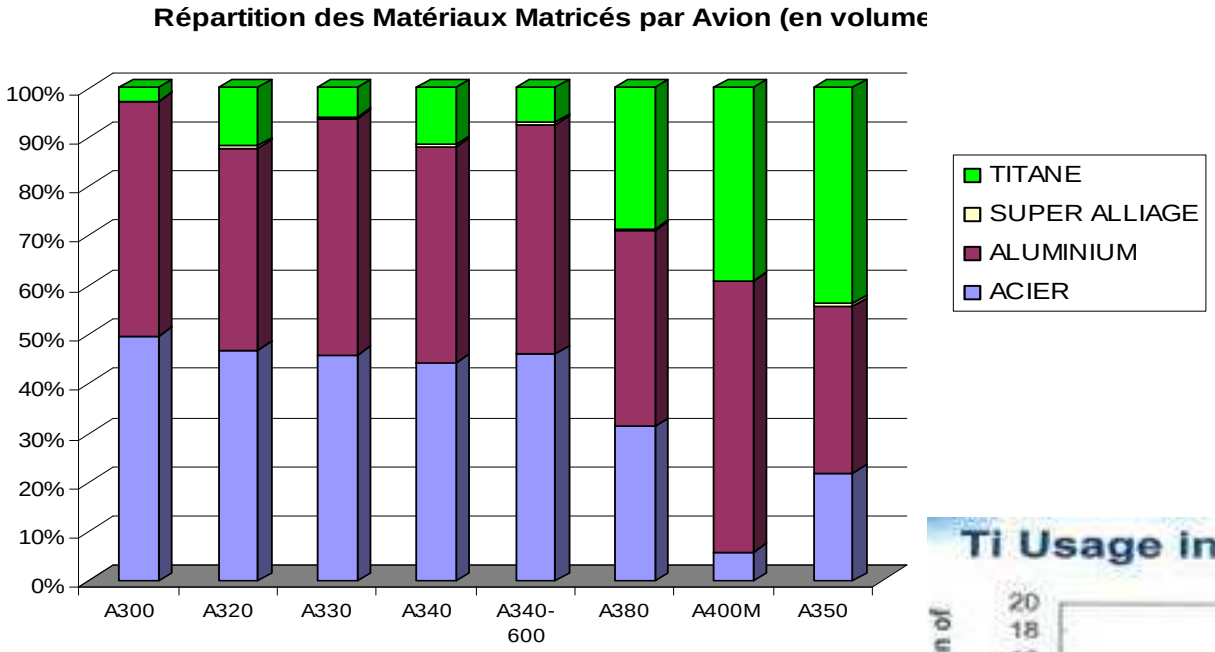
AUBERT&DUVAL

UKAD

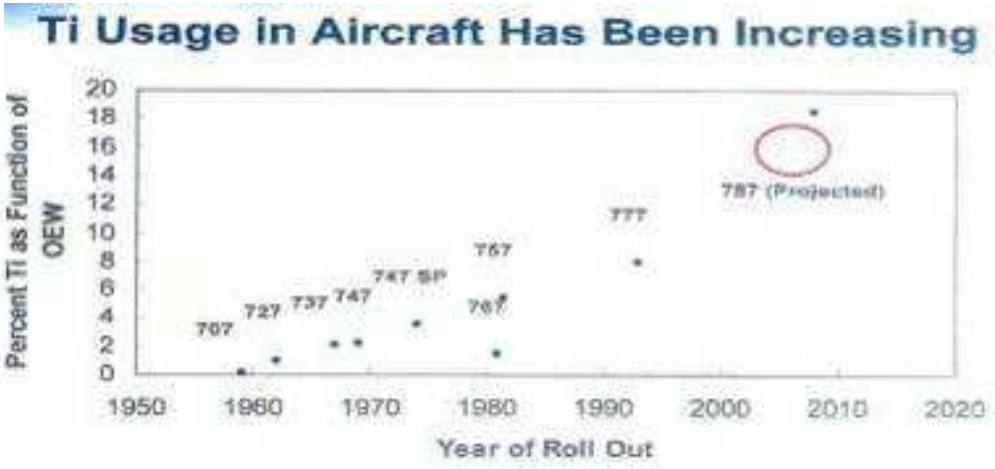
WHY UKAD

Growth of Titanium content in Airplanes



Airbus

Boeing



- Military Aircraft 9% (F-4) to 35% on Current Aircraft

Players on the Titanium Market

SPONGE INGOTS BILLETS CLOSED DIE FORGINGS

SOCIETE	PAYS	EPONGE		LINGOTS		BILLETTES	MATRICES
		KT 2005	KT 2010	KT 2005	KT 2010		
VSMPO-AVISMA	RUSSIE	28	42	24	35		
UKTMP	***KAZAKHSTAN***	22	24	0	10		
UKAD							
AD	***France***						
TOHO	JAPON	15	16	9	19		
SUMITOMO	JAPON	20	24	5	5		
TIMET	USA/UK/France	9	13	44	53		
ALLEGHENY+ UNITI	USA	0	5	33	38		
WYMAN	USA						
LADISH	USA						
FUCHS	Allemagne						
ZUN YI	CHINE	7	20				
FUSHUN	CHINE	2	8				
AUTRES	CHINE	8	28				
BAOTI	CHINE			5	12		
SHANGHAI N°5	CHINE			5	10		
AUTRES	CHINE			10	20		
AUTRES				12	12		

The UKAD project

- **50/50 Joint Venture between**
  - ARDOR HOLDING, commercial partner of UKTMP
  - AUBERT & DUVAL
- 2005 : **First order from AD to UKTMP**
- January 2006 : **First talks about the partnership**
- 08/02/2008 : **Signed Memorandum of Understanding with EADS Airbus**
- 24/12/2008 : **Creation of the UKAD company**

