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**Stewart, R.W. and Crockett, L. and Atkinson, D. and Barlee, K. and Sozer, E. and McLernon, M. and MacEwen, N. (2015) The teaching and learning of DSP enabled Software Defined Radio using MATLAB & Simulink and the RTL-SDR. In: New England Workshop for Software Defined Radio (NEWSDR'15), 2015-05-22 - 2015-05-22, Worcester Polytechnic Institute. ,**

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## Real Time, Low Cost SDR for the Classroom

- The RTL-SDR brings low cost SDR to everyone!
- \$15 per USB radio (inc. antenna!) and widely available.
- Designed for Digital TV, but now useable as a tunable SDR.
- Well known and used in SDR & Ham Radio Communities.
- Now in the classroom, home, and engineer's desk.

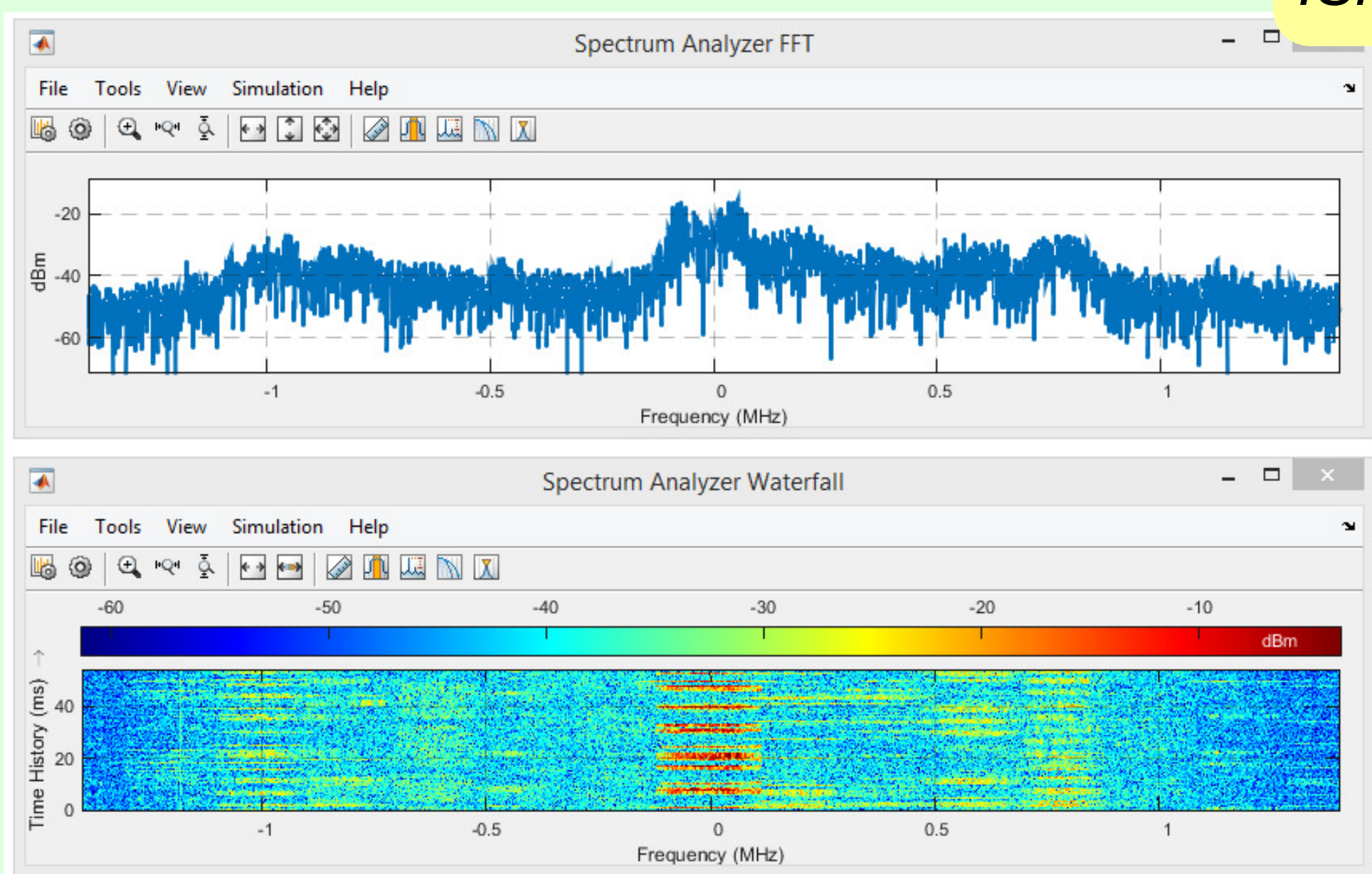


## Off Air Spectral Viewing

- Tunable range 50MHz to 1.7GHz
- Baseband sampling at up to  $f_s = 2.8\text{MHz}$
- Almost 8 bits I/Q receiver resolution
- Analyse time and frequency domains.

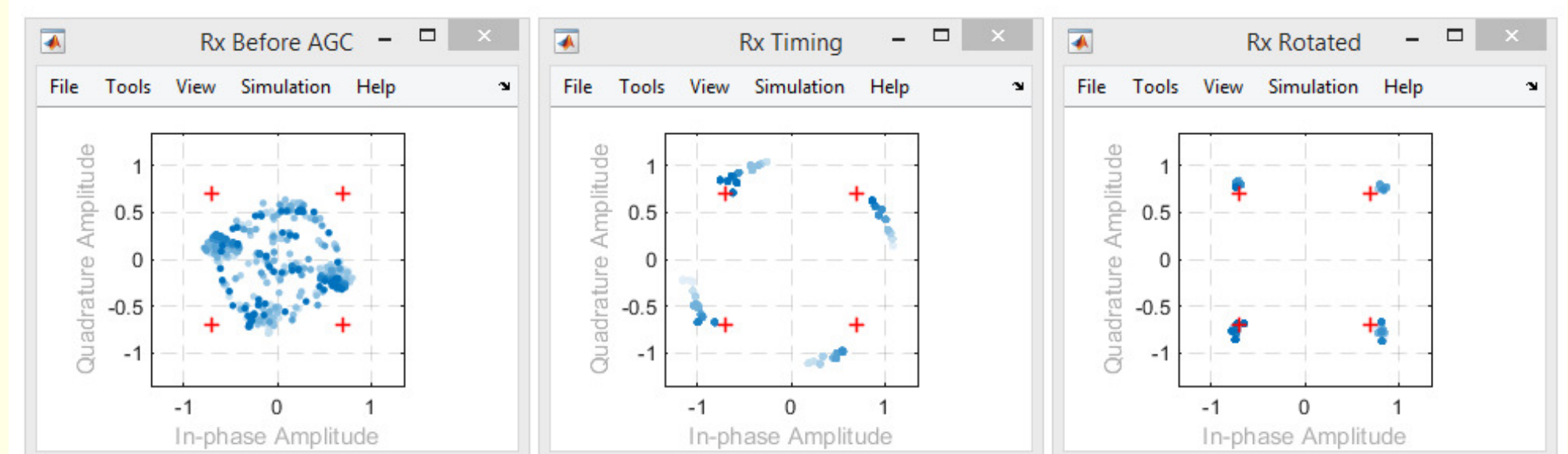
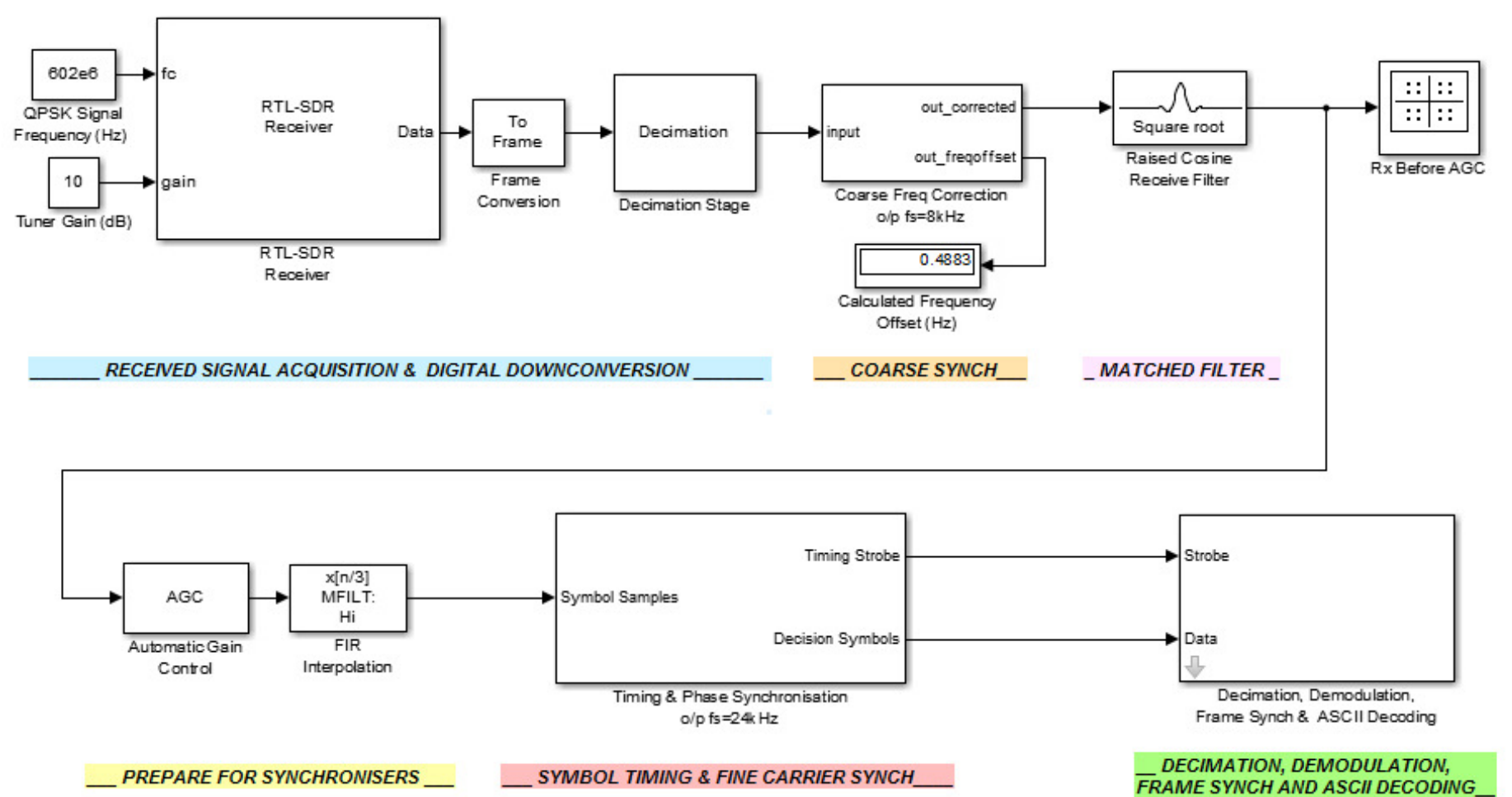
Radio Beacons  
AM & FM  
GPS  
GSM  
Satellite  
LTE  
ISM band

