



MedAustron Beam Intercepting Devices

BID Workpackage Review

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15 March 2012

Speakers:

Ramon FOLCH – EN/STI - WP holder Asen CHRISTOV – EN/STI – FLUKA expert Melanie DELONCA – EN/STI – Mechanical Engineer Manuel FURTINGER – MedAustron – Mechanical Designer

PIMS: PP-120315-a-RFO EDMS: 1203528



Objectives of this Review

- 1. Visit the design status of the BIDs with respect to MedAustron's specifications
- 2. Report about the progress on the BIDs workpackage and validate the work planned





Agenda

- I. Workpackage overview R. Folch (25' + 5')
- II. Functional requirements of the BIDs R. Folch (5' + 5')
- III. FLUKA simulations A. Christov (15' + 5')
- IV. Thermo-mechanical analysis M. Delonca (25' + 5')
- V. BREAK (15')
- V. Conceptual and detailed design M. Fürtinger (25' + 5')
- VI. Controls for movable BIDs R. Folch (10' + 5')
- VII. Manufacturing strategy R. Folch (15')
- VIII. Discussion All (15')

End 12:00



I. Workpackage Overview

- MedAustron Facility
- Beam Intercepting Devices
- BID workpackage
 - Scope and organization
 - Quality assurance
 - Work plan and schedule
 - Progress status



MedAustron Facility



Wiener Neustadt (A)



A therapy and research center based on synchrotron proton and carbon-ions beams

3 irradiation rooms for clinical purpose

- Protons < 250 MeV
- ${}^{12}C^{6+}$ ions < 400 MeV/u
- 1 irradiation room for physics purpose
 - Protons < 800 MeV
 - ${}^{12}C^{6+}$ ions < 400 MeV/u



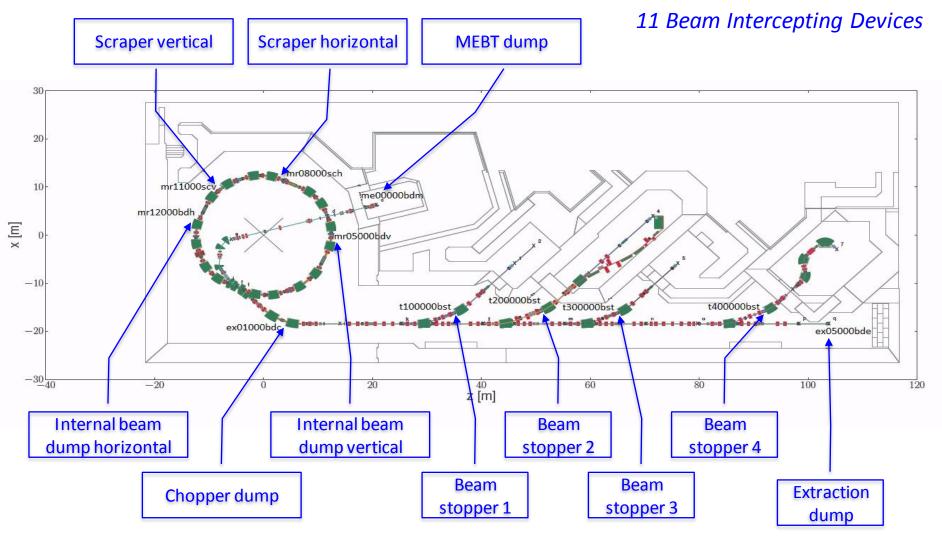


- LEBT, MEBT, injection line
 - 7MeV/u for both particles
- Synchrotron
 - 3e10 protons < 800 MeV</p>
 - 1.5e9 C-ions < 400 MeV/u
 - Revolution 0.2μs (extr.), 2μs (inj.)
- HEBT line
 - Spill duration 0.1s to 10s
 - Repetition rate 1Hz





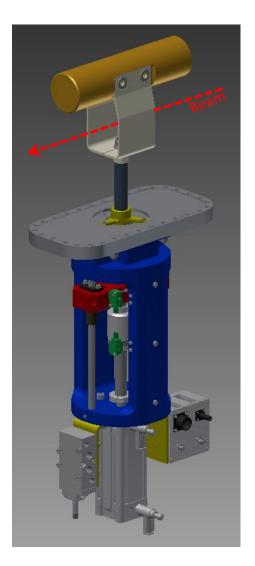
BIDs in the MedAustron Facility





BDM - MEBT Dump

- Number and location
 - One device
 - Located inside the linac bunker
- Function
 - To allow the operation of the linac while the synchrotron is open for access
- Design
 - Movable device, two positions
 - Pneumatic actuation
 - Fail-safe position into the beam
 - Material of the intercepting block: W

