Upgrades and New Capabilities of the GFZ SLR Timing System

Evan Hoffman, Ludwig Grunwaldt, Stefan Weisheit, Thomas Gerber

GFZ Potsdam



Timing System



Timing System

- Improvement in frequency stability by orders of magnitude
 - $5 \ge 10^{-11} \rightarrow 2.7 \ge 10^{-13}$ for 1000 sec avg.
- Allows experiments requiring observations of independent timing source over long term



Aglient Cesium vs Polarx4/SecureSync Geoforschungszentrum June 30 2014



3 Way Test





Second from t0 = Mon, 30 Jun 2014 9:30:30 GMT

Clock Monitoring Software



- Keeps log of CS to UTC PPS measurements for UTC traceability
- Reports health of timing system
- Clock comparison and analysis

Geometry



Transmit Delay Measurements





Transmit Delay Measurements

									2013-07-26 10:47:12	\otimes
71.2 mV Diagr	ram1: Ch1,Ch2		Meseur						Horizontal setti Res: 50 ps / 20 C Rec len: 1 kSa Scl: 5 ns/div Position: -13.5 ns	ngs _{3Sa/s} IT
Amplitude /Time			Measur	ement Re				Euont	Mode: Auto	gs
measurement	Current	+Peak	-Peak	μ (Αν	g) RM	IS	σ(S-dev)	count	Type-A: Edge 🖌 Ch: Level: -84.203 mV	1
Delay, mv	-33.244 ns	-33.191 ns	-33.3	37 ns -	33.238 ns	33.238 ns	8.7932 ps	39178	39199	
									Ch1Wfm1 Pos: 3.22 div Off: 0 V Scl: 40 mV/div Cpl: DC 1MΩ Dec: Sa TA: Of Ch2Wfm1 Pos: 1.94 div Off: 0 V Scl: 200 mV/div Cpl: DC 1MΩ Dec: Sa TA: Of	ff ff
200.0 mV								-		
- 288.8 mV	<u> </u>	\$	1							
-328.8 mV	-30 ns	-25 ns	-20 ns	-15	ns -1(0 ns	-5ns (- 1 S	5 ns 1	1.5 ns

Measurement Results

	Average	Std. Dev	Sample Size	
PD Cable Delay (ns)	92.327	0.013	7727	
SD Cable Delay (ns)	5.083	0.009	39879	
SD – PD Direct Meas. (ns)	-33.238	0.009	62659	
PD Peak-toPeak (mV)	220.76	5.738	12287	
PD Fall time (ns)	0.766	0.022	12877	
SD-ET Trigger Uncertainty (ns)	0.053		1	
ND Glass Delay (ns)	0.009		Theoretical	
Dist. Btw. INV of Telescopes (ns)	6.926		Given	
STDDEV of Measurements				0.018
SD – PD Delays removed (ns)				53.998
Delay from TX INV cross to SD (ns)				50.535