Max-Planck-Institut für Radioastronomie

Some Polarimeter Harware Options

IF Polarimeter:

DBBC with Koyel Das firmware

DBBC with Gino Tuccari firmware

Linear-Circular Polarization Conversion:

ALMA Phasing Project Approach (software)

Uni Bern Linear-Circular Real-Time (FPGA)

Alan Roy

With input from Gino Tuccari, Koyel Das, Axel Murk

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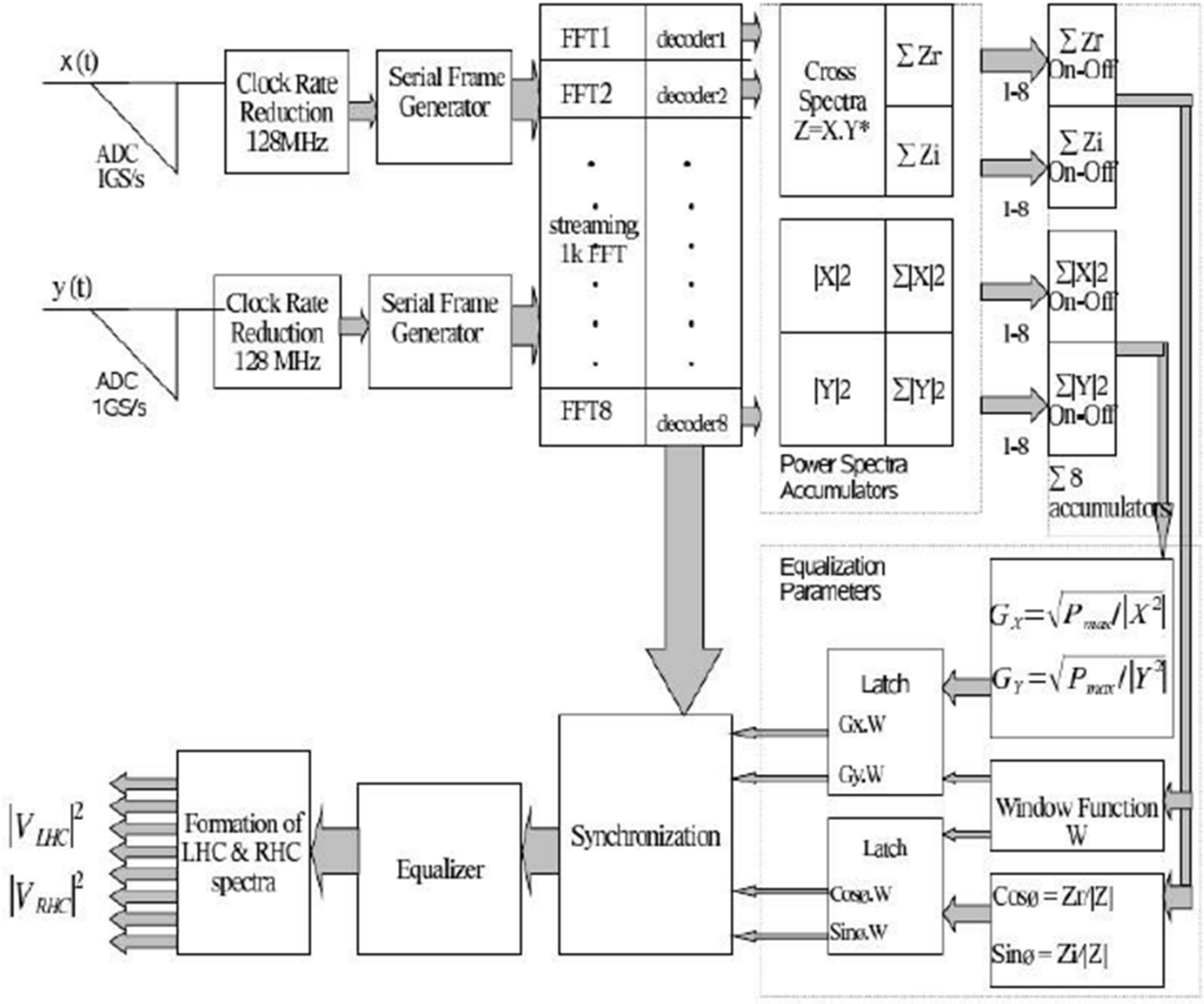
Converter/Polarimeter: DBBC / Koyel Das



