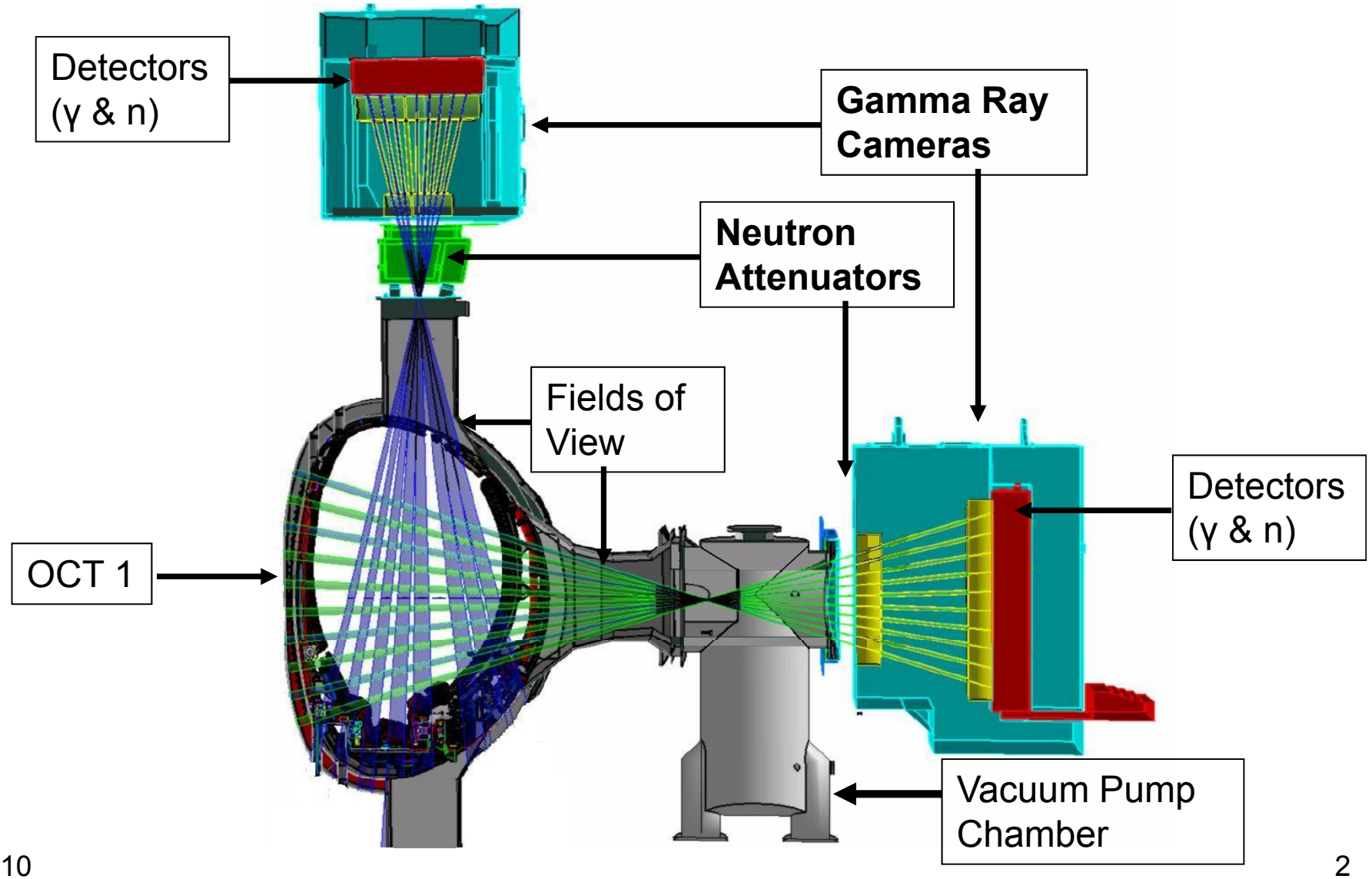
"Upgrade of Gamma-Ray Cameras: Neutron Attenuators"
GRC

EURATOM / MEdC Association Days
Iasi
2-3 Iunie 2010

Marian CURUIA
Association EURATOM-MEdC
National Institute for Cryogenics and
Isotope Technologies
Rm. Valcea, Romania

I. KN3-NA: environment



Outline:

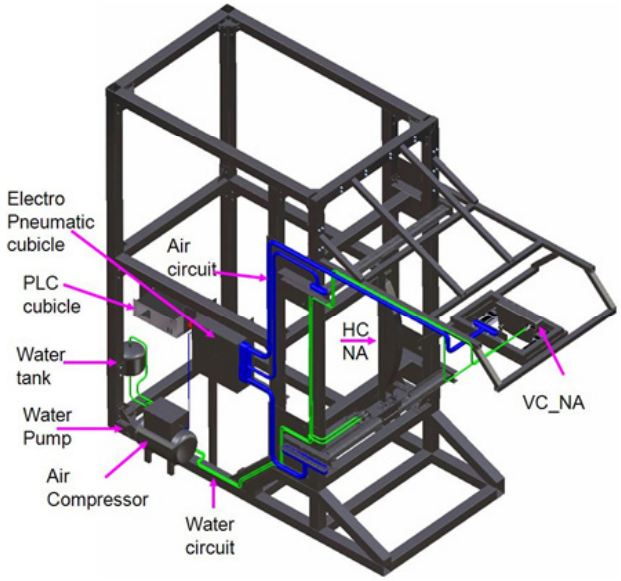
I.Current status: manufacture (main components and test stand), assembly, tests

