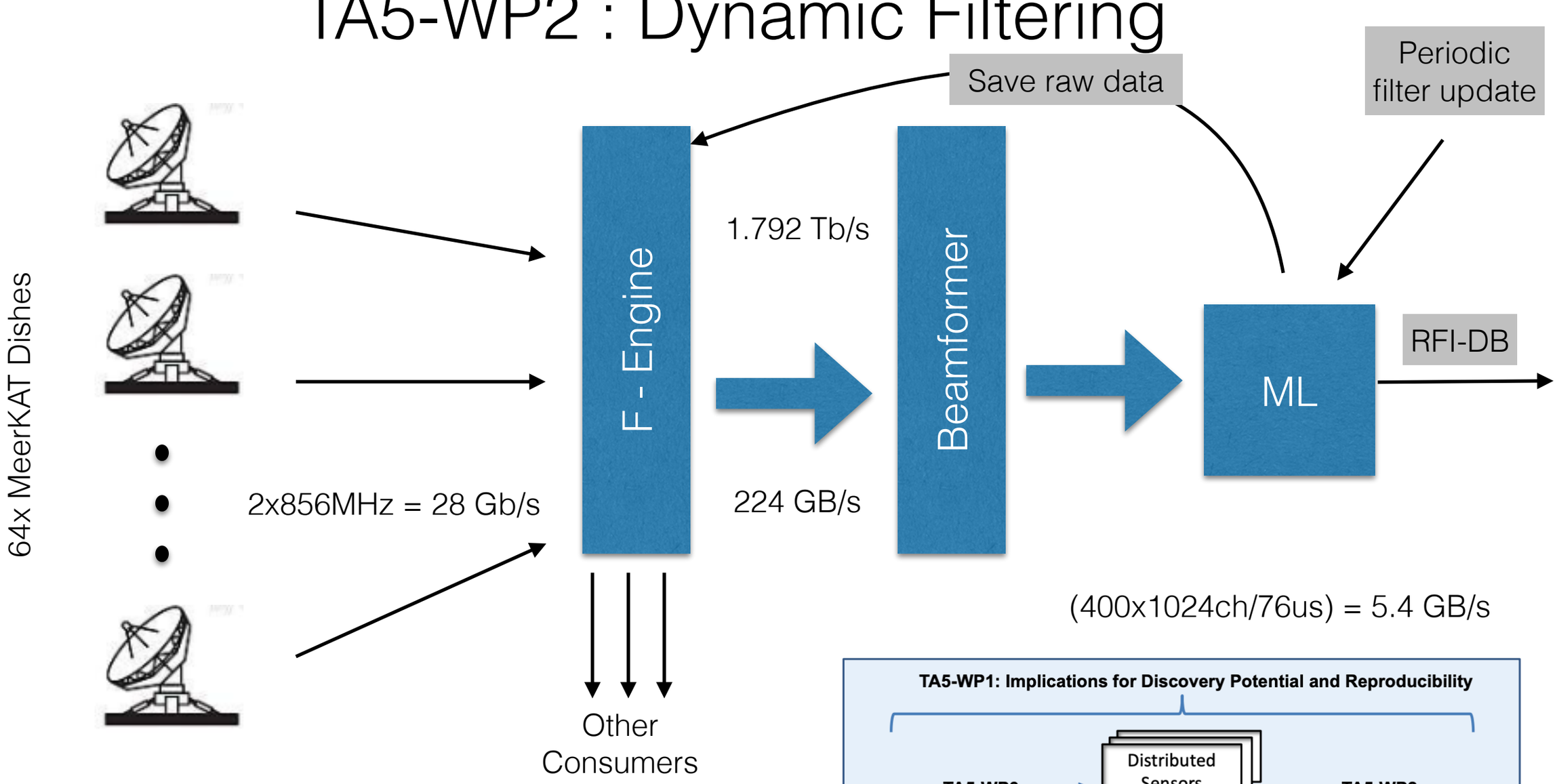
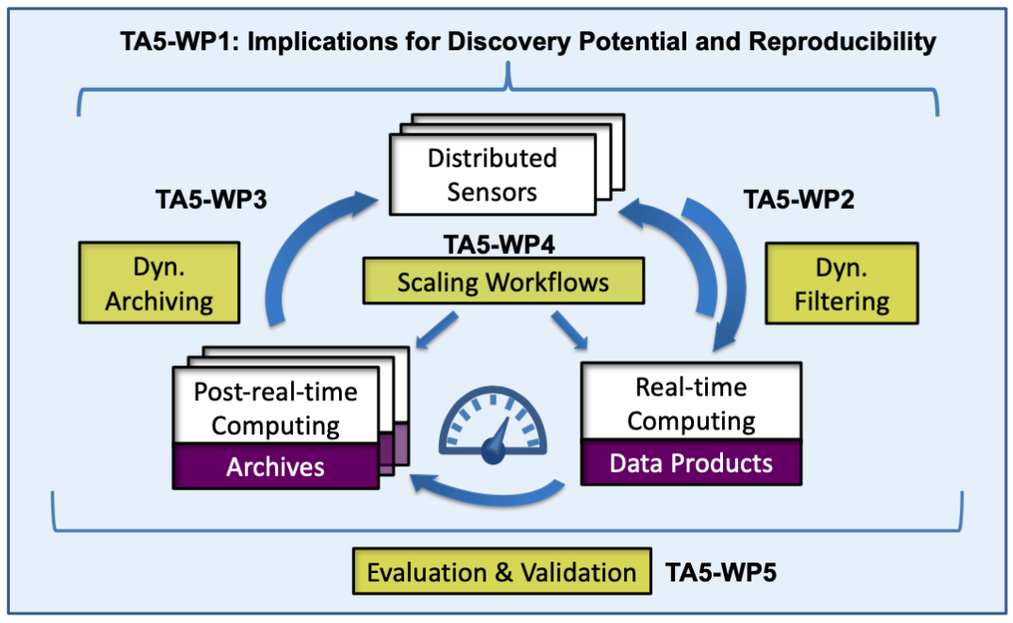
TA5-WP2 : Dynamic Filtering