Koyel Das (2010 A&A, 2013 PhD thesis)

Platform: DBBC

Bandwidth: 512 MHz

Freq resolution: 1 MHz

Circ Pol Purity: -58 dB

Aims:

- Linear-circ pol conv real time for VLBI Polarimeter

Status:

- Designed
- Meets timing
- Algorithm tests passed
- Needs implementation

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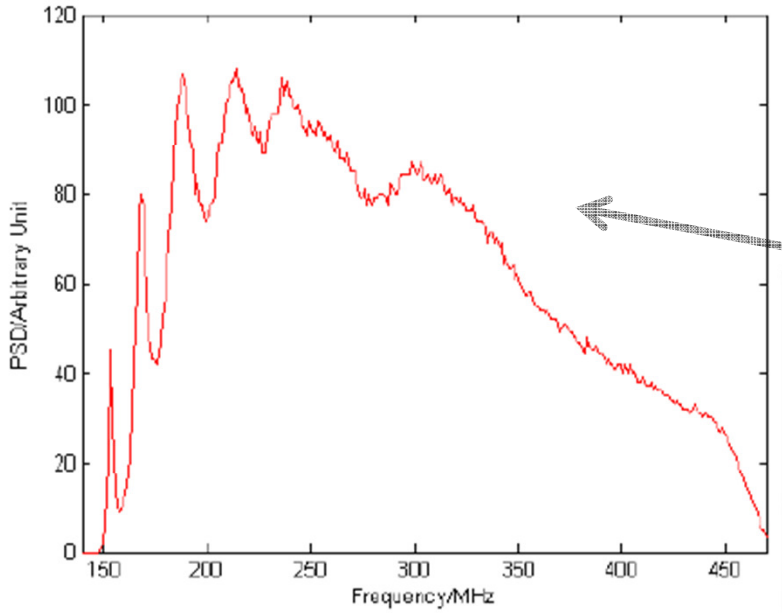
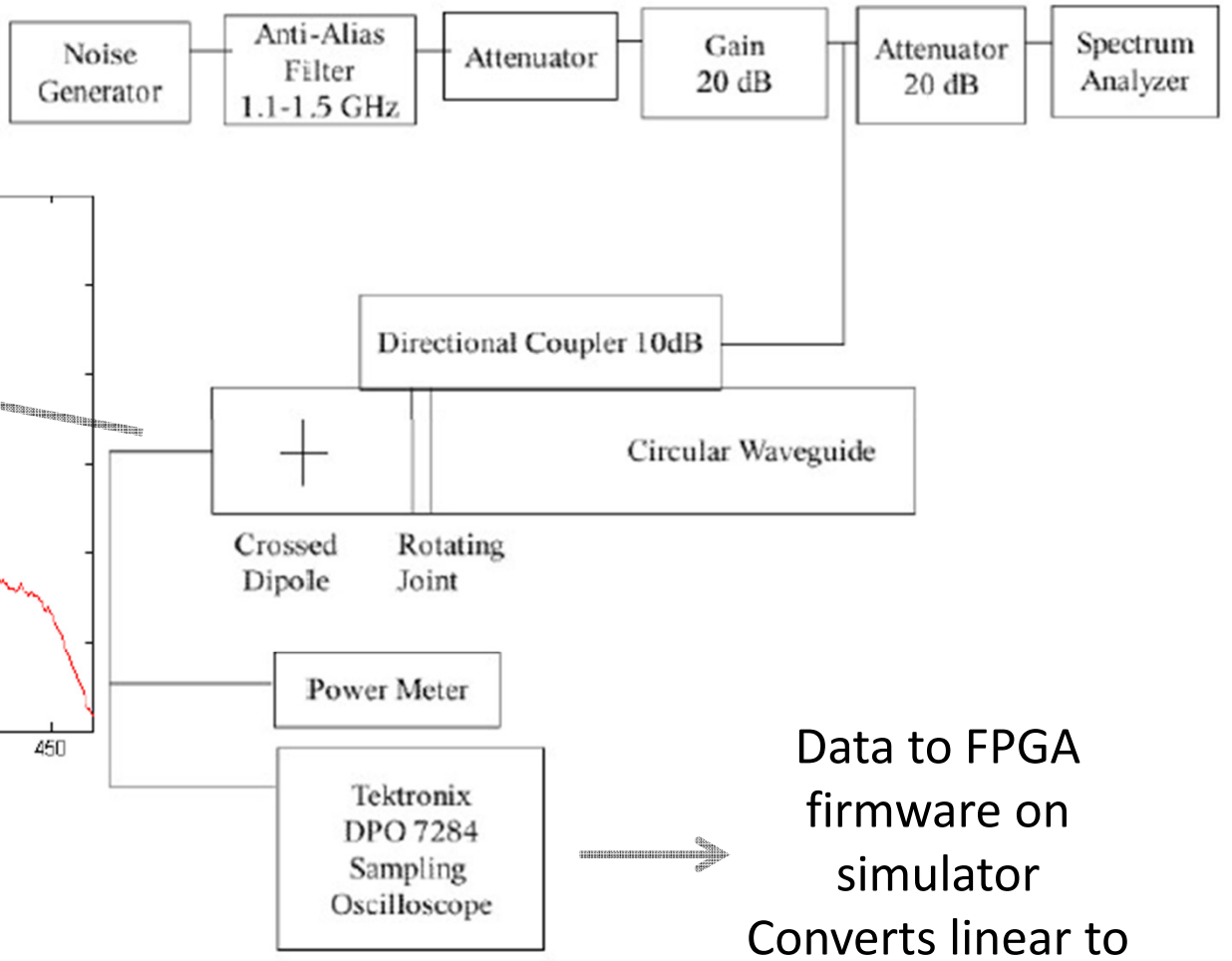
Polarimeter: DBBC / Koyel Das: Lab Demo