Off-Air 945MHz GSM Signal with 200kHz Channels



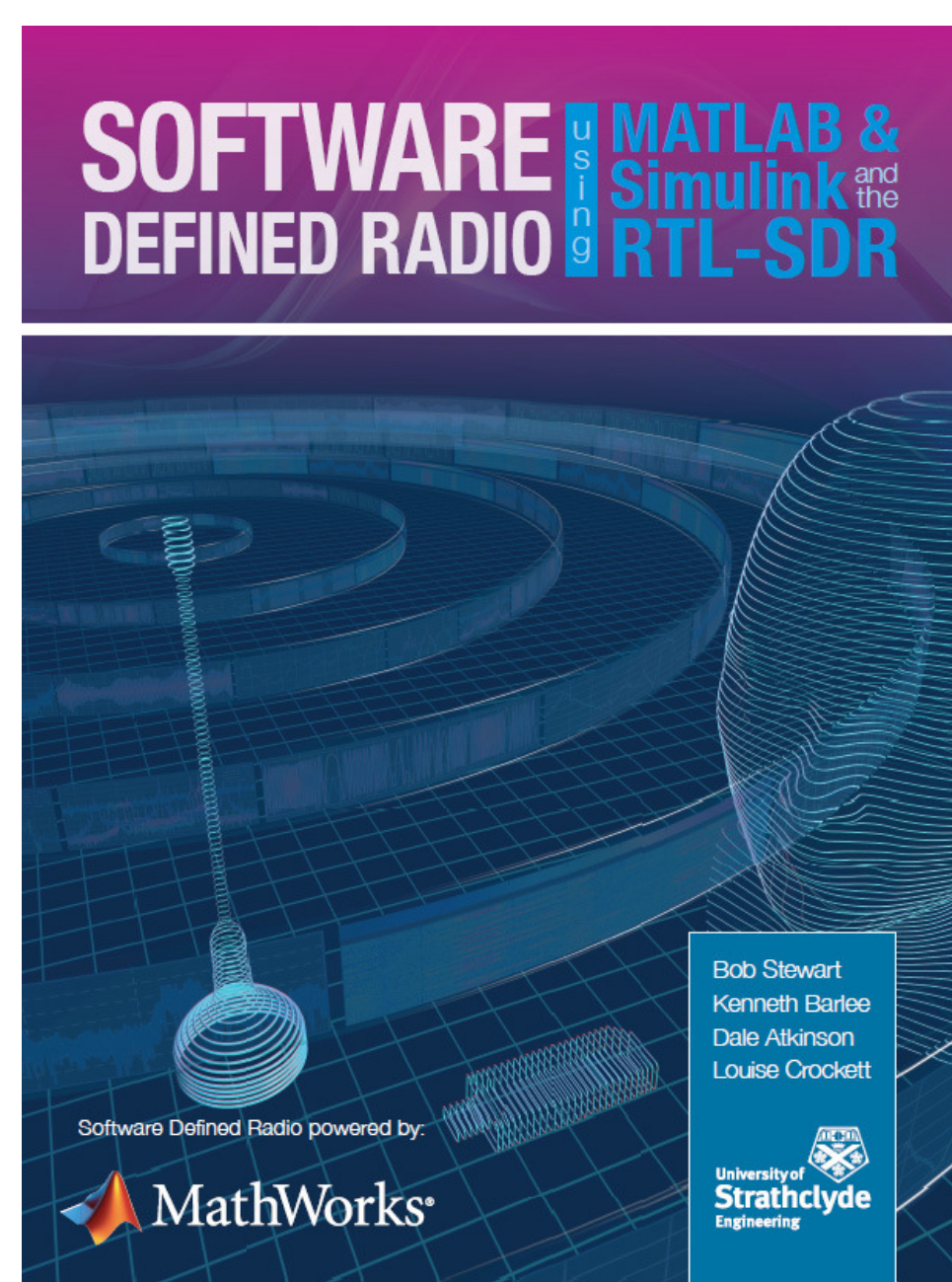
## MATLAB & Simulink Designed SDR

- Open the box and you are 'SDR'ing' in 30 mins!
- Compatible with MATLAB & Simulink 2014b+ with
  - DSP Systems Toolbox
  - Communications System Toolbox
  - RTL-SDR Hardware Support Package
- Professional, Student or Home Editions
- SDR running real-time on the MATLAB desktop
- Floating point implementations
- Real time, first principles DSP-SDR designs



## Coming July 2015...

- A 640 page textbook
- More than 100 hands-on RTL-SDR receiver examples
- **Free** to download book, examples and support files.
- Full colour print available from *Amazon.com* & bookstores.
- Tried and tested on ugrad labs and student projects.



## For a few dollars more... Desktop Tx and Rx

- Design \$15 AM transmitters using low cost components and transmit on ISM 433MHz.
- Use a \$10 FM RF transmitter & implement PHY & MAC Tx/Rx for data, audio, image transmission.
- With a USRP Tx at the front of the classroom and students receive and decode digital comms.