOS/IERS Pilot Project to test various High Frequency EOP models</i> , contact <a href="mailto:epavlis@umbc.edu">epavlis@umbc.edu</a>
11	ALL ACs	Look out for a call for the complete reanalysis of the full SLR data set using SLRF2014 and allowing for all-systematics adjustment to be ready and delivered to CCs by the end of 2017 (instructions with the call).
12	ALL ACs	Look out for a call for submission of a test series including all weekly SINEXs of 2016 reanalyzed with the inclusion of LARES data and the estimation of a 4x4 set of gravitational harmonics (details with the call)

## II. Operation Center Data Screening Harmonization Process Spreadsheet with Proposed Actions

Record Type	Record Name	Field Name	CRD Format Specification	New Spec	Error Type	Questions/Comments
H1	Format Header	H1	"H1" or "H1"	"H1" or "H1"	Error	
H1	Format Header	CRD	"CRD" or "crd"	"CRD" or "crd"	Error	
H1	Format Header	Format Version	1	[0 (warning),1,...,99]	Error	
H1	Format Header	Year of file production		[1950,...,2100]	Error	
H1	Format Header	Month of file production		[1,...,12]	Error	
H1	Format Header	Day of file production		[1,...,31]	Error	
H1	Format Header	Hour of file production (UTC)		[0,...,23]	Error	
H1	Format Header	Other H1 Check	One and only one H1 Record Must Exist	One and only one H1 Record Must Exist	Error	
H1	Format Header	Other H1 Check		Date of file production must be valid	Error	
H1	Format Header	Other H1 Check	Fixed Format	Wrong pattern of record (spaces at wrong positions) or record length not exact 23 characters	Error	
H2	Station Header	H2	"H2" or "H2"	"H2" or "H2"	Error	
H2	Station Header	Station name from official list		Station name exists on official list	Error	
H2	Station Header	Crustal Dynamics Project 4-Digit Pad Identifier				
H2	Station Header	Crustal Dynamics Project 2-digit system number				
H2	Station Header	Crustal Dynamics Project 2-digit occupancy sequence number				
H2	Station Header	Station Epoch Time Scale – Indicated the time scale reference	[0,1,...]	[0,...,99]	Error	Currently recognized values are 3,4,7 Any need to discuss the process of accepting others?
H2	Station Header	Other H2 Check	One and only one H2 Record Must Exist	One and only one H2 Record Must Exist	Error	
H2	Station Header	Other H2 Check		Station name and SOD number must be from the same station		
H2	Station Header	Other H2 Check		SOD & CDP numbers exist in station lists	Error	
H2	Station Header	Other H2 Check	Fixed Format	Wrong pattern of record (spaces at wrong positions) or record length not exact 27 characters	Error	
H3	Target Header	H3	"H3" or "H3"	"H3" or "H3"	Error	
H3	Target Header	Target name from official list		Target name must be found on official target name	Error	
H3	Target Header	Target name from official list		Target name should be in lowercase and right justified	Warning	
H3	Target Header	Target name from official list		Target information must be correct/SIC must fit to satellite name	Error	
H3	Target Header	ILRS Satellite Identifier (Based on COSPAR ID)		Satellite identifier must be found in ILRS	Error	
H3	Target Header	SIC		Target SIC must be found on official target SIC	Error	
H3	Target Header	SIC		SIC must fit to satellite name	Error	
H3	Target Header	NORAD ID		NORAD ID must be found on official target NORAD ID based in ILRS ID or -1	Error	Do the satellite name, SIC, COSPAR, and NORAD ID all need to match? Is one most/least important?

