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PLATFORM
OMGEVINGSTECHNOLOGIE

Reliability

Reliability aanpak cryogene koelers

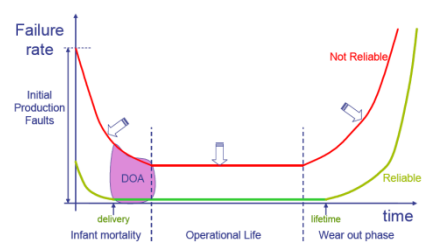
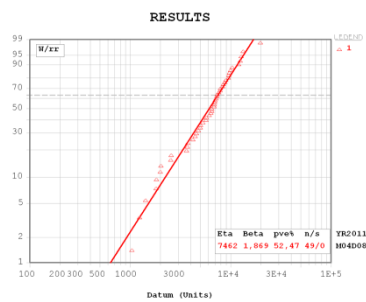
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Omgevingstest



Reliability



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THALES

Cryogenics

Reliable Cryogenic Solutions to make the world

VISIBLE
VISIBLE
VISIBLE

- Veel onderzoek gedaan door diverse personen met diverse methoden
- Behoefte aan goede onderbouwing reliability cijfers → eenduidige aanpak voor reliability

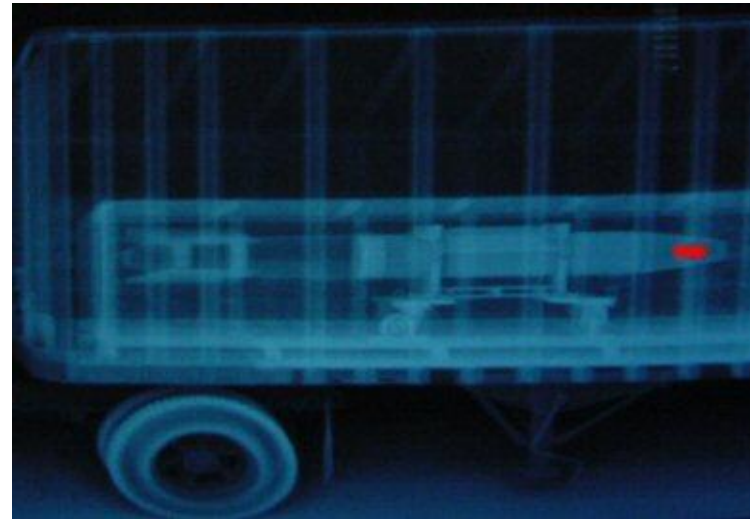
Reliability cryogene koelers

- Koelers en toepassingen
- Type koelers en eisen van klanten
- Faalmechanismes
- Analyse van uitgevoerde levensduurtesten
- Aanpak voor reliability

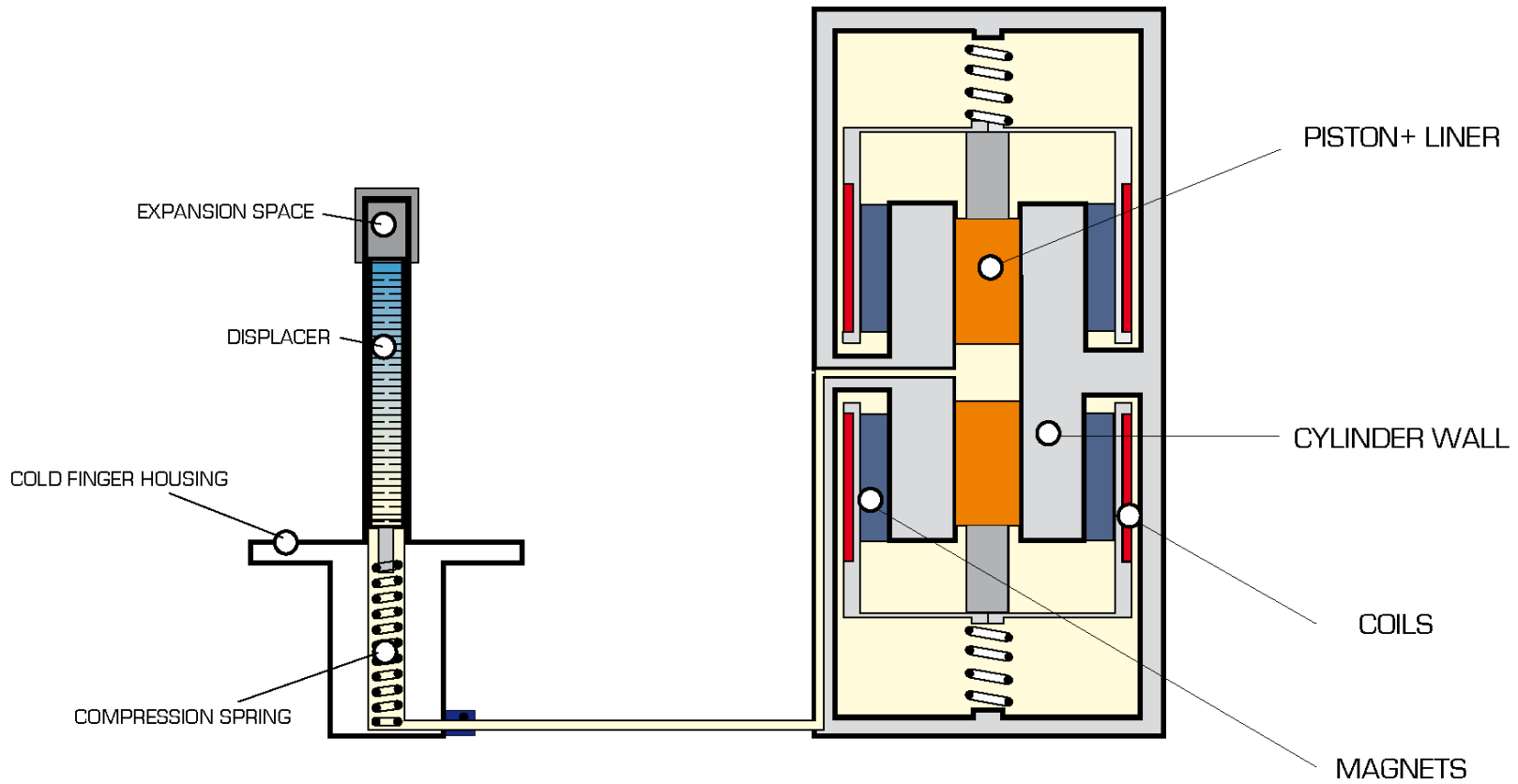
Detectoren / sensoren:

