Kick-off meeting @ESS

F. Ardellier

- Need to define some points of contract before send to lawyers.
- nBLM
  - ICS (Integrated Control System) has to be defined in the 1st part of the project but is not included in the SoW
  - Tom: when?
  - F. end of year in the PDR
  - Irena: which PDR? 1 or 2?
  - In 1 plans and strategy in 2 final design

    ⟶ need to be defined

Thomas:

- Schedule for the end of the project 2019, when? To be checked on spring
- Dimension 14x20x10 cm^3 are given as an indication
- Time response depends on the moderator → few microseconds seems feasible → Gergios results.
- U-238 → low gain, high signals, no backgrounds, only fission products can give a signal
  - Tom: works with MMs? Is not slower?
  - Thomas: MM detector has been working in... facing a plutonium source for more than a year. Time response depends on the drift, 100ns signal development
  - Can be use as a risk mitigation strategy if background discrimination worst than expected.
  - From discussion on Tuesday, not very happy to have U-238 but will check
- Segmentation: between 1-5, better for higher rates
- Tom: Possibility to test at least 1 nBLM with the RFQ (3.6 MeV)?? Thomas: yes we can test one by then probably but need dates for RFQ installation…

  ⟶ End of September 2019 still the correct one?
  - Tom: it will exist a CS "portable" for first tests
- BI (Beam Instrumentation) is responsible of the algorithm of Warning signal, not MPS
- Then send signal to MPS
  - Then we (CEA) need to know which kind of signal to send → work collaboratively
- In PDR1 just design or also mechanical parts?

  ⟶ Nor too much about mechanics, but electronics and detector
- When PDR1 come in place also will be use to define some of the interfaces not defined yet.
  - Cover at high level ICS functionality (both ICS)
  - In order to define interfaces to ICS we need some information
  - Resources availability, work to be shared….
- Handover April 2019
- Tom: CDR2 at March 2018 and delivery to September detectors at end 2018 seems very aggressive. Is any potential delays consider? How can we reduce the risk?
  - What can be deliver after CDR1?
    - Vertical integration test btw CDR1 and CDR2.
    - Probably electronics, gas systems, power supply
  - What is the most consuming part?
    - Previous detector took few weeks.
    - Industry can provide PCBs, but detector can be manufactured at CEA maybe
    - Time to order components

⟶ Tom: to use CDR1 as a milestone to try to reduce delays to be ready to order as many components as possible by then. Use CDR1 to start some procurements.

- Lifetime of the system? 60 years!
  - Overall strategy not completely defined about team to operate, take care of system etc.
  - Ageing tests at reactors planned
- Necessity of calibration / detector checking system? Electronics checking system? → YES. More tests than calibration
  - Online checking and monitoring
  - Experts to recommend how and when?
    - Electronics can be checked injecting some pulses.
    - Request to stop the beam for the time needed (~2mins maybe)
    - Probably this is already plan to happen every week
    - Pulses go 14 Hz, 3 ms long
      - Maybe tests can be schedule btw pulses if the test is short
  - Calibration: not need energy calibration probably
  - We need to define detector requirements → defined at PDR1
  - Define also checks for gas
  - Tom: we want an alarm when something does not work? Other way around ok signal all the time.
- No easy access on few part of the accelerator
  → 1)electronics, ok or not? 2)gas is ok or not? 3)radiation source response
- Test at Saclay with superconductive cavities → micromegas + IC_Cern + diamond (if we have one)
- Flashes (with the pulse, sustain over ms → not a burst for us)
  - Difficult to say if there will be shorter bursts → these can be dangerous for the detectors
    - xrays backgrounds
  - Limits on flashes, data from LINAC DTL for example
- Gas system
  - Gas leakage definition like 10^{-6} mbar…. Tightness level needed? Gas leak detectors?
  - EU standards
  - Need to be taken into account in case can interact with other gases, for ex. → *discuss tomorrow*
- Variation gain expected between nBLM
- Mechanical support/special interfaces
  - Design: CEA with ESS inputs
  - Construction of support and installation

    ⟶ need to be specified. .
- Shipment to ESS → like with other components (Doppler detector) → ESS responsibility
- Components in the tunnel → ESS responsibility (insurance etc)
- Technical specifications, different need to be defined → see slides
- List of risks → slides

  ⟶ Add aggressive schedule as a potential risk
- µTCA crate, TDC and ADC (to be checked) should be taken in charge by ESS
- 1.18 M€ → to be checked for double counting (Tom)

Françoise

- Separated contract for the CS?
  - Irena: is included in the actual annexe of the contract

    ⟶ needs review to clarify

- Vertical system (The unit to test at Saclay, first ESS integrated nBLM system)
  - Cabling drawing, internal/external cablings, installation of electronic crates in cabinets, who?
- What is not taken by CEA control team would be taken by other CEA Saclay people
- Integration vs deployment
- Note: COTS: Components On The Shelf
- T0 is not defined yet, could be attached to March 2017 proposed by Thomas (first PDR + some months).
  - F: maybe is too tight time for the control box
  - Tom: can we have it deliver from ESS by March 2017?
    - Timo: will depend on the electronics...

