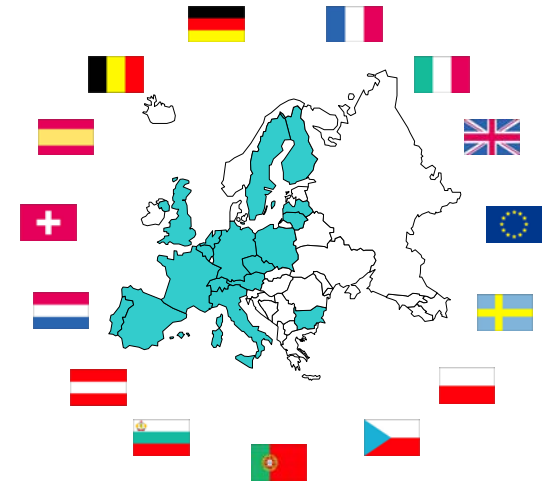


EUROTRANS

DM1 DESIGN

WP1.3
Accelerator



Jean-Luc BIARROTTE, CNRS / IPN Orsay

General specifications

Table 1 – XT-ADS and EFIT proton beam general specifications

	XT-ADS	EFIT
Maximum beam intensity	5 mA	25 mA
Proton energy	350 MeV	1 GeV
Beam entry	Vertically from above	
Beam trip number	< 20 per year (exceeding 1 second)	< 3 per year (exceeding 1 second)
Beam stability	Energy: $\pm 1\%$, Intensity: $\pm 2\%$, Size: $\pm 10\%$	
Beam footprint on target	Circular \varnothing 5 to 10 cm, "donut-shaped"	An area of up to 100 cm ² must be "paintable" with any arbitrary selectable intensity profile
Beam time structure	CW, with 200 μ s zero-current holes every 10 ⁻³ to 1 Hz, + pulsed mode capability (repetition rate around 50 Hz)	

