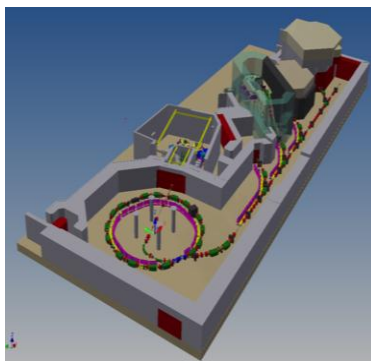


# MedAustron

## Beam Intercepting Devices

# BID Workpackage Review



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

# 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

<https://indico.cern.ch/conferenceDisplay.py?confId=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*

# I. Workpackage Overview

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

Wiener Neustadt (A)



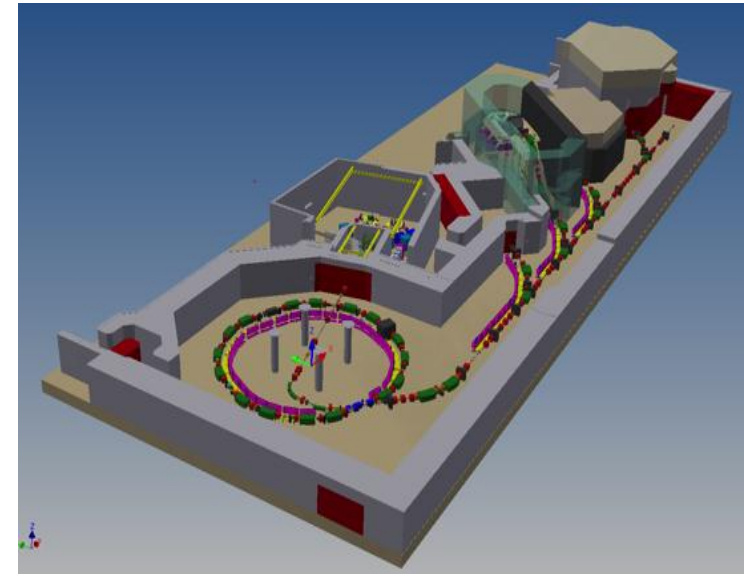
A therapy and research center based on synchrotron proton and carbon-ions beams

3 irradiation rooms for clinical purpose

- Protons < 250 MeV
- $^{12}\text{C}^{6+}$  ions < 400 MeV/u

1 irradiation room for physics purpose

- Protons < 800 MeV
- $^{12}\text{C}^{6+}$  ions < 400 MeV/u



- LEBT, MEBT, injection line
  - 7MeV/u for both particles
- Synchrotron
  - $3 \times 10^{10}$  protons < 800 MeV
  - $1.5 \times 10^9$  C-ions < 400 MeV/u
  - Revolution  $0.2 \mu\text{s}$  (extr.),  $2 \mu\text{s}$  (inj.)
- HEBT line
  - Spill duration 0.1s to 10s
  - Repetition rate 1Hz