Quality Management System

UKAD
Comité Directeur :
B.M. SHAYAKHMETOV Président
G. DUVAL
S. GEHLER
A. PRIGOGINE
Y.C. RICCI
Ph. GUNDERMANN

DG : P. MORGEN
D Fi : H. ROUSSEL

A&D

Experts :
Direction Technique A&D (SM, labo,…)
Production : P. Delaborde
Méthodes : Y. Le Collen
Environnement : C. Poulet
Qualité et Progrès : I. Duret
RH : F. Kieffer
Sécurité : H. Reynoudt
…

ERAMET

ERAMET Ingénierie :
Chef de Projet : J.F. BART

Equipe projet

Directeur de projet :	P. CHOVET
Responsable Exploitation & Responsable Achats :	C. REBILLON
Chef de Projet Travaux Neufs :	D. CAILLOT
Qualité :	I. DURET / G.DUVAL

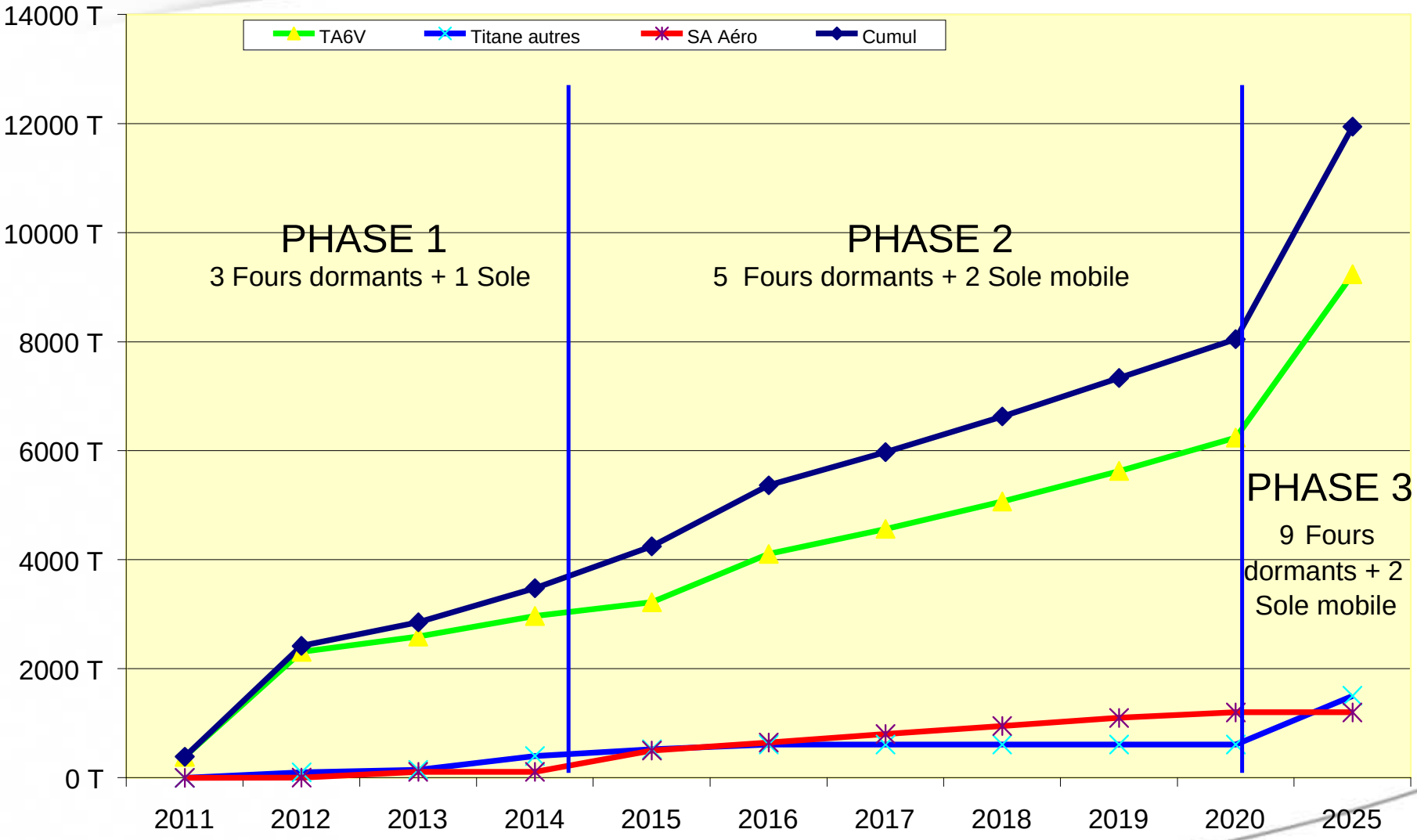
Activities

- **Conversion of titanium ingots from UKTMP :**
  - Long products, bars,
  - Wires, sheets, plates,…

- **Supplying the markets :**
  - Aeronautics
  - Energy
  - Defence
  - Medical…