Cells in yellow are fields where we are seeking input  
Input on any field is welc

H3	Target Header	NORAD ID							
H3	Target Header	Spacecraft Epoch Time Scale	[0,1,2]	[0,1,2]	[0,1,2]	Error			
H3	Target Header	Target type	[1,2,3,4]	[1,2,3,4]	[1.....4]	Error			
H3	Target Header	Other H3 Check	One and only one H3 Record Must Exist	Only one H3 Record Must Exist		Error			
H3	Target Header	Other H3 Check		Target type must be found on official target type based on IIRS ID		Error			
H3	Target Header	Other H3 Check		If Target Type ==3 or ==4 Transponder Configuration C4 Record Required		Error			
H3	Target Header	Other H3 Check		Wrong pattern of record (spaces at wrong positions) or record length not exact 40 characters		Error			
H3	Target Header	Other H3 Check	Fixed Format	Wrong pattern of record (spaces at wrong positions) or record length not exact 40 characters		Error			
H4	Session (Pass) Header	H4	"H4" or "h4"	"H4" or "h4"		Error			
H4	Session (Pass) Header	Data Type	[0,1,2]	[0,1,2,3 (time transfer), 4 (visual) ]		Error			
H4	Session (Pass) Header	Data Type		Data type !=1 for normal points (11 record)		Error			
H4	Session (Pass) Header	Data Type		Data type !=0 for full-rate data (10 record)		Error			
H4	Session (Pass) Header	Starting Year		[1950.....2100]		Error			
H4	Session (Pass) Header	Starting Month		[1.....12]		Error			
H4	Session (Pass) Header	Starting Day		[1.....31]		Error			
H4	Session (Pass) Header	Starting Hour		[0.....23]		Error			
H4	Session (Pass) Header	Starting Minute		[0.....59]		Error			
H4	Session (Pass) Header	Starting Second		[0.....59]		Error			
H4	Session (Pass) Header	Ending Year		[-1, 1950.....,2100]		Error			
H4	Session (Pass) Header	Ending Month		[-1, 1.....,12]		Error			
H4	Session (Pass) Header	Ending Day		[-1, 1.....,31]		Error			
H4	Session (Pass) Header	Ending Hour		[-1, 0.....,23]		Error			
H4	Session (Pass) Header	Ending Minute		[-1, 0.....,59]		Error			
H4	Session (Pass) Header	Ending Second		[-1, 0.....,59]		Error			
H4	Session (Pass) Header	A flag to indicate the data release	[0, 1, 2,...]	[0.....,99]		Error			
H4	Session (Pass) Header	Tropospheric refraction correction applied indicator	[0,1]	[0,1]; if set to 1, a record 12 must exist		Error			
H4	Session (Pass) Header	Center of mass correction applied indicator	[0,1]	[0,1]; if set to 1, a record 12 must exist		Error			
H4	Session (Pass) Header	Received amplitude correction applied indicator	[0,1]	[0,1]		Error			
H4	Session (Pass) Header	Station system delay applied indicator	[0,1]	[0,1]		Error			
H4	Session (Pass) Header	Spacecraft system delay applied indicator (transponders) indicator	[0,1]	[0,1]		Error			
H4	Session (Pass) Header	Range type indicator	[0,1,2,3,4]	[0,1,2,3,4]		Error			
H4	Session (Pass) Header	Data quality alert indicator	[0,1,2]	[0,1,2]		Error			
H4	Session (Pass) Header	Other H4 Check	One and only one H4 Record Must Exist	Only one H4 Record Must Exist		Error			
H4	Session (Pass) Header	Other H4 Check		Starting date must be valid		Error			
H4	Session (Pass) Header	Other H4 Check		Ending date must be valid		Error			
H4	Session (Pass) Header	Other H4 Check	Fixed Format	Wrong pattern of record (spaces at wrong positions) or record length not exact 62 characters		Error			
H4	Session (Pass) Header	Other H4 Check		End Year - Start Year must be <=1					
H4	Session (Pass) Header	Other H4 Check		(iff end year !=-1)					
H4	Session (Pass) Header	Other H4 Check		Duration must be less than one day (MJD or Unix or whatever)					