Ground breaking: December 2010



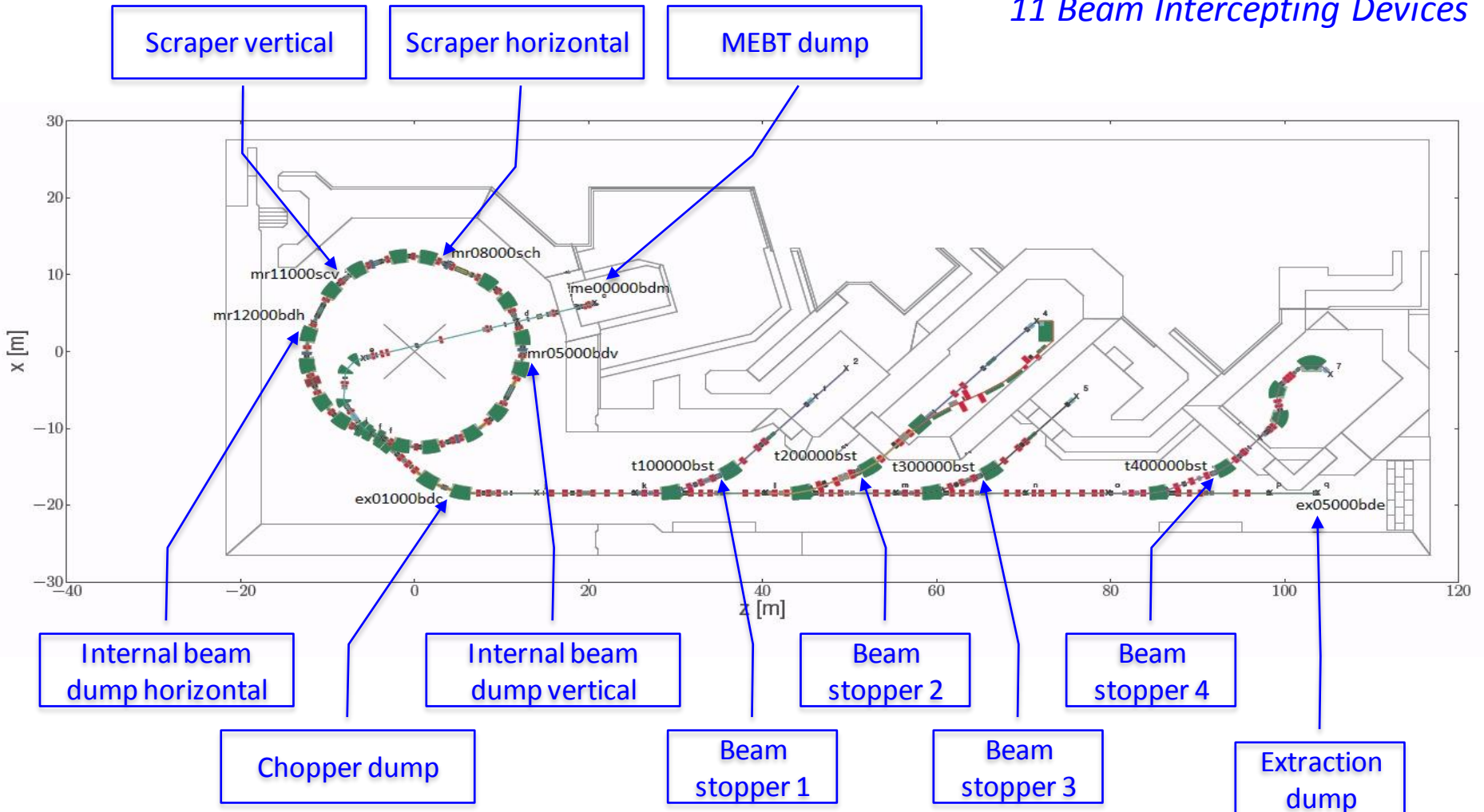
March 2012: structure almost completed



test facility at CERN

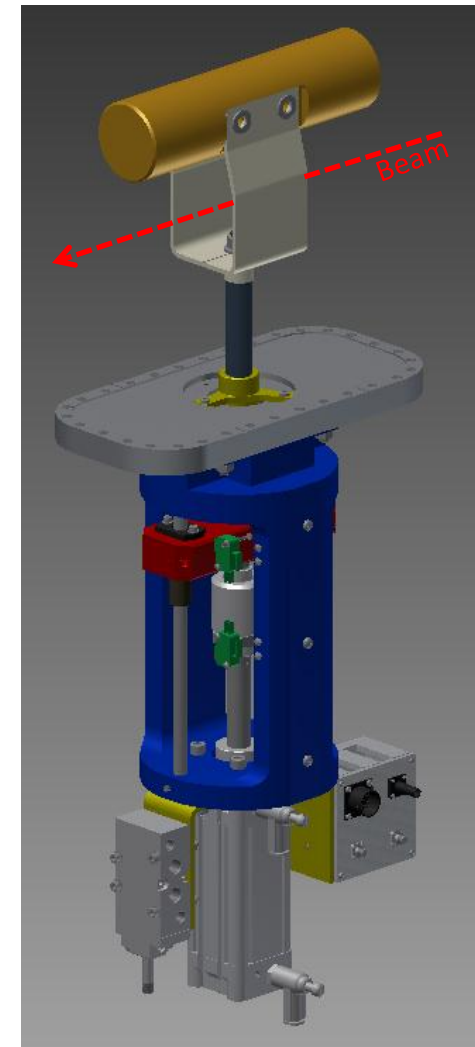
# BIDs in the MedAustron Facility

*11 Beam Intercepting Devices*



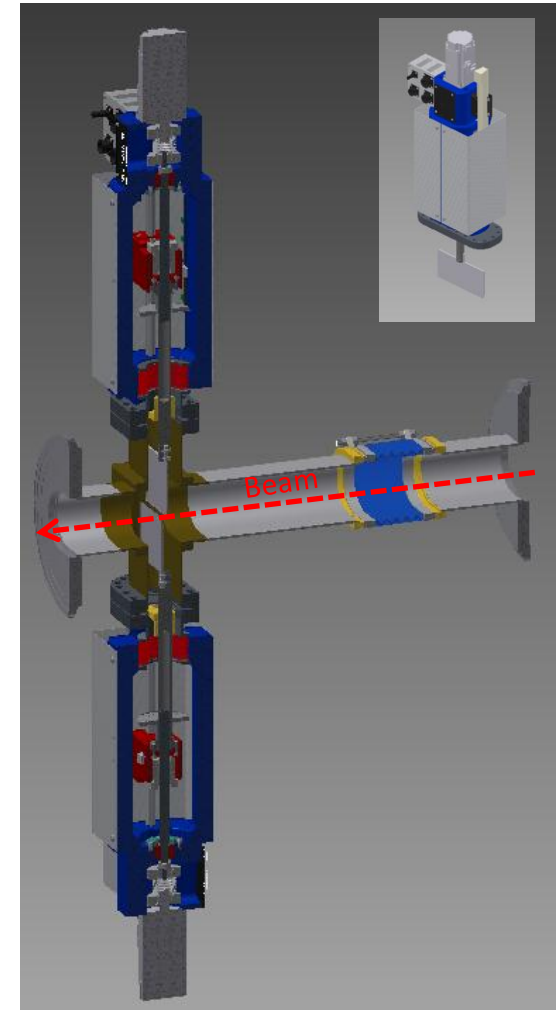
# BDM - MEBT Dump

- 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

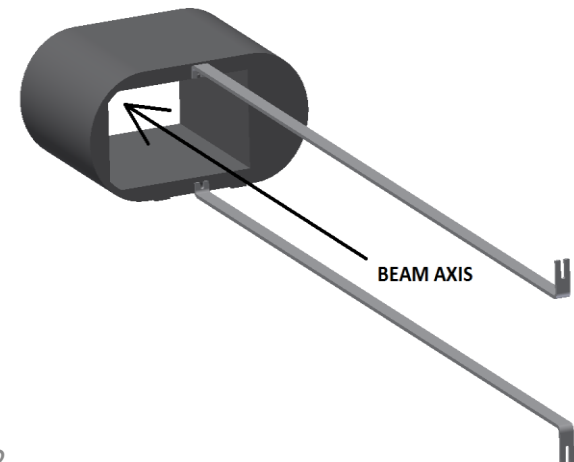
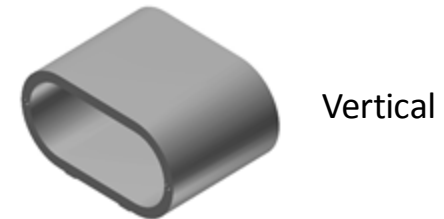
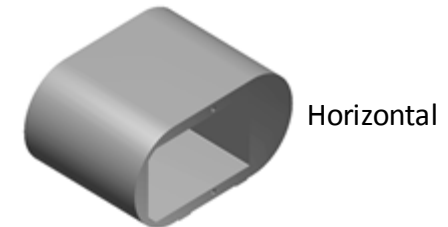
- Number and location
  - Two pairs of scrapers: 1 horizontal, 1 vertical
  - Located in the main ring of the synchrotron
- Function
  - To suppress the beam halo and to reduce the beam dimension (during injection)
  - To measure (scan) the beam dimension and profile during commissioning
- Design
  -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





