



# The use of computer simulations in specific job training, risk communication and safety.

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SCK•CEN

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EUTERP Workshop Education and Training in Radiation  
Protection: Improving ALARA Culture*

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## Content

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- From general to specific job training in RP
- Planning and training support using 3D simulation
- Different tools available and a look to the future
- Conclusion



## From general to specific job training in RP and ALARA

- Different target audiences different outcomes
  - General education
    - Expert level
      - Broad context training on RP and the means to implement ALARA, coping with different circumstances
      - To be able to apply ALARA in practice
    - Operator level
      - Broad RP training
      - Understanding the risks related to ionising radiation
      - Good practices
      - Understanding residual risk
      - Specific radiation risks on the workflow



## From general to specific job training in RP

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- Site Specific Job Training

- Informs the operator of specific risk and the specific properties of the work environment.
- Needs information on geometry, sources, radiation fields, protective measures in operation or to be put in operation
- Risk awareness, visualisation of the residual risk
- Knowledge and Awareness leads to optimisation on the work floor



## Tools to improve the effectiveness of the RP and ALARA training

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- Making the risk of ionizing radiation visible
  - Visualisation of the doses on the workflow
  - Dose maps
  - Dose at worker position
- Making the consequences of implementing RP measures visible
  - Explore different dose reducing options and evaluate the level of protection
    - Shielding, distance to the sources, time of exposure
- Take into account the specific geometry of the workplace



# 3D computer simulation



## Different approaches

- 3D environments
  - Based on a general workplace layout
    - Training good attitude towards the radiation risks
    - Example environments to learn about optimisation methods
  - Based on a real situation
    - To plan and optimise
    - To visualise the risk and the residual risk
    - To learn the specifics of the work place



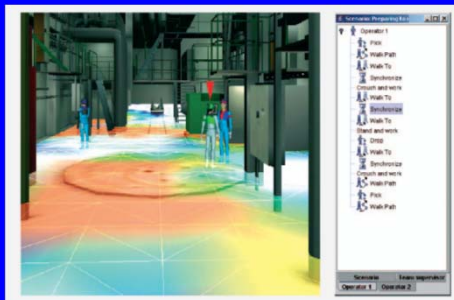
## Developments in 3D simulation in the RP field

Tools combining planning  
and risk communication

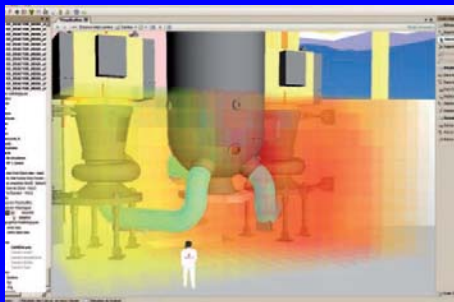
- VR-Domain Rolls Royce Associates
  - *Application in sub marine reactor maintenance*
- Virtual radiation field Un. Florida
  - *Application in decommissioning Hanford tank C-106*
- VR-dose Halden VR-centre
  - *developed by IFE and Japan Nuclear Cycle development institute (JNC) ,decommissioning of the Fugen Nuclear Power Station Tsuruga, Japan*
- VRIMOR European project
  - HesPi UPM
  - ErgoDose NNC
    - *Developed in the VRIMOR project to test in applications for maintenance outage and repair*
- Narveos
  - Combining calculation and visualisation
- VISIPLAN 3D ALARA planning tool (SCK•CEN)
  - *Developed in the context of decommissioning BR3, now established in different applications*



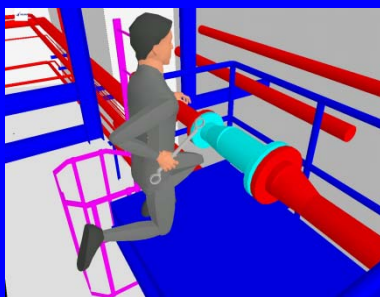
# Simulation programs a picture says more than a thousand words



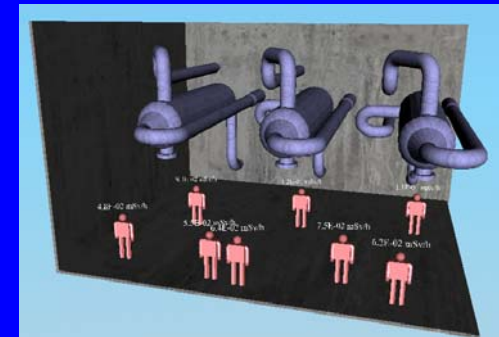
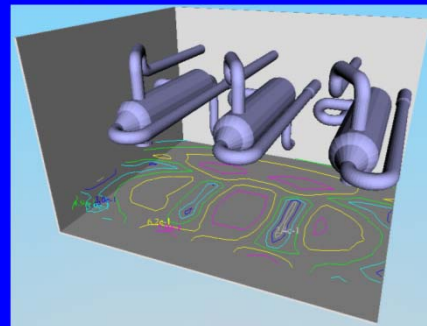
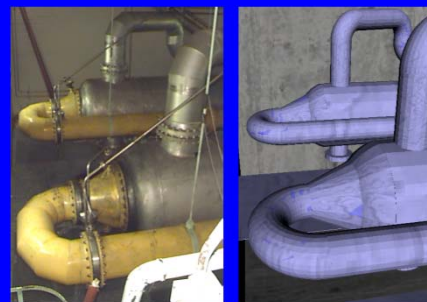
VRDose  
IFE Halden



