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**SYSTEMES D'ACQUISITION D'UNE GEOMETRIE 3D - ESSAI  
A LA CENTRALE DE CHOOZ B.**

**3D - ACQUISITION SYSTEMS - TEST IN CHOOZ B  
NUCLEAR PLANT**

EDF - 93NJ00004



Direction des Etudes et Recherches

**EDF**

**Direction des Etudes et Recherches**

**Electricité  
de France**

SERVICE INFORMATIQUE ET MATHÉMATIQUES APPLIQUÉES  
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SYSTEMES D'ACQUISITION D'UNE GEOMETRIE  
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## **SYNTHÈSE :**

L'acquisition de la géométrie précise de zones critiques de centrales est indispensable à EDF pour la préparation de simulations informatiques d'interventions dans ces zones. Les simulations doivent déboucher sur une augmentation de l'efficacité de l'intervention effective.

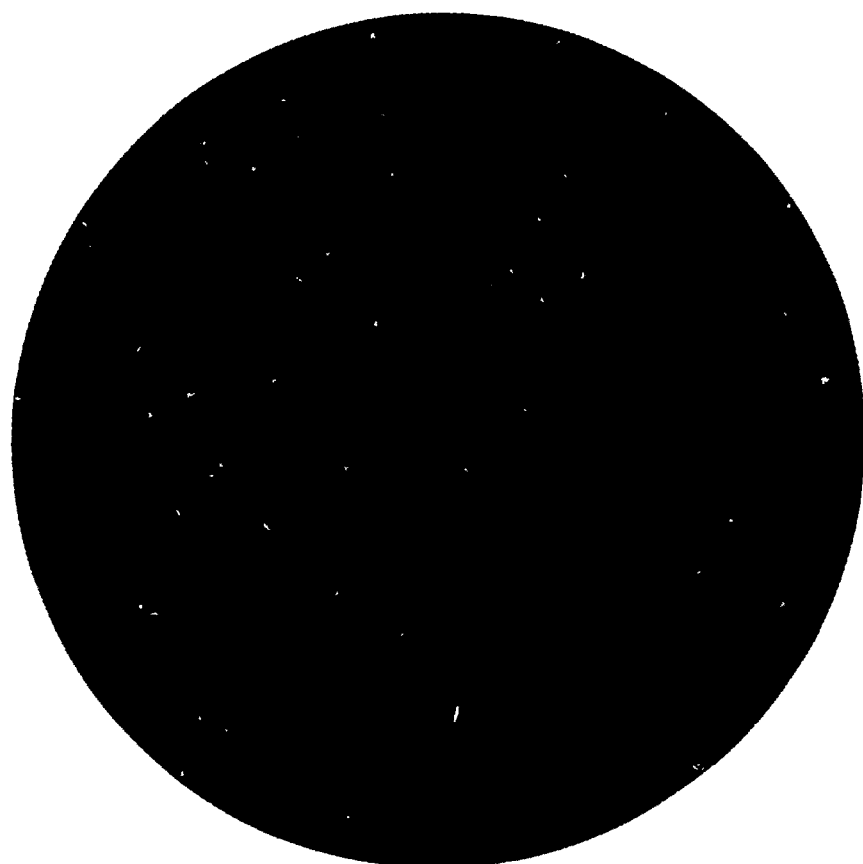
La capture d'une géométrie 3D peut être réalisée au moyen de différents systèmes d'acquisition ; quatre d'entre eux sont en cours d'évaluation pour le Service de la Production Thermique par la Direction des Etudes et Recherches à la centrale de Chooz B dans le cadre d'une plateforme d'essai comparatif. Ce test doit permettre de déterminer la solution la mieux adaptée pour chaque type de problème d'acquisition.

**EXECUTIVE SUMMARY :**

EDF needs 3D-acquisition systems to get the precise geometry of critical nuclear spaces in order to prepare computer simulations of operations in these areas. The simulations must lead to an increase of the efficiency of the operation.

The acquisition of the 3D-geometry can be done using 3D-acquisition systems.

To answer the needs of the Construction Division, four different systems are compared by the Research Division in Chooz B nuclear plant in order to determine the right solution for each 3D-acquisition problem.



## **EDF needs**

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Operations in nuclear spaces (contaminated or not) such as major operations (on steam generator), frequent modifications (on filters...) or validation of new specific tools can now be computed. Computer simulations of operations are committed to increase the efficiency of the operations by :

- reducing the time of human exposure
- increasing the time of full use of the power of the plant.

To insure that such simulations will give a valid result, 3D models must correspond to the effective geometry of the plant. 3D-acquisition systems can answer this matter. They are intended to be able to :

- precisely acquire the geometry of the studied area (3D-points)
- translate the 3D-points into CAD format
- update the prior conception model (if exists<sup>1</sup>).

## **An evaluation test of four 3D-acquisition systems**

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EDF has launched a test of evaluation test of 4 different 3D-acquisition systems (Chooz B nuclear plant - June and October 1992). Those systems are :

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<sup>1</sup> EDF uses CAD tools (PDMS) to design civils and piping of the recent nuclear plants (the prior plants are not described by CAD systems).

- Soisic (MENSI)

type : dense range imaging  
technique : laser triangulation  
distance range : from 2 m to 20 m  
accuracy : +/- 1 mm at 5 m ; +/- 2 mm at 10 m (estimation)  
speed : 120 mesures per minute

- Alis (CEA-LETI)

type : dense range imaging  
technique : laser time of flight pursuit  
distance range : from 50 cm to 25 m  
accuracy : +/- 2 cm if distance < 2 m ; +/- 0.5 % if distance > 2 m (estimation)  
speed : one image of 120-150 mesures every 0.25 seconde

- Hazmap (UCL)

type : digital photogrammetry  
technique : CCD cameras  
distance range : from 1 m to 50 m  
accuracy : 1 : 5000

- Mao (SETP)

type : stereophotogrammetry  
technique : classical films  
distance range : from 1 m to 50 m  
accuracy : > 1 : 5000

2 different zones have been chosen for the tesi, a bottom of a steam generator and a local with pipes. The first zone corresponds to a critical area of intervention ; the second one contains representative matters. The 3D-acquisition systems will have to show they can scan these areas with an +/-1 cm accuracy.

We have besides selected sub-zones to test the very best each system can provide. These sub-zones are areas of highly important interest for the preparation of the operation (for example, the connexion between the steam generator and the primary pipes). The test of acquisition in these sub-zones will let us follow precisely the accuracy of acquisition and translation.

For each solution, we want to investigate the aspects connected with the capture of the geometry and with the translation of the 3D-datas into CAD objects.

**Aspects connected with the capture of the geometry**  
use of the captor

- ease of use
- use constraints (min-max distances)
- time of scanning
- time of human manipulation

#### accuracy

- accuracy of the calibration
- accuracy of an acquired 3D-point

#### Aspects connected with the translation

- potentialities
- ergonomy
- repetability
- accuracy
- time of treatment for :
  - the recognition of a primitive
  - the construction of a PDMS database
  - the correction of an existing database

#### Control

During the whole test, accuracy control will be done by reference to a frame given by EDF-CNEPE (theodolite).

#### Conclusion

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The final report of the test will describe the qualities of each system for the creation of 3D database in the case of different types of 3D scenes.