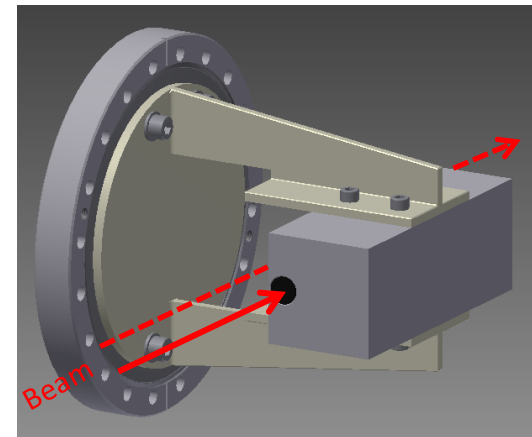
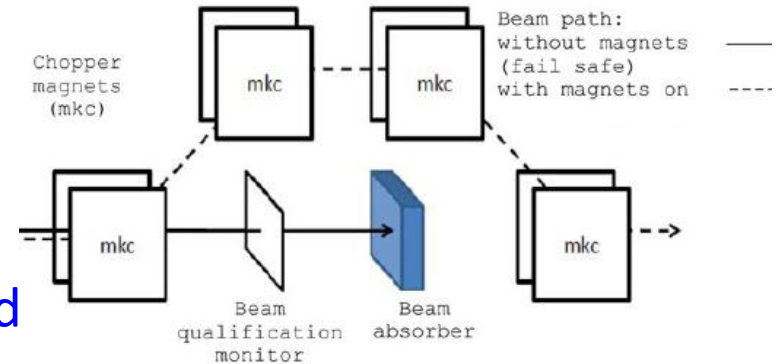
# DBH/DBV - Internal Dumps

