

The Optical Line for the Electron Spectrometer

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and M. Wing

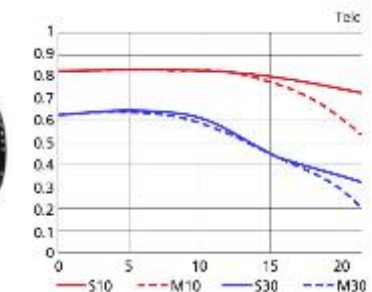
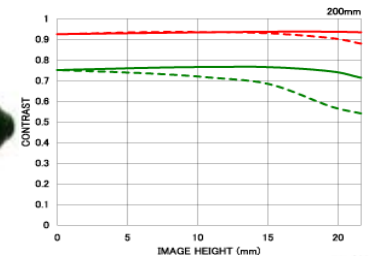


Outline

- Spectrometer optical line layout and integration;
- Alternative optical line proposal;
- Optical line tests;

Spectrometer optical line

- Camera position: TSG4, ~17.4 m from scintillator screen;
- Baseline: reflective elements to ~350 mm camera lens – optical elements calculations ongoing;
- To be discussed: TSG42 safety exit? Lights (optical line completely enclosed)?
- Sigma apo 200-500 mm, F# 1.1-2.8
- Nikon 70-300 mm, F# 4 with optical coupler (available - BI)