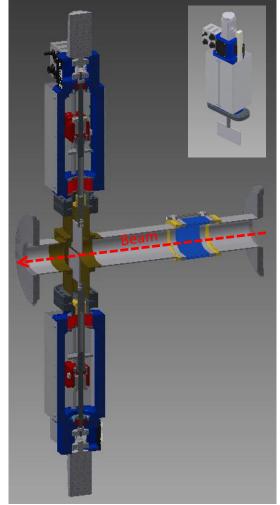






SCH/SCV - Scrapers

- Number and location
 - Two pairs of scrapers: 1 horizontal, 1 vertical
 - Located in the main ring of the synchrotron
- Function
 - To suppress the beam halo and to reduce the beam dimension (during injection)
 - To measure (scan) the beam dimension and profile during commissioning
- Design
 - Movable devices (continuous)
 - Electrical motors
 - Material of the intercepting plates: Cu / Al

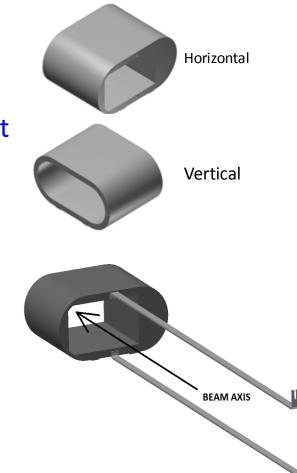






DBH/DBV - Internal Dumps

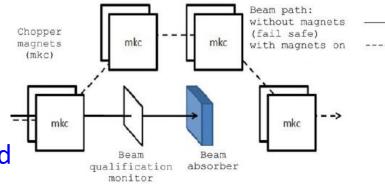
- Number and location
 - Two devices: 1 horizontal, 1 vertical
 - Located in the main ring of the synchrotron
- Function
 - Horizontal: intercept particles degraded by the scrapers and dump particles that are not extracted once the dipoles ramp up
 - Vertical: intercept the beam dumped on request via a closed orbit bump
- Design
 - Fixed device
 - Inserted in the vacuum chamber
 - Material of the intercepting block: W

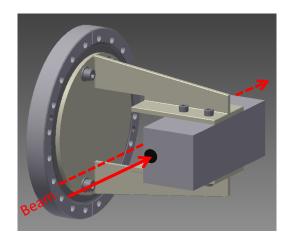




BDC - Chopper Dump

- Number and location
 - One device
 - Located in extraction line
- Function
 - To intercept the 10% of the extracted beam of each spill for clinical purpose
 - Once stabilized the beam is shifted horizontally by the chopper magnets
- Design
 - Fixed device
 - Inserted in a vacuum tank
 - Material of the intercepting block: graphite and W

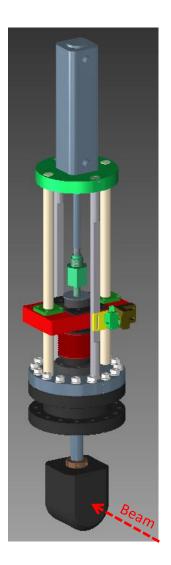






BST - Beam Stoppers

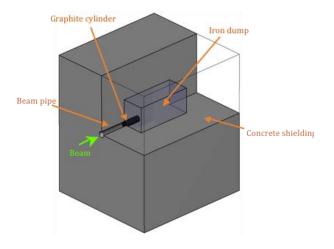
- Number and location
 - One BST in each of the four irradiation rooms
 - Located inside the extraction line hall between the 2 switching dipoles, upstream each of the 4 irradiation rooms
- Function
 - To protect the irradiation room from unintended beam. The secondary shower will be dumped into the last dipole
- Design
 - Movable device, two positions
 - Pneumatic actuation
 - Fail-safe position into the beam
 - Material of the intercepting block: W





BDE - EX Beam Dump

- Location
 - One device
 - Located at the end of the main extraction line
- Function
 - The beam will be directed to the BDE for commissioning purposes or to verify the accelerator performance
- Design
 - Fixed device
 - Material of the intercepting block: graphite + iron + concrete





