

# Migrating Towards a Modern IP Tracking interface

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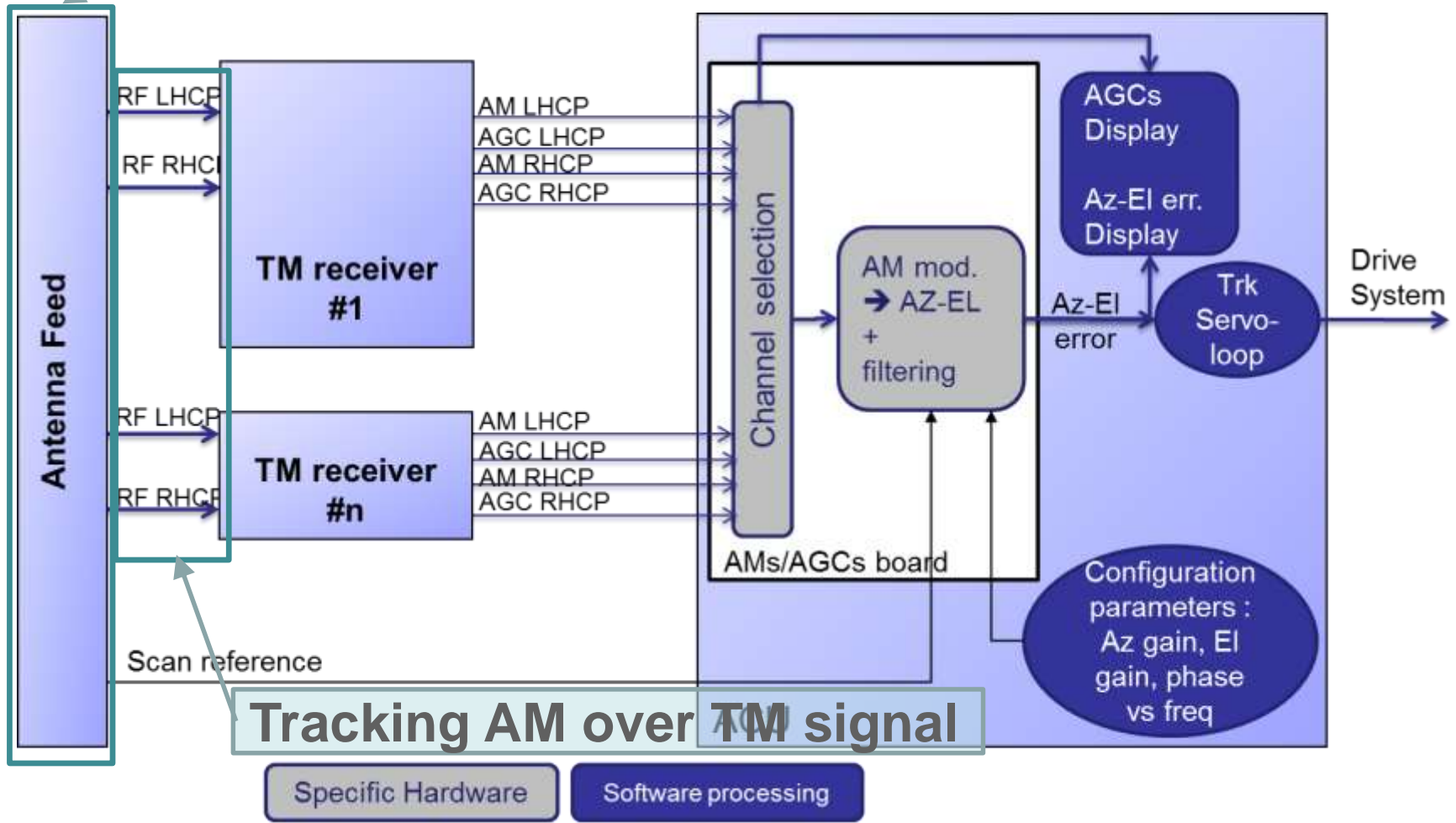
Speaker: Pierre Bastie – Zodiac Data Systems inc.

