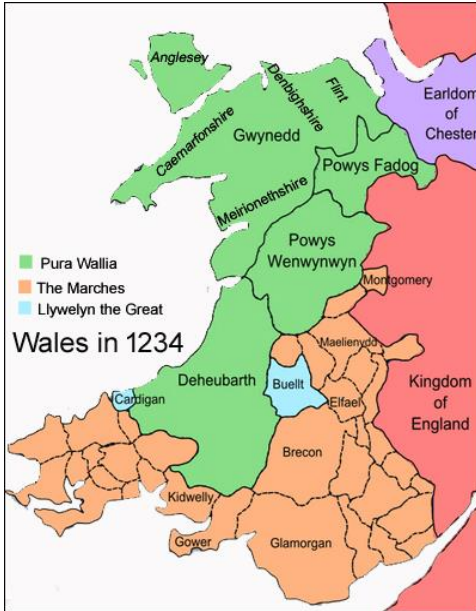


A black and white photograph of a stone archway with a wooden door. Above the door is a lantern. The archway is made of rough stone, and the door is made of vertical wooden planks. The lantern is ornate and hangs from a chain. The scene is set against a light-colored wall.

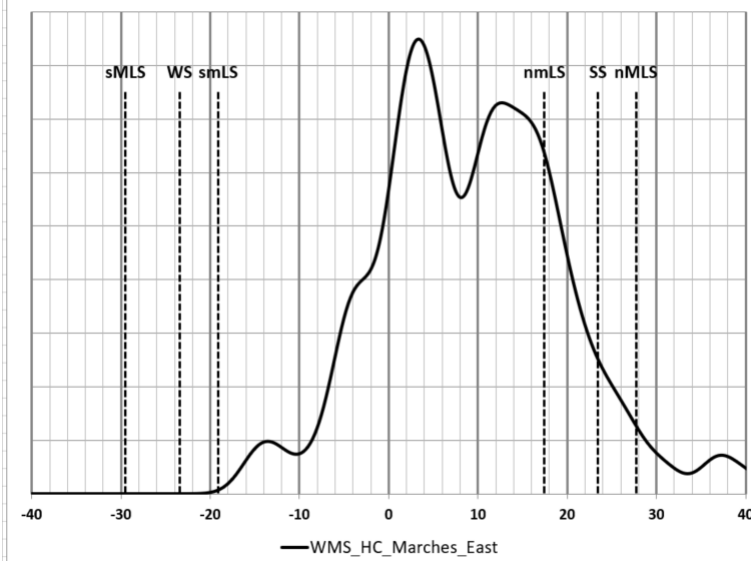
Historical Context



- ❖ Many of the churches were first built in the 'Era of the Saints', in the 6th century, by Irish peregrines.
- ❖ Later the *Pura Wallia* area maintained its Celtic Christianity resisting the European/French version of Christianity.
- ❖ In the 13th century the *Pura Wallia* churches were rebuilt in stone, however it is generally considered that they were not reoriented.
- ❖ Additionally it is known that many of these saints appropriated pre-Christian holy sites and thus today there is **speculation that some of these churches reflect the early pre-Christian, or Celtic, orientations** of earlier structures. (Hinton 2012, 72).

The Welsh church's tend to sit in their original oval llans





Histograms of the eastern declinations of the historical churches smooths out, or removes, the unique ambiguities that lay within the data.

Working with a Spread Sheet

Cluster	Name	Town	Modern County	Historic County	Cantref	Cymwd	Marches or Pura Wallia	County	Curfew	3rd date	Data Content
HC005	St Michael Church, Llanmihangel	Llanmihangel	Glamorgan	Galmorganshire	Gorfynydd	Kenfig	Marches	13	7		
HC006	St James Church, Wick	Wick	Glamorgan	Gwent	Gorfynydd	Kenfig	Marches	12	6		
HC007	St Augustine's Church, Penarth	Penarth	Glamorgan	Galmorganshire	Penychen	Tal-y-Fan	Marches	13	7	level? Rb	
HC008	St Bridget, St Bride's Major	St Bride's Major	Glamorgan	Galmorganshire	Gorfynydd	Kenfig	Marches	12	6	1141	
HC009	St John the Baptist Church, Cardiff	Cardiff	Glamorgan	Galmorganshire	Gwent Is Coed	Llyfnydd	Marches	12	6	1180	
HC010	St Senwyr Church, Llansannor	Llansannor	Glamorgan	Galmorganshire	Penychen	Tal-y-Fan	Marches	12	6		
HC011	St Cadog Church, Cheriton	Cheriton (Gower Peninsula - Hospitaliers)	Glamorgan	Galmorganshire	Eginog	Gwyr Is Coed	Marches	13	7		
HC012	St Cattwg, Port Eynon	Port Eynon (Gower Peninsula - Hospitaliers)	Glamorgan	Galmorganshire	Eginog	Gwyr Is Coed	Marches	6	1	12th	
HC013	St Illtyd Church, Oxwich	Oxwich (Gower Peninsula)	Glamorgan	Galmorganshire	Eginog	Gwyr Is Coed	Marches	6	1	14th	
HC014	St Mary's Church, Rhossili	Rhossili (Gower Peninsula - Hospitaliers)	Glamorgan	Galmorganshire	Gwyr	Is Coed	Marches	6	1	1200	
HC015	St Nicholas Church, Nicholaston	Nicholaston (Gower Peninsula)	Glamorgan	Galmorganshire	Eginog	Gwyr Is Coed	Marches	14	7		
HC016	St David - EAST, Llanddewi	Knelston (Gower Peninsula)	Glamorgan	Galmorganshire	Eginog	Gwyr Is Coed	Marches	13	7		
HC016	St David - WEST, Llanddewi	Knelston (Gower Peninsula)	Glamorgan	Galmorganshire	Eginog	Gwyr Is Coed	Marches	13	7		
HC017	St Mary's Church, Pennard	Pennard (Gower Peninsula)	Glamorgan	Galmorganshire	Eginog	Gwyr Is Coed	Marches	13	7		
HC018	St Teilo, Bishopston	Bishopston (Gower Peninsula)	Glamorgan	Galmorganshire	Eginog	Gwyr Is Coed	Marches	5	1	13th	
HC019	St George Church, Reynoldston	Reynoldston (Gower Peninsula)	Glamorgan	Galmorganshire	Eginog	Gwyr Is Coed	Marches	13	7	19th	
HC020	St Illtyd - EAST, Ilston	Ilston (Gower Peninsula - Hospitaliers)	Glamorgan	Galmorganshire	Eginog	Gwyr Is Coed	Marches	6	1	13th	