Infrarood

X-Ray, Gamma ray

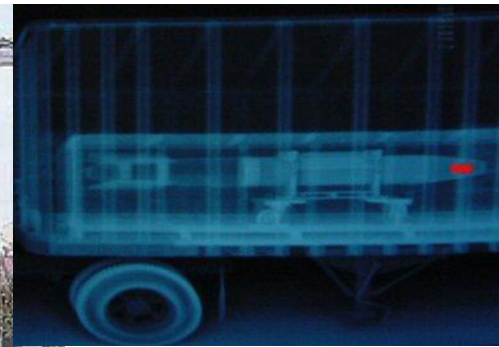


Verlaging van ruisniveau, koeltemperatuur 70 – 80 Kelvin

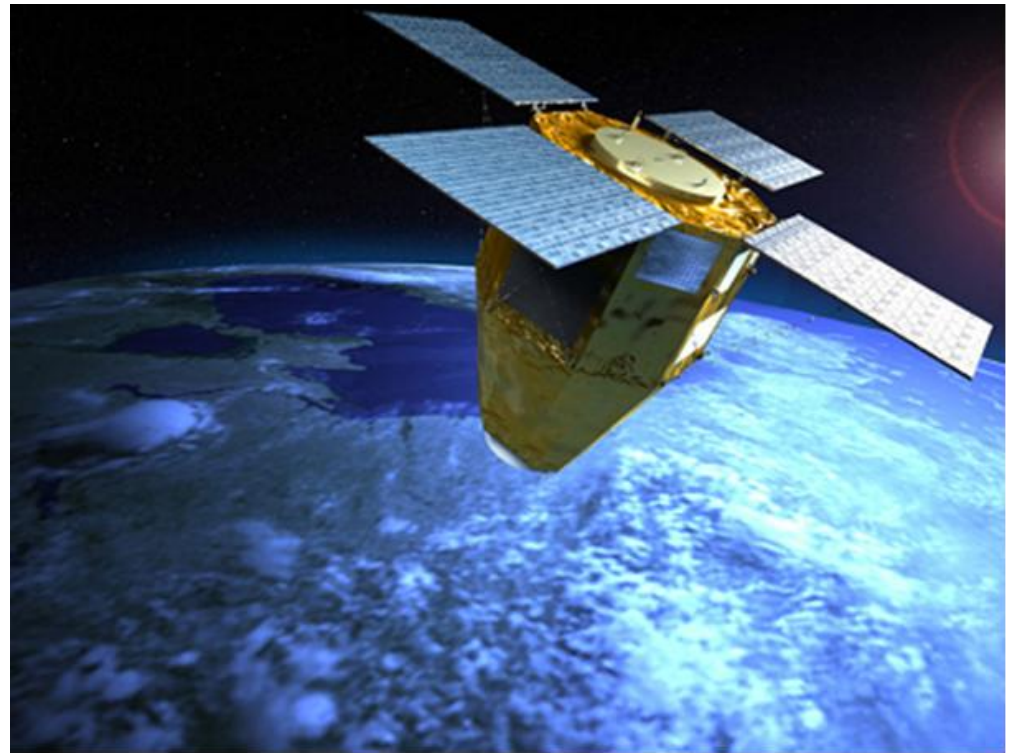
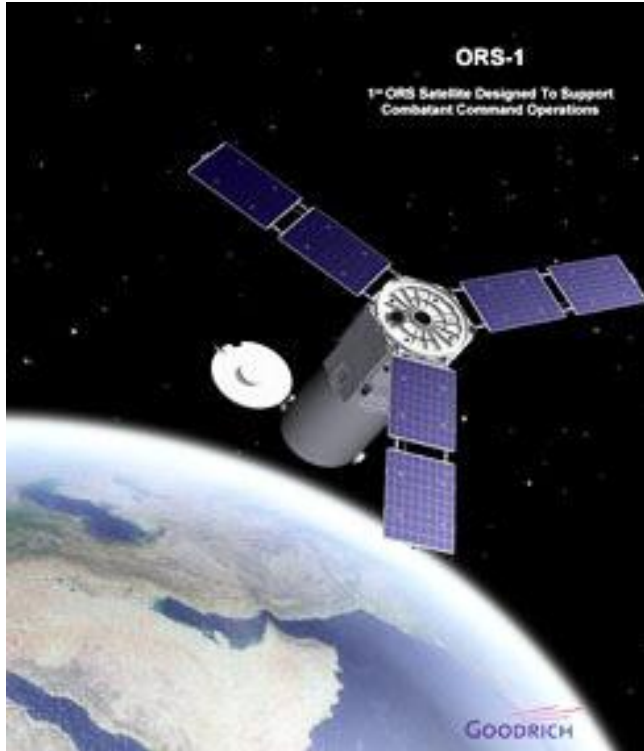




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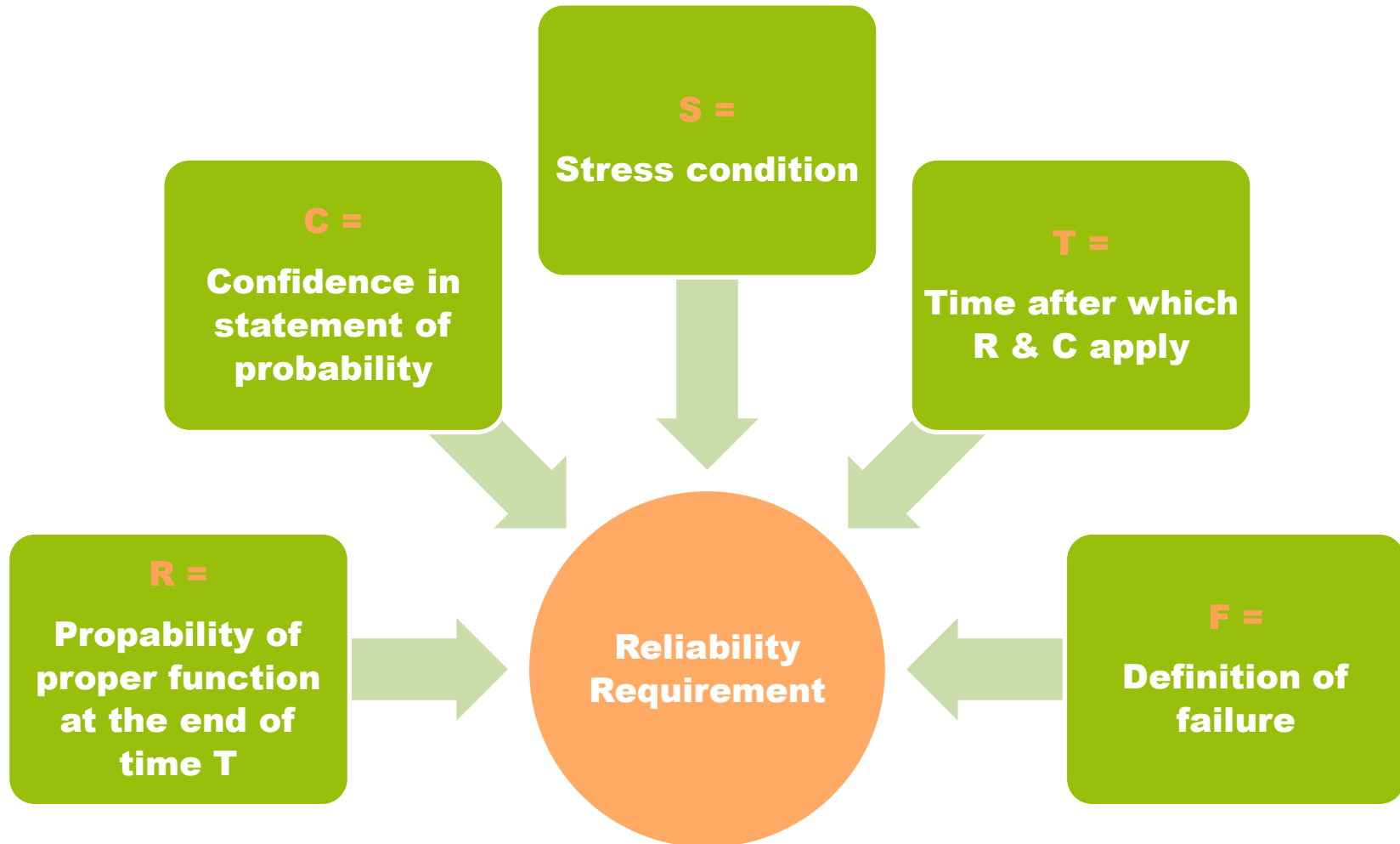


