

INFN Energia e Industria

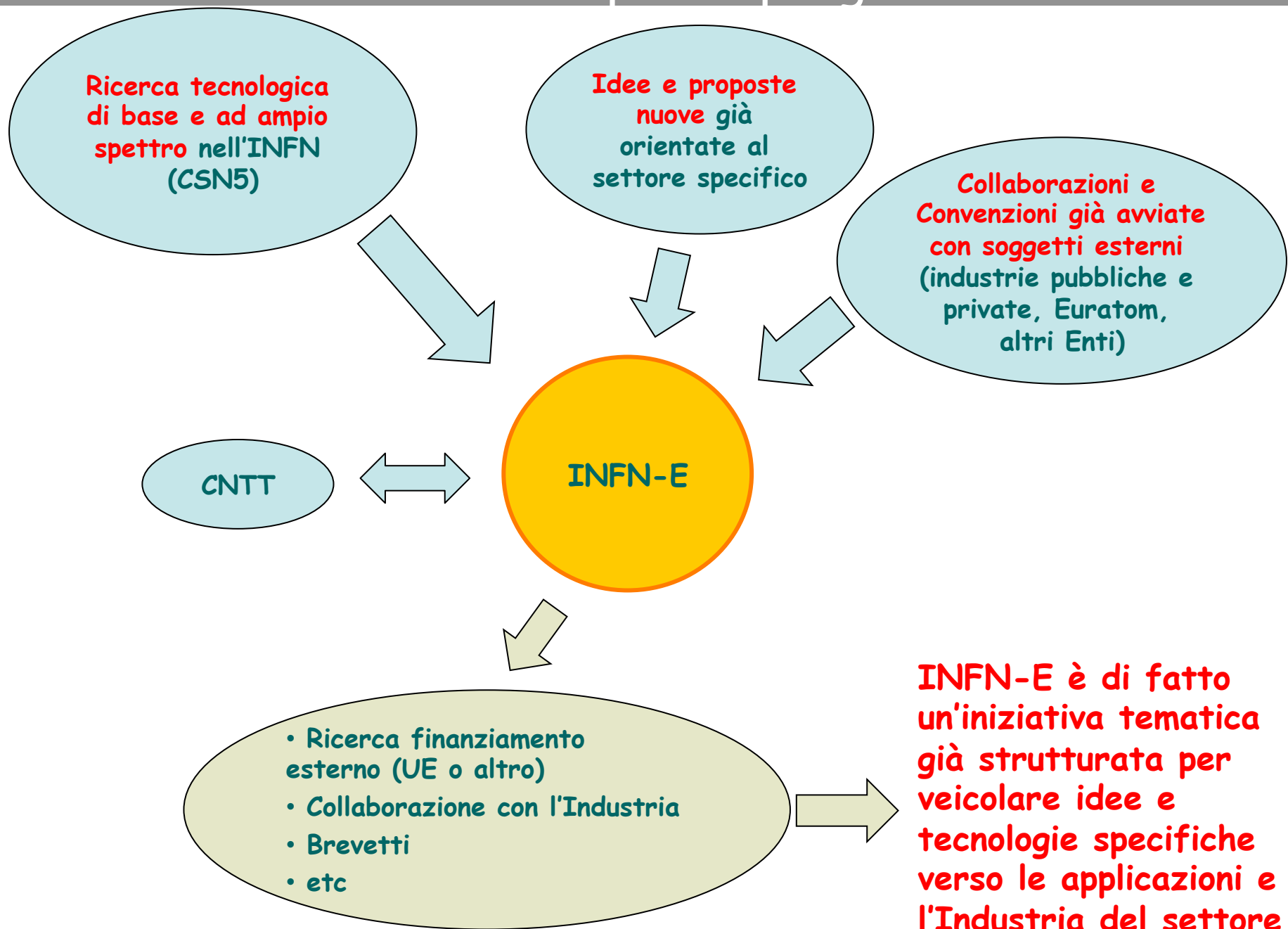


Fisica, economia, industria, comunicazione

Tavolo di discussione pubblica con rappresentanti
della ricerca, della politica e dell'industria

Lecce, Officine Cantelmo
23 settembre 2013

INFN-E: input al progetto



Competenze dell'Ente

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graph TD; A([Competenze dell'Ente]) --> B([Problematich...]);
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Problematich... legate all'energia