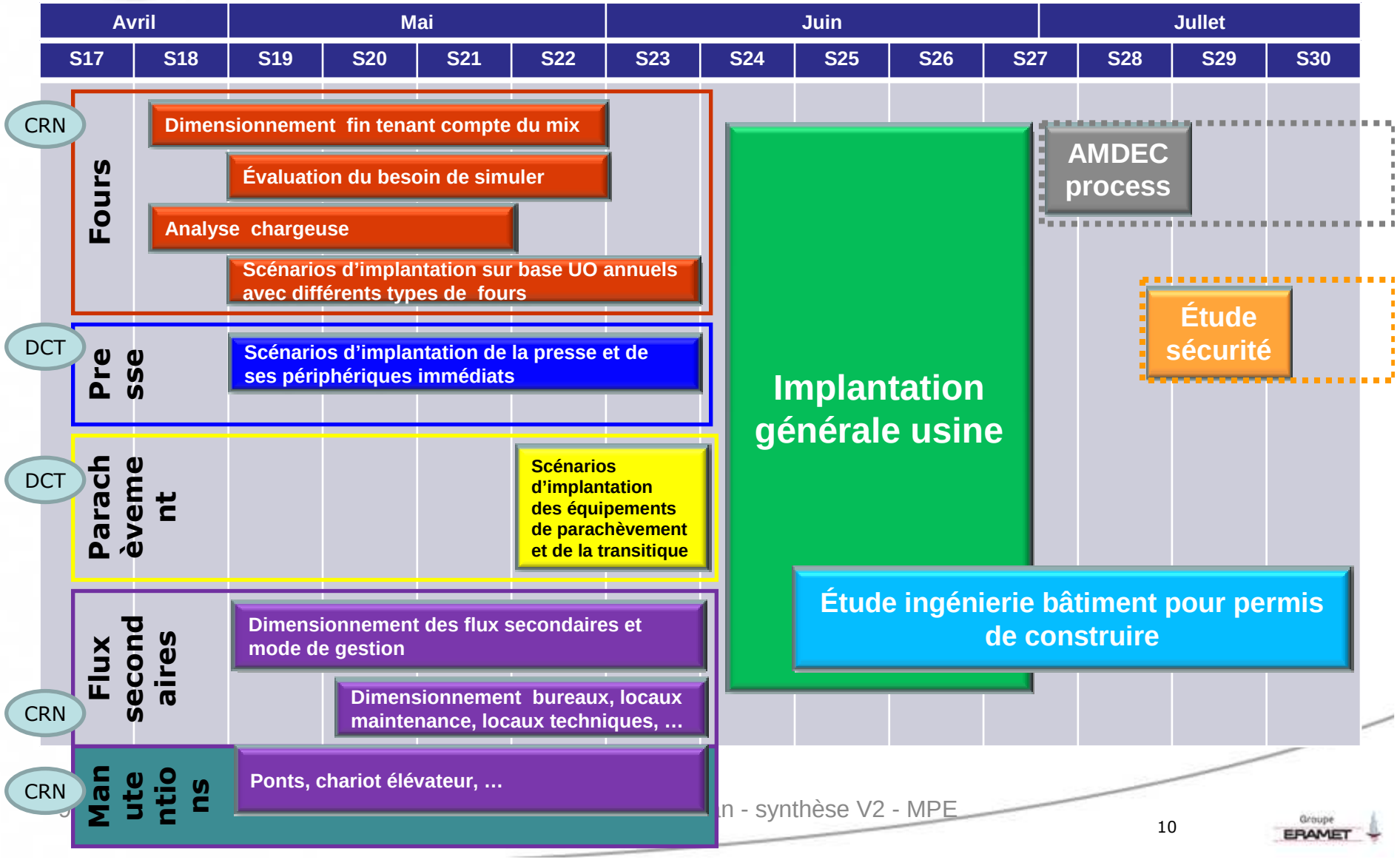
- **Contract signed with EADS Airbus to supply billets and bars until 2020**

Business Plan



UKAD
Business Unit Design

Lean Studies : planning



Lean Studies : Layout plan

Scenario 1

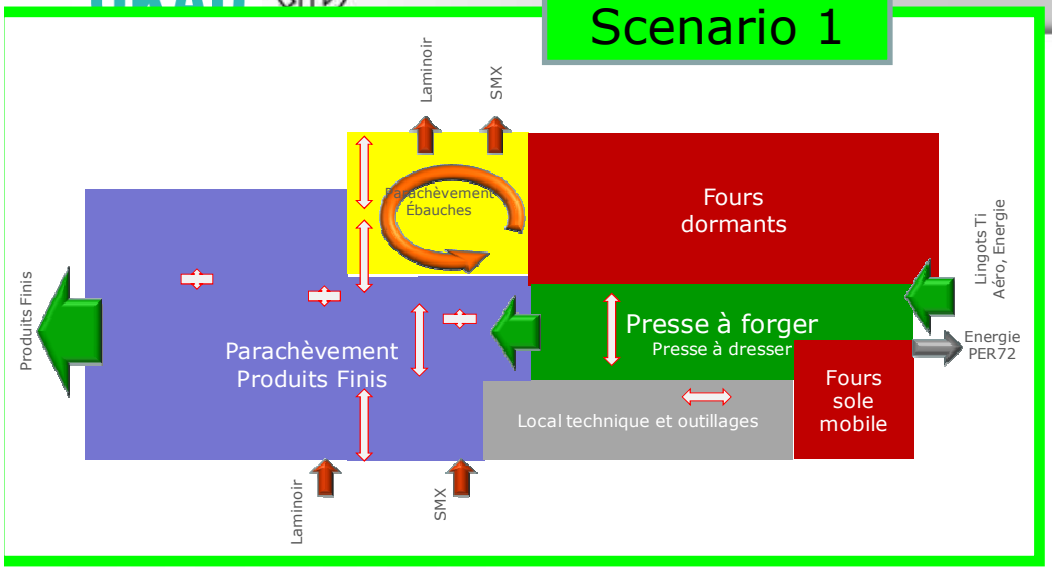
Example of flow mappings for plant layout optimization

