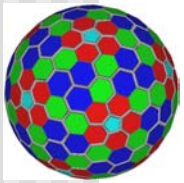


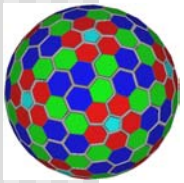
AGATA Local Level Processing

PREPROCESSING ALGORITHMS (PPA)

Definition:

Algorithms, that need to run on individual channel level on the full data stream of continuously sampled ADC data on dedicated hardware.

- Trigger
- Baseline Restauration
- Moving Window Deconvolution

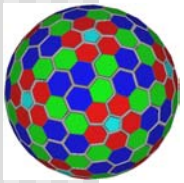


AGATA Preprocessing Algorithms

Moving Window Deconvolution (MWD)

Algorithm, that extracts precise energy information from the sampled data with minimum processing dead time, i.e. even at high rates and large ballistic deficits.

- Time invariant digital filter
- Trapezoidal noise residual function (shaping function)
- Individual adjustment of shaping parameters
- Adaptive shaping



AGATA Preprocessing Algorithms

MWD - tests and hardware implementations

Examples:

Strasbourg: Implementation on TNT hardware

P. Medina, M. Richer, C. Santos

Daresbury, Heidelberg: Implementation on GRT4 hardware

I. Lazarus, M. Lauer

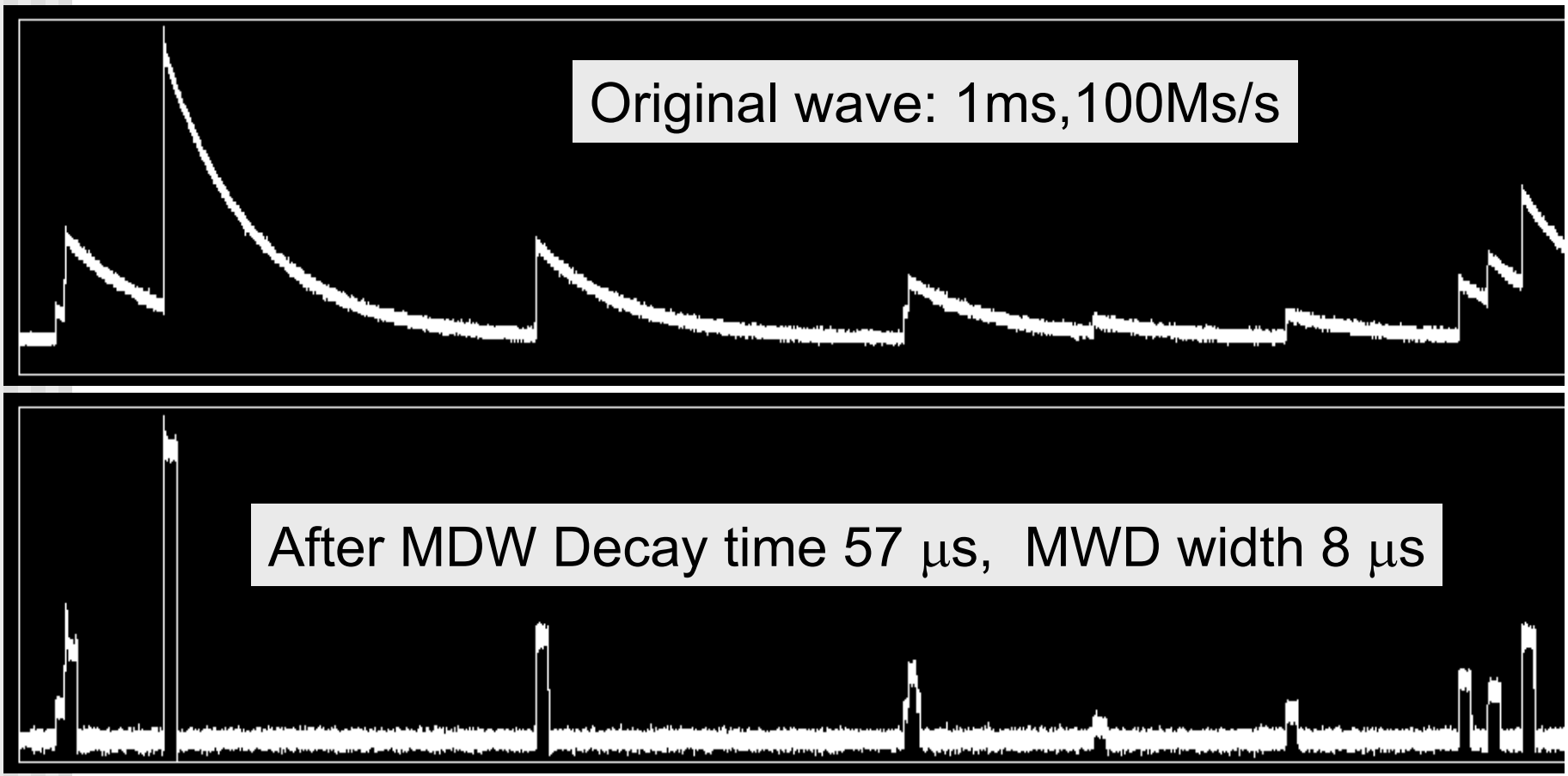
Padova: Test with the MARS detector

R. Venturelli, A. Pullia, R. Isocrate, M. Bellato, D. Bazzacco

- Data taken with 8 bit digital scopes
  (problems: linearity, dynamic range)
- Algorithm implemented in C or C++
- Algorithm implemented in FPGA

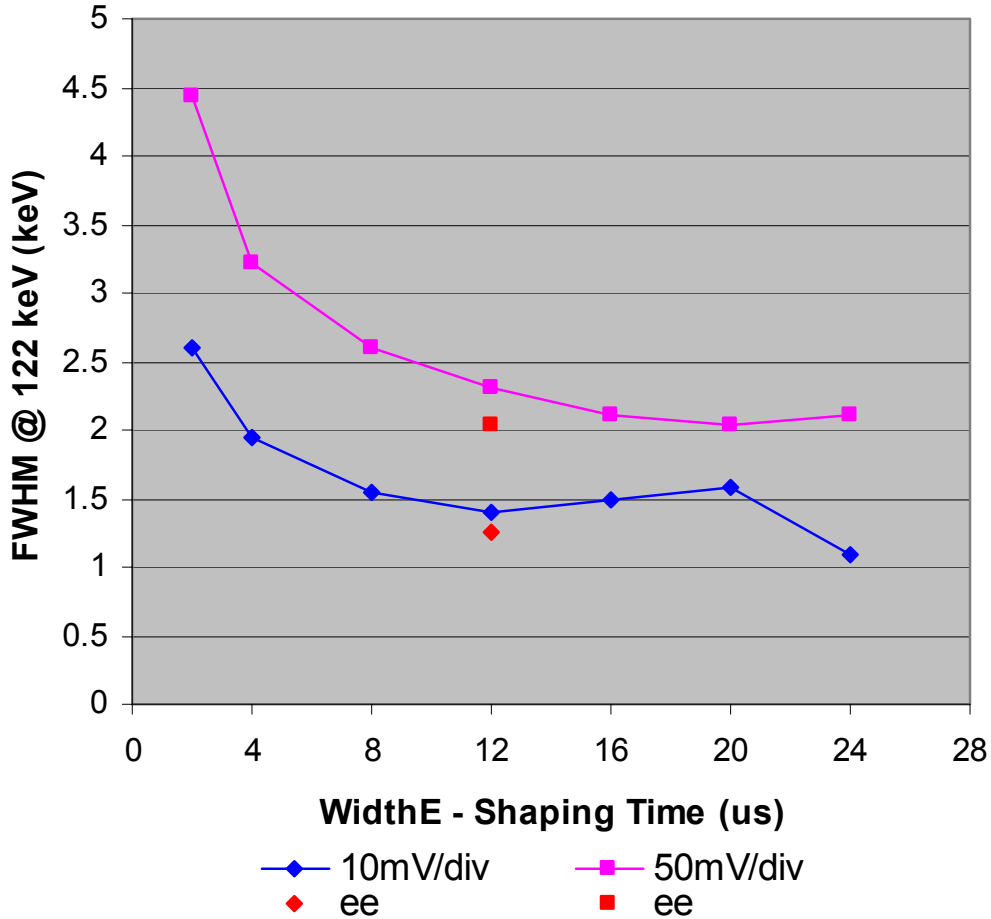
AGATA Preprocessing Algorithms

Test of MWD with the MARS detector: waveforms



AGATA Preprocessing Algorithms

Test of MWD with the MARS detector: energy resolution



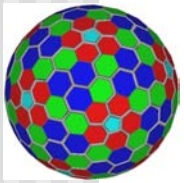
AGATA Preprocessing Algorithms

MWD summary:

Well established and tested algorithm, commonly accepted to be used as the method to extract energy information.