- ✓ Decommissioning siti nucleari
- ✓ Siti di stoccaggio di rifiuti radioattivi
- ✓ Sicurezza industriale e pubblica, sicurezza ai varchi
- ✓ Monitoraggio dei reattori
- ✓ Sistemi a fissione di nuova generazione (ADS e reattori veloci)
- ✓ Programmi sulla fusione nucleare
- ✓ Misure di neutronica in tutti questi ambiti

Sicurezza nucleare:
siti di stoccaggio,
industrie, varchi,
mappatura della
radioattività
ambientale

Waste monitoring at storage facilities

The problem...



radioactive waste is produced worldwide and generally packed into special drums

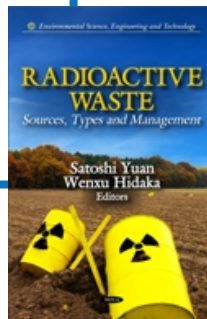
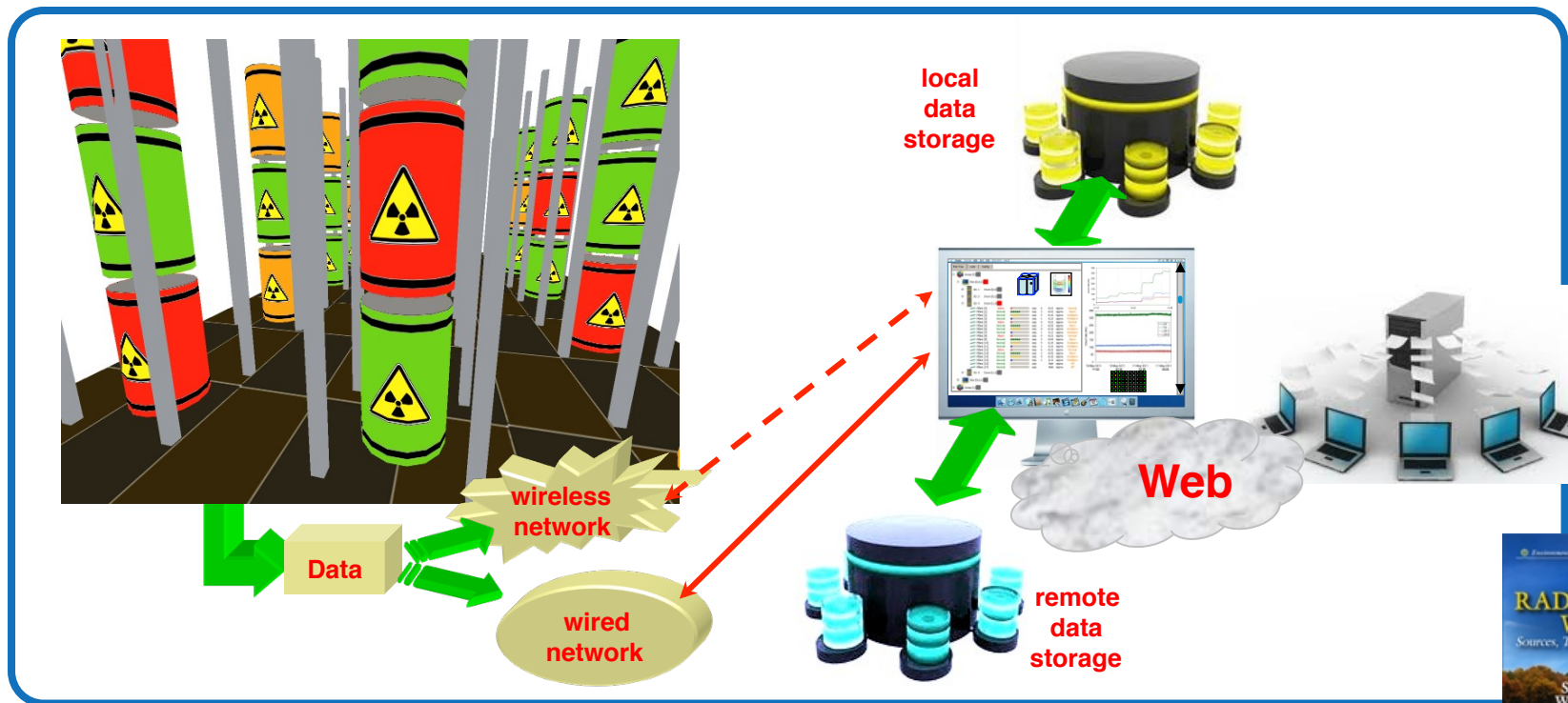
the storage site should be monitored for leaks or breaks to prevent possible contamination of the environment and/or people



