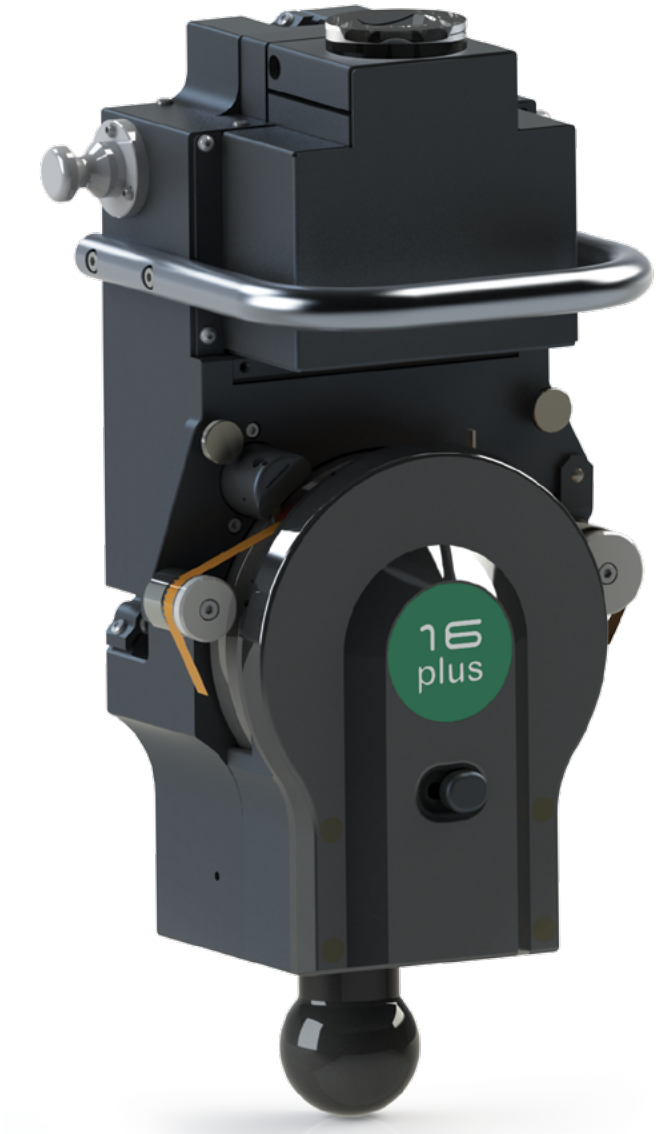
digital film technology

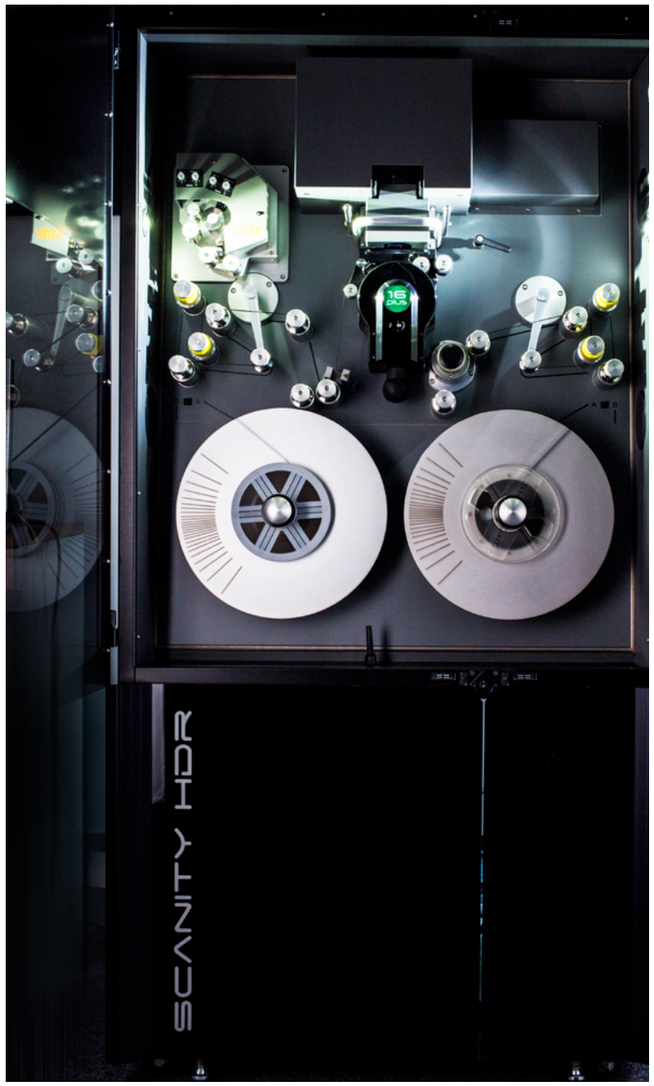
16 Plus

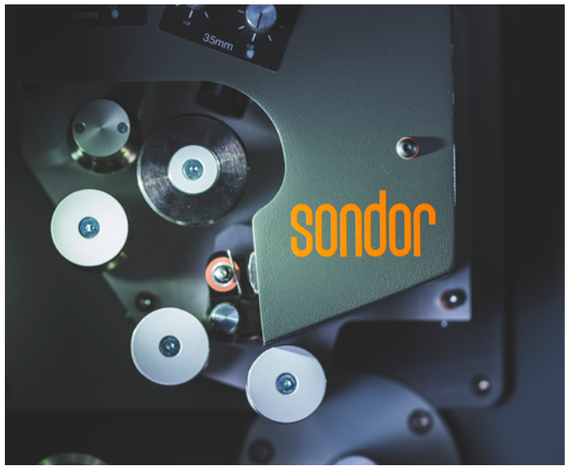
Supporting small film format gauges

white paper

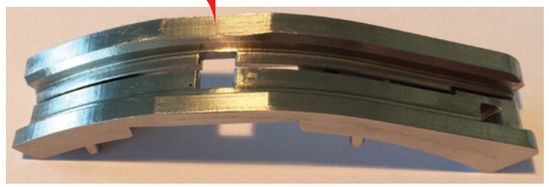


dft
standing the test of time

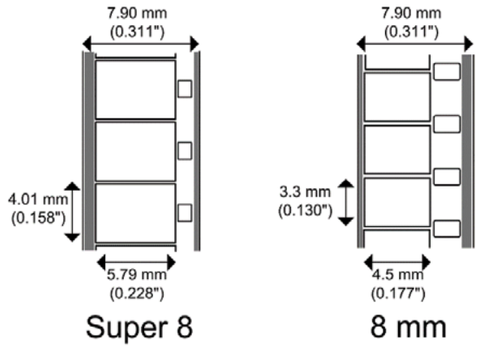




Film format adaptor



Super8 and N8mm film format



Introduction >>>

The beginning of the 19th century saw many “startup” companies compete in the amateur film market. Film needed to be cost-effective, and was usually derived from 35 mm professional raw stock that was available in large quantities. The film was cut in two or three lengths - substandard size , or “Schmalfilm” (small film) size in Germany .

There were many formats, including 17½ mm with perforations on one side or in the center, 15mm center perforation and even 20mm with notches. Many of the companies and formats were not successful and vanished, but some had more success:

9.5mm

In 1922 Pathé introduced the Pathé Baby, a home cinema system. Between the perforations of 35mm film, three stripes of 9.5mm were slit. Pathé launched a hand cranked camera a year later, which, being small, handy and economical, made it popular in a very short time. For the first time amateur film gained a wider acceptance with estimated 300,000 projectors sold.

8mm

The success of Pathé’s 9.5mm format lasted until Kodak introduced the 8mm format in 1932. In a first step one half of the film was exposed. Thereafter the reel was turned and the other half was shot. After processing, the film was slit in the middle and the two 8mm stripes spliced together resulting in as many frames on a 25ft small reel as on a 100ft, 16mm film.

Super 8

In 1965, 8mm film underwent a transformation. By reducing the size of the perforations, the picture aperture could be enlarged by 50%. Supplied in 50ft, 8mm cassettes, Super 8 film (mostly reversal material) was a huge success, and from 1973, it also included a magnetic sound stripe. Fuji attempted to introduce a far better version and conceived the Single 8mm system (which used a thin polyester base) but they struggled to withstand Kodak’s Super 8mm version and consequently their film was not universally accepted.

Life on the Shelf

Large quantities of smaller film formats, such the 9.5mm, 8mm and Super 8mm formats, are stored in archives around the world. Not visible to the public, this part of the world's cultural heritage waits is in danger of being lost forever, as until now, it has not been possible to digitize these formats in high quality and at a high speed.