Scenario 2

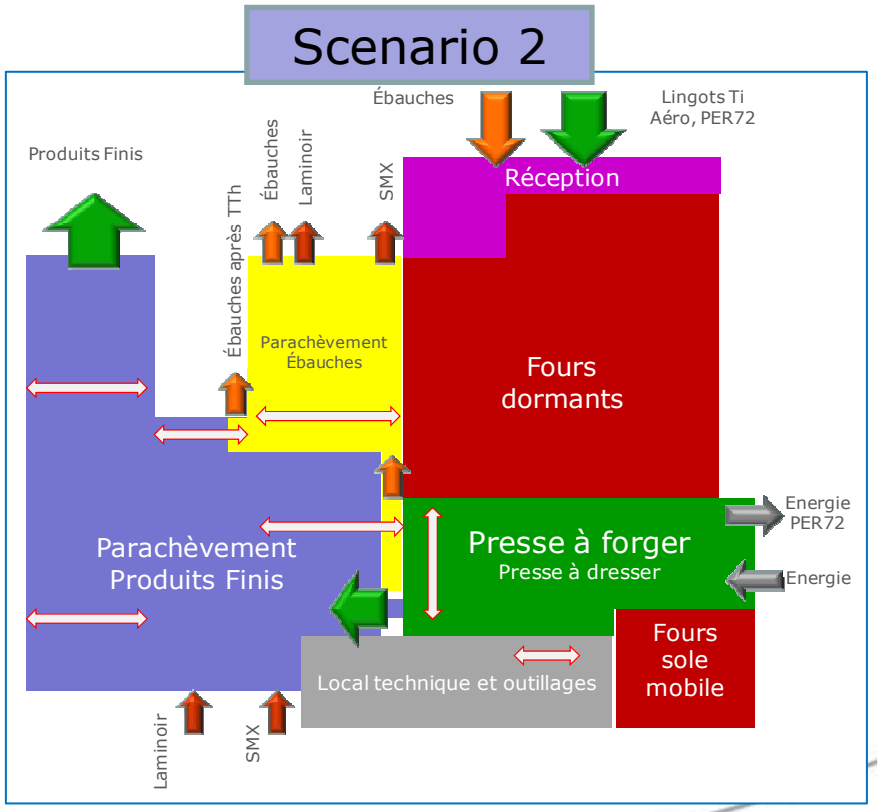
Scenario 3

Layout Plan (2020)
Flow mapping

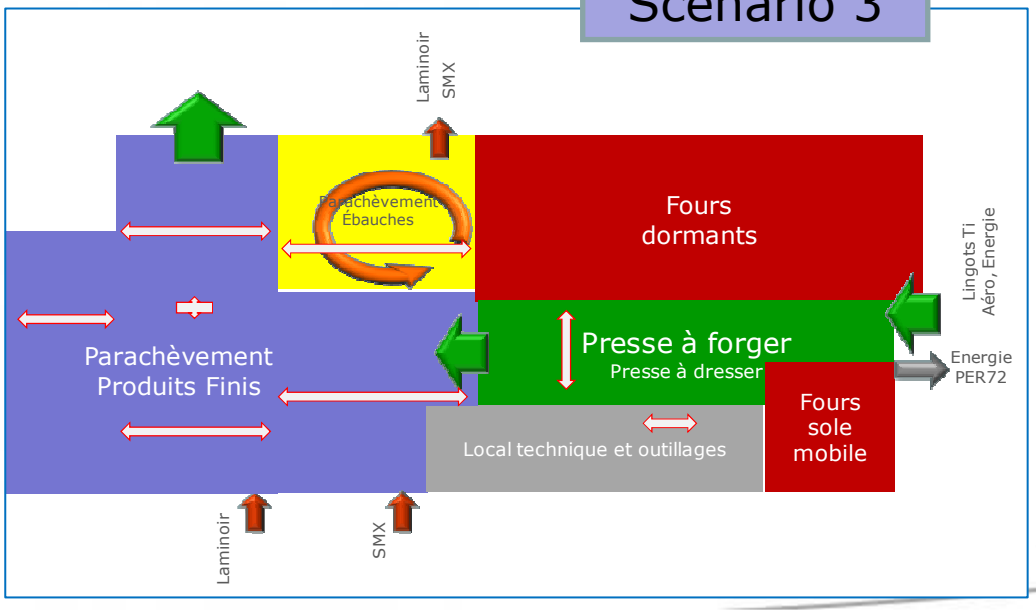
Scenario 1



Scenario 2



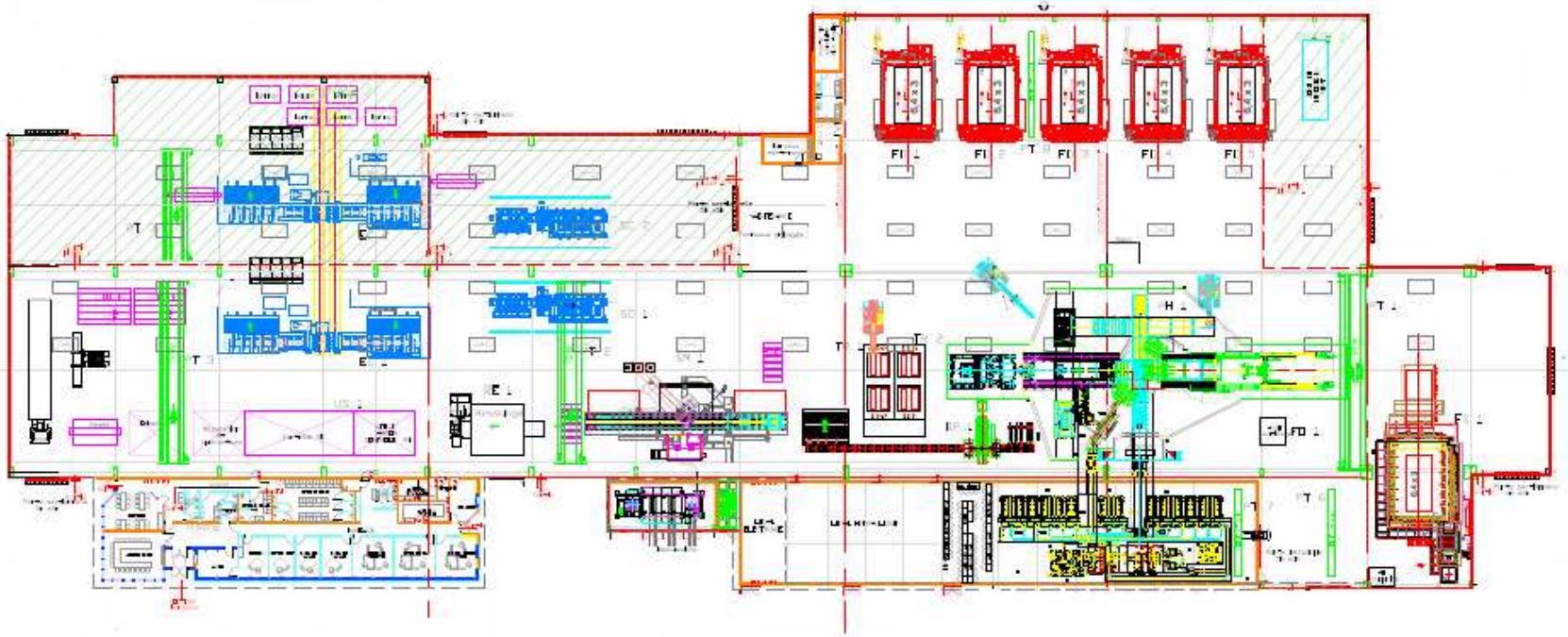
Scenario 3



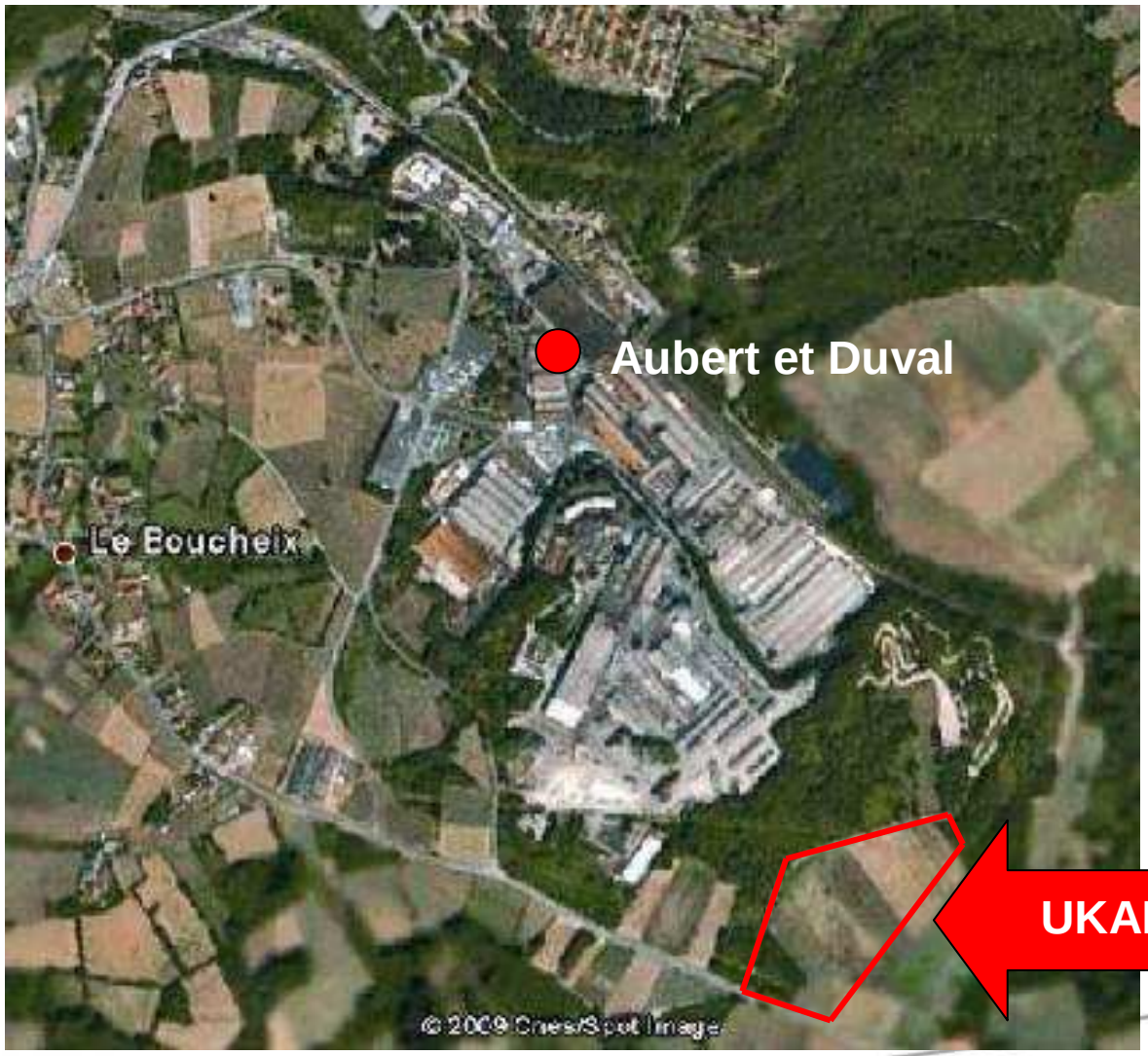
Production equipments

- **Heating furnaces**
- **A 4500-ton forging press with two integrated manipulators**
- **Heating Furnaces**
- **Peeling, sawing equipments**
- **Non Destructive Testing Equipments (US + Penetrant)**

