

POMORSKI FAKULTET U RIJECI

Predmetni nastavnik: prof. dr. sc. Renato Filjar, dipl. ing. el.

PRIMIJENJENA SATELITSKA NAVIGACIJA

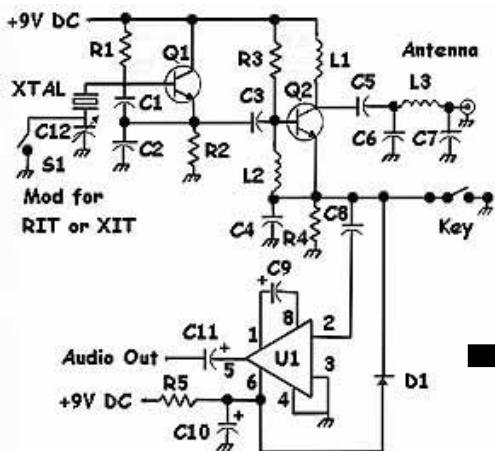
P27 Programski određen GNSS prijamnik

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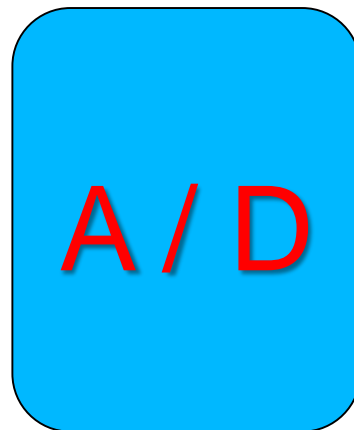
Primijenjena satelitska navigacija

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- Programski određen GNSS prijamnik
- Idejni koncept programski određenog radija