II.IPPLM Association participate

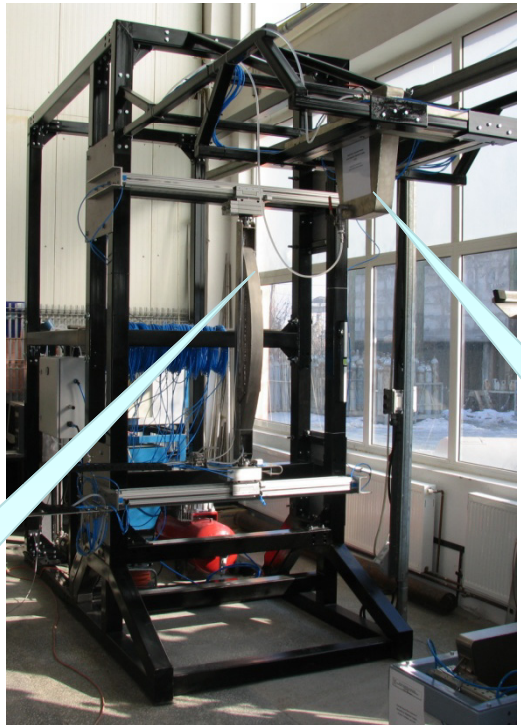
III. Planning & review list of M&D

KN3-NA Assembly

KN3 NA Assembly on Test Stand - CATIA Design



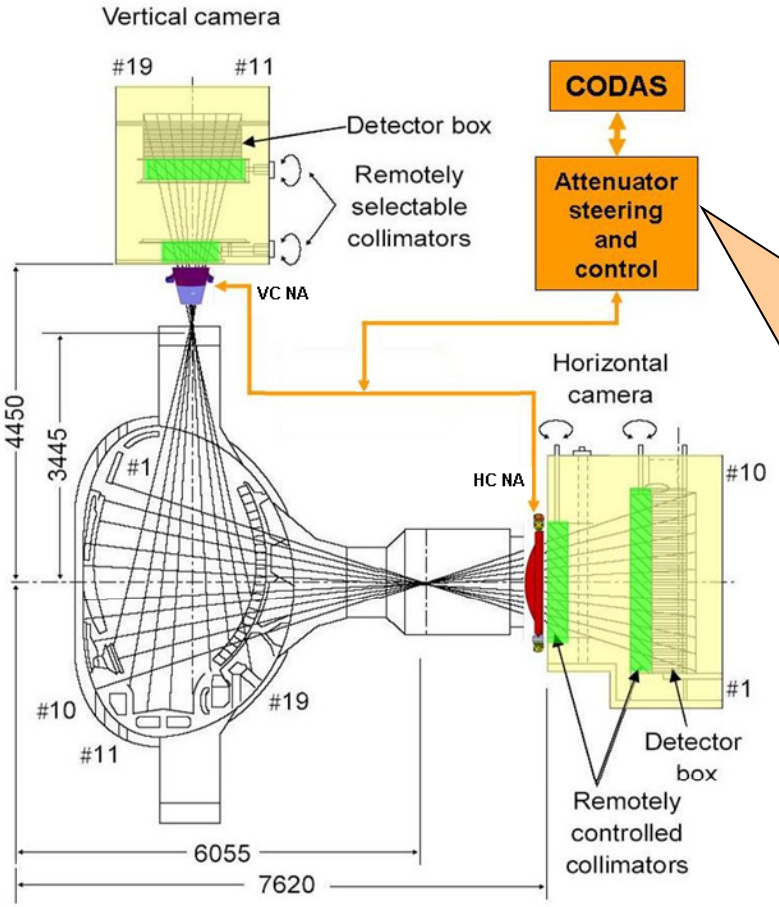
KN3 NA Assembly- front view

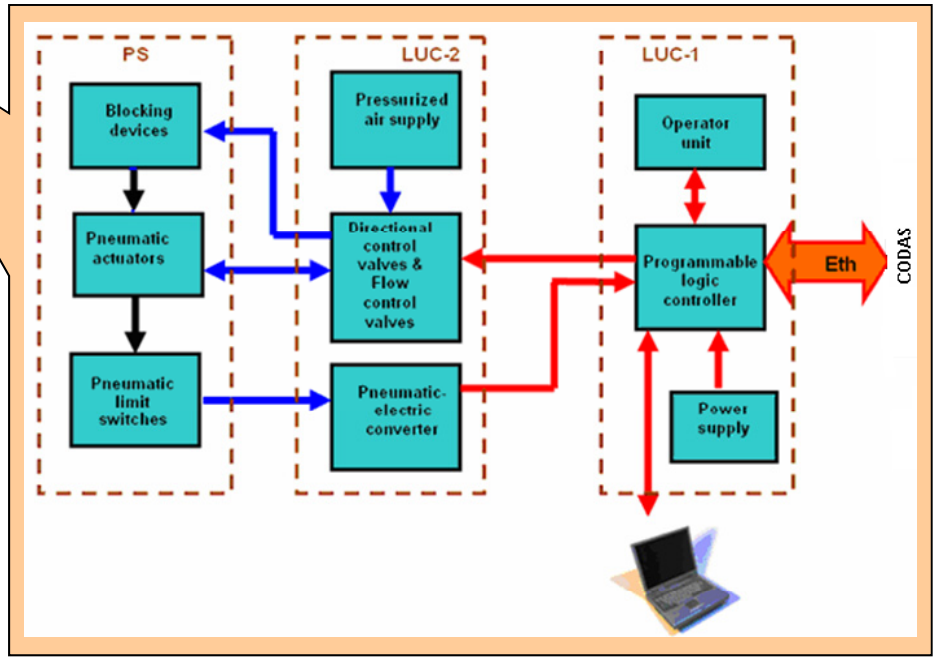


Horizontal camera neutron attenuator (HC NA)

