

POLITECNICO
MILANO 1863

DEPARTMENT OF MECHANICAL
ENGINEERING



Concepts & Project overview

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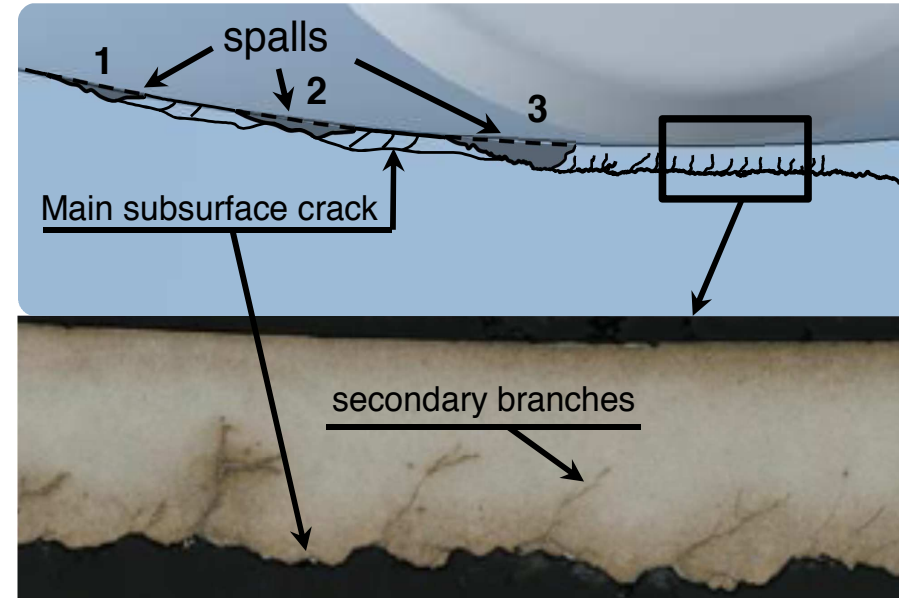
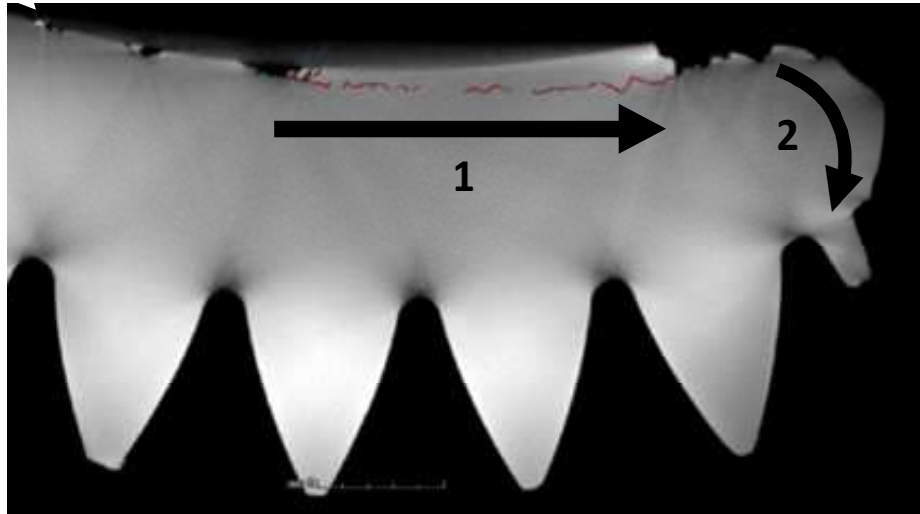