- 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



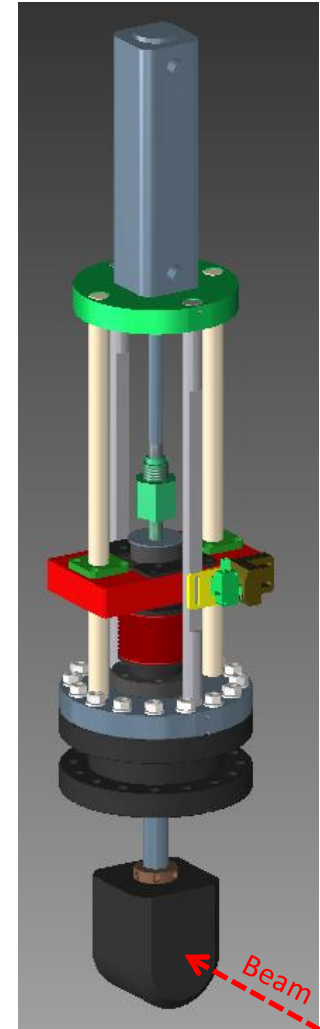
# BDC - Chopper Dump

- 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



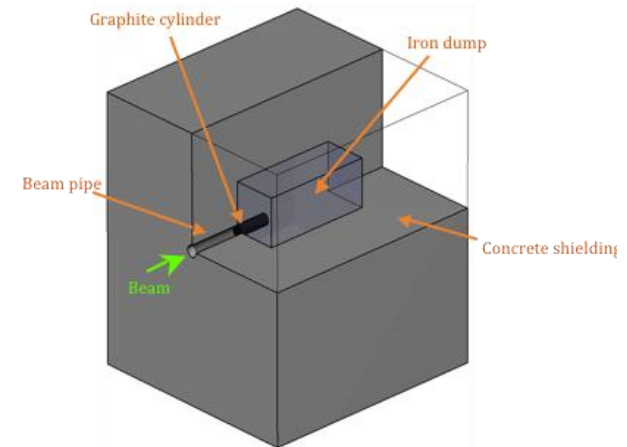
# BST - Beam Stoppers

- 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

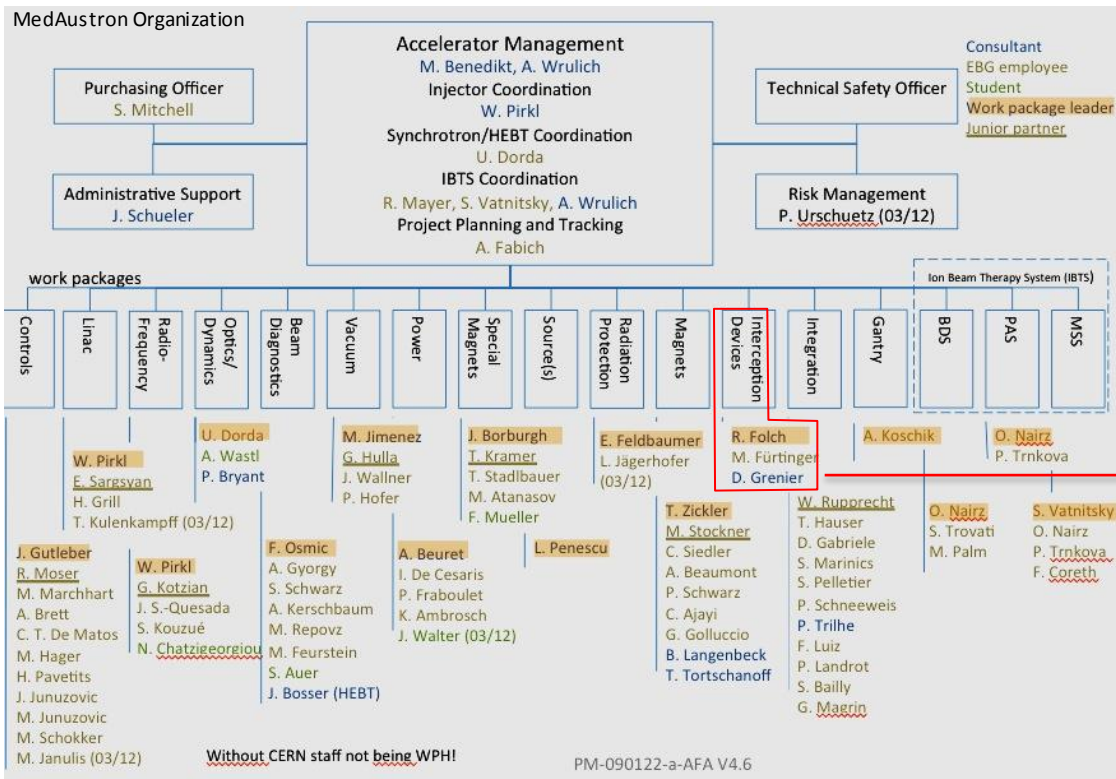
- 11 Beam Intercepting Devices grouped in 3 families
  - Dumps (MEBT dump, MR dumps, Chopper dump, HEBT dump)
  - Scrapers
  - Beam stoppers
- Conceptual design based on CNAO existing BIDs
  - 3D models
  - Thermo-mechanical verifications
- Follow-up of
  - Detailed design
  - Manufacturing/procurement 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

Interfaces and meetings:

- MA management
- Other WP partners
- MA Design & Integration
- CERN groups and experts
- WP Follow-up
- Approval meetings



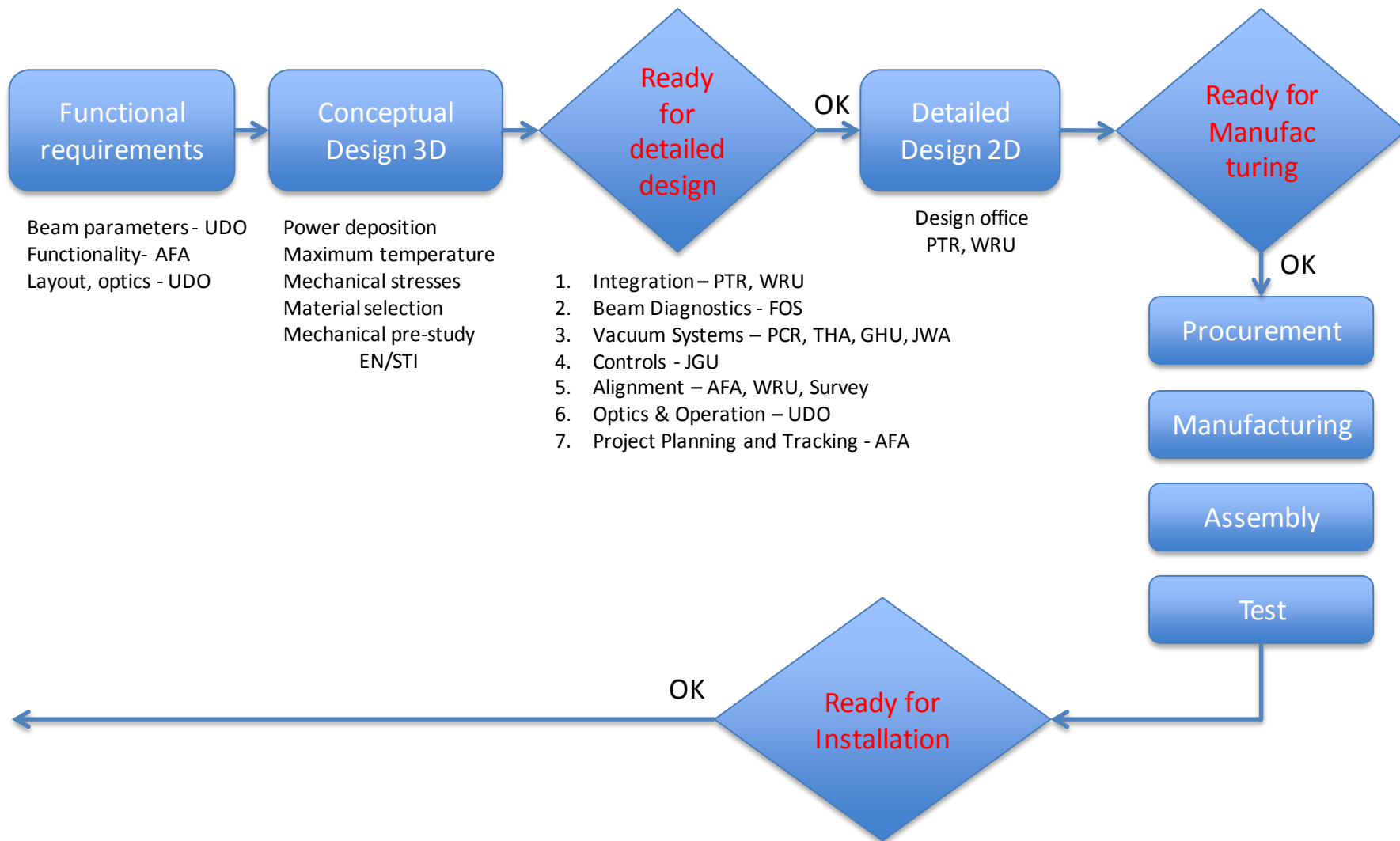
+ EN/STI support for production, calculation, FE control, FLUKA and activation studies, etc.