- up to 960 beam ~ 11GB/s
- SKA is upwards to 2000 beams + many more dishes



Dynamic Life Cycle Model

TA5-WP2 : Prototype with Effelsberg

Effelsberg 100m

Save raw data

7-Beam Rx

2x640MSPS
1380MB/s

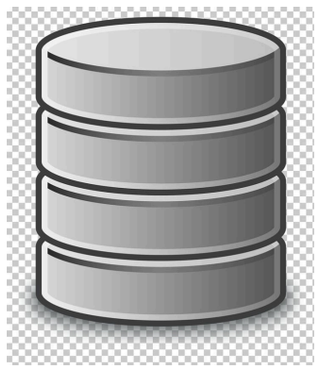
FPGA
(FFT)

ML
Alveo
U55C

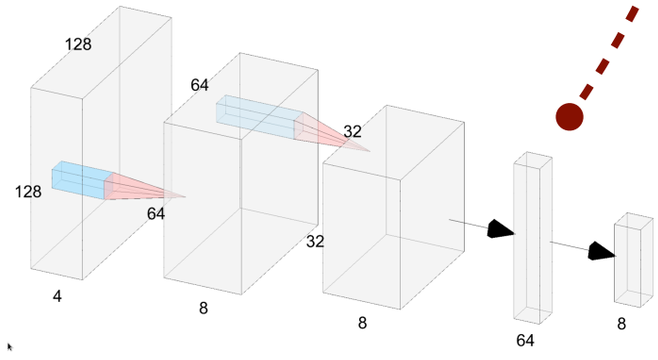
Realtime ML Inference

OFFLINE Training/Model selection

HLS4ML



Spectrograms
(FFT)



TA5-WP2 : Prototype with Effelsberg

- 20m of ADC output on disk - 1.5625ns sampled, 8-bits
  - contains dispersed radio pulse and RFI
- Data transformed to spectrograms: 256x256, 1.5625MHz, 102.4us = 46150 spectrograms
- Expert-inspected, labelled spectrograms - Training data set with real data
- Training data set augmented with simulated data to cover larger parameter space (DM and S/N)
- TensorFlow based CNN (3 convolutional layers, 4 to 8 5x5 filters, 8 outputs).
- Keras tuner to explore hyperparameters
- Horovod for distributed training - cuts down training by 10x
- Model being targeted to Alveo U55C
  - 1st Version to use high bandwidth memory on U55C to hold spectrograms
  - 2nd Version to have 100GbE interface to stream data from telescope
  - nfilt*filter_w*filer_h*nfilt_last_layer < 4096 : HLS4ML loop unroll limitation.

Performance of 5 different models selected using Keras tuner. All models with 3 conv. layers, and 8 outputs.