No repository with online monitoring (to our knowledge)

On-line monitoring could minimize the need of human operators inside (ALARA)

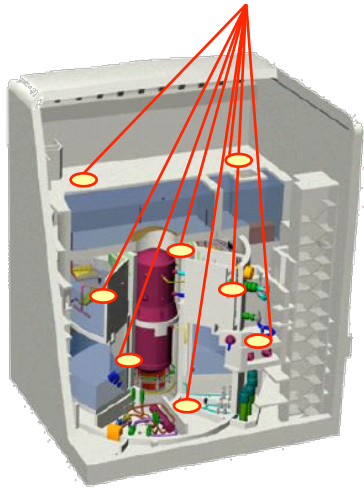
INFN-E DMNR project: Detector Mesh for Nuclear Repositories



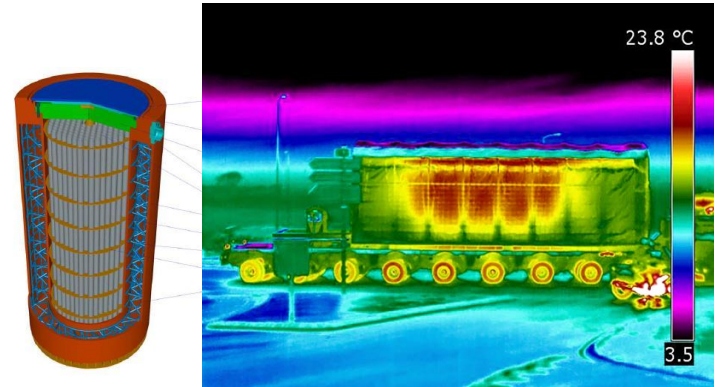
- Un Accordo Quadro tra INFN e SOGIN SpA è stato siglato il 7 Novembre 2012, accompagnato da un Accordo Attuativo per attività specifiche al Garigliano

HElimum3-Less Neutron Monitors

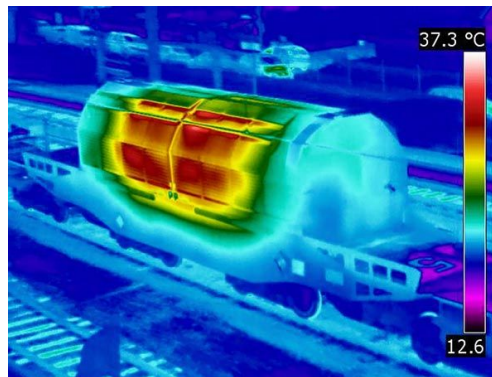
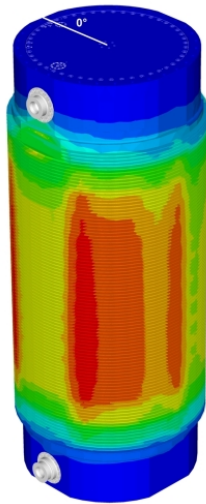
Out-of-core reactor zone monitoring



Waste and spent fuel monitoring in place and/or during transportation



Collaborazione con JRC-Ispra



Elaborato brevetto INFN tramite CNTT

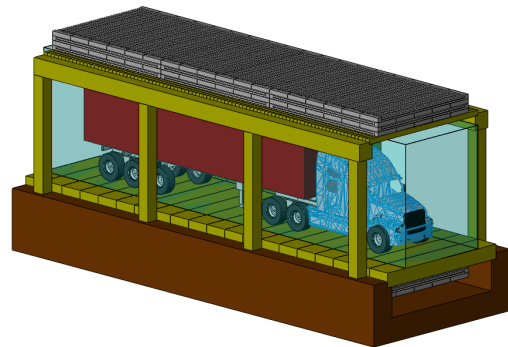
(*) cask for storage and transport of radioactive material