Basic historical data for each Church recorded

Working with a Spread Sheet

Cluster	Name	Long	Lat	Az E	Alt E	Dec E	E.Date 1	Julian Date E1	Feast Day	E.Date 2	Julian Date E2	Feast Day	Alt W	Dec W	W.Date1	Julian Date W1	W.Date 2
HC005	Michael St Michael Church, Llanmihangel	-3.466852	51.436802	88	0.5	1.637632855	19-Mar	12-Mar	71	14-Sep	07-Sep	250	1.9	0.2395619	15-Mar	08-Mar	17-Sep
HC006	St James Church, Wick	-3.550445	51.438373	72	0.2	11.26551569	13-Apr	07-Apr	97	19-Aug	13-Aug	225	-0.2	-11.26552	13-Feb	07-Feb	18-Oct
HC007	St Augustine's Church, Penarth	-3.169094	51.441557	85	0	3.114141839	23-Mar	16-Mar	75	10-Sep	03-Sep	246	0.2	-2.957509	07-Mar	28-Feb	25-Sep
HC008	St Bridget, St Bride's Major	-3.593248	51.463219	117.4	2	-15.0249065	01-Feb	26-Jan	26	30-Oct	24-Oct	297	3	19.102367	10-May	04-May	23-Jul
HC009	St John the Baptist Church, Cardiff	-3.178309	51.480694	60	0.8	18.80103441	08-May	02-May	122	25-Jul	19-Jul	200	1.7	-16.74073	27-Jan	21-Jan	04-Nov
HC010	St Sennyor Church, Llanannor	-3.450796	51.48756	89	2	2.187433139	20-Mar	14-Mar	73	12-Sep	06-Sep	249	3.2	1.8812679	19-Mar	13-Mar	14-Sep
HC011	St Cadog Church, Cheriton	-4.2394	51.61611	106.5	5.7	-5.602559866	28-Feb	21-Feb	52	03-Oct	26-Sep	269	3	12.540855	18-Apr	11-Apr	14-Aug
HC012	St Cathew, Port Lyonn	-4.21249	51.546462	75.5	1.4	10.06660855	10-Apr	09-Apr	99	22-Aug	21-Aug	233	3	-6.575244	25-Feb	24-Feb	06-Oct
HC013	St Illtud Church, Oswest	-4.158974	51.554037	109	0.4	-11.35912316	13-Feb	12-Feb	43	18-Oct	17-Oct	290	11.3	20.60788	18-May	17-May	16-Jul
HC014	St Mary's Church, Rhossili	-4.285955	51.569315	97.5	2.9	-2.37240262	09-Mar	08-Mar	67	24-Sep	23-Sep	266	3	4.4963675	25-Mar	24-Mar	07-Sep
HC015	St Nicholas Church, Nicholasston	-4.14795	51.575043	78	2.3	9.238874579	07-Apr	31-Mar	90	25-Aug	18-Aug	230	0	-7.424224	24-Feb	17-Feb	07-Oct
HC016	St David - EAST, Llanddewi	-4.223825	51.579256	99	0.7	-5.027530954	01-Mar	22-Feb	53	02-Oct	25-Sep	268	1.6	6.8373434	01-Apr	25-Mar	31-Aug
HC016	St David - WEST, Llanddewi	-4.223825	51.579256	95	0.5	-2.712380704	07-Mar	28-Feb	59	25-Sep	18-Sep	261	1.6	4.3595975	25-Mar	18-Mar	07-Sep
HC017	St Mary's Church, Penmael	-4.071684	51.579231	95.5	0.2	-3.257669102	06-Mar	27-Feb	58	26-Sep	19-Sep	262	0.8	4.0424028	25-Mar	18-Mar	07-Sep
HC018	St Teilo, Bishopston	-4.053982	51.585117	102	8.8	-0.446691805	14-Mar	13-Mar	72	19-Sep	18-Sep	261	3	10.575321	12-Apr	11-Apr	20-Aug
HC019	St George Church, Reynoldston	-4.196278	51.588503	116	3.2	-13.19097595	07-Feb	31-Jan	31	24-Oct	17-Oct	290	1.1	16.699641	01-May	24-Apr	01-Aug
HC020	St Illtud - EAST, Iston	-4.085085	51.593269	69	5.1	16.94241667	01-May	30-Apr	120	01-Aug	31-Jul	212	4.5	-9.233829	19-Feb	18-Feb	12-Oct

Fieldwork data for each Church recorded with some auto checking for solar dates

	Az E	Alt E	Dec E	E.Date 1	Julian Date E1
Llanmihangel	88	0.5	1.637632855	19-Mar	12-Mar
St James Church, Wick	72	0.2	11.26551569	13-Apr	07-Apr
St Augustine's Church, Penarth	85	0	3.114141839	23-Mar	16-Mar
St Bridget, St Bride's Major	117.4	2	-15.0249065	01-Feb	26-Jan
St John the Baptist Church, Cardiff	60	0.8	18.80103441	08-May	02-May
St Sennyor Church, Llanannor	89	2	2.187433139	20-Mar	14-Mar

By using the Data/Filtering feature of Excel, I could sort ANY column

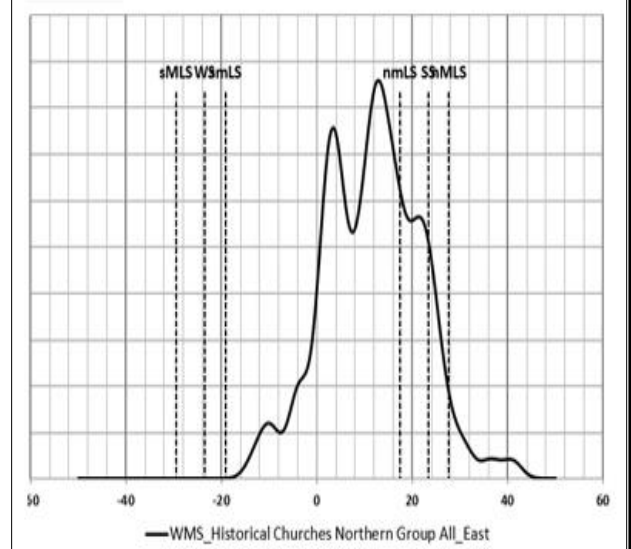
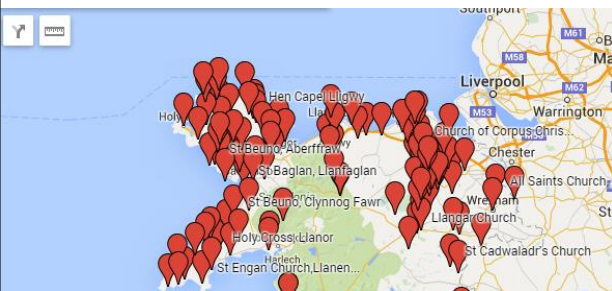
One micro-cluster

- In checking the entire database only **14 of the 261** churches were found to have an orientation to the sunrise at the summer solstice - +23.5.
- 12 of these 14 churches were located in **North Wales**.