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```
bf <- butter(5, 0.2)
freqz(bf)

ch <- cheby2(5, 20, 0.2)
freqz(ch, Fs = 100) # frequency plot for a sample rate = 100 Hz

zplane(ch) # look at the poles and zeros

t <- seq(0, 1, by = 0.01) # 1 second sample, Fs = 100 Hz
x <- sin(2*pi*t*2.3) + 0.25*rnorm(length(t)) # 2.3 Hz sinusoid+noise
z <- filter(ch, x) # apply filter
```



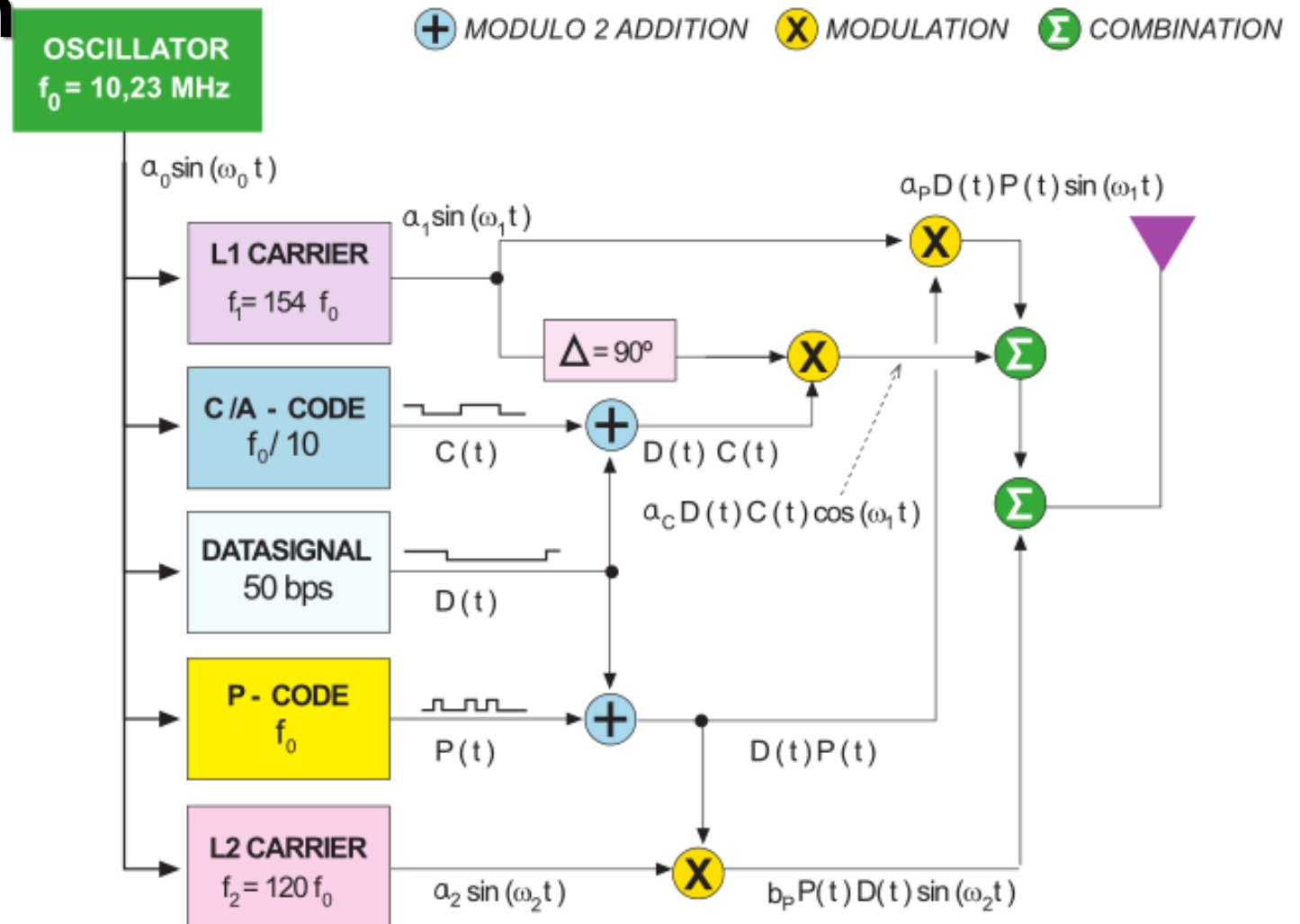