Data to FPGA firmware on simulator
Converts linear to circular

Koyel Das (2010 A&A, 2013 PhD thesis)

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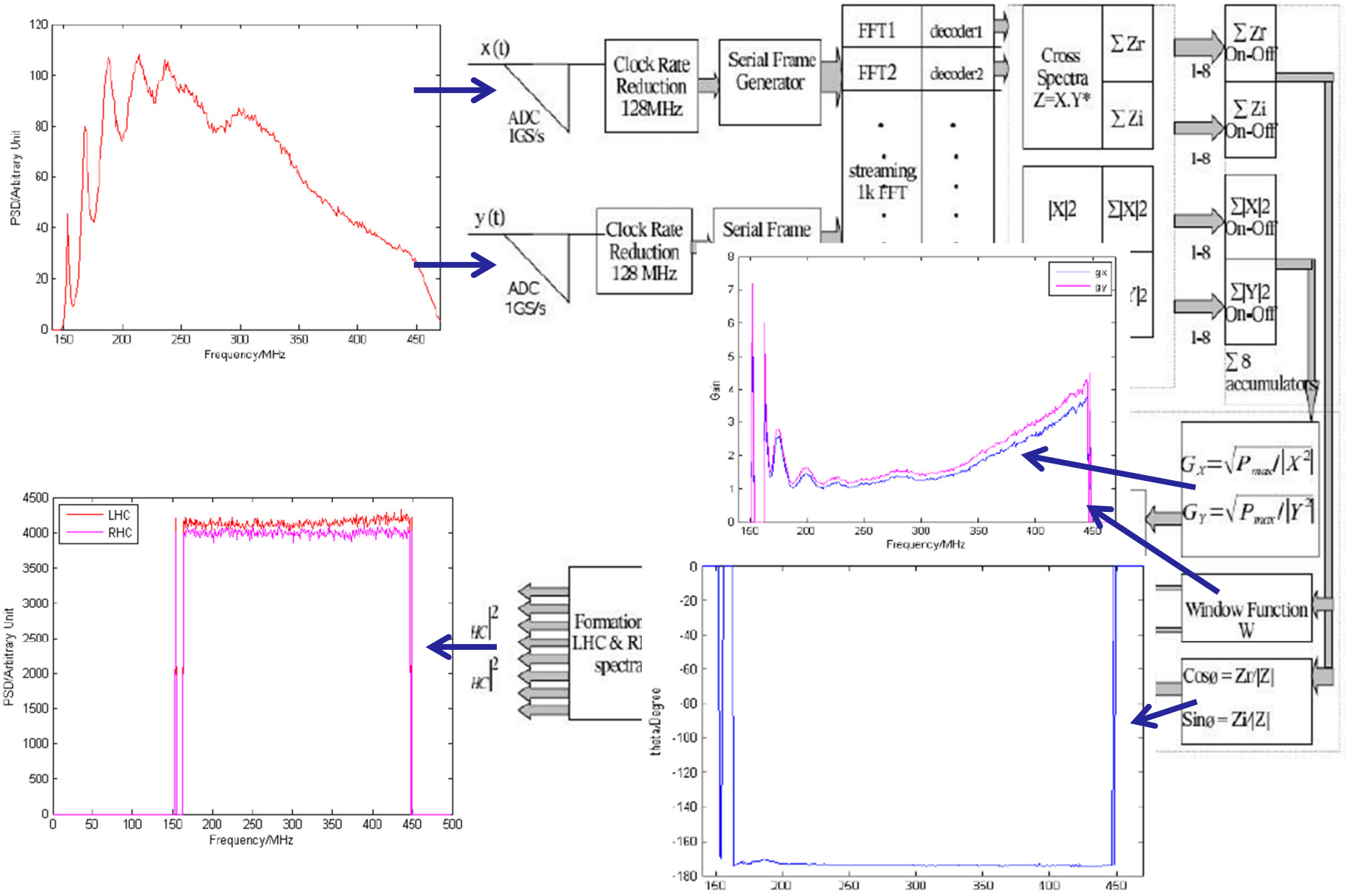