Vertical camera neutron attenuator (VC NA)

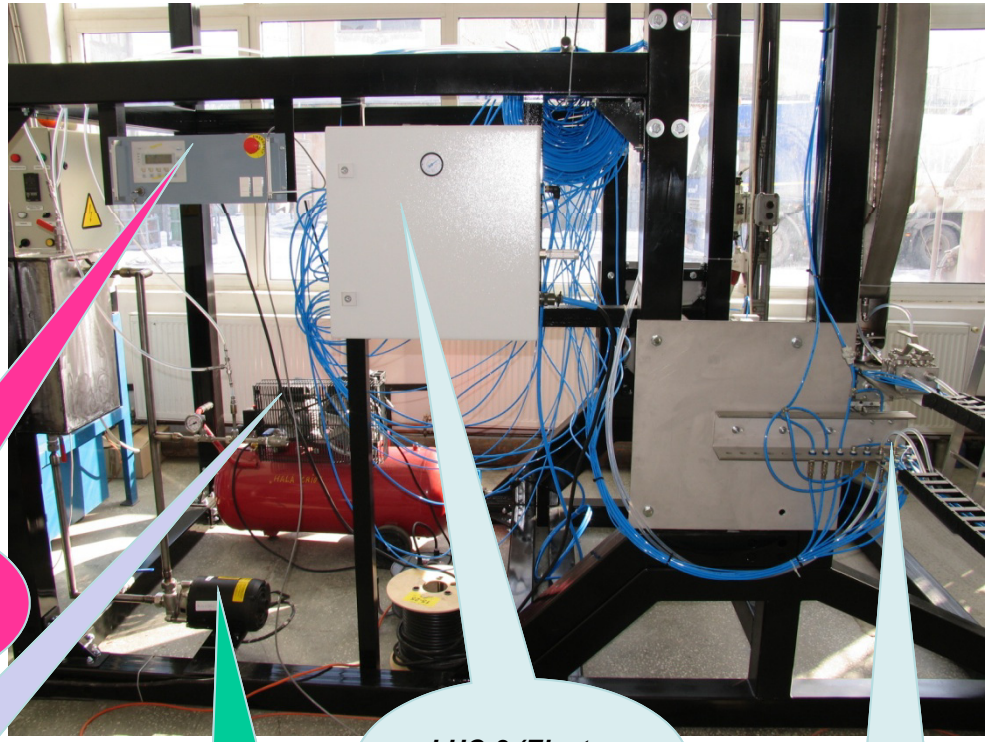
Schematic representation of the KN3-NA assembly





PS= pneumatic system
LUC=Local Unit Cubicle
Eth= Ethernet connection

KN3 NA Assembly- details



LUC-1 (PLC Cubicle)

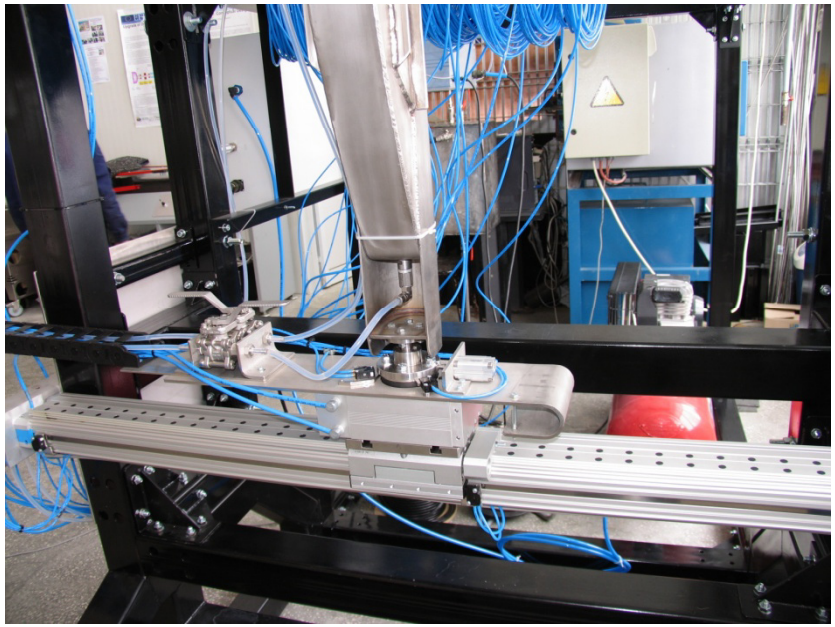
Pressurized air supply

Water pump

LUC-2 (Electro-Pneumatic Cubicle)