+ Power control by beam intensity only

+ Emergency shutdown in less than 100

Linac reference layout

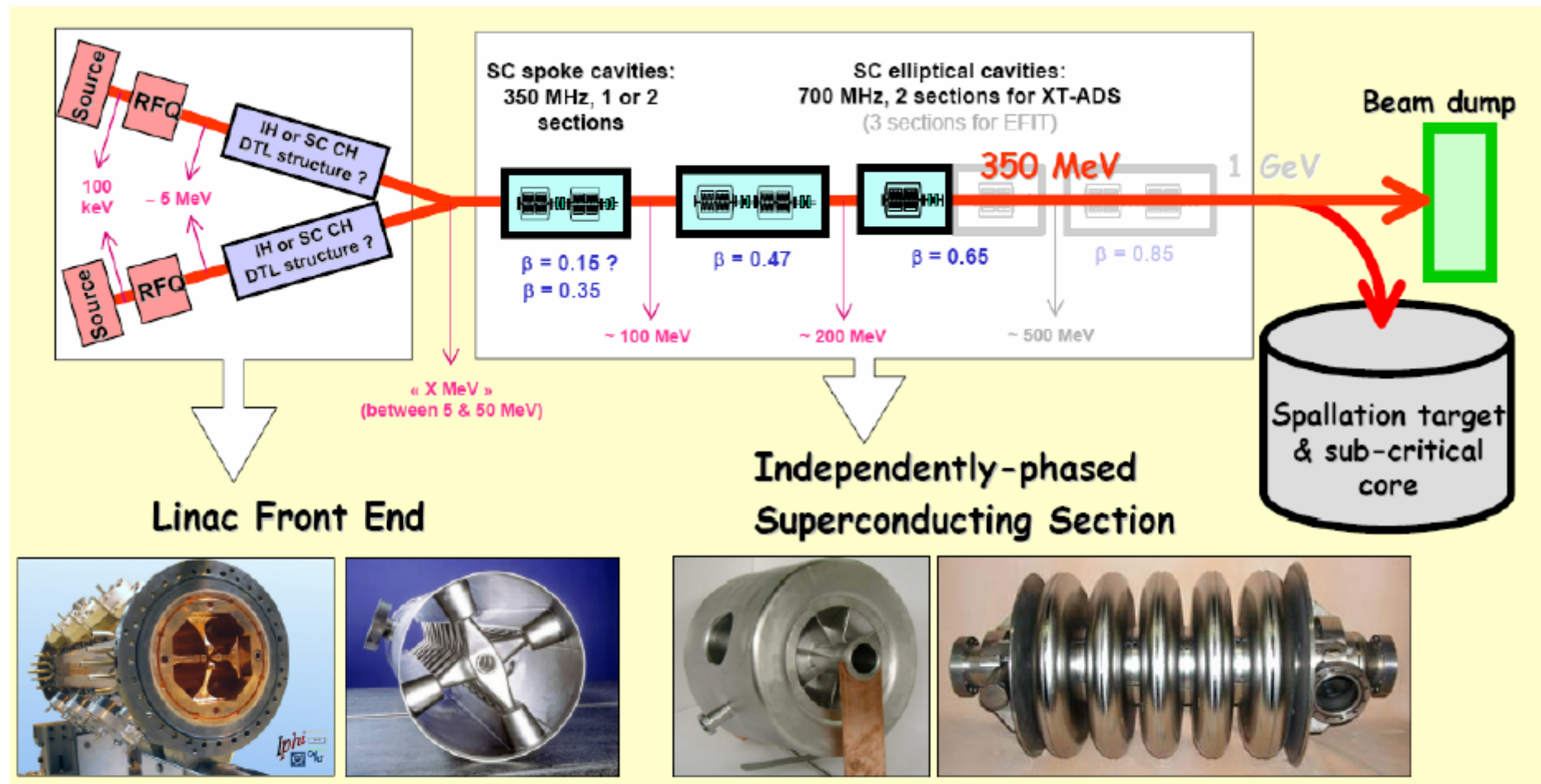


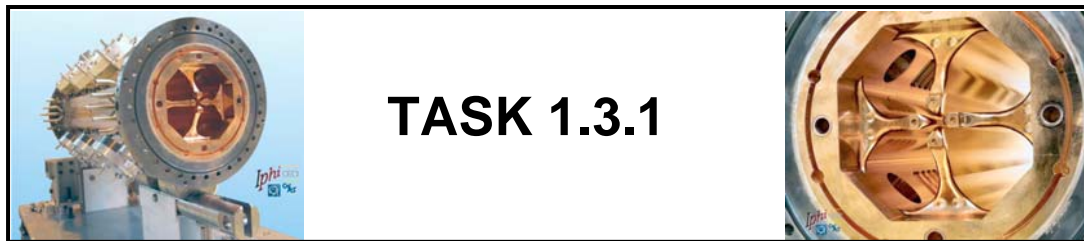
Figure 2 – XT-ADS reference accelerator scheme: a doubled linac front end is followed by a fully modular spoke and elliptical cavity SC section, upgradeable from 350 MeV up to 1 GeV for the EFIT needs. Typical cavity prototypes are shown in the lower part: from left to right RFO, CH structure, Spoke, Elliptical 5-cell.

OBJECTIVES of WP 1.3

- Study of the accelerator for the ETD (XT-ADS & EFIT), with special focus on the experimental demonstration of the required reliability
- First 18M = elaboration of detailed specifications and preparation of experiments

DM1 Design

WP 1.3 Accelerator		Year 1	Year 2	Year 3	Year 4
Task 1.3.1					
Injector Reliability	Schedule	Specs	Preparation	Tests	Synth
	Deliverables	D1.3.1	D1.3.2		D1.3.3
	Milestones	M1.3.1	M1.3.2		M1.3.3 M1.3.4
Task 1.3.2					
Interm. Energy Reliabil.	Schedule	Design	Construction	Tests	Synth
	Deliverables	D1.3.4	D1.3.5		D1.3.6
	Milestones	M1.3.5		M1.3.6	M1.3.7 M1.3.8
Task 1.3.3					
High Energy Reliability	Schedule	Design	Construction	Tests	Synth
	Deliverables	D1.3.7	D1.3.8		D1.3.9
	Milestones	M1.3.9	M1.3.10	M1.3.11	M1.3.12 M1.3.13
Task 1.3.4					
R.F. Control Reliability	Schedule	Specs	Modelling	VHDL analysis	Synth
	Deliverables	D1.3.10		D1.3.11	D1.3.12
	Milestones	M1.3.14		M1.3.15	M1.3.16
Task 1.3.5					
Global Coherence	Schedule	Gen. Specs	Beam Dynam. Simulations	Reliability Analysis, Costs & Synthesis	
	Deliverables	D1.3.13		D1.3.14	D1.3.15+16
	Milestones	M1.3.17	M1.3.18	M1.3.19	M1.3.20 M1.3.21+22 M1.3.23



TASK 1.3.1

GOAL:

The injector IPHI, developed by CEA and CNRS, will be used for a long run test to demonstrate on a real scale the reliability of the injector part.