H8	End of Session Footer	H8	"H8" or "h8"	"H8" or "h8"	Must contain H8 before H9	Error	
H8	End of Session Footer	Other H8 Check			One and only one H8 Record Must Exist in single pass file	Error	
H8	End of Session Footer	Other H8 Check			Must have same number of H4 and H8 records		
H8	End of Session Footer	Other H8 Check					
H9	End of File Footer	H9	"H9" or "h9"	"H9" or "h9"		Error	
H9	End of File Footer	Other H9 Check			One and only one H9 Record Must Exist at the end of file	Error	
C0	System Configuration	C0	"C0" or "c0"	"C0" or "c0"		Error	
C0	System Configuration	Detail Type	0	0		Error	
C0	System Configuration	Transmit Wavelength (nm)			Suggest Check: maintain list of standard wavelengths and check that the value is within +/- 1% of something on the list. Proposed list: 355, 423, 532, 694, 847, 1064, 1550	Error	How much leeway from the specified list is appropriate?
C0	System Configuration				CO record Transmit Wavelength <= C1 Primary Wavelength		
C0	System Configuration				CO record Transmit Wavelength <= C2 Applicable Wavelength		
C0	System Configuration	System Configuration ID					
C0	System Configuration	Component A configuration ID					
C0	System Configuration	Component B configuration ID					
C0	System Configuration	Component C configuration ID					
C0	System Configuration	Component D configuration ID					
C0	System Configuration	Other C0 Check			The record length must be at least 4 characters	Error	
C1	Laser Configuration	C1	"C1" or "c1"	"C1" or "c1"		Error	
C1	Laser Configuration	Detail Type	0	0		Error	
C1	Laser Configuration	Laser Configuration ID			Laser configuration id match CO record Component A configuration id	Warning	
C1	Laser Configuration	Laser Type					
C1	Laser Configuration	Primary wavelength (nm)			Suggest Check: maintain list of standard wavelengths and check that the value is within +/- 1% of something on the list. Proposed list: 355, 423, 532, 694, 847, 1064, 1550	Error	How much leeway from the specified list is appropriate?
C1	Laser Configuration	Nominal Fire Rate (Hz)			[-1.0, 1, ..., 10000] or not in [ > 0 ] (n.a. -1)	Warning	
C1	Laser Configuration	Pulse Energy (mJ)			[-1.0, 1, ..., 1000] or not in [ > 0 ] (n.a. -1)	Warning	
C1	Laser Configuration	Pulse Width (FWHM in ps)			[-1.0, 1, ..., 10000] or not in [ > 0 ] (n.a. -1)	Warning	
C1	Laser Configuration	Beam Divergence (arcsec)			[-1.0, 1, ..., 40] or not in [ > 0 ] (n.a. -1)	Warning	
C1	Laser Configuration	Number of pulses in outgoing semi-train			[-1.0, 1, ..., 1000] or not in [ > 0 ] (n.a. -1)	Warning	
C1	Laser Configuration	Other			The record length must contain 10 fields	Error	
C2	Detector Configuration	C2	"C2" or "c2"	"C2" or "c2"		Error	
C2	Detector Configuration	Detail Type	0	0		Error	
C2	Detector Configuration	Detector Configuration ID			Detector Configuration ID match CO record Component B configuration id	Warning	
C2	Detector Configuration	Detector Type					