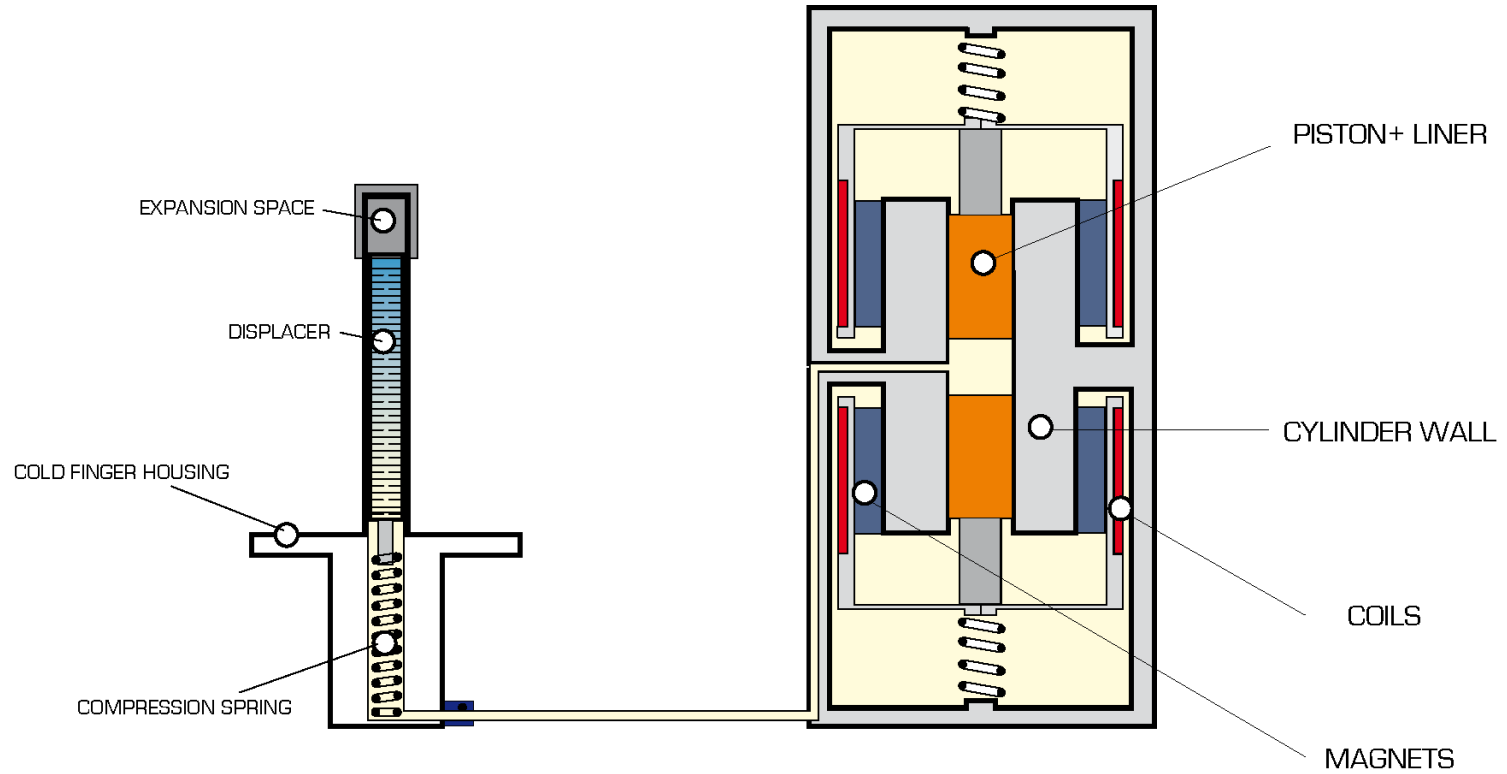
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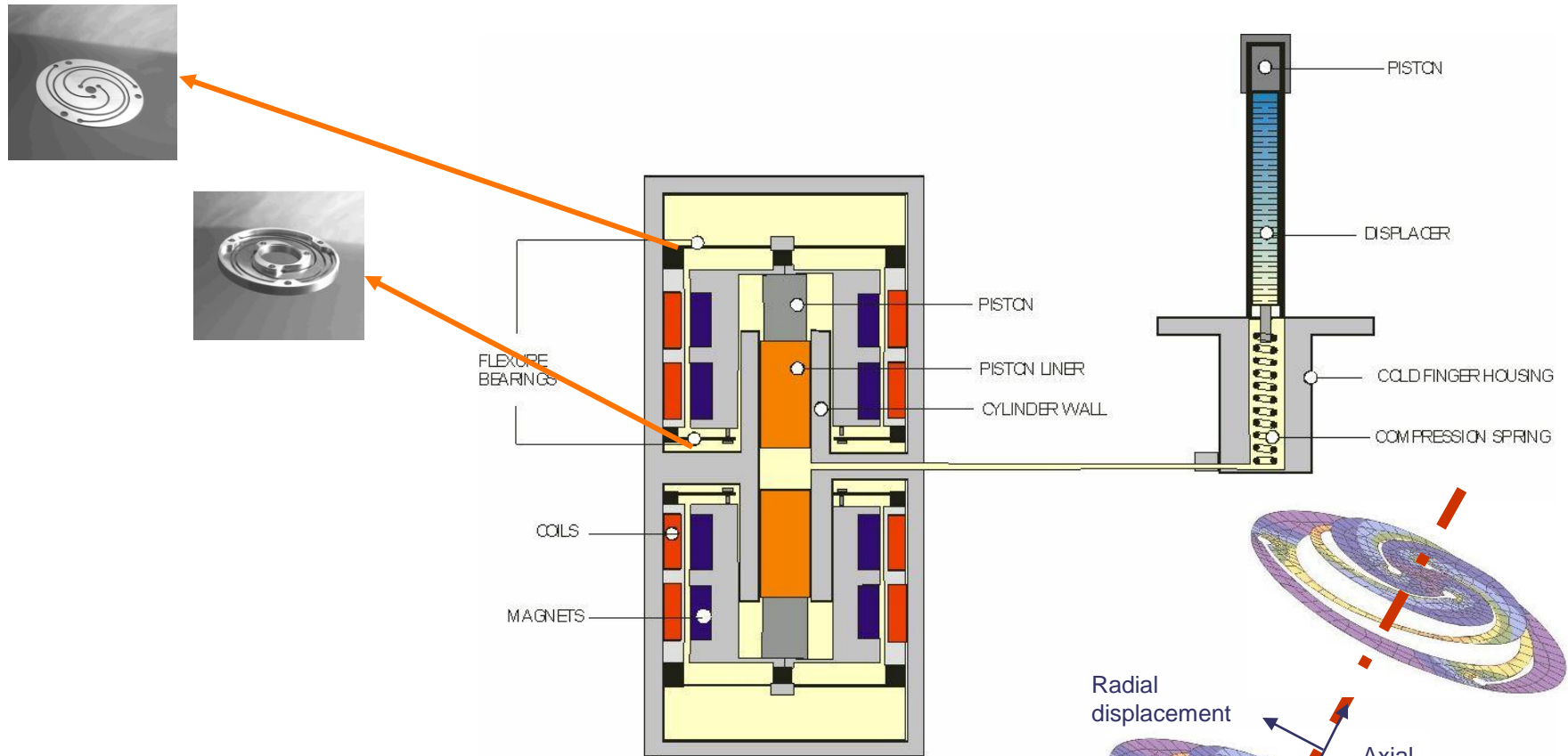


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1. Temperatuur bereik
2. Koelvermogen
3. Temperatuur stabiliteit
4. Cool down tijd
5. Vibrations gevoeligheid
6. Heat sinking
7. Afmetingen, gewicht
- 8. Koeler reliability**