Philippe

- Map of the experimental hall
- Cables 20 m → for ns timing, have some margin of operation
- 2.5 Gsamples/sec
- Request: Analogue output compatible with standards digitizers and so on.
  - Tune the analogue time response to standard equipment
- Pre-amplifiers on the FEE fixed on the nBLM itself → 250 MHz (BW, Tom)
- Radiative background → table which has also to be provided for ESS Bilbao
- Develop an electronic compliant to commercial pre-amplifier → OK for Philippe

Timo

- EEE = ESS Epics Environment

  ⟶ When Saclay should get a board from ESS?

- FMC: standard interface, mezzanine card + connections to FPGA or ADC card
- BIS: Beam Interlock System
- ESS Timing system
  - RF generator for the accelerator-machine (88MHz)→ master generator →trigger events
  - Accelerator synchronization freq 88 MHz

Q: calibration of MMs? Possibility to monitor the amplitude of alpha particles for calibration checking in parallel (Thomas)

Annika

- Continuous beam losses: it will always be some, determined when define the detector
- Accidental beam losses: from ns to seconds
- nBLM last layer of protection, want to stop before a lost occurs.
- But minimize unnecessary down-time due to spurious trips
- MPS wants a signal from us saying system is OK (received by the interlock system)
  - But rest of data nice to be stored.
  - Need to define what happens if one of the nBLM detectors failed, should the beam being stopped? Depends on dependency on this system.
  - Discussing an option of multi-signals analysis to determine response.
- 300 ns with the LEBT Chopper and its “beam dump”, 10 ns before the total beam is deflected
- It exists some time after a failure that the beam still going into the linac no matters what.

- Local protection system: internal failure controlled by us (sanity checks)
  If the failure has an impact on beam operations send a signal to MPS
  but should be documented to be reviewed in any case.

Note: Georgios randomly appearance/disappearance.

Irena

- nBLM seat mainly around DTL (5tanks) and some in MEBT
  - Maybe some also in the cold linac, more as a development idea, if there are spares
- 1.1x10^9 p/bunch
- Commissioning of the MEBT we want some around (as we mentioned before)
- Mebt-DTL < 5 μs and SC linac < 10 μs for perpendicular incident angle
- Fluxes difficult to estimate
  - Up to few tens of MeV, is it applicable for DTL??
- Lost of scenarios exists but huge.
  - Simplified it to proceed
- 3.6 Mev to 90 MeV in the DTL tanks where a perp. incidence could happen. Still not very likely, although need to repeat simus with more detailed geometry

  ⟶ Before Background rates known need to know location and detector size. Detector location+size : need to be able to see accidental losses.
  - Determined together with Irena.
- 1W/m
  - In the DTL other limit,
    - Automatic shielding (gamma)
- In a lost of 1W/m compared with normal: increase 1-2 order of magnitude (but what time? n/seconds).
- In normal operation, lower number of neutrons at normal operation in the 5th tank.

Duy Phan

- Main concern: fire safety, what can emit gas or anything flammable.
- Not radiation tolerance requirements, radiation resistance is not a priority
- Will send 5 doc today. No handbook yet defined by ESS.
  - Plastics materials
  - ESS
  - Material classification in base of radiation hardness
  - Guideline operation of absorb dose depending where installed
  - Radiological hazard
- Matt needs to approve the answer
- We can send a list of materials
- Flammability limits
  - He+5% methane is ok?

  ⟶ Duy will send an answer
- For He is ok because there will be more from the cryo,...

  ⟶ Action: send gas properties (% of quencher, etc...)

  ⟶ Send list of materials
  also for the electronics components

  ⟶⟶⟶Preliminary list of materials with PDR1
- Cd doesn't seem ok, Tom said that maybe is already plan to be used...

- Adding an external layer of Al in front of Cd.
- If not we can define a substitute
- Cable, if possible halogen-0
- Jurgen Mattson to be invited for electrical safety and recommendations for PDR for instance
- ESS handbook for electrical equipments, Swedish regulation but inspired by EU directions
- We want nA precision to control the MMs.

  ⟶ Duy will ask which kind of information we need to provide in the PDR1 from the electrical point of view.

⟶ For PDR1 also elements for gas system: size of the pipes specifically, + maybe valves, flow-meters, …

Georgios

- For Geant 4 → Livermore applet, which seems to be compliant to old Srim
- To re do analysis with different moderator thicknesses for time response (it was 4 cm in the presentation)

Laura

- Background from photons (coming from cavities) should be difficult to get
- Q: ESS has to design the cable for gas system (for puling cables)??
- Gas system: Saclay push it and ESS install it
- Cables, trays… ESS has drawings to determine the lengths. They need to know which kind (Saclay)

Control discussions

- Document of Ingo? Example: motion motor = ESS, threshold = BIS or generic=ESS, specific=BIS.
- Françoise :
  - Slow part → HV, LV, Gas
  - Fast part → detector with FEE, acquisition
  - No Epics development
- Who is in charge of fpga programming??

  ⟶ ESS will look for someone from his side as CEA doesn't have the expertise.

  ⟶ Definition of algorithms to define threshold etc to go into fpga by Irena with input from Thomas and CEA (collaborative work!!).

  ⟶ CEA CS team are able to develop EPICS language program to use outputs from fpga.