INFN Laboratori Nazionali del Sud, Catania

MU-STEEL

PROJECT TITLE : "Muons scanner to detect radioactive sources hidden in scrap metal containers"

**Research Fund for Coal and Steel
GRANT AGREEMENT No RFSR-CT-2010-00033**



The Consortium

- 1. TECNOGAMMA**
- 2. UNIVERSITA' DEGLI STUDI DI PADOVA**
(Physics Dept. & Information Engineering Dept.)
- 3. ISTITUTO NAZIONALE DI FISICA NUCLEARE**
- 4. UNIVERSITA' DEGLI STUDI DI BRESCIA**
(Mechanical Engineering Dept.)
- 5. S.R.B. COSTRUZIONI SRL**
- 6. AFV ACCIAIERIE BELTRAME SPA**



INFN and University of Padova

The “orphan sources” problem

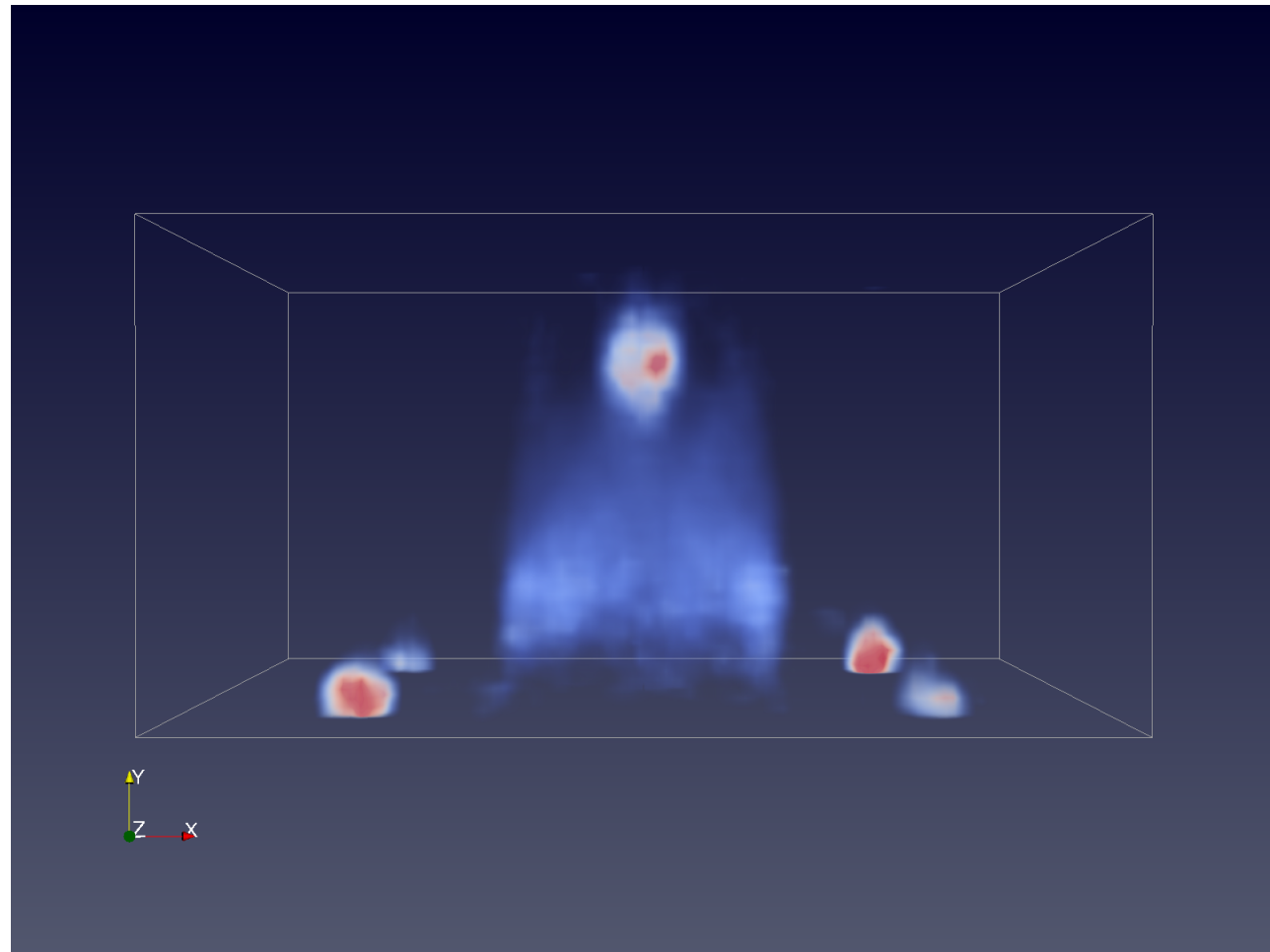
- Sometimes, radioactive sources are present in recyclable scrap metal. For this reason foundries are equipped with radiation monitors at the material entry point
- However, if the source is shielded it goes undetected and ends up being melted in the furnace, with severe consequences for the workers, the infrastructure and the environment.
- The purpose of the MuSteel project is to provide means to detect the shielding, complementing the radiation detectors.