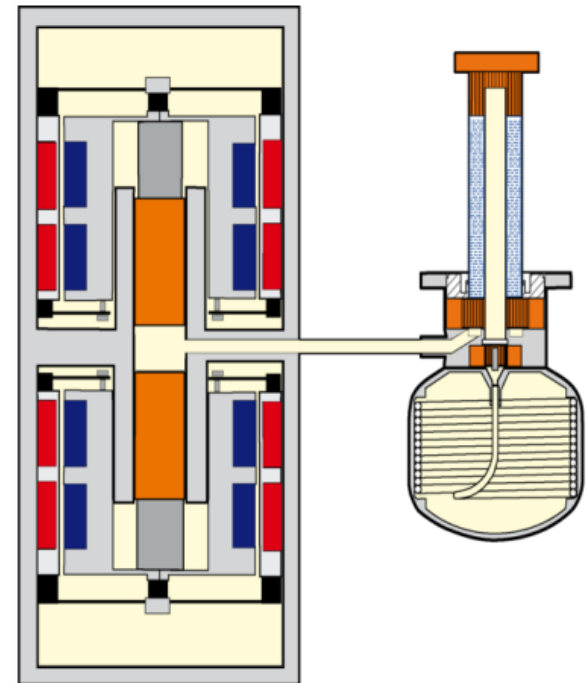


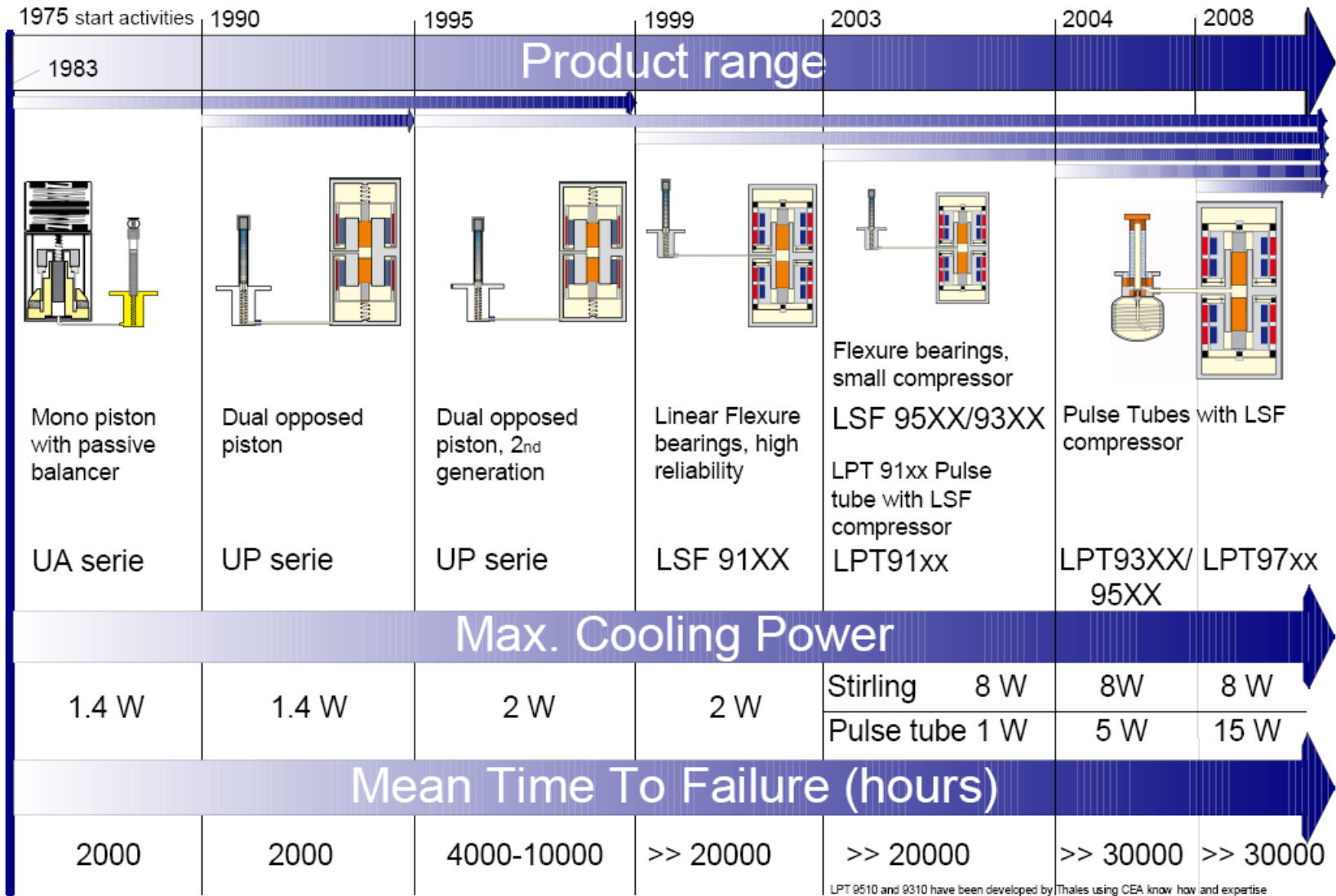


- ✓ Geen bewegende spoelen
- ✓ Spoelen buiten He --> geen vervuiling

◆ LPT: Pulse tube koeler

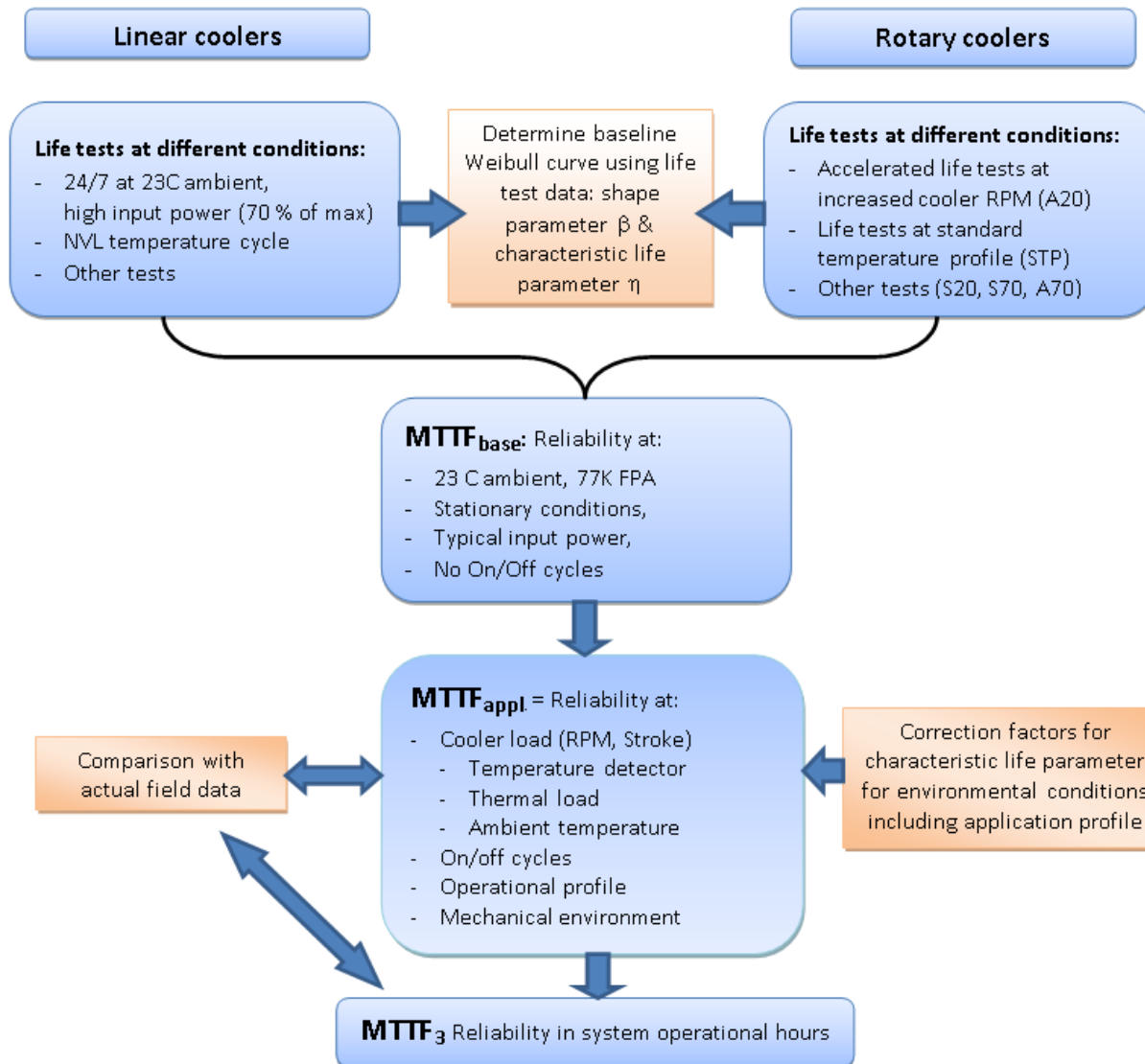
- ✓ Flexure bearing reliability van LSF compressor
- ✓ Geen bewegend massa in koude vinger:
gas is in beweging
- ✓ Lage trilniveaus