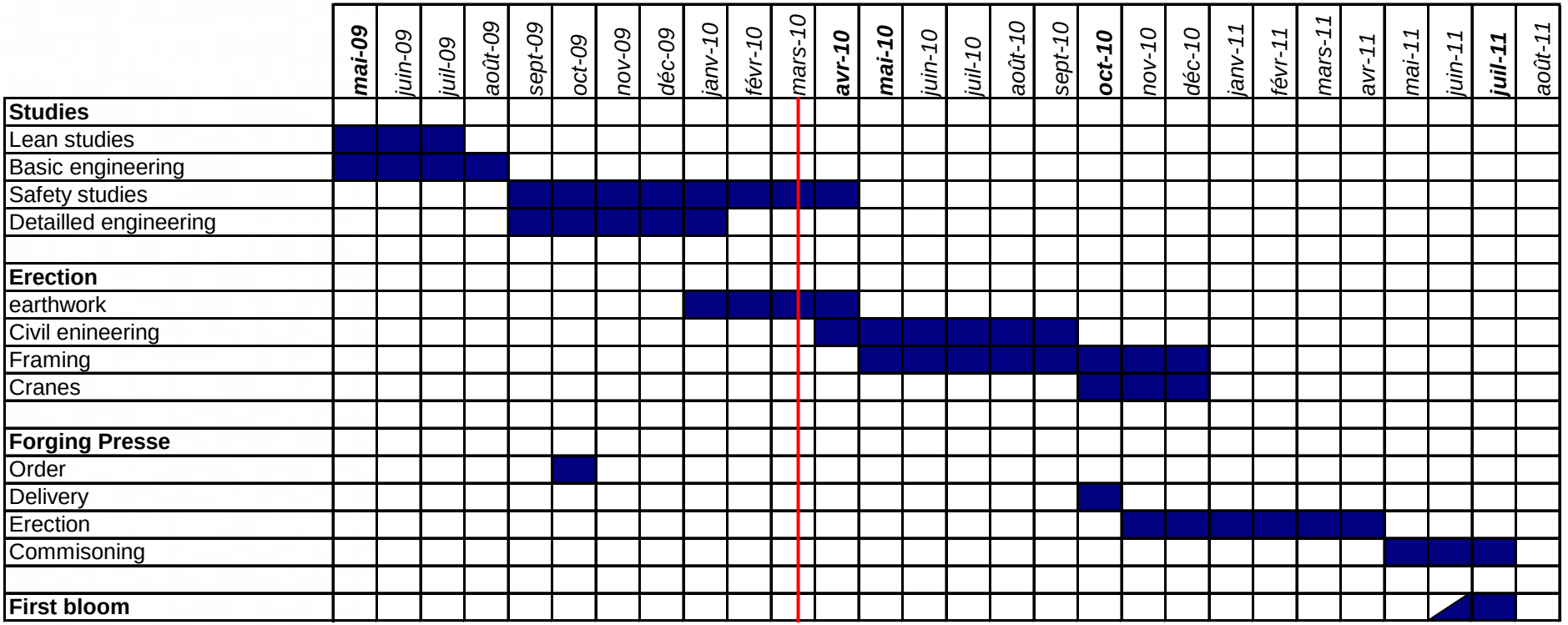
Layout Phase 1 and 2



Location :
St Georges de Mons, Auvergne, France



Project Schedule



Earthwork

AUBERT&DUVAL

UKAD

Groupe ERAMET

Quality Management

- UKAD was created in December 2008 and is in project phase
- The project is managed in compliance with Aubert & Duval (A&D) quality system
- UKAD quality management system is in progress
- UKAD's goal is to be compliant by 2012 (second semester) with:
  - ISO 9001
  - EN 9100
  - Nadcap Non-Destructive Testing
  - And later on: EN 14001

Quality Management System

- QMS development:
  - Definition of UKAD's perimeter
  - Mapping of the processes and their interaction
  - Writing of the Quality Manual for June 2010
  - GRAMS compliance
  - …
- Non-Conformances, waivers, claims and internal audits are intended to be managed through UKAD's ERP.

Quality Assurance : UKTMP project

- First audit conducted in December 2009
  - Scope: - evaluation of UKTMP's QMS
    - evaluation of UKTMP's lab capability to be certified NADCAP
  - Auditors used NADCAP check lists to perform the audit
  - Conclusion: The auditors gave 6 recommendations to UKTMP. UKAD is confident that UKTMP can be certified NADCAP LMT
- Second audit to be conducted 2nd quarter 2010
- UKTMP is certified
  - ISO 9001 and AS 9100
  - ISO 17025

and intends to be compliant with Airbus' GRAMS

QUALIFICATION PROCESS

DYNAMET

TITANIUM 6 Al 4V

BLOOM SIZE 9 SQ.

