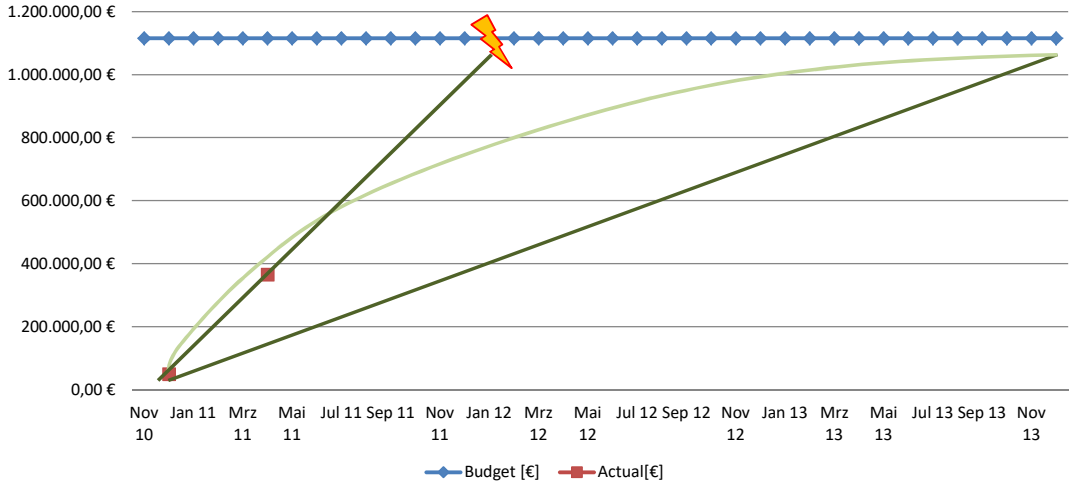
Earned Value Management

1. Motivation
2. Key Figures
3. About EVM
4. Examples

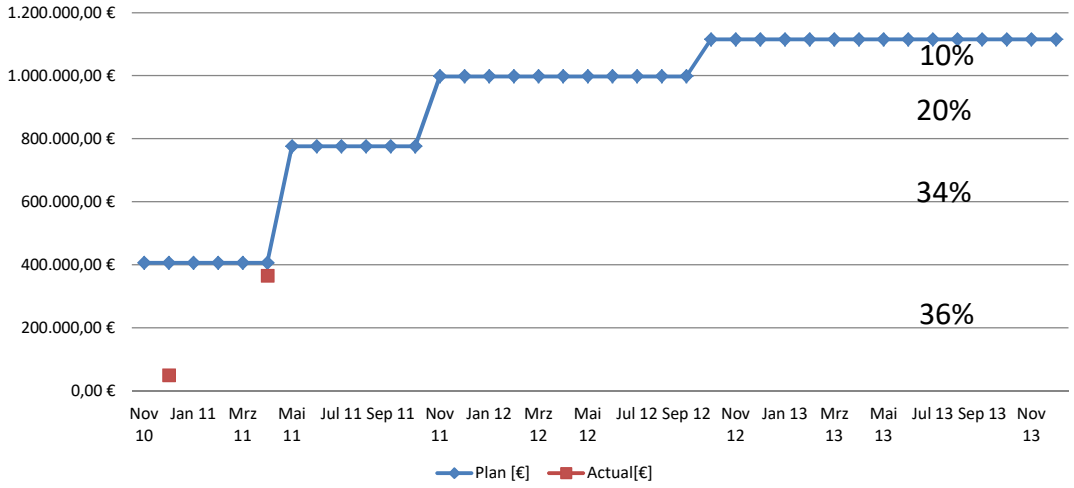
Part 1

Motivation