Reporting to MedAustron and EN/STI management

# 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

# BID WP - Quality Assurance Flow Scheme





# Document Management

**PIMS** Project Information Management System

**EDMS** Electronic Document Management System

Project Information and Management System ebg MedAustron

ME-080731-a-ADA your login 'Folch' has level 3 access File Upload | Mail | Project Terminology | Web Admin

PBS WBS OBS RBS Documents Activities Issues Dashboard At Hand

Code	Title	Date	Planned	In-work	Released	Obsolete
LE-120229-a-BAC	Einzelraumregulung - Ergaenzung	2012-03-02	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
MM-120210-a-ABT	Electrical measurements of PCB coils_Fluxmeter	2012-03-02	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
TS-101015-a-CGH	Cooling water for accelerator and auxiliaries	2012-03-02	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A-UE-L-10-Xx-200-001	LAGEPLAN AUSSENANLAGEN	2012-03-02	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
E-MO-G-09-Xa-560-211	Schwachstrom E09	2012-03-02	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
E-MO-G-09-Xa-560-212	Schwachstrom E09	2012-03-02	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
E-MO-G-09-Xa-560-213	Schwachstrom E09	2012-03-02	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
E-MO-G-09-Xa-560-214	Schwachstrom E09	2012-03-02	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
LE-120229-a-ELI	Einreichung Schwachstrom E09	2012-03-02	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
TN-120118-a-SIB	Wasseraufbereitung Produktkatalog	2012-03-02	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
TN-120221-a-SIB	Blockschaltbild Wasseraufbereitung	2012-03-02	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
LE-120301-a-SIB	Einreichung Produktkatalog Wasseraufbereitung VO.2	2012-03-02	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
EN-120116-a-TSS	MKC preliminary data package from Danfysik	2012-03-01	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
EN-120130-a-TKR	Review - MKC preliminary data package from Danfysik	2012-03-01	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
TD-110905-a-TTO	MXZ-C main ring sextupoles	2012-03-01	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
EN-120229-a-TSS	MBH-B detailed design package	2012-03-01	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
ES-110804-a-SPE	Cable database - Optical Cables (LWL)	2012-03-01	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A-AB-G-10-Xa-200-032	Grundriss EG	2012-03-01	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
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TN-110502-a-WTO	Türliste	2012-03-01	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

MedAustron

EN Department

- EN-DH-DH
- EN Publications & Presentations
- Technical Committees
- EN Training Office
- EN-IOO - Departmental Office
- EN Safety
- EN-CV Cooling Ventilation
- EN-EL Electrical Engineering (ELG)
- EN-GMS - General Management & Secretariat
- EN-HE Handling Engineering
- EN-ICE - Industrial Controls & Electronics
- EN-MEF - Machines & Experimental Facilities
- EN-MME Mechanical & Materials Engineering
- EN-STI - Sources, Targets & Interactions
- GENERAL
- THEMIS
- Task Forces
- Projects
- Linac4
- EN-STI-EE
- EN-STI-EP
- EN-STI-RBS
- EN-STI-TCD
- AB-ATB-TCD Section
- Beam Intercepting Device Design
- General Criteria
- Dumps
- Targets
- Calimators
- References
- Data Collection

EDMS Project Page

Proj. Id: CERN-0000076703 v.0  
Eq. code: -  
In Work

EN Department

Documents in this node: 11

Doc ID	Title	Date	Status
1063495 v.1	SUI PID hot water / eau chaude FREA-103		In Work
1064927 v.2	PROCEDURE D'ACCES AUX PONTS ROULANTS PAR ECHELLES A CRINOLINES EN SM12		Released
1092612 v.1	Sludge Factory Bat 376 ENCV Background Info		Released
1093449 v.1	Summary of RSO coffee meeting Wednesday 25 August 2010		Released
1105581 v.1	Installation MUX		In Work
1126632 v.1	TECHNICAL SPECIFICATION FOR THE AIR CONDITIONING SYSTEM		In Work
1151431 v.1	INSTALLATION DES GAINES EN VOUTE TNC ET DIMR		In Work
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 CEC/CCR du 16.06.2011		Released

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

Beam Intercepting Devices

2700 Wiener Neustadt - Austria

DOCUMENT ID	REV. NO.	STATUS
ES-081117-a-UDO	9.4	DRAFT

Date: 2011-08-15

Engineering specification

**Naming convention of the  
MedAustron accelerator complex**

BDE	Beam dump end of EX
BDH	Beam dump MR horizontal
BDV	Beam dump MR vertical
BDC	Beam dump chopper
BDM	Beam dump MEBT
BST	Beam stopper (T1-T4)
SCH	Scraper horizontal
SCV	Scraper vertical

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  
 S2 Source 2, Starting at reference point V, up to the entrance to the switching dipole  
 S3 Source 3, Starting at reference point X, up to the entrance to the switching dipole  
 S4 Source 4, Starting at reference point Y, up to the entrance to the switching dipole  
 LE LEBT, From including the first switching dipole till the entrance of the RFQ  
 LI 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 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  
 V2 irradiationline, V2 is the vertical beam line to the treatment room with vertical and horizi 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 switchi iso-center.  
 T5 irradiationline, T5, containing the ion gantry is not part of the baseline layout. In anticip can be used. Line starts from the end of the switching dipole from EX and ends at the i

