LAPP
Laboratoire d'Annecy-le-Vieux
de Physique des Particules

Drive Maintenance

cta
cherenkov telescope array

cnrs

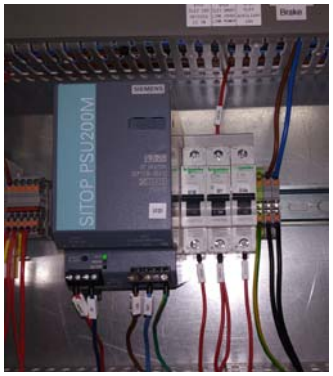
UNIVERSITÉ
SAVOIE
MONT BLANC

Differents Device Family of Drive System

Electro-Mecanical Devices

Motors
Encoders
Brakes
Reducers
…

Electrical Devices



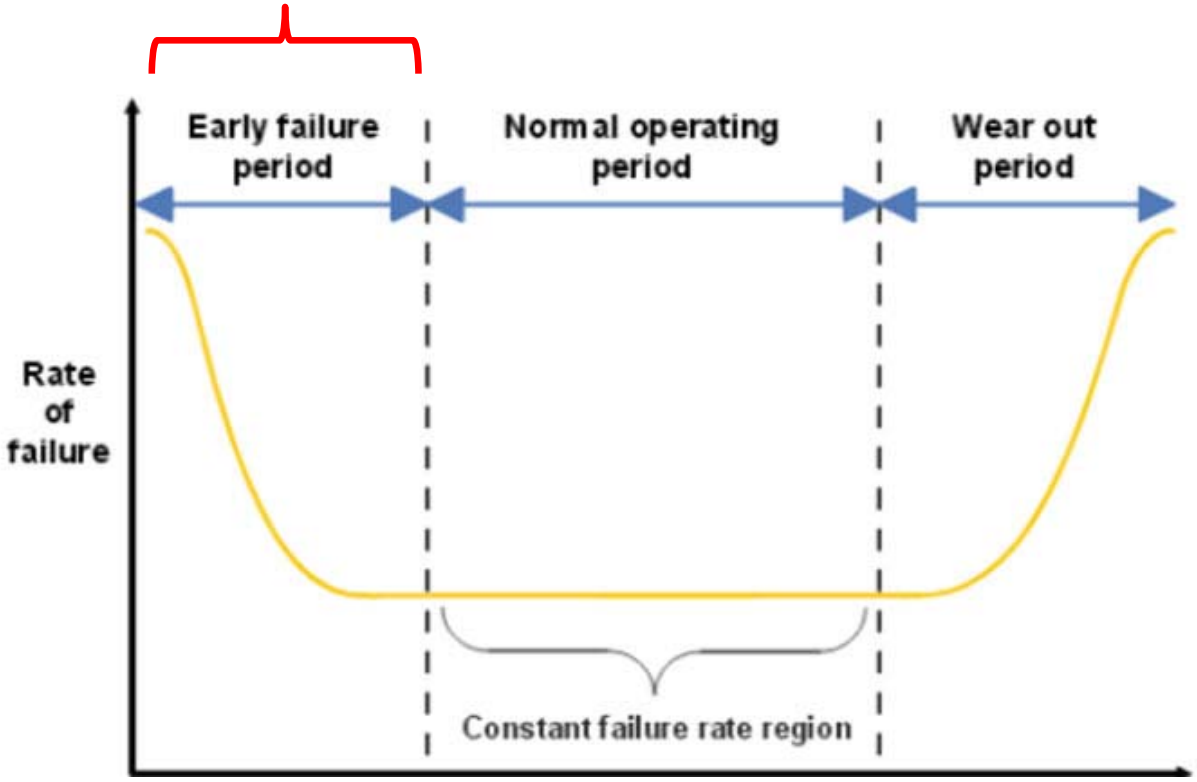
Motors Controllers
Circuit Breaker
Relays
24V Power Supply
…