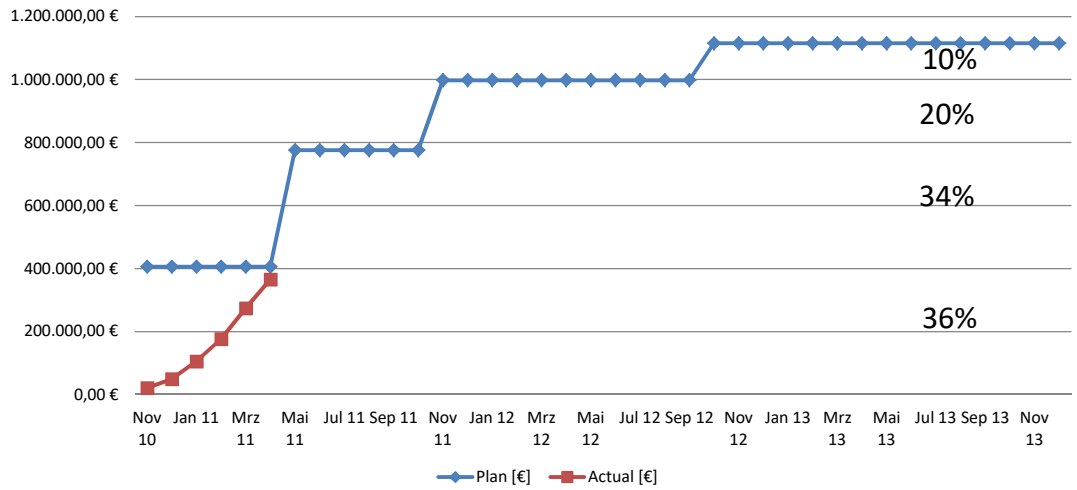
Status and Forecast (1)



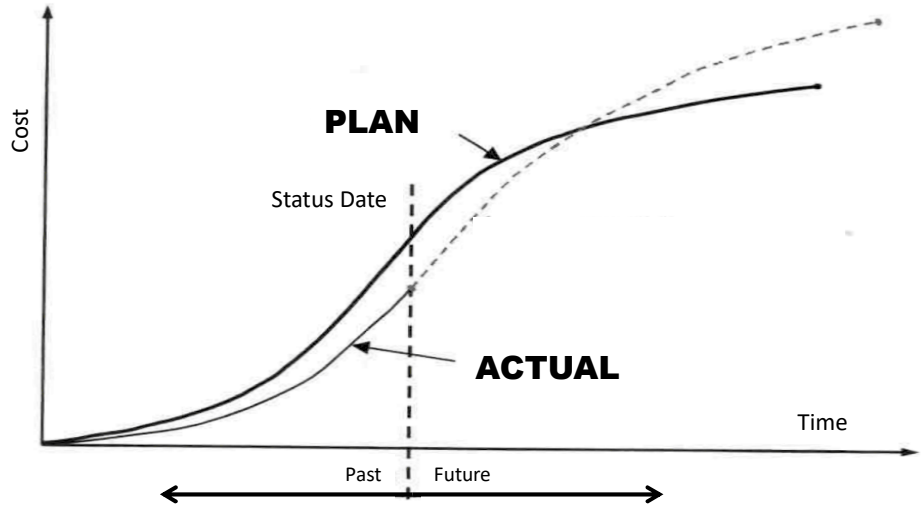
Status and Forecast (2)



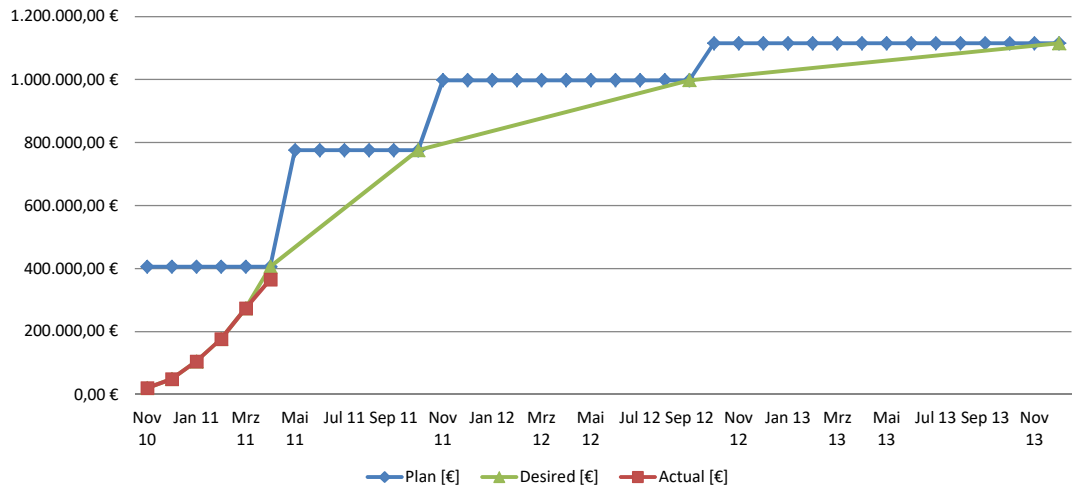
Status and Forecast (3)