Still to be done:

- Time variant adaptive shaping
- Implementation into preprocessing hardware
- Automatic procedures to adjust shaping parameters



AGATA Preprocessing Algorithms

Baseline Restauration (BLR)

Algorithm, that calculates continuously, for each pulse, the baseline reference value from the sampled data with highest precision depending on the actual noise and count rate figures.

- Time variant digital filter (gated baseline restorer)
- Fast and stable overload recovery
- Adaptive shaping
- Output used to control the offset of the ADC

AGATA Preprocessing Algorithms

BLR - tests of candidate algorithms

Moving Window Deconvolution (MWD), Moving Average (MAV), Continuous Average (CAV), etc.
Examples:

Strasbourg: Count rate effects on MWD

P. Medina, M. Richer, C. Santos

Daresbury, Heidelberg: Recursive filter, MAV

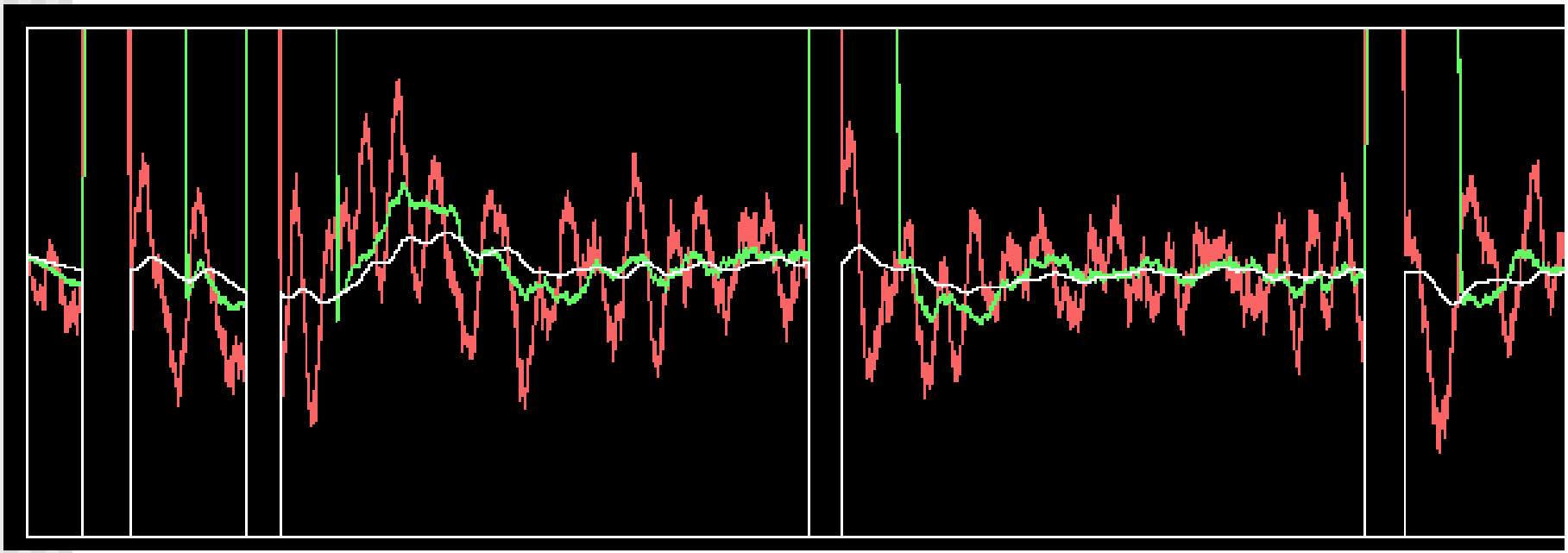
I. Lazarus, M. Lauer

Padova: Comparison of MWD and CAV

R. Venturelli, A. Pullia, R. Isocrate, M. Bellato, D. Bazzacco

AGATA Preprocessing Algorithms

Comparison of MWD and CAV



Base line from:

trapezoidal filter 6 μs
trapezoidal filter 30 μs
continuous average

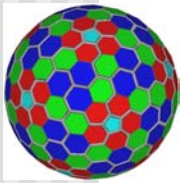
AGATA Preprocessing Algorithms

BLR summary:

No commonly accepted algorithm established yet, but reasonable candidates exist. Different algorithms for different experimental conditions (count rate, overload, pulsed beams, noise enviroment) may have to be forseen.