Chemical requirements

Elements	DYNAMET DI-2111 Rev B	typical requirement including Airbus specifications	PROJECT UKAD
	(weight %)	(weight %)	(weight %)
Aluminium	5,90 ≤ % ≤ 6,30 Aim 6,15	5,5 ≤ % ≤ 6,75	5,90 ≤ % ≤ 6,30 Aim 6,15
Vanadium	3,50 ≤ % ≤ 4,50 Aim 4,00	3,50 ≤ % ≤ 4,50	3,50 ≤ % ≤ 4,50 Aim 4,00
Iron	0,13 ≤ % ≤ 0,25 Aim 0,17	≤ 0,30	0,13 ≤ % ≤ 0,25 Aim 0,17
Hydrogen (1)	≤ 0,0020 (ingot);≤0,0030 (bloom)	≤ 0,0060 (on ingot); ≤ 0,0125 (on product)	≤ 0,0050 (bloom)
Oxygen (2)	0,14 ≤ % ≤ 0,17 Aim 0,16	≤ 0,20	0,14 ≤ % ≤ 0,17 Aim 0,16
Carbon	0,007 ≤ % ≤ 0,060	≤ 0,08	0,007 ≤ % ≤ 0,060
Nitrogen	0,004 ≤ % ≤ 0,020	≤ 0,050	0,004 ≤ % ≤ 0,020
Copper (3)	≤ 0,050		≤ 0,050
Boron (3)	≤ 0,0030		≤ 0,0030
Silicon (3)	≤ 0,050		≤ 0,050
Yttrium (3)	≤ 0,0050	≤ 0,0050	≤ 0,0050
Ruthenium			
Palladium			
Titanium	remainder		remainder
Other elements each (3)	≤ 0,050		≤ 0,050
Other elements total	≤ 0,20		≤ 0,20

(1) The requirement of ≤0,0030 on bloom seems very challenging for forged product and has to be explained

(2) Maximum and minimum should aim to be within 0,01 of average within an ingot

(3) To be inclued in the other element total

MELTING TECHNIQUE

- Ingots will be produced by a multiple melting process as specified in the referenced specification, AMS4928 latest revision.

⇒ UKTMP qualification process

- UKAD internal specification
  → chemical analysis
  → AMS 4928 requirements

- UKTMP internal qualification survey

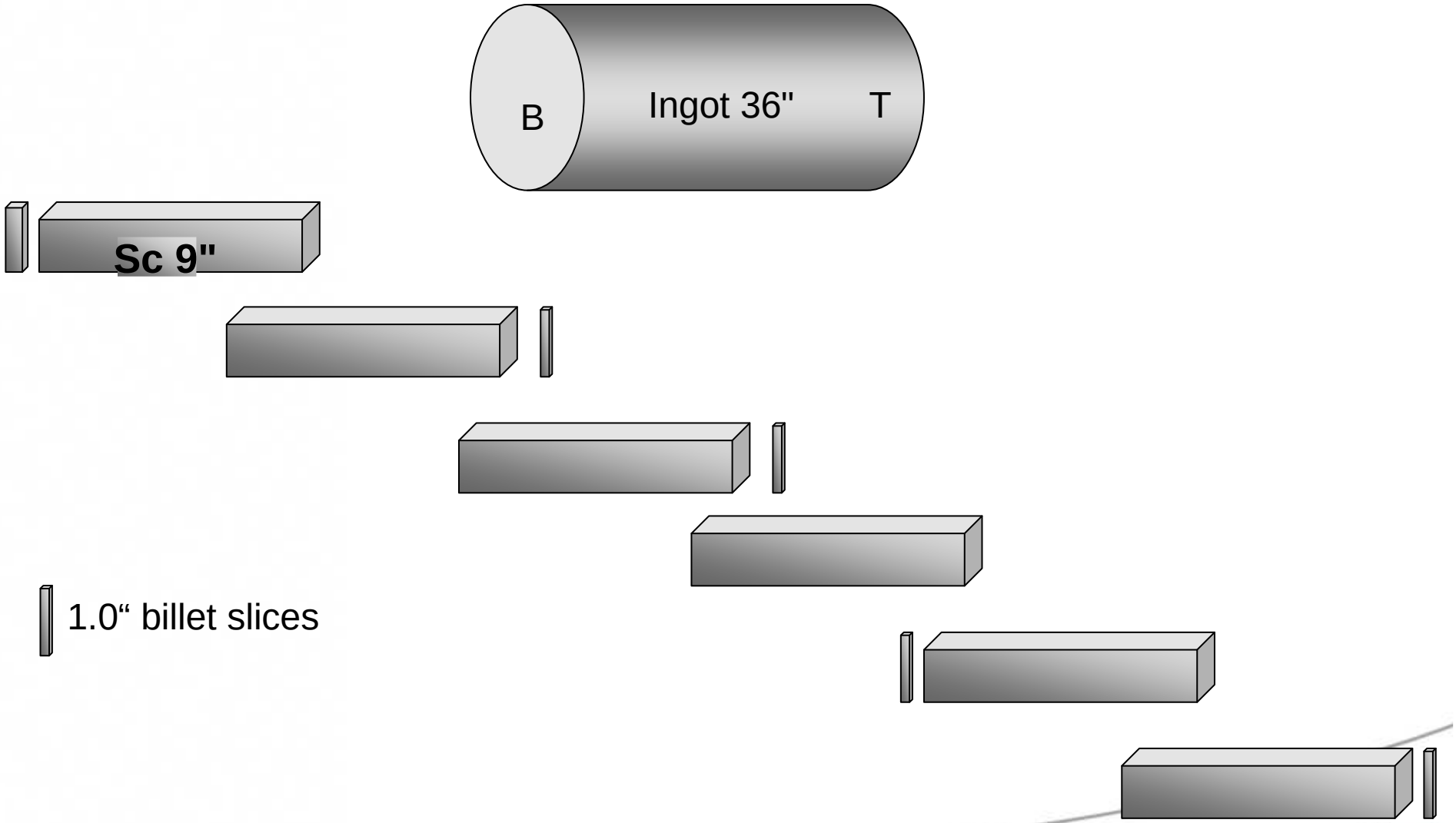
UKAD requirements for ingots

- UKTMP shall furnish a complete chemical analysis from the top and bottom ingot locations.