Some known events

Date	Country	Industry	Source	Cost Estimate
1983	Mexico	N.A.	37 GBq ⁶⁰ Co	N.A.
1997	Italy	ALFA ACCIAI	⁶⁰ Co ¹³⁷ Ce	17M€
1998	Spain	ACERINOX	¹³⁷ Cs	26M\$
2000	Great Britain	AVESTA STEEL	²³⁸ Pu	2M€
2004	Italy	AFV BELTRAME	¹³⁷ Cs	13M€

Muon detector prototype (based on CMS detectors)

A realistic case: 250 k μ (5÷10 min exposure time)



Technique proposed to inspect Fukushima cores: K. Borodzin et al., PRL 109,152501 (2012)

Servono O(2 MEuro) per un prototipo full-scale
→ contatti in corso con Industrie, Euratom, IAEA,...

UE-SCINTILLA



Seventh Framework Programme (FP7/2007-2013)
Grant Agreement n.285204



Project scope: *Development of detection capabilities of difficult to detect radioactive sources and nuclear material*

Project Type: *Collaborative project (FP7-SEC-2011-1.5-1) involving **CEA, JRC, INFN, ANSALDO, IKI, FhG INT, ARTTIC, SAPHYMO, SYMETRICA***

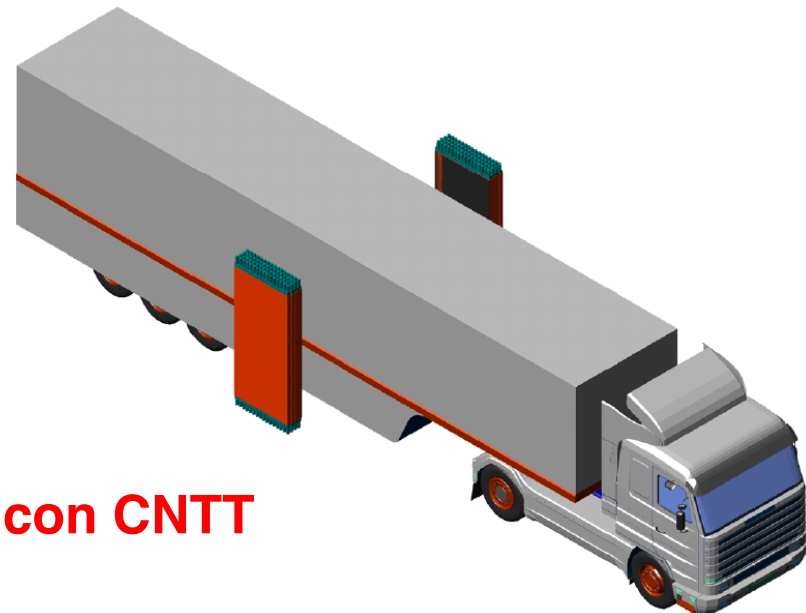
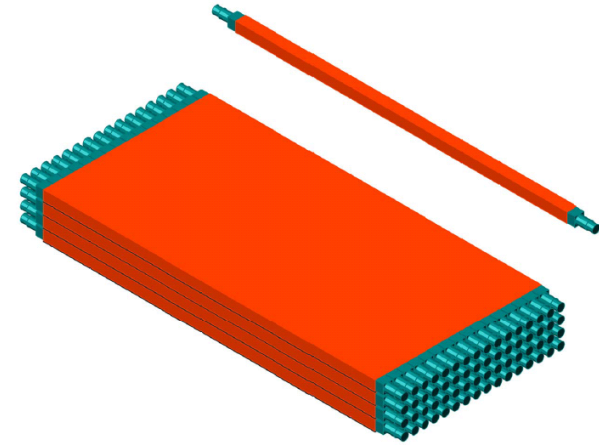
Project Duration: *36 months (1/1/2012 - 31/12/2014)*