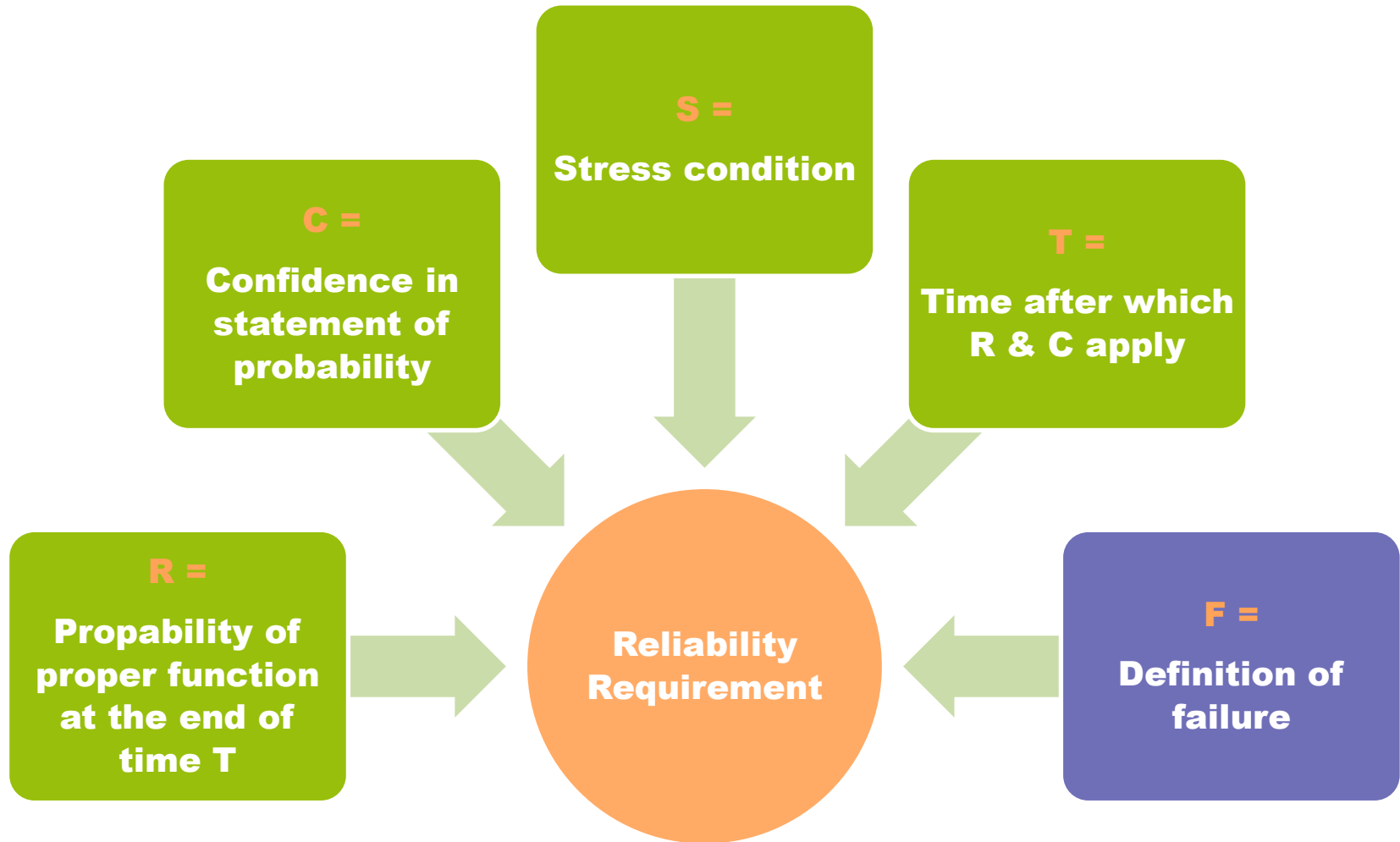


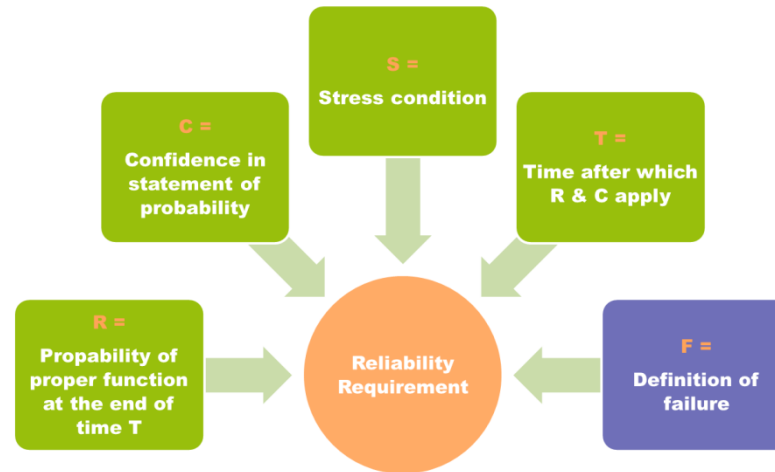


LPT 9510 and 9310 have been developed by Thales using CEA know how and expertise

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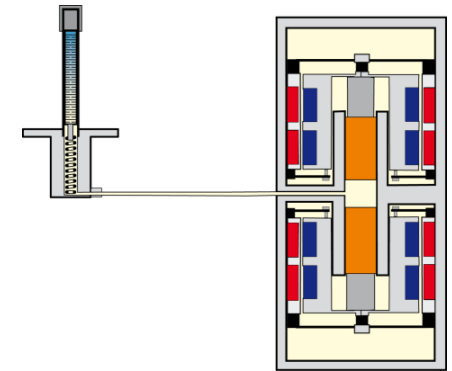
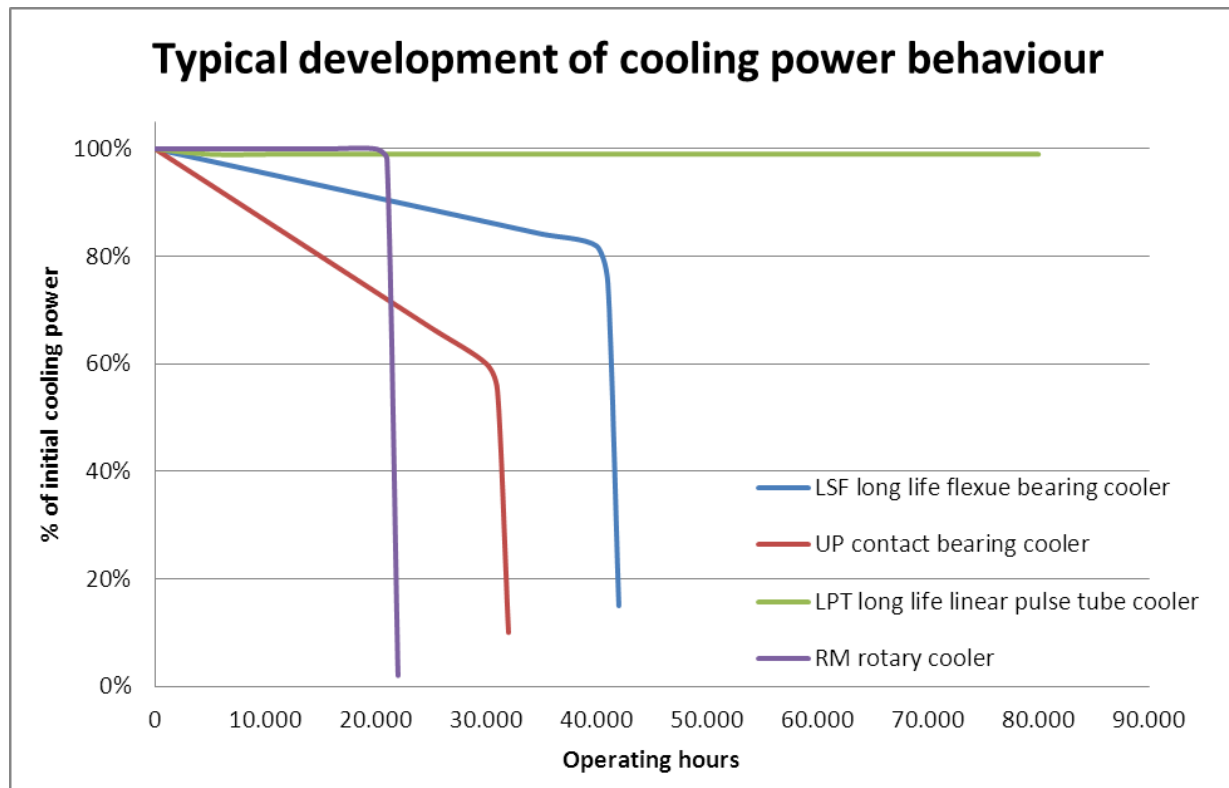