Planned & Actual (1)



Planned & Actual (2)



Key Figures

- Budget: 1.115.000 € (100 %)
- Planned Value: 406.000 € (36 %)
- Actual Cost: 366.000 € (33 %)
- Earned Value: 30 % (335.000 €) - estimated

Key Figures - CPI

- Cost Performance Index = EV/AC
  - 30% Earned Value / 33% Actual Cost
  - CPI = 0,91
  - Less money spent than planned but also less value achieved
  - More money used that planned

Key Figures - SPI

- Schedule Performance Index = EV/PV
  - 30% Earned Value / 36% Planned Value
  - SPI = 0,83
  - Project is behind schedule!
  - More time needed that planned to get the achieved value

Forecast with EVM (1)

- **Estimate At Completion (EAC)**
  - EAC_OPT = AC + (BAC – EV) / 1
  - EAC_REAL = AC + (BAC – EV) / CPI
  - EAC_PESS = AC + (BAC – EV) / (CPI x SPI)

  Budget At Completion (BAC)

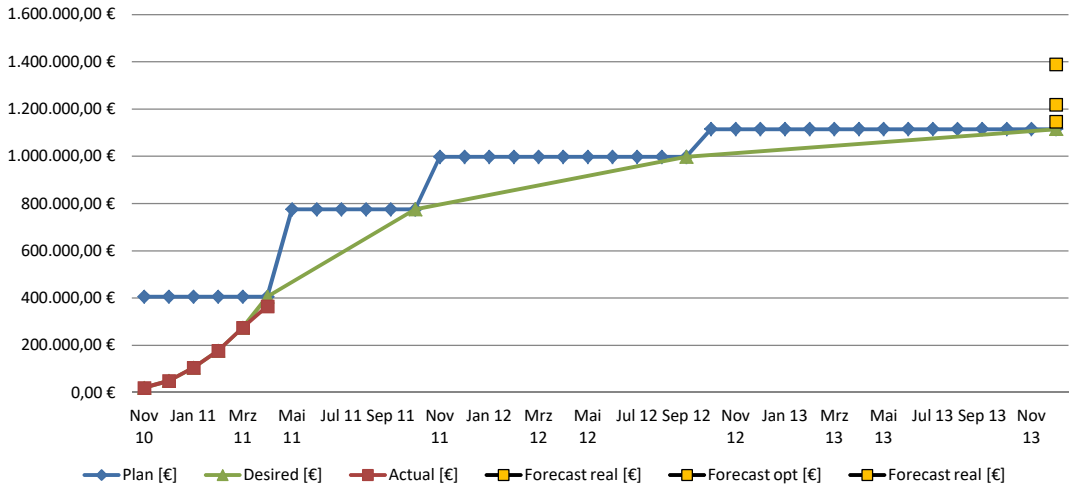
- **Example (BAC = 1.115.000 €)**
  - EAC_OPT = 1.146.000 €
  - EAC_REAL = 1.219.000 €
  - EAC_PESS = 1.390.000 €

Forecast with EVM (2)