C2	Detector Configuration	Applicable wavelength (nm)		Suggest Check: maintain list of standard wavelengths and check that the value is within +/- 1% of something on the list. Proposed list: 355, 423, 532, 694, 847, 1064, 1550	Error	How much leeway from the specified list is appropriate?
C2	Detector Configuration	Quantum efficiency at applicable wavelength (%)		[-1, ..., 100]	Warning	
C2	Detector Configuration	Applied voltage (V)		[-1.e4, ..., 1e4]	Warning	
C2	Detector Configuration	Dark Count (KHz)		[-1, ..., 1e3]	Warning	
C2	Detector Configuration	Output pulse width		[-1, ..., 1e6]	Warning	
C2	Detector Configuration	Output pulse width (ps)		[-1, ..., 1e2]	Warning	
C2	Detector Configuration	Spectral Filter (nm)		[-1, ..., 1e2]	Warning	
C2	Detector Configuration	% Transmission of Spectral Filter		[-1, ..., 100]	Warning	
C2	Detector Configuration	Spatial Filter (arcsec)		[-1, ..., 1e2]	Warning	
C2	Detector Configuration	External Signal processing		The record length must contain 14 fields	Error	
C3	Timing Configuration	Other		"C3" or "C3"	Error	
C3	Timing Configuration	Detail Type		0	Error	
C3	Timing Configuration	Timing System Configuration ID		Timing system configuration id match C0 record Component C configuration id	Warning	
C3	Timing Configuration	Time Source				
C3	Timing Configuration	Frequency Source				
C3	Timing Configuration	Timer				
C3	Timing Configuration	Timer Serial Number				
C3	Timing Configuration	Epoch Delay Correction (µs)		[-1, -5.e5, ..., 5.e5]	Warning	
C3	Timing Configuration	Other		The record length must contain 8 fields	Error	
C4	Transponder (Clock)	C4		"C4" or "C4"	Error	
C4	Transponder (Clock)	Detail Type		0	Error	
C4	Transponder (Clock)	Transponder Configuration ID		Transponder configuration if match C0 record Component D configuration id	Warning	
C4	Transponder (Clock)	Estimated Station UTC offset (nanosec)		[-5e8, ..., 5e8]	Warning	What might appropriate values be?
C4	Transponder (Clock)	Estimated Station Oscillator Drift		Numerical Test	Error	What might appropriate values be?
C4	Transponder (Clock)	Estimated Transponder UTC offset		Numerical Test	Error	What might appropriate values be?
C4	Transponder (Clock)	Estimated Transponder Oscillator Drift		Numerical Test	Error	What might appropriate values be?
C4	Transponder (Clock)	Transponder Clock Reference Time		Numerical Test	Error	What might appropriate values be?
C4	Transponder (Clock)	Station clock offset and drift applied indicator		[0, 1, 2, 3]	Warning	
C4	Transponder (Clock)	Spacecraft clock offset and drift applied indicator		[0, 1, 2, 3]	Warning	
C4	Transponder (Clock)	Spacecraft time simplified		[0, 1]	Warning	
C4	Transponder (Clock)	Other		The record length must contain 11 fields	Error	
C4	Transponder (Clock)	Other		"10"	Error	
10	Range (Full rate)	Seconds of day		[0, ..., 86400]	Error	Appropriate upper bound? E.g. 2 x 86400 = 172800
10	Range (Full rate)	Time of flight in seconds		[-1, ..., 10000]	Error	
10	Range (Full rate)	System configuration id		System configuration ID must be in C0-record	Error	



10	Range (Full rate)	Epoch event	[0,1,2,3,4,5,6]	[0,1,2,3,4,5,6]	[0,1,2]	Warning	
10	Range (Full rate)	Filter flag	[0,1,2]	[0,1,2]	[0,1,2]	Warning	
10	Range (Full rate)	Detector channel	[0,1,...,99]	[0,1,...,99]	[0,1,...,99]	Error	
10	Range (Full rate)	Stop number	[0,1,...]	[0,1,...,99]	[0,1,...,99]	Error	
10	Range (Full rate)	Receive Amplitude		[-1,0,...,99999]		Warning	
10	Range (Full rate)	Other 10 Check		The record length must contain 9 fields		Error	
11	Range (Normal Point)		"11"	"11"		Error	
11	Range (Normal Point)	Seconds of day		[0,...,86400]		Error	Appropriate upper bound? E.g. 2 x 86400 = 172800
11	Range (Normal Point)			Must be in same revolution		Error	
11	Range (Normal Point)	Time of flight in seconds		[-1,...,10000]		Error	
11	Range (Normal Point)	System configuration id		Valid System Configuration ID/ System configuration ID must be in Co-record		Error	
11	Range (Normal Point)	Epoch event	[0,1,2,3,4,5,6]	[0,1,2,3,4,5,6]	[0,1,2,3,4,5,6]	Warning	
11	Range (Normal Point)	Normal point window length (sec)		[0,1,...,3600]		Warning	Is thr a relevant threshold?
11	Range (Normal Point)	Number of raw ranges		[0,1,...]		Warning	
11	Range (Normal Point)	Bin RMS from mean of raw accepted time of flight values minus the trend function (ps)		[0,1,...,1e5] (test to see what extremes are good data and use those values)		Warning	What might appropriate values be?
11	Range (Normal Point)	Bin skew from mean of raw accepted time of flight values minus the trend function		(test to see what extremes are good data and use those values)		Warning	What might appropriate values be?
11	Range (Normal Point)	Bin kurtosis from mean of raw accepted time of flight values minus the trend function		(test to see what extremes are good data and use those values)		Warning	What might appropriate values be?
11	Range (Normal Point)	Bin peak – mean (ps)		[-1.e5,...,1.e5]		Warning	What might appropriate values be?
11	Range (Normal Point)	Return rate		[-1,0,1,...,100]		Warning	
11	Range (Normal Point)	Detector channel	[0,1,...]	[0,1,...,99]		Error	
11	Range (Normal Point)	Other 11 Check		The record length must contain 13 fields		Error	
12	Range Supplement		"12"	"12"		Error	
12	Range Supplement	Seconds of day		[0,...,86400]		Error	Appropriate upper bound? E.g. 2 x 86400 = 172800
12	Range Supplement	System configuration id		Valid system configuration id/ System configuration id must be in Co-record		Error	
12	Range Supplement	Tropospheric refraction correction		[-1,0,...,2e5]		Warning	What might appropriate values be?
12	Range Supplement	Target center of mass correction		[-1,0,..., ]		Warning	What might appropriate values be?
12	Range Supplement	Neutral density filter value		[-1,0,...,100]		Warning	What might appropriate values be?
12	Range Supplement	Time bias applied		[-10,...,10]		Warning	What might appropriate values be?
12	Range Supplement	Other 12 Check		The record length must contain 7 fields		Error	
20	Meteorological		"20"	"20"		Error	
20	Meteorological	Seconds of day		[0,...,86400]		Error	Appropriate upper bound? E.g. 2 x 86400 = 172800
20	Meteorological	Surface pressure		[600,...,1100]		Error	
20	Meteorological	Surface temperature (K)		[200,...,340]		Error	
20	Meteorological	Relative humidity (%)		[0,...,100]		Error	
20	Meteorological	Origin of values	[0,1]	[-1,0,1]		[0,1]	

