

Assembly of NCC Stripixel Layers

http://www.phenix.bnl.gov/~suhanov/ncc/proposal/assembly/stripixel_assembly.pdf

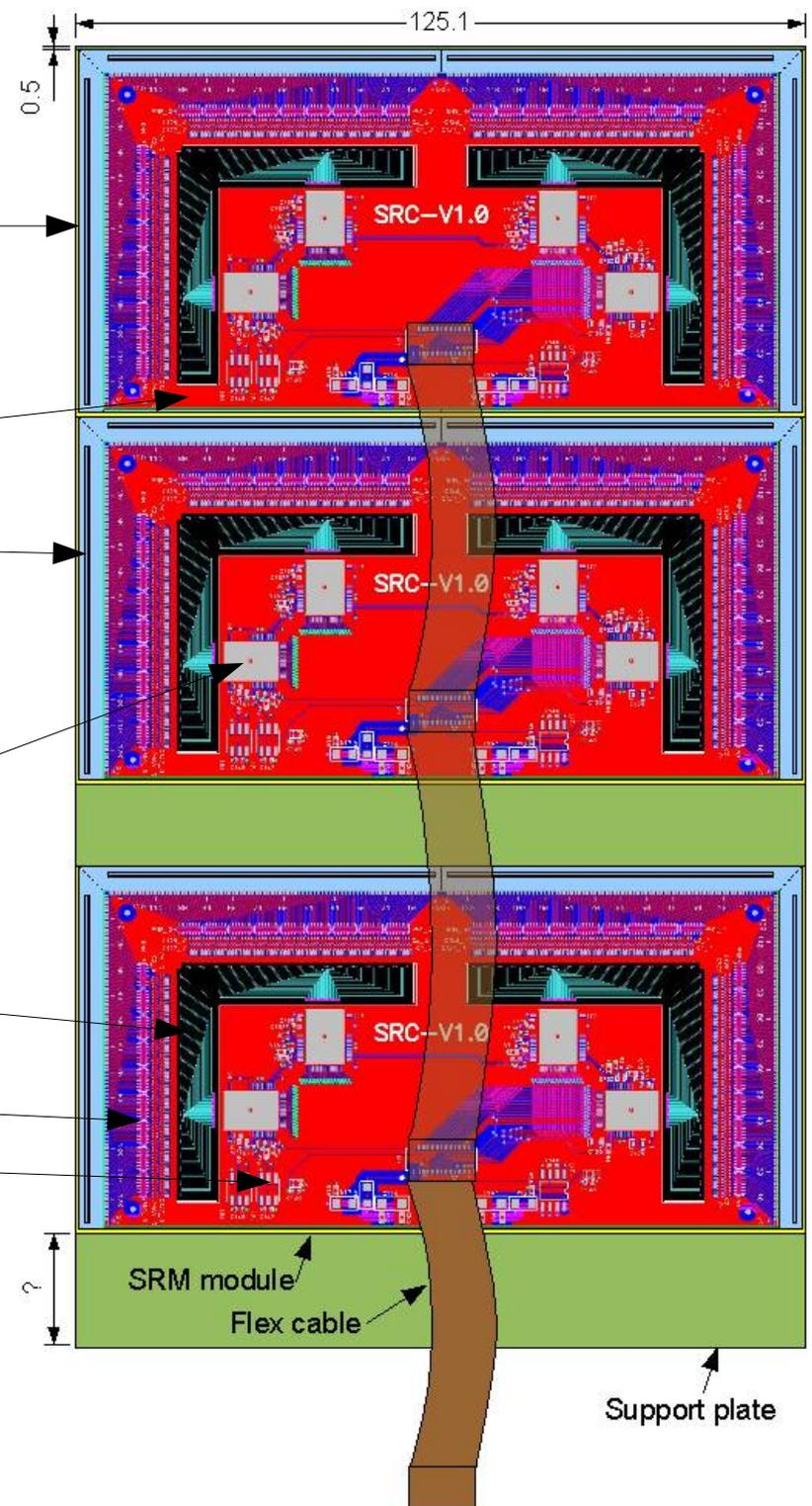
Design

Stripixel Readout Module (**SRM**) is a basic building block of the stripixel layers. It consists of two silicon sensors and a readout PCB (Stripixel Readout Card or **SRC**).

Stripixel sensors are DC-coupled, they have positive bias voltage on the bottom aluminum layer. The biasing resistors are incorporated on the sensor.