Polarimeter: DBBC / Koyel Das



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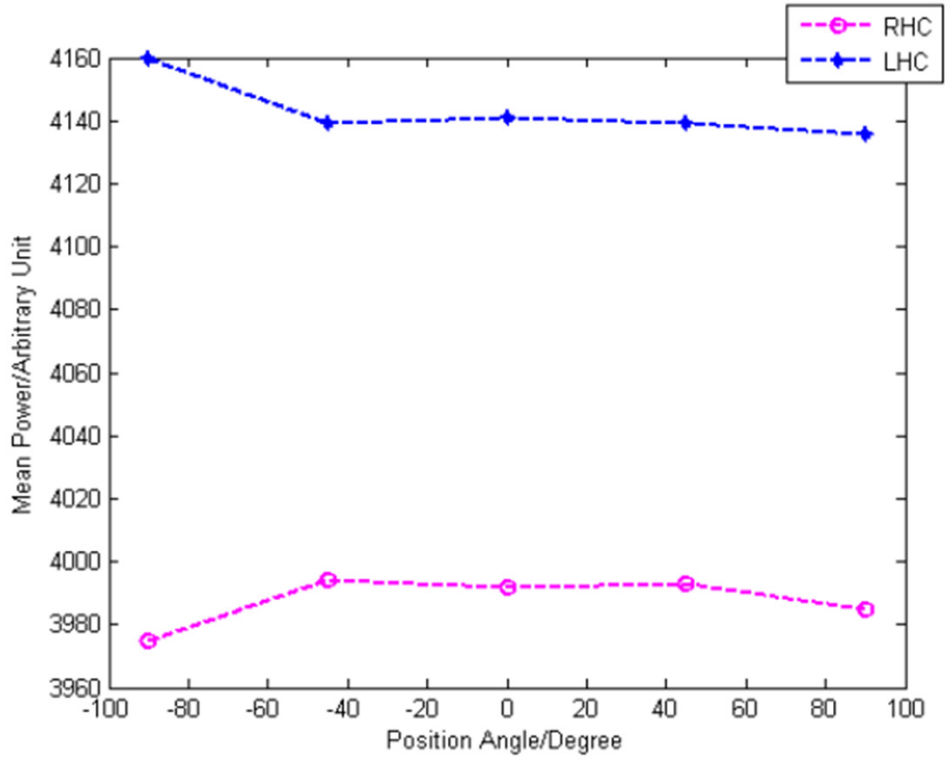
Polarimeter: DBBC / Koyel Das