Reliability

Electonics Devices

PLC
IO Control Device
Sensors
Fieldbus Devices
…

Commissionning and test phase



			MTBF (Failure)
6EP1332-2BA20	24 V / 2,5 A	SITOP smart	205,94y
6EP1334-1AL11	24 V / 10 A	SITOP	134,30y
6EP1333-3BA10	24 V/5 A	SITOP PSU200M	128,31y
6ES7131-6BF01-0BA0	ET 200SP, DI 8x 24V DC ST	SIMATIC S7	356,53y
6ES7132-4BD00-0AA0	4DO standard	SIMATIC S7	101,80y
6ES7134-4GB00-0AB0	ET200 analog input	SIMATIC S7	64,80y
6ES7441-2AA04-0AE0	CP 441-2	SIMATIC S7	96,10y
6ES7317-6TJ10-0AB0	CPU 317T-2DP	SIMATIC S7	26,20y

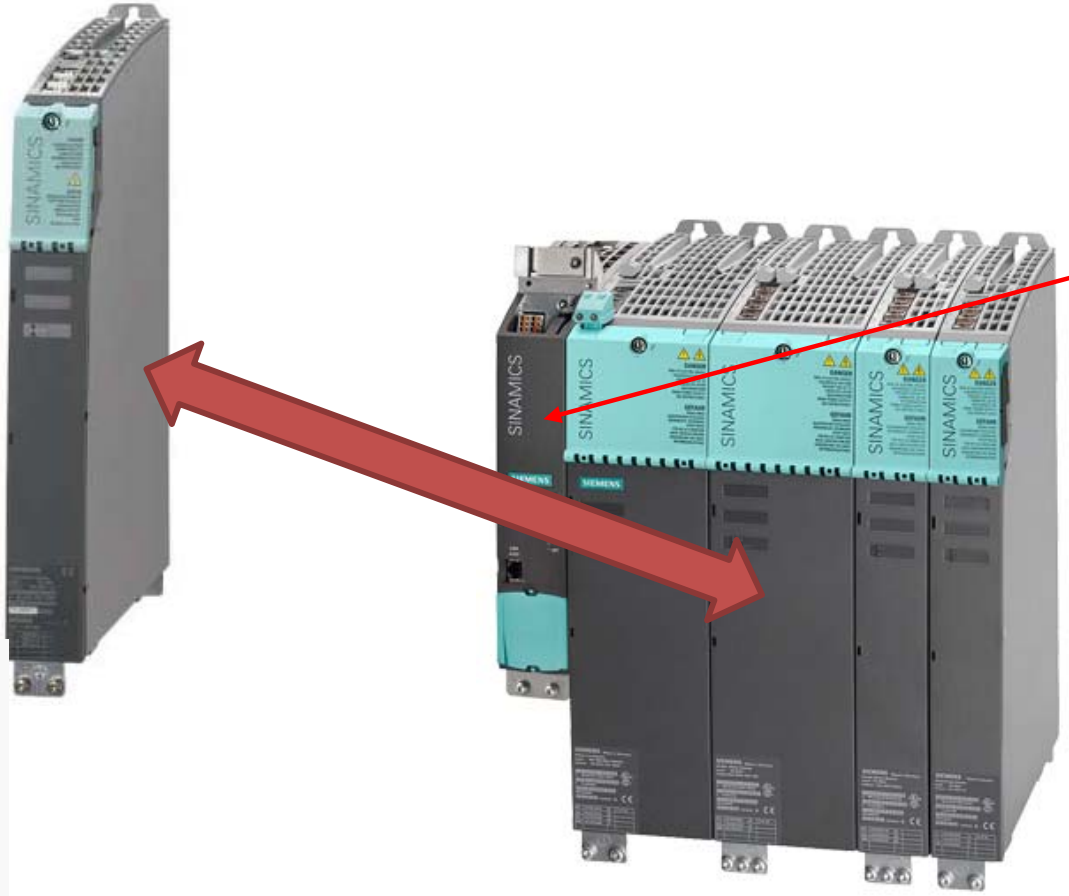
To our expericence in other experiment with this material (Hess 2):
No failure on electrical/electronical device since 2010

But external problems can occurs like rats damage.