SRC contains a chain of four readout chips SVX4, pitch adapter, RC decoupling networks, elements of slow control.

Several SRMs are mounted on a support plate and form a Stripixel **Ladder**. There are ladders of three sizes, hosting 4, 6 or 7 SRMs.



Choice of Materials

Ceramics for the SRM

- Thermal expansion should be similar to Silicon
- Good thermal conductivity

Material of choice: Al₂O₃ (ADS-96R from CoorsTek)

Support plate

- Thermal expansion should be similar to selected ceramics
- Rigidity

Materials to consider: FR4, ceramics ADS96R, carbon fiber composite,

Table V. Typical Material Characteristics

Characteristic	Unit	Test Method	AD99-90R	AD99-96R
Alumina Content	Weight %	ASTM D2442	91	96
Color	Ø	Ø	Dark Brown	White
Density	g/cm ³ (lb/ft ³)	ASTM C373	3.72 min. (0.134)	3.75 min. (0.135)
Hardness Ø Rockwell	Ø	ASTM E18, R45N	78	82
Surface Finish Ø CLA (as-fired)	Micrometers (Microinches)	Profilometer .0004" Radius Stylus .030" Cutoff ANSI/ASME B46.1	≤ 45 (1.14)	≤ 35 (0.89)
Average Grain Size	Micrometers	Intercept Method	5-7	4-7
Water Absorption	%	ASTM C373	NIL	NIL
Gas Permeability	Ø	*	NIL	NIL
Flexural Strength	Kpsi (MPa)	ASTM F394	53 (365)	58 (400)
Elastic Modulus	10 ⁶ psi (GPa)	ASTM C623	45 (310)	44 (331)
Poisson's Ratio	Ø	ASTM C623	.24	.25
Coefficient of Linear Thermal Expansion	10 ⁻⁶ /°C (10 ⁻⁶ /°F)	ASTM C372		
25%4200°C			6.4 (3.5)	6.4 (3.5)
25%4500°C			7.3 (4.1)	7.2 (4.0)
25%4800°C			8.0 (4.4)	7.9 (4.6)
25%41000°C			8.4 (4.7)	8.2 (4.6)
Thermal Conductivity	W/m°C	Various (Btu × in/ft ² × h × °F)		
20°C			13 (90)	26 (180)
100°C			12 (83)	20 (139)
400°C			8 (56)	12 (83)
Dielectric Strength (60 cycles AC avg. RMS) .025" thick .040" thick	Volts/mil (Kv/mm)	ASTM D149	540 (21.3) Ø	600 (23.6) 490 (19.3)
Dielectric Constant (Relative Permittivity)	@25°C	ASTM D150		
1KHz			11.8	9.5
1MHz			10.3	9.5
Dissipation Factor (Loss Tangent)	@25°C	ASTM D150		
1KHz			.1	.0010
1MHz			.005	.0004
Loss Index (Loss Factor)	@25°C	ASTM D150		
1KHz			1.2	.009
1MHz			.05	.004
Volume Resistivity	ohm-cm or ohm-cm ² /cm	ASTM D1829		
25°C			> 10 ¹⁴	> 10 ¹⁴
300°C			4 × 10 ⁸	1.0 × 10 ¹²
500°C			Ø	1.0 × 10 ⁹
700°C			7 × 10 ⁶	1.0 × 10 ⁸