INFN

Development of a neutron detector based on Gd-Lined plastic scintillators for usage in Radiation Portal Monitors

RPM for container inspection

- Fissile material (Uranium or Plutonium) hidden in cargo containers can be detected by measuring gammas and neutrons from spontaneous fission
- Standard requirement is to measure 2.5 counts per ng of Cf252



Brevetto INFN/Ansaldo Nucleare elaborato con CNTT
→ in dirittura d'arrivo

Monitoraggio reattori con antineutrini: CORMORINO @ Cernavoda (Ro)



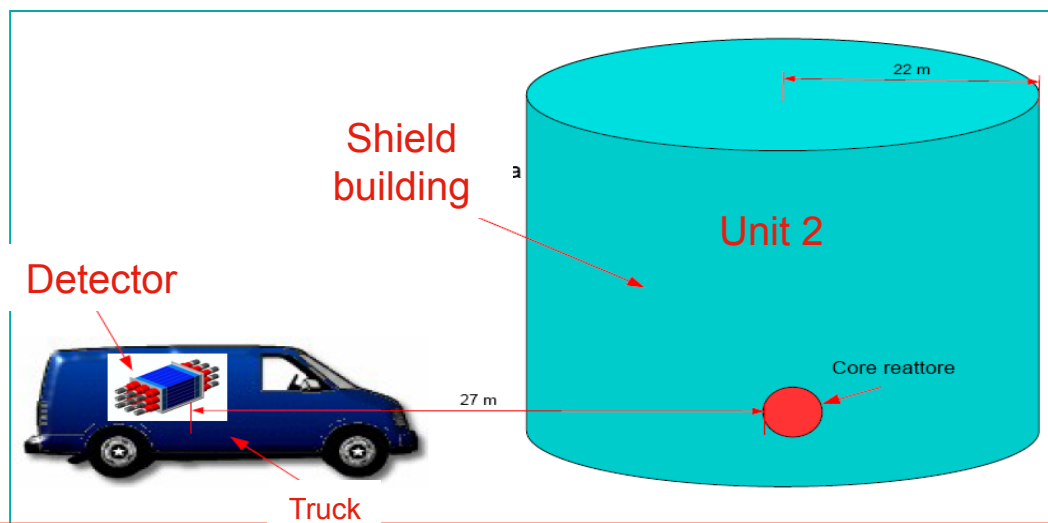
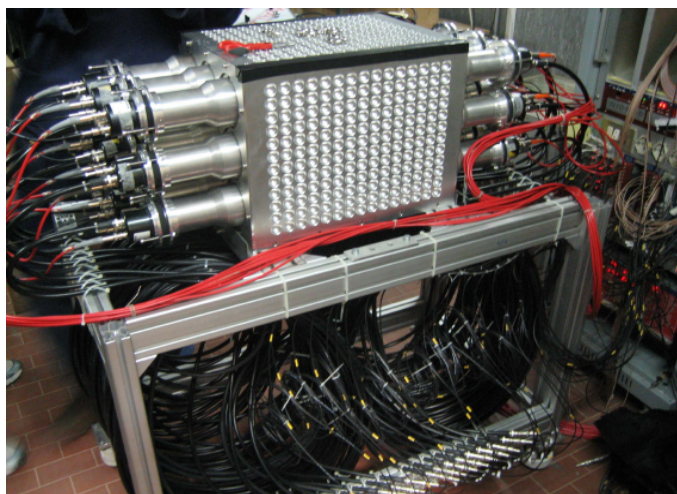
Test run in collaborazione con Ansaldo Nucleare al reattore di Cernavoda (Ro)

2 GW reactor off/on for maintenance
~30m far from the reactor core
In-truck movable detector

Obiettivi

★ Test apparato e determinazione fondi

Progetto in standby → servono fondi per un rivelatore full-scale O(1 MEuro)