Baseline: 2 spares for each device are planned
Usable indifferently on the 4 LST telescopes

Over costs some device can change this baseline
(only 1 spare for azimuth power supply)

Get experience from other telescopes (Magic, Hess …) to eventually adjust the number of spares



Configuration Data
Must be Updated

Device change are not plug and play !!!

Who: Local Experts + LAPP Experts (at least on call).

Preventive Maintenance Motors

Table 9-2 Maintenance measures

Maintenance measures	Maintenance intervals
Initial inspection	After 500 operating hours, at the latest after six months
Regreasing	See the lubricant plate
Permanent lubrication (with coupling output)	Replace bearings after approximately 20,000 operating hours, at the latest after three years
Cleaning	Depending on the degree of pollution
Main inspection	After approximately 16,000 operating hours, at the latest after two years

Inspection interval

Perform the following checks after approx. 16,000 operating hours or two years, whichever comes first.

Implementation

- While the motor is running, check that:
  - The stated electrical characteristics are being observed
  - The smooth running characteristics and machine running noise have not deteriorated
- Once the machine has been shut down, check that:
  - The motor foundation has no indentations or cracks
  - The machine is aligned within the permissible tolerance ranges
  - All the fixing bolts/screws for the mechanical and electrical connections have been securely tightened
  - The winding insulation resistances are sufficiently high
  - Any bearing insulation has been fitted as shown on plates and labeling.
  - Cables and insulating parts and components are in good condition and there is no evidence of discoloring

CAUTION
If you detect any defects or malfunctions during the inspection, you must rectify them immediately. They may otherwise cause damage to the machine.

Who: Local Experts

Preventive Maintenance Motors

Table 8- 1 Maintenance measures after operating times or intervals

Operating times and intervals	Measure
Operation	
Daily; if possible, more frequently during operation	Monitor and check the motor for unusual noise, vibrations, and changes
After approx. 10,000 operating hours, at the latest after two years	If oil-lubricated, replace the radial shaft seal rings
As required, or after 25,000 operating hours	Replace the motor bearings

8.2.3 Bearing replacement interval

The bearings are subject to wear and must be replaced after a defined number of operating hours.

For average load levels, the bearings must be replaced after approx. 25,000 hours.

Bearing replacement intervals can be extended if the motor is operated under favorable conditions, e.g. low average speeds, low radial forces (cantilever forces), vibration load.

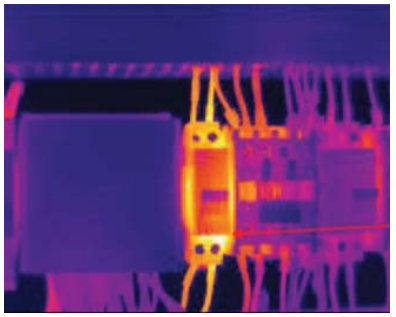
Note

Harsh operating conditions

If the motor is subject to harsh operating conditions (e.g. continuous operation at n_{max}, high vibration/shock loads, frequent reversing duty etc.), the bearing replacement intervals t_{LW} can decrease by up to 50 %.