Focusing on North Wales

There are 105 historical churches in North Wales

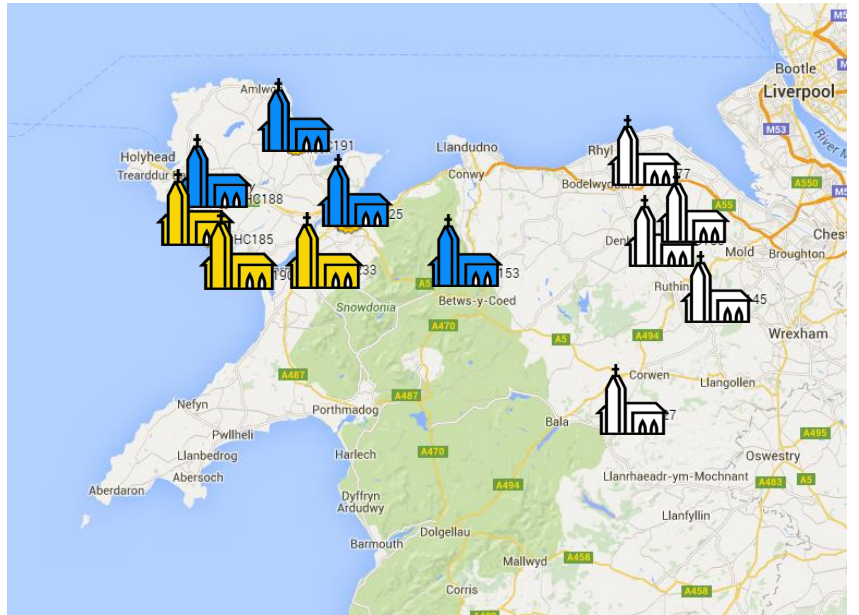


Once again in looking at the histograms of the declinations of the 105 North Wales churches this unique cluster of summer solstice churches is visually removed.

The cluster of twelve summer sunrise solstice churches in North Wales

The next step was to visit all of these churches and do live field work.

This field work confirmed the virtual data AND gave me a 'feel' for the setting of each church.

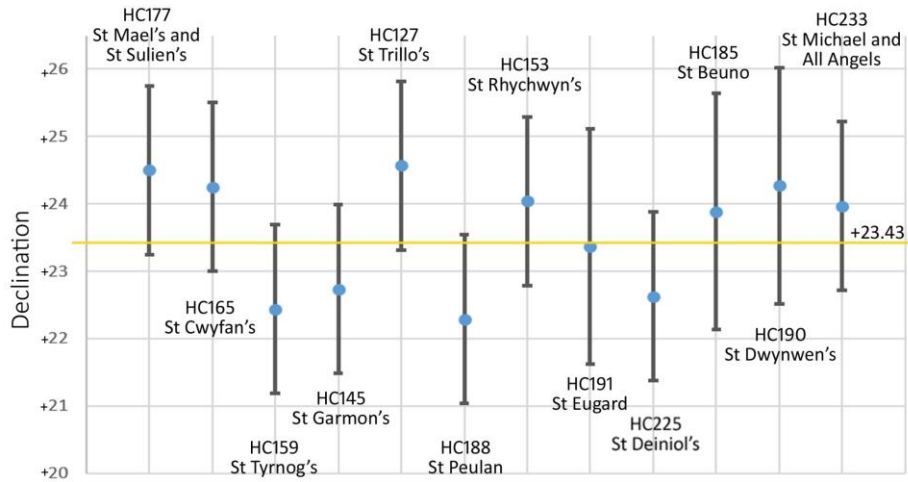


Measure of Uncertainty

With a level of **uncertainty of 0.5° applied to both instruments**, a declination level of uncertainty **was $\pm 1^\circ$** . Additionally, because I was working with the phenomena of sunrise or sunset, if this occurred on a **distant horizon** Bradley Schaefer's refraction uncertainty formula was applied to the resulting measurements (Schaefer 1990, 804). This added a further **error margin of 0.5° to the declinations**. Finally, the disk of the **Sun measured 0.5° in diameter**, and so, with no way of knowing what limb of the Sun's disc the original builders may have used, an **additional level of uncertainty of 0.25°** was factored in to the final figures. Thus, the level of uncertainty in declination for the Sun on a **distant horizon was $\pm 1.75^\circ$** but, for solar events on a raised horizon, such as a nearby ridge, then refraction was not an issue and the **level of uncertainty was $\pm 1.25^\circ$** .

Altitude of horizon	Uncertainty margin	Min. declination	Max. declination
$\leq 1^\circ$	$\pm 1.75^\circ$	21.68°	25.18°
$> 1^\circ$	$\pm 1.25^\circ$	22.18°	24.70°

Eastern Declinations of the Solstitial Churches



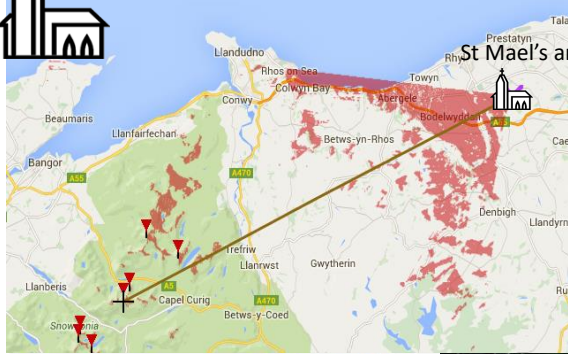
Denbighshire Valley





Group 1

HC177 St Mael's and St Sulien's Declinations: East 24.5 , West -14.0 Latitude 52.19, Longitude -3.34