Accelerator

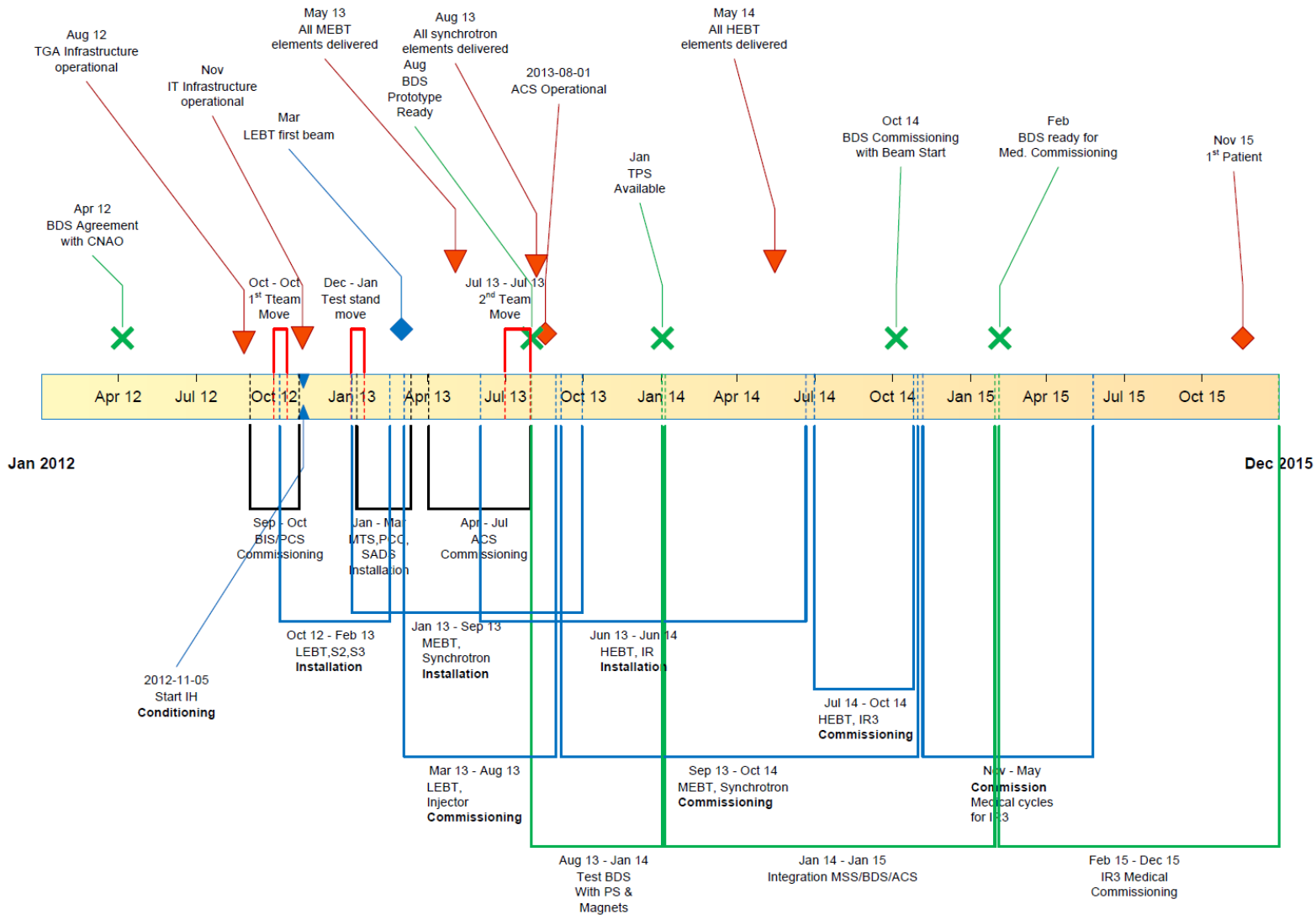
PO power converter  
 CS control system  
 BD beam diagnostic  
 RF radio frequency  
 OP optics/operation  
 SM Special magnets  
 MA normal magnets  
 RP radiation protection  
 VA Vacuum  
 BS Beam delivery System  
 GA gantry  
 SR Sources  
 ID Interception devices  
 IS interlock system