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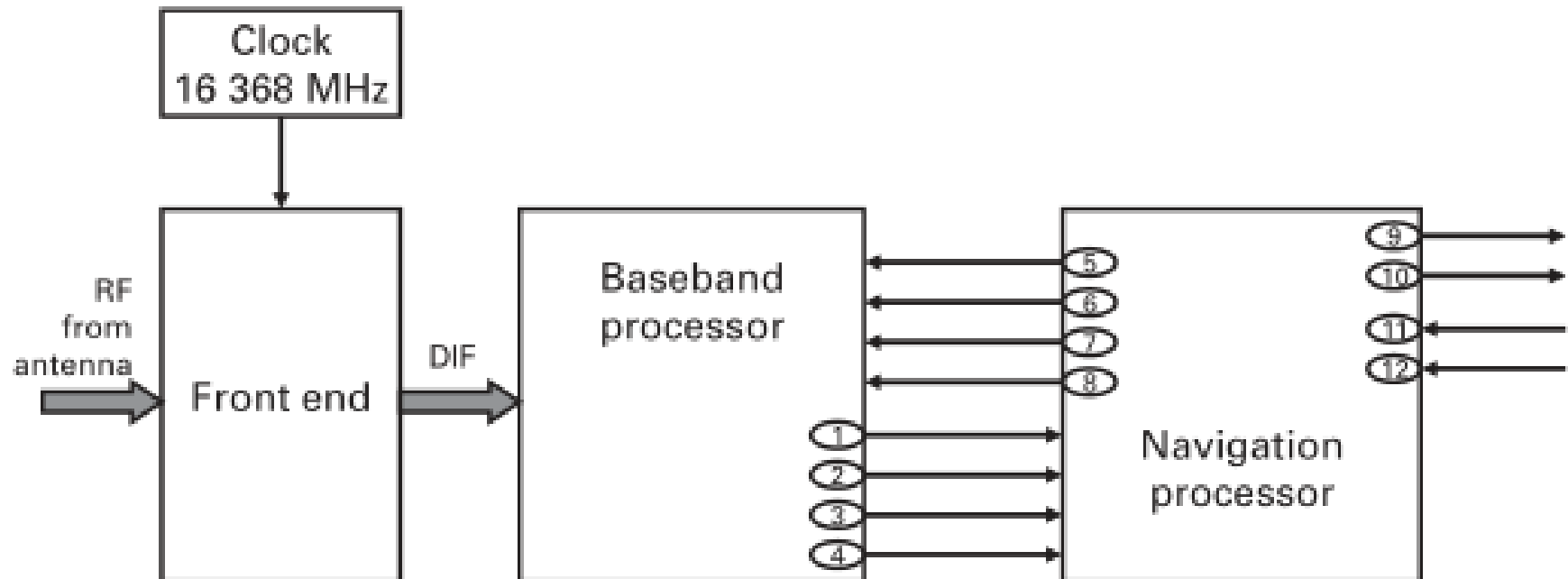
- Programski određen GNSS prijamnik

- Generiranje satelitskog GPS signala



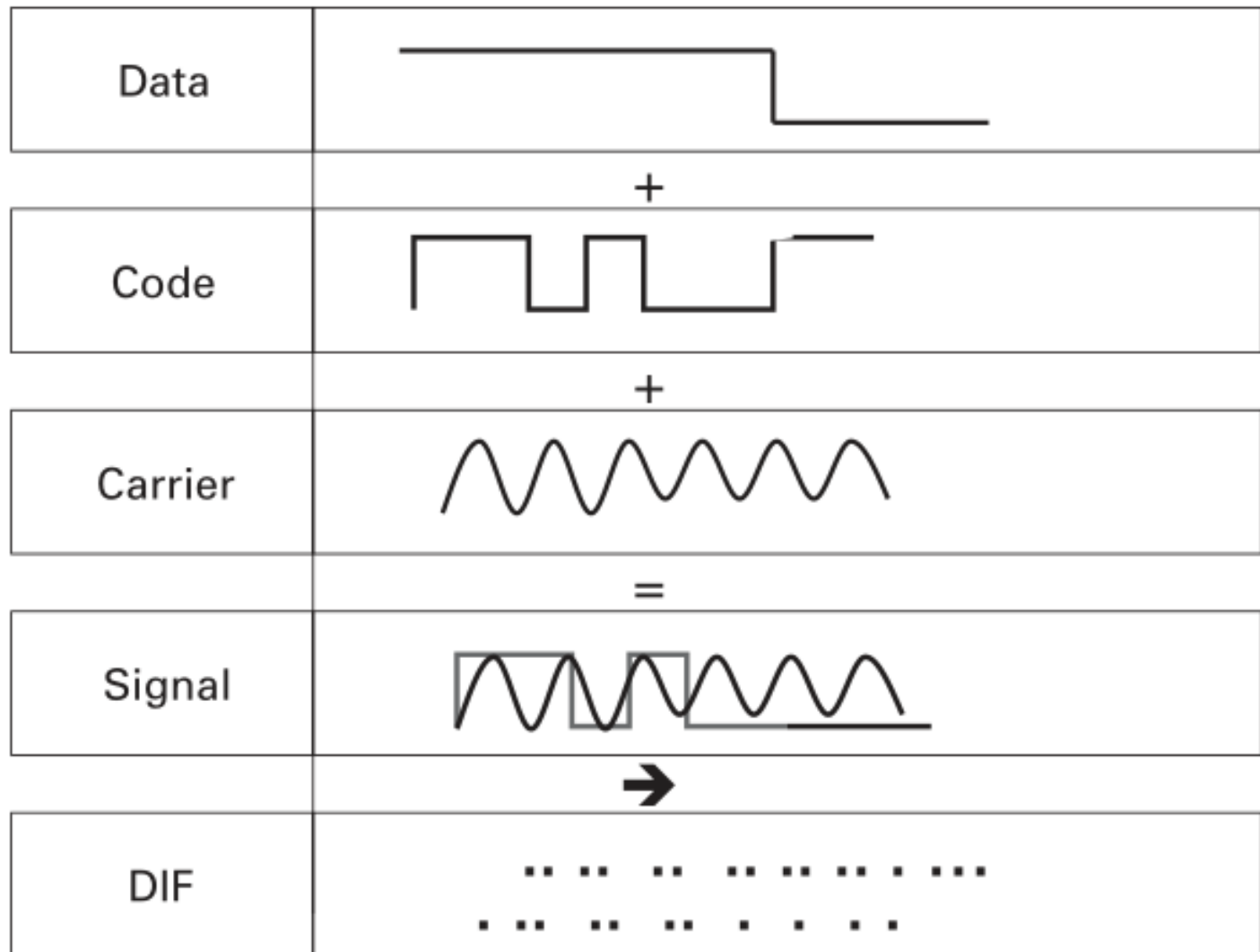
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- **Programski određen GNSS prijamnik**
- Osnovni blokovi GNSS prijamnika (programska realizacija za SDR)



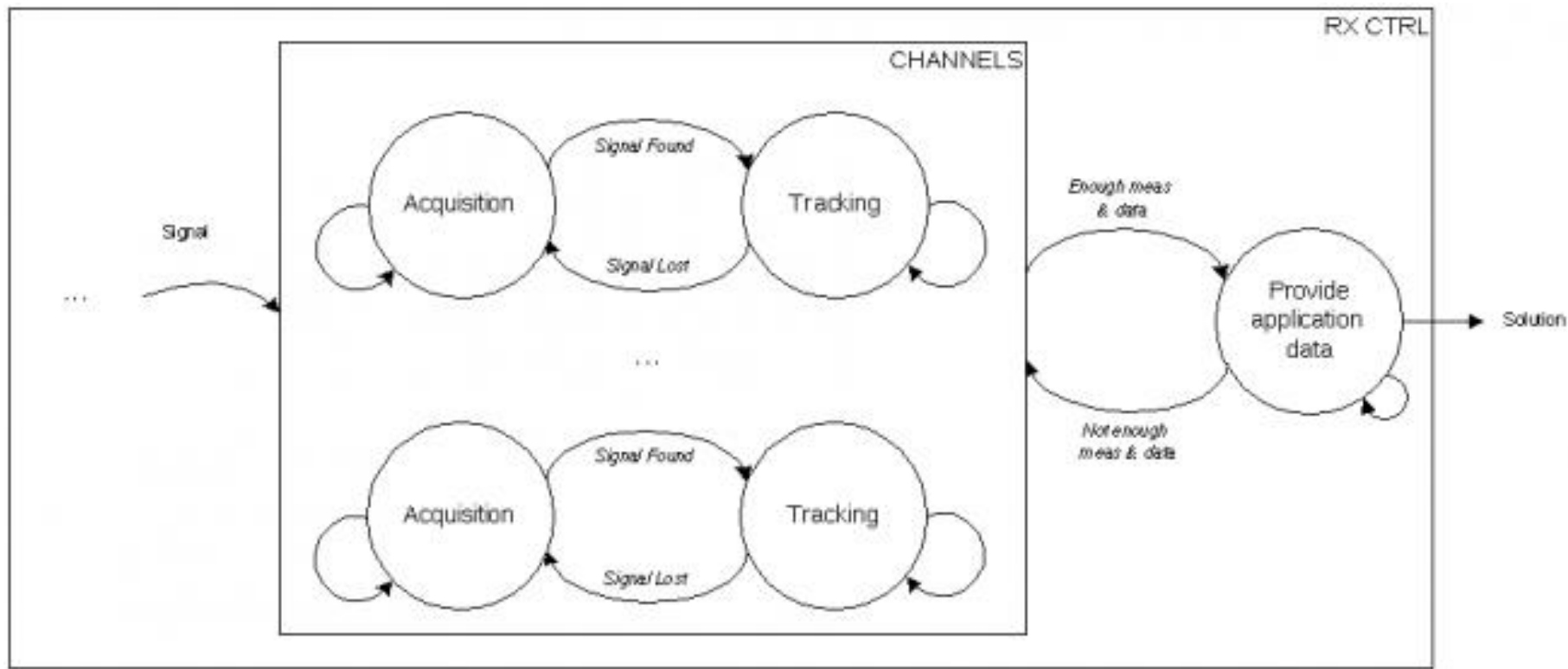
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■ Programski određen GNSS prijamnik