Who: Local Experts

Preventive Maintenance Electrical Cabinet

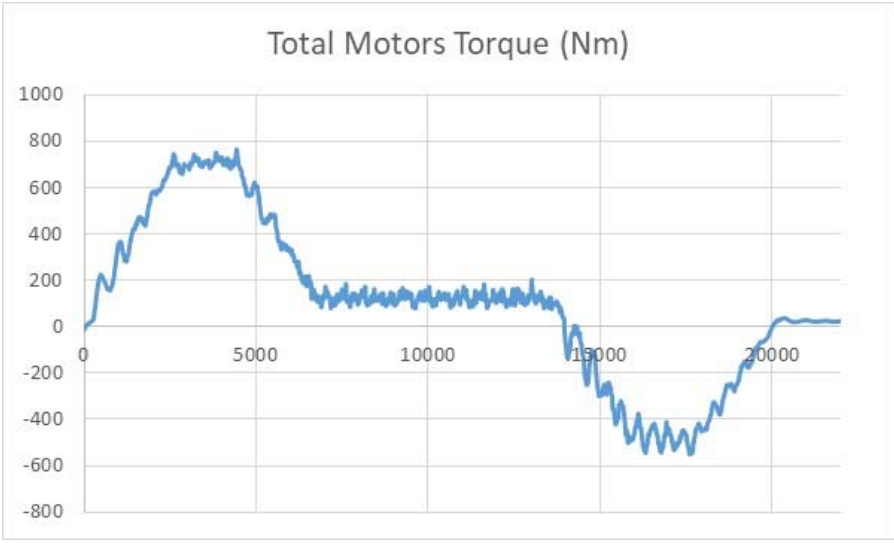


OverHeat Measurement (Every 6 Month ?)

Screw retightening campaign with torque screwdriver (Every Year)

Who: Local Experts

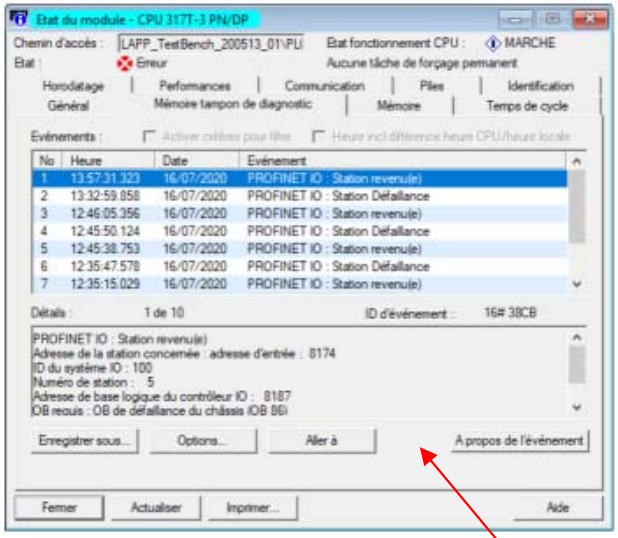
Define Specific maintenance motion for making a torque measurement in identical conditions

