



Scenarios for new 3MeV test stand and L4 spare modulator

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Possible scenarios

Scenario	New 3MeV test stand	L4
1	ESS	Leave as is
2	upgraded 3MeV	Leave as is
3	ESS	2 x upgraded 3MeV modulators
4	1 x upgraded 3 MeV but limited in time	2 x upgraded 3MeV modulators (+ option with 1 mod. Accessible by crane)
5	1 x L4 full power modulator	2 x upgraded 3MeV modulators
6	1 x upgraded 3 MeV	2 x upgraded 3MeV modulators

Costs associated to 3MeV mod. upgrade

- Situation: we have 1 «old» 3MeV modulator + spare components
- Upgrading the existing one (RF needs 1.1ms stable flat-top at higher voltage and current)
 - Need for new pulse transformer: 50 kCHF
 - Extended capacitor bank: 1 kCHF
 - Modified bouncer circuit: 1 kCHF
 - Main switch ? (not sure yet if existing can be re-used): 40 kCHF
 - Labour: 5 kCHF

Total of ~ 100 KCHF

Estimate with only 10% price increase since 2006!

Costs associated to 3MeV mod. upgrade

- Construct additional units (for new spec): **175 kCHF/unit** (cannot reuse our spares...)
- Totals:
 - 2 units: 275 kCHF (reminder: 1 x full power modulator 350 kCHF)
 - 3 units: 450 kCHF
- ➔ **For L4 installing 2 upgraded 3MeV side by side (hot spare) less expensive compared to buying one full power modulator...**
- ESS modulator: unknown exact cost for putting it into operation – received at CERN, tests in our labs starting soon
 - High installation cost! (50 kCHF???)

Scenarios details

Scenario 1: ESS modulator in new 3MeV & leave as is in L4

- **PROS**

- We can be ready for April 2022 in New 3MeV test stand
- Lowest cost solution (tough still some unknown on ESS mod. & installation)

- **CONS**

- Unique modulator (not operated by SY-EPC)
- No spares in 3MeV
- No spares in L4

Scenarios details

Scenario 2: upgraded 3MeV modulator in new 3MeV & leave as is in L4

- **PROS**

- We could be ready for April 2022 in New 3MeV test stand (but need budget now to launch orders!)
- Low cost solution : 100 kCHF
- EPC standard converter (operation supported by SY-EPC)

- **CONS**

- No spares in 3MeV
- No spares in L4

Scenarios details

Scenario 3: ESS modulator in new 3MeV & 2 x upgraded 3MeV modulators in L4

- **PROS**

- We can be ready for April 2022 in New 3MeV test stand
- L4 has an hot spare for RFQ and we create a full power modulator spare

- **CONS**

- Solution cost : 275 kCHF + ?? ESS install + ?? install in L4
- Unique modulator (not operated by SY-EPC)
- No spares in 3MeV

Scenarios details

Scenario 4: Upgraded 3MeV modulator in new 3MeV for a limited time & 2 x upgraded 3MeV modulators in L4

We can imagine to upgrade only 2 x 3MeV modulators. One of them will be used in new 3MeV test stand for a limited time (LS3?) and then we install the 2 modulators in the RFQ zone in L4

- **PROS**
 - We could be ready for April 2022 in New 3MeV test stand
 - L4 has an hot spare for RFQ and we create a full power modulator spare
 - Solution cost: 275 kCHF + ?? install in L4
- **CONS**
 - L4 has to wait for stabilizing the situation

Scenarios details

Scenario 4 bis: Upgraded 3MeV modulator in new 3MeV & 1 x upgraded 3MeV modulators in L4

As proposed by Suitbert: L4 integration change to install modulator in front of the klystron to allow the crane reaching it → faster exchange

- **PROS**

- We could be ready for April 2022 in New 3MeV test stand
- L4's RFQ modulator can be replaced rapidly - 1-2 days.
- Solution cost: 275 kCHF + layout change in L4 ?

- **CONS**

- L4 still has 1-2 days for modulator replacement in case of serious failure
- 3MeV test stand stopped in case of failure in L4
- For the announced cost we do not have any component spare (transformer, main switch, etc.)! To be put in perspective with 3 MeV test stand medium term strategy

Scenarios details

Scenario 5: 1 full power modulator in new 3MeV & 2 x upgraded 3MeV modulators in L4

- **PROS**

- We could be ready for April 2022 in New 3MeV test stand (maybe first with a 3MeV modulator and when we can make the exchange in L4 we install the full power modulator in the 3MeV test stand)
- L4 has an hot spare for RFQ and we create a full power modulator spare
- Solution cost: 275 kCHF + ?? install in L4

- **CONS**

- Painful reinstallation sequences in 3MeV

Scenarios details

Scenario 6: Upgraded 3MeV modulator in new 3MeV & 2 x upgraded 3MeV modulators in L4

- **PROS**

- We could be ready for April 2022 in New 3MeV test stand
- L4 has an hot spare for RFQ and we create a full power modulator spare

- **CONS**

- Solution cost : 450 kCHF + ?? install in L4. To be put in perspective with 3 MeV test stand medium term strategy

Summary

Scenario	New 3MeV test st.	L4	Comments
1	ESS	Leave as is	Nobody like it
2	upgraded 3MeV	Leave as is	EPC does not like it
3	ESS	2 x upgraded 3MeV modulators	EPC does not like it
4	1 x upgraded 3 MeV but limited in time	2 x upgraded 3MeV modulators	EPC like it!
4 bis	1 x upgraded 3 MeV	1 x upgraded 3 MeV	EPC like it if 2 nd unit back to L4 in medium term or if spares purchased)
5	1 x L4 full power modulator	2 x upgraded 3MeV modulators	EPC is ok!
6	1 x upgraded 3 MeV	2 x upgraded 3MeV mod.	EPC like it!