Project Proposal
Active / Passive Acoustic SHM System for Impact Detection (APASHI)

"General Aviation and European Air Transport System Third Call FP7"

WARSAW, Institute of Aviation

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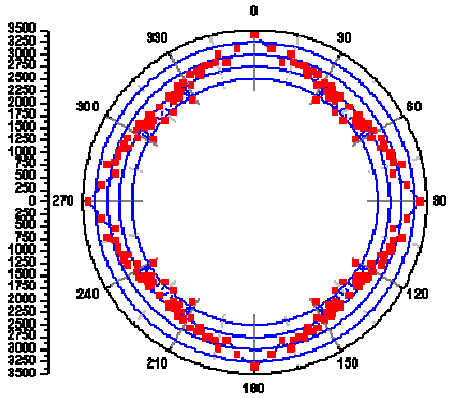
Background from CESAR Project

- **New Orthotropic Location / Damping Algorithm for Acoustic Emission**
- **Direct Impact damage detection by Acoustic Emission**
- **Impact Damage Quantification by Acoustic Emission on Demand Algorithm**
- **Assessment of cheaper sensor for AE Applications**

Background from CESAR Project

- **New Orthotropic Location / Damping Algorithm for Acoustic Emission**



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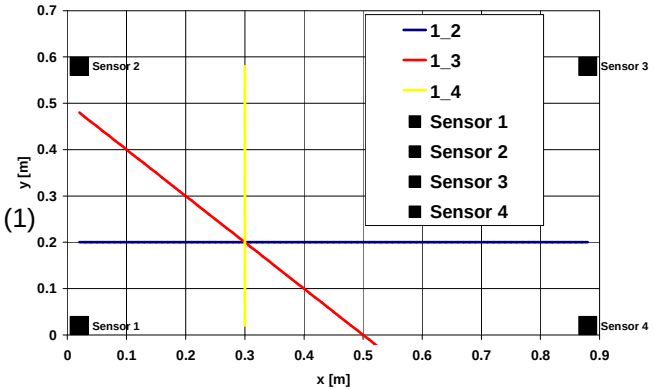
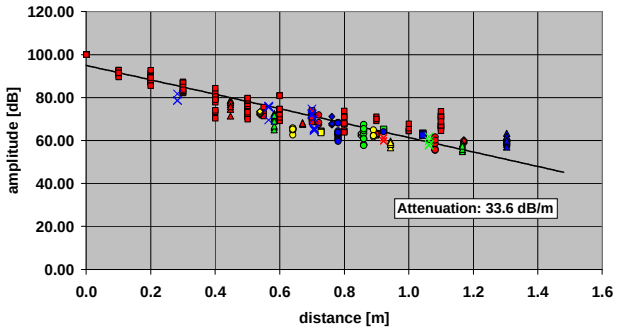




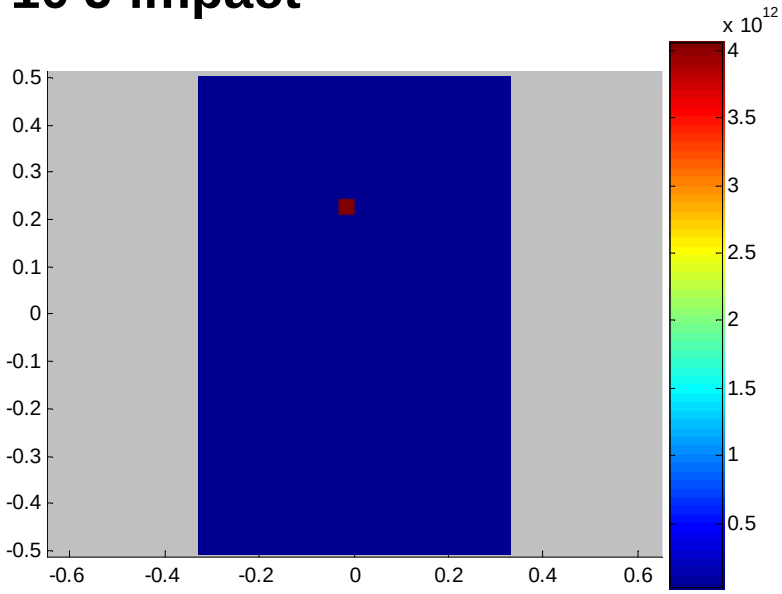
$$signal\_strenght = \int_{0}^{t=duration} |V(t)|dt$$

