Thoughts on experimental background studies @ ATF2 to validate BDSIM/GEANT4 computation

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My few words of caution…

- Still very new to ATF(2)
- In many places, I am guessing what the situation is
  - And try to elaborate from there…
  - I will be happy to be corrected when wrong, incomplete, or if “shaking” misleading ideas…

Some considerations (1/2)

- Background simulation has an intrinsic interest as a kind of “service task” to the ATF2 collaboration
  - Prediction of background levels in BSM/BPM

- For monitors (I would guess that) “little” precision is sufficient
  - Background prediction up to a “not too big factor”
  - 2 ? 10 ? (question to you ;-) !)
  - Main considerations (I guess) are:
    - Radiation level low enough to not damage devices
    - Radiation level low enough to have devices operating properly

Some considerations (2/2)

- Can targeting higher background prediction precisions be of interest ?
  - Probably not if ATF2 were a “final” experiment in itself
    - Background monitoring would be relevant and sufficient
  - So, may be yes, as what can be learnt may serve as a basis to try to extrapolate to the high energy machine
    - If “good” precision in background prediction can be achieved in ATF2, this may make us confident in the simulation for the high energy machine
- In addition to the “golden goals” of ATF2, we may use the ATF2 phase to prototype the background simulation
  - Identifying the critical points
  - Elaborate simulation techniques
  - Perform dedicated background measurements
- In the following, I will try to give my naïve view on these items

Identifying critical points ? (1/2)

- Beam halo is a well identified issue
  - A realistic background simulation will rely on the halo knowledge/measurement
- Geometry
  - Inner beam line description is made simple
    - Will need to be refined at some point
    - Fortunately as line optic element position, shape… are known, improvements in line with real beam line look doable
  - Outside of line description is more “tricky”
    - External counterpart of matter of optic elements can be guessed
    - But far to be the only volumes in the tunnel…
  - May we hit, at some stage, the problem of a sizeable fraction of background scattered from the outside of the beam line and back into measurement devices ?

Identifying critical points ? (2/2)

- Physics processes
  - A large fraction of interactions is due to EM physics
    - In general well under control in simulation
  - But what about neutron production, and transport, for example ?

- Other ?

Elaborate simulation techniques ?

- At present, obtaining statistics with BDSIM/Geant4 simulation looks a time consuming process
- We proposed in June the idea of introducing the “event biasing” technique
  - E.g. importance sampling
  - Can be of potential interest
  - But have to evaluate when, where to apply
  - … and how.

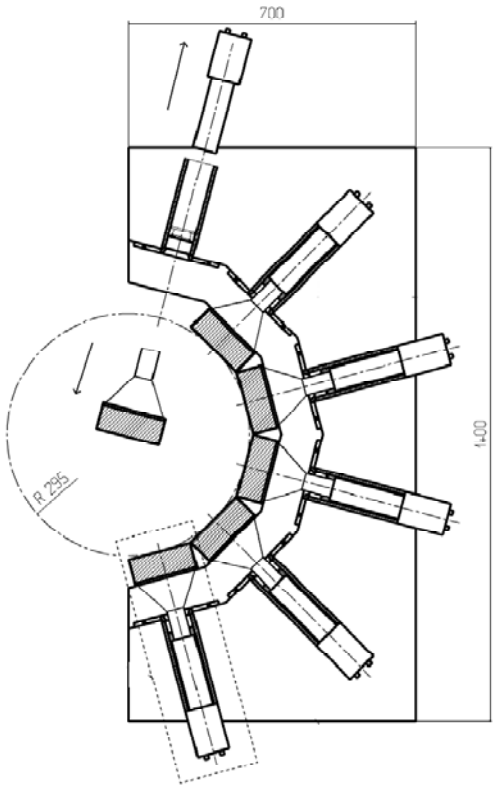
- Other techniques ?

Perform dedicated background measurements ?

- Performing background measurements would of course be a vital point to validate the simulation
- Share the experience and measurements on the BSM/BPM devices is a clear necessity.
- We should anticipate dedicated measurements in addition
  - And take advantage of this meeting to discuss ideas about this !

Possible devices for bgk measurements

- CsI crystal ring
  - For photons & electrons flux
  - Was used during BaBar commissioning



- A “mini-TPC”
  - Charged tracks
  - Used during BaBar commissioning as well

Neutron counting ?

- Neutron production can occur through photo/electro-nuclear processes
- What rate may we expect ?
- Example of neutron counter:
  - Taken from BaBar MDI:
    - BF_3 tube surrounded by a moderator (polyethylene) to slow down the neutrons:

      $^{10}B+n \rightarrow Li(0.84\ MeV)+\alpha(1.47\ MeV)+\gamma(0.48\ MeV)$

      $^{11}B+n \rightarrow {}^{7}Li(1.02\ MeV)+\alpha(1.78\ MeV)$
    - Combination a several counters can provide information on the source location

Conclusion

- We may take advantage of ATF2 to prototype also the background simulation
  - Useful for ATF2
  - Possible basis for the future high energy machine
- Critical points, trying simulation techniques, and implementing dedicated background measurements might be easier in a not too large scale experiment like ATF2
- “Human scale” experiment ATF2 would certainly help with easier interactions and communications between members