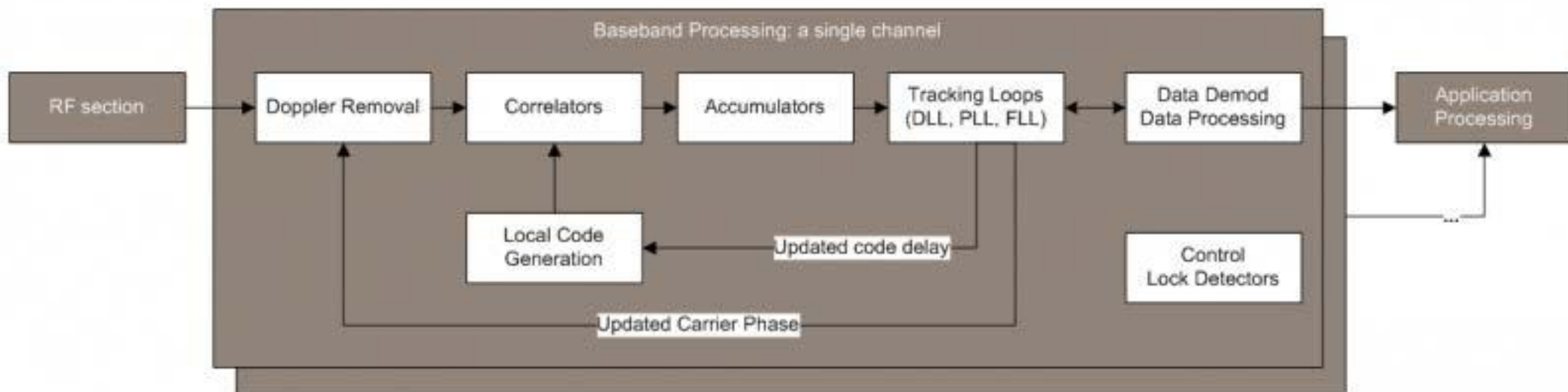
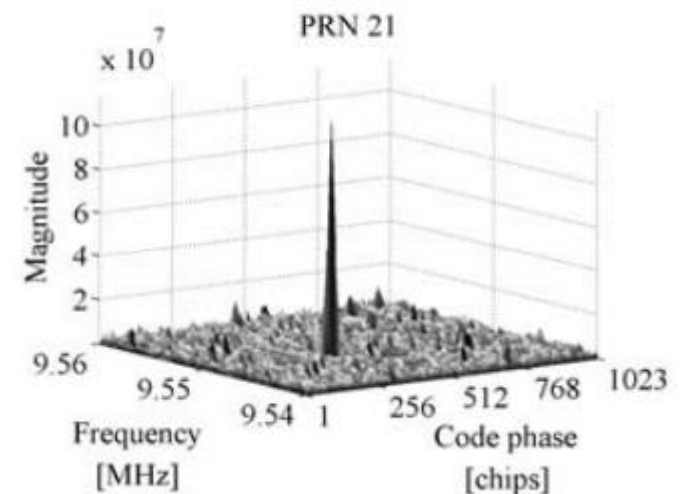
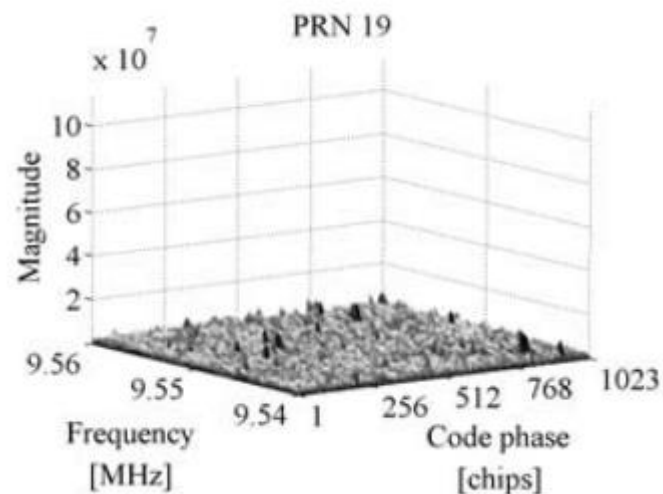
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- **Programski određen GNSS prijamnik**
- Procesiranje u osnovnoj frekvencijskoj domeni



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■ Programski određen GNSS prijamnik



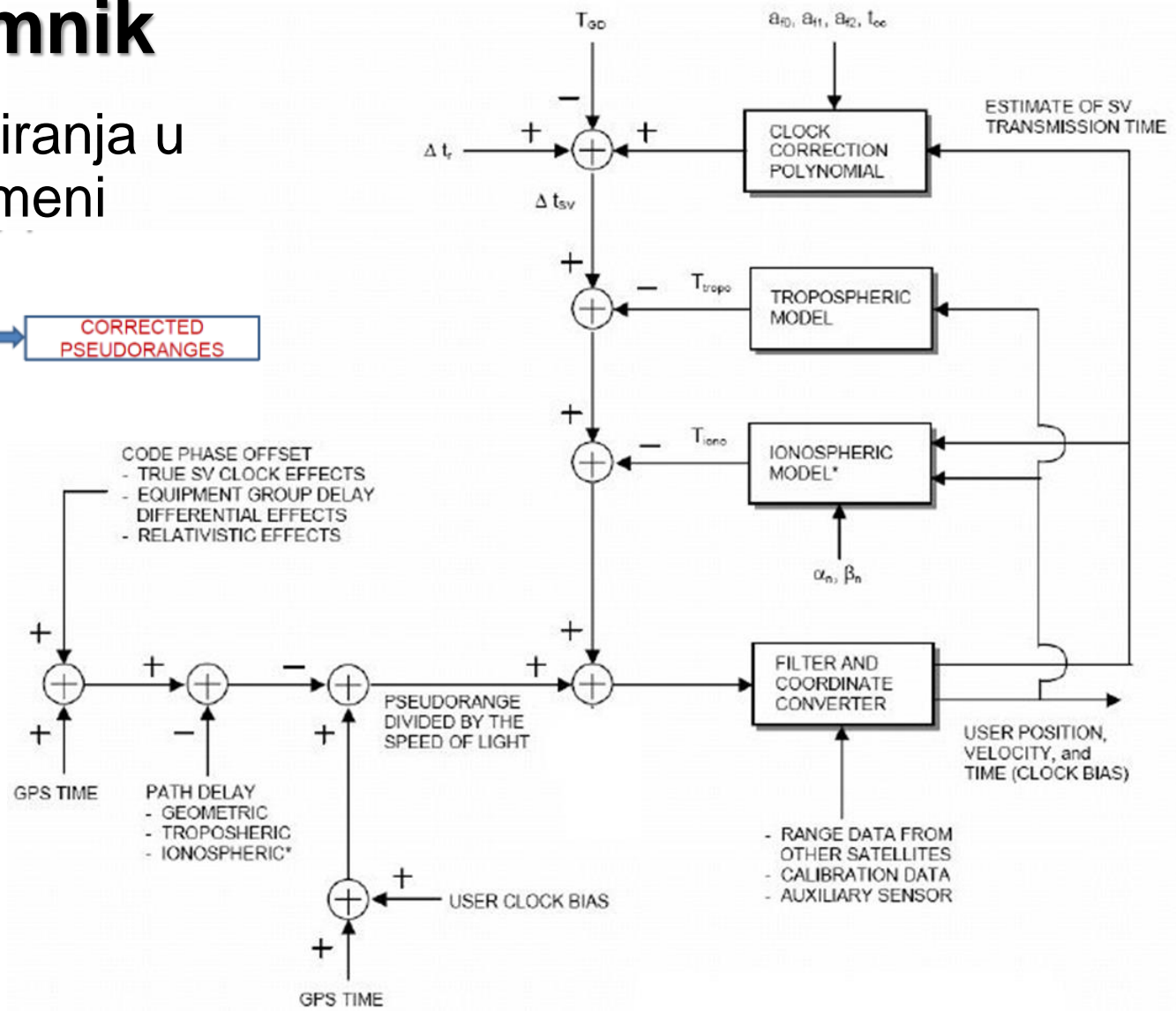
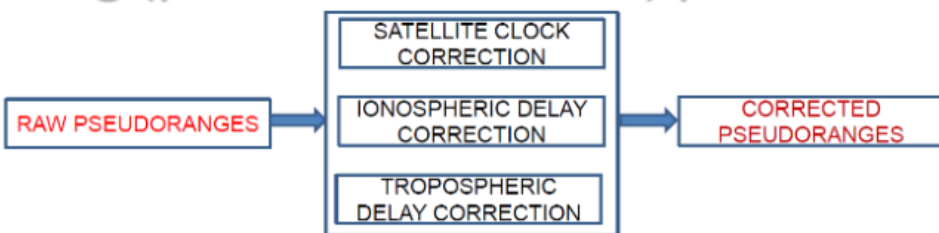