Optical line layout

Scr/M₀: 1 m

M₁: 93 cm

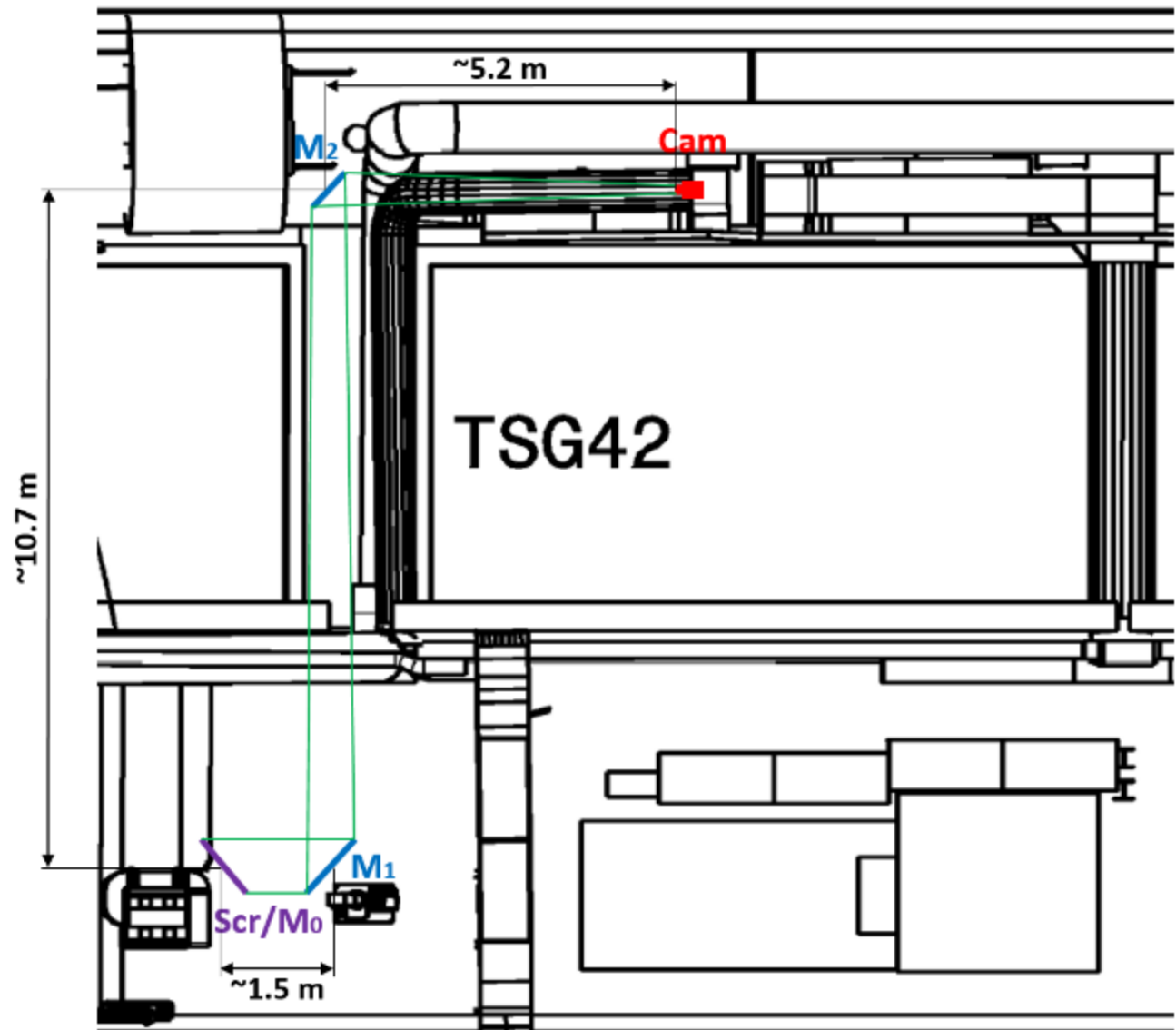
M₂: 43 cm

Total length: 17.4 m

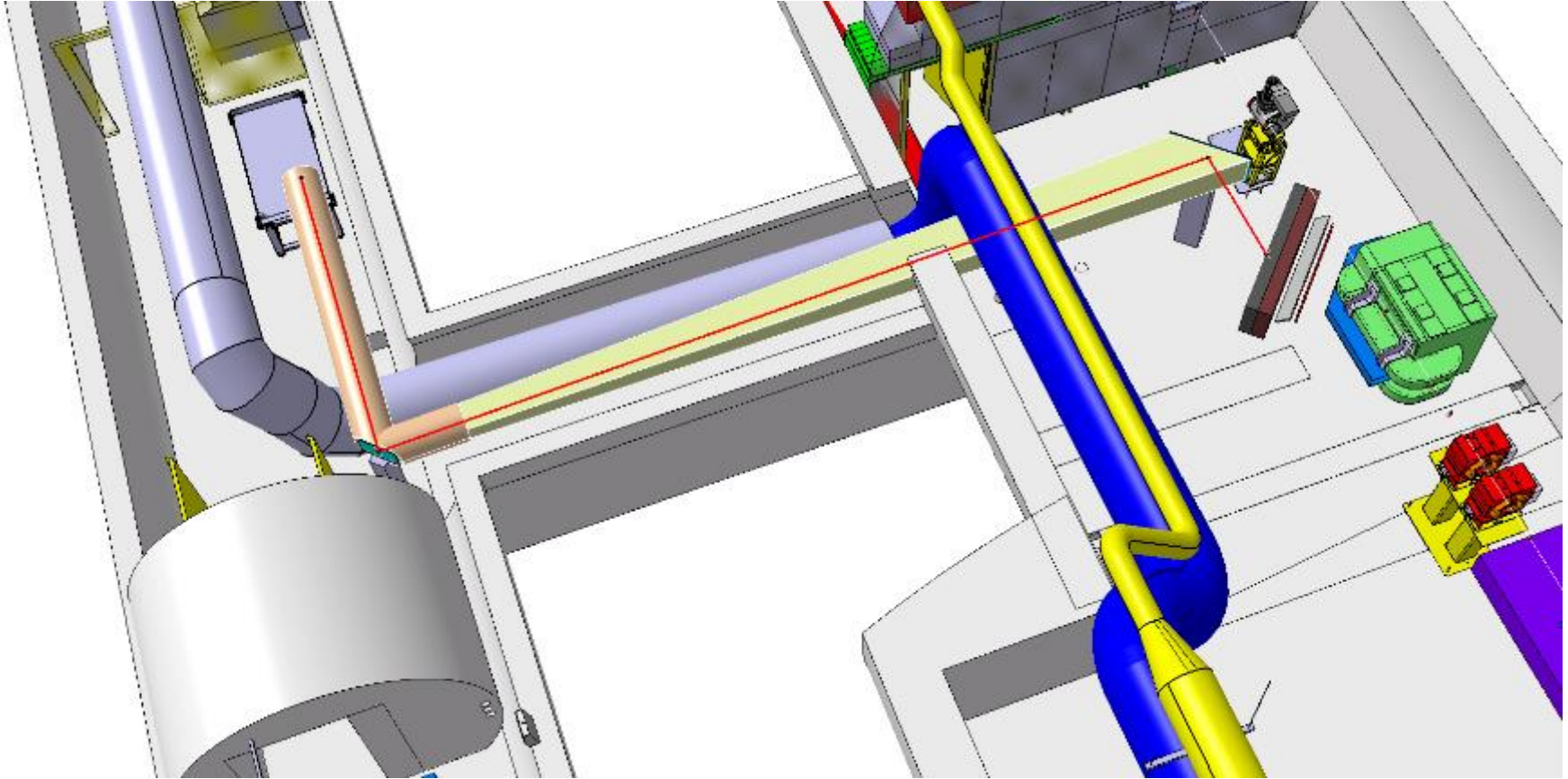
Mirrors:

Unprotected
metallic coating;

In contact with
OptoSigma (custom
made mirrors)



Optical line layout



Vincent Clerc
EN/MEF

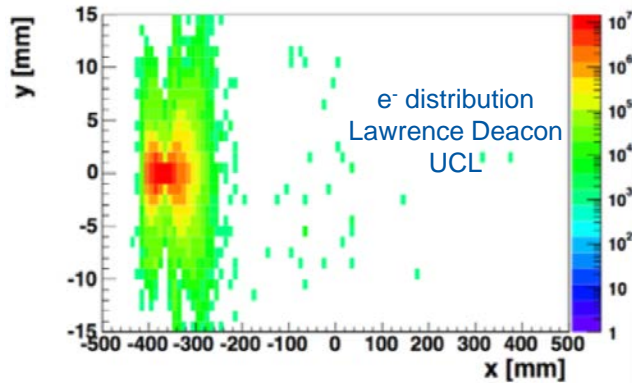




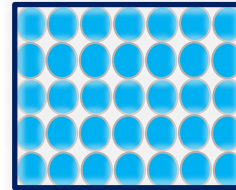
Alternative solution – optical fibres

- Pros:
 - Higher light yield;
 - Easier integration (compact solution);
 - Could be used as scintillator (no need for the LANEX screen)?
- Cons:
 - radiation degradation (high attenuation) – to be studied (plastics × quartz);
 - challenging manufacturing, arrangement of array & fibre sampling;

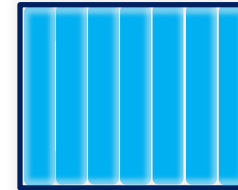
Alternative solution – optical fibres



2D fibre array



Linear array (integral)



or

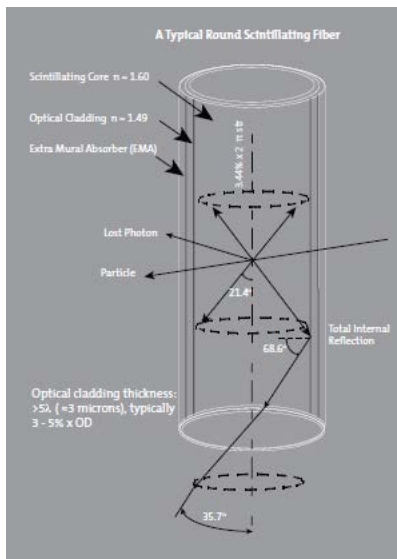
→ Fibre bundle



→ Camera



- In contact with Thomas Schneider from PH-DT



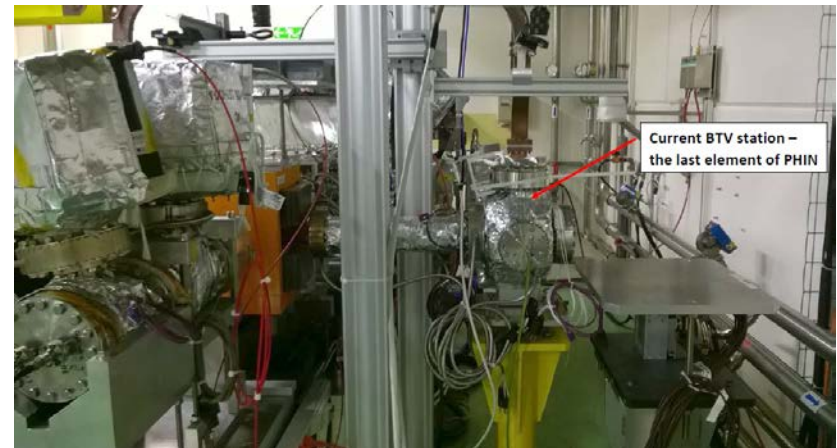
Example for Saint-Gobain BCF-12 (scintillating plastic fibre):

- 8000 ph/MeV (MIP)
- 4% trapping efficiency
- Resulting in approx. 8 ph/particle
- For 1 mm dia: **10⁶ photons** per fibre per bunch