$$signal\_strenght_{corrected} = signal\_strenght_{measured} \cdot 10^{\frac{k_{damping,Amplitude} \bullet d}{20}}$$

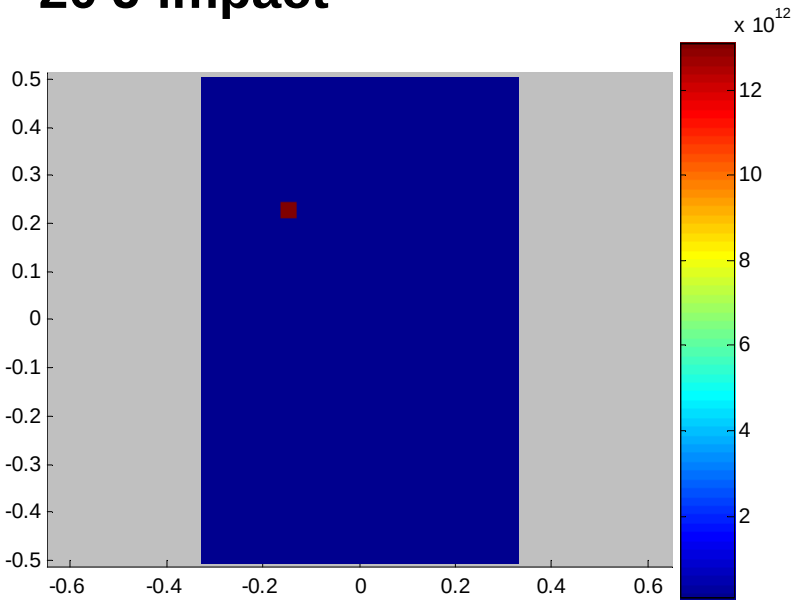
Background from CESAR Project

- **Direct Impact damage detection by Acoustic Emission – large GFRP panels**