St Mael's and St Sulien's

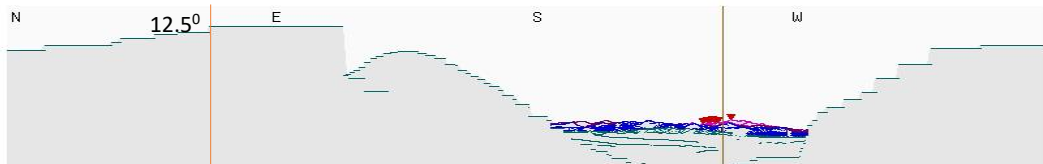
Denbighshire



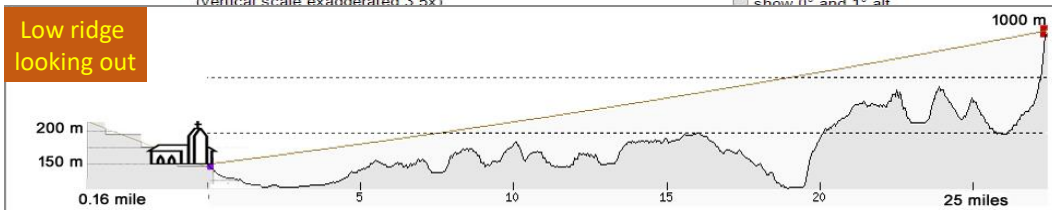
HC177 St Mael's and St Sulien's, $\tau Az 65.5^\circ$ Latitude 52.19, Longitude -3.34

dec 24.5

dec -14.0

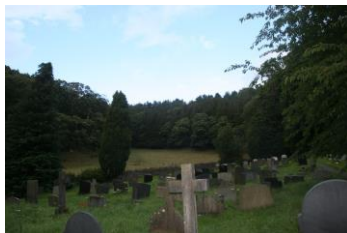


Low ridge
looking out



St Mael's and St Sulien's

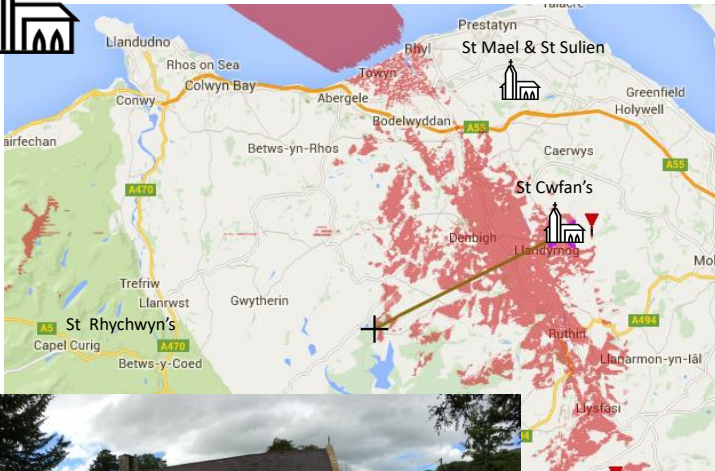
- Two miles north-east of St Asaph
- Recorded in 1291
- Stone work 14th century
- Land slopes down towards the west, the floor is also on two levels.
- East view (image left) looks to the hills. Long view towards the **west**





Group 1

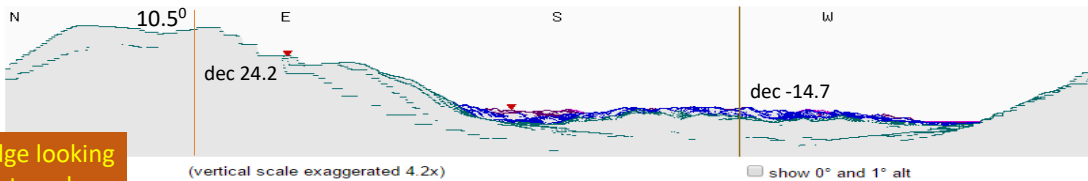
HC165 St Cwfan's, Declinations: East 24.2, West -14.7 Latitude 53.18, Longitude -3.31



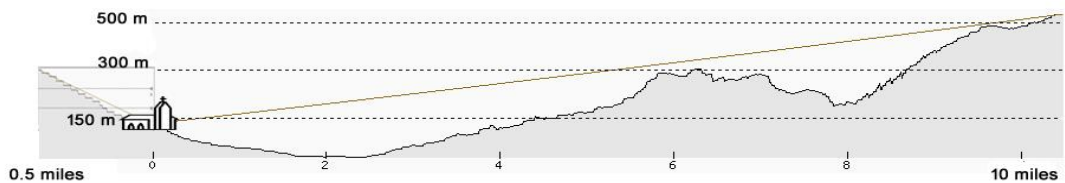
Llandyrnog
It easterly
orientation to
the low hills