Soms duidelijk: geen koelvermogen
Soms onduidelijk en afhankelijk van applicatie

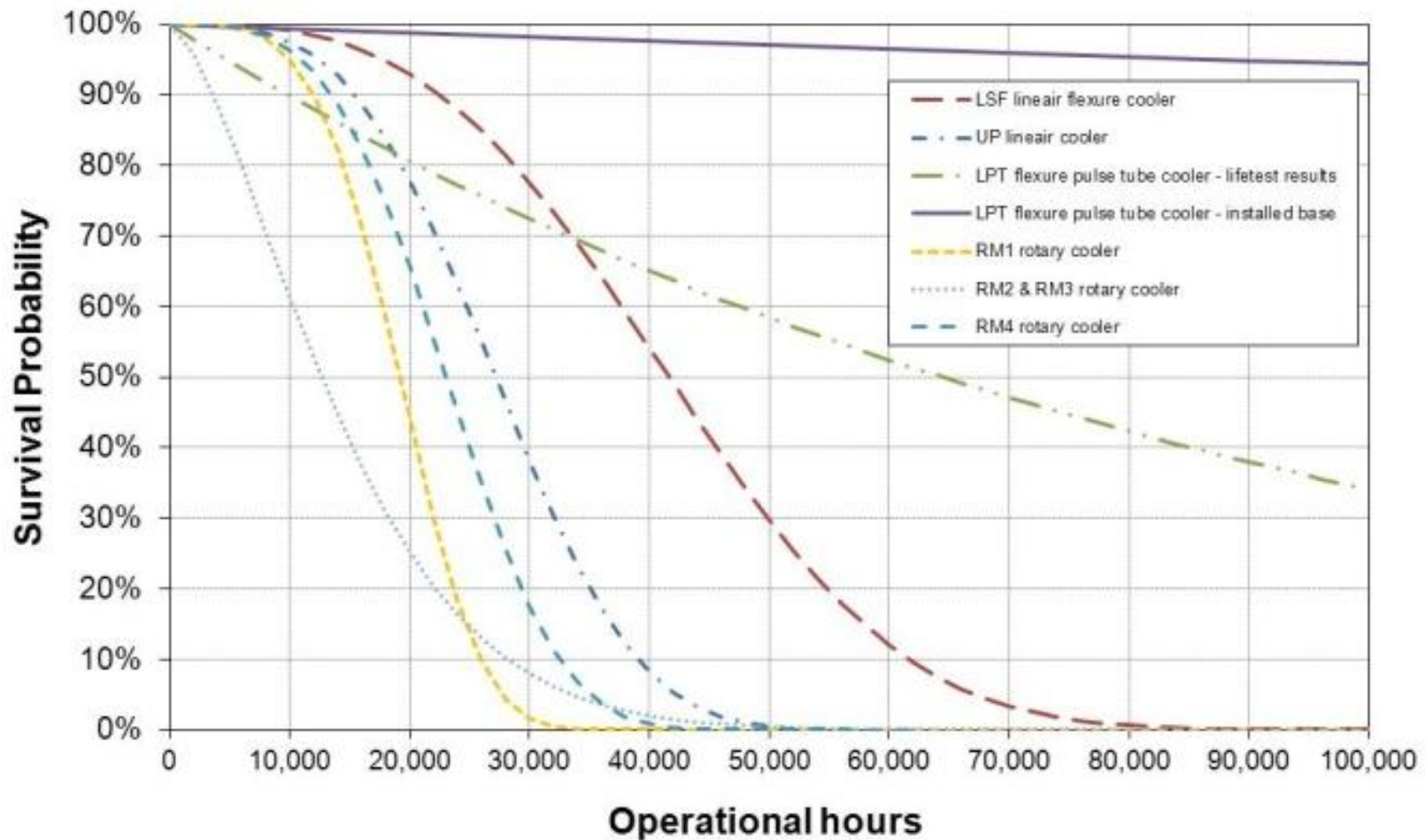
- “geen goed beeld meer”
- cooldown time buiten spec

Voorbeeld: 70% van oorspronkelijke koelvermogen

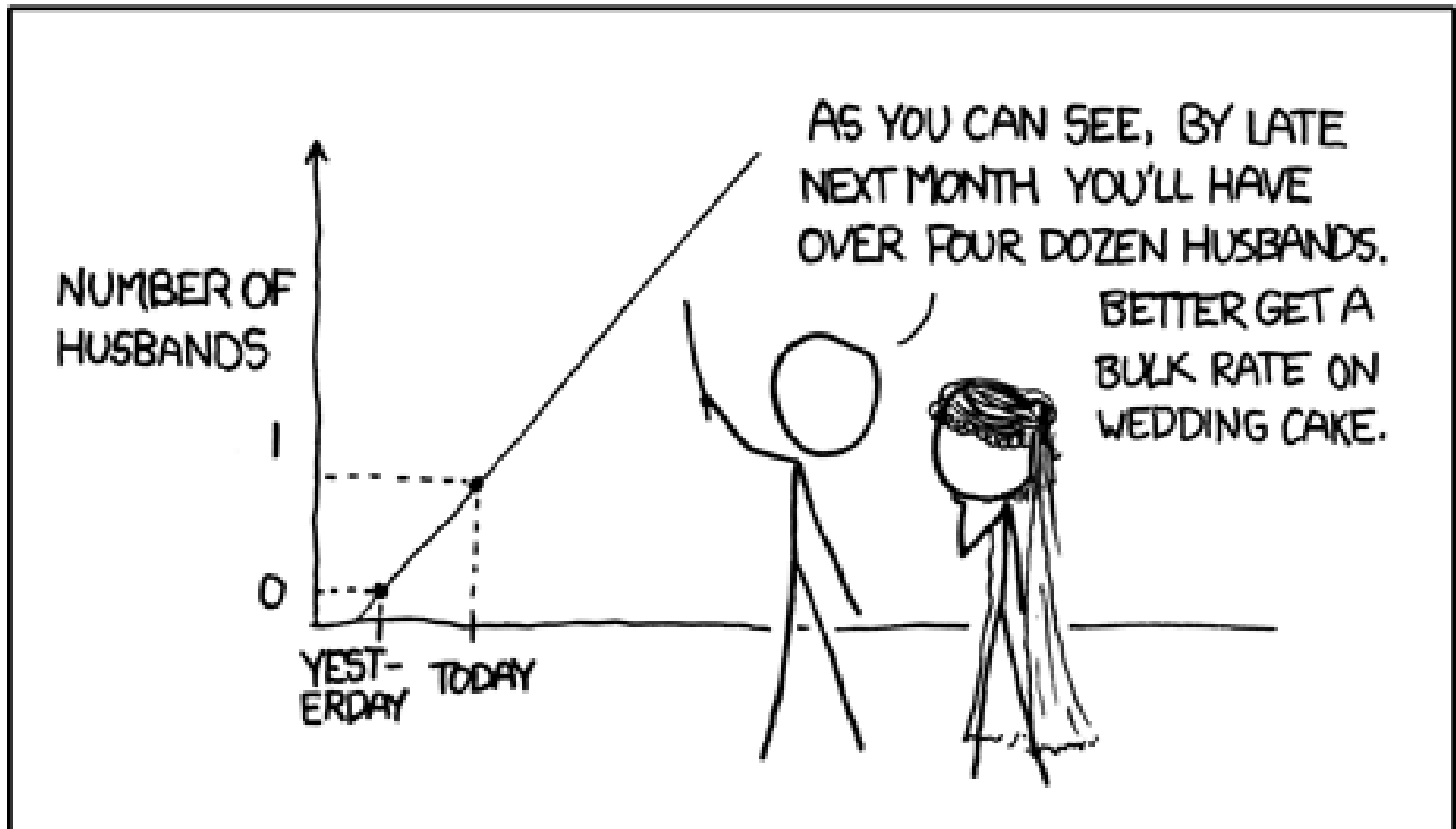
- ❑ Mechanische of elektrische fout (veer, connectie etc.): bijna altijd direct functieverlies
- ❑ Compressor en koude vinger slijtage → afname van koelvermogen