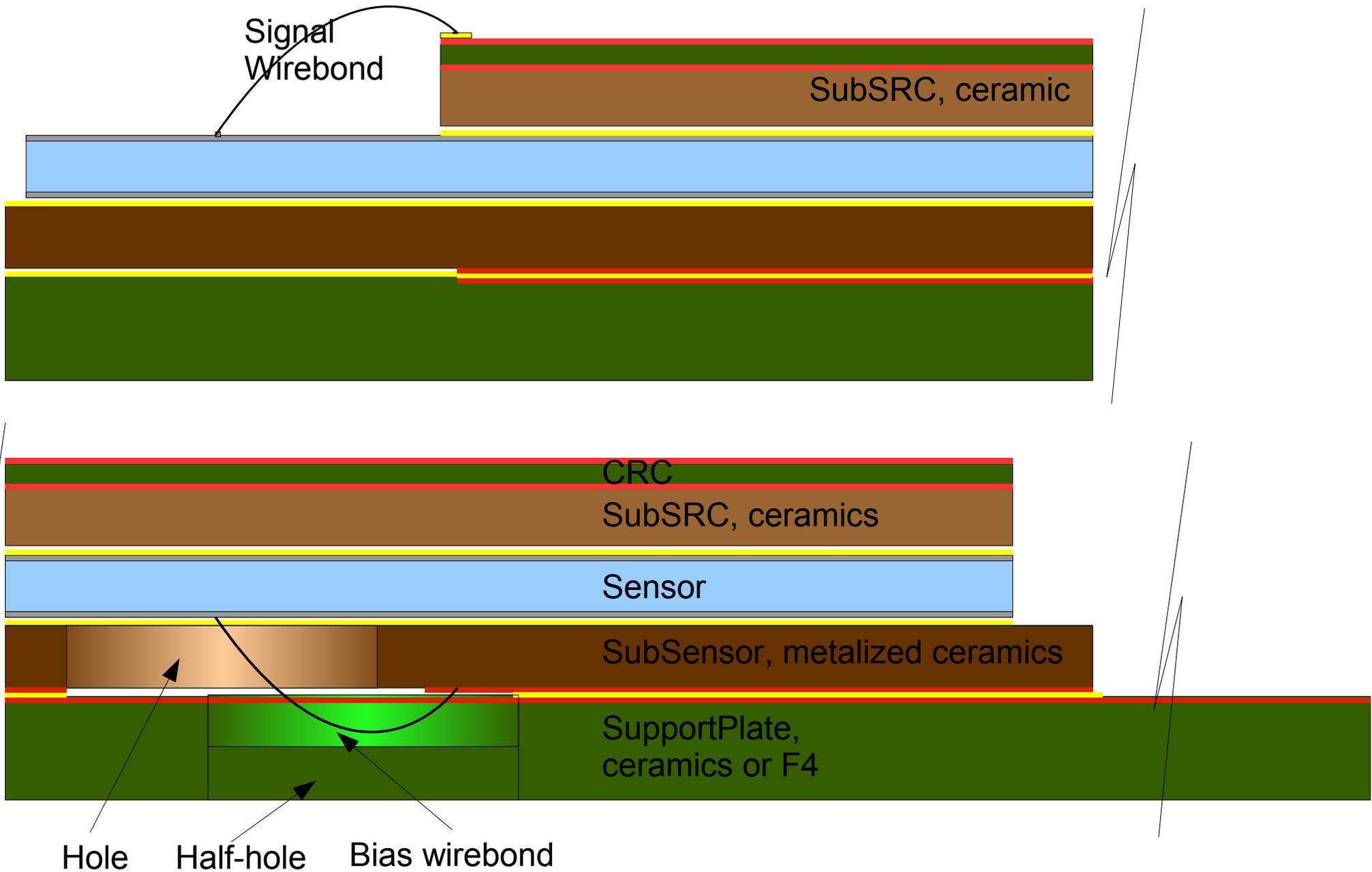
Conductors on Ceramics

- 1) Deposition of the seed layer of tungsten. Cheapest and least reliable. Impossible to solder or wire bond.
- 2) Thick-Film conductor Silver/Silver. Good for AL wirebonding and soldering.
- 3) Thick-Film conductor Gold/Gold. Most expensive, best for wirebonding