HC165 St Cwfan's, tAz 63^0 , Latitude 53.18, Longitude -3.31

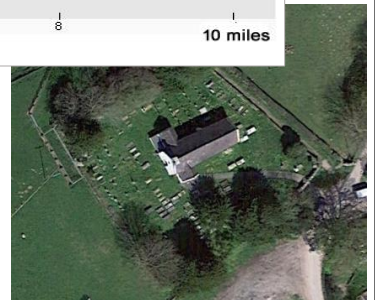


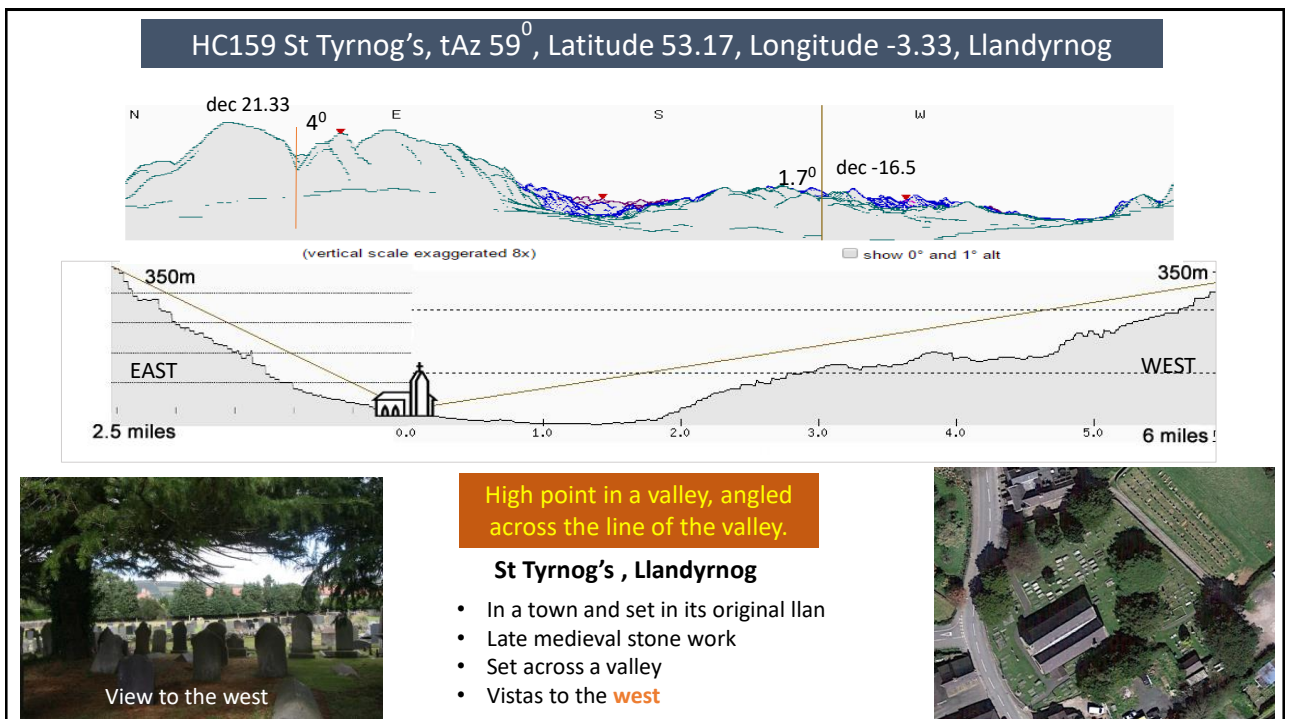
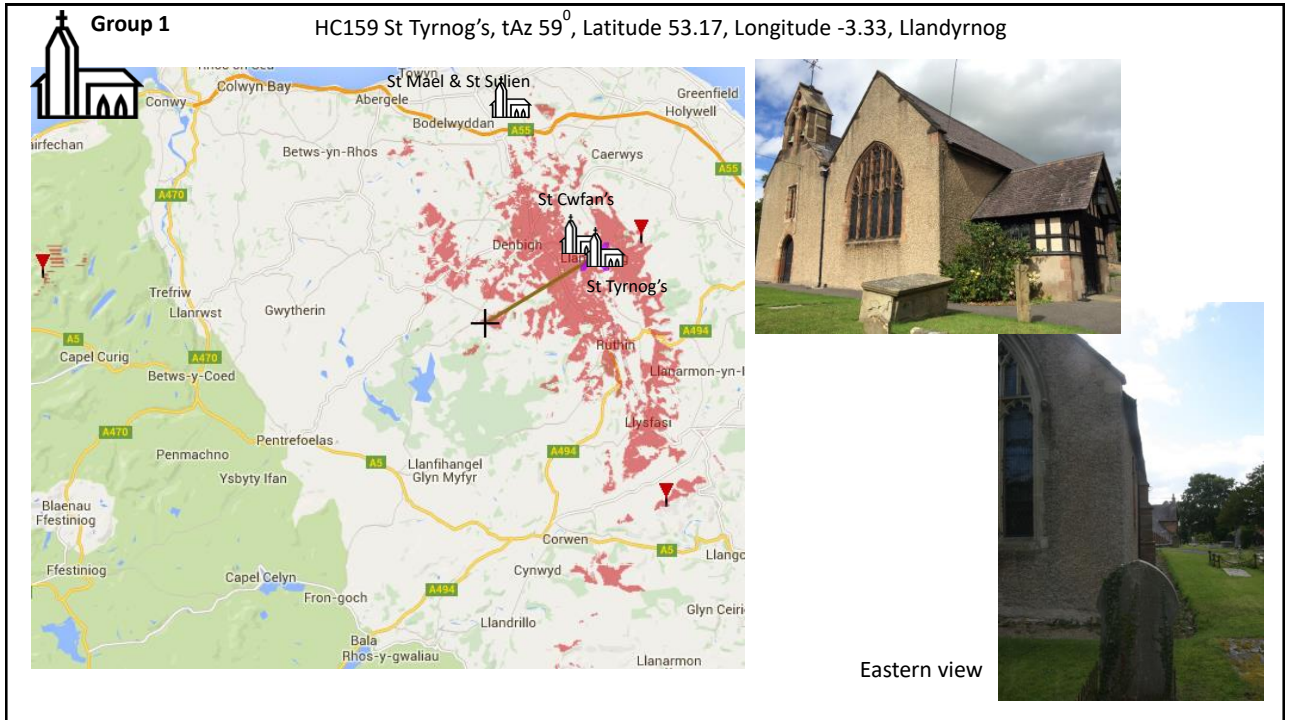
Low ridge looking
westward