10 J impact



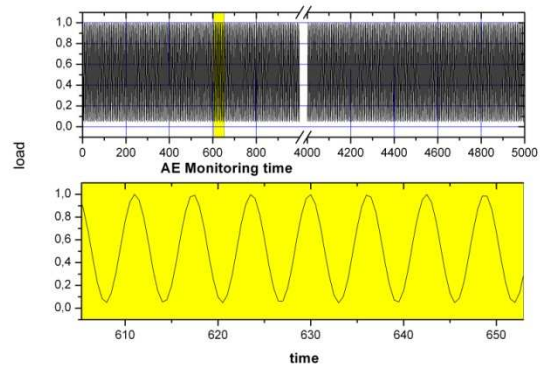
20 J impact

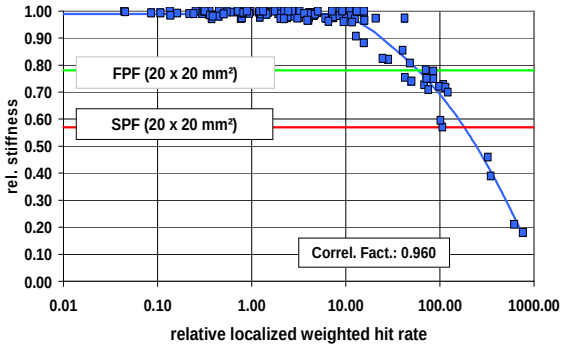


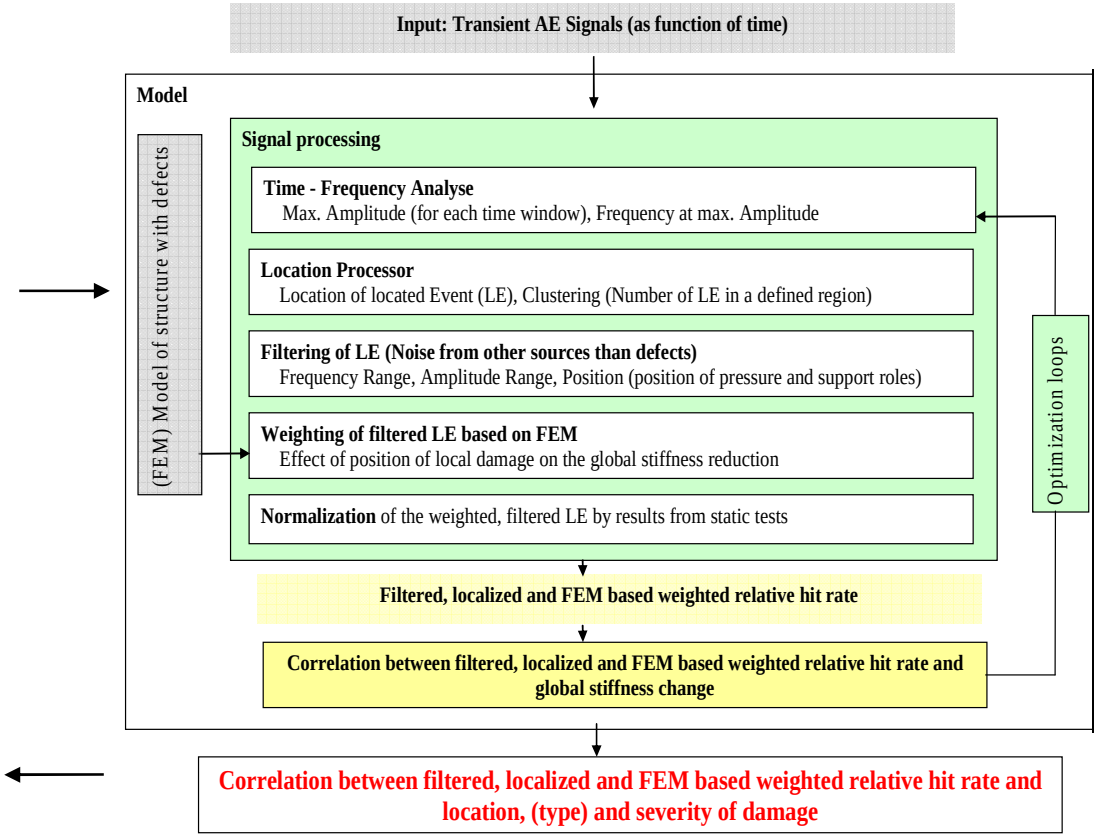
- **Location accuracy: +/- 3 mm /**
- **Linear correlation between Impact Energy and recalculated AE energy**