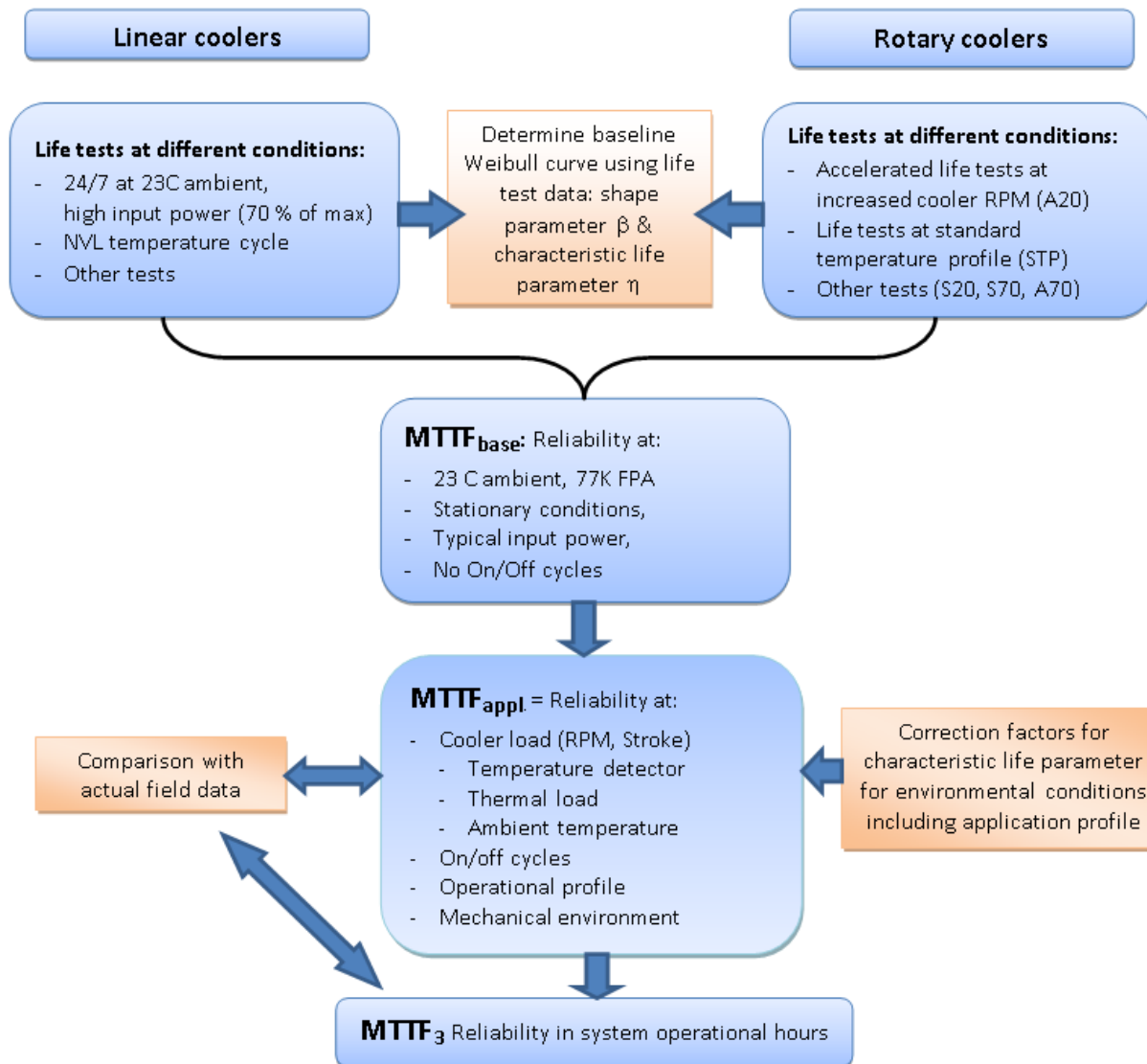


Base survival probability Thales coolers



MY HOBBY: EXTRAPOLATING





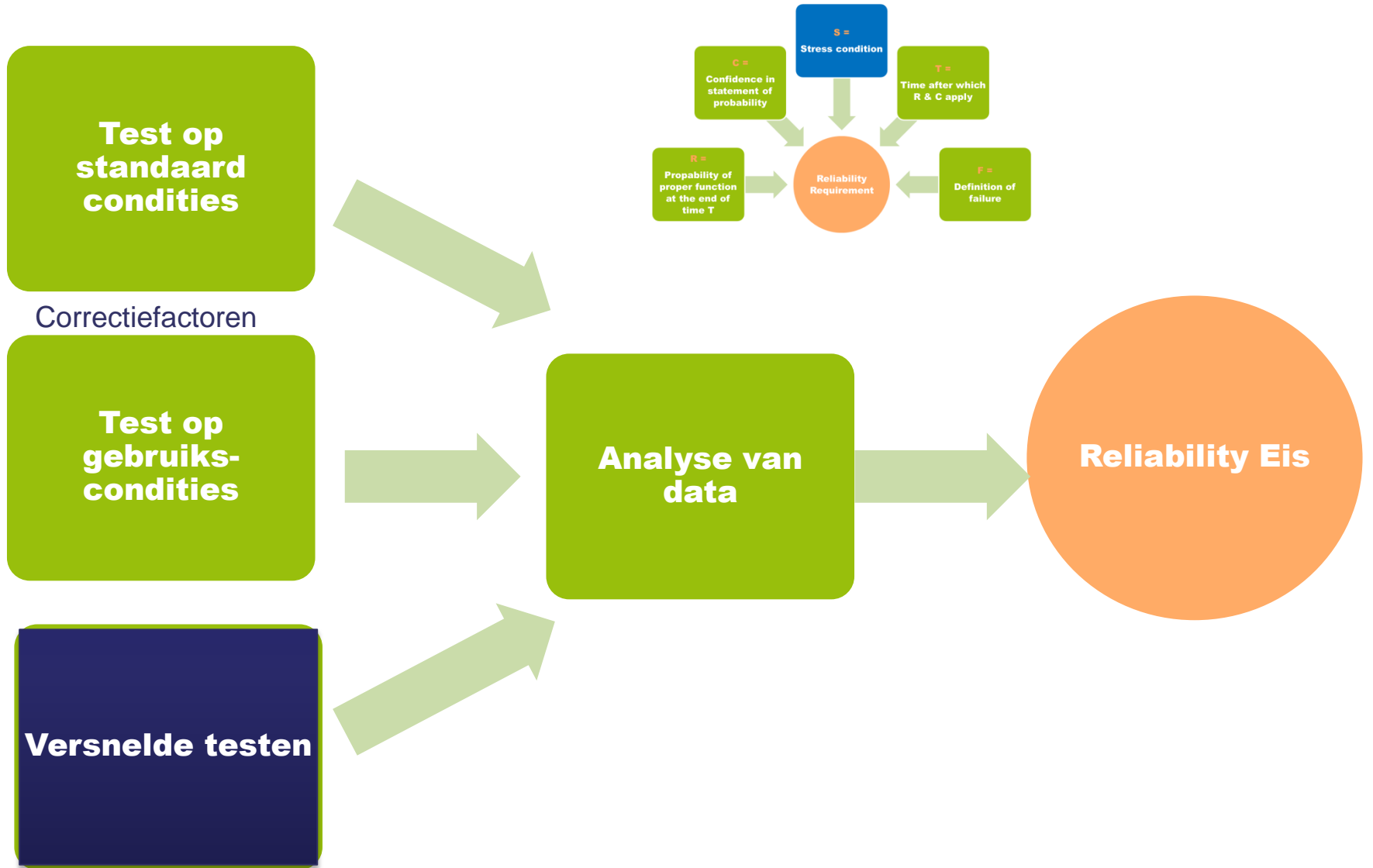
□ Application MTF:

- MTF uitgedrukt in kalender tijd
- Combineert de reliability van verschillende delen van een gebruikersprofiel (hoge / lage temperatuur , aan / uit)

$$MTF_{app} = \frac{\gamma}{\frac{\alpha_1}{MTF_{\alpha_1}} + \frac{\alpha_2}{MTF_{\alpha_2}} + \dots + \frac{\alpha_n}{MTF_{\alpha_n}}}$$