- UKTMP will provide beta transus temperature top and bottom ingot samples.The beta transus temperature will be determined by calculation in accordance with DI – 2111 latest revision.

AUBERT&DUVAL
UKAD

BILLETS PROCESS QUALIFICATION
Graphic representation of material requirement



AUBERT&DUVAL

UKAD

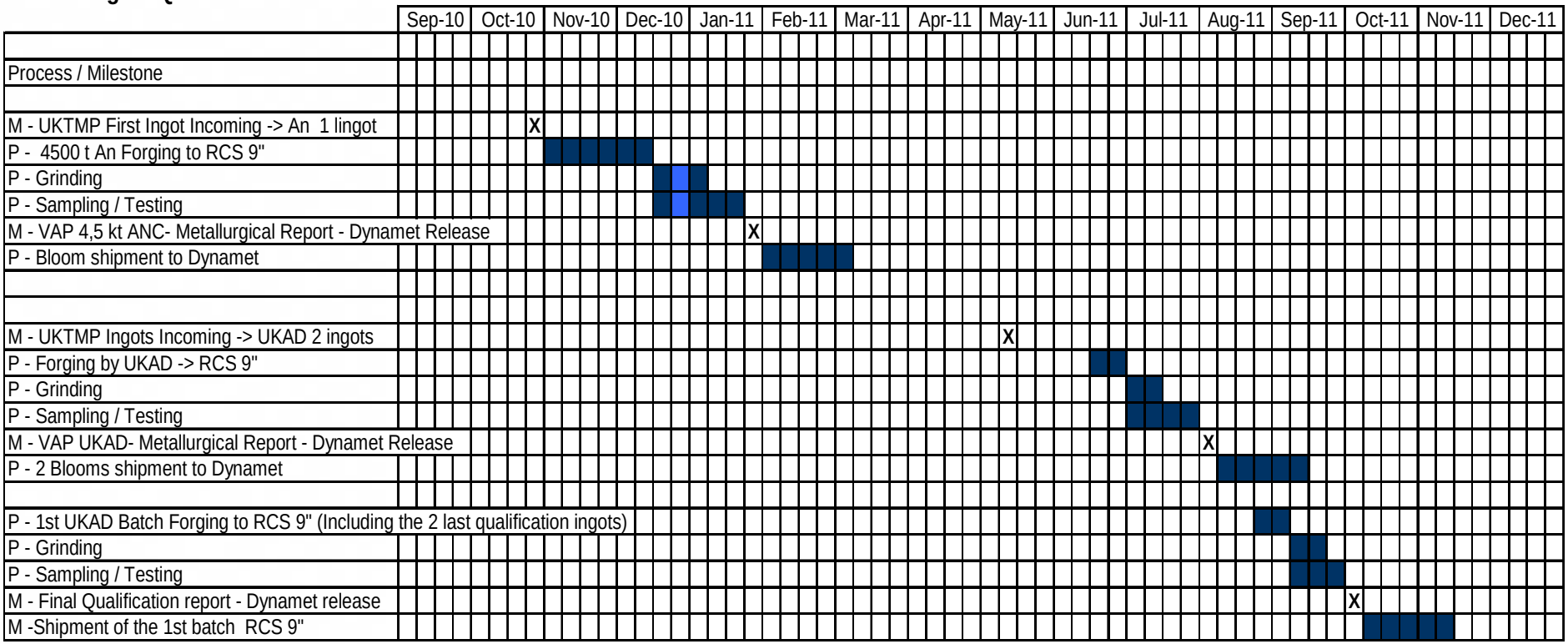
TEST ON SLICES
5 slices per ingot on 5 ingots
(First shipment after 3 complete ingots evaluation and dynamet release)

- **Statistical chemistry analysis (100% sclices)**
  - Evaluation of edge to center variation :0.25 inch of the rim, mid-radius and center
  - Evaluation of top to bottom variation

    ➔ The DI-2111 rev B has a new requirement for Hydrogen (<0,0030%) different from rev A (contractual) to be discussed
- **Macrostructure / Microstucture (100% slices)**
  - The structure shall be the result of final working bellow the beta transus. Capable of AMS 4928R and ASTM B348 after final $\alpha\beta$ reduction process by Dynamet.
- **Beta transus evaluation (3 slices)**
  - On top, bottom,and middle by calculation in accordance with DI-2111
  - The transus shall be determined on some samples by metallography to confirm the calculated transus

Qualification Schedule (proposal)

RCS 9" Ingots Qualification



Technical contact

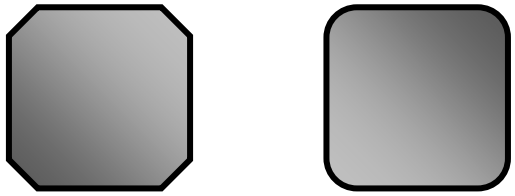
- We need to establish a technical / quality product contact with Dynamet in order to :
  - Validate the « VAP »
  - Obtain the product release

  Nota : our qualification schedule includes a release from Dynamet within one week.

AOB

- UKAD proposals on DI-1036
  - Bloom surface: would it be possible to deliver raw surface products as forged with local grinding when needed ? (Dynamet requirement: blooms totally ground)

  - Flat Corner instead of Round Square Corner



- Confidentiality

QUALIFICATION PROCESS

Questions