2nd AWAKE Run 2 Meeting

8 February 2019

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with input from Alexey, Ans

Run 2 Baseline

- We have to agree on a baseline layout
- Key decisions need to be taken before more detailed studies can be launched.
  - E.g. 1 or 2 plasma cell, electron beam parameters

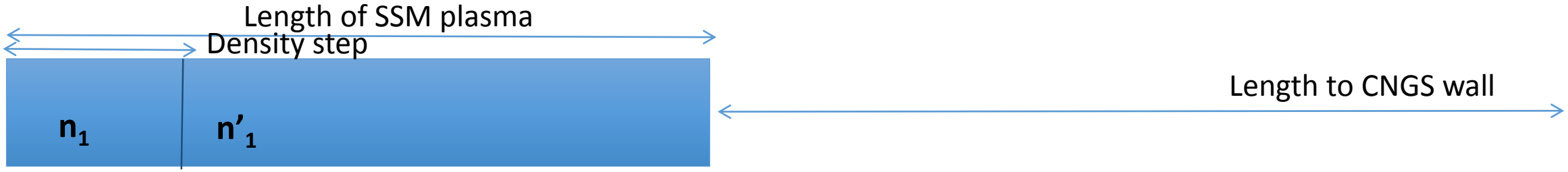
- Aim of this meeting is – if not decide – then to clarify exactly the tasks that need to be done to come to a decision.

To advance in our process:

- Table with key issues
  - Issue – who has worked on it so far – comments – what can we already say
- Now define:
  - who works on it? when can we expect result? What additional info is needed?

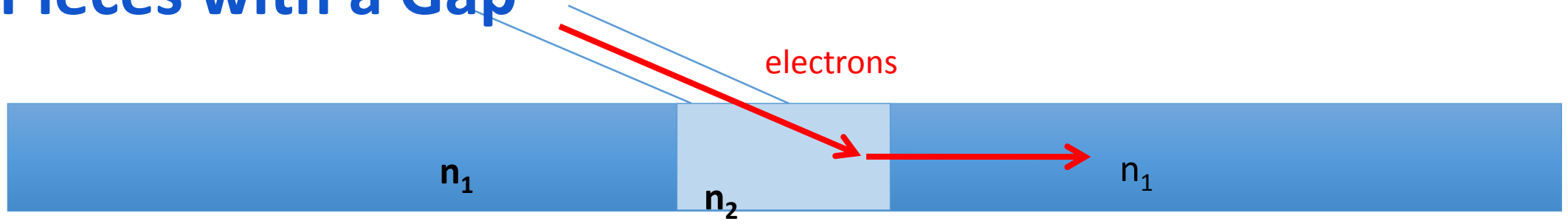
Note: Table is incomplete and more points will be added.

Integration and Plasma Cell



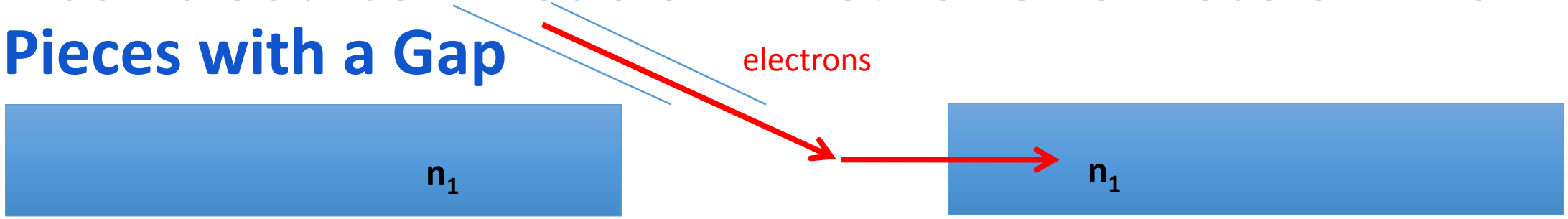
Issues	Who so far	Comments	What can we already say
Length of SSM plasma	Alexey, Konstantin	**Not very well understood in 3D. Density step in 3D (QV3D) is less efficient than in 2D (LCODE). Probably this can be resolved only in experiment.**	**Most variants at n=7e14 require 8-10 m long first plasma cell (if we want to inject e- into the stable wakefield). We can expect the scaling 1/sqrt(n) with plasma density – but this needs to be checked in simulations.**
What is the density step	Alexey, Konstantin	**Again should be checked in 3D (in progress now).**	**Typical step 2-5% at 50-100 cm. @ n = 7e14**
Where is the density step	Alexey, Konstantin		**50-100 cm @ n = 7e14**
How much can we move the plasma cell upstream	Brennan		
Remove vacuum window	Brennan		
How much space is available to CNGS wall	Ans		