# WP coordination meetings

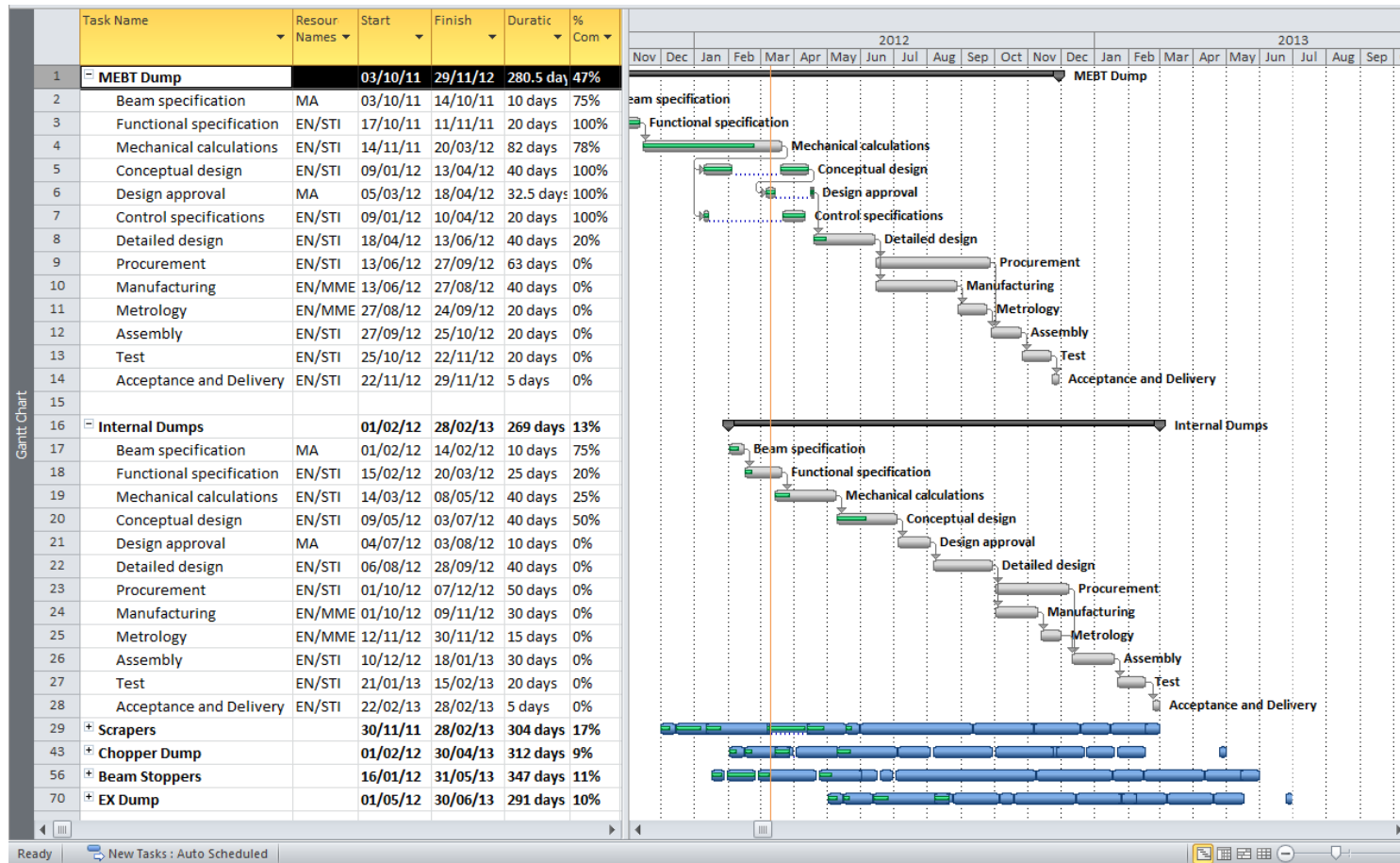
- MAMBO (weekly)
- Approval meetings (design)
- Integration meetings
- Vacuum / BID meetings
- Ad-hoc meetings
- Work plan and actions follow-up (weekly)

Priority	Action list (last update 09.03.12)	Respo.	Due date	Progress	MEBT dum	Scrapers	Beam stoppi	Internal beam dum	Choper dum	Extr. dum	Status
1	11 Prepare drawings of the scraper plates	MFU	26.01.12			x					...
1	6 Explore the sourcing of the actuator system	MFU	01.02.12	See Fadmar after all data is prepared.	x						...
1	1 Select and procure Screw lockers for testing	MFU	09.03.12	In progress. Untightening test to be done with Fred	x	x	x	x	x	x	...
1	25 Check the position of the rods +bellows w.r.t. beam direction	MFU	09.03.12					x			...
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		x					...
1	9 Calculations of screws (max torque, temperature. Etc.)	MFU	15.03.12	check with expansion of dump and melanie values							...
1	10 Dynamic efforts assessment	MFU	15.03.12	3 seconds max, Ansys for the fork							...
1	18 Presentation of the design for the review of the 15.03.11	MFU	15.03.12	draft for the 2nd of March	x	x	x	x	x	x	...
1	26 Ask the feasibility of the Internal dumps (drawing)	MFU	16.03.12					x			...
1	28 Agree on the location of the patch panels	RFO	16.03.12	Intergration team, Sébastien			x				...
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 /		x	x	x	x		...
2	23 Assembly procedure of MEBT-Dump	MFU	23.03.12		x						...
2	27 Provide the 3D model of the DBV and DVH (approval review)	MFU	23.03.12					x			...