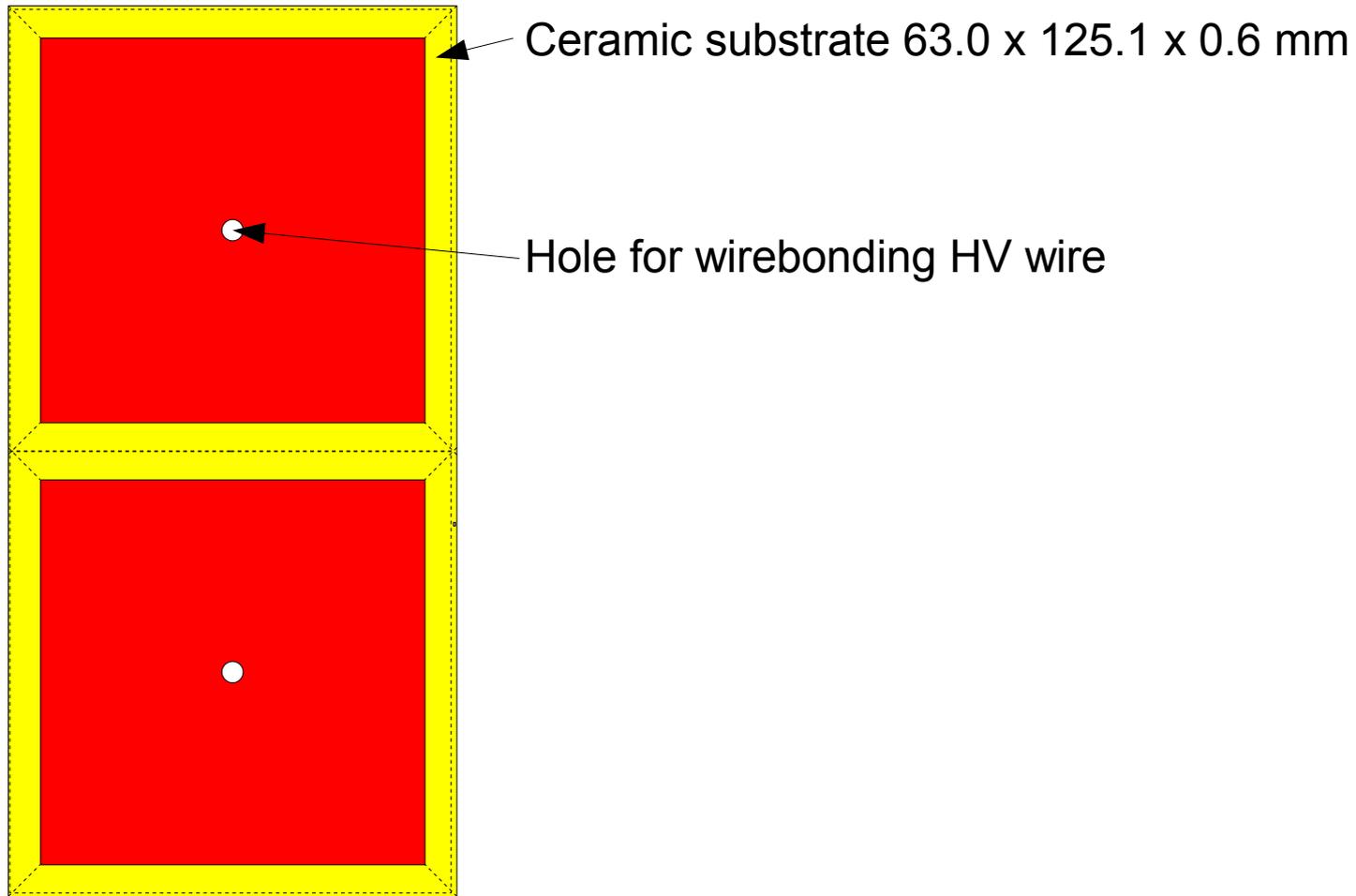
Property	Seed Layers		Plated Conductors			Thick-Film Conductors	
	MoMn	Tungsten	Nickel ^a	Gold ^b	Tin ^b	Gold/Gold Alloys	Silver/Silver Alloys
Typical Fired Thickness μ " (μ m)	400 – 1200 (10 – 30)	400 – 1200 (10 – 30)	80 – 180 (2 – 4.5)	40 (1) min. Flash: 15 (0.4) min.	80 – 180 (2 – 4.5)	Wire bond: \leq 500 (12.5) Solder: 300 – 700 (7.5 – 17.5) Etch: 150 – 200 (3.75 – 5)	Wire bond: \leq 500 (12.5) Solder: 300 – 700 (7.5 – 17.5) Etch: 150 – 200 (3.75 – 5)
Minimum Trace Widths; Spaces (mm)	0.005" \pm 0.002" (0.13 \pm 0.05)	0.005" \pm 0.002" (0.13 \pm 0.05)	–	–	–	Std: 0.005" \pm 0.002" (0.13 \pm 0.05) Ultra fine line: 0.001" \pm 0.0001" (0.03 \pm 0.003)	Std: 0.005" \pm 0.002" (0.13 \pm 0.05) Ultra fine line: 0.001" \pm 0.0001" (0.03 \pm 0.003)
Cost* (Relative to Manufacturing Costs)	1	1	4	5	4	5	3
Leach Resist. Solderable Materials (Good, Fair, Poor)	–	–	Good	Good	Good	Pure Gold: Poor Gold Alloys: Good	Pure Silver: Poor Silver Alloys: Fair – Good
Aluminum Wire Bonding Rating*	–	–	1–2	3	2	4	4
Gold Wire Bond Rating*	–	–	1	4–5	1	5	1
Resistivity, 20° C milliohm (mohm/sq) ^{††}	–	5–6	8–9	2–3	11–12	Pure Gold: 2–3 Gold Platinum: 60–100 [†]	Pure Silver: 1–2 Silver Palladium: 10–50 Silver Platinum: 4–5
Solderability*	–	–	4	5	3	Pure Gold: 1 Gold Alloys: 4–5	Pure Silver: 5 Silver Alloy: 2–4