# Plan

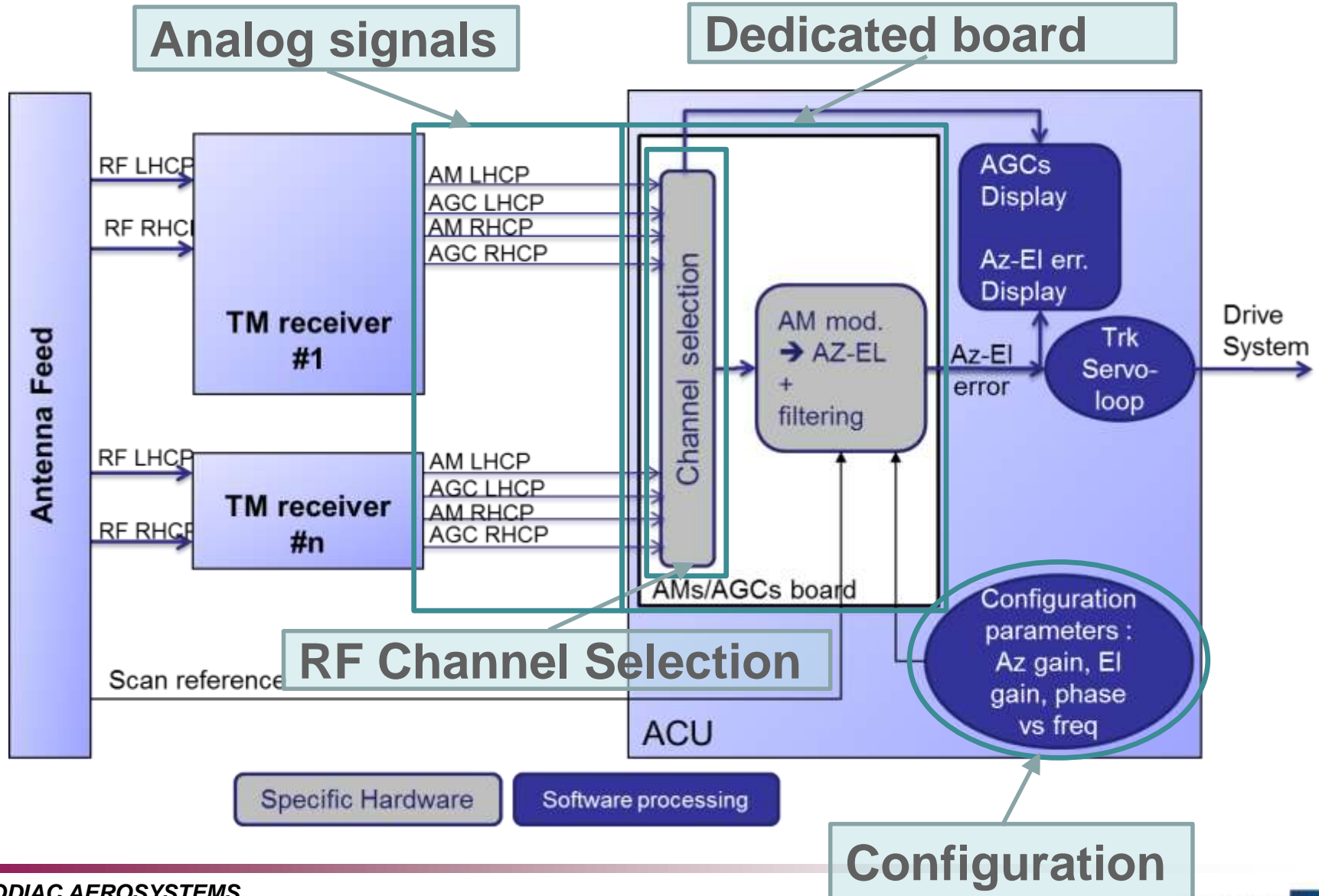
- **Pros and Cons of legacy tracking system architecture**
- **Objectives of the new architecture**
- **Description of the new architecture : « Digi-Track »**

# Legacy GFT tracking architecture : feeds

Conical Scan / eScan / SCM

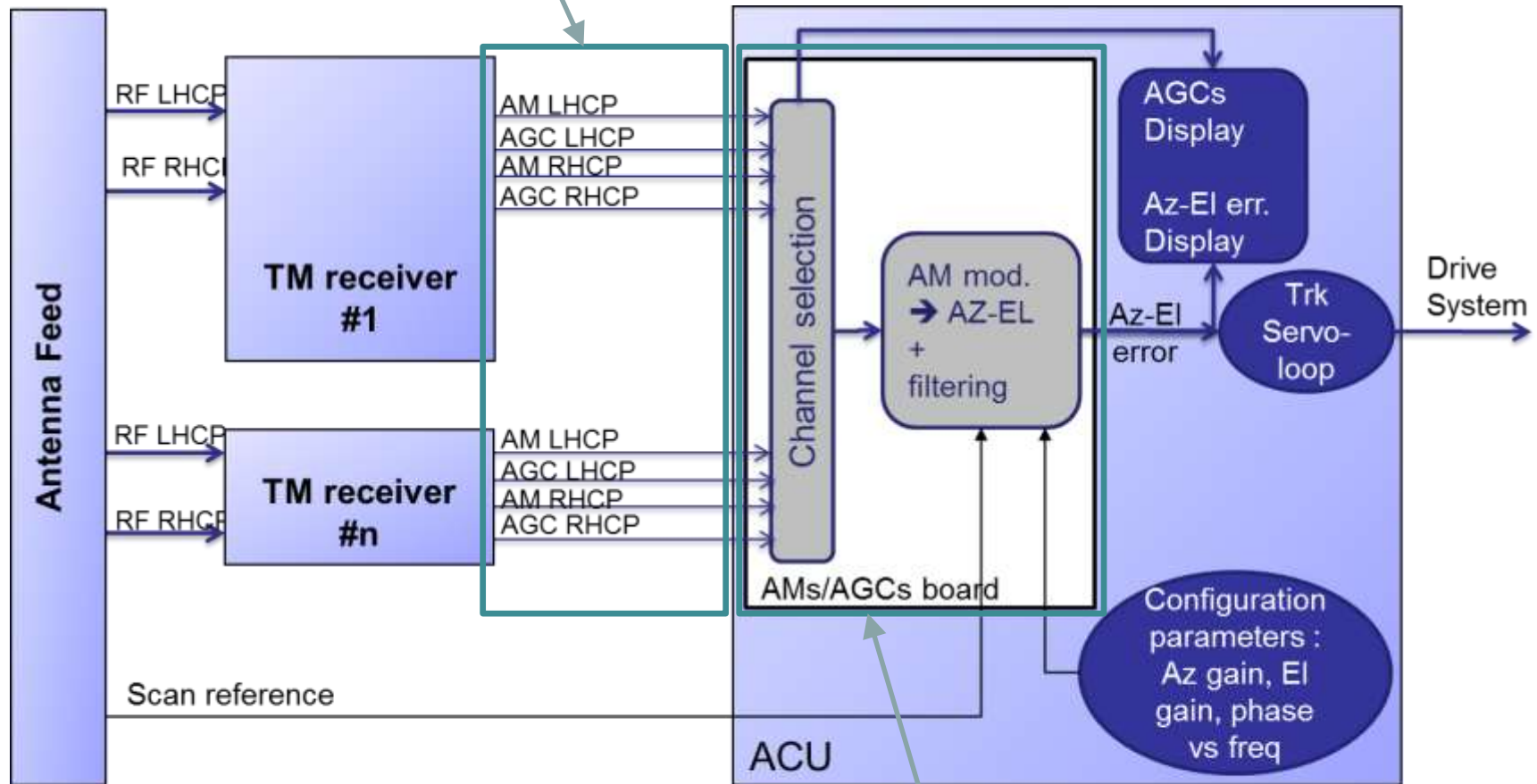


# Legacy GFT tracking architecture : features



# Legacy GFT tracking architecture : Pros

Standardized Rx ajustement

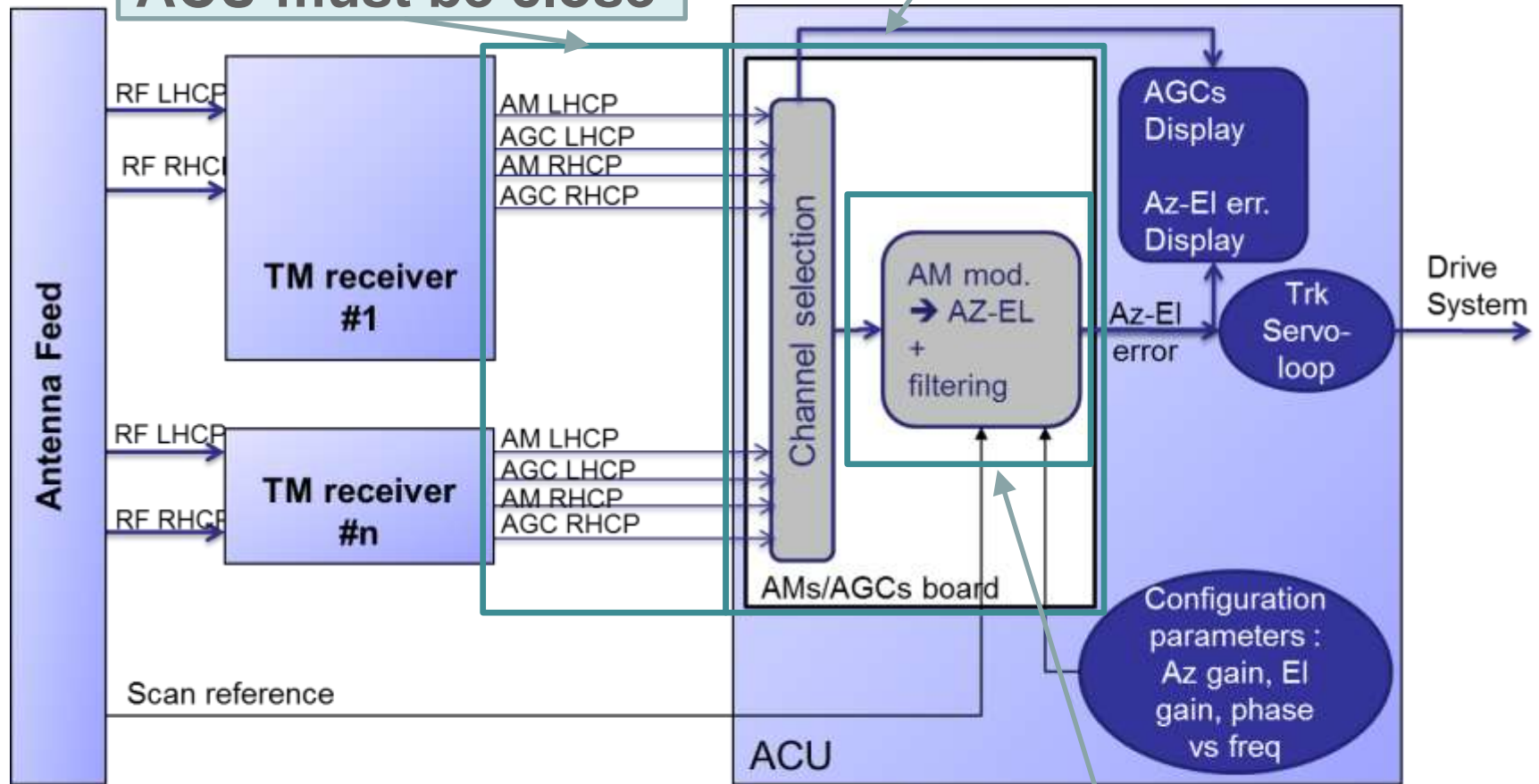


No delay in processing

# Legacy GFT tracking architecture : Cons

Many cables & ACU must be close

Specific HW → Cost



Specific Hardware

Software processing

Only one set of tracking errors

# New tracking system architecture

## Objectives

- **Moving from AMs/AGCs analog to digital links between telemetry receivers and ACU**
- **Keeping the capacity to acquire several telemetry receivers AMs/AGCs**
- **Making integration easy by having ACU and receivers not in the same room, giving flexibility for mobile stations**
- **Availability of simultaneous tracking errors for enhanced tracking algorithms**

# Key point : TM receiver to ACU digital link

## ■ Which type of link ?

- Ethernet link is preferred

## ■ Which data between TM receiver and ACU ?

### ■ Possibility # 1: TM receiver Digitizes AMs and AGCs

- AM must be digitized at 39 ks/s (1000Hz E.scan or SCM) to allow ACU processing with phase error  $\leq 5^\circ$
- Feed scan reference must be digitized by the TM receiver

### ■ Possibility # 2: TM receiver Pre-computes tracking errors

- Tracking errors must be transmitted to ACU at 80 s/s to allow tracking loop correct operation
- Feed scan reference is processed by the TM receiver, but no more transmitted to the ACU



# TM receiver to ACU digital link bandwidth

IP Tracking Flow	Tracking System Scan reference Frequency (Hz)	One message size (in bytes w/ 68 bytes Header) Selected Sampling Frequency	Data Transfer Rate	
			for 1 Dual channels receiver	for 8 Dual channels receivers
Digitized AM/AGC/ScanRef	Conical Scan 25-50 Hz	580 Fs=19 531 Samples / Sec	0.35 Mbps	5.66 Mbps
	eScan/SCM Up to 1000 Hz	1092 Fs= 39 062 Samples / Sec	0.66 Mbps	10,66 Mbps
Pre-computed Tracking Errors	Any	68 + 8 80 Messages / Sec	0,05 Mbps	1.50 Mbps

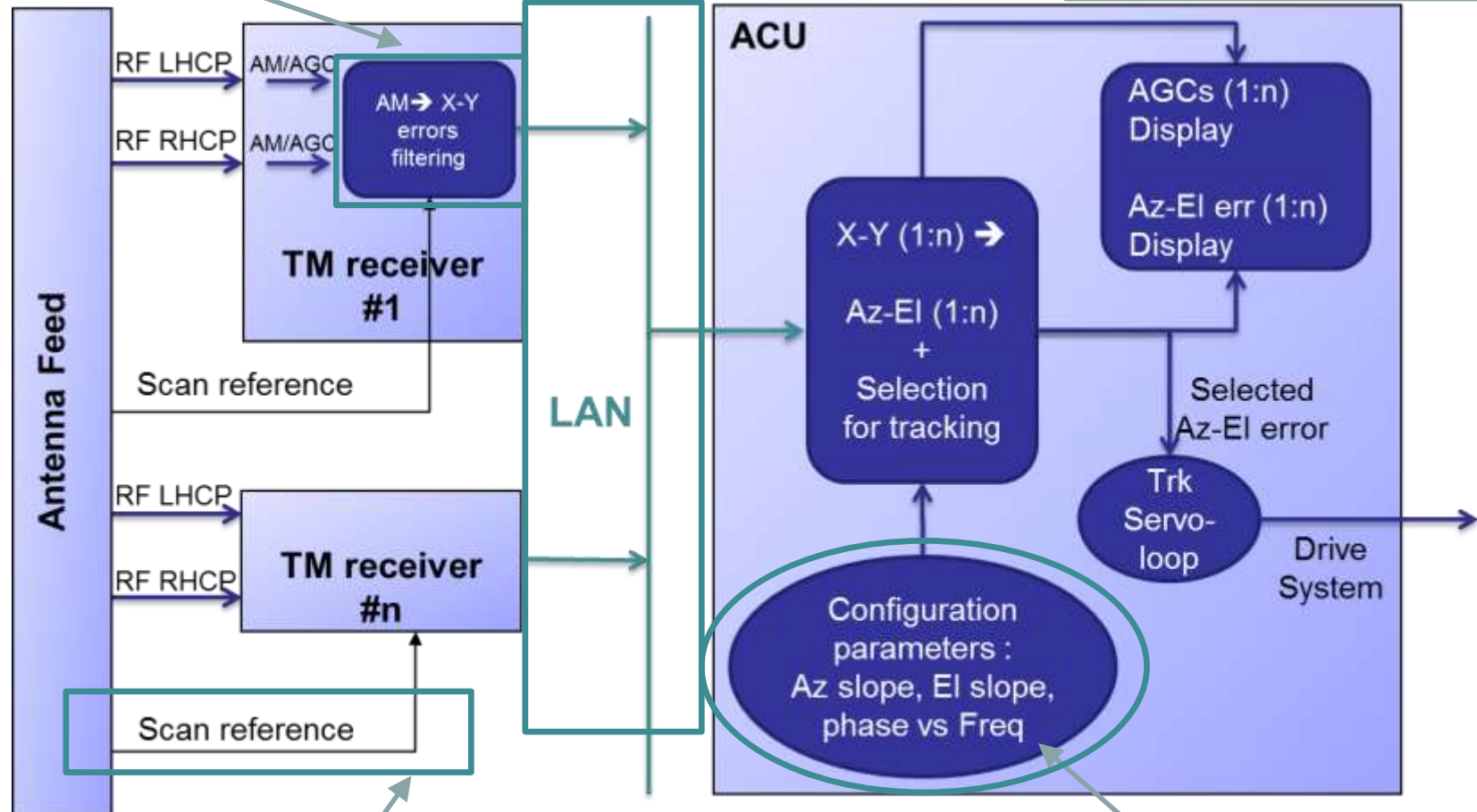
- **Pre-computed Tracking errors method is selected**
  - Lower data rate on the Ethernet,
  - Compatible with Ethernet transmission lag and jitter

# “Digi-track” system architecture

**AM Processing**

**Ethernet**

- Tracking message 80s/s**
- Normalized Tracking errors (X and Y)
  - AGC
  - TM receiver Id
  - Channel Id (RHCP / LHCP / Combined)
  - RF frequency
  - Receiver Lock/Unlock



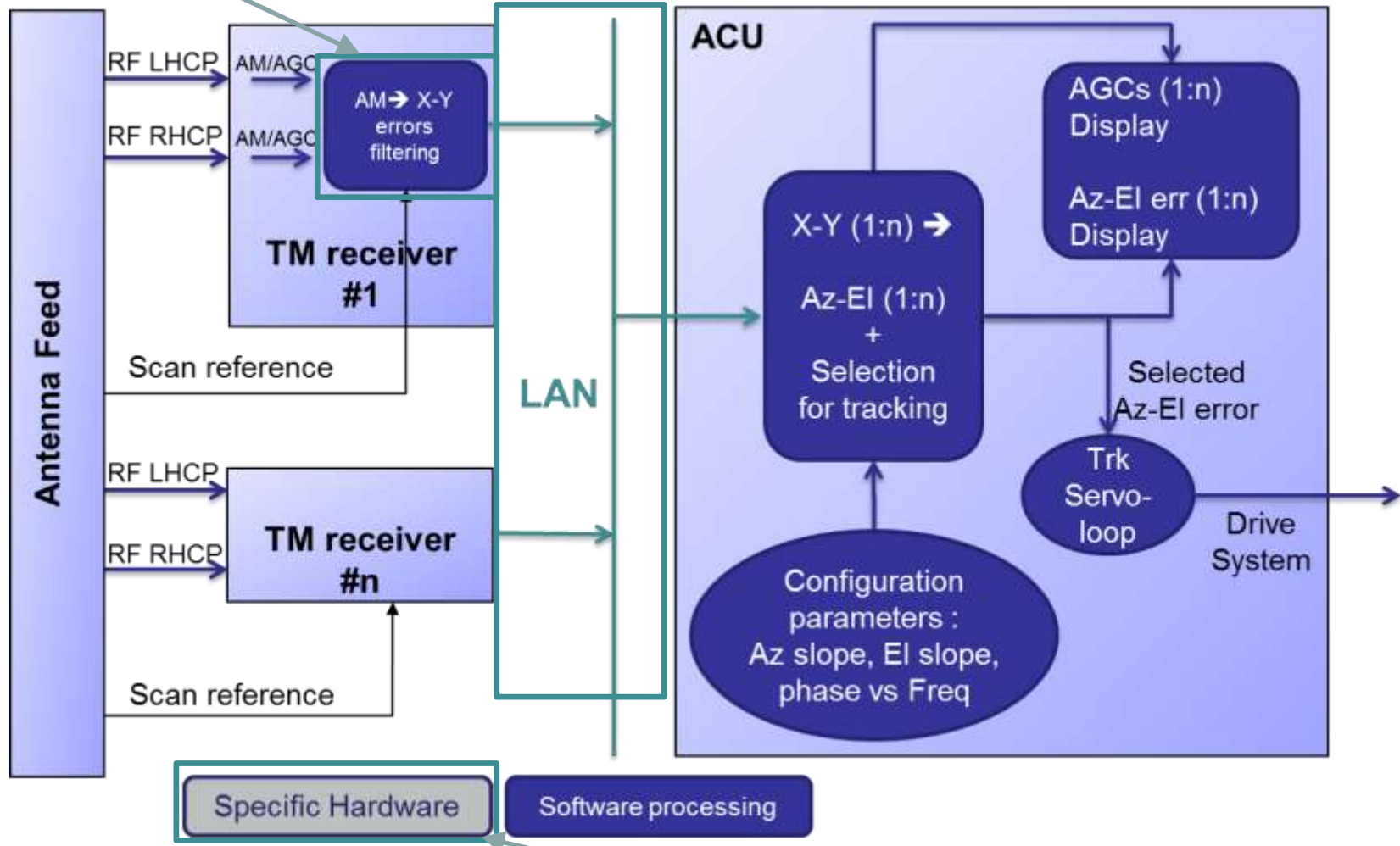
**Feed scan ref distribution**

**Configuration**

# “Digi-track” system architecture : Pros

Better resolution

ACU and RX in different places

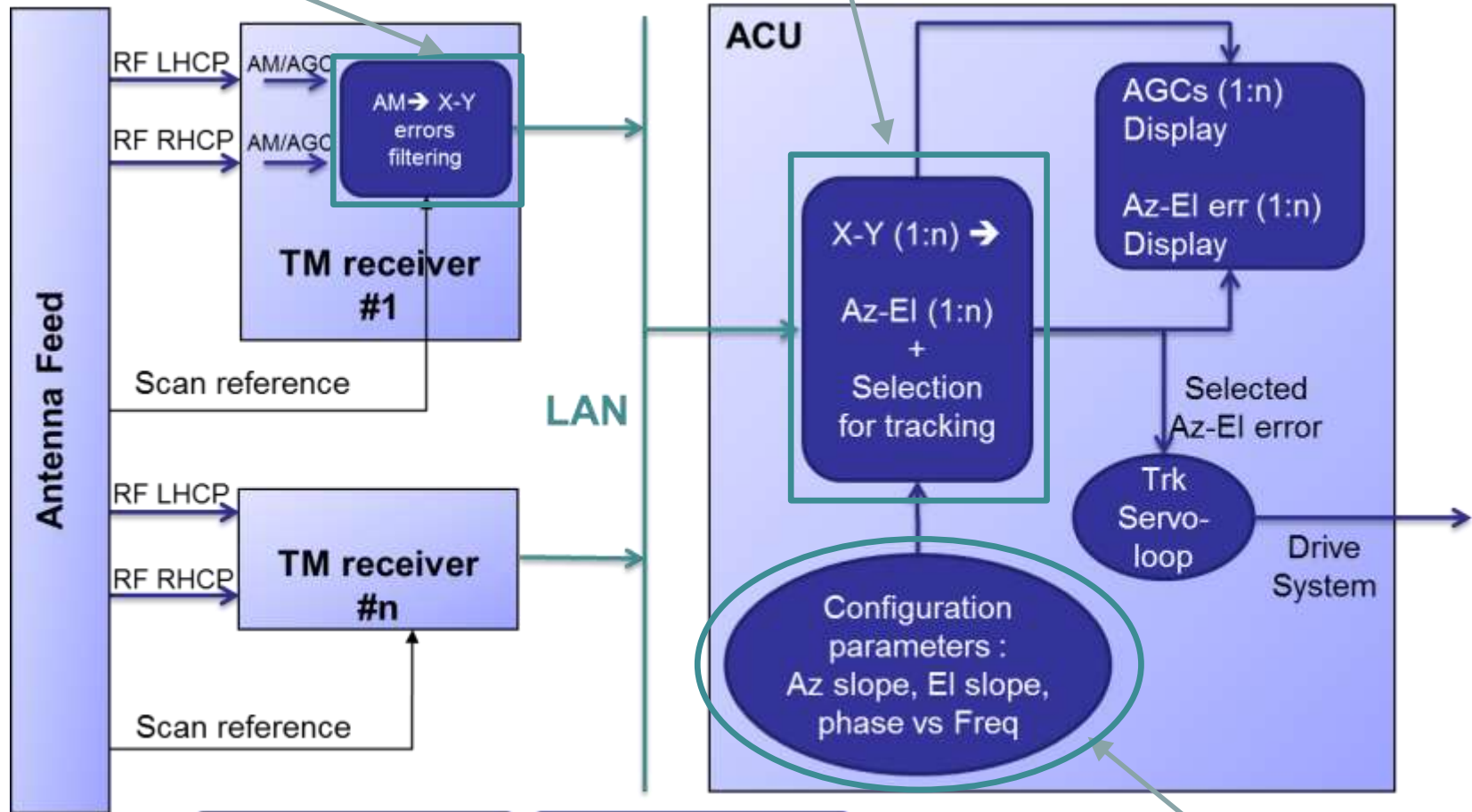


No specific HW : ACU = PC

# “Digitrack” system architecture : Pros (Cont.)

Standardized errors

Simultaneous tracking errors

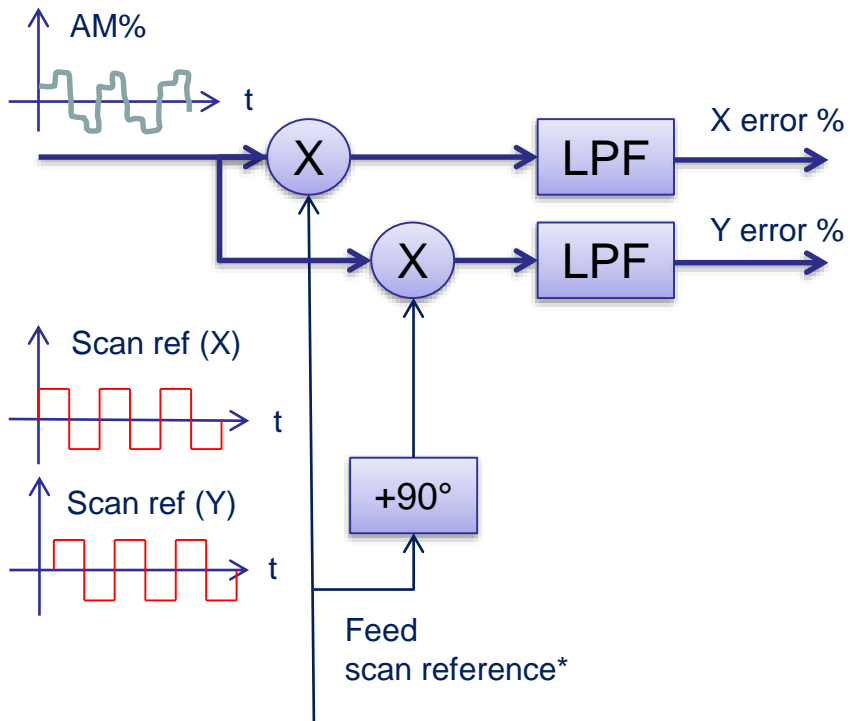


Specific Hardware

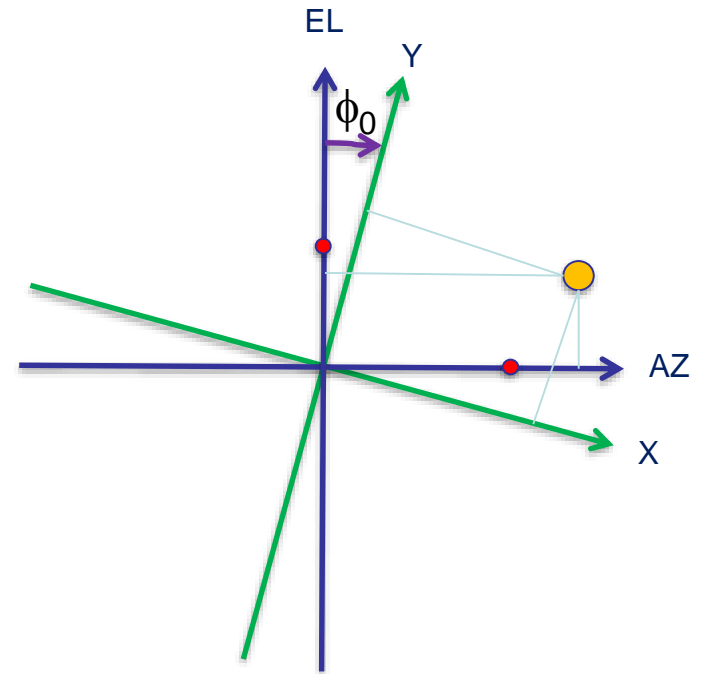
Software processing

Automatic config

# “Digitrack” system architecture: TM receivers and ACU implementation



## TM receiver additional processing

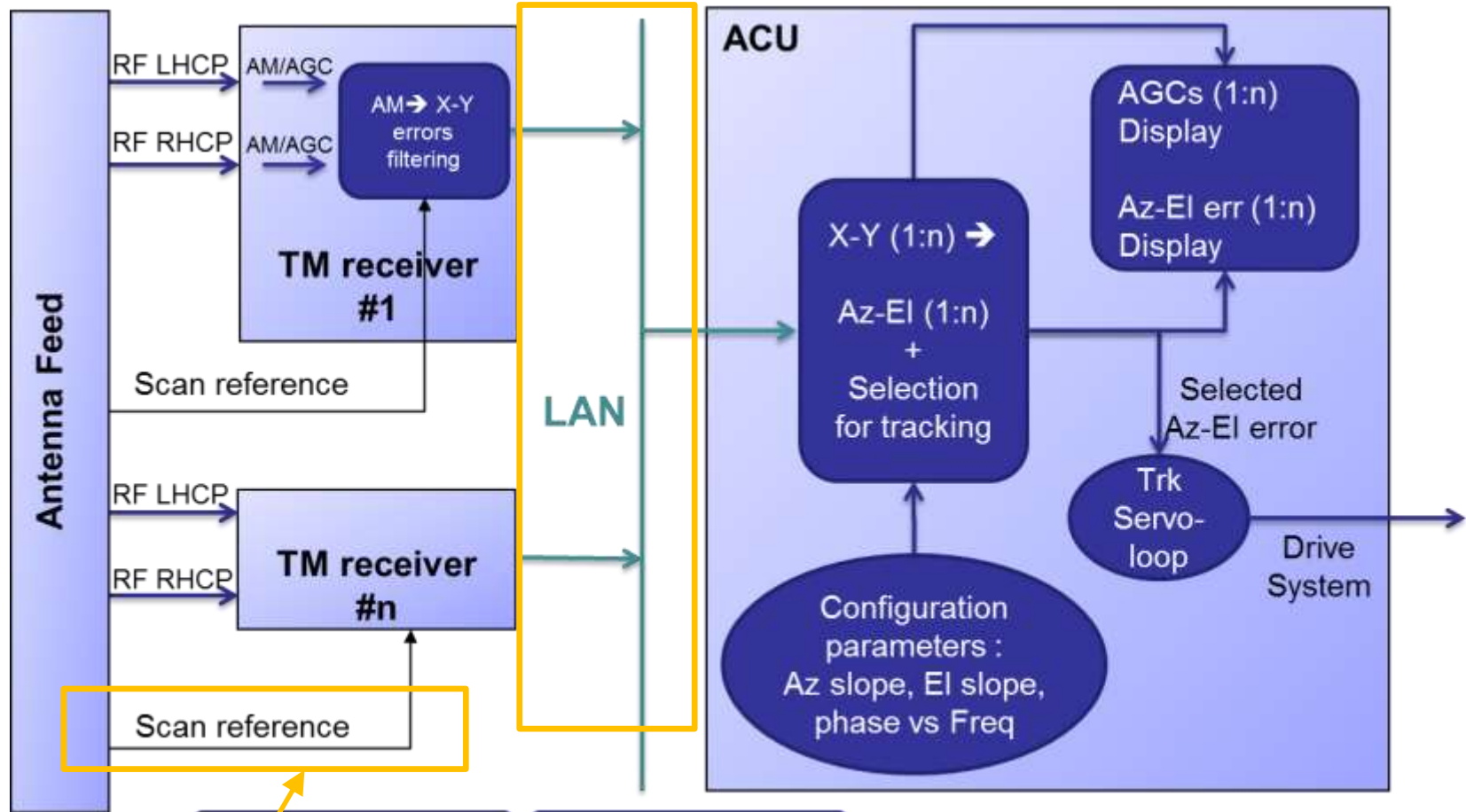


## ACU s/w processing

- Acquire tracking messages @ 80Hz
- Projection of {X,Y} to {AZ,EL} with  $f_0$
- Applying Az\_slope and EL\_slope to get normalized errors (red points)

# “Digi-track” system architecture : Cons

**Latency in Ethernet link**



**Feed Scan distribution** Software processing

# Conclusion

## ▪ Benefits of the « Digi-track » architecture

- Removing many analog & short AMs/AGCs cables
- Easy integration of ACUs & receivers thank to Ethernet links,
- ACU & receivers no longer have to be co-located
- ACU becomes a standard PC
- Availability of simultaneous tracking errors for enhanced tracking algorithms

## ▪ Implementations

- ZDS has already delivered single box ACU-Rx with very good performances
- For further deployment, need interface standardization
- Limited impact on receivers
- Time reference could be an alternative to Scan Pulse for eScan/SCM

**Thank you for  
your attention...**

