

# Greenfield Approach

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*MEDICIS-Promed Workshop on CARBON-11 FOR ION BEAM THERAPY*

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- Greenfield VS. Upgrade
- The design bricks
- The specific challenges
- Baseline and analysis
- Next steps

Greenfield facility		Facility upgrade
Optimized design	←	Design limitations Operational limitations
Full-facility costs	→	Reduced costs

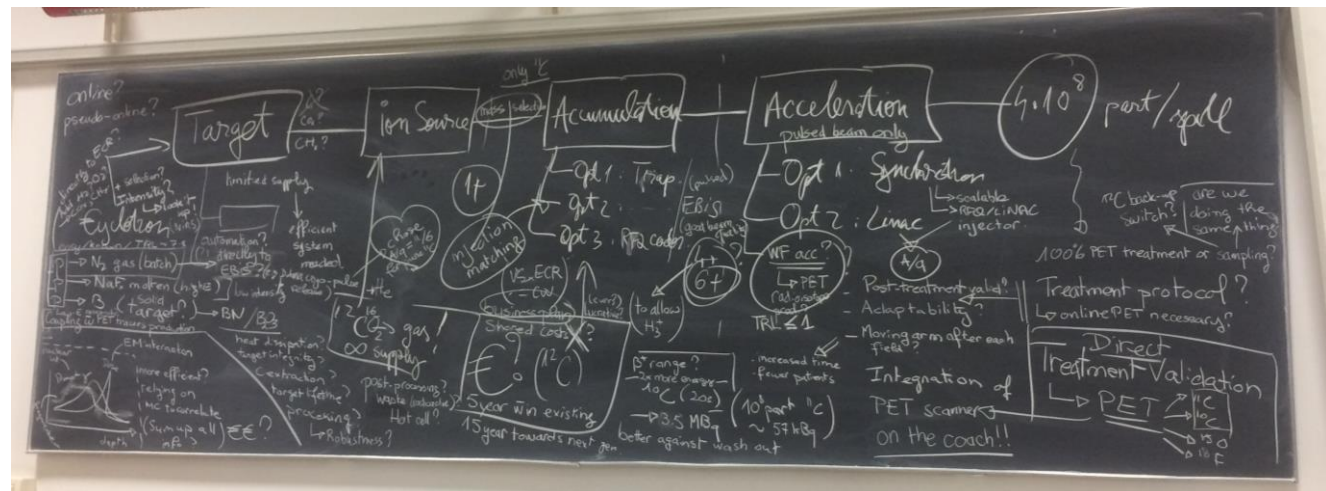
The greenfield case is used for:

- Identifying the design BRICKS
- BENCHMARKING the upgrade cases (performance, costs)

# The design bricks

Purpose	Systems
Production	Target Ion source Accumulation chain
Acceleration	Synchrotron / Linac / Cyclotron
Delivery	(same as for C-12 facilities)

Discussions in Pavia  
(2017)



## ➤ For C-12 treatment facilities

### **SPILLS:**

0.1 to 10 seconds

### **ENERGIES:**

C<sup>6+</sup>: 120 to 400 MeV/u

- *Energies corresponding to 3-37 cm penetration depth in human tissue*
- *~1 minute to deliver 2 Gray in 1 L tumor volume*

### **INTENSITIES:**

C<sup>6+</sup>:  $\leq 4 \cdot 10^8$  particles/spill

*(4 intensity steps for each beam species)*

### **BEAM SIZES:**

4 to 10mm

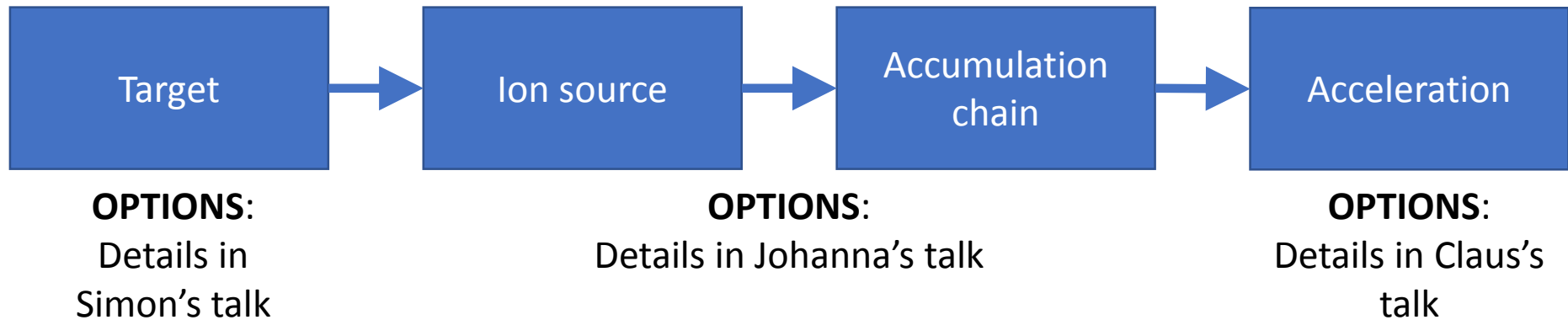
*(4 size steps)*

## ➤ For C-11 treatment facility

Identical as for C-12 (to discuss...)

The main challenges to solve for a C-11 facility are:

- **Production of C-11**
- **Accumulation of C-11**
- **Stable and reproducible performance**



## Analysis for each element and option:

Input (& acceptance)	Performance	Output

- Started at the Summer School in Pavia, 2017
- To be finalized in the TDR

- Choose **BEST OPTION** for each element of the puzzle
- **GREENFIELD solution**: “free” use of the puzzle elements
- **Facility UPGRADE solution**: use elements according to specific constraints