Crosssection of the Ladder

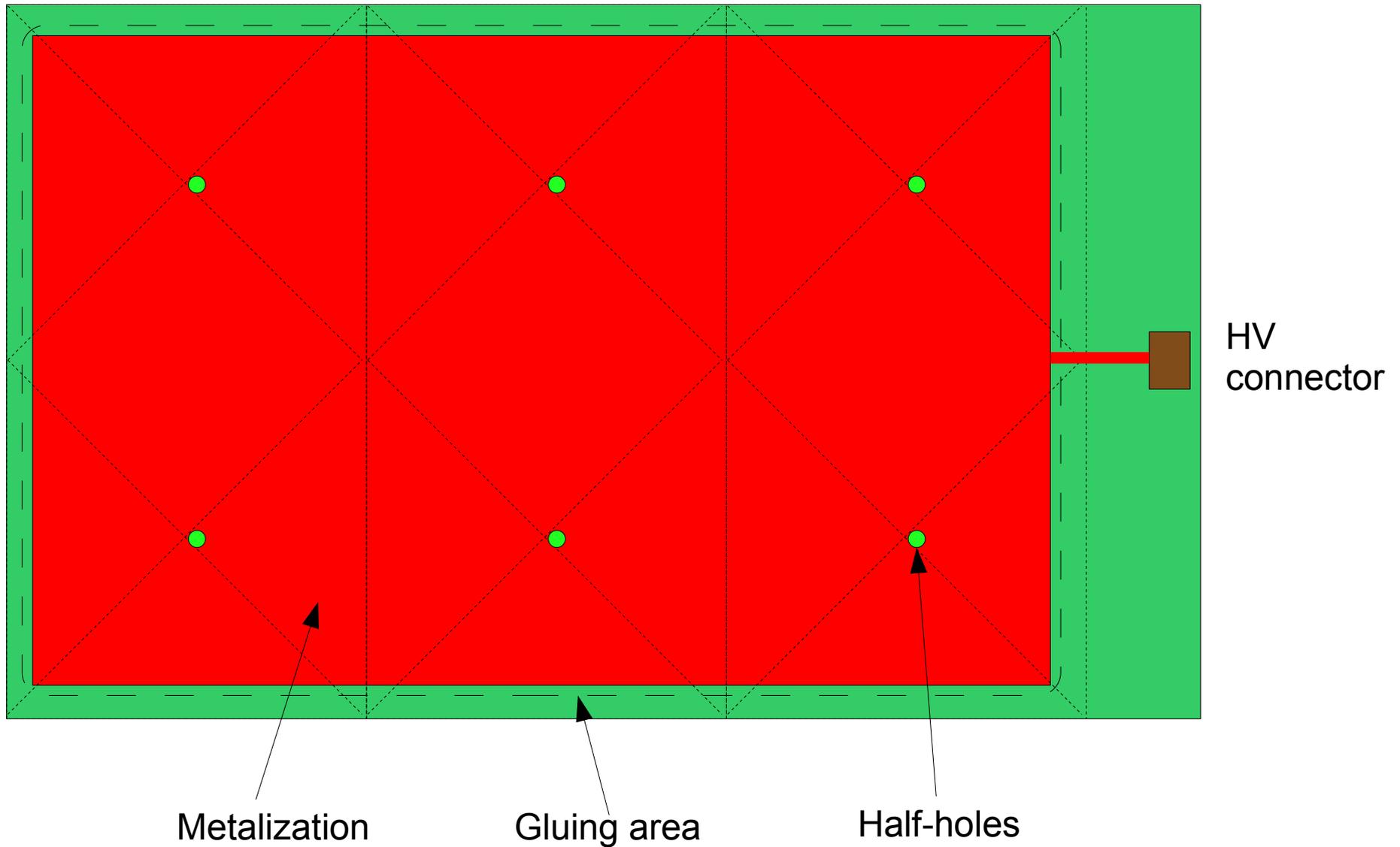
Scale 20:1



Sensor Substrate

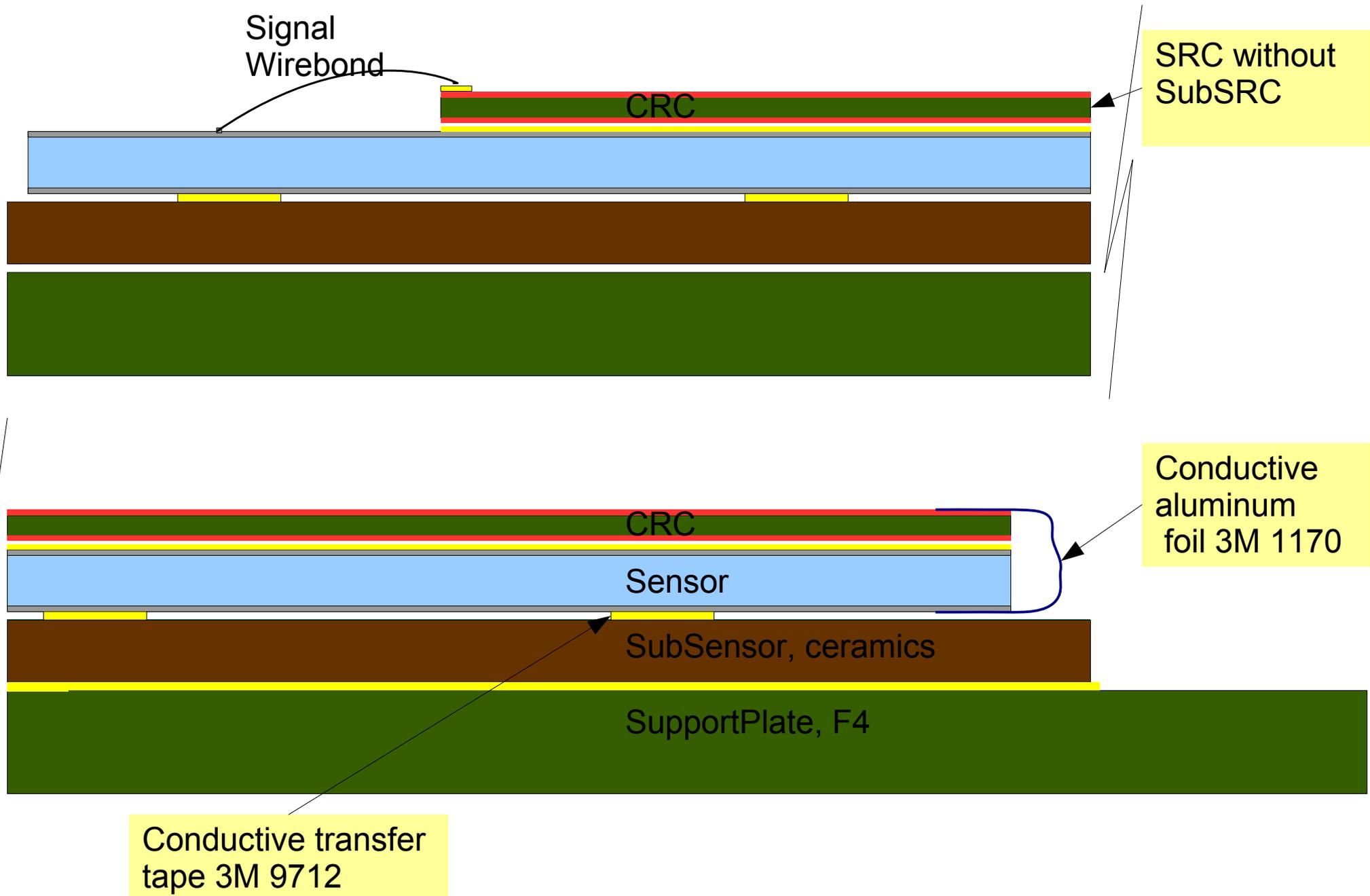


Support Plate



Prototype for Run 10/06 at CERN

Run 10/06. Crosssection of the Module Scale 20:1



Run 10/06. Assembly Sequence