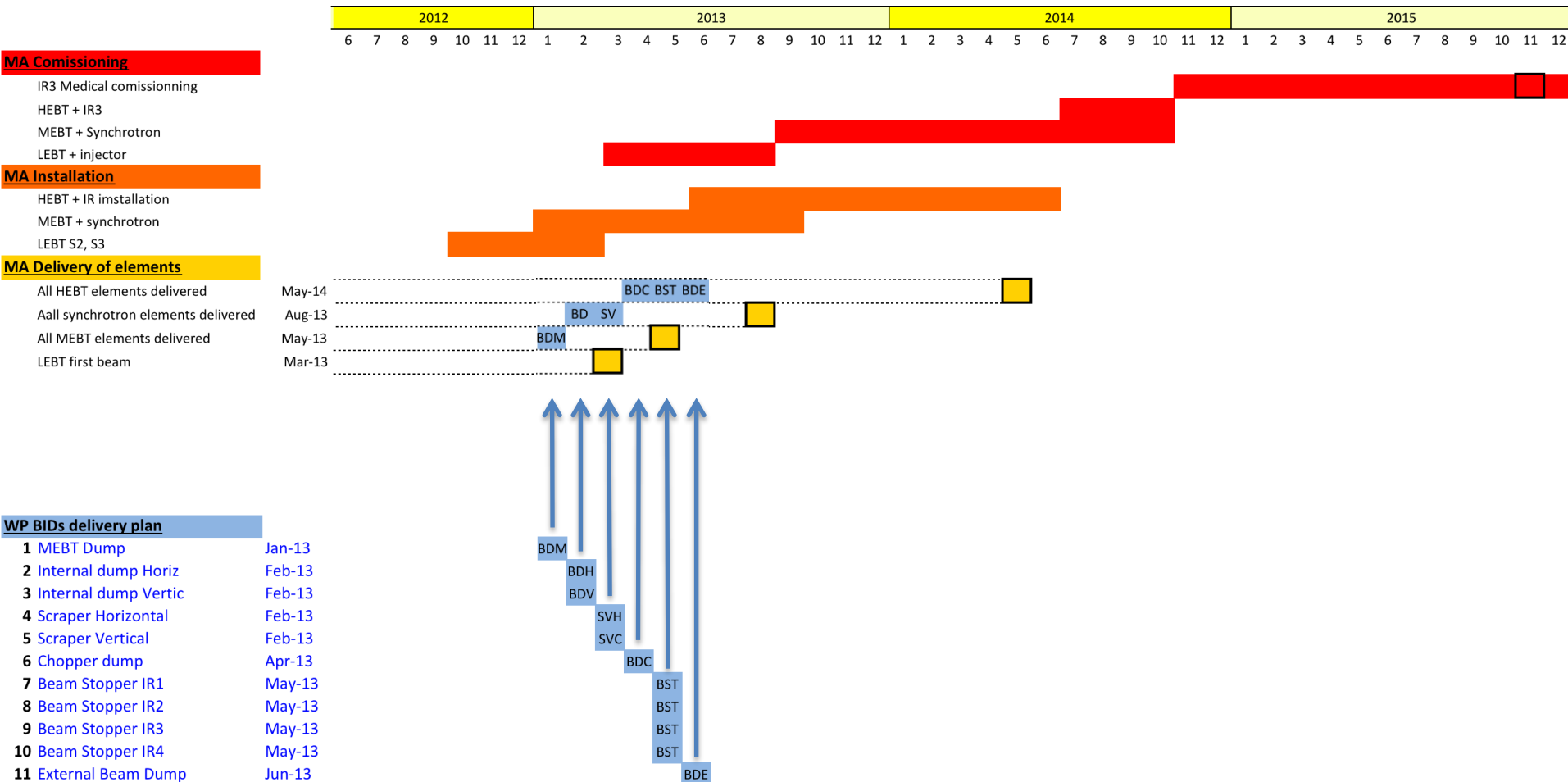
# MedAustron main Schedule (January 2012)



# Workpackage detailed Schedule (March 2012)



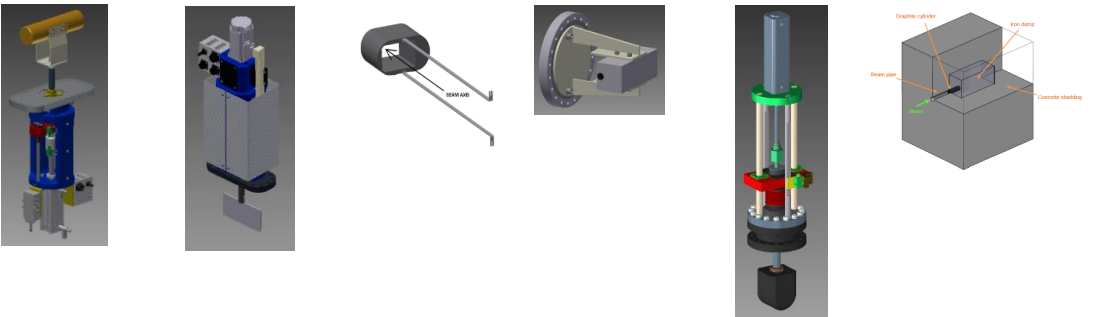
# Main schedule / WP schedule



# WP Progress dashboard

		MEBT	Scrapers	Internal	Chopper	Beam	Extraction
		Dump		Dumps	Dump	stoppers	Dump
		BDM	SCV B5VH	BDH BBDV	BDC	BST -4	BDE
Beam specification	MedAustron	Done	Done	Done	Done	Done	Done
Conceptual design	Manuel	Done	Done	Done	Done	Done	Done
Functional specification	Ramon	Done	In progress	In progress	Done	Done	In progress
Pre-calculation	Melanie/Manuel	Done	Done	Done	Done	Done	Done
FLUKA studies	Asen	In progress	Not required	Not required	In progress	Not required	Not required
Detailed calculations	Melanie/Manuel	In progress	Done	Done	Done	Done	Done
Approval 3D model	Manuel	Done	In progress	In progress	In progress	In progress	Done
Detailed design	Manuel	In progress	Done	Done	In progress	Done	Done
Driving system definition	Ramon	Done	Done	Not applicable	Not applicable	Done	Not applicable
Control definition (XML)	Ramon	Done	Not applicable	Not applicable	Not applicable	Done	Not applicable
Materials ordering	WP BID	Done	Done	In progress	Done	Done	Done
Manufacturing	WP BID	Done	Done	In progress	Done	Done	Done
Assembly	WP BID	In progress	Done	Done	Done	Done	Done
Final test	WP BID	Done	Done	Done	Done	Done	Done
Delivery target	WP BID	Jan 2013	Feb 2013	Feb 2013	Apr 2013	May 2013	June 2013

- Done
- In progress
- Stand-by
- Not started





# Agenda

<https://indico.cern.ch/conferenceDisplay.py?confid=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')
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- VII. Manufacturing strategy – R. Folch (15')
- VIII. Discussion – All (15')

*End 12:00*