

# **Fusion Technologies**

## **IT, Control and Data Acquisition**

### **Exercises**

J. Decker 02.05.2023

#### **1) storage arrangement and failure risks**

- a) Assuming that the risk of HDD failure is 1/200000 per hour, what are the chances of at least one drive failure per year in a storage array made of
- 6 drives ( $\sim 10^3$ ) ?
  - 36 drives ( $\sim 10^4$ ) ?
- b) What do you think about the result and its consequences ?
- c) If a RAID 5 member drive fails, replacing the disk initiates a parity rebuilt process during which that each disk must be read entirely. In that case, assuming that the drive r/w speed is 100MB/s, what are the risk of unrecoverable array failure for :
- a 10TB RAID5 array made of 6x 2TB drives ( $\sim 10^3$ ) ?
  - a 630TB RAID5 array made of 36x18TB drives ( $\sim 10^4$ ) ?
- d) For drives bought from the same series, the rate of failure triples if one drive fails. How does the risk of unrecoverable array failure evolve?
- e) What would the risks of unrecoverable array failure be for a RAID6 array ?
- f) What conclusions do you draw from this study?

#### **2) Digitization and data storage**

To digitize a sinusoidal wave with at least 1% accuracy one needs at least 32 samples per period and a 6-bit precision

- a) for a 16 kHz sinusoidal wave, what are the storage requirement to store as single precision the corresponding data acquired for 8 seconds by an "ideal minimalist digitizer"?
- b) what are the storage requirements if we serialize the data?
- c) all we have is a 12-bit digitizer. if we don't cut the data and store it at double precision, what is the stored data size ?
- d) the physical signal also carries a secondary sinusoidal wave at 128 kHz and a comparative -30 dB power. What are the minimal rate and accuracy to also capture this signal? What are the storage requirements in double precision?
- e) what are the storage requirements if we use a FPGA performing a kHz FFT of the signal and keep the 32 strongest features at single precision? What do you conclude?