20	Meteorological	Other 20 Check			The record length must contain 6 fields	Error	
20	Meteorological				There must be at least one meteorological record	Error	
21	Meteorological Supp	21	"21"	"21"		Error	
21	Meteorological Supp	Seconds of Day		[0,,,,,86400]	Appropriate upper bound? E.g. 2 x 86400 = 172800	Error	
21	Meteorological Supp	Wind Speed (m/s)		[-1,,,,,100]		Warning	
21	Meteorological Supp	Wind Direction (deg az north=0)		[-1,-180,,,360]		Warning	
21	Meteorological Supp	Precipitation type					
21	Meteorological Supp	Visibility (km)		[-1,,,,,100]		Warning	
21	Meteorological Supp	Sky Clarity (zenith extinction coeff)		[-1,,,,,100]		Warning	
21	Meteorological Supp	Atmospheric seeing (arcsec)		[-1,,,,,100]		Warning	
21	Meteorological Supp	Cloud cover (%)		[-1,,,,,100]		Warning	
21	Meteorological Supp	Other 21 Check			The record length must contain 9 fields	Error	
30	Pointing Angles	30	"30"	"30"		Error	
30	Pointing Angles	Seconds of Day		[0,,,,,86400]	Appropriate upper bound? E.g. 2 x 86400 = 172800	Error	
30	Pointing Angles	Azimuth in degrees		[-1,-180,,,360]		Warning	
30	Pointing Angles	Elevation in degrees		[-1,,,,,180]		Warning	
30	Pointing Angles	Direction Flag	[0,1,2]	[-1,,,,,2]		Warning	
30	Pointing Angles	Angle origin indicator	[0,1,2,3]	[0,,,,,3]		Warning	
30	Pointing Angles	Refraction corrected	[0,1]	[0,1]		Warning	
30	Pointing Angles	Other 30 Check			The record length must contain 7 fields	Error	
40	Calibration	40	"40"	"40"		Error	
40	Calibration	Seconds of Day		[0,,,,,86400]	Appropriate upper bound? E.g. 2 x 86400 = 172800	Error	
40	Calibration	Type of data	[0,1,2,3,4,5]	[0,,,,,5]		Error	
40	Calibration	System configuration id			Valid System configuration ID must be in CO-record	Error	
40	Calibration	Number of data points recorded	[-1,0,1,...]	[-1,,,,,1e8]		Warning	
40	Calibration	Number of data points used	[-1,0,1,...]	[-1,,,,,1e8]		Warning	
40	Calibration	One way target distance (m)	[-1,0,1,...]	[-1,0,0,,,,,1e4]		Warning	
40	Calibration	Calibration System Delay (ps)		[-1,e4,,,,,1e8]	What might appropriate values be?	Error	
40	Calibration	Calibration Delay Shift (ps)		[-1,e5,,,,,1e5]	What might appropriate values be?	Error	
40	Calibration	RMS of raw system delay		[-1,,,,,2,e5]	What might appropriate values be?	Error	
40	Calibration	Skew of raw system delay values from the mean			(test to see what extremes are good data and use those values)	Warning	
40	Calibration	Kurtosis of raw system delay values from the mean			(test to see what extremes are good data and use those values)	Warning	
40	Calibration	System delay peak – mean		[-1,e5,,,,,1,e5]	What might appropriate values be?	Warning	
40	Calibration	Calibration Type Indicator	[0,1,2,3,4,5]	[0,1,2,3,4,5]		Warning	
40	Calibration	Calibration Shift Type Indicator	[0,1,2,3,4]	[0,1,2,3,4]		Warning	
40	Calibration	Detector channel	[0,1,...]	[0,,,,,99]		Error	
40	Calibration	Other 40 Check			The record length must contain 16 fields	Error	
50	Session (Pass) Statistics	50	"50"	"50"		Error	
50	Session (Pass) Statistics	System Configuration id			Valid system configuration ID/ System configuration ID must be in CO-record	Error	

