JÜLICH
FORSCHUNGSZENTRUM

# MCA Costing Exercise - DREAM

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# Boundary Conditions for the Calculation

- Mechanical Construction incomplete =>
  - Actuators and Sensors not properly defined
  - Mechanical construction is continuously changing
- Motion Control list of allowed devices is under development
- No final decision on the allowed electronics components
- Some open issues in the interface between ESS and in kind partners => consequences for labor costs

=> Only rough estimation is possible

# General Approach

- Starting Point: MCA Table defined by the Motion Control Group
- Extend it by two additional columns for
  - Sensors (switches, encoders, …) and actuators (motors, pneumatic elements,…)
  - Electronics (PLCs, motor controllers, frequency converters, SSI-modules, connectors, cables
- Assume costs according to axis type (pneumatic, stepper motors with or without encoders, AC drives,….)
- Fixed costs (racks, PLCs,…) are linearly distributed
- Define the labor costs according to work packages and assume an average price per FTE

# MCA Table

| | A | B | C | D | E | F | G | H | I | J | K |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Instrument | | | | | | | | | | |
| 2 | Rev. | 1 | | | | | | | | | |
| 3 | Axis | Device Description | Motion Type | Actuator Type | Accuracy (mm/°) | Vacuum | Location | Distance from moderator (m) | Notes / Comments | Cost for motors, encoders, switches, | Cost for Electronics |
| 4 | 1 | Bispectral switch | Translation | Electrical | 0,1 | Atmosphere | Bunker | 6 | | 2000 | 1500 |
| 5 | 2 | Bispectral switch | Rotation | Electrical | 0,01 | Atmosphere | Bunker | 6 | | 9000 | 2500 |
| 6 | 3 | Heavy shutter 1 | Translation or Rotation | Pneumatic | 0,01 | Rough Vacuum | Bunker | 22 | Slope for horizontal, Safety iussue? | 2000 | 1000 |
| 7 | 4 | Slit 1 | Translation | Electrical | 0,1 | High Vacuum | Cave | 75,5 | in / out, Piezo | 4000 | 2500 |
| 8 | 5 | | Translation | Electrical | 0,1 | High Vacuum | Cave | 75,5 | in / out, Piezo | 4000 | 2500 |
| 9 | 6 | | Translation | Electrical | 0,1 | High Vacuum | Cave | 75,5 | in / out, Piezo | 4000 | 2500 |
| 10 | 7 | | Translation | Electrical | 0,1 | High Vacuum | Cave | 75,5 | in / out, Piezo | 4000 | 2500 |

- Costs for motors etc. differ very much from requirements:
  - Application in bunker: High radiation,
  - Pneumatics tend to be cheap in control
  - Piezo control in high vacuum are expensive
- Overall sum: 135.500 €

# Labor Costs

- Rough Definition of Work Packages:
  - Schematic drawings: 2 MM
  - Construction of electrical cabinets: 5 MM
  - Engineering and project management: 5 MM
  - Motion Control SW (PLC,..): 6 MM
  - PC Software (Linux): 4 MM
  - Pre-Commissioning in Jülich: 4 MM
  - Installation and cabling in Lund: 2 MM
  - Commissioning in Lund: 4 MM
  - **Total: 32 MM = 2.7 FTE**

- Total labor cost:  ca. 300.000 €
  - Assumption: Average FTE cost is ca. 110.000 € per year

# Time Line

- Mapping to the timeline is quite open
- => possible approach: linear distribution

| | 01 Phase 1 | 02 Project Management & Integration | 03 Design | 04 Procurement & Fabrication | 05 Installation | 06 Cold Commissioning | Total |
|---|---|---|---|---|---|---|---|
| **07 Motion Control and Automation** | € 0 | € 60 000 | € 60 000 | € 195 500 | € 60 000 | € 60 000 | **€ 435 500** |

- => better approach is to distribute the different work packages (last slide) to the different phases of the project