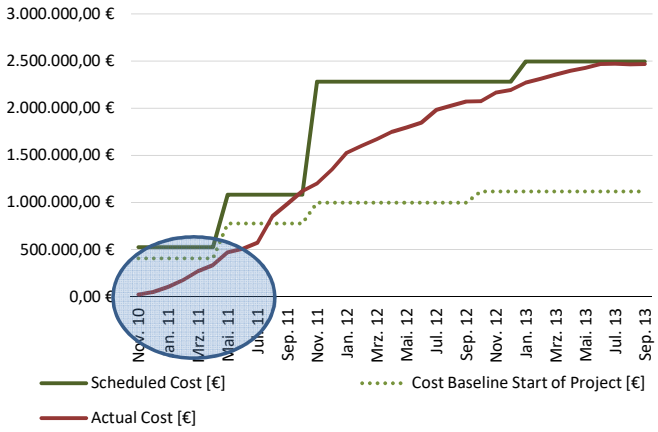
BAC	1.114.978,48 €	1.114.978,48 €	1.114.978,48 €	1.114.978,48 €
Planned Cost (PC)	405.852,17 €	405.852,17 €	405.852,17 €	405.852,17 €
Actual Cost (AC)	365.676,25 €	365.676,25 €	365.676,25 €	365.676,25 €
Planned Value (PV)	405.852,17 €	405.852,17 €	405.852,17 €	405.852,17 €
Earned Value(EV)	334.500,00 €	300.000,00 €	200.000,00 €	450.000,00 €
CPI	0,91	0,82	0,55	1,23
SPI	0,82	0,74	0,49	1,11
EAC_opt	1.146.154,73 €	1.180.654,73 €	1.280.654,73 €	1.030.654,73 €
EAC_real	1.218.897,31 €	1.359.070,50 €	2.038.605,75 €	906.047,00 €
EAC_pess	1.400.897,83 €	1.709.580,29 €	3.760.486,58 €	853.033,23 €

Accuracy of the evaluated earned value is
extremely important for the correctness of the forecast

Status and Forecast



How did the project continue?



Part 2

Key Figures

Budget At Completion (BAC)

- How much was originally planned for this project to cost
- Is the total budget for the project

Planned Value (PV)

- How much work should have been completed at a point in time based on the plan
- Derived by measuring planned work completed at a point in time
- PV = BAC * Planned%Completed

Earned Value (EV)

- How much work was actually completed during a given period of time
- Derived by measuring actual work completed at a point in the schedule
- EV = BAC * Actual%Completed

Actual Cost (AC)

- Money spent during a given period of time
- Sum of the costs for the given period of time

Cost Variance (CV)

- Difference between what we expected to spend and what we actually spent
- CV = EV - AC

Schedule Variance (SV)

- Difference between where we planned to be in the schedule and where we are in the schedule
- SV = EV - PV

Cost Performance Index (CPI)

- Rate at which the project performance is meeting cost expectations during a given period of time
- CPI = EV / AC
- Higher index is good (>1)

Schedule Performance Index (SPI)

- Rate at which the project performance is meeting schedule expectations up to a point in time
- SPI = EV / PV
- Higher index is good (>1)

Estimate At Completion (EAC)

- Projecting the total cost at completion based on project performance up to a point in time
- EAC = AC + BAC – EV (opt.)
- EAC = BAC / CPI^c (real.)
- EAC = AC + [(BAC – EC) / SPI^c] (pess.)

Estimate To Completion (ETC)

- Projecting how much more will be spent on the project, based on past performance
- ETC = EAC - AC

Variance At Completion (VAC)

- The difference between what was budgeted and what will actually be spent
- VAC = BAC - EAC

To-Complete Performance Index (TCPI)

- Performance that must be achieved in order to meet financial or schedule goals
- TCPI = (BAC – EV) / RemainingFunds
  = (BAC – EV) / (BAC – AC)
- Lower index is good

EVM – Example 1

You are the project manager of the construction of 20 miles of sidewalk.

According to your plan, the cost of construction will be $ 15,000 per mile and will take 8 weeks to complete.

2 weeks into the project, you have spent $55,000, and completed 4 miles of sidewalk, and you have to report performance and determine how much time and cost remain.

EVM – Example 1

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Metric	Formula	Value	Calculation
BAC			
PV			
EV			
AC			
CV			
SV			
CPI			
SPI			
EAC			
ETC			
VAC			
TCPI			

Part 3

About EVM

What is EVM about?