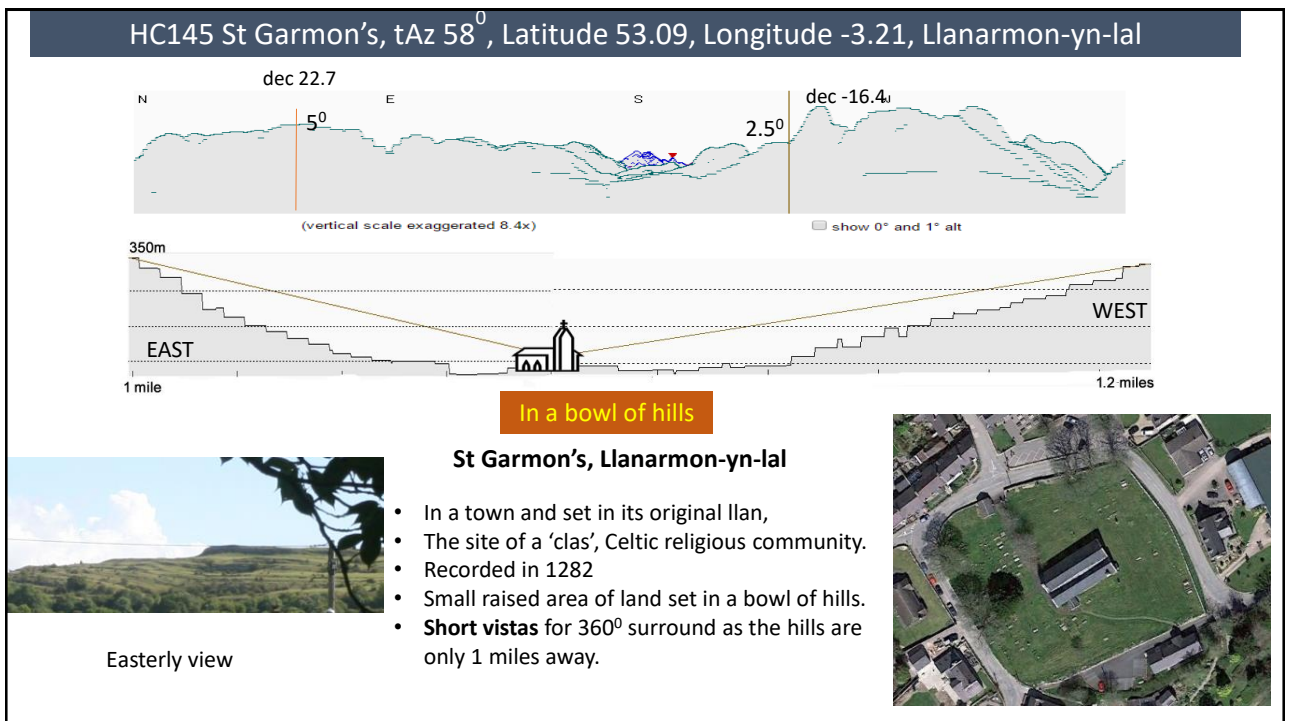


St Cwfan's Llandyrnog

- Location on a pilgrim route to Holywell
- Recorded in 1254
- Stone work early medieval
- Flat land, with hills to the east and open to the west.
- **Western** view (image left) look towards the Snowdonia Mountains.

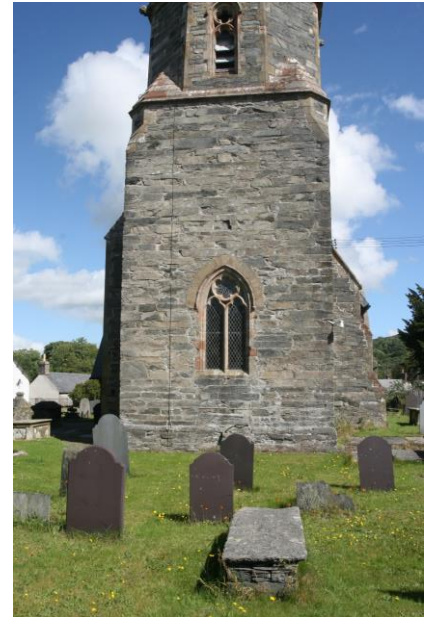
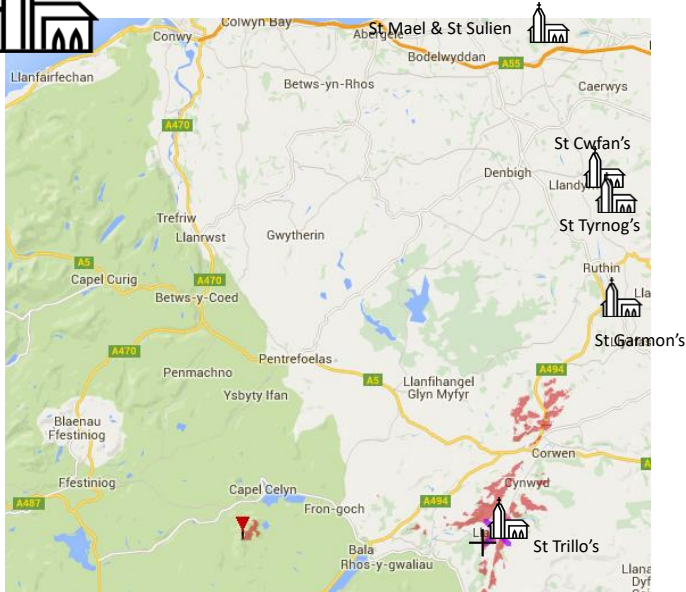






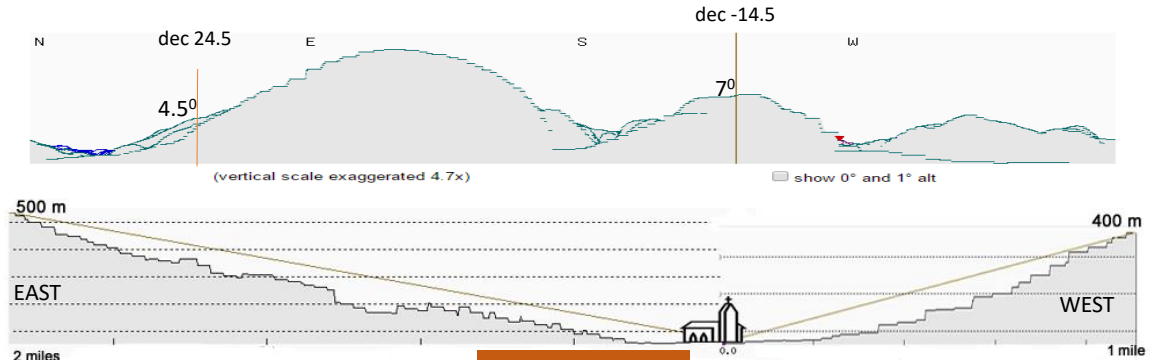
**Group 1**

HC127 St Trillo's, Declinations: East 24.5 , West -14.7 Latitude 52.92, Longitude -3.43, Llandrillo



Llandrillo, surrounded by hills

HC127 St Trillo's, tAz 54°, Latitude 52.92, Longitude -3.43, Llandrillo



In a bowl of hills

St Trillo, Llandrillo

- In a town and set in its original llan.
- Recorded in 1254
- Stone work early medieval
- Small raised area of land set in a bowl of hills.
- **Short vistas** for 360° surround as the hills are only 2 miles away.

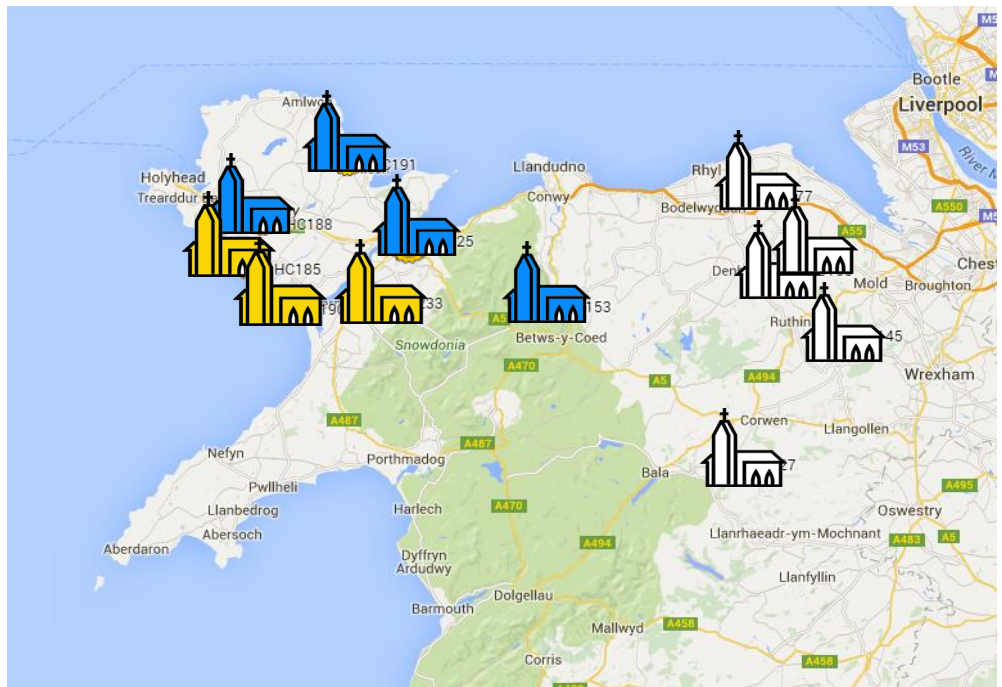


Western view



All the
White
Churches
are facing
east +23.5

And facing
West to
+14 to +16



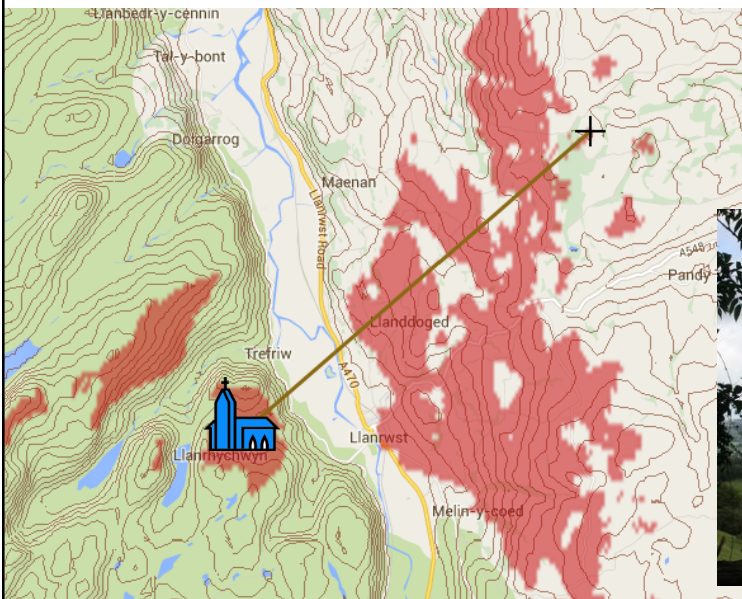


Conway Valley

Group 2

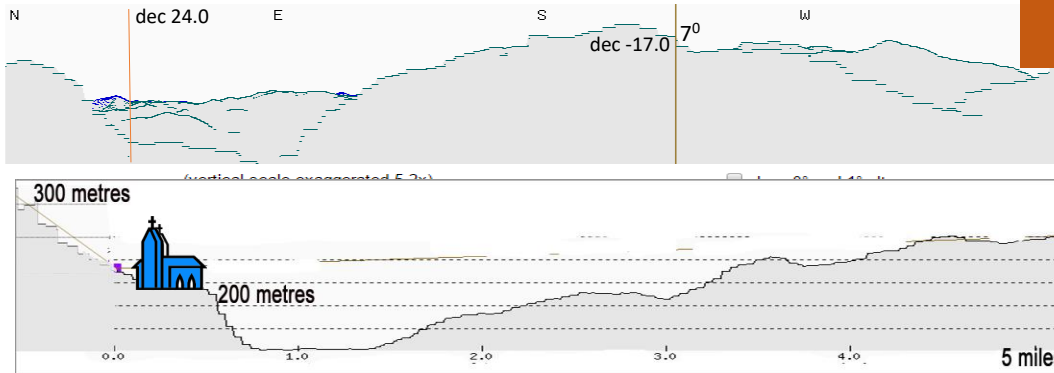


HC153 St Rhychwyn's
East 24.0 West -17.0



HC153 St Rhychwyn's, $\text{tAz } 49^0$ Latitude 53.14, Longitude -3.83.

On a ridge, the edge of the Snowdonia Mountains

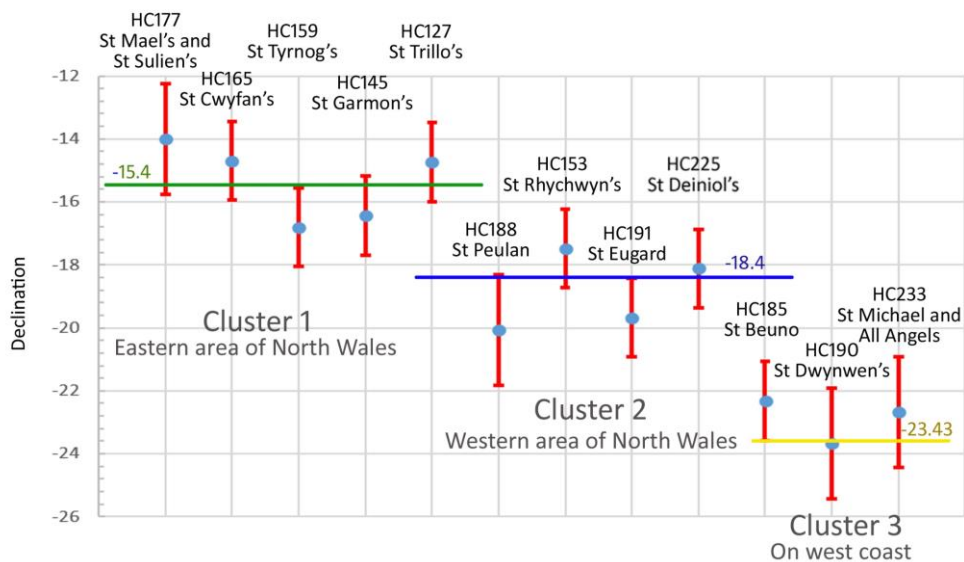


St Rhychwyn's

- Considered to be the oldest church in Wales – 6th century
- Stone work 11th century
- Isolated on high pasture lands on the edge of the Snowdonia Mountains.
- Land slopes down towards the **east**.