Scope of the BID workpackage

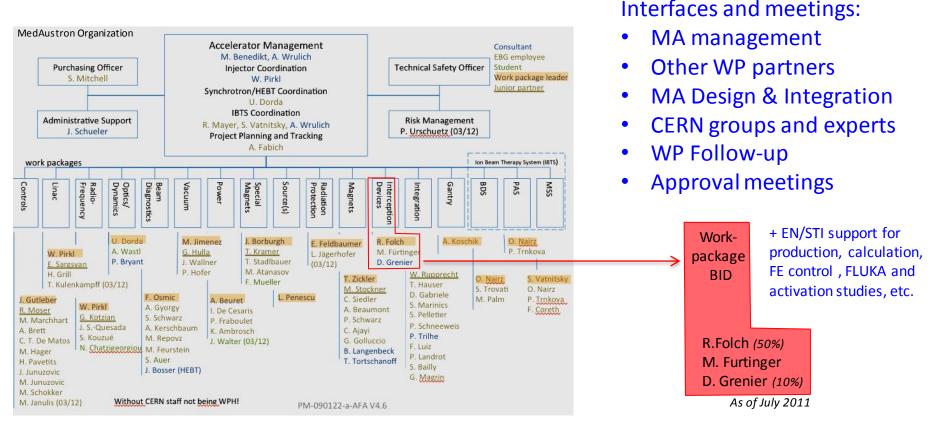
- 11 Beam Intercepting Devices grouped in 3 families
 - Dumps (MEBT dump, MR dumps, Chopper dump, HEBT dump)
 - Scrapers
 - Beam stoppers
- Conceptual design based on CNAO existing BIDs
 - 3D models
 - Thermo-mechanical verifications
- Follow-up of
 - Detailed design
 - Manufacturing/procurement of critical components
 - Final assembly and testing
 - Front end controls
- Expertise support on controls
- FLUKA simulations whenever required
- Not included in the WP
 - Low level and high level electronic controls
 - Vacuum tanks and chambers
 - Integration and installation

Workpackage agreement

Document: PM-100901-a-OAB Formal start by EN/STI: July 2011



WP Organization Scheme



Reporting to MedAustron and EN/STI management

EN

ST



Budget and Resources

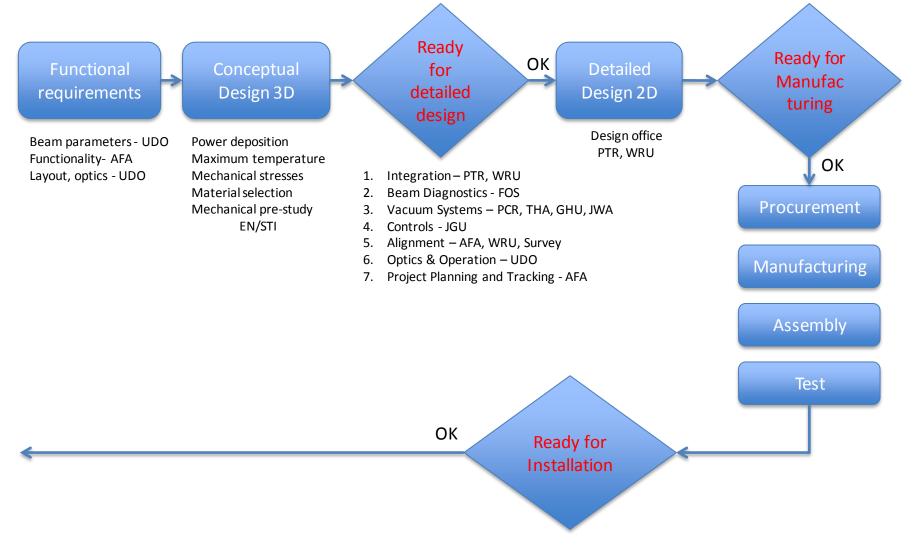
- The WP budget is 1.6 MCHF (avg. 145kCHF/type)
 - Material
 - Raw material and supplies
 - Manufacturing (EN/MME or procurement)
 - Tooling, treatments
 - Manpower
 - WP management 0.5 FTE
 - 3D models and pre-design work 1FTE
 - Assembly and test 1 FTE (FSU)
- EN/STI support, studies and calculations (1 FTE)
- Other related activities supported by MedAustron



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BID WP - Quality Assurance Flow Scheme