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■ Programski određen GNSS prijamnik

- Priprema procesiranja u navigacijskoj domeni



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- **Programski određen GNSS prijamnik**

- Procesiranje u navigacijskoj domeni

$$\rho_j = R_j + c(\delta t_r - \delta t_j) + T_T + T_I + K_{c,f,r} + K_{c,f,j} + M_{c,f} + \varepsilon_r, j = 1, \dots, n$$

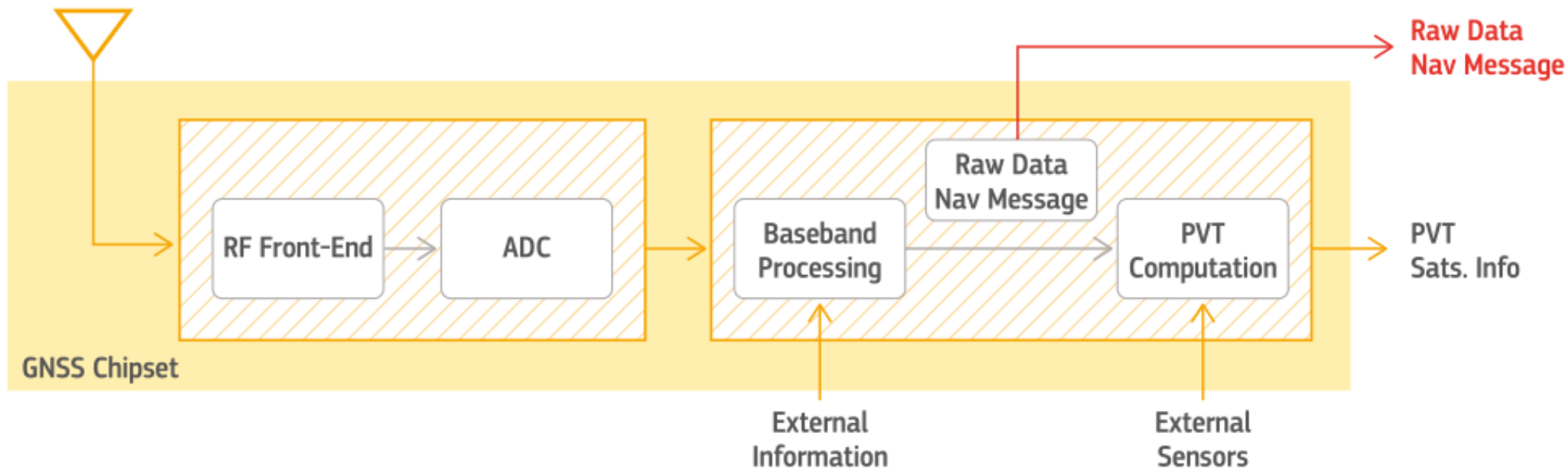