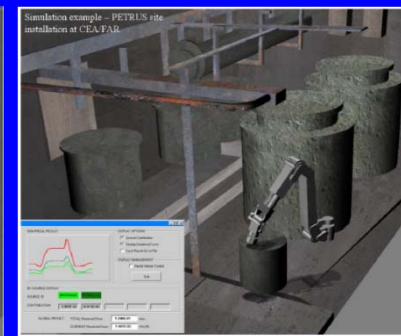
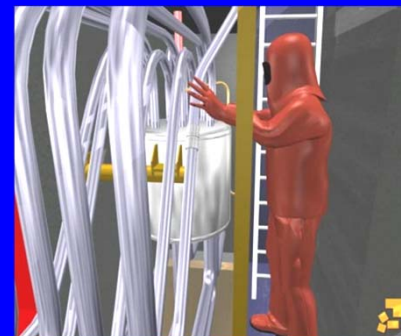
Narveos



ErgoDose NNC



VISIPLAN 3D  
ALARA planning tool  
SCK•CEN

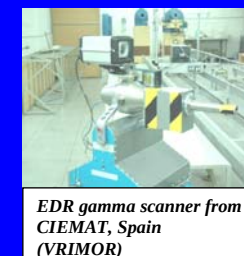
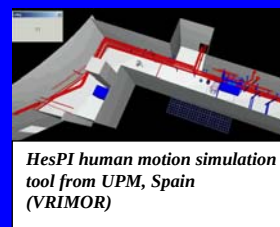
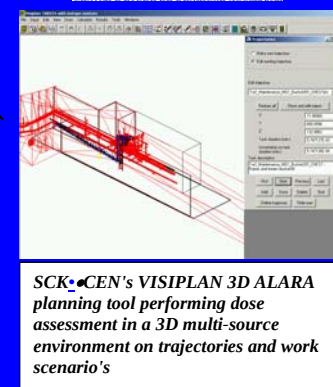
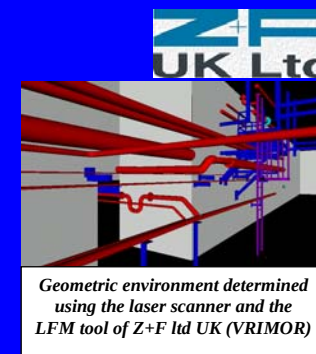
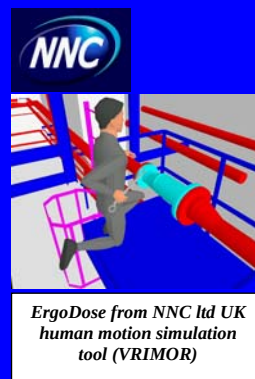


CHAVIR CEA-LIST



# The VRIMOR project

Bringing together  
geometric scanning,  
Radiological scanning,  
human movement  
simulation software and 3D  
ALARA planning software



# Trajectory Simulation how detailed and for what purpose



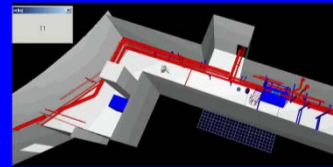
HeSPI (UPM)



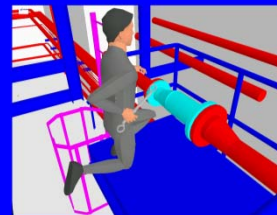
ERGODose (NNC)



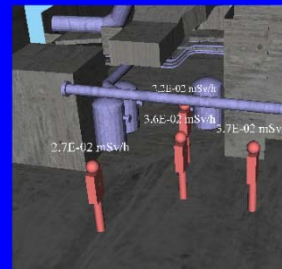
Trajectory calculation  
VISIPLAN (SCK•CEN)