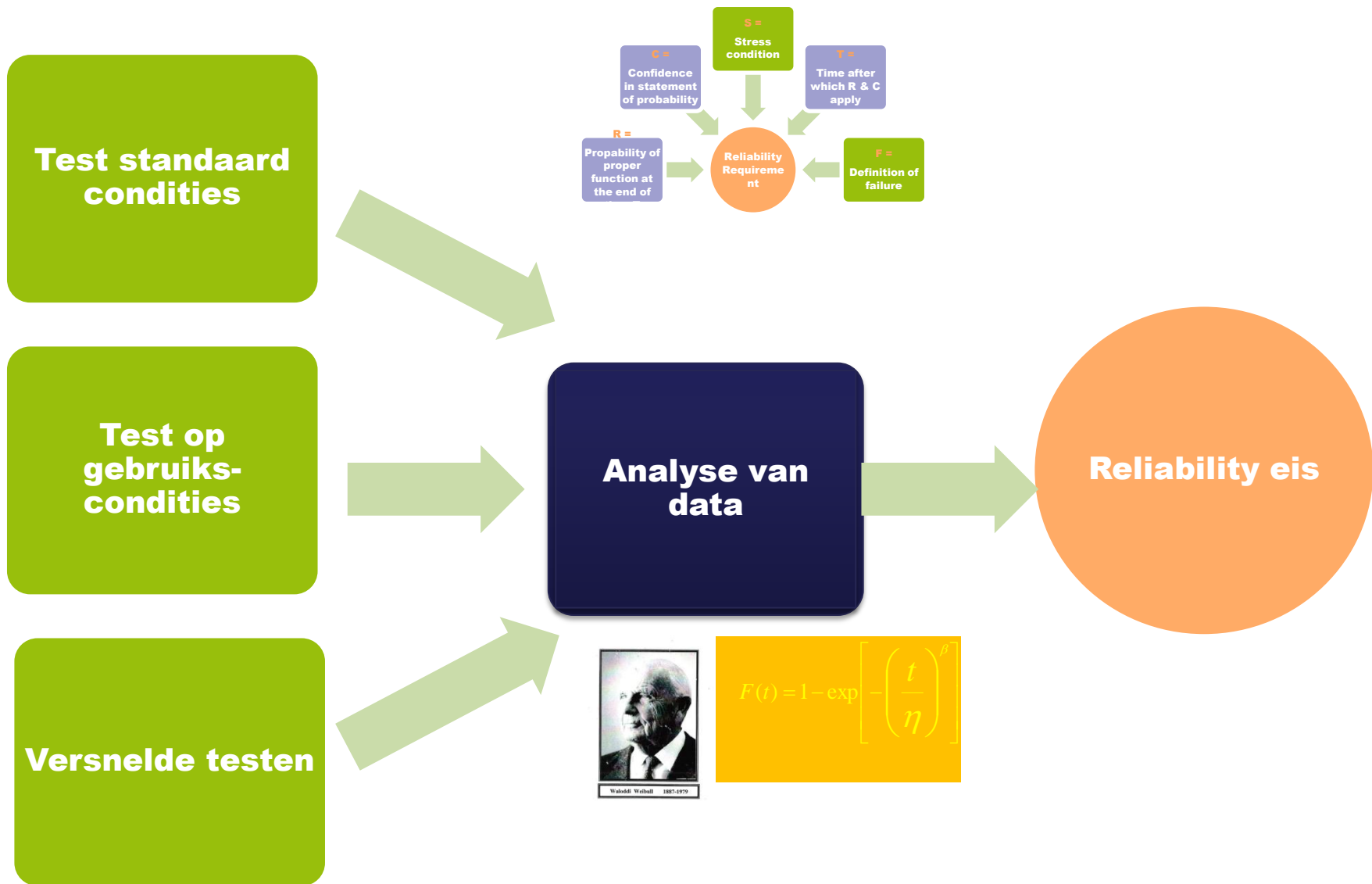
□ Application MTF wordt berekend:

- MTF_{α_n} is base MTF met correcties voor de specifieke omgevingen (α_n)
- γ totaal aantal uren
- α_n = aantal uren voor een bepaalde omgeving (bv aantal uur met trillen..)



Versnelling mogelijk door:

- **Aan uit cycli**
- **Frequentie**
- **Input vermogen → koelvermogen**
- **Temperatuur**
- **Vibration**



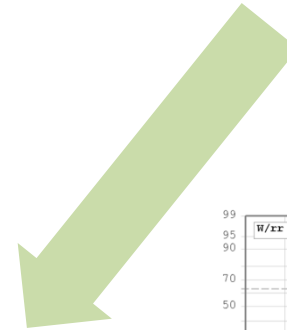
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Pro-actieve proces

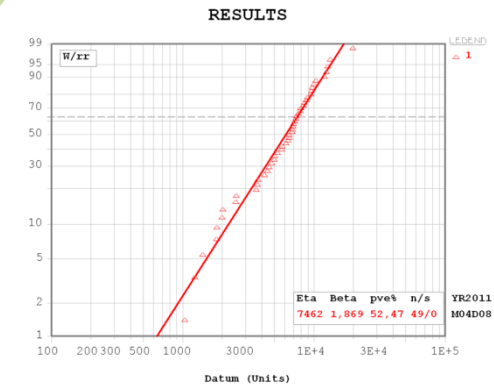
Re-actieve proces

Test data

Veld data



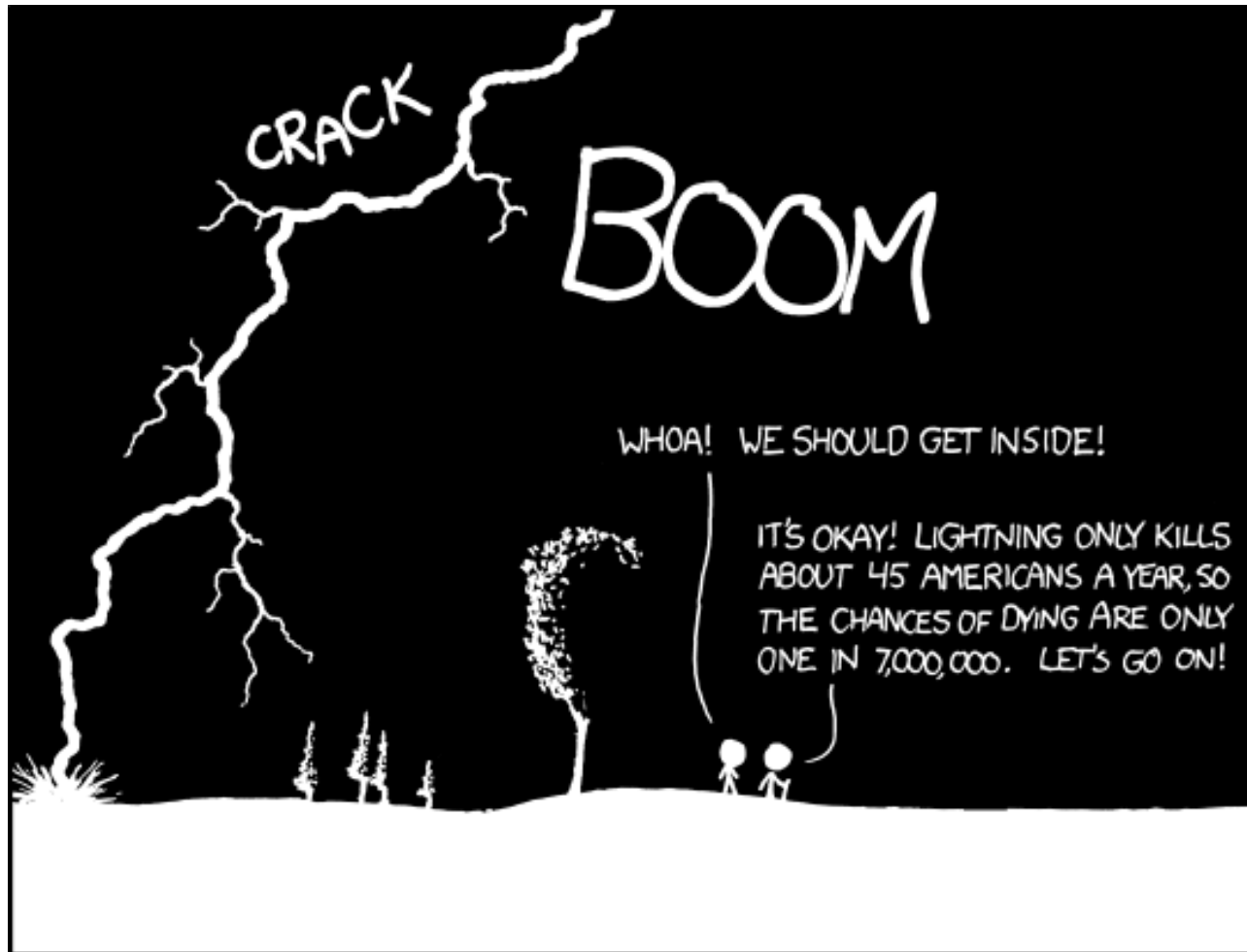
Reliability Eis



- **Statistische betere onderbouwing van reliability getallen**
- **Service data beter analyseren**
- **Klanten vragen om input (ook van nog werkende systemen)**
- **Gebruikscondities (beter) achterhalen**
- **Duidelijke aanpak opzetten levensduur (bv aantallen koelers per type) met versnellingsmethodes**
- **Bepaling correctiefactoren voor omgevingscondities**
- **Deelsystemen testen waar mogelijke (koelers / koude vingers)**
- **Alle reliability inputs verzamelen → FRACAS**

PLATFORM OMGEVINGSTECHNOLOGIE

- **Netwerk met specialisten**
- **Reliability werkgroep**
- **Ledenbijeenkomsten / seminars**



THE ANNUAL DEATH RATE AMONG PEOPLE WHO KNOW THAT STATISTIC IS ONE IN SIX.