- Comparison of planned and actual cost not significant
  - 10% behind plan
  - 39% work completed
  - still 132.587€ budget available
- What performance was achieved till now - compared to the plan?
- What are the actual costs for the currently achieved result?

What is the benefit of EVM?

- Assessment of project status
- Forecast of remaining project costs and duration
- Statement about efficiency

What is EVM doing?

- Examination of reference date
- Proportion of
  - Effort (costs) to
  - Earning (progress of result achievement)
- Key figures
  - Progress according to plan (planned value)
  - Actual progress (earned value)
  - Costs (actual costs)
- Forecast figures

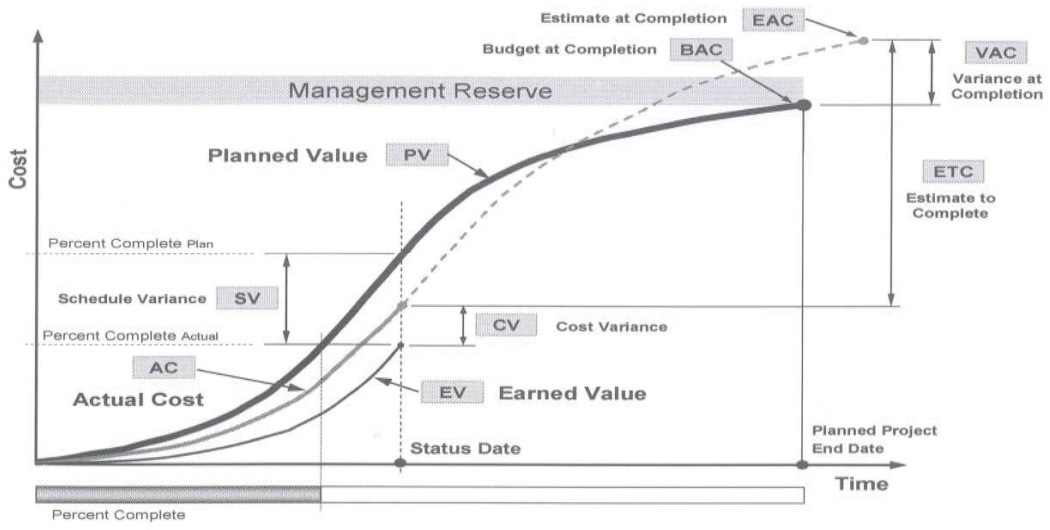
EVM Problems

- Inconsistent wording
- Several variations
- Determination of the earned value

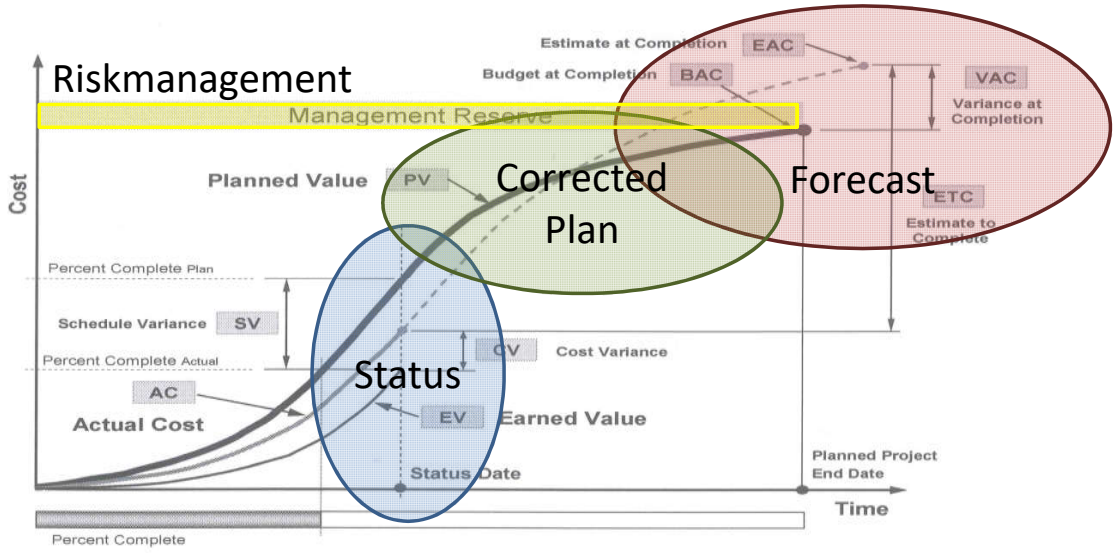
EVM Preconditions

- Work is planned
- Work is broken down into work packages
- Progress of achieved work performance, costs , and milestones is measurable
- All actual costs are known
- Deviations are rated
- Changes of the base plan are managed