Western Declinations of the Solstitial Churches



Azimuths range from 48 to 65.5, thus a 17.5° range

Code/Church	t.Az. E	Alt E/W	Dec E	Dec W
Group 1				
HC177 St Mael's and St Sulien's RIDGE	65.5	12.5 / 0.4	24.5	-14.0
HC165 St Cwyfan's RIDGE	63	10.3 / 1.3	24.3	-14.7
HC159 St Tyrnog's ACROSS VALLEY	59	4.5 / 1.7	21.7	-16.5
HC145 St Garmon's BOWL	58	3.7 / 2.5	21.7	-16.4
HC127 St Trillo's BOWL	54	4.5 / 7	24.6	-14.7
Group 2				
HC153 St Rhychwyn's RIDGE	49	1/7	24.0	-17.0
HC225 St Deiniol's Cathedral COASTAL	55	2/2.3	21.5	-17.8
HC188 St Peulan ANGLESEY - inland	54.5	1.7/0.6	21.9	-19.8
HC191 St Eugard ANGLESEY N. COAST	48	-0.2/4.4	23.4	-19.7
Group 3				
HC185 St Beuno, ANGLESEY S. COAST	48	0.3/1.5	23.9	-22.3
HC190 St Dwynwen ANGLESEY S. COAST	48	0.7/0	24.3	-23.7
HC233 St Michael and All Angels COASTAL	50	1.5/0	24.0	-22.7

Margin of uncertainty +/- 1.75, or for hills, +/- 1.25

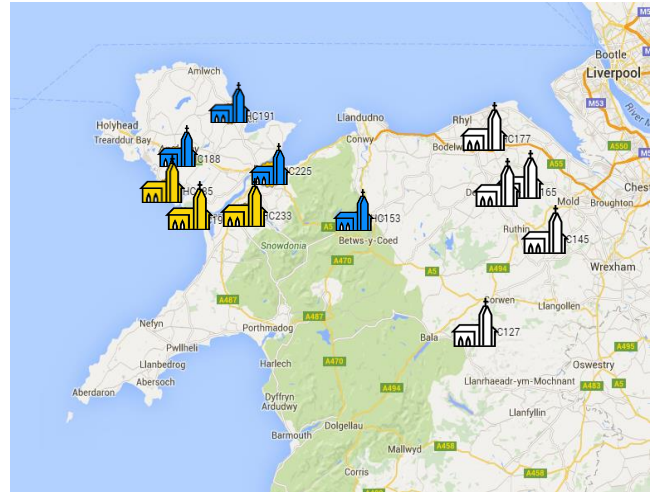
A Pre Christian Footprint in the Welsh Churches

Code/Church	Dec E	Dec W	Sunset		Celtic
Group 1			Early	Late	
HC177 St Mael's and St Sulien's	24.5	-14.0	Mid Feb	End Oct to Nov	31 Oct - Samhain
HC165 St Cwyfan's	24.3	-14.7	Mid Feb	End Oct to Nov	31 Oct - Samhain
HC159 St Tyrnog's	21.7	-16.5	Early Feb	Mid Nov	2 Feb - Imbolic
HC145 St Garmon's	21.7	-16.4	Early Feb	Mid Nov	2 Feb - Imbolic
HC127 St Trillo's	24.6	-14.7	Mid Feb	End Oct to Nov	31 Oct - Samhain
Group 2					
HC153 St Rhychwyn's	24.0	-17.0	Early Feb	Mid Nov	2 Feb - Imbolic
HC225 St Deiniol's Cathedral	21.5	-17.8	Late Jan to Feb	Mid Nov	2 Feb - Imbolic
HC188 St Peulan	21.9	-19.8	Late Jan	Mid Nov	2 Feb – Imbolic?
HC191 St Eugard	23.4	-19.7	Late Jan	Mid Nov	2 Feb – Imbolic?
Group 3					
HC185 St Beuno,	23.9	-22.3	Winter Solstice		
HC190 St Dwynwen	24.3	-23.7	Winter Solstice		
HC233 St Michael and All Angels	24.0	-22.7	Winter Solstice		

Margin of error: The sun moves more rapidly in the early February and late October period and thus the error margin of +/- 1.25 (raised horizon) or +/- 1.75 (includes refraction) translated to only 8 to 9 days.

Intentionality or Chance

- The probabilities of all five solstitial churches in the eastern region is roughly 1:25000 (4.5×10^{-5}) or, with refraction, 1:5000 (2.42×10^{-4}), (White group)
- The probabilities of all four solstitial churches in the western area sharing the same western declination is roughly 1:3000 or, with refraction, 1:1000. (Blue Group)
- Finally, to have all the solstitial churches in North Wales which do not align to the winter solstice sunset aligning to just these two declinations is roughly 1: 1 trillion (9.849×10^{-12}) or, with refraction, 1:5 million (3.105×10^{-7}).



Are these Sixth Century Christian orientations or are they pre-Christian?

- ☐ To find these locations a deep knowledge of the landscape was required.
- ☐ This knowledge needed to include **star-lines** or gained by the careful watching of the sun for many years in order to find the right location to achieve the effect of the both the sun rise and sun set occurring for the correct dates of the year.
- ☐ Question: Did the early Irish saints have this knowledge when they located the sites for their llans?
- ☐ Is it more feasible to assume that they **appropriated pre-Christian orientations** of stone rows or circles already held to be sacred by the local people, and thus built their churches mirroring the orientation of the stones?

Conclusion – Four Key Points

- It was essential to consider the **landscape** when considering the orientation of these churches. This contradicts the findings of Alie and Cunich¹, and Hoare and Sweet², and also Hinton.³
- **Work with clusters** rather than merging all churches into a large data set. This challenges Stephen McCluskey comments made in 2015 which argued for cultural groups but large enough for a statistical approach.⁴ My research has been anthropological in its method and worked with small clusters.
- Both the **eastern and western** orientations need to be considered.
- The solstitial churches are a feature of North Wales and their orientations offers **tangible evidence** to support the idea that some churches followed **pre-Christian orientations**.

1. Ali, Jason R, and Cunich, Peter, 'The Orientation of Churches: Some New Evidence', *The Antiquaries Journal*, 81 (2001), 155-193.

2. Hoare, Peter G, and Sweet, Caroline S, 'The Orientation of Early Medieval Churches in England', *Journal of Historical Geography*, 26 (2000), 162-173.

3. Hinton, Ian, *The Alignment and Location of Medieval Rural Churches* (Oxford: Archaeopress, 2012).

4. McCluskey, Stephen C, 'Orientation of Christian Churches', in *The Handbook of Archaeoastronomy and Ethnoastronomy*, ed. by Clive L. N. Ruggles (New York: Springer Reference, 2015,) pp. 1703-1710, 1709.