DIPARTIMENTO DI ECCELLENZA
MIUR 2018-2022



29.01,2024 Milano

The original problem of the project

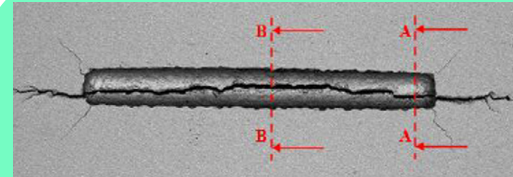
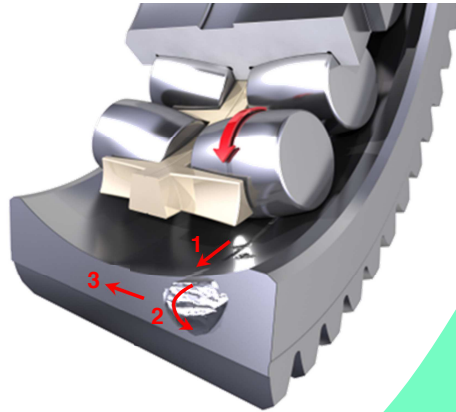


The original problem at the origin of the proposal for the Clean Sky was to cover this kind of uncontained failures, characterized by:

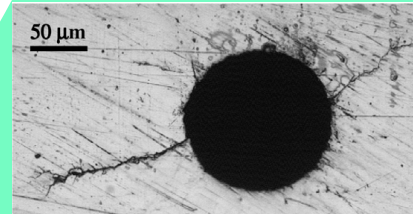
- growth of cracks under shear;
- branch in radial direction.