Background from CESAR Project

- **Impact Damage Quantification by Acoustic Emission on Demand Algorithm**

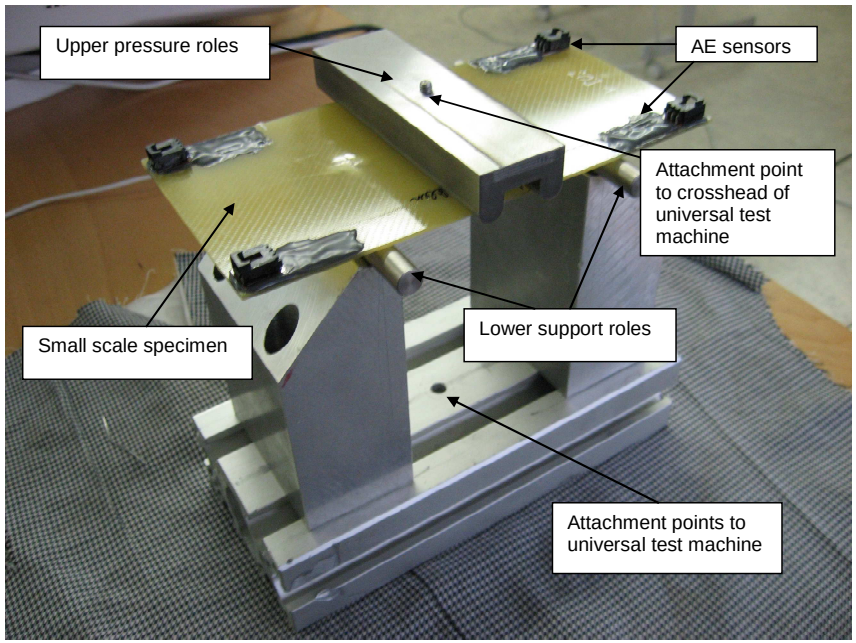






Background from CESAR Project

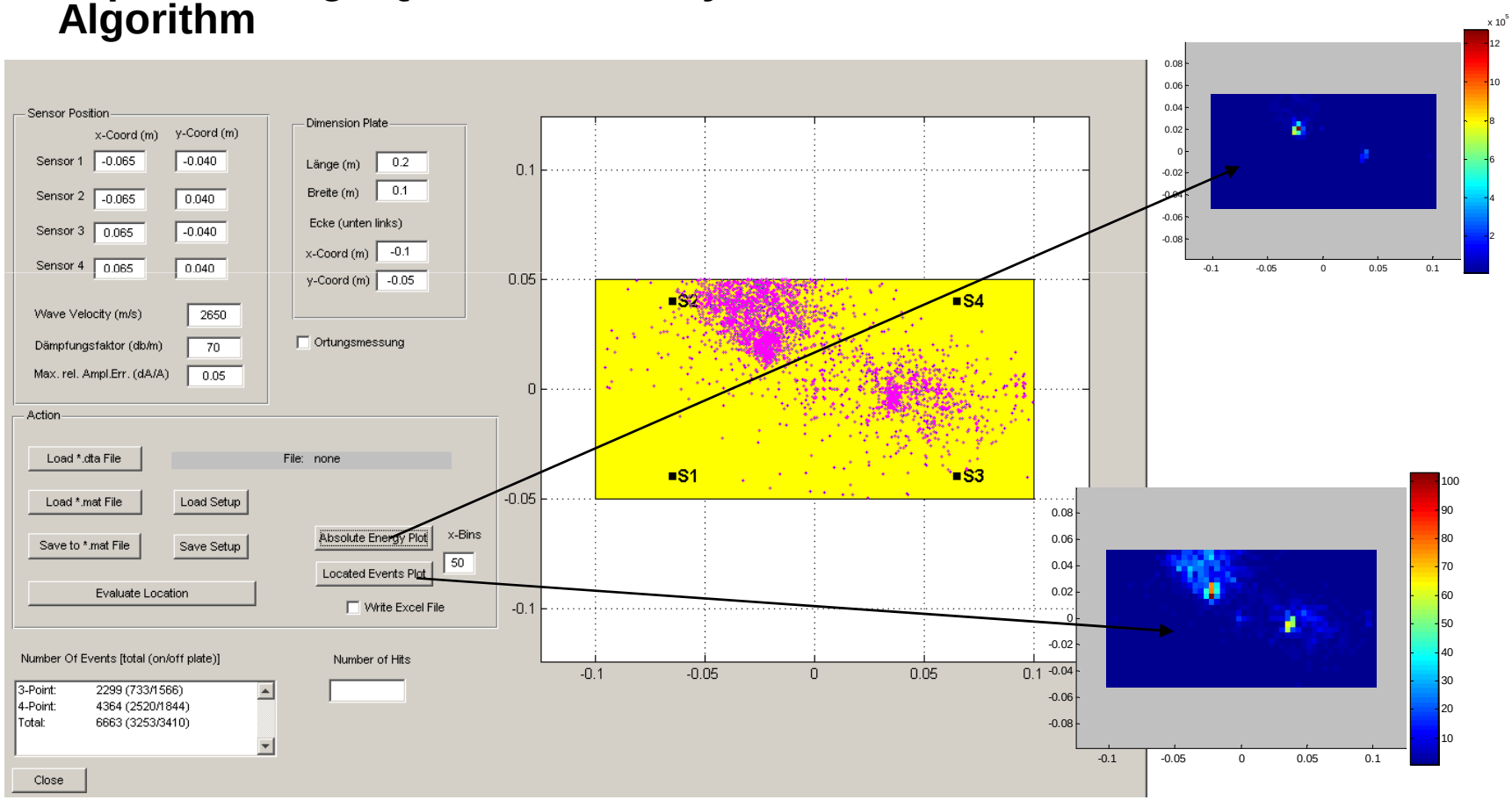
- **Impact Damage Quantification by Acoustic Emission on Demand Algorithm**