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Document Management

PIMS Project Information Management System

EDMS Electronic Document Management System

Project Information and Management System ebg MedAustro									
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1064927 v.2	PROCEDURE D'ACCES AUX PONTS ROULANTS PAR ECHELLES A CRINOLINES EN SMI2	Released
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1093449 v.1	Summary of RSO coffee meeting Wednesday 25 August 2010	Released
Doc. page	Summary_of_RSO_coffee_meeting_Wednesday_ 25_August_2010 docx (i8 xb)	
1105581 v.1	Installation MUX	In Work
Doc. page	090722_01_A4 <u>pdf</u> (501 кb)	
1126632 v.1	TECHNICAL SPECIFICATION FOR THE AIR CONDITIONING SYSTEM	In Work
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1151431 v.1	INSTALLATION DES GAINES EN VOUTE TNC ET DIMR	In Work
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1154161 v.1	Compte Rendu No. 01 de la réunion de coordination des travaux EN, pour le projet de consolidation de l'infrastructure de la CCC/CCR du 16.06.2011	Released

MedAustron

CERN



WP Documentation Handling

- PIMS is the standard documentation management system by MedAustron project
- EDMS is the reference EN department system for the approval, issuing and archiving all official documents
- This workpackage involves both MedAustron and CERN commitments. So, for those documents involving CERN responsibility, we shall use EDMS in addition to PIMS



Naming convention

Reference document	BDEBeam dump end of EXBDHBeam dump MR horizontalBDVBeam dump MR verticalBDCBeam dump chopper		
ebg <i>Med</i> Austron 2700 Wiener Neustadt - Austria	DOCUMENT ID REV. NO. STATUS D81117-a-UDO 9.4 DRAFT		BDMBeam dump MEBTBSTBeam stopper (T1-T4)SCHScraper horizontalSCVScraper vertical
	Date: 2011-08-15	Beam lines	TS Injector teststand short TL Injector teststand short B1 Test bench 1 B2 Test bench 2 S1 Source 1, Starting at reference point W, up to the entrance to the switching dipole
Engineerin	g specification		 Source 2, Starting at reference point X, up to the entrance to the switching dipole Source 3, Starting at reference point X, up to the entrance to the switching dipole Source 4, Starting at reference point Y, up to the entrance to the switching dipole LEBT, From including the first switching dipole till the entrance of the RFQ Linac, From RFQ entrance to the end of the stripping foil tank ME MEBT, From linac exit to Main Ring injection point MR Main ring + Btrain magnet EX main extractionline, From extraction point of the main ring till incl. beam dump T1 irradiationline, T1 is the research room beam line with horizontal beam delivery. Lines s
Naming cor	vention of the	and ends at the irradiation rooms isocenter T2 irradiationline, T2 is the first part of the beam line to the treatment room with horizontal end of the switching dipole from EX and ends at the exit of the switching dipole to V2. H2 irradiationline, straight extension of T2	
MedAustron ac	celerator complex		 P2 irradiationline, Stagint extension of 12 V2 irradiationline, C1 is the vertical beam line to the treatment room with vertical and horize switching dipole from T2 T3 irradiationline, T3 is the medical beam line with horizontal beam delivery. Line starts fro at the irradiation rooms iso-center. T4 irradiationline, T4 is the proton gantry beam line. Line starts from the end of the switchin iso-center. T5 irradiationline, T5, containing the ion gantry is not part of the baseline layout. In anticipa can be used, Line starts from the end of the switching dipole from EX and ends at the ir
15.03.12		Accelerator	PO power converter CS control system BD beam diagnostic RF radio frequency O optics/operation SM Special magnets MA normal magnets Pradiation protection VA Vacuum SB Beam delivery System GA gantry SR Sources ID Interception devices IS interlock system

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WP coordination meetings

- MAMBO (weekly)
- Approval meetings (design)
- Integration meetings
- Vacuum / BID meetings
- Ad-hoc meetings
- Work plan and actions follow-up (weekly)