CO-ORDINATING CONTRACTOR:

CEA (F) – *Raphaël Gobin*

MILESTONES:

M1.3.1: Specifications for the long test run (t₀+9 months)

M1.3.2: Injector operational for test (+18)

M1.3.3: Experimental tests accomplished (+36)

M1.3.4: Final report: results and analysis (+39)

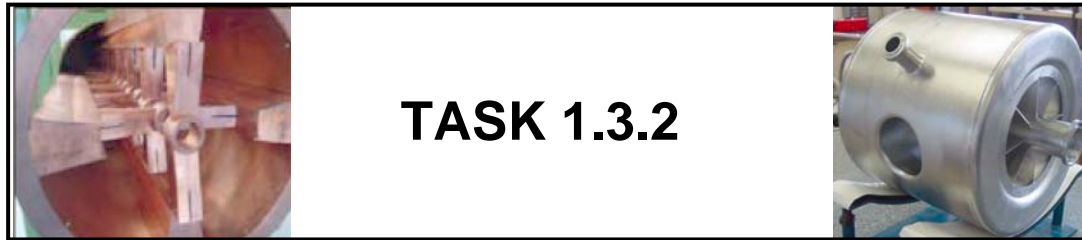
DM1 DESIGN WP1.3 - Accelerator	Task 1.3.1		
	Experimental evaluation of the proton injector reliability		
	Cons. k€	PM	Total k€
P5-CEA (F)	140	38	520
P8-CNRS (F)	0	15	150
P13.4-IAP-FU (D)	0	0	0
P13.12-UPM (SP)	0	0	0
P18-IBA (B)	0	0	0
P19-INFN (I)	0	0	0
P21-ITN (P)	0	0	0
P31-FANP GmbH (D)	0	0	0
Total WP1.3	140	53	670

DELIVERABLES:

D1.3.1: Preliminary short report. Specifications of the long test runs (CEA, +9)

D1.3.2: Intermediate progress report on injector status and proposed test schedule (CEA, +18)

D1.3.3: Final report on results and analysis (CEA, +39)



TASK 1.3.2

GOAL:

Evaluation of room-temperature cavities and superconducting cavities performances, reliability and cost. Determination of the energy transition from where on doubling of the injector is no longer required for reliability.

CO-ORDINATING CONTRACTOR:

CNRS (F) – *Tomas Junquera*

MILESTONES:

M1.3.5: Specifications for prototypes (+6)

M1.3.6: Prototypes ready for test (+27)

M1.3.7: Experimental results of prototypes performances (+39)

M1.3.8: Final report: synthesis and design proposals (+42)

DM1 DESIGN WP1.3 - Accelerator	Task 1.3.2 Assessment of the reliability performances of the intermediate energy accelerating components		
	Cons. k€	PM	Total k€
P5-CEA (F)	0	1	10
P8-CNRS (F)	50	24	290
P13.4-IAP-FU (D)	70	24	310
P13.12-UPM (SP)	0	0	0
P18-IBA (B)	170	15	320
P19-INFN (I)	0	0	0
P21-ITN (P)	0	0	0
P31-FANP GmbH (D)	0	0	0
Total WP1.3	290	64	930

DELIVERABLES:

D1.3.4: Preliminary report. Specifications of the prototypes (IAP_FU, +6)

D1.3.5: Intermediate report on prototype test schedules (IBA, +18)

D1.3.6: Final report: tests results, synthesis and design proposals (CNRS, +42)



TASK 1.3.3

GOAL:

Design, construction and test of a full prototypical cryomodule of the high energy section of the proton linac.

CO-ORDINATING CONTRACTOR:

INFN (I) – *Paolo Pierini*

MILESTONES:

M1.3.9: Preliminary cryomodule specifications (+9)

M1.3.10: Cryomodule design finalized (+15)

M1.3.11: Cryomodule is ready for test (+30)

M1.3.12: Experimental results of cryomodule performances (+39)

M1.3.13: Final report: synthesis and design proposals (+42)