- **Two impacts per panel: 5/ 10 / 15 / 20 J**

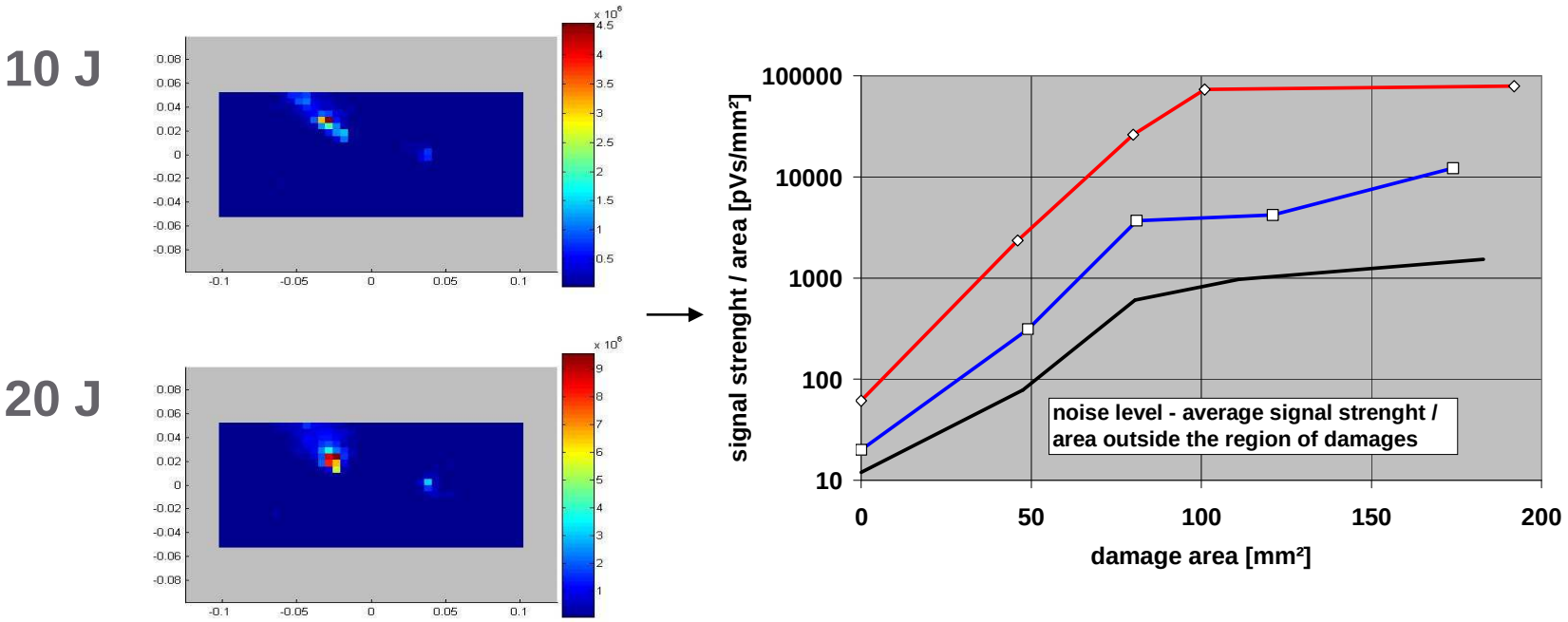
Background from CESAR Project

- **Impact Damage Quantification by Acoustic Emission on Demand Algorithm**



Background from CESAR Project

- **Impact Damage Quantification by Acoustic Emission on Demand Algorithm**

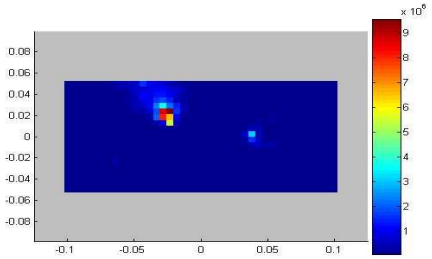


- **Location accuracy: +/- 3 mm on 200 x 100 mm² GFRP plates**
- **Strong dependence on actual load history on the Quantification**

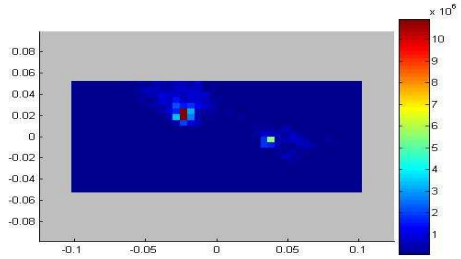
Background from CESAR Project

- **Assessment of cheaper sensor for AE Applications**

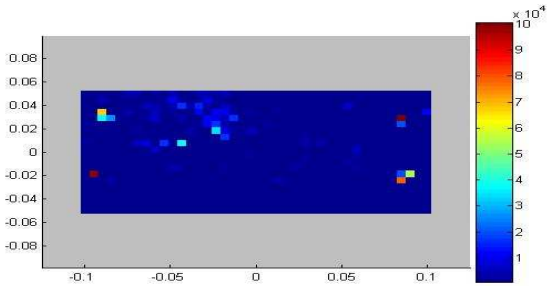
PAC



smart layer



PVDF



- **Comparable results with conventional AE sensor and smart layer / currently unreasonable results with PVDF foil sensor**

Project Idea

- **Development and Application of a Active / Passive Acoustic SHM System for Impact Damage Detection in primary composite structures using cheaper and easy to install or even embeddable sensors**

Proposed Project Steps

- **Identification of relevant types and sizes of damages for a prototype primary composite structure**
- **Analyses of the necessary actuator / sensor configuration**
- **Definition of the hardware / software requirements**
- **Development / Procurement of the necessary hardware**
- **Development of the damage quantification algorithm**
- **Verification of the system on simplified substructures and the final prototype structure under simulated real environmental conditions**

Reference 1

AUSTRIAN INSTITUTE OF TECHNOLOGY
TOMORROW TODAY

CESAR-Cost Effective Small AiRcraft

WP2 Task 2.4 SMART STRUCTURAL HEALTH MONITORING

- Subtask 2.4.1 Systems Definition
- Subtask 2.4.2 Systems Analysis
- Subtask 2.4.3: Systems Design and Fabrication
- Subtask 2.4.4: Systems Testing and Results Analysis

Partners: Aernnova, AIT (ARC), VZLU, Evektor, Merl, CIRA, Eurocopter, HAI, NLR, PZL, ILOT