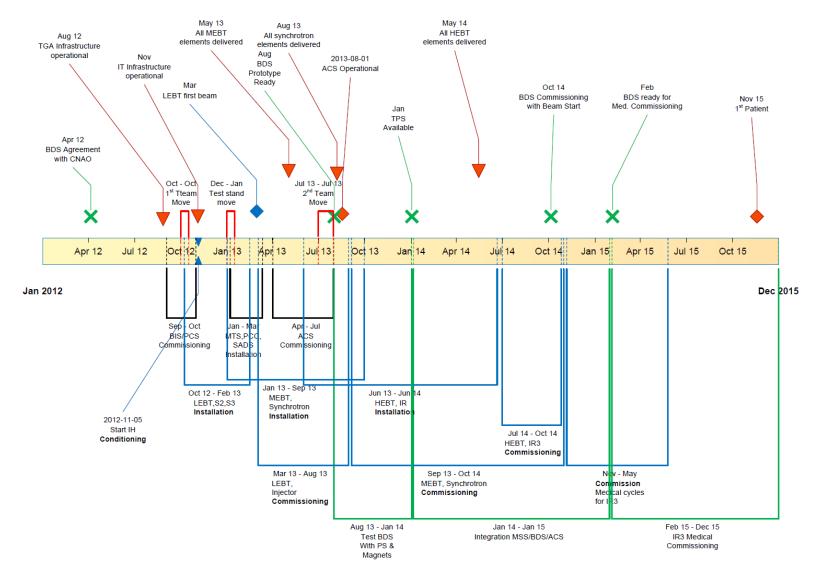
I prity	•	Action list (last update 09.03.12)	Resp.	Due date	Progress	•	MEBT dum 🖵	Scrapers	Beam stopp	Internal beam dum	Choper dum 🚽	Extr. dum 🖵	<u>St</u>
1	11	Prepare drawings of the scraper plates	MFU	26.01.12				х					.
1	6	Explore the sourcing of the actuator system	MFU	01.02.12	See Fadmar after all data is prepared.		х						
1	1	Select and procure Screw lockers for testing	MFU	09.03.12	In progress. Untightening test to be done with Fred		х	х	х	х	х	х	.
1	25	Check the position of the rods +bellows w.r.t. beam direction	MFU	09.03.12						х			
1	24	Can we accept 8 mm less for the SCV-A chamber (email J. Wallner	MFU	11.03.12	Check in the integration meeting 11.03.12			х					
1	9	Calculations of screws (max torque, temperature. Etc.)	MFU	15.03.12	check with expansion of dump and melanie values		х						.
1	10	Dynamic efforts assessment	MFU	15.03.12	3 seconds max, Ansys for the fork		х						
1	18	Presentation of the design for the review of the 15.03.11	MFU	15.03.12	draft for the 2nd of March		х	х	х	х	х	х	
1	26	Ask the feasibility of the Internal dumps (drawing)	MFU	16.03.12						х			
1	28	Agree on the location of the patch panels	RFO	16.03.12	Intergration team, Sébastien		х		х				1
2	20	Prepare and update drawings for Mebt dump	MFU	23.03.12	detailed drawings		x						
2	13	Prepare the design study of the scrapers and the internal dumps	MFU	23.03.12	Size int dumps / Round flanges Scrapers / BST /			х	х	х	х		
2	23	Assembly procedure of MEBT-Dump	MFU	23.03.12			х						1
2	27	Provide the 3D model of the DBV and DVH (approval review)	MFU	23.03.12						x			
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MedAustron main Schedule (January 2012)





Workpackage detailed Schedule (March 2012)