$$R_j = \sqrt{(x_j - x_r)^2 + (y_j - y_r)^2 + (z_j - z_r)^2}, j = 1, \dots, n$$

$$\begin{bmatrix} dx \\ dy \\ dz \\ c\delta t \end{bmatrix} = \begin{bmatrix} \frac{x_0 - x_1}{R_{1,0}} & \frac{y_0 - y_1}{R_{1,0}} & \frac{z_0 - z_1}{R_{1,0}} & 1 \\ \vdots & \vdots & \vdots & \vdots \\ \frac{x_0 - x_n}{R_{n,0}} & \frac{y_0 - y_n}{R_{n,0}} & \frac{z_0 - z_n}{R_{n,0}} & 1 \end{bmatrix}^T \begin{bmatrix} \rho_1 - R_{1,0} - D_1 \\ \vdots \\ \rho_n - R_{n,0} - D_n \end{bmatrix}$$

$$\begin{bmatrix} x_r \\ y_r \\ z_r \end{bmatrix} = \begin{bmatrix} x_0 \\ y_0 \\ z_0 \end{bmatrix} + \begin{bmatrix} dx \\ dy \\ dz \end{bmatrix}$$

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- **Programski određen GNSS prijамnik**
- Očitavanje pseudoudaljenosti iz GNSS SDR prijамnika



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**ZAHVALJUJEM NA
POZORNOSTI !**

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