Polarization Purity Measurement:

Rotate plane of input linear

Expect no change in output circular power vs PA



Result: Cross-power coupling = -58 dB

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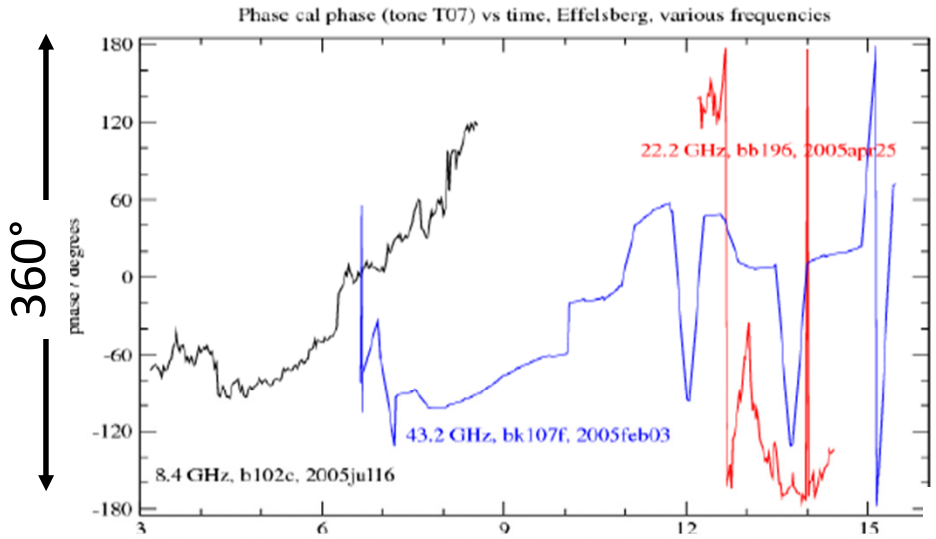
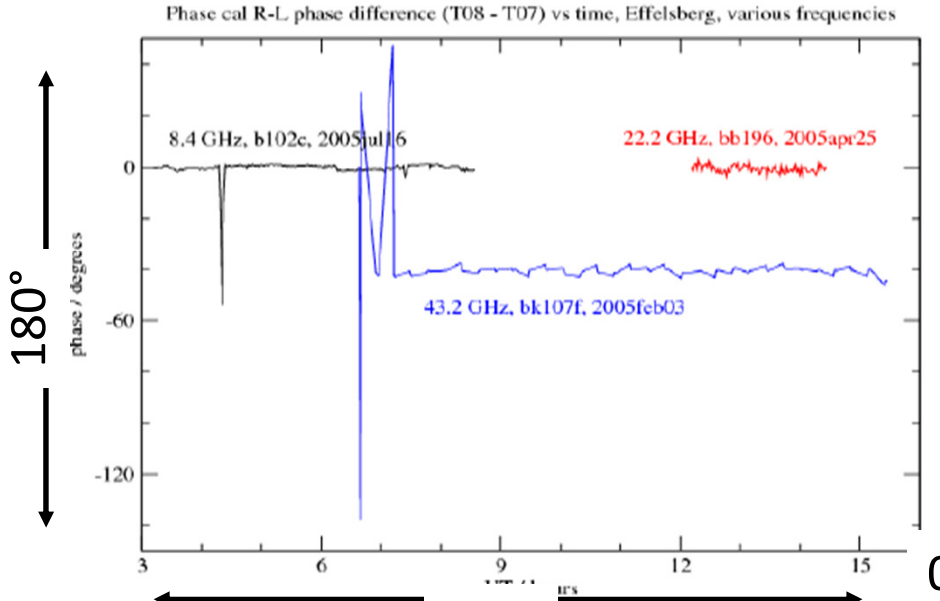
Polarimeter: DBBC / Koyel Das