EVM - At a Glance

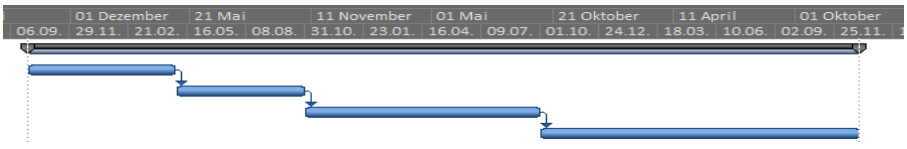


EVM - At a Glance



EVM with MS Project 2010

Vorgan	Vorgangsname	Dauer	Anfang	Fertig stellen	Kosten	Geplante Kosten
	MyProject	**848 Tage**	**Fr 01.10.10**	**Di 31.12.13**	**1.114.978,48 €**	**1.114.978,48 €**
	A-Muster	151 Tage	Fr 01.10.10	Fr 29.04.11	405.852,17 €	405.852,17 €
	B-Muster	131 Tage	Mo 02.05.11	Mo 31.10.11	370.172,85 €	370.172,85 €
	C-Muster	240 Tage	Di 01.11.11	Mo 01.10.12	221.880,72 €	221.880,72 €
	D-Muster	326 Tage	Di 02.10.12	Di 31.12.13	117.072,74 €	117.072,74 €



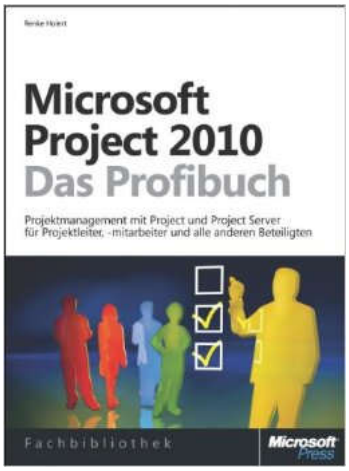
EVM with MS Project 2010

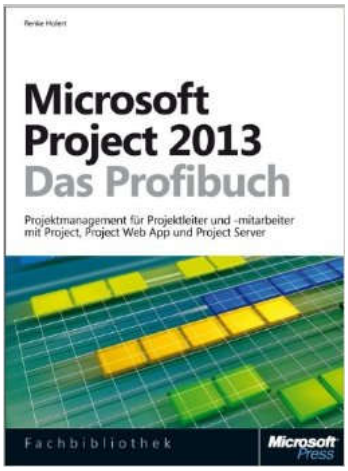
Name	Anfang	PV / SKBA	EV /SKAA	AC / IKAA	CPI / KLI	SPI / PLI	Phys.%	Abg. %	EAC_opt	EAC_real	EAC_pess
MyProject	**Fr 01.10.10**	**405.852,16 €**	**332.798,78 €**	**401.793,64 €**	**0,83**	**0,82**	**30%**	**26%**	**0,00 €**	**0,00 €**	**0,00 €**
A-Muster	Fr 01.10.10	405.852,16 €	332.798,78 €	401.793,64 €	0,83	0,82	82%	99%	474.847,00 €	489.992,20 €	509.352,88 €
B-Muster	Mo 02.05.11	0,00 €	0,00 €	0,00 €	0	0	0%	0%	370.172,84 €	#FEHLER	#FEHLER
C-Muster	Di 01.11.11	0,00 €	0,00 €	0,00 €	0	0	0%	0%	221.880,72 €	#FEHLER	#FEHLER
D-Muster	Mo 01.10.12	0,00 €	0,00 €	0,00 €	0	0	0%	0%	117.072,74 €	#FEHLER	#FEHLER