Light yield test

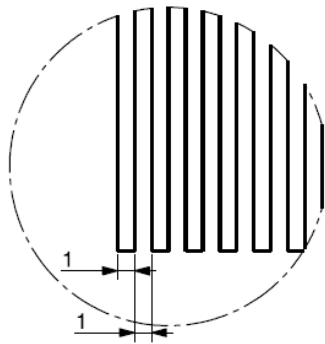
- Test of the LANEX scintillator light yield and camera;
- In PHIN (5 MeV e^- , flux several orders of magnitude higher than foreseen in AWAKE – to be scaled);
- Several LANEX samples (10cm \times 10cm) with different thickness;
- Andor iStar 340T camera with Nikkor 70-300 mm lens, 17.4 m from the screen;
- Planned for August 2015;



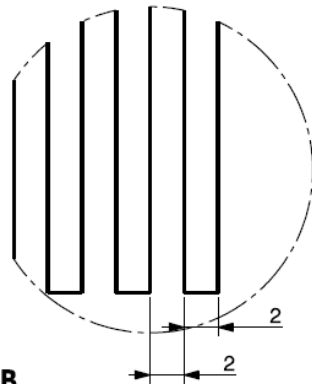
Optical system test

- Test of optical resolution of the optical system vs. mirror quality;
- Several optical targets (black/white stripes)
 - 0.5mm, 1mm, 2mm, 4mm, 8mm, 16mm stripes;
- Andor iStar 340T camera with Nikkor 70-300 mm lens, 17.4 m from the target;
- Optical line with/without mirrors (of different quality, standard vs. laser quality);
- Planned for September/October 2015 in BI lab;

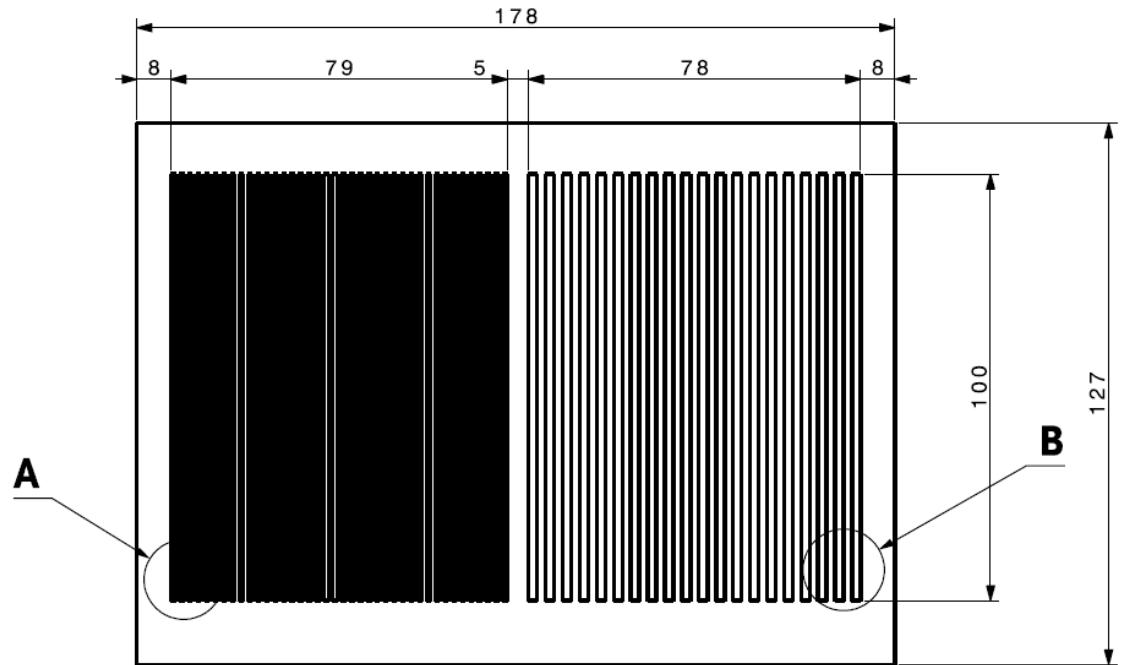
Optical system test - targets



A 40 lines
4:1



B 20 lines
4:1



1		1				
QUA	DESCRIPTION	POS	MAT.	OBSERVATIONS	REF. CERN	
ENS/ASS		S. ENS/S. ASS				
Test Target 1 Test Target 1				SCALE	1:1	
				DRAWN	A. GOLDBLATT	2015-04-17
				CONTROLLED		
				RELEASED		
				APPROVED		
				CAD Document Number	ST0675409_02	
				REPLACES		
NON VALABLE POUR EXECUTION NOT VALID FOR EXECUTION		QAC	-	SIZE	3	



Conclusions

- Discussion about optical line integration started, several tasks to be clarified;
- Optical line calculations ongoing;
- Feasibility studies of using optical fibres ongoing;
- Light yield and optical system tests in preparation for August-October;

Thank you for your attention