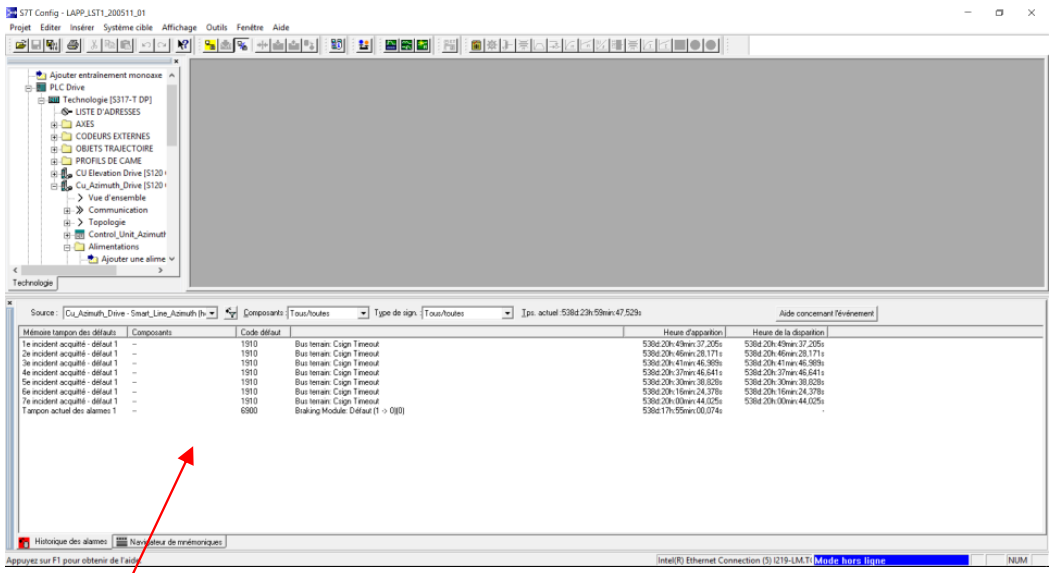


Detect abnormal Torque value or torque Drift

(Every Week -> Every Month ?)

Who: Normal shifters





Siemens tools give a lot of trouble shooting information and logs about PLC and motor controllers

Aide de l'événement 3xCB

L'appareil IO PROFINET dont l'adresse figure dans l'information détaillée est défaillant (événement 39CB) / revenu (événement 38CB).
D'autres appareils défaillants/défectueux sont également signalés.

Causes possibles

- L'appareil IO PROFINET a été mis hors service / en service.
- La ligne de liaison à l'appareil IO PROFINET a été interrompue / rétablie.

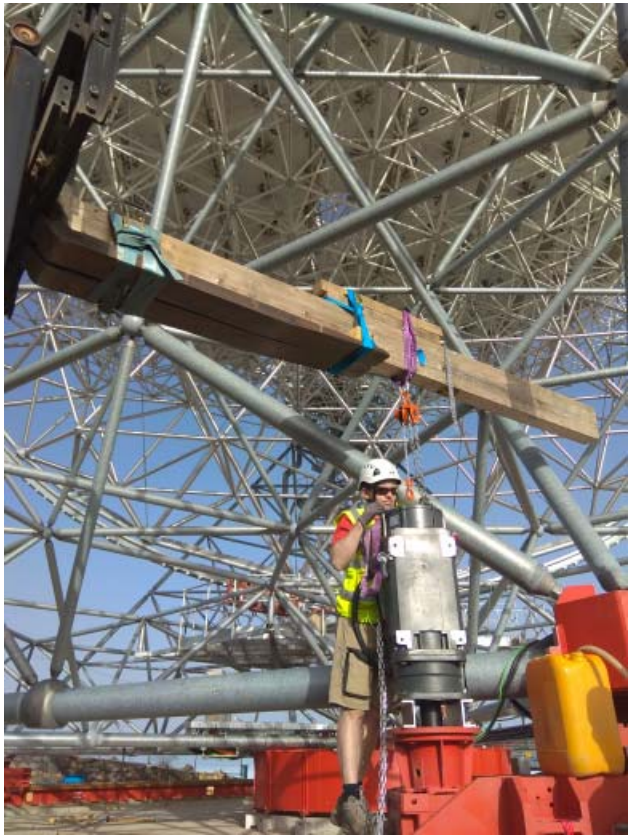
Solution

- Contrôlez l'état de l'appareil IO PROFINET/I-Device.
- Contrôlez la ligne de liaison à l'appareil IO PROFINET/I-Device.

Nota

Tenez compte du manuel système "Description système PROFINET", en particulier dans le cas d'un I-Device.

Who: LAPP Experts (on call)



Azimuth Motor Maintenance can be difficult (motor handling)

Who: Local expert

Difficulties of Maintenance 2/2

A specific tool must be studied

Handling the Azimuth Power supply out of it cabinet is difficult (180Kg + few space in the Drive Container)

Who: LAPP expert

Everything remains to be done in maintenance of the Drive

Define/buy/manage Spare devices.

Write Maintenance/Configuration Manuals

Study some handling tools (also useful for next installations)

Developing software tool for maintenance (get working hour, traceability of maintenance operation, direct manufacturer documentation links).