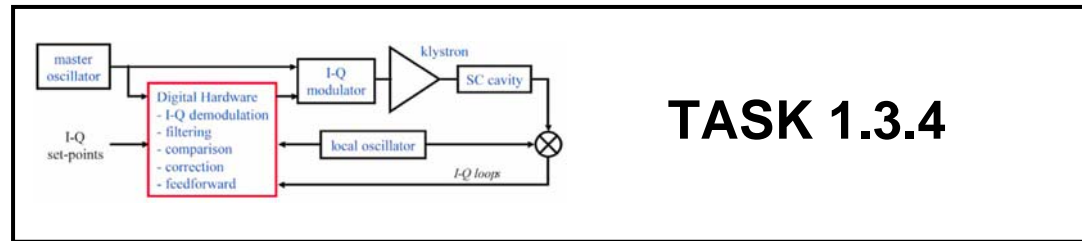
DM1 DESIGN WP1.3 - Accelerator	Task 1.3.3 Qualification of the reliability performances of a high energy cryomodule at full power and nominal temperature		
	Cons. k€	PM	Total k€
P5-CEA (F)	0	1	10
P8-CNRS (F)	100	80	900
P13.4-IAP-FU (D)	0	0	0
P13.12-UPM (SP)	0	0	0
P18-IBA (B)	0	0	0
P19-INFN (I)	440	60	1040
P21-ITN (P)	0	5	50
P31-FANP GmbH (D)	0	0	0
Total WP1.3	540	146	2000

DELIVERABLES:

D1.3.7: Preliminary report: specifications for the cryomodule (INFN, +9)

D1.3.8: Report on cryomodule design and schedule (CNRS, +15)

D1.3.9: Final report: test results, synthesis and design proposals (INFN, +42)



TASK 1.3.4

GOAL:

Modelling and VHDL analysis of a digital RF control system for fault tolerant operation of the linear accelerator (*prototyping of an RF control unit is strongly recommended*).

CO-ORDINATING CONTRACTOR:

CEA (F) – Michel Luong

MILESTONES:

M1.3.14: Preliminary RF control system specifications (+6)

M1.3.15: RF control system modelling (+24)

M1.3.16: Final report: VHDL architecture and synthesis (+42)

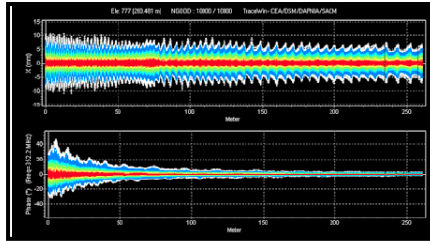
DM1 DESIGN WP1.3 - Accelerator	Task 1.3.4 Conceptual design of an RF control system for fault tolerant operation of the linear accelerator		
	Cons. k€	PM	Total k€
P5-CEA (F)	10	15	160
P8-CNRS (F)	0	5	50
P13.4-IAP-FU (D)	0	0	0
P13.12-UPM (SP)	0	0	0
P18-IBA (B)	0	1	10
P19-INFN (I)	10	0	10
P21-ITN (P)	0	0	0
P31-FANP GmbH (D)	0	0	0
Total WP1.3	20	21	230

DELIVERABLES:

D1.3.10: Preliminary specifications of the RF control system (CEA, +6)

D1.3.11: Report on RF control system modelling (CEA, +24)

D1.3.12: Final report: VHDL architectures and synthesis (CEA, +42)



TASK 1.3.5

GOAL:

Overall coherence of the accelerator design, including beam dynamics simulations, integrated reliability analysis, accidental scenarios, beam line design and cost estimation.

CO-ORDINATING CONTRACTOR:

CNRS (F) – *Jean-Luc Biarrotte*

MILESTONES:

M1.3.17: General specifications (+6)

M1.3.18: WP1.3 overall task review (+18)

M1.3.19: Results of beam dynamic simulations (+30)

M1.3.20: Reliability study experimental results (+39)

M1.3.21: Integrated reliability analysis (+45)

M1.3.22: Cost Analysis (+45)

M1.3.23: Final report (+48)

DM1 DESIGN WP1.3 - Accelerator	Task 1.3.5		
	Overall coherence of the accelerator design, final reliability analysis, cost estimation of XT-ADS and EFIT		
	Cons. k€	PM	Total k€
P5-CEA (F)	20	12	140
P8-CNRS (F)	30	14	170
P13.4-IAP-FU (D)	5	3	35
P13.12-UPM (SP)	3	4	43
P18-IBA (B)	12	4	52
P19-INFN (I)	30	5	80
P21-ITN (P)	10	5	60
P31-FANP GmbH (D)	3	2	23
Total WP1.3	113	49	603

DELIVERABLES:

D1.3.13: General specifications for all the tasks (CNRS, +6)

D1.3.14: Beam dynamics simulations for fault tolerance (CNRS, +30)

D1.3.15: Report on integrated reliability analysis of the accelerator (INFN, +48)

D1.3.16: Final report: accelerator design, performances, costs for XT-ADS and EFIT and associated road map (CNRS, +48)

Beyond EUROTRANS... XT-ADS @ Mol ?