Problems of such formats

Like many other archived film material, small gauge film exhibits a number of problems including; shrinkage, bending, warping, weak or bad splices, damaged or missing perforations, notched or broken edges, and many different formats.

dft's Approach to small film gauges

Given the wide range of formats in existence, dft has developed a flexible but effective solution to support small film formats, which combine with the proven features of Scanity and Scanity HDR to deliver solutions for the world's archive facilities:

- Digital Servo Control
  Scanity's digital servo system together with the capstan based film transport precisely controls acceleration and film tension individually for film formats ensuring the smoothest possible film treatment.
- Reduced Shuttle Speed
  Some archive material is so delicate or fragile that despite the most gentle film transport, reduced film transport speed is desired. With Scanity and Scanity HDR, simply flip a switch to lower the speed of the film transport as well as acceleration and slowing down in visible shuttle or spooling mode.
- Optical Perforation Detection
  Scanity's optical perforation detection is an alternative to mechanical perforation systems using pins that provide a tight and possibly harmful grip on the perforations. Steadiness of images are electronically corrected using a sophisticated processor.
- Individual Light and Density Range Control
  Poor colors can fade both positive and negative film due to age and inappropriate storage or use. As long as there is a little remaining color, information left in the color layers can be recovered. Scanity offers a wide range and headroom of light as well as the tools to control the intensity of each color of the LED illumination. Scanity also controls adjustable density range that allows users to get the very best out of the film.

How it works?

A new, modular, 16mm Lens Gate Assembly (LGA) named 16plus has been designed, based on Scanity's well-known customized 16mm optics. The new LGA supports S16/ N16 mm film and optional film format specific adapters allows the usage of smaller film gauges as Max8mm / S8mm / 8mm and 9.5mm. This flexible approach, in combination with Scanity's proven touchless perforation detection, means that almost all perforation positions and formats (even in centerline) can be supported.

Table -1 Resolution and Speed

			Pathe 9.5		Normal 8		Super 8		Max 8	
					SMPTE 231-1995		SMPTE 157-1994			
Camera Aperture	inch		0.335	0.256	0.192	0.145	0.228	0.163	0.250	0.166
	mm		8.509	6.502	4.880	3.680	5.790	4.140	6.350	4.216
Max. resolution on film	lp/mm		80	80	80	80	80	80	80	80
h & v resolution			h	v	h	v	h	v	h	v
resolution needed		pixel	1,361	1,040	781	589	926	662	1,016	675
Scanity resolution	4K	pixel	2,840	2,180	1,640	1,240	1,940	1,380	2,120	1,420
	2K	pixel	1,420	1,090	820	620	970	690	1,060	710
Speed	4K	fps	18		30		30		30	
	2K	fps	30		50		50		50	

Is Scanity's S16mm lens good enough?

Different publications (including ITU's test results from 2002*) show that the available resolution on original camera negative (OCN) film material is around 80 lp/mm. This means that a 4K sensor needs to be able to scan 35mm FA OCN material. However, scanning a first-generation OCN is the extreme case; especially if we consider small gauges like the very successful Super 8mm format. Most of the S8 material used in the past was reversal material with much lower resolution than OCN. ITU tests show that after just one film generation (print), the MTF at 80 lp/ mm was only about 4%; in fact, 20% modulation level was maintained only to about 50 lp/mm. This second generation's information content could therefore be captured adequately with far less scanning resolution than 4K. In summary, the maximum resolution to be found on small gauge film material is around 80 lp/mm.

The result of the calculation e.g. for Super 8mm format is:

> Camera aperture width:
> 5.79mm x 80lp/mm =
> 926 pixel/line

This is well within Scanity's resolution performance both in the 4K and in 2K modes of operation. Thus, maximum speed will be around 30fps in 4K mode and 50fps in 2K mode respectively. For more details on other formats, see Table 1.

Sound

Although Scanity and Scanity HDR have sound ingest capability for 16mm / 35mm COM-OPT and 16mm for COM-MAG, a small gauge sound option will not be available immediately on Scanity.

A good investment

The new 16plus LGA together with optional available film format adapters enriches the Scanity and Scanity HDR proven feature set by enabling archives to scan a wide range of small film formats, including 8mm and 9.5mm. For the first time, archives are now able to cost effectively handle these small formats above real-time speed and at 16bit RGB.

** - ITU Report by Vittorio Baroncini, Hank Mahler, Matthieu Sintas and Thierry Delpit*

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