Statusdatum: 08.12.11

Name	Anfang	PV / SKBA	EV /SKAA	AC / IKAA	CPI / KLI	SPI / PLI	Phys.%	Abg. %	EAC_opt	EAC_real	EAC_pess
MyProject	Fr 01.10.10	406.283,48 €	334.493,54 €	367.942,88 €	0,91	0,82	30%	33%	1.148.427,84 €	1.226.476,40 €	1.410.737,28 €

EVM with MS Project



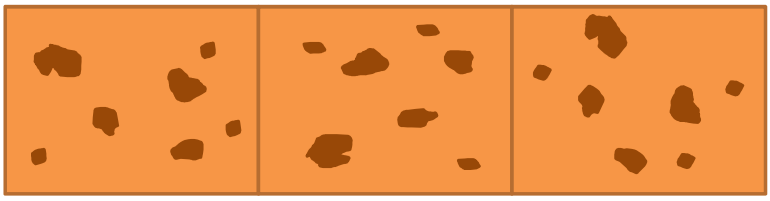


Part 4

Example

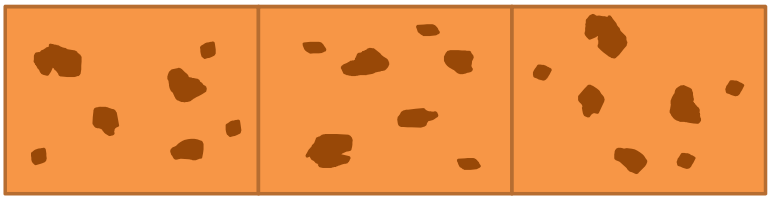
EVM – Example 2

- Horticultural Show:
  - 3 ha area to be cultivated
  - 3 workers á 100 € per person and hour
  - project start: Monday



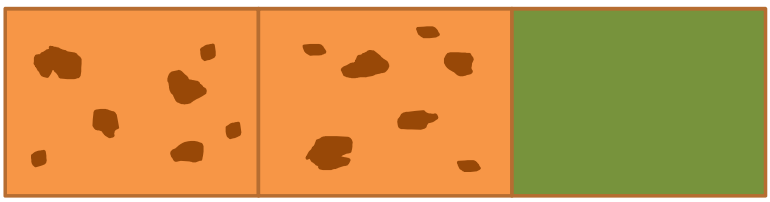
EVM – Example 2

- Plan:
  - 3 days work → finished by Wednesday evening
  - 3 x 8 h. x 3 workers x 100 € = 7.200 €



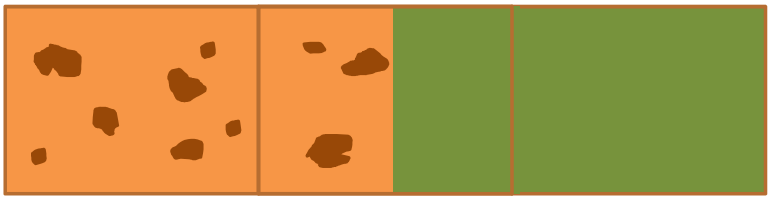
EVM – Example 2

- Monday, day 1
  - 1 ha (33% work) finished
  - Expenses so far: 2.400 € of 7.200 €



EVM – Example 2

- Tuesday, day 2
  - 1,5 ha (50 % work) finished (longer distances)
  - 1 worker: drop-out after 4 h
  - Expenses so far: 4.400 € of 7.200 €



EVM – Example 2

- Wednesday, day 3
  - Machine for 300 € / h executes 0,5 ha/h
  - 3h work: 900 € machine, 600 € workers
  - 3 ha (100% work) finished

- PV = BAC * Planned%Completed
- EV = BAC * Actual%Completed
- CV = EV – AC
- SV = EV – PV
- CPI = EV / AC
- SPI = EV / PV
- EAC = BAC / CPI (real.)
- VAC = BAC – EAC
- TCPI = (BAC – EV) / (BAC – AC)