Detailed continuous  
movement controlled by  
voice command



Detailed continuous  
movement controlled by a  
SpaceMouse



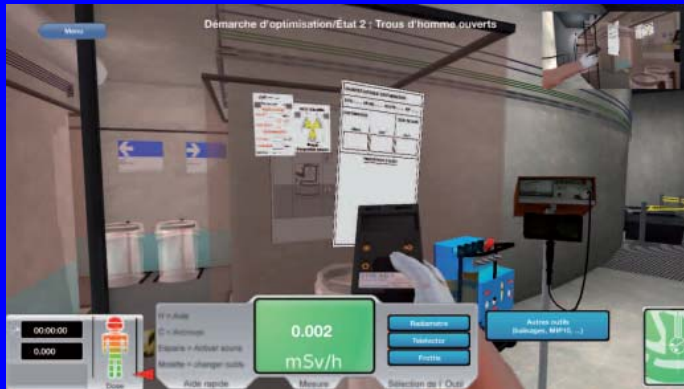
Stepwise simulation with  
dummies fixed at work or  
action positions

Conclusion:

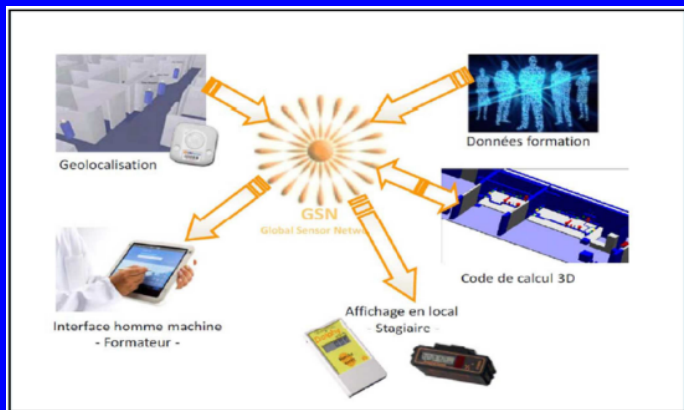
- Stepwise simulation and calculation suffices for ALARA dose assessment
- Continuous movement for education and training purposes



## Specific training tools (not directly aimed at planning)



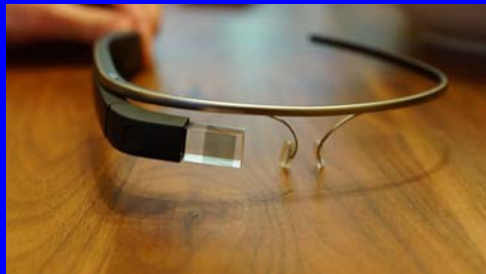
- “Serious Game” (3D video games) for training workers at nuclear facilities



- Chantier Ecole Radioprotection NUMérique (CERNUM)



## What will the future bring ?

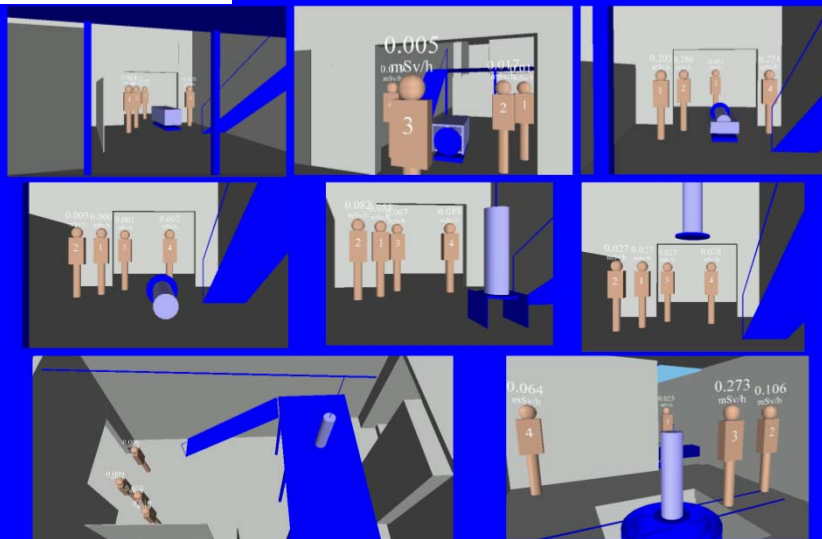


- What next ? Augmented reality
  - ATLAS (CERN) Supervision Post and Augmented Reality Project
  - Investigating Real time gamma ray imaging system
- (Real time) visualisation of the radiation fields ?
- (Real time) visualisation of the doses ?
- (Real time) visualisation of the sources ?





## Back to the present Fuel loading REBUS



Virtual



Reality

Knowledge of the geometry of the radiation field led to a dose reduction  
due to pro-active actions of the workers



## Conclusion

- The use of simulation and 3D representation of the workplace and radiation risks enables
  - A better training of the ALARA analyst (testing and evaluating different scenario's)
  - A better communication during the pre-job ALARA studies between the stakeholders.
  - A better final preparation of the worker
  - A better awareness of the residual risk and the radiation protection measures put into practice
- Further R&D is going on to enhance display capabilities, calculation speed, human machine interfaces and interfaces to geometry and gamma-ray scanners