Still to be done:

- Study of noise spectra under different exp. conditions
- Theoretical study of optimal filters for different noise spectra
- Test of optimal adaptive filter algorithms and implementation into preprocessing hardware
- Test of feedback to control ADC offset
- Automatic procedures to adjust parameters



AGATA Preprocessing Algorithms

Slope Condition Counting (SCC) trigger

Algorithm, that detects with high sensitivity and reasonable timing accuracy the occurence of a signal in the sampled data stream.

- Time invariant digital filter
- Shape and amplitude insensitive timing
- Small deadtime
- Noise insensitive threshold

AGATA Preprocessing Algorithms

SCC - tests and implementations

Padova: Test with the MARS detector

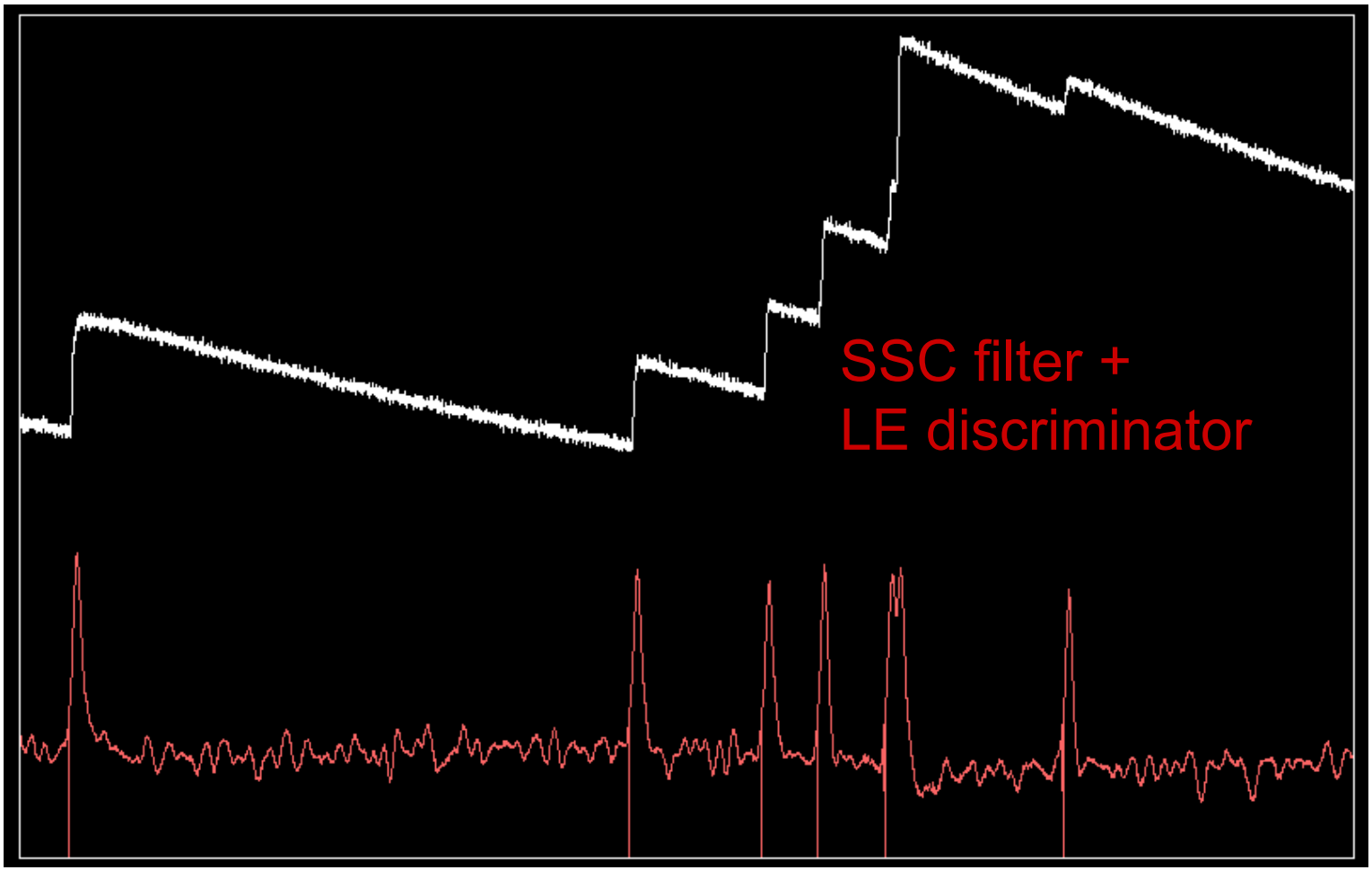
R. Venturelli, A. Pullia, R. Isocrate, M. Bellato, D. Bazzacco