HC&VC pneumatic (RAFFIX) and water (push-in) connections

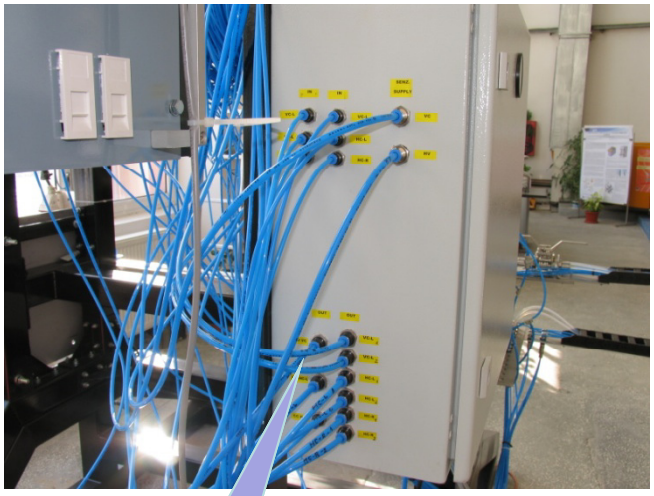
KN3 NA Assembly- details



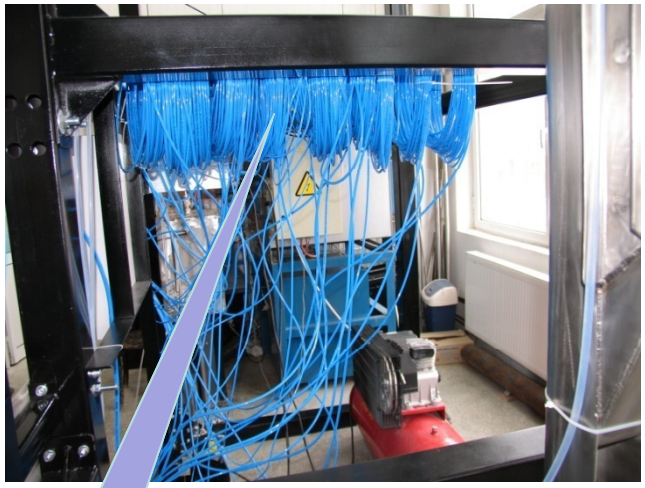
HC NA lower linear/rotating actuator and water inlet

VC NA linear actuators and water Inlet

KN3 NA Assembly- details



LUC-2 pneumatic (push-in) connections



25 m pneumatic hoses

III. GRC Project Management Phase II

PMP modified:

-IPPLM Association involved in the GRC Project on the new task T-1.3: Radiation tests on a neutron attenuator prototype and related Milestone M-1.3 and Deliverable D-1.3 added

-IPPLM Association Contact Person added: M. Scholz

-31 ppd under Notification for MEdC added for new tasks T-1.3
-69 ppd and 50 k€ under Notification for IPPLM added to the project for new tasks T-1.3

IV. Project planning, review list of M&D

Milestones schedule

No.	Responsible Organization	Description of Deliverable	Due dates	Revised dates	Real dates
M-2.4.04	MEdC	Test stand for the KN3-NA attenuator assembly-in-house tests		March 2010	
M-2.5.01	MEdC, CCFE, JOC	Installation on JET of the KN3-NA assembly		Oct 2010	
M-1.3	IPPLM, MEdC	Radiations tests on a neutron attenuator prototype		Nov 2010	
M-2.6.01	MEdC, CCFE, JOC	Commissioning of the KN3-NA	Dec 2010	June 2011	
M-4.6.01	MHST, CCFE, MEdC	Calculation of the neutron flux at the location of the KN3 CsI(Tl) detectors. Calculation of the CsI(Tl) detector efficiency per incident neutron	June 2009	March 2010	
M-4.7.01	MHST, CCFE, MEdC	Calculation of the influence of the neutron attenuators on the neutron cross-talk between different KN3 collimator channels	Dec 2009	Dec 2010	
M-4.7.02	MEdC, MHST, CCFE, JOC	Final Project Activities		Sep 2011	