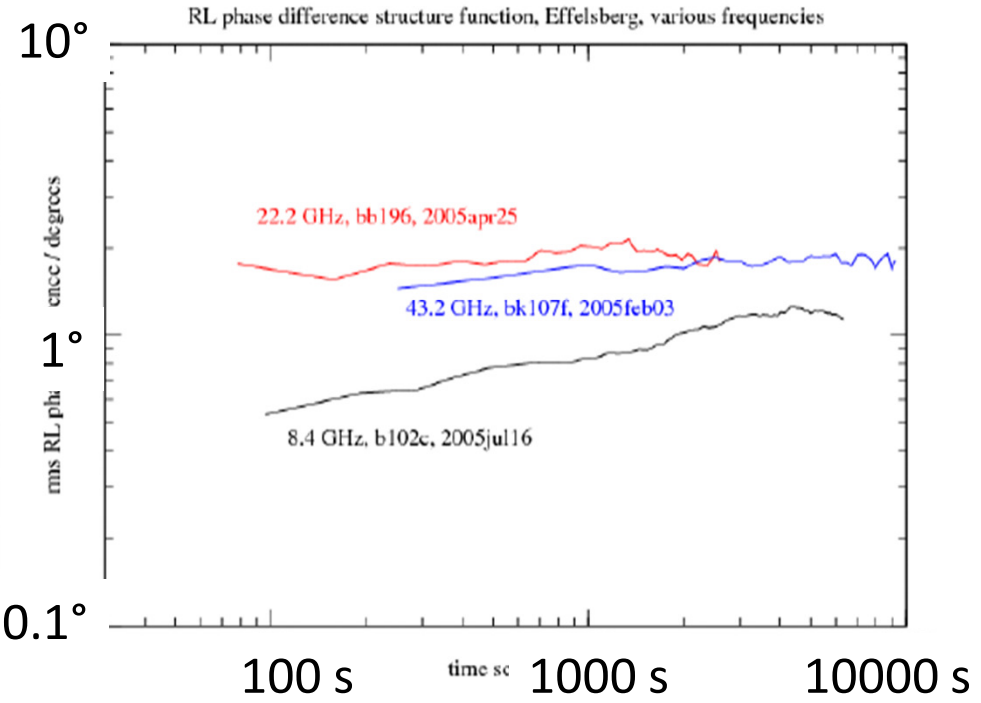




IF Polarimetry cable length stability study

- Uses VLBI phase-cal system
- Inject pulse train in feed horn
- Extract phases at VLBI rack
- Monitor RCP and LCP cable lengths

Das et al. (2010) A&A



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Polarimeter: DBBC / Gino Tuccari

System Requirements:	DBBC with >= 2 Ifs	
	Firmware	
	Post-processing software	
Existing firmware:	Polyphase filter bank	
	Digital down-converter	
DBBC Bandwidth:	Now:	512 MHz or 1024 MHz per sampler/FPGA
	2015+:	4096 MHz per sampler/FPGA
Development time:	Pol Firmware	1 man-month
	Control software	1 man week
	Post-processing software	2 man weeks
	Validation tests	<open>