The special tools of IDERPLANE

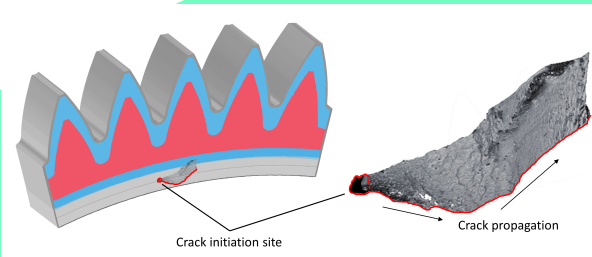
The problem



Tests on specimens
subjected to RCF
conditions

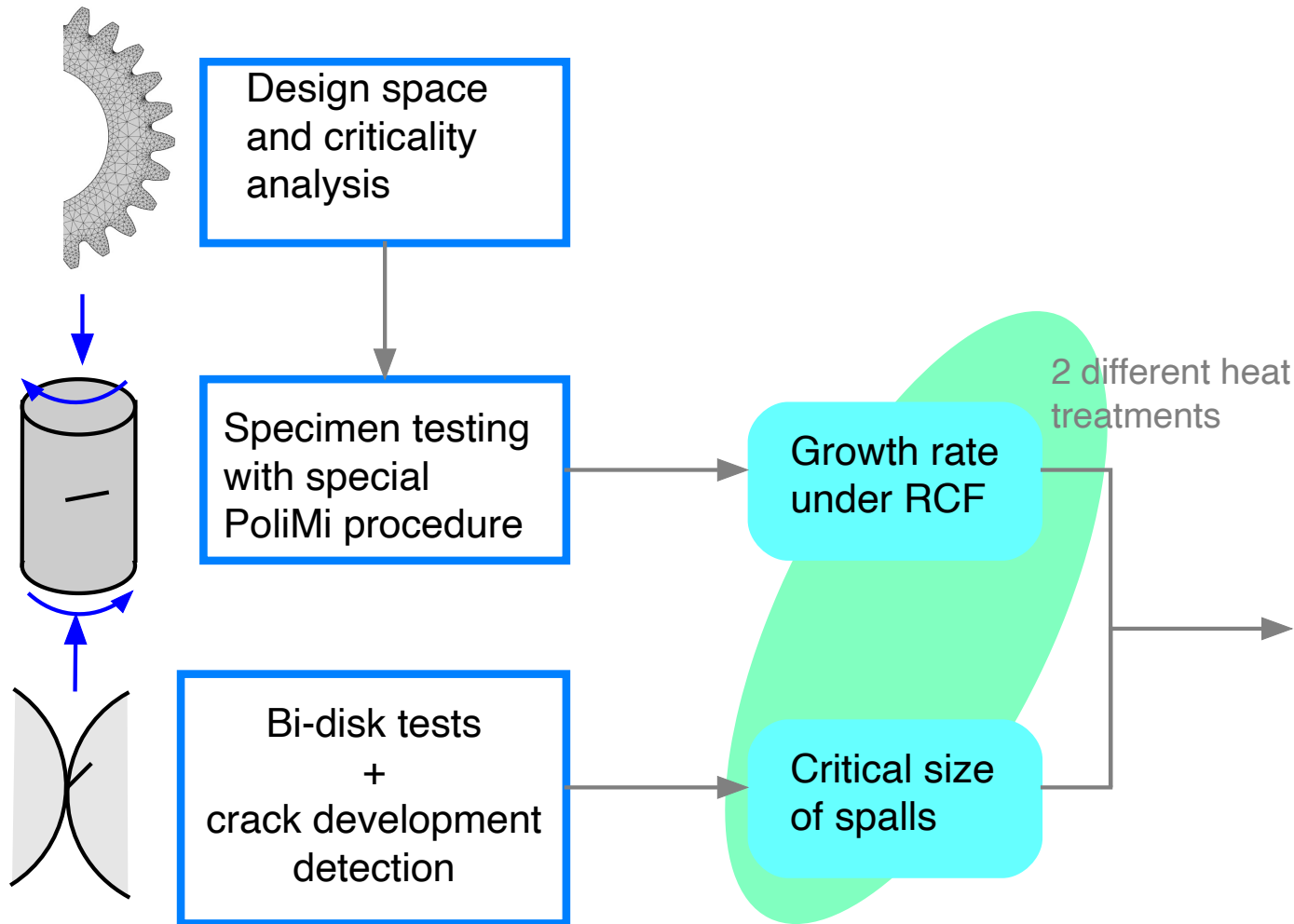


Bi-disk RCF tests
with defects



Full-scale tests
with artificial pits
and damage
detection by
synchrotron

The sequence of activities - 1



Skills needed:

- know-how on innovative test methods for reproducing RCF conditions on specimens to derive growth rates ;
- the ability to run bi-disk tests under different conditions with monitoring of the damage;
- the ability on apply advanced method for detection and measurements of cracks for accurate 3D models of the cracks at different stages of propagation

The sequence of activities - 2

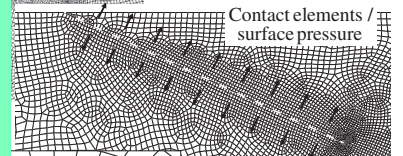
interaction with Topic leader

Set-up of a model
for competitive crack
growth under RCF

Design criteria for
a Planet gear with
improved reliability

Proof of concept for
the design criteria by
full-scale tests
validated by
synchrotron detection

FE model with crack



$\frac{da}{dN}$

Mode I

Mode II

Skills needed:

- know-how on design of gear transmissions ;
- the ability to run accurate FE analyses for contact conditions and lubrication;
- the ability to design a new test gearbox for full-scale test articles

POLIMI

- Project coordination;
- multiaxial fatigue tests;
- life models;
- design of the new test gearbox;
- full-scale tests

INSA

- tomographic analysis under X-ray and synchrotron;
- interpretation of mechanisms of crack growth under RCF .

ARGO

- support to data management;
- web & communications.

UNIBS

- bi-disk tests;
- FE analyses for cracks under RCF;
- interpretation of mechanisms of crack growth under RCF.

UNIBZ

- 3D FEM analysis for gearbox;
- analysis of lubrication condition for full-scale tests.

Time planning

The original planning was completely messed up by COVID

		Year 1 (nov18 - oct19)	Year 2 (nov19 - oct20)	Year 3 (nov20 - oct21)	Year 4 (nov21 - oct22)	Year 5 (nov22 - oct23)	Year 6
WP1	Definition of design space and preliminary damage tolerance analysis	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	
WP2	Subscale testing	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	
WP3	Design criteria	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	
WP4	Fullscale testing	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	
WP5	Management	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	
WP6	Dissemination, exploitation and communication	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	

A special attention was paid to ensure that specimens /disks and full-scale test articles had the same HT and finish of the real components