Plasma Source – Decision whether One Piece or Two Pieces with a Gap



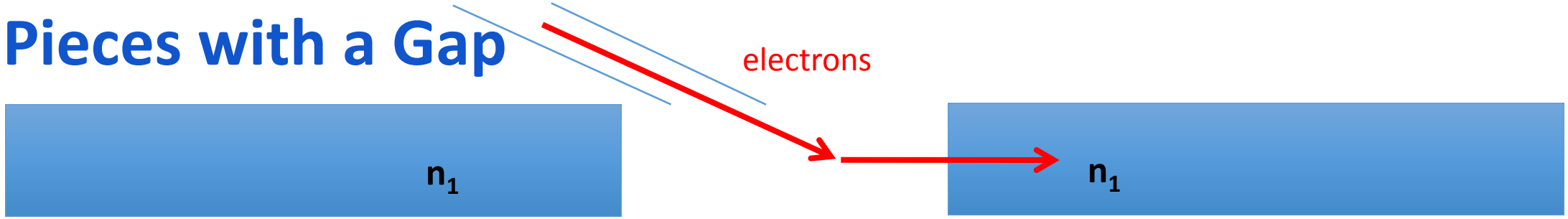
Issues	Who	Comments	What has been already done?	What do we know sofar
Ratio between n_2 and n_1	Alexey, Konstantin, simulations	Could be show-stopper: general feasibility of technical implementation (n_2 below freezing point?)	**Two cases checked so far: +25% and -25%.**	Limited in experiments so far to +3% by Rb condensation
Electron injection process	Alexey, Hossein	3D problem! very complex, not yet understood	**The work is in progress (QV3D).**	There are longitudinal and transverse plasma ramps

Plasma Source – Decision whether One Piece or Two Pieces with a Gap



Issues	Who so far	Comments	What has been already done?	What do we know so far
What happens to the protons in the gap?	Alexey, Konstantin, Hossein		simulations	**Protons are diverging. Protons in the tail diverge more than in the head.**
What is the maximum gap length	Alexey, Konstantin, simulations	As function of gap length show wakefield, emittance,…. **Wakefields not so important, but influence on emittance**	simulations	**1 m reduces wakefield by 40-50% 0.2 m – by 5-10%. The higher the wakefield the more it is sensitive to the gap length.**
What is the minimum gap length	Brennan			
Electron injection process	Alexey, Konstantin, Hossein	In vacuum, less complex, 2D?	simulations	**The head SMI in preionized 2nd stage disappears with far enough seed position.**

Plasma Source – Decision whether One Piece or Two Pieces with a Gap



Issues	Who so far	Comments	What has been already done?	What do we know so far
Effect of window	Livio, Alexey		First results by Livio **The effect of plasma produced at the window is not studied.**	1 (0.1) mm Al: ε grow from 0 to 8 (2.5)mmmrad
Electrons: emittance is function energy, laser beam dump, window, proton beam	Alexey, Konstantin	Dependency curves are needed and match with e-line design		
Injection optics of electrons: optics is function E, ε, bunch-length	Brennan	Dependency curves needed		
Electron beam parameters matched to plasma	Steffen, Brennan	Define feasible parameter phase space		

Integration

New electron source + beam line + plasma cell + diagnostics

Issues	Who	Comments	What has been already done?	What do we know so far
Footprint of electron source	Steffen			
Footprint of beam line	Brennan			
Civil engineering studies for electron source and beam line	Ans	What can be done before footprint of e-source and line is known?		
Laser line for 2nd plasma cell	Valentin, Josh	Need decision on 2 or 1 plasma cell before		
CNGS emptying	Ans	Is it needed?		

Instrumentation

Protons and electrons

Issues	Who	Comments	What has been already done?	What do we know so far
Define instrumentation requirements	Stefano	How much can be done now already?		