50	Session (Pass) Statistics	Session RMS from the mean of raw, accepted time of flight values minus the trend function		[0....2e4]	Warning	What might appropriate values be?
50	Session (Pass) Statistics	Session skewness from the mean of raw accepted time of flight values minus the trend function		(test to see what extremes are good data and use those values)	Warning	What might appropriate values be?
50	Session (Pass) Statistics	Session Kurtosis from the mean of raw accepted time of flight values minus the trend function		(test to see what extremes are good data and use those values)	Warning	What might appropriate values be?
50	Session (Pass) Statistics	Session peak – mean		[-1.e5,..1.e5]	Warning	What might appropriate values be?
50	Session (Pass) Statistics	Data quality assessment indicator	[0,1,2,3,4,5]	[0,1,2,3,4,5]	Warning	
50	Session (Pass) Statistics	Other 50 Check		The record length must contain 7 fields	Error	
60	Compatibility Record	60		"60"	Error	
60	Compatibility Record	System configuration id		"Valid System Configuration ID" or "Valid system configuration ID/ System configuration ID must be in CO+record"	Error	
60	Compatibility Record	System change indicator	[0,1,2,3,4,5,6,7,8,9]	[-1,0....,9]	Warning	
60	Compatibility Record	System Configuration indicator		[-1,0....,9]	Warning	
60	Compatibility Record	Other 60 Check		The record length must contain 4 fields	Error	
9X	User-defined	9X		not in [ '9x' ]	Error	
00	Comment	00		"00"		
00	Comment	Other Comment Check		Length of line must be less than or equal to 80 characters	Error	
global	Other Format Check	Other Format Check		Record type must be recognized	Error	
global	Other Format Check	Other Format Check		Record type must be a C1-3 or 60 record	Error	

### **III. Operation Center Data Screening Harmonization Process Spreadsheet for Users' Comments**

## SLR Operations Centers CRD Quality Check (QC) Standard Review

Reviewer Comments				Disposition			
Item	Reviewer Name	Record Type	Field Name	Recommended Change (Be Specific)	Accept (X)	Reject (X)	Disposition Comments
example	K. Stevenson	H3	Target name	It's easier to process target names aligned left instead of the current aligned right.			
1.							
2.							
3.							
4.							
5.							
6.							
7.							
8.							
9.							
10.							
11.							
12.							

NOTE: ILRS Operations Centers perform QC on CRD received from stations. The purpose of the QC upgrade is to align the QC with the CRD format update (currently in progress) and to make the QC more thorough and valuable to the user community. The goal of this review is to elicit feedback from the ILRS community on the proposed QC.

**IV. ASC List of Attendees, Riga Meeting, Univ. of Latvia, Riga, Latvia**  
**Sunday, October 1, 09:00 – 16:00**

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