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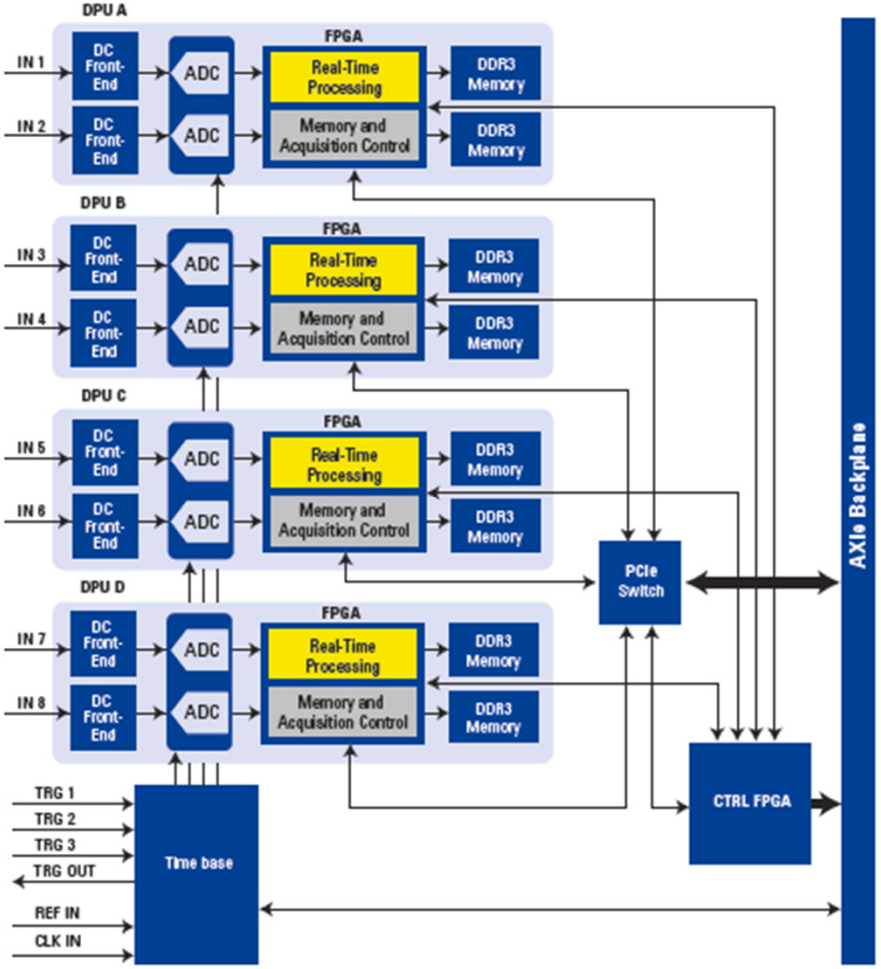
Linear-Circular Pol Conversion: Uni Bern

Uni Bern approach:

Real-time, FPGA, Agilent hardware
(M9703A 12 bit wide-band digital receiver
8 channel, 3.2 Gsps)

Application:

Radiometer, atmospheric physics,
pressure-broadened atmospheric lines
(Axel Murk et al.)



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Linear-Circular Pol Coversion: ALMA

Background: ALMA is linear pol
VLBI wants circular
MPIfR (VLBI group) + Onsala provides conversion

Solution: Software after DiFX correlator
Calibrate xy phase using measurement set from ALMA correlator
Form linear combinations of circular-linear cross-correlations
with +- 90d phase shift