Parameters

- SCC window width 400ns (deadtime)
- Moving average window width 200ns
- Algorithm implemented in C or C++ and FPGA

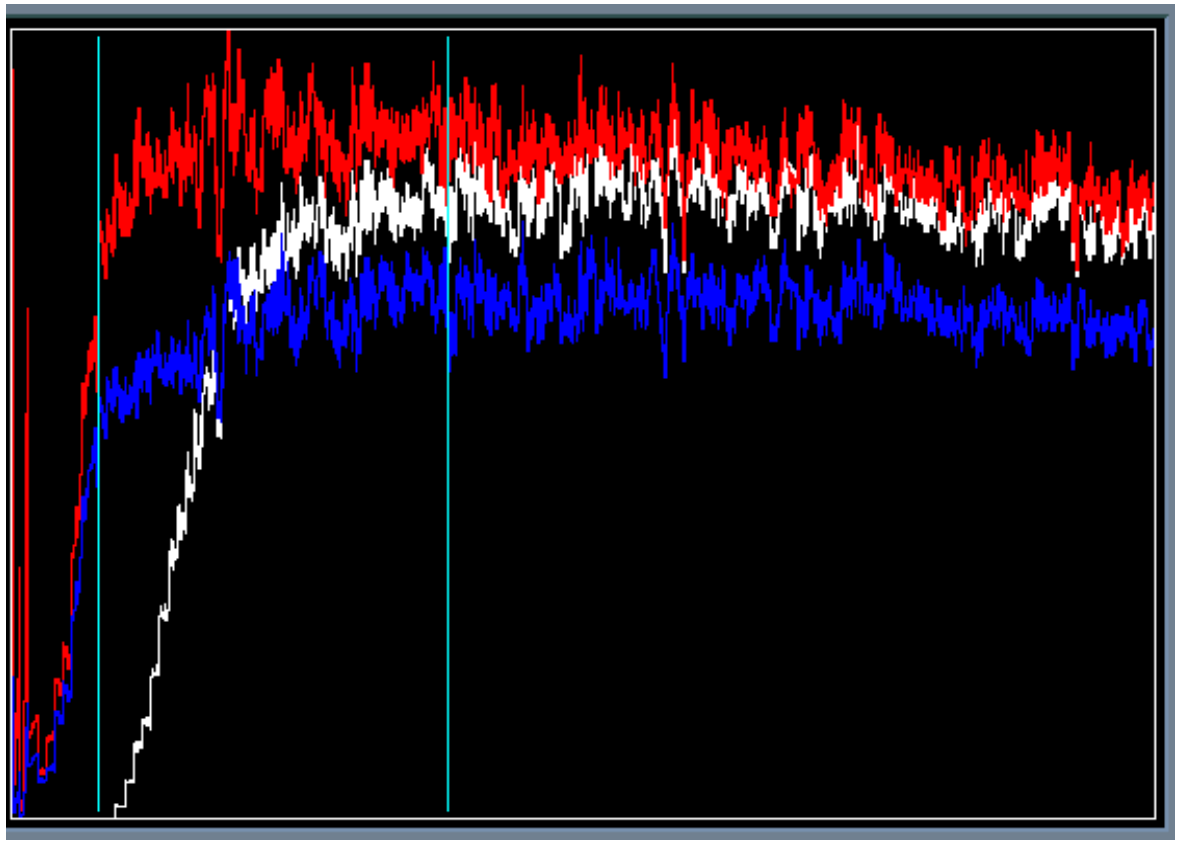
AGATA Preprocessing Algorithms

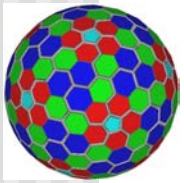
SCC time invariant filter response



AGATA Preprocessing Algorithms

SCC threshold





AGATA Preprocessing Algorithms

SCC summary:

SCC is not a completely established algorithm yet, but a good candidate.

Still to be done:

- Optimization of shaping parameters
- Comparison to other trigger algorithms
- Study of sensitivity at small signal falltimes
- Implementation into preprocessing hardware
- Procedures to adjust parameters automatically