Deliverables schedule

No.	Responsible Organization	Description of Deliverable	Due dates	Revised dates	Real dates
D-2.4.2	MEdC	Report on the non nuclear (in-house tests)		June 2010	
D-2.5	MEdC, CCFE, JOC	KN3-NA Installation on JET report	Oct 2010	Dec 2010	
D-1.3	IPPLM, MEdC	Radiations tests on a neutron attenuator prototype report		Dec 2010	
D-2.6	MEdC, CCFE, JOC	KN3-NA commissioning report	Dec 2010	June 2011	
D-4.6	MHST, CCFE, MEdC	Calculation of the neutron flux at the location of the KN3 CsI(Tl) detectors. Calculation of the CsI(Tl) detector efficiency per incident neutron	June 2009	June 2010	
D-4.7	MHST, CCFE, MEdC	Calculation of the influence of the neutron attenuators on the neutron cross-talk between different KN3 collimator channels	Dec 2010	June 2011	
D-4.8	MEdC, MHST, CCFE, JOC	Final Report on the project		Sep 2011	

Gamma-Ray Cameras-Neutron Attenuators *Project costs (in k€) (February 2010)*

Procurement Art. 6 Orders	Manpower +missions Art.6 Orders	Total Art.6 Orders	Notifications				Total	Comments
			MEdC	MHST	UKAEA/ CCFE	IPPLM		
Phase I (KN3&KX1-G)								
	38	38	163	72	13		286	2005-2006 (KN3&KX1-G)
Phase II (KN3-NA&KM6-T)								
			150				150 +JOC	2007 (KN3-NA+KM6T)
			+JOC					
			120	50	16		186 +JOC	2008 (KN3-NA+KM6T)
			+JOC					
45	23.160	68.160	152				220.160 +JOC	2009 (KN3-NA)
			+JOC					
	22	22	130	50		95	297 +JOC	2010 (KN3-NA)
			+JOC					
	25.453	25.453		50			75.613 +JOC	2011 (KN3NA)
			+JOC					
45	65.613	110.613	552	150	16	95	928.613 +JOC	Total Phase II

Next steps-2010

- KN3-NA Assembly tests (ongoing) in home lab
- Raising of Inspection Release Note in accordance with QP (April – MEdC)
- Installation procedure
- Finalizing of tests and presentation of the report (June – JET)
- Transfer to JET (June-July)
- Installation at JET (October)
- Radiation tests - experiment proposal (April – JET)
- Radiation tests - preliminary measurements (May - IPPLM)
- Radiation tests - nuclear tests on prototype (September - IPPLM)
- Radiation Tests report (December-JET)
- Calculation of the neutron flux at the location of the KN3 CsI(Tl) detectors. Calculation of the CsI(Tl) detector efficiency per incident neutron (March)

Tandem Collimators for gamma-ray Spectrometer
TCS

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Sorin SOARE
Association EURATOM-MEdC
National Institute for Cryogenics and
Isotope Technologies
Rm. Valcea, Romania

Outline:

I.Introduction

II.TCS Status

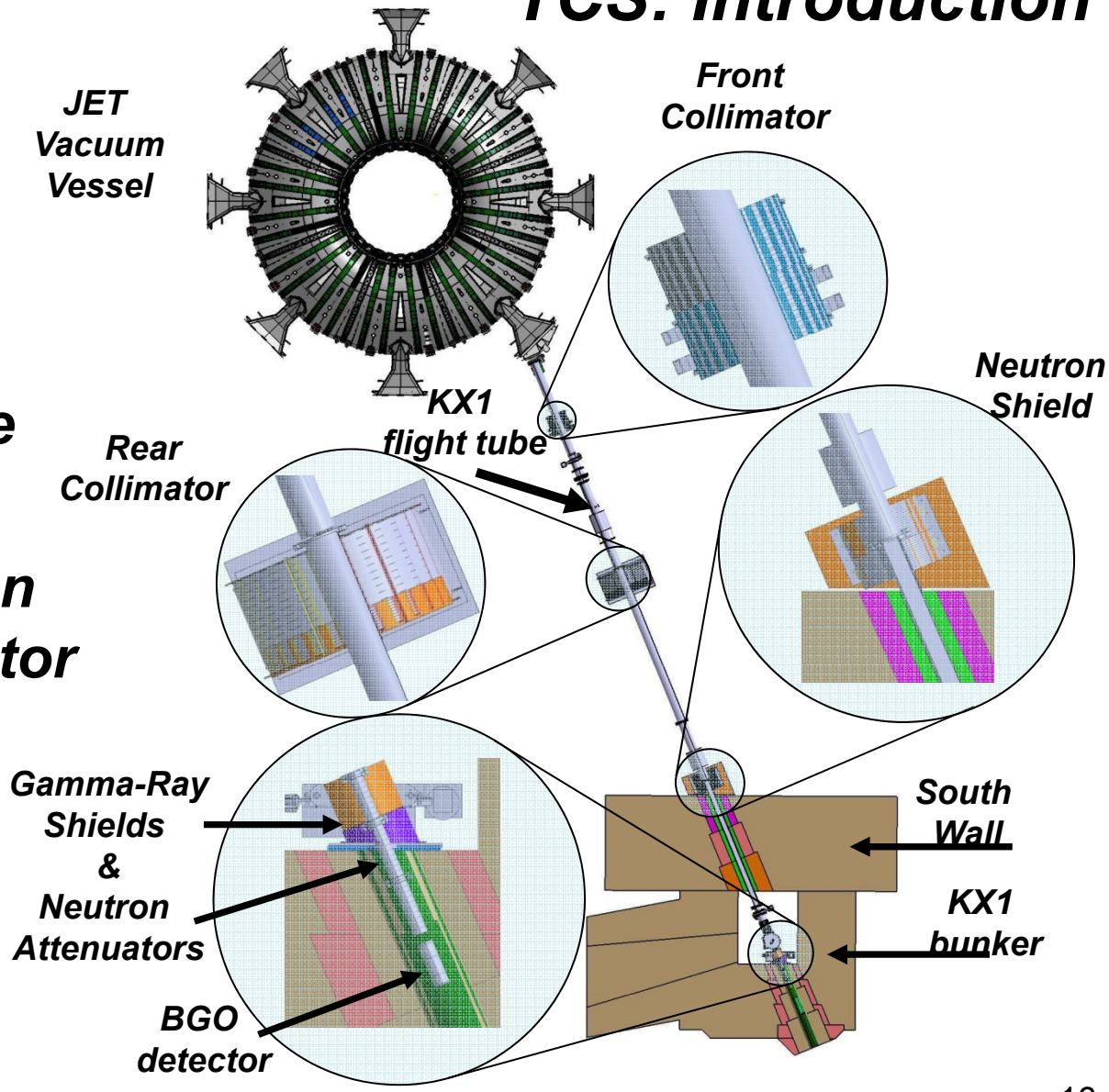
III.TCS PMP

TCS: Introduction

KM6T tangential Gamma-Ray Spectrometer

I. KM6T full diagnostic upgrade

II. KM6T reduced option KM6T Tandem Collimator (KM6T-TC)



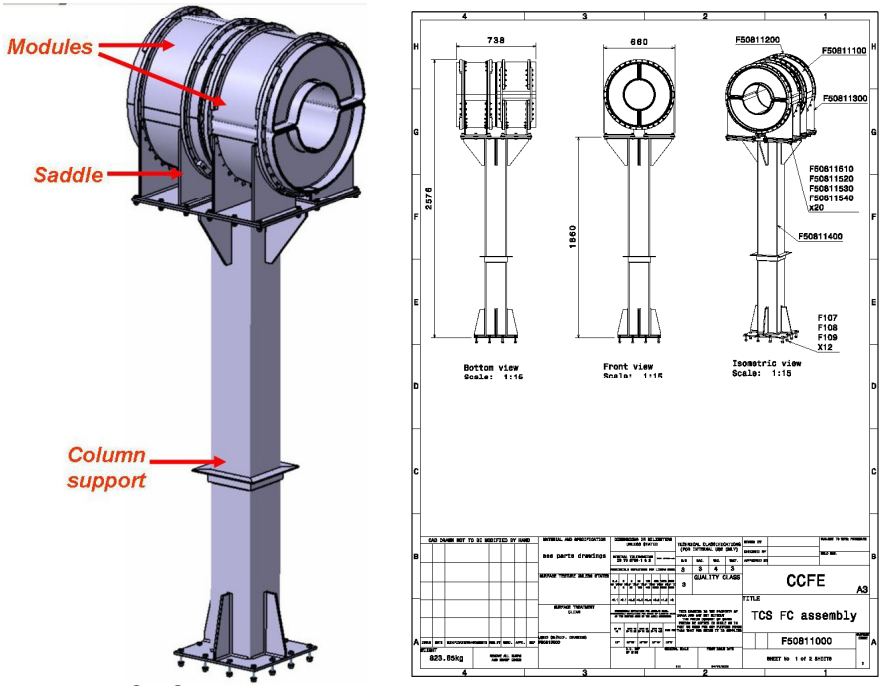
Detailed Design

TCS Status -1

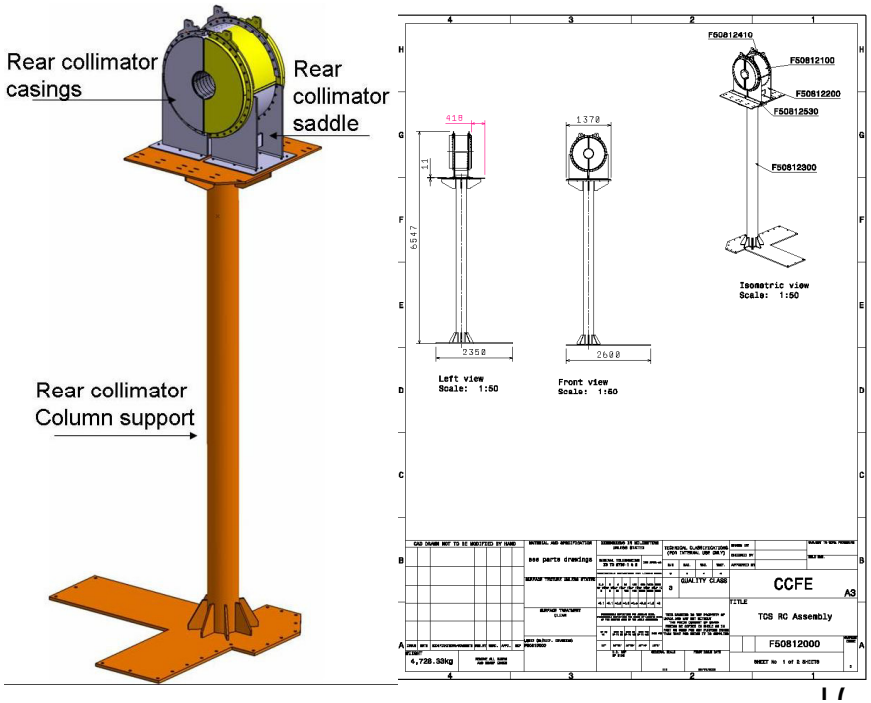
Detailed Design Review meeting was held on 02.12.2009