Fissione e Fusione

ISR

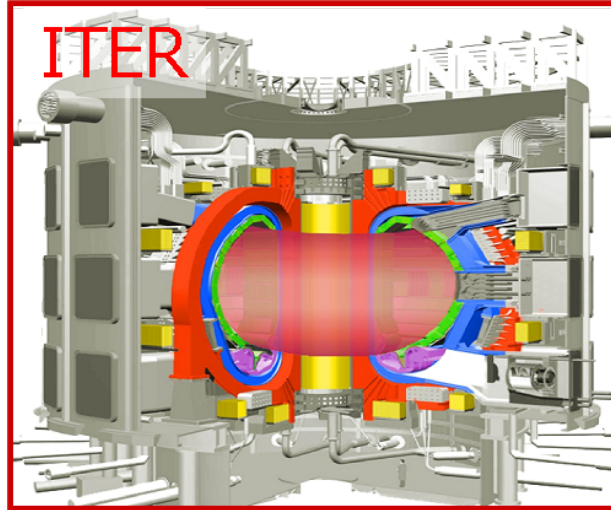
Intrinsically Safe Reactor

A NATIONAL INFRASTRUCTURE FOR TRAINING AND RESEARCH ON
NUCLEAR TECHNOLOGIES AND WASTE TRANSMUTATION

[CLICK HERE FOR SECTIONS](#)



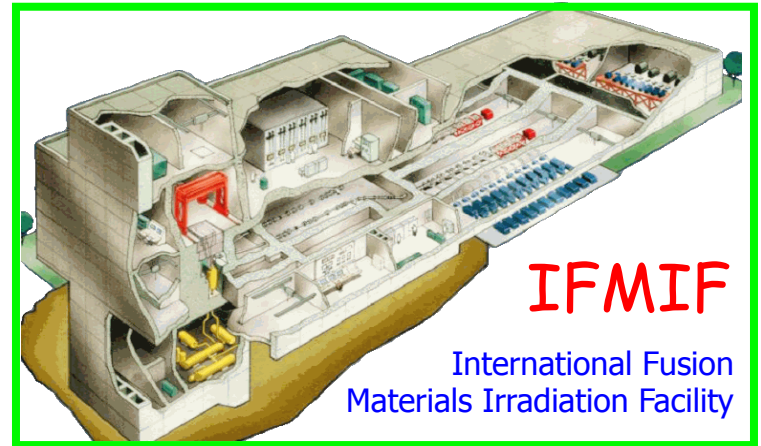
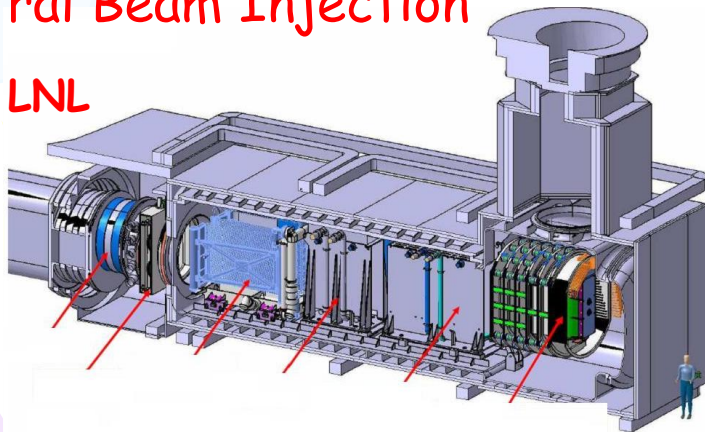
CONCEPTUAL DESIGN REPORT
(DRAFT)



L'INFN dà un importante contributo a

Neutral Beam Injection

INFN LNL



INFN LNL, PD, TO, BO

Tecnologie innovative per misure nei siti sensibili, reattori, ADS, Tokamak

Molti progetti sui cui non ho tempo di soffermarmi...
"immagini" a raggi X del plasma, rivelazione di alti flussi di
neutroni etc etc.

Conclusioni

- Nell'ambito delle applicazioni nucleari, c'è una **sintonia particolarmente forte** di interessi tra INFN, Industrie e altri Enti su problematiche specifiche che ha creato un particolare circuito collaborativo
- Questo dimostra che iniziative tematiche possono costituire uno strumento efficace per l'apertura di collaborazioni con altri Enti e col mondo industriale