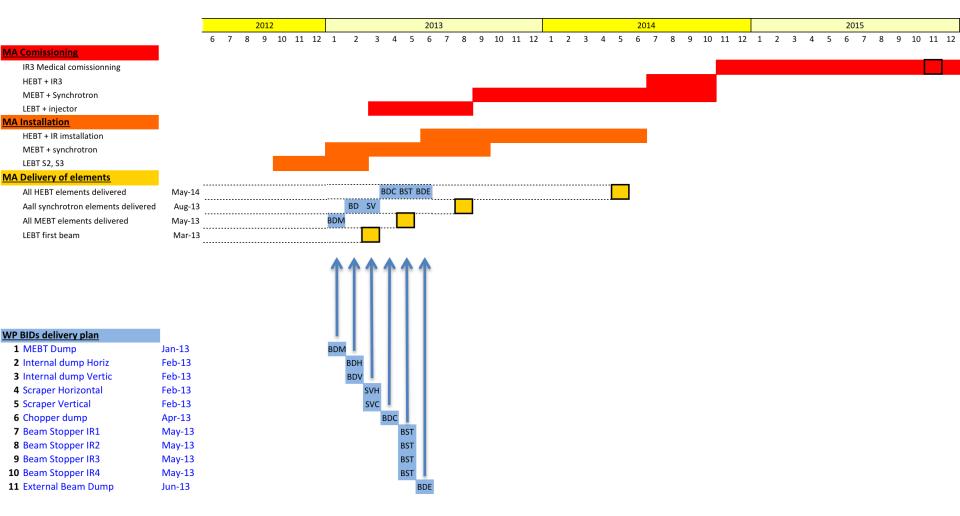
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21 Design approval MA 04/07/12 03/08/12 10 days 0% 22 Detailed design EN/STI 06/08/12 28/09/12 40 days 0% 23 Procurement EN/STI 01/10/12 07/12/12 50 days 0% 24 Manufacturing EN/ME 01/10/12 09/11/12 30 days 0% 25 Metrology EN/STI 10/12/12 18/01/13 30 days 0% 26 Assembly EN/STI 10/12/12 18/01/13 30 days 0% 27 Test EN/STI 12/10/13 15/02/13 20 days 0% 28 Acceptance and Delivery EN/STI 12/01/13 15/02/13 20 days 0% 29 * Scrapers 30/11/11 28/02/13 344 days 17% 43 * Chopper Dump 01/05/12 30/61/3 321 days 9% 56 * Beam Stoppers 16/01/12 31/05/13 347 days 11% 70 * EX Dump 01/05/12 30/61/3 291 days 10% <td>19</td> <td>Mechanical calculations</td> <td>EN/STI</td> <td>14/03/12</td> <td>08/05/12</td> <td>40 days</td> <td>25%</td> <td>Mechanical calculations</td>	19	Mechanical calculations	EN/STI	14/03/12	08/05/12	40 days	25%	Mechanical calculations
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23 Procurement EN/STI 01/01/2 07/12/12 S0 days 0% 24 Manufacturing EN/MME 01/01/2 09/11/2 S0 days 0% 25 Metrology EN/STI 01/10/2 09/11/2 S0 days 0% 25 Metrology EN/STI 10/11/2 30/11/2 15 days 0% 26 Assembly EN/STI 10/12/12 18/01/3 30 days 0% 27 Test EN/STI 21/01/13 15/02/13 20 days 0% 28 Acceptance and Delivery EN/STI 22/02/13 28/02/13 5 days 0% 29 * Scrapers 30/11/1 28/02/13 304 days 1% 43 * Chopper Dump 01/02/12 30/04/13 312 days 9% 56 * Beam Stoppers 16/01/12 31/05/13 347 days 11% 70 * EX Dump 01/05/12 30/61/3 291 days 10% 4 Im Im Im Im Im	21	Design approval	MA	04/07/12	03/08/12	10 days	0%	Design approval
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	56	* Beam Stoppers		16/01/12	31/05/13	347 days	11%	
	70	± EX Dump		01/05/12	30/06/13	291 days	10%	
	4						•	
	Ready	Rew Tasks : Auto Scheduled						



ebg MedAustron



Main schedule / WP schedule





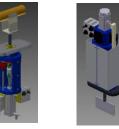
WP Progress dashboard

Beam specification Conceptual design **Functional specification** Pre-calculation **FLUKA** studies Detailed calculations Approval 3D model Detailed design Driving system definition Control definition (XML) Materials ordering Manufacturing Assembly Final test **Delivery target**

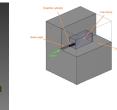
Done In progress Stand-by Not started

CERN

	MEBT	Scrapers	Internal	Chopper	Beam	Extraction
	Dump		Dumps	Dump	stoppers	Dump
	BDM	SCV & SVH	BDH & BDV	BDC	BST 1-4	BDE
MedAustron						
Manuel						
Ramon						
Melanie/Manuel						
Asen		Not required	Not required		Not required	Not required
Melanie/Manuel						
Manuel						
Manuel						
Ramon			Not applicable	Not applicable		Not applicable
Ramon		Not applicable	Not applicable	Not applicable		Not applicable
WP BID						
WP BID						
WP BID						
WP BID						
WP BID	Jan 2013	Feb 2013	Feb 2013	Apr 2013	May 2013	June 2013











Agenda

https://indico.cern.ch/conferenceDisplay.py?confld=181008

- I. Workpackage overview R. Folch (25' + 5')
- II. Functional requirements of the BIDs R. Folch (5' + 5')
- III. FLUKA simulations A. Christov (15' + 5')
- IV. Thermo-mechanical analysis M. Delonca (25' + 5')
- V. BREAK (15')
- V. Conceptual and detailed design M. Fürtinger (25' + 5')
- VI. Controls for movable BIDs R. Folch (10' + 5')
- VII. Manufacturing strategy R. Folch (15')
- VIII. Discussion All (15')

End 12:00