- ***Drawings updated with the latest comments & suggestions***

Front Collimator CATIA Model & drawing



Rear Collimator CATIA Model & drawing



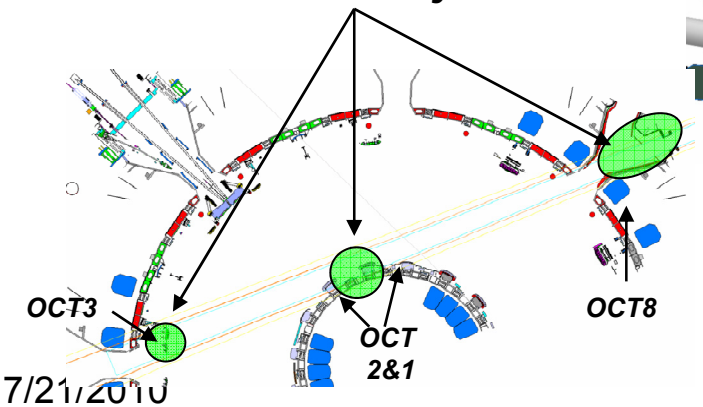
Additional Collar TCS Status -2

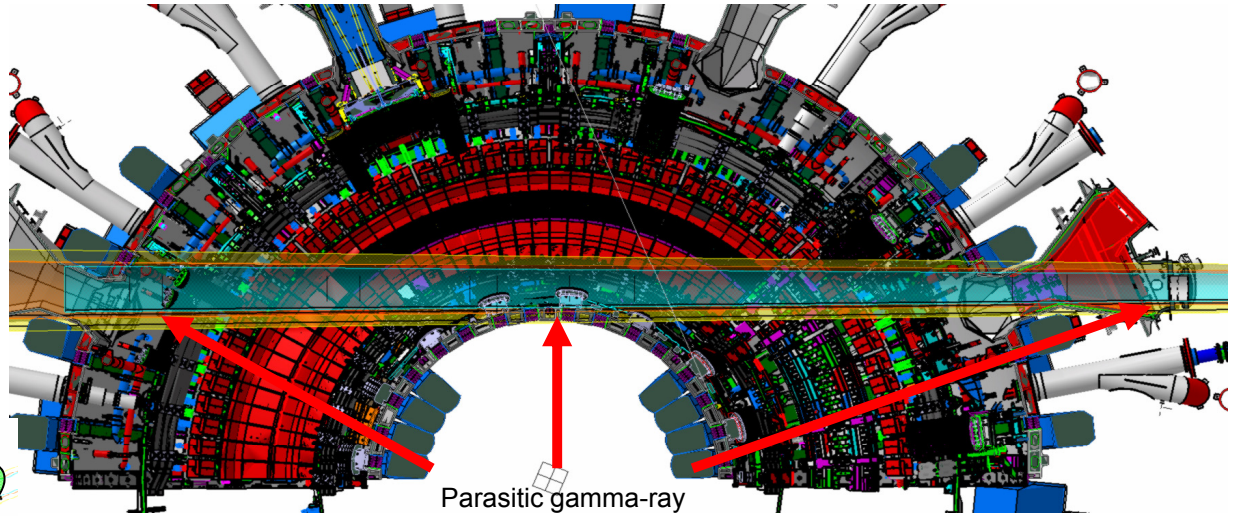
Scope:

-***Substantially improves the overall collimation of the originally proposed system (TCS project)***

-***Overcomes the increased clearance (as recommended by EAG) to KX1 line***

Parasitic Gamma-Ray sources



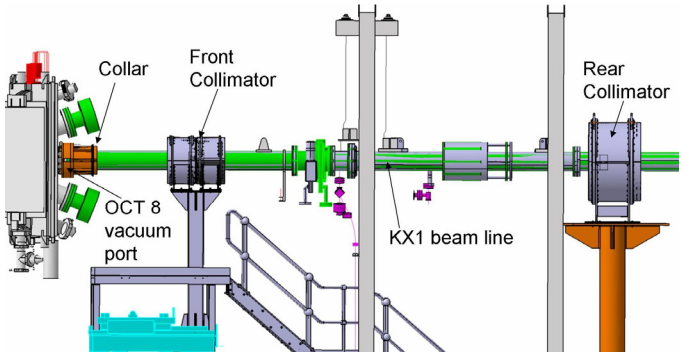


Parasitic Gamma-Ray sources:

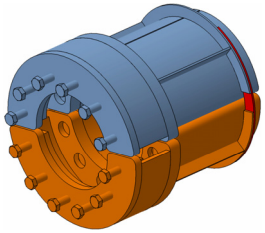
- ***LHCD Antenna – OCT3***
- ***Inner Guard Limiter - OCT2***
- ***Duct Scraper – OCT 8***
- ***Poloidal Limiter – OCT3***
- ***Inner Guard Limiter – OCT1***

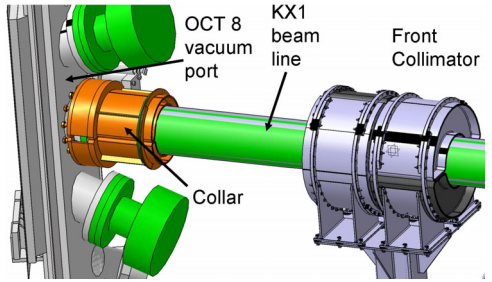
Additional Collar

Additional component: collar (total weight = 200kg)
- Collimating material: Pb slabs
- Casing material: all steel welded structure
- Proposed location: OCT8 vacuum port

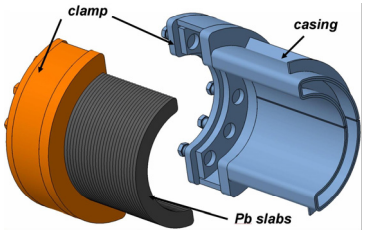


Benefit:
- the BGO detector field of view is reduced for both DD and DT configurations
-parasitic gamma-ray sources reduced in terms of area and volume





OCT.	FC FoV		Collar FoV		Reduction %	Reduction %
	LHCD Antenna (m2)	Poloidal Limiter (m2)	LHCD Antenna (m2)	Poloidal Limiter (m2)	LHCD Antenna (m2)	Poloidal Limiter (m2)
3	0.075	0.077	0.054	0.061	28	20.78



OCT	FC FoV		Collar FoV		Reduction %	Reduction %
	Be (kg)	INCONEL (kg)	Be (kg)	INCONEL (kg)	kg of Be	kg of INCONEL
1	12.4	7.5	10.9	6.6	12.10	12.00
2	12.12	7.36	10.6	6.4	12.54	13.04
3	7.56	12.88	5.58	9.2	26.19	28.57

	Volume of Cu (Duct Scraper)		Reduction %
OCT	FC FoV (m3)	Collar FoV (m3)	
8	0.004	0.001	75

PM - M & D, schedule

Deliverables Schedule:

No.	Responsible Organisation	Description of Deliverable	Due Dates	Revised dates	Real dates
D-2.1.01	MEdC, CCFE, JOC	KM6T Scheme Design report	Aug. 2009	Oct. 2009	
D-2.2.01	MEdC, JOC	KM6T Detailed Design report (*)	Nov. 2009	Dec. 2009	
D-3.1.01	MEdC, CCFE	KM6T -TC 14 MeV neutrons performance (numerical evaluation)	Dec 2009	Dec. 2009	
D-2.3.01	JOC	KM6T_TC Inspection Release Note	Sept. 2010		
D-2.4.01	JOC, MEdC	KM6T-TC Installation & Commissioning of Mechanical Components ready for operation	March 2011		
D-2.5.01	MEdC, CCFE	KM6T_TC Commissioning report	May 2011		
D-1.2.01	MEdC	Final Report	June 2011		

Milestones Schedule:

No.	Responsible Organisation	Description of Milestones	Due Dates (Issue 1)	Revised dates	Real dates
M-2.1.01	MEdC, JOC, CCFE	KM6T Tandem Collimator Scheme Design	Aug. 2009	Oct. 2009	
M-2.2.01	MEdC, JOC	KM6T Tandem Collimator Detailed Design	Oct. 2009	Dec. 2009	
M-3.1.01	MEdC, CCFE	KM6T -TC 14 MeV neutrons performance (numerical evaluation)	Dec. 2009	Dec. 2009	
M-2.3.01	JOC	KM6T Tandem Collimator Manufacture	June 2010		
M-2.4.01	JOC, MEdC	KM6T Tandem Collimator Installation	Oct. 2010		
M-2.5.01	MEdC, CCFE	KM6T-TC Commissioning	March 2011		
M-1.2.01	MEdC	Final Project Board	July 2011		

PMP: M & D, schedule

Next Steps:

- ***TCS project will proceed as planned***

- ***Collar activities will proceed as parallel activity***
  - ***Option I: continue with the design up to manufacturing point***

  - ***Option II: continue with design and manufacture within the timescale originally proposed for TCS***
    - ***Constrains: financial (budget was constructed for the tandem collimators)***

Thank you!

Future developments and/or Application to ITER

•No design has been done so far for the ITER GRC.

•A combination of the techniques developed for the JET gamma-ray diagnostics (KN3 gamma-ray camera and KM6T tangential gamma-ray spectrometer) could be used to design a gamma-ray camera for ITER.

•It should be pointed out that the design solution presented in the drawing is very close to one of the first designs we proposed in 2006 for the JET GRC. Water was proposed to be used instead of the LiH filters.