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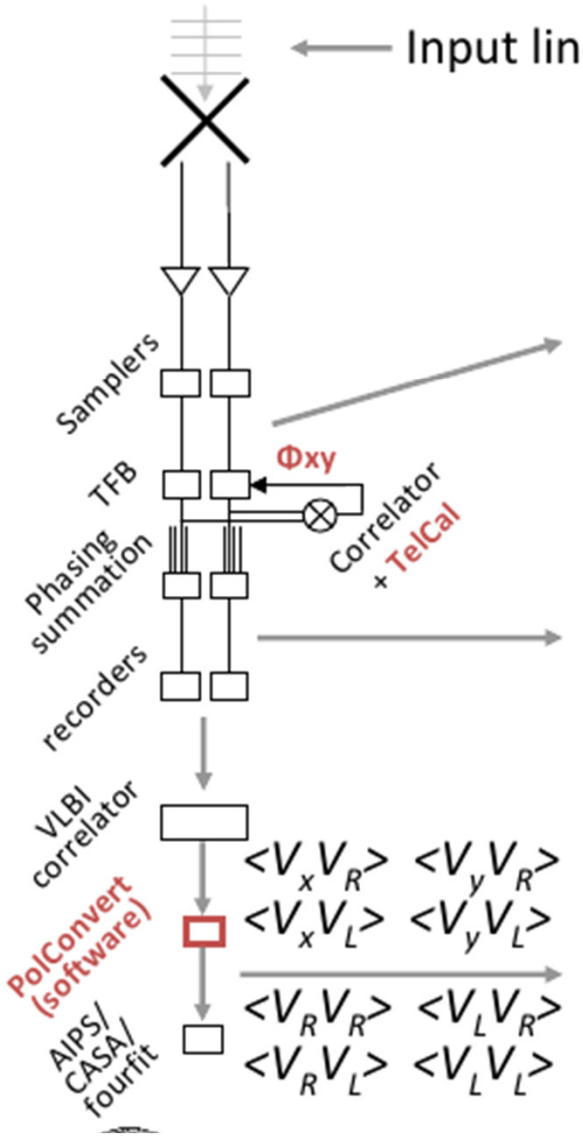
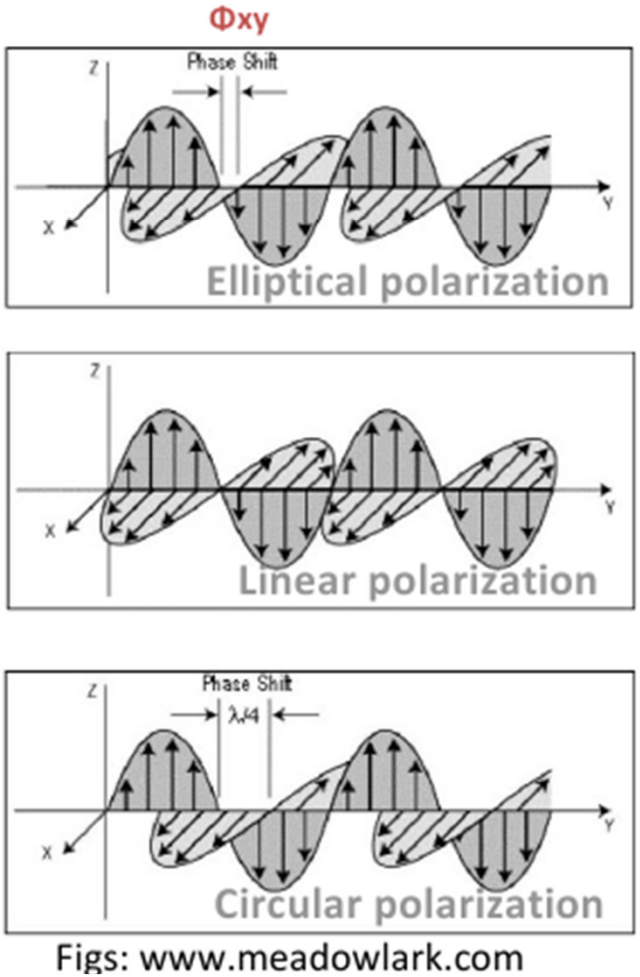
Linear-Circular Pol Coversion: ALMA





Figs: www.meadowlark.com

$V_x = E_x \sin(\omega t)$

$V_y = E_y \sin(\omega t + \Phi xy)$

$V_x = E_x \sin(\omega t)$

$V_y = E_y \sin(\omega t)$

$V_R = V_x + j\